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Patent and Antitrust Developments in the European Economic Community—A Sequel

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SUMMARY

SINCE THE MIDDLE OF 1965, no further progress has been made on the European Patent Convention. A body of antitrust law has slowly continued to grow. This report examines some questions in these fields and suggests trends in the light of the economic and political changes now occurring in Europe.

INTRODUCTION

THIS REPORT IS A SEQUEL to that published in Spring 1964[1] which followed a series of public lectures and discussion conducted by The Patent, Trademark, and Copyright Research Institute on "Current International Industrial Property Developments and the Relation Thereto of Antitrust and Trade Practice Laws and Policy" in 1963. This report is based on interviews with selected officials of national and Community institutions, on discussions with patent and antitrust practitioners in the Community, and on subsequent correspondence to

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[1] "Patent and Antitrust Development and Prospects of the European Economic Community," *IDEA*, Vol. 8, No. 1 (Spring 1964), p. 1.

update and review this report. The officials conferred with included Dr. Kurt W. Haertel, President of the German Patent Office; Dr. Ebehardt Günther, President Bundeskartellamt; Dr. Franz Froschmaier of the General Directorate of Competition of the EEC. The discussions with these officials and other practitioners were held in Summer 1965 in Munich, Bonn, and Brussels and are supplemented by personal observations by the reporter.

EUROPEAN PATENT CONVENTION

Formal work on the European Patent Convention has made very limited progress because of other political difficulties confronting the European Economic Community (EEC). In the meantime, however, further study is being given to controversial questions so that various alternatives and compromises be available for action by the EEC Council at the time this organization is ready to proceed again with new legislation.

Problems Under Consideration

Scope of Product Protection

Among the questions under study is the extent of protection to be granted to chemical products. Should, on one hand, the chemical products be given absolute claim protection as under United States law? Or should they be given more limited protection by claims to the composition containing the chemical or to the use or uses of the compound or of the composition? In principle the prevailing opinion would grant protection to the compound as such with provisions in the law for compulsory licensing, especially to a party who is dependent or dominated by the product patent. The trend seems to be that the stronger the contemplated protection for the compound, the greater the necessity for safety clauses to minimize abuse by the holder of the product patent.

Accessibility

In order to avoid questions of violation of Article 2 of the Paris Convention and at the same time to recognize certain practical aspects when the Convention comes into effect, an alternative proposal to those already under consideration[2] is being discussed. Under this proposal the principle of free accessibility would be recognized in the

[2] Saul Jecies, "Non-Accessibility of Proposed Common Market Patents of Third Party Nationals and Its Effect on U.S. Convention Rights," *IDEA*, Vol. 9, No. 1 (Spring 1965), p. 61, and *supra*, note 1 at page 10, Editor's Note.

Convention but it would be put into effect on a limited basis over a period of transitional years. It is hoped in this way to avoid that the Patent Office be submerged under a flood of new applications.[3] Since the present Draft of the Convention already provides for a gradual introduction of various areas of technical subject matter through a transitional period, it is doubted that gradual free accessibility would be really needed or be different from existing provisions. It would seem that the provisions in the Convention are already elastic enough to deal with the practical aspects of the situation as it may develop without violations of the Paris Convention.

Exploitation and Exhaustion of the Patent Right

Concern is evident in patent and antitrust circles that the EEC patent should not be a potential tool for division of the EEC market. The EEC is dedicated to the gradual abolition of political barriers to the free flow of goods and to the promotion of economic integration. Patents as tools of technical development should not be used in a manner inconsistent with these aims. This is a primary concern about which there appears to be substantial agreement. In a recent Memorandum on Concentration of Enterprises in the Common Market,[4] the Commission again emphasized that the European Patent Law should remove the possibility of dividing the EEC markets through licensing agreements. It is not yet resolved how far a patentee and his various licensees in various EEC countries—possibly for various embodiments of the invention—can exploit the invention before his patent right should be considered exhausted. Likewise, there appears no agreement as to whether the acts of the patentee and his licensee should be controlled by provisions in the EEC Patent Convention or by the antitrust law. There are two schools of thought on this problem: one favors provisions in the patent law; the other is opposed thereto. Moreover, there seems to be no consensus yet whether the propriety of the patentee's acts in exploiting his patent, as by licenses, should be measured now against existing rules or rules to be written now, or against a developing yardstick as the EEC market economically integrates. The German Patent Office favors an elastic, non-regimented approach to this question with the propriety of the acts of the patentee to be determined as the market integrates.[5] The EEC antitrust de-

[3] The German Patent Office has estimated that 30,000 patent applications a year would be filed in the EEC Patent Office if there were free accessibility.

[4] CCH Rpt. N. 26 (3/17/66) para. 10.

[5] "Introduction to the General Aspects of the EEC Patent Convention," Address by President Kurt W. Haertel (1965).

partment is looking for a solution to avoid the splitting of the EEC territory by use of national patents. With respect to this problem, some have taken the position that in the case of several national patents existing for the same invention and belonging to the same patentee, these patents are exhausted, when either the patentee or his licensee has placed the protected goods in commerce in a territory covered by one of the patents.[6] And the German Cartel Office has taken a similar position.[7] How far a patentee or his licensee can exploit his patent consistent with the basic aims and accomplishments of the EEC will remain a very difficult problem to solve. Except for writing a few fundamentals into the law, it would appear that a pragmatic approach based on situations as they occur will be preferred over an attempt at establishing new rules for present and future conduct.

The Institutions and Their Relationship to the Type of Patent Convention

Two basic approaches have prevailed until now regarding the type of patent system considered by the European Patent Convention: an internation and world-wide patent or an EEC patent. The first would have special clauses for the EEC member countries; the latter suitable clauses for its extension to other countries.[8] The question of the number, type and location of institutions required for the system is related to the system contemplated. It is generally accepted that five institutions will be needed for the patent system: a patent office, a supervisory administrative board, a decision-making body, and a board of appeal. These institutions, except for the patent office which should be newly created, can be organized within the framework of existing EEC institutions. The EEC Council, the Commission and the Court of Justice could be used in that connection. Thus, an EEC patent, rather than an international approach, would favor better utilization of existing facilities and also the integration of the EEC. The prevailing trend appears in that direction.

Other Considerations

Opposition to an EEC Patent Solution

Unlike the situation prevailing a number of years ago, the principal advocate for an international patent and opposer to an EEC patent is

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[6] Norbert Koch and Franz Froschmaier, "The Doctrine of Territoriality in Patent Law and the Common Market," *IDEA*, Vol. 9, No. 2 (Summer 1965), p. 343. The reader is referred to this excellent article for study of these views.

[7] *Supra* note 1 at p. 16.

[8] *Supra* note 1 at p. 21 and 22.

now reported to be Holland. France and Germany are reportedly agreed on the advisability of an EEC patent system. The position of Holland is apparently based in part on its desire to wait for a more definite evaluation of its deferred examination system and its hope for participation by the United Kingdom in the European Patent Convention. The Dutch deferred examination system transitional period expires in 1970; the value of such a system for Holland and its applicability to the EEC (or of a system similar to it) could then be better evaluated.

Holland strongly favors the accessibility or some participation of Great Britain to correct the balance of industrial and political powers which often leaves that country isolated from the Franco-German industrial group. The close intertwining of certain sections of Dutch and British industry gives further support to those who advocate that the proposed European Patent Convention system should include Great Britain in order to give it a broad representative base. In answer, those who advocate a patent system primarily EEC in outlook take the position that countries like Britain, Ireland, Austria, Sweden, Switzerland, and Norway cannot contribute to the fundamental decisions involved in establishing the European Patent Convention and to the functioning of the system itself since they lack the basic economic and political community of interest that brought and keeps the six members of the EEC together. Moreover, such advocates point out that these countries are really not politically ready or willing to surrender enough national sovereignty to the supra-national institutions that would be required for participation in the European Patent Convention.

Future of the European Patent Convention

It is being recognized that an unlimited time cannot be allowed to lapse if the Convention Draft is to be enacted into law. While it is discouraging that so little progress has been made in the last year, the feeling seems to prevail that once the Council is ready to act again on new legislation, the objections of Holland alone could not successfully prevent the enactment of the Convention into law.

It should be noted, however, that the problems confronting the EEC countries in 1965 will have to be reviewed in an entirely different light when the matter is taken up for discussion again. Since the middle of 1965, when the last discussions were held on these questions, basic political and economic changes have and are taking place in Europe. The problems relating to the EEC patent will have to be reviewed in this changed context; and while some may have been solved by themselves or become less acute, other new problems may of course also arise. If the patent questions tend to follow other political trends, one could expect increasing cooperation on an inter- and supra-national European level beyond the EEC boundaries, preserving as much as possible of the national aspects of the respective patent systems.

Such a trend could further support the increasing coooperation and harmonization which is taking place in the field of national patent law and it may become the main outlet for future EEC patent developments.

The Applicability of the Dutch Law to Other Countries

Patent circles in Europe point out that soundness of the Dutch law must await the results of its national patent applications. Only 20 percent of the applications filed in Holland are of Dutch origin; the remainder are foreign applicants who may request examination on the merits or become involved in opposition proceedings on grounds not directly related to the reasons for establishing the Dutch law. Thus the outcome or proceedings in which foreign originated applications are involved are not believed to be the true test for evaluating the soundness of the Dutch law. The value or applicability of the law should be tested with regard to Dutch applications. Its results in connection thereto can then have some significance for the United States or Germany.[9] These results can be properly evaluated only during the next four years to determine to what extent they are of value to the United States. The American Patent Law Association and others have considered the new Dutch law in conjunction with various alternative systems[10] without apparently recognizing that the value of the Dutch law in solving Dutch problems has not yet been fully ascertained and, of course, much less its value to the United States.

Changes in German Law

Not only are the Dutch or the United States patent laws in a transitional stage, but the German patent law as well. While there is a statutory basis for the Compact Prosecution in the United States, there is none in German law. Although the German patent law Section 26, Paragraph 1 requires that the description "shall conclude with an indication of the subject matter which is to benefit from the pro-

[9] About 20 percent of the applications filed in the U.S. and about 41 percent of the applications filed in Germany are of foreign origin.

[10] *American Patent Law Association Bulletin,* December 1965, p. 577.

tection by patent claims,"[11] German patent practice has so developed as to allow for claim changes which are not normally allowed under United States law. To introduce anything akin to United States Compact Prosecution in German practice would be very difficult without suitable legislative change.

It is pointed out by patent circles in Europe that countries like France that rely on a registration system really test the value of their patent by filing it in examination countries like the United States or Germany. Only in this way do they obtain an idea of the strength and value of their patent for licensing, even licensing in the non-examination country. Without such possibility of examination and evaluation of their patent in countries other than the registration country, the registration system alone is believed to be of relatively little value.

At this juncture of patent law evaluation, it is apparent that the soundness of the Dutch system is yet to be fully assessed. The French system has introduced examination for novelty and inventiveness in certain technical fields, or relies on a fuller examination system for evaluating its inventions by filing the case in the United States. The German system is emphasizing that "The more differentiated and complex technology is becoming, the more carefully and precisely inventions must be examined as regards novelty before patents, meaning monopoly rights, are granted for them."[12] The value of examination of patent applications for inventiveness, in addition to novelty, is being implicitly recognized concurrently with a search for more efficient means therefor because of its technical and financial burdens.

These facts also point to another pattern. When a patent office does not have the main responsibility for full examination for novelty and patentability, the burden to ascertain them shifts to the applicant. The value of the patent is then determined in another forum: either in another patent office and/or in courts domestic or foreign. Where the shift of the proceedings is to the courts, the parties are under pressure to reach, at some time prior to or during the proceedings, an arrangement settling their differences. Arrangements involving patents (cross-licensing, straight licensing and others) are generally considered to be more common in Europe than in the United States; such arrangements appear to be even more prevalent in European countries having less or no examination for patentability. The lesser the examination, the greater appears to be the tendency towards an

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[11] German Patent Law (1961).

[12] Dr. Kurt W. Haertel, Talk to the National Association of Manufacturers, New York, 1965, and interview.

arrangement between the parties outside of the scrutiny of administrative or judicial forum. It probably can be agreed that an administrative agency or a court is more likely to be more concerned with or representative of the public interest than private organizations which primarily will be motivated by their own organizational interests in reaching agreement involving industrial property rights. This would suggest that when determination of patentability is shifted out of the patent office, even to the courts, a trend towards private arrangements between the parties involved is likely to be promoted. Whether such a practice is best designed to serve the interest of the public should be given careful consideration before encouraging a trend in that direction.

Antitrust Developments

Inactivity or slow-down in the enactment of new patent legislation has not meant inactivity in the antitrust field. Since the antitrust laws are already in effect, the national agencies and courts and the EEC agencies have been applying them in numerous fields, notably in that of exclusive distributorships.

Decisions After the Grundig Case

Noteworthy is the attempt of the EEC Antitrust Commission to clarify the law in the field of exclusive distributorship which is suffering from the incertitudes introduced by its *Grundig* decision.[13] The decision in this case, which is now an appeal before the Court of Justice of the EEC, is not considered to be sound. While the reasons therefor vary widely, it is often stated that its weakness lies in that the Commission has enjoined the entire arrangement rather than prohibiting a particular practice.

A number of decisions following the *Grundig* case are noteworthy.[14] They all approved exclusive distributorship arrangements which had the following features in common: The arrangements did not impose any re-export prohibitions by the distributor of the manufacturer into

[13] 161 *Journal Officiel des Communautés Européennes* (hereinafter cited as *JOCE*) 2545 (1964) and (*supra* note 2); "Recent EEC Antitrust Activity Relating to Exclusive Distributorships and Trademarks," *IDEA*, Vol. 9, No. 1 (Spring 1965), p. 35.

[14] Maison Jallate v. Voss and Vandeputte, Press Release No. 1P (66) 5 by the EEC Commission, January 10, 1966; D.R.U. v. Blondel, Press Release No. 1P (65) 134, July 1965, same authority. Hummel v. Isbecque, Press Release, September 1965, same authority.

other EEC countries; it did not prevent parallel import into the territory assigned to the distributor, thus allowing imports by other dealers into the territory from buyers of the manufacturer. All cases also involved a certain amount of technical competency due to the technical nature of the products involved, though it is evident that that element alone would not have been adequate to justify the arrangements. All cases, except the latest one, did not impose a prohibition on the distributor to handle competitive products. Neither did the manufacturers fix the price of the distributors' goods on resale.

In contrast to the *Grundig* arrangement, in none of the more recent cases were the distributors granted absolute territorial protection free from actual or potential competition. These cases together with the proposed group exemption for exclusive distributorships now before the Consultative Committee on Cartels and Monopolies are expected to continue to clarify the law in this field.

CONCLUSION

In the antitrust field a body of law is growing which tends to clarify the propriety of certain practices in common commercial arrangements involving patent, trademarks and know-how. In the patent field, the EEC is in a state of expectancy; the next year may well be a crucial one in determining whether the Draft of the European Patent Convention will be translated into a going reality or modified into a different body of supra-national patent law.

The USSR Trademark System and East-West Trade

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SUMMARY

THE USSR DESIRE TO INCREASE commercial relations with the West is manifested, among other activities, by changes in its trademark system in recent years to bring it more into conformity with Western concepts of trademark protection. Also, growing Soviet emphasis on consumer fulfillment and on exporting have created a new respect for trademarks as competitive sales and advertising devices, as well as identification and quality control symbols.

The present USSR trademark law, which entered into force in June 1962, provides for protection of marks to distinguish services as well as goods. It establishes a classification system and examination procedure and also permits a trademark registrant to seek injunctive action and damages in infringement suits against unauthorized users of his mark on imports as well as domestic manufactures. In the past, most United States originated trademark applications intended for filing in the USSR were filed in the name of European subsidiaries. Now, since the Soviets have joined the Paris Convention, established more licensing flexibility, and made other changes in their trademark system more acceptable to United States concepts, more American firms are filing directly in that country.

Although there is little experience on which to base any meaningful judgments regarding Soviet treatment of foreign trademark rights, it is apparent that an American registering his trademark in the USSR

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will establish (1) a legal basis for enforcing it against imitations in that country, (2) a focal point around which to develop any market promotion for the subject products that may be possible, (3) an important identification for his imported products and (4) a better basis for concluding licensing agreements where "package deals" which include patents and technical know-how as well as trademarks are the only types that can feasibly be negotiated.

PROCEDURES IN THE USSR for administering and enforcing trademark protection are not markedly different from those of most Western industrialized countries. As in the case of trademarks in these countries, the Soviet counterpart[1] is intended to indicate the origin of the goods, serve as a guarantee symbol of their quality and provide a focal point around which to create a demand for them. The significance of trademarks in a country such as the USSR is always open to question since trademarks are generally associated with concepts of commercial individuality and competitiveness which are basically outside the realm of "command economy" planning. In recent years, however, as production of consumer goods has gradually increased and the Liberman concepts of price and profit criteria have developed, a growing interest has been stimulated in the use of distinctive markings by those factory managers who believe they may be producing particularly good consumer articles.[2] Projected Soviet plans for increasing exports of fin-

[1] I.e., a Soviet registered trademark or service mark, as distinct from a factory identification symbol.

[2] Dr. Stephen P. Ladas who visited Moscow in May 1959, reports that "Regardless of government formulae, some factories or shops may make articles of this kind [canned goods, cigarettes, watches, hats, chocolates, pastry, bread, etc.] a little better than others using the same formulae. They are allowed to sell them at higher prices. People stand in line to buy these goods rather than those of other factories. Some adventuresome government factories or shops have even discovered the value of a good picture on the label or carton, and this seems to be especially so for cigarettes." *The Trademark Reporter* (September 1959) No. 9, p. 897.

Also, Dr. Marshall I. Goldman, in his book *Soviet Marketing* (London, 1963) points out "The simplest explanation for the appearance of overproduction in the 'planned' Soviet economy is that for the first time the Soviet consumer is being given a choice in the selection of certain items. As production of consumers' goods [in USSR] gradually increases, it is not only a question of deciding between a camera or a television set, it is also necessary to choose between expensive makes of television sets. If measurement of consumer demand is to serve as a gauge of how to allocate television sets to retail outlets, it is now necessary to ascertain not only how many television sets will be demanded but also how many of a specific make and model." (p. 73) Later, in discussing the growth of advertising in the USSR, he notes that it is becoming more competitive, as evidenced, among other things, by competing claims "seen now in advertisements appearing for different brands of radio and television sets." (p. 196.)

ished products are also directing the attention of Soviet enterprises to trademarks not only in terms of their use to distinguish products but as important advertising devices.

Now that the USSR has ratified the International Convention for the Protection of Industrial Property (Paris Union), its trademark, as well as patent practices will be pertinent elements for consideration in East-West commercial relations. Clearly, Soviet adherence to the Convention will have its most significant impact on protection of inventions. It is important to note, however, that the Convention establishes comprehensive machinery for the protection of trademarks in the context of industrial property rights. Since Soviet goods are required to bear a registered trademark if they are to be sold abroad, it would appear desirable for American firms to be fully aware of the protection to which they are now entitled in the USSR not only for their own marks but against the use by Soviet enterprises of marks in foreign trade that might willfully copy American marks. Also, it is well for Western firms to consider the inter-relationships that may be involved in the licensing of patents and trademarks to Soviet enterprises and the possible coupling of such rights to secure the maximum protection and compensation that such "licensing packages" may offer.

This article will explore the ramifications of Soviet adherence to the Paris Industrial Property Convention and then examine, in detail, the Soviet trademark system and its significance in terms of United States trade relations with the USSR.

USSR Membership in Paris Convention

The recent USSR adherence to the Convention is another apparent manifestation of its desire to increase commercial relations with the West and to share in the technological growth of leading industrialized countries.[3] All of the Eastern European countries, except Albania, are now Convention members. Soviet entry into the Paris Union emanates from a number of basic changes that have taken place in its economic and managerial framework since Stalin,[4] and from its practical realization of the need to participate in some form of international system that will provide adequate protection of its industrial property rights aboard. The Paris Convention is the major intergovernmental agreement in the industrial property rights field and is now adhered to

[3] USSR Council of Ministers Decree of March 8, 1965 (No. 848) announced Soviet accession as of July 1, 1965.

[4] For further details on these changes see Herschel F. Clesner's article "Additional Aspects of Proprietary Rights and East-West Trade," *IDEA*, Vol. 9, No. 2 (Summer 1965).

by approximately 75 countries including the United States and Canada, five countries in Latin America, all of the industrialized countries in Europe, most of the African countries and many in the Middle East and Asia.[5] Its basic principle is a guarantee by each member country to provide foreigners the same protection for their industrial property rights that it provides its own nationals (i.e., national treatment). The Convention goes beyond national treatment, however, and also provides certain special benefits and advantages for nationals of member countries, such as a one-year period after the first filing of a patent application in a member country (or a six-month's period in the case of trademarks) in which to file a corresponding application in another member country and receive in the latter the benefit of the first application filing date. Other advantages include protection in each member country of a member-national's patent against arbitrary forfeiture for non-working and a right of a member national to file a trademark application in another member country (subject to its domestic law) without first having to register the mark at home.[6] By adhering to the Convention, the USSR has now joined approximately 75 other nations in agreeing to abide by those internationally accepted principles that have been in effect for industrial property rights protection since the Convention was adopted in 1883.

The Soviets have had to make a number of changes in their laws and regulations to bring them into conformity with Convention commitments, particularly on priority rights recognition. It appears that pertinent revisions have been made in the USSR patent and trademark laws to implement the Convention's provisions. The changes in the trademark law will be discussed later in detail. It is of interest to note that the USSR recently expanded the scope of its industrial property rights system by promulgating a "Law on Industrial Designs"[7] to supplement its patent and trademarks laws. We know that the Soviets have obtained patents and trademarks in Western countries in the post World War II period and that Western firms have applied for and obtained such rights in that country. Presently, however, there is little experience on which to base any meaningful projection as to the rights

[5] Industrial property rights are defined in the Convention as patents, utility models, industrial designs, trademarks, service marks, trade names, and indications of source or appellations of origin (Art. 1, Revision of 1958).

[6] The 1958 Revision, which is the latest in effect, to which most of the countries including the USSR adhere, incorporates this feature. Earlier revisions (1911, 1925, and 1934) to which some countries still adhere as their latest revision in force, still permit them to retain the "prior home registration requirement" if they so desire it.

[7] Council of Ministers Order (No. 535), July 9, 1965.

and protection which Westerners can expect to receive in the USSR. Soviet officials have given assurances that foreigners will be afforded competent enforcement of their industrial property rights and complete access to Soviet legal and judicial procedures.[8] Since the Soviets have shown an increasing interest in protecting their own technological advances abroad as well as in negotiating licensing agreements with the West,[9] it can now be hoped that, as Convention participants, they will be fully aware of the desirability of extending Western firms the same degree of protection they would expect their own nationals to be accorded under these internationally accepted principles.

Earlier Soviet Trademark Practices

Trademarks in the USSR have served primarily as factory identification and quality control symbols. Until enactment of the present trademark law in 1962, little attention was paid to their potential function as competitive sales and advertising devices and as distinctive identifications to enable prospective buyers to choose between similar goods made by different enterprises.

The earlier Soviet Trademark Law of 1936 established two classes of marks—production marks and trademarks. A production mark was obligatory on all manufactured goods, their containers or wrappers, and had to show the factory's name, location, State agency in charge of it, quality of its goods and its standard number. Certain factories producing military type goods were exempted from this requirement to avoid disclosures for security reasons. The other class of mark—the trademark—was similar to the form of protection provided by our own law. Adoption of such a mark by a factory or other producing enter-

[8] Soviet Delegate to the Geneva meeting of Paris Union members on March 15, 1965, in announcing his country's adherence to the Convention, stated: "In the USSR, foreigners have the right to apply to USSR courts and enjoy civil lawsuit rights. The protection of every civil right in the USSR is ensured in accordance with Article 6 of the Principles of Civil Legislation of the USSR and Union Republics, particularly by way of a reconstitution of the situation which had existed before the right was infringed, by the suppression of actions infringing another's rights, and by compelling the infringer of another's rights to compensate the damages caused by the infringement."

[9] Chairman of the USSR Council of Ministers Kosygin reporting on the 1966-70 Plan at the 23rd Party Congress (April 6, 1966) stated: "Until recently we tended to underestimate the importance of trading in patents and licenses. Such trade is playing an increasingly prominent role in the world today and is developing faster than commerce in industrial goods. Our scientific and technical personnel are able to create—and this has been proved in practice—up-to-date machines and equipment. We can and must, therefore, assume our due place in the world's license market. In some cases, we too could profit by purchasing licenses, rather than developing the problem concerned [sic] ourselves. . . ."

prise to distinguish an article was voluntary. Marks not registrable were those which were confusingly similar to marks already registered, those containing false or misleading connotations in relation to their goods, those simulating the Red Cross or Red Crescent and those too generally descriptive of the goods for which they were intended. Trademarks could be "graphic images, original names, combinations of letters, et cetera," and different marks could be used for different goods or the same mark for all goods produced by a factory. An enterprise, such as an exporting entity, dealing with goods produced by others, was also permitted to have and to use in connection with its sales, its own mark.

The registration system was originally decentralized into three categories—the People's Commissariat for Heavy Industry registered all marks used on machines, tools, building supplies and chemicals; the Commissariat for Public Health registered all marks used on medical supplies and instruments; and the Commissariat for Internal Trade registered marks used on other classes of goods. In 1959, the registration system was centralized in the State Committe for Inventions and Discoveries which, today, administers the patent and industrial design laws, as well as that on trademarks.[10] The earlier trademark law contained no use requirement but conditions were such that once a mark was registered it was put to use. The law permitted the owner of a registration to sue for infringement against unauthorized use of his mark on imported as well as on domestically manufactured products and to seek injunctions and recover damages in infringement cases. Actions could also be sought to invalidate a registration.

Under the 1936 law foreigners could register their marks in the USSR only if their home countries extended the benefits of their trademark laws to Soviet nationals. This was no bar so far as United States nationals were concerned since our trademark law makes no distinction as to nationality and enables a Soviet or any other national to apply for and receive trademark protection. The Soviet law also required a foreign applicant to have a prior home registration for his mark before it could be registered in the USSR. Registration was issued only for a term not exceeding the home registration.

This and earlier Soviet trademark laws were oriented toward identification and quality maintenance concepts. There appears to have been little attempt by the Soviets, before 1959, to make any significant changes in their trademark system to bring it more in conformity with international standards of practice and procedure. Long before the

[10] It is an "independent agency" reporting directly to the Council of Ministers.

Soviets joined the Convention, six Eastern European countries (Czechoslovakia, Bulgaria, Rumania, Hungary, Poland and Yugoslavia) were members of the Paris Convention and adherents to its international standards of trademark as well as patent protection. In the USSR, where articles have been produced in most part for industrial usage and for domestic consumption, the earlier trademark systems did little more than to force State enterprises to use certain markings on their goods so that liability could be established in cases of quality defects or faulty handling of goods.

Salient Features of Present Trademark System

The present law, which came into force in 1962, does not deal specifically with "production or factory marks" which characterize the 1936 law. But since such marks are not apparently abolished or repealed thereby, State production enterprises may still have to use them on their goods for identification and liability purposes if they do not otherwise see fit to develop and to use any registrable trademarks.

Scope of Present Trademark Protection

The law provides that "Every trademark shall, before it is used in the USSR, be subject to compulsory State registration with the State Committee for Inventions and Discoveries . . . ."[11] The owner of a registered mark is entitled to its exclusive use in the USSR.[12] The law is not clear on whether a non-registered mark may be used in the USSR, with no recognized exclusive rights therein, or whether no trademark whatsoever may be used unless it is first registered in that country. In the absence of any legal decisions or other official interpretations from the government, no further clarifying information is yet available. Trademarks are registered for the term indicated by the applicant up to 10 years from the application filing date.[13] Renewals also cannot be made for more than 10 years at a time.[14] The applicant is not obliged to show prior use of his mark in order to apply for and to receive a registration.[15] However, where there is a dispute over several applications on file for similar or identical marks, registration may be granted to the first applicant as determined by the date his application was received by the State Committee.[16]

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[11] See Appendix, "Union of Soviet Socialist Republics Law Concerning Trademarks," Art. 2.
[12] *Op. cit.*, Art. 4.
[13] *Op. cit.*, Art. 19.
[14] *Op. cit.*, Art. 20.
[15] *Op. cit.*, Art. 9.
[16] *Op. cit.*, Art. 11.

Soviet law includes protection for "service marks." Thus, in line with Paris Convention principles, the law provides for protection of marks used to identify services as well as to distinguish goods. A trademark is defined as "an artistic representation, original in its form" and can consist of "names and words, separate combinations of letters and figures, vignettes, different forms of packing, artistic compositions and drawings, whether combined or not with letters, figures, words, etc., ..."[17] Not registrable as trademarks are "marks commonly used to denote goods of a well-known kind (free marks)"; marks which constitute national emblems and insignia; marks of international organizations, including the Red Cross and Red Crescent; business-type summary information about the product and the applicant; marks containing false or misleading information about the manufacturer or geographic origin of the product; marks "conflicting with the public interest or the requirements of Socialist morality," and marks which conflict with international agreements to which the USSR adheres.[18]

Filing and Registration Particulars

The USSR Chamber of Commerce's Patent Bureau generally handles all filing and prosecution actions for foreigners' applications.[19] It requires an appropriate power of attorney and also collects the various fees charged by the government in addition to its own agency fees.

Since the USSR has ratified the Paris Convention, a trademark owner in the United States or any other Convention country is entitled to claim a six-month "right of priority" therein after a first filing of his trademark in another Convention country.[20] Soviet citizens, of course, have the same "priority rights" in this country on the basis of USSR Convention membership. The filing date of a foreigner's application in the USSR is determined by the date it was received by the State Committee.[21]

Applications are subject to examination and, if refused, the applicant is entitled to an administrative appeal.[22] There are no provisions for opposition. An application shall be refused if the mark applied for is similar to one already registered in the same class of goods or to one

[17] *Op. cit.*, Art. 1, 1st para.

[18] *Op. cit.*, Art. 1, 2nd para.

[19] Details on filing procedures and fees can be secured by writing directly to the Bureau at 6 Kuibyshev Ul., Moscow.

[20] *Op. cit.*, Art. 11, 2nd, 3rd, 4th paras.

[21] *Op. cit.*, Art. 11, 1st para.

[22] *Op. cit.*, Art. 16.

which is the subject of a previous application in the USSR on which a decision has not yet been made.[23] If the application is acceptable to the State Committee, the trademark is recorded in the State Register and a registration certification is granted entitling the registrant to the exclusive right to use his mark.[24]

Soviet law provides a preliminary examination system to persons desiring to know if their trademarks are registrable before they decide to file formal applications. Upon request by such person, the State Committee may examine his mark and certify whether it is suitable for registration. If the applicant is informed that he is entitled to the registration but fails to apply for it within three months after being so informed, the mark (or one similar to it) may be registrable to another applicant.[25]

Classification Procedures

The Soviets have established a classification system for trademark registrations. It consists of product classes 1 through 34 and service classes 35 through 42. The product classes are comparable to those in the present "International Classification System" adopted by a number of countries under the "Paris Union" framework. A separate application must be filed in the USSR for each class of goods.[26] The same mark may be registered in different classes by one party.[27] The restriction of rights by class appears to be quite rigid and susceptible to inequities.

Infringement Actions

The law prohibits the use of a trademark without the registrant's consent and enables him to seek injunctive action against its unauthorized use and damages for infringement.[28] Infringement action can presumably be taken against unauthorized use of a mark on imports. Civil law suits, including those on trademark infringements, are apparently within the jurisdiction of district (city) people's courts unless a higher court decides to have a case referred to it as the court of first instance. Few trademark infringement suits appear to have been filed in the USSR in recent years.[29]

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23 *Op. cit.,* Art. 15.
24 *Op. cit.,* Art. 17.
25 *Op. cit.,* Art. 18.
26 *Op. cit.,* Art. 9, 2nd para.
27 *Op. cit.,* Art. 8.
28 *Op. cit.,* Arts. 4 and 21.

Licenses and Assignments

A trademark registrant is permitted to license his mark. Licensing agreements, which must be entered in the State Register of Trademarks to be legal, must contain commitments by the parties that quality standards equivalent to or higher than those of the licensor will be maintained on the goods bearing the licensed mark.[30]

Ownership of a trademark registration can also be assigned (in which case the existing registration is voided and a new one issued) or trademark rights can otherwise be transferred by agreement. Such action must also be recorded in the State Register.[31]

Other Major Characteristics

There is no obligation to use a registered mark, but it would seem that most marks registered in the USSR are done so with the expectation of their eventual, if not immediate, use. The trademark registrations, renewals, licensing, assignment and transfer actions, which are required to be recorded in the State Register, are published by the State Committee in its *Bulletin of Inventions, Trademarks and Designs.*[32]

The law contains a reciprocity provision for foreign nationals, i.e., it applies only to those foreigners whose countries extend national treatment to Soviet citizens under their trademark laws.[33] This reciprocity provision, however, is no bar to United States filings since our trademark law, as mentioned earlier, makes no distinction as to nationality so far as rights of applicants to file for and secure registrations are concerned. Also, the principle of national treatment is established in the Paris Convention.

In the USSR, a State production or service enterprise can own one mark for use on all its goods or services, or a separate one for use on each type product it sells or type of service it renders.[34] Also, a

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29 In a most recent case involving a foreign mark, the Belgian-West German firm, Gevaert-AGFA N.V. of Antwerp, was subject to an infringement suit as a result of its use of AGFA in a Soviet trade fair. The suit was brought by an East German firm, Volkseigener Betrieb (VEB) Filmfabrik Wolfen, which had acquired an AGFA registration in the USSR in 1955. The Moscow City Court ruled in the case, in January 1966, that Gevaert-AGFA could not use its name in the USSR because AGFA had already been registered there by the East German firm. The Soviet Supreme Court upheld this verdict in a decision of April 28, 1966. (Reported in *The Journal of Commerce,* April 29, 1966.)

30 *Op. cit.,* Art. 23.

31 *Op. cit.,* Art. 22.

32 *Op. cit.,* Art. 25.

33 *Op. cit.,* Art. 26.

34 *Op. cit.,* Art. 5.

Soviet commercial enterprise, including an export organization, may use its own trademark in place of, or together with, the trademark of the manufacturer on goods handled by it or made to its special order.[35]

The present trademark law was approved by the State Committee for Inventions and Discoveries on June 23, 1962, and amended on May 4 and 19, 1965, to reflect changes needed to implement the Paris Convention. The amendments entered into force on July 1, 1965.

Trademarks and Soviet Trade

As the USSR continues to show an increasing interest in foreign trade and as American firms respond to President Johnson's appeal to build bridges to Eastern Europe,[36] the United States foreign trader may want to consider, among other things, what protection he should appropriately secure for his industrial property rights in the Soviet Union and how such rights might best be used to his business advantage.

Most American companies seriously interested in foreign trade register at least half their trademarks in the major Western countries primarily for protection rather than for income purposes. In many countries, as in the USSR, the first person to apply for a mark is entitled to its registration and to legal recognition of its exclusive use. Unlike the United States, the right to a trademark in the USSR does not arise out of a system of common law appropriation and use. It is based on registration, as previously noted.

The owner of a foreign mark who finds that someone else has already applied for or registered it in the USSR is faced with the problem of contesting the "pirated" application or registration. Should he decide not to contest it, or should he be unsuccessful in such action, he is then faced with possible foreclosure of his trademark in the Soviet market. More important, Soviet registrations of "pirated" marks may create problems for the rightful owner of the mark in third country markets, particularly in less developed areas.

Companies having an internationally used trademark (a "house mark," product or service mark) which they publicize abroad, find it highly desirable to register such a mark in every country where a possible sales interest or piracy problem may exist. Under the Paris Convention, member countries are required to protect "well-known"

[35] *Op. cit.*, Art. 7.

[36] Expressed in "State of the Union Message," January 12, 1966, and a White House luncheon on December 2, 1964, for officials of Radio Free Europe.

marks against registration by persons other than the rightful owners.[37] Past experience, however, has indicated that the term "well-known" is subject to a wide variety of interpretations among member countries. A mark widely used and registered abroad may not necessarily qualify as a "well-known" mark. Most companies engaging in foreign trade, therefore, find it desirable to register their most important marks for protection, in the first instance, rather than to rely on the Paris Convention premise that "well-known" trademarks shall be protected even in the absence of a registration.

The Soviets have shown considerable interest in technical interchanges and licensing agreements with the West. Many important steps have been taken by the USSR to develop favorable conditions for licensing activities—including changes in its industrial property system in recent years along lines more comparable to Western systems, creation of an agency specifically to handle licensing and other industrial property transactions with foreigners,[38] and the re-tailoring of patent, technical know-how and trademark provisions in its commercial agreements to conform more to Western standards of accepted protection. As noted earlier, foreign trademark filings and prosecutions are generally handled by the USSR Chamber of Commerce's Patent Bureau. The Chamber which, among other activities, represents various organizations interested in foreign-trade promotion, is one of the principal Soviet entities delegated responsibilities for making contacts with foreign business organizations. Also, administration of all industrial property rights laws, including trademarks, are coordinated within the framework of one agency—the State Committee for Inventions and Discoveries. Here, it is to be noted that trademark administration has not been relegated to any lesser agency than that responsible for administering the important laws pertaining to protection and utilization of inventions and technology.

It is likely that, in many instances, trademarks will be coupled closely to patents or know-how in the licensing of United States products to Soviet enterprises. In this connection, most licensing consultants in the United States strongly advise their clients, in the interest of their

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[37] Under this Convention, a member country must provide the rightful owner of a "well-known" mark registered to someone else, a period of at least five years from the date of such registration in which to seek its cancellation. After that time, however, it can prohibit a party from seeking such cancellation on grounds of being the rightful owner of the "well-known" mark.

[38] The USSR has established the All-Union Export-Import Association "Litsensintorg" to handle licensing transactions with foreigners. This agency, among other things, endeavors to interest foreigners in selling or licensing their industrial property to the USSR.

future safety as potential licensors as well as trademark owners, to register their marks in their own name abroad and to protect them as such.

Trademarks in Soviet Markets

Soviet imports from the West now run about $3 billion annually.[39] The USSR is primarily interested in purchasing machinery, equipment and other manufactured products from the West. Thus, trademark protection in the USSR can be significant to suppliers of these and other goods of the type that are generally trademarked to identify, advertise and guarantee them. The Soviets have never shown any great interest in importing consumer goods from the United States. They have been interested in purchasing machinery, transport equipment and other manufactured products from this country.

Foreign firms interested in the Soviet market, bearing in mind that imports are controlled by State trading organizations and that distribution is geared to State planning directives, may nevertheless look into various marketing techniques that might possibly be adapted to the USSR.

Advertising is now permitted in that country, not only in scientific and technical publications, but in newspapers and other media. Many well-known foreign firms have already used Soviet news media to advertise their trademarked products and to inform the planners and buying public of their quality and performance standards. There is no evidence to indicate how extensively these companies have built their advertising campaigns around trademarks but it is interesting to note that in the USSR the Soviet lawmakers themselves now recognize the role of trademarks in advertising. The first paragraph of the present trademark law emphasizes that the purpose of a trademark is not only to distinguish an enterprise's goods and services but "to advertise them."

Use of trademarks as important promotional devices may also be considered in international trade fairs and exhibitions in the USSR. The Soviet trademark law provides recognized protection for an unregistered trademark on goods displayed at such exhibitions should the applicant wish to file for its registration within six months after he puts the goods on display. In such instances, his application filing date is the date on which he first displayed his goods.[40]

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[39] U. S. Department of Commerce *Overseas Business Report* "Basic Data on the Economy of U.S.S.R." (April 1966).

[40] *Op. cit.*, Art. 11, 5th para.

CONCLUSION

In the USSR, where the distribution of goods and services is subject to a system of State directives, trademarks have served primarily as symbols of identification for guarantee and quality-control purposes. They have played a lesser role as tools for marketing, business promotion and "goodwill" development. Nevertheless, American businessmen interested in Soviet trade might consider applying for trademark registrations in the USSR for a number of reasons. A trademark registered in accordance with the law will establish a legally recognized form of protection subject to enforcement against unauthorized imitations, including those on imports. Also, such marks will be useful focal points around which to develop any market promotion that can be accomplished within the limitations of the Soviet system. Furthermore, such registered marks, entitled to exclusive use under Soviet law, will provide important identification for a firm's products imported into the USSR. Trademark registrations will also facilitate conclusion of licensing agreements in those product areas where "package deals," including patents and technical know-how, may be the only type of arrangements that can be negotiated.

The USSR has "Westernized" its trademark law and is participating in the world "Union" of countries which abide by internationally accepted principles of patent and trademark protection. So far, there is little experience on which to determine how successful American firms will be in protecting their rights in that country. The American businessman will have to consult carefully with his attorney and licensing adviser for guidance on the procedures to be followed in acquiring and maintaining the fullest possible protection available under Soviet law.

Table 1, which follows, shows United States trademark filings in the Soviet Union and other Eastern European countries. The increase in filings in the USSR since 1964 is undoubtedly due to anticipation of better trade opportunities, the greater flexibility in licensing provided by the new law, and the ratification of the International Convention by the USSR. In the past, many United States marks were filed through, and in the name of, Western European subsidiaries of United States firms to take greater advantage of trading opportunities. Since 1962, more United States firms are filing directly in the USSR. The only complete figures readily available on United States filings in Eastern Europe are those provided by the U.S. State Department's Authentication Office which, at the request of many foreign governments, authenticates on United States applications and related documents to be filed in their countries, the signature, ownership and residence of the United States applicants.

TABLE 1

UNITED STATES TRADEMARK APPLICATIONS FILED IN EASTERN EUROPE
(By Number of Filings)

Country of Filing	1964	1965	Jan. 1 to Mar. 31, 1966
USSR	139	202	98
Poland	11	16	3
Rumania	44	56	15
Hungary	66	75	16
Czechoslovakia	5	8	6
Bulgaria	41	52	17
Yugoslavia	4	6	0

Source: Department of State, Authentication Office

For comparison purposes, Table 2 contains figures on United States trademark application filings in other selected countries in 1964. These figures are taken from the latest statistics, published in 1966, by the International Bureaux for the Protection of Intellectual Property (BIRPI) in Geneva, which administers the Paris Convention. Lack of information on foreign filings reported by Eastern European countries and others to BIRPI precludes its publication of more complete statistics on these and other more important countries.

United States filings in the USSR and other Soviet Bloc countries are by no means numerically comparable to those for leading countries in Western Europe and other geographic regions. However, the potential magnitude of the Soviet market and USSR adherence to the Paris Convention may change this picture considerably in the next few years.

TABLE 2

UNITED STATES TRADEMARK APPLICATIONS FILED IN SELECTED FREE WORLD COUNTRIES
(By Number of Filings in 1964)

Country of Filing	
Western Europe	
United Kingdom	1,879
France	1,383
Germany	1,499
Belgium	823
Sweden	808
Switzerland	639[1]
Norway	527
Austria	434
Latin America	
Venezuela	652[1]
Colombia	463
Trinidad and Tobago	118
Far East	
New Zealand	626
India	484
Thailand	308
Malaya	235
Ceylon	228
Pakistan	168
North Africa and Middle East	
Israel	304
Lebanon	229
Iran	172
Morocco	135
United Arab Republic	161
Kuwait	98
Africa (Other)	
South Africa	747
Southern Rhodesia	162
Nigeria	300
Sudan	89
Ghana	87
Uganda	84

[1] Registrations

Source: *Industrial Property* (No. 2, February 1966) published by the United International Bureaux for the Protection of Intellectual Property (BIRPI) in Geneva, Switzerland.

APPENDIX (*Translation*) *

UNION OF SOVIET SOCIALIST REPUBLICS

LAW

Concerning Trademarks

Approved by the State Committee for Inventions and Discoveries of the USSR on June 23, 1962, as amended on May 4 and 19, 1965[1]

1.—A trademark or service mark is an artistic representation, original in its form (original names and words, separate combinations of letters and figures, vignettes, different forms of packing, artistic compositions and drawings whether combined or not with letters, figures, words, etc.), used to distinguish goods or services of one enterprise from similar goods or services of other enterprises, and to advertise them.

The following shall not be used as trademarks and cannot be accepted for registration:

(*a*) marks commonly used to denote goods of a well-known kind (free marks);

(*b*) State insignia, facsimiles, seals, stamps; control, guarantee or other marks; emblems of international organizations without the consent of the appropriate bodies; or marks containing a representation of the Red Cross or Red Crescent;

(*c*) representations consisting exclusively of a text containing information about the time of manufacture of the goods, the address of the enterprise, price, quantity, size, etc. Where such information supplements the basic representation of a mark, only the basic representation may be registered as a trademark, without the text. The text may be used together with the trademark but not on the representation of the mark itself;

(*d*) representations containing false information, or information capable of misleading a purchaser, about the manufacturer or the place of production (origin) of the goods;

(*e*) representations conflicting with the public interest or the requirements of Socialist morality;

(*f*) representations conflicting with international conventions to which the USSR is a party.

2.—Every trademark shall, before it is used in the USSR, be subject to compulsory State registration with the State Committee for Inventions and Discoveries of the USSR, in accordance with Order No. 442 of the Council of Ministers of the USSR, of May 15, 1962, "Concerning Trademarks".

3.—Trademarks cannot be used for liquid, gaseous, or loose and unconsolidated substances supplied or sold without packing, or for other goods exempted from all kinds of marking in accordance with State All-Union Standards (GOST) or technical specifications.

4.—An enterprise shall be entitled, in the territory of the USSR, to the exclusive use of a trademark or service mark registered in its name. The use of a trademark or service mark without the consent of the enterprise in the name of which it is registered is prohibited.

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[1]) The latest amendments came into force on July 1, 1965.

**Industrial Property*, monthly review of the United International Bureaux for the Protection of Intellectual Property (BIRPI), Geneva, Switzerland, (No. 11, November 1965), pp. 252-255.

5.—An enterprise (organization, or production associations thereof) shall be entitled to possess a single trademark (service mark) for all the goods it markets or all the services it renders, or to use different marks for various kinds of goods or services.

6.—An enterprise may also place trademarks or service marks registered in its name on technical drawings, prospectuses, accounts, forms, labels, and other documentation accompanying goods or connected with their distribution operations.

7.—A commercial enterprise (organization) shall have the right to place its own trademark instead of or beside the trademark of the manufacturing enterprise on goods handled by it or manufactured to its special order (from models), special formulae and prescriptions, etc. The same right shall be granted to foreign-trade organizations in respect of goods handled by them.

8.—Trademarks and service marks shall be registered for a definite class of goods (services). The same mark may be registered for different classes of goods (services) in the name of one enterprise (organization).

9.—State registration of trademarks and service marks shall be carried out by the State Committee for Inventions and Discoveries of the USSR on the basis of applications filed by enterprises (production associations of enterprises) and by organizations either directly or through agents duly authorized for the purpose. An application for registration of a trademark filed through an agent must be accompanied by a signed power of attorney in the prescribed form. Powers of attorney executed abroad must be duly legalized in consular offices of the USSR unless such legalization is not required by virtue of international treaties.

A separate application must be filed for each class of goods for which a trademark (service mark) is to be registered.

The application shall comprise the following materials:

(*a*) two copies of a declaration stating the full designation and postal address of the enterprise (organization) in the name of which the trademark is to be registered, and also the duration of the trademark registration;

(*b*) two copies of a complete list of the goods for which the trademark is to be registered, and an indication of the manner in which the mark is to be applied to the goods;

(*c*) twenty copies of a specimen and two copies of a description of the trademark;

(*d*) a receipt from the State Bank for payment of the prescribed application fee (2.50 roubles for each class of goods);

(*e*) one copy of a document certifying the hierarchical subordination of the enterprise.

If the trademark or service mark contains information concerning the origin of the goods, the applicant must append to the application one copy of an official document certifying the correctness of the information concerning the origin of the goods contained in the representation of the trademark.

10.—A trademark (service mark) submitted for registration in color shall be registered and protected only in that color. A trademark (service mark) submitted for registration without indication of color shall be registered in black and white and may be used in any color unless it repeats a similar mark registered in a specified color.

A trademark (service mark) of similar representation may not be registered in other color combinations for other goods of the same class in the name of other proprietors.

11.—The date of priority of an application for a trademark (service mark) shall be determined by the date on which the application is received by the State Committee for Inventions and Discoveries of the USSR. Applications may be sent by registered post. In case of dispute, the date of application shall be deemed to be the date of dispatch as fixed by the postmark, and for foreign applicants the date of dispatch to the State Committee by a patent agent domiciled in the USSR.

In the case of nationals of foreign countries and foreign legal entities, the priority of an application for a trademark, in conformity with the International Convention to which the USSR is a party, shall be established as the date of priority of the first lawfully valid application filed in a country which is also a party to the said Convention, provided that the application is filed in the USSR within a period of six months after that date.

Any person who wishes to avail himself of the priority established in accordance with the International Convention shall immediately, upon filing the application, make a statement to that effect, and shall indicate the date of priority and the country where the trademark was first filed.

The requisite certified copy of the foreign application and all other materials necessary for establishing the date of priority may be furnished later, but not later than three months from the date of filing of the application in the USSR.

The priority of an application for a trademark used on exhibits displayed in international exhibitions organized in the USSR shall be determined by the date on which the exhibit is put on display in the exhibition, provided that the application is filed not later than six months after that date.

12.—The State Committee for Inventions and Discoveries of the USSR shall examine all applications reaching it in order to ascertain that the documents comprised in the application and the representation of the trademark (service mark) submitted for registration satisfy the requirements of this Law.

13.—The State Committee for Inventions and Discoveries of the USSR shall be entitled to require an applicant to submit the additional materials necessary for its decision concerning the registrability of the trademark (service mark).

If the applicant does not submit the required additional materials within three months from the date on which he receives the request of the State Committee for Inventions and Discoveries of the USSR, the application shall not be considered.

14.—The State Committee for Inventions and Discoveries of the USSR shall notify the applicant of the decision to register the trademark (service mark) within one month from the expiration of a six-month period after the date of filing of the application or of receipt of the required additional materials.

In the event of refusal to register the trademark, the decision, together with the grounds therefor, must be communicated to the applicant within three months from the date of filing of the application or the date of receipt of the required additional materials, and, if the refusal is based upon the application of a national of a foreign country or a foreign legal entity, benefiting from an earlier priority, in accordance with the International Convention, within one month from the date on which the application is filed with the State Committee for Inventions and Discoveries of the USSR.

15.—The State Committee for Inventions and Discoveries of the USSR shall refuse to register a trademark (service mark) if the mark for which application is made for a specified class of goods is similar to:

(a) a trademark (service mark) registered in the same class of goods in the USSR;

(b) a trademark (service mark) for which an application has already been made in the USSR and on which no decision has yet been made.

16.—An applicant who disagrees with a refusal to register a trademark (service mark) may, within two months from the date on which he receives the decision, lodge with the State Committee for Inventions and Discoveries of the USSR an objection with the grounds therefor. The objection shall be accompanied by a receipt for payment of the prescribed fee (2.50 roubles for each class of goods).

The State Committee for Inventions and Discoveries of the USSR shall consider the objection within two months. The decision of the Chairman of the Committee or his Deputy shall be final.

17.—After reaching a decision to register a trademark (service mark), the State Committee for Inventions and Discoveries of the USSR shall enter the same in the State Register of Trademarks of the USSR and issue to the applicant a certificate granting him the right to the exclusive use of the mark.

Where a single trademark (service mark) is registered in the name of one and the same applicant for several classes of goods, a separate certificate shall be issued for each class.

Copies of the certificate granting the right to the exclusive use of the trademark may be issued only after presentation of an official announcement of the loss of the said certificate published in the local press, and, in the case of another loss, on presentation of documents confirming the loss of the certificate.

18.—An applicant may request the State Committee for Inventions and Discoveries of the USSR to conduct a preliminary examination of a trademark in order to determine whether its registration is possible. Such preliminary examination shall be conducted on submission of one copy each of the application, a specimen of the trademark, and a list of the goods in connection with which it is proposed to use the trademark, together with the receipt of the State Bank for payment of the prescribed fee (2.50 roubles for each class of goods).

If within three months from the date of dispatch to the applicant of the positive conclusion of the preliminary examination of the trademark an application for registration of the said trademark (service mark) has not been sent to the State Committee for Inventions and Discoveries of the USSR by the applicant, the mark (or marks similar to it) may be registered in the name of another applicant.

19.—Trademarks (service marks) shall be registered for the term specified by the applicant, but no longer than ten years, counted from the date on which the application reaches the State Committee for Inventions and Discoveries of the USSR.

20.—The term of validity of the certificate granting the right to the exclusive use of a trademark (service mark) may be extended for not more than ten years each time. The term of validity of a certificate shall be extended on application filed by the proprietor during the last year of validity of the certificate, but not later than six months after the expiry of this term.

An application for extension of the term of validity of a certificate shall be accompanied by:

(a) the original certificate granting the right to the exclusive use of the trademark;

(b) a receipt from the State Bank for payment of the application fee (2.50 roubles for each class of goods);

(c) a receipt for payment of the publication fee.

21.—During the term of validity of the certificate granting the right to the exclusive use of a trademark, the proprietor of the certificate may require, in the manner prescribed by law, the cessation of unlawful use of an identical or analogous trademark or service mark in connection with goods or services of the same class, and damages for any loss caused to him.

22.—The right to the exclusive use of a trademark (service mark) may be transferred from one enterprise (organization) to another on their reorganization, and/ or on assignment of the trademark (service mark).

In such cases, the certificate granting the right to the exclusive use of the trademark shall be cancelled and a new certificate shall be issued in its stead in the name of the new proprietor, who shall submit to the Committee within three months:

(*a*) a notarized copy of the deed or other document concerning the transfer of the right;

(*b*) the original certificate granting the right to the exclusive use of the trademark;

(*c*) a receipt for payment of the prescribed fee (2.50 roubles for each class of goods);

(*d*) a receipt for payment of the publication fee.

23.—An enterprise (organization) in the name of which a trademark (service mark) is registered shall be entitled to grant a license for full or partial use of its trademark to another enterprise (organization).

A license may be granted only on the condition that the license agreement provides that the quality of the goods of the licensee shall not be inferior to the quality of the goods of the proprietor of the trademark for which the mark was registered, and that the proprietor who has transferred the mark shall control the fulfillment of this condition.

The agreement to transfer the right to a trademark (service mark) or to grant a license must be registered with the State Committee for Inventions and Discoveries of the USSR.

Unless so registered, the agreement shall be invalid.

24.—The right to the exclusive use of a trademark shall lapse:

(*a*) on expiry of the term of its validity;

(*b*) in virtue of a declaration by the proprietor of the certificate that he waives his right to use the mark;

(*c*) on liquidation of the enterprise.

25.—A note of every registration of a trademark (service mark), extension of a term of validity, transfer of the right to a trademark, grant of a license, and change in the designation of the proprietor of a certificate, shall be entered in the State Register of Trademarks of the USSR and published in the *Bulletin of Inventions and Trademarks* issued by the State Committee for Inventions and Discoveries of the USSR.

The applicant shall pay 3 roubles for the publication of such a notice.

26.—Foreign legal entities and nationals of foreign countries shall, subject to reciprocity, enjoy the rights provided under this Law on equal terms with enterprises and organizations of the USSR.

Further Observations on Comparative Patent Yields from Government Versus Industry Financed R&D

BARKEV S. SANDERS*

SUMMARY

IN THIS INTERIM REPORT we have again considered comparative patent productivity of R&D expenditures by industry, using information obtained by the Senate Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary. The Subcommittee obtained the information by sending questionnaires to 120 prime contractors of the Department of Defense. As was indicated in a previous interim report (see footnote 1), only 78 companies returned the questionnaires and some of these failed to respond to all the questions. In the current report we have tried to explore the extent to which comparative patent productivity seems to be associated with:

A. Percentage of company production that is sold to the Federal Government. (This information was sought by the Subcommittee.)

B. The size of the company, obtained where available from Moody for 1959, in terms of: a. Aggregate net sales
b. Gross assets
c. Aggregate net profits
d. Number of employees

C. The Federal R&D grants for the fiscal years 1949 through 1959 as reported by the company.

D. Company R&D outlays during the fiscal years 1949 through 1959.

E. The ratio of item *C* to item *D*.

The analytic differential criteria used are:

1. The mean R&D dollar amounts per patent application, per patent granted, and per patent application still pending.

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Such means were obtained by dividing the federal R&D grants to each company by the specified frequency of patent activity attributed by the company to the federal R&D. These federal averages are then compared with averages obtained by dividing the company-supplied R&D by the respective frequencies of patent activity reported by the company, excluding those patent applications, grants, and pending patents attributed to federally-supplied R&D.

Comparative dollar expenditures per patent application, patent granted, and patent pending—given in Tables 2 through 6, and Tables 9 through 11—are composite weighted averages for groups of companies which supplied all of the information needed to compute each of the six sets of averages. In the text discussion, however, the averages used are weighted averages for groups of companies which supplied sufficient information to compute the specific average—that is, they are based as a rule on a larger number of companies included in the average.

2. The differential patent productivity ratio.

This ratio is obtained by dividing the mean expenditure of federal R&D expenditure by the corresponding mean company-supplied R&D expenditure per patent application, per patent granted, and per patent application pending, respectively.

Two types of differential ratios are shown in the tables, weighted and unweighted. The weighted ratios are obtained by dividing the mean from federally-financed R&D by the mean derived from company-financed R&D. This is equivalent to adding all the R&D dollars reported by the companies in a group and dividing these dollars by the sum of all the patent applications attributed by those companies to federally-suppplied R&D, and doing the same with all patents granted, and those pending, respectively. The unweighted ratios on the other hand were obtained by summing the individual company ratios for applications, grants, and pending patents, respectively, and dividing by the number of ratios summed. It should be stressed again that these ratios are limited to companies which supplied all the necessary information to compute the differential ratios shown.

The lower the differential ratio, the more favorable is the comparative patent productivity of federally-supplied R&D dollars. As the ratio increases, it reflects relative decline in comparative patent productivity of federally-supplied R&D dollars.

Summary Findings

The findings from present limited analyses suggest:

I. In general, there is some indication that companies which sell all or almost all of their production to the Government have a higher federal R&D expenditure per patent, i.e., show a larger differential ratio. The differential ratio is highest for companies which sell almost all of their production to the Government. There is a tendency for this differential ratio to decline with the declining fraction of company production sold to the Government—though there are frequent exceptions to this general rule. See Tables 1 and 2.

II. By and large, the largest corporations in our sample for which all the necessary information is supplied to obtain differential ratios have a comparatively smaller average differential. This is most discernible for companies grouped according to their aggregate net sales in 1959. There is a tendency for this ratio to become larger as company size declines. See Tables 3 through 6. This suggests that, in a relative sense, large corporations seem to be more productive from their federal R&D grants than smaller corporations, though there are many exceptions to this rule. See Tables 3 through 6.

III. There is no regular pattern of relationship between the amount of federal R&D grants given to various companies and the differential ratio of patent productivity of these companies. See Table 9.

IV. The most marked and consistent pattern of association is found between the amount of company-supplied R&D and the differential ratio. This ratio is lowest for companies with the largest company-supplied R&D funds and increases progressively and rather sharply with declining amounts of company-supplied R&D funds. See Table 10.

V. Companies with the largest relative excess of federal R&D funds, as compared with the company's own outlay for R&D, also show a consistent pattern of relationship between this ratio and the differential ratio for patent productivity. Companies with the highest federal R&D grants in relation to company R&D outlays have the highest differential ratios. That is, their relative patent productivity from their federal R&D funds is the lowest. As the ratio of federal R&D funds divided by company R&D funds declines, the patent productivity ratio also declines progressively and quite consistently.

The findings in Sections IV and V of this summary are consistent and tend to strengthen a conclusion arrived at in our earlier interim report based on a different type of analysis. That earlier finding reads:

"These relationships suggest that the 78 companies getting the lion's share of federal R&D, perhaps, do not represent the most skilled companies of the land—companies which would have the highest patent yield per unit of R&D dollars."[1]

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[1] Sanders, B. S., "Comparative Patent Yields from Government Versus Industry-Financed R&D," *IDEA,* Vol. 9 ,No. 1 (Spring 1965), p. 10.

This concurrence makes all the more important the need for new and independent data obtained specifically to test the validity, and to quantify the extent of this loss in patent productivity if the relationship is confirmed: that is, the Government's loss in that it fails to avail itself of the most knowledgeable of corporations with respect to the largest number of patent returns from R&D dollars. This loss would seem to be a consequence of the present attitude of the Federal Government with respect to company rights in patents resulting from federal R&D dollars.

IN A PREVIOUS INTERIM REPORT dealing with the question of comparative patent yields from Government-financed R&D versus the yield from industry-financed R&D, it was found that, on the average, in terms of dollar amounts, the patents flowing from privately-financed R&D were 13 times as numerous as those from Government-financed R&D.[2] This average ratio, however, varied widely from 1,735 to 1 at one extreme, to 0.4 to 1 at the other. This wide range of variation in the comparative ratio of R&D expenditures per patent would suggest that there may be many important contributing factors determining the number of patented inventions that might result from a given amount of R&D expenditure, whether such funds are supplied by Government or industry. To identify and quantify the causal contribution of the various factors which determine the flow of patents from a given outlay for R&D might not be possible. Nevertheless, it has seemed to us worthwhile to consider the apparent association between these comparative ratios and the few variables about which we have some information in order to discern to what extent these variables appear to be associated with comparative patent yield from Government versus industry-supplied R&D funds. We appreciate, of course, that even if we could demonstrate an apparent association favoring certain hypotheses, this would at best be only suggestive of a causal relationship.

One of the items on which the Senate Subcommittee on Patents, Trademarks, and Copyrights obtained information was the percentage of sales of company products made to the Government by each of the reporting companies.

PERCENTAGE OF SALES TO THE FEDERAL GOVERNMENT

It is of interest to see whether the comparative yield of patents resulting from Government-financed R&D, as against company-financed

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[2] *Op. cit.*, see especially Table 6, pp. 20-21, showing range of variation among the different companies.

R&D, is consistently different for companies which sell all or most of their products to the Government, as against companies which sell only a fraction of their production to the Government. The companies which sell all their products to the Government are what might be regarded as creatures of the Government and, as a result, some may not have R&D outlays of their own. In such cases only their mean Government-supplied R&D expenditures per patent can be compared with such expenditures per patent reported by other companies.

To test this relationship, in Table 1 we have arrayed 77 companies which supplied information to the Senate Subcommittee on the percentage of their sales to the Government. Having arrayed them in order of percentage of sales to the Government, we have divided the series into four sub-groups. Group I consists of 19 companies which sell all or almost all (96 percent or more) of their products to the Government. The average federally-supplied R&D expenditure-per-patent-received reported by these companies is \$8.742 million, and the average per patent received for company-supplied R&D funds is \$0.184 million.[3] To obtain a ratio reflecting the comparative yield, we must limit our consideration to those companies which supply all the needed information to obtain the respective ratios per patent applied for, patent granted, and patent pending, respectively.

These summary comparisons are given in Table 2. Our index of comparison in these tables would be a ratio obtained by dividing the mean federally-supplied R&D dollars—per patent applied for, granted, and pending—by the corresponding mean company-supplied dollars. Thus in Table 2, the ratio per patent application for Group I, column 8, is obtained by dividing \$3,347,682 in column 2, by \$72,952 in column 5. It follows, therefore, that the higher the ratio, the lower is the comparative productivity of Government R&D dollars vis-a-vis company-supplied R&D funds. For instance, in Table 2, Group I, column 9 indicates that the average Government R&D dollars spent per patent granted was more than 51 times the average from company-supplied

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[3] These averages are based on all companies which supplied sufficient information to enable computation of the average expenditure from Government or company-financed R&D. They may differ from the averages shown in Table 2, where the information supplied is based only on those companies giving the necessary information both for Government R&D expenditure and patents flowing from it, as well as the company-supplied R&D funds and the patents attributable to that. It should be observed, however, that the relative contrast is not markedly different, since much of the data used for both summaries are the same, even though the averages in Table 2 are based on a more restricted group of companies. The average corresponding to the \$8.742 million is \$9.345 million in Table 2, and that to \$0.184 million is \$0.183 million.

TABLE I

CORPORATIONS REPORTING, ARRAYED ACCORDING TO THE PERCENTAGE OF THEIR SALES TO THE FEDERAL GOVERNMENT SHOWING FEDERAL AND CORPORATION-SUPPLIED R&D EXPENDITURES FOR THE YEARS 1949-1959, PATENT ACTIVITY IN THESE YEARS, AND COMPARATIVE PATENT YIELDS FOR PATENT APPLICATIONS, PATENTS GRANTED, AND PATENTS PENDING, FROM FEDERALLY AND COMPANY-SUPPLIED R&D FUNDS, RESPECTIVELY.

Rank (1)	Corporations (2)	% of Sales to Gov. (3)	Fed. R&D Dollars (4)	Patents from Federal R&D			Co. R&D Expend. (8)	Patents from Company R&D			Differential Patent-Yield Ratios, per Patent:		
				Appli. (5)	Granted (6)	Pend. (7)		Appli. (9)	Granted (10)	Pend. (11)	Appli. (12)	Granted (13)	Pend. (14)
	GROUP I												
1	Cont. Aviation	100	$51,781,838	38	19	16	$3,143,766	38	19	15	16.5	16.5	15.4
2	The Marquardt Corp.	100	99,524,611	26	5	15	103,277	23	9	8	852.5	1,734.6	514.0
3	Space Tech. Lab.	100	109,297,000	1	0	1	76,000	0	0	0	—	—	—
4	Aeronutronic Systems	99	23,900,000	0	0	0	700,000	9	1	8	—	—	—
5	Melpar, Inc.	99	124,475,000	30	10	18	None	38	20	5	—	—	—
6	North American Avi.	99	1,975,000,000	391	172	191	15,000,000	462	194	180	155.6	148.5	124.1
7	Astrodyne	99	—	0	0	0	475,000	0	0	0	—	—	—
8	Aerojet General	98.9	689,745,717	328	25	203	3,596,833	112	27	68	65.5	207.1	64.2
9	Grumman Aircraft	98.6	80,225,572	5	5	0	38,960,360	8	1	6	3.3	.4	—
10	Aeronca Manufacturing	98	258,992	0	0	0	884.916	6	4	2	—	—	—
11	Interstate Electronic	98	14,402,000	0	0	0	None	0	0	0	—	—	—
12	Sanders Associates	98	25,900,000	20	12	8	1,250,000	116	49	47	120.2	84.6	121.7
13	Martin Co.	97.4	739,254,000	120	79	41	9,064,000	99	42	57	67.3	43.4	113.4
14	Northern Ordnance	97	26,365,000	6	0	6	46,897	5	5	0	468.5	—	—
15	Radiation, Inc.	97	31,749,000	7	3	4	690,000	28	11	17	184.1	168.7	195.6
16	Hughes Aircraft Co.	96.6	800,000,000	458	174	225	28,400,000	485	192	209	29.8	31.1	26.2
17	All American Eng.	96.4	25,600,000	65	44	21	148,000	—	—	—	—	—	—
18	Bell Aircraft Corp.	96.3	69,960,148	18	12	?	5,594,989	81	33	?	56.3	34.4	—
19	Stavid Eng., Inc.	96	34,094,840	3	3	0	20,000	2	2	0	1,136.5	1.136.5	—
	GROUP II												
20	Computer Control	95	$ 2,074,589	0	0	0	$ 362,383	6	1	0	—	—	—
21	Hazeltine Corp.	95	50,894,000	87	77	—	5,442,000	291	182	—	31.3	22.1	—
22	Boeing Airplane Co.	94.5	76,635,361	27	23	3	68,057,238	297	206	92	12.4	10.1	34.5
23	Hayes Aircraft	93.6	14,664,748	1	0	1	944,090	2	1	1	31.1	—	15.5
24	Acoustica Associates	90	3,520,600	5	0	5	500,000	17	0	17	23.9	—	23.9
25	Airborne Instruments	90	67,800,000	13	10	3	footnote[1]	22	10	12	—	—	—
26	Air Logistics	90	100,000	0	0	0	2,500,000	40	18	15	—	—	—
27	Cont. Electronics	90	30,000,000	1	1	0	500,000	10	5	3	600.0	300.0	—
28	Northrop Corp.	90	414,178,815	361	328	33	10,241,105	74	51	23	8.3	6.3	28.2
29	Brown Eng. Co.	87.5	8,789,213	0	0	0	None	0	0	0	—	—	—
30	United Aircraft	86.3	502,000,000	278	171	85	616,000,000	524	271	203	1.5	1.3	—
31	Land Air, Inc.	85	5,522,461	1	1	0	3,000,000	8	5	2	14.7	9.2	2.0
32	Lockheed Aircraft	84	282,851,000	7	7	0	145,000,000	356	207	116	99.2	57.7	—
33	Collins Radio Corp.	84	110,000,000	215	131	65	35,000,000	273	165	22	4.0	4.0	—
34	Ryan Aeronautical	82.8	52,680,000	18	6	10	?	59	19	25	—	—	1.1
35	Fairchild Eng.	82.5	86,653,039	17	11	5	13,308,508	26	14	12	10.0	8.3	15.6
36	Thiokol Chemical	81	254,030,808	39	0	38	3,527,122	40	15	17	73.9	—	32.2

37	Atlantic Research	80	13,681,244	34	13	19	1,710,315	12	1	10	2.8	.6	4.2
38	The Garret Corp.	79	12,886,618	25	18	8	10,776,040	312	131	158	14.9	8.7	23.6
	GROUP III												
39	Douglas Aircraft	78	$31,468,253	19	12	6	$31,742,990	213	87	60	11.1	7.2	9.9
40	Vitro Corp. of Amer.	71.5	40,904,941	42	22	11	3,002,839	34	12	14	11.0	7.4	17.3
41	Curtis Wright	71.3	135,935,250	73	20	38	33,591,260	331	112	164	18.4	22.7	17.5
42	Thompson Ramo	70.4	139,731,000	80	15	63	78,822,000	913	412	434	20.2	48.7	12.2
43	General Precision	70	—	—	—	—	—	—	—	—	—	—	—
44	American Bosch Arma	66	198,302,000	55	20	31	1,854,000	207	85	72	402.6	454.6	248.4
45	IT&T	63	265,129,696	321	218	92	120,137,000	2,389	1,040	874	16.4	10.5	21.0
46	Cook Electric Co.	60	44,000,000	40	14	?	500,000	60	21	?	132.0	132.0	—
47	Raytheon Co.	59	325,000,000	376	212	112	38,000,000	973	568	294	22.1	22.9	22.5
48	Texas Instruments	52	11,900,000	19	5	8	18,000,000	299	107	132	10.4	14.2	10.9
49	Goodyear Aircraft	50	116,750,000	50	16	20	6,594,000	18	17	4	6.9	18.8	3.5
50	PRD Electronic	50	10,000,000	28	17	7	650,000	0	0	0	—	—	—
51	Avco Corp.	45	336,590,866	71	25	46	25,000,000	228	144	48	43.2	77.6	14.1
52	Sperry Rand Corp.	42	854,272,580	488	252	225	132,522,231	1,528	924	432	20.2	23.6	12.4
53	Bendix Corp.	37.5	—	287	?	?	—	2,438	?	?	—	—	—
54	American Machine	36.5	86,300,000	22	10	12	44,000,000	474	297	126	42.3	58.3	20.6
55	Emerson Electric	36	13,500,000	11	3	2	5,100,000	18	12	6	4.3	10.6	7.9
56	R. G. LeTourneau	35	4,768,908	0	0	0	20,000,000	130	78	14	—	—	—
57	Sangamo Electric	35	3,123,977	0	0	0	5,000,000	24	13	11	—	—	—
	GROUP IV												
58	ACF Industries	31	$ 41,466,000	43	6	37	$ 12,478,000	440	251	140	34.0	139.0	12.6
59	IBM	27.3	253,653,929	406	68	312	184,055,064	2,090	817	1,157	7.1	16.6	5.1
60	General Electric	25	1,500,000,000	804	471	258	1,370,000,000	8,153	5,189	1,642	11.1	12.1	7.0
61	Arthur D. Little	24.3	21,920,000	45	14	26	68,260,000	235	103	137	1.7	2.4	1.7
62	Western Electric	24.3	760,000,000	419	247	160	576,988,000	1,086	799	204	3.4	4.3	1.7
63	Sylvania Electric	24	222,000,000	145	65	67	footnote[2]	1,479	495	758	—	—	—
64	Telemeter Magnetics	23.4	2,222,000	0	0	0	431,000	10	1	8	—	—	—
65	Motorola	21.8	73,100,000	31	12	18	53,500,000	541	365	123	2.4	41.6	9.3
66	RCA	20.2	275,486,000	244	43	119	324,406,000	5,269	2,592	1,271	18.3	51.2	9.1
67	Westinghouse Electr.	19.6	249,693,185	262	123	74	1,013,086,815	5,166	3,165	1,123	4.9	6.3	3.7
68	Litton Industries	16.6	32,300,000	51	29	20	7,000,000	384	253	92	34.7	40.3	21.2
69	Universal Watch	10.0	21,288,466	—	—	—	3,000,000	50	45	5	—	—	—
70	Chrysler Corp.	8.5	97,000,000	19	12	3	447,000,000	575	318	166	6.6	5.8	12.0
71	General Motors	7.9	334,094,021	447	265	140	1,646,946,000	6,163	3,812	1,670	2.8	2.9	2.4
72	Olin Mathieson	6.3	35,767,000	298	44	224	65,931,000	1,042	392	470	1.9	4.9	1.1
73	American Standard	5	4,800,000	5	4	0	30,400,000	415	191	124	13.1	7.5	—
74	Eastman Kodak	4.5	69,496,301	40	14	25	324,023,000	2,733	1,686	762	14.7	25.7	6.5
75	Hercules Powder	3.7	19,610,686	24	5	?	82,877,000	923	462	?	9.1	21.9	—
76	Clevite Corp.	2.4	15,454,000	42	28	14	27,033,000	267	99	98	3.6	2.0	4.0
77	Rohm & Haas	1.1	16,444,900	23	2	17	56,686,726	1,115	665	347	14.1	96.5	5.9

[1] Paid by customer.
[2] 6% of non-military sales.

R&D funds. It follows, therefore, that as the ratio in columns 8 through 13 increases, the comparative productivity of Government-supplied R&D monies drops, and if the ratio declines, the converse occurs.

The mean ratios for companies which sell all or almost all of their product to the Government (Group I companies) are about 46 to 1 for patents applied for, 51 to 1 for patents granted, and 40 to 1 for patents pending. On the face of it, these companies show a much lower average comparative patent yield from federally-supplied R&D money in comparison to the over-all ratios when all the responding companies are combined. The latter ratios are approximately 11 to 1, 13 to 1, and 7 to 1, for patents applied for, granted and pending, respectively (see last line in Table 2).

The average ratios of yield for companies which sell almost all of their production to the Government are weighted in terms of dollar amounts involved, and are shown in Table 2, columns 8 through 10. The average disparity in yields without weighting are comparatively much greater, as may be seen in Table 2, columns 11 through 13. This difference would indicate that the highest disparity in yields from Government-financed R&D versus company-financed R&D is found among companies with smaller R&D expenditures, especially company supplied R&D expenditures.[4]

In terms of the average ratios, the association between selling all or almost all of the product to the Government and an unfavorable yield ratio of Government-supplied R&D funds expended per patent seems marked, but not strongly so when one considers the individual companies. As shown in Table 1, the ratios in this first group range from 1,735 to 1, to 0.4 to 1. This is the full range of the entire observation. The association between percentage of sales to the Government and unfavorable ratios, while suggestive, does not seem to be based on a

[4] This is in general borne out. Correlating the rank order of companies according to their differential yield (from highest to lowest) with the ranking by the amount of company-supplied R&D funds (from lowest to highest) gives a rank order coefficient of .78, i.e., the companies with minimal R&D expenditure of their own show the highest differential yield, seen by the larger ratios in Table 2. Conversely, correlating the rank order of companies according to their differential yield with the ranking companies on the basis of federally-supplied R&D (from smallest to largest) gives a small but negative coefficient (—.17) which is consistent with our interpretation. On the other hand, there is a positive rank correlation between companies arrayed according to their own R&D expenditures and those received from the Government. This coefficient of correlation is .45. This suggests that the major factor accounting for the high differential in this group appears to be the relatively high patent yield from the R&D amounts spent by these companies from their own funds.

TABLE 2

Companies Grouped According to Percentage of Their Sales to the Federal Government Showing Average Federal and Private R&D Expenditures Per Patent Application, Patent Granted and Patent Pending, Also Average Comparative Federal R&D Patent-Yield Ratios for Each Group; Weighted by Dollar Amounts, and Unweighted.

Groups by % sales to Government	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios: Weighted averages			Differential-yield ratios: Unweighted averages		
(1)	Appli. (2)	Granted (3)	Pend. (4)	Appli. (5)	Granted (6)	Pend. (7)	Pat. Appli. (8)	Pat. Granted (9)	Pat. Pend. (10)	Pat. Appli. (11)	Pat. Granted (12)	Pat. Pend. (13)
Group I—96-100%	3,347,682	9,345,887	6,601,544	72,952	182,565	165,212	45.9	51.2	40.0	263.0	327.8	146.8
Group II—79-95%	1,693,710	2,381,169	6,903,814	400,729	720,243	1,318,997	4.2	3.3	5.2	66.3	38.9	18.1
Group III—35-78%	1,544,352	3,040,276	3,824,186	72,014	143,679	210,062	21.5	21.2	18.2	54.4	64.9	32.2
Group IV—0-34%	1,187,171	2,741,534	2,614,304	171,855	297,311	651,167	6.9	9.2	4.0	10.8	28.3	6.9
Total	1,757,710	3,684,832	4,156,685	163,459	292,383	575,560	10.8	12.6	7.2	88.2	102.3	40.8

firm foundation—it could be fortuitous—since there is no strong internal consistency within each group.

The second group includes companies which sold anywhere from 79 to 95 percent of their production to the Government. The average expenditure of Government R&D funds per patent by these companies is considerably less than for the first group; $2.496 million, as against $8.742 million. The average company-supplied R&D expenditure per patent of these companies is considerably greater than that for the first group; $0.704 million, versus $0.184 million. Turning to the ratios of these expenditures, again limited to companies which supplied all the necessary information to obtain these ratios, the weighted differential ratios for this second group are the lowest of all; 4 to 1, 3 to 1, and 5 to 1, for patent applications, patents granted and patents pending, respectively (as shown in Table 2, columns 8 through 10). In relation to these weighted ratios, the unweighted ratios are less favorable to the Government. This again suggests a more favorable ratio, as far as yields from Government-financed R&D is concerned, from companies with relatively large Government R&D allocations.

Considering the range of ratios for the individual companies, Table 1 shows considerable disparity. The range in ratios for patents granted is from 300 to 1 at one extreme, to .6 to 1 at the other. Comparatively speaking, however, this spread in the ratios is narrower than for the first group, for which the range was 1,735 to 1 at one extreme, to .4 to 1 at the other.

Group III includes corporations which reported 35 to 78 percent of their sales to the Government. For these corporations the average federally-supplied R&D funds per patent granted was $3.040 million, and the average for company-supplied R&D funds per patent granted was $0.144 million (the lowest average of all). The average differential in yield for these companies is intermediate to those shown for the previous two groups with a higher percentage of sales. The differential average yields for this group are 21 to 1, 21 to 1, and 18 to 1, for patent applications, patents granted, and patents pending, respectively. The unweighted ratios are again less favorable to the Government in terms of comparative yields. This is consistent with our general observation for all groups.

Considering the range in the ratios for individual companies in this group, we find it to be 455 to 1 at one extreme, and 7 to 1 at the other—still a wide range.

Turning to the last group—companies which reported less than a third, and some much less, of their sales to the Government—the average federal R&D expenditure per patent granted by these companies was $2.786 million. The average expenditure per patent of company-supplied R&D funds was $0.290 million. The ratios of patent production costs based on company R&D funds related to that based on federally-supplied R&D funds are 7 to 1, 9 to 1, and 4 to 1, for patents applied for, granted, and pending, respectively. These ratios are relatively more favorable to the Government than are the overall ratios shown in Table 2. The unweighted averages are again less favorable. This is consistent with our general observation of a more favorable federal yield from larger corporations, as compared to smaller corporations, as measured by the size of R&D expenditures reported. Considering the individual ratios shown in Table 1 for patents granted, they range from 139 to 1 at one extreme to 2 to 1 at the other. This shows a narrower range than for any other group.

It would seem that there is some association in which we are interested between percentage of sales to the Government and the comparative patent yield from federally-supplied R&D funds, but the association is comparatively weak and nonlinear in nature. The most favorable ratios, as far as Government R&D expenditure is concerned, are found among companies in Group II, followed by companies in Group IV (the latter sell a third or less of their production to the Government). The lowest comparative yield is found for Group I (companies selling almost all of their production to the Government), followed by Group III. However, in each group there are frequent exceptions to the rule indicating that if there is any causal relationship, it is not too strong since other factors neutralize or reverse the interrelationship.

In each of the four groups, the differential yield adverse to the Government is much more marked if the ratios are averaged without weighting them by the dollar amounts involved in the aggregate R&D amounts. This suggests a yield ratio less favorable to Government-supplied R&D funds in companies with large R&D funds as compared to those with small amounts involved, and especially companies with large disparity in their Government-financed versus company-financed R&D. Thus, companies in Group II with the highest private expenditure per patent have the lowest differential, while companies with the highest governmental funds—in Group I—show the greatest differential, i.e., lower relative patent productivity from Government-financed R&D.

Even though the relationship between differential patent yield and the proportion of production sold to the Government appears to be nonlinear, the rank order of companies shown in Table I was correlated with the rank order of comparative patent yield least favorable to the

Government. The coefficient of correlation between these ranks were .51 for patent applications, .26 for patents granted, and .66 for patents pending . This would seem to suggest that companies dealing largely, if not exclusively, with the Government tend to spend a larger amount of federally-supplied R&D funds per patent than company-supplied R&D funds. Before leaving this discussion, it should be noted that if we were to consider the unweighted differential ratios as shown by columns 11 through 13 of Table 2, we find a more consistent pattern of linear relationship between comparative patent-yield ratio and percentage of company production sold to the Government. In all three of these columns (11, 12, and 13) the highest ratio (least favorable to the Government) is found among companies which sell almost all of their production to the Government, and the lowest ratio (most favorable to the Government) among those companies selling less than one third of their production to the Government. For column 11, the ratio for comparative yield in terms of patent applications, the gradient is linear. There is, therefore, some general negative association between comparative patent yield and proportion of product sold to the Government. Companies which sell all or most of their production to the Government show a higher ratio than companies which sell only a fraction of their products to the Government. This association, however, is not so strong as to eliminate exceptions and suppress other influences. This may be seen from Table 1, as well as Table 2. While average dollar expenditure per patent in terms of Government R&D funds shows some downward trend with declining percentage of sales to the Government (Table 2, columns 2 through 4), there is no such regularity in the average expenditure per patent from company-supplied R&D funds with decreasing percentage of sales to the Government (Table 2, columns 5 through 7).

Volume of Sales

Our second inquiry is to relate the comparative patent yield from Government-financed R&D to yield from industry-financed R&D for companies arrayed according to their total sales in 1959. The information on the volume of sales in dollars was obtained from *Moody's Industrial Manual.* Companies for which the volume of sales was reported were arrayed and divided into four groups. On the average, companies for which this information was not supplied were deemed to be those with the smallest sales in comparison to those listed; so they are considered to represent a fifth group, having the smallest 1959 sales among the companies represented in our list. The detailed table, comparable to Table 1, is not shown. Instead, Table 3 gives a summary of

TABLE 3

COMPANIES GROUPED ACCORDING TO THEIR NET SALES IN 1959, SHOWING AVERAGE FEDERAL AND COMPANY R&D EXPENDITURES PER PATENT APPLICATION, PATENT GRANTED AND PATENT PENDING, ALSO AVERAGE COMPARATIVE FEDERAL R&D PATENT-YIELD RATIOS FOR EACH GROUP WEIGHTED BY DOLLAR AMOUNTS AND UNWEIGHTED—GROUP V, COMPANIES WITH NO SALES REPORTED IN *Moody*.

Groups by aggregate net sales reported in *Moody* or non-reported	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios					
							Weighted averages			Unweighted averages		
	Appli.	Granted	Pend.	Appli.	Granted	Pend.	Pat. Appli.	Pat. Granted	Pat. Pend.	Pat. Appli.	Pat. Granted	Pat. Pend.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Group I	1,810,405	3,615,672	4,462,073	189,659	329,280	705,259	9.5	11.0	6.3	24.5	25.2	17.0
Group II	1,716,967	3,928,876	3,874,213	83,806	167,749	222,564	20.5	23.4	17.4	24.4	43.3	30.3
Group III	1,546,411	3,256,217	3,236,479	56,718	107,500	174,054	27.3	30.4	18.6	55.2	73.9	34.9
Group IV	1,242,565	2,227,110	3,678,437	35,588	72,808	117,540	34.9	30.6	31.3	197.4	274.1	127.5
All Listed Corps.	1,737,790	3,584,647	4,168,642	164,017	292,172	583,007	10.6	12.3	7.2	65.6	86.6	42.6
Group V	2,024,675	5,430,768	4,025,898	134,826	306,181	322,045	15.0	17.7	12.5	280.4	294.8	14.5
Total	1,757,710	3,684,832	4,156,685	163,459	292,383	575,560	10.7	12.6	7.2	88.2	102.3	40.8

it. As in Table 2, Table 3 is limited to companies for which all the information is supplied for obtaining the comparative yield ratios for patent applications, grants, and those pending, respectively.

The first group consists of 16 companies with the highest aggregate of sales in 1959. The average Government-supplied R&D expenditure per patent granted to these companies is $3.616 million, as compared to an average of $0.329 million on the basis of company-supplied R&D funds. These averages, unlike those shown in Table 3, include all the companies for which an average expenditure per patent could be determined. Turning to Table 3, which is restricted to companies for which all the information is available to compute the comparative ratios, the approximate weighted differential-yield ratios for these companies with the highest sales are approximately 10 to 1, 11 to 1, and 6 to 1, for patent applications, those granted, and pending, respectively. The corresponding average ratios without weighting are appreciably higher, as seen in Table 2. The averages in differentials for Group I are not markedly below the overall averages.

For the second group of companies, the average expenditure per patent is $3.890 million for the Government-financed R&D, and $0.168 million for industry-financed R&D. The comparative productivity of Government R&D funds is considerably lower for this group as compared to the first group. The ratios, instead of being 10 to 1, 11 to 1, and 6 to 1 (Group I), are 20 to 1, 23 to 1, and 17 to 1 (Group II) for patent applications, patents granted, and patents pending, respectively. Inspection of Table 3 shows that the unweighted average ratios for this group are not much higher than those in Group I. In fact, for patent applications, the unweighted ratios are about the same.

For the third group of companies, the average expenditure per patent is about the same as for the other two groups as far as Government R&D dollars are concerned—$3.701 million—but appreciably lower for the company expenditures—$0.106 million. The differential-yield ratios are less favorable to the Government for this group. In other words, there is a progressive increase in the differential ratio with declining rank in sales. The weighted average ratios are 27 to 1, 30 to 1, and 19 to 1, for patent applications, grants, and those pending, respectively. As usual, the unweighted ratios are appreciably higher.

The fourth group of companies, those with the smallest volume of sales reported, show an average expenditure per patent granted of $1.972 million, which is the lowest of all such averages, and $0.073 million of private R&D—which is again lower than for any group in this table. The differential ratio for these companies is highest of all, being

35 to 1, 31 to 1, and 31 to 1, for patents applied for, granted, and pending, respectively. The unweighted differentials are much higher, remaining consistent with the general pattern that we have already observed.

Group V companies, for which no sales information was supplied, do not fit in the continuum. The average Government expenditure per patent granted for these companies is by far the highest of all, $5.541 million; although the average company expenditure per patent granted for this group (Group V) is not radically different from that for companies with known amounts of sales (Groups I-IV) –$0.306, and $0.292 million, respectively. The average for Group V is only somewhat less than that for Group I, i.e., $0.329 million.

The weighted average differential ratios also fail to maintain the observed increase in the differential ratios unfavorable to Government R&D expenditures. These ratios are 15 to 1, 18 to 1, and 12 to 1, for patent applications, those granted, and pending, respectively. These ratios are lower than the ratios for companies in Groups II, III, and IV, though somewhat higher than the aggregate weighted ratios for all corporations with reported sales—11 to 1, 12 to 1, and 7 to 1. In terms of unweighted ratios, however, for patent applications and grants the ratios for this group are the highest—though not for patents pending. It would seem that for companies with known amounts of sales, the differential in favor of company-financed R&D vis-a-vis Government-financed R&D improves with declining volume in sales. This does not hold true for companies for which no sales are reported—if these are, in fact, companies with the smallest sales, as we have assumed. In other words, the largest companies on the basis of volume of sales generally have a lower differential patent yield from their Government R&D funds than do smaller companies.

Company Assets

Company assets bring into operation certain attributes of companies separate and distinct from the volume of sales, although unquestionably there would be a high degree of correlation between relative company sales and company assets. The rank coefficient of correlation between company sales and assets is .97 for companies in our sample reported in Moody for 1959.

The information on assets was again taken from Moody, and there was a residual group of companies on our list for which this information was not supplied. The companies with reported assets in 1959 were arrayed from the highest to the lowest and then divided, as before, into

TABLE 4

Companies Grouped According to Their Gross Assets in 1959, Showing Average Federal and Company R&D Expenditures Per Patent Application, Patent Granted and Patent Pending, Also Average Comparative Federal R&D Patent-Yield Ratios for Each Group Weighted by Dollar Amounts and Unweighted—Group V, Companies with No Assets Reported in *Moody*.

Groups by gross assets reported in *Moody* or non-reported	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios: Weighted averages			Differential-yield ratios: Unweighted averages		
(1)	Appli. (2)	Granted (3)	Pend. (4)	Appli. (5)	Granted (6)	Pend. (7)	Pat. Appli. (8)	Pat. Granted (9)	Pat. Pend. (10)	Pat. Appli. (11)	Pat. Granted (12)	Pat. Pend. (13)
Group I	1,428,353	3,076,452	3,288,493	197,437	339,437	741,822	7.2	9.1	4.4	14.8	16.6	7.9
Group II	2,678,527	5,318,988	6,503,628	66,239	130,694	181,956	40.4	40.7	35.7	35.4	50.0	36.1
Group III	1,649,309	3,168,134	4,452,305	87,361	184,535	251,112	18.9	17.2	17.7	53.2	65.9	41.6
Group IV	1,270,855	2,534,321	2,965,298	28,235	54,223	87,879	45.0	46.7	33.7	182.6	260.6	113.1
All Listed Corps.	1,737,790	3,584,647	4,168,642	164,017	292,172	583,007	10.6	12.3	7.2	65.6	86.6	42.6
Group V	2,024,675	5,430,769	4,025,898	134,826	306,181	322,045	15.0	17.7	12.5	280.4	294.8	14.5
Total	1,758,184	3,684,832	4,156,685	163,459	292,383	575,560	10.8	12.6	7.2	88.2	102.3	40.8

four groups. Companies for which no assets were reported were deemed to consist primarily of those with smallest assets, and to represent a descending order in this respect. The analysis of companies ranked according to assets in relation to their comparative patent yields from Government versus company-financed R&D follows the pattern already developed. Again we deemed it unnecessary to give the detailed information for each company. We have shown in Table 4 merely the summary characteristic in patent productivity relative to Government and company-financed R&D.

The mean expenditure of Government R&D funds per patent granted is: $3.076, $5.257, $3.221, $2.203, and $5.541 million, for companies with largest assets, down to those with no assets, as reported in Moody. This relationship suggests no linear gradient. The overall average for all companies with listed assets is $3.582 million, considerably below the average for the fifth group—companies not reported by Moody. But there is no suggestion that companies with the smallest assets have higher unit cost, since Group IV—those companies with the lowest reported assets—has also the lowest average dollar input per patent, with $2.203 million. Companies in Group II have the second highest, with $5.257 million.

With respect to company-supplied R&D expenditure per patent, the averages are $0.197, $0.066, $0.087, $0.028, and $0.135 million for Groups I through V, respectively. Again, we discern no consistent pattern.

In Table 4, these averages are limited to those companies which supplied all the necessary information to compute the differential ratios in expenditures per patent. These ratios for Group I companies—those with the largest assets—were 7 to 1, 9 to 1, and 4 to 1, for patents applied for, granted, and pending, respectively. The examination of the ratios for the individual companies in this group shows relative consistency, although hardly a trend or linear gradient, with one exception. The unweighted ratios are higher than the weighted, as in previous tables. The differential ratios for Group I are the lowest of all, i.e., relatively most favorable to Government-financed R&D.

For Group II these ratios are second highest, i.e., 40 to 1, 41 to 1, and 36 to 1, for patents applied for, granted, and pending, respectively. The unweighted ratios for these are not much higher. For Group III the ratios are considerably lower than for Group II—19 to 1, 17 to 1, and 18 to 1—though materially higher in terms of the non-weighted ratios. For Group IV the ratios are the highest—45 to 1, 47 to 1, and 34 to 1—with still higher ratios for the unweighted. In Group V, those companies for which no assets are reported, the ratios are the second lowest (the lowest being for Group I) but higher than the weighted average ratios for all corporations with known assets. In terms of unweighted ratios, companies with no assets reported show the highest ratio, except patents pending.

In general, we find little consistent pattern of relationship for weighted ratios between gross assets and compartive yields from Government-financed R&D compared with company-financed R&D, as we did when companies were grouped according to their net sales and assets. This correlation in ranks, as we have said, was .97. It would seem that the shift of one or two corporations from one grouping to another can have a tremendous effect on weighted differential ratios. The unweighted ratios show a more consistent pattern of ascent in the differential ratio in terms of reported assets. Thus, for patents granted the ratios are 17 to 1, 50 to 1, 66 to 1, 261 to 1, and 295 to 1, starting with corporations with the largest assets and descending to those with no assets reported. (We assume the latter to be companies with the smallest assets, comparatively speaking.) The gradient is even more evident in terms of patent applications and is not completely eradicated with respect to patents pending. Thus, despite the absence of any consistent pattern in terms of weighted ratios, perhaps there is a certain underlying pattern, susceptible to easy distortion, indicating an association between company size, as measured in assets, and patent-yield differential. The smaller the corporation, other things being equal, the greater the differential, i.e., a smaller patent yield from Government-financed R&D as against industrially-financed R&D.

Total Net Earnings

The magnitude of earnings is another important attribute of corporation size. Again the information on it was obtained from Moody, for 1959. The average Government R&D expenditure per patent is highest of all for Group II companies, at $6.352 million per patent. The second highest are the companies not reported in Moody, which we assume to be the smallest, comparatively speaking—$5.299 million. The smallest average is for the Group III companies, at $2.239 million. The proportionate differential for companies grouped according to their aggregate net income is summarized in Table 5. The smallest differential is found for Group III companies; 6 to 1, 4 to 1, and 6 to 1 for patent applications, grants, and patents pending, respectively. Second in rank (companies with the next lowest differential) are companies in Group I—those with highest income—namely 9 to 1, 11 to 1, and 6 to 1, for patents applied for, granted, and pending, respectively. The highest

TABLE 5

Companies Grouped According to Their Aggregate Net Earnings in 1959, Showing Average Federal and Company R&D Expenditures Per Patent Application, Patent Granted, and Patent Pending, Also Average Comparative Federal R&D Patent-Yield Ratios for Each Group Weighted by Dollar Amounts and Unweighted—Group V, Companies with No Earnings Reported in Moody.

Groups by aggregate net earnings reported in *Moody* or non-reported	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios					
							Weighted averages			Unweighted averages		
(1)	Appli. (2)	Granted (3)	Pend. (4)	Appli. (5)	Granted (6)	Pend. (7)	Pat. Appli. (8)	Pat. Granted (9)	Pat. Pend. (10)	Pat. Appli. (11)	Pat. Granted (12)	Pat. Pend. (13)
Group I	1,612,652	3,414,626	3,740,451	172,417	303,553	639,418	9.4	11.3	5.8	19.0	23.7	15.0
Group II	2,468,941	6,647,581	5,201,940	98,118	180,592	284,103	25.2	36.8	18.3	33.1	54.5	29.6
Group III	1,508,587	2,174,066	5,615,393	264,135	508,279	882,476	5.7	4.3	6.4	55.7	56.7	42.1
Group IV	1,462,032	2,870,576	3,614,235	38,025	72,859	130,070	38.5	39.4	27.8	182.0	259.7	113.1
All Listed Corps.	1,739,867	3,589,554	4,173,937	164,082	292,263	583,879	10.6	12.3	7.2	66.6	88.1	43.3
Group V	1,979,185	5,187,153	3,979,961	132,764	299,890	317,838	14.9	17.3	12.5	242.7	239.1	14.7
Total	1,757,710	3,684,832	4,156,685	163,459	292,383	575,986	10.8	12.6	7.2	88.2	102.3	40.8

differentials are reported by Group IV companies. These are 38 to 1, 39 to 1, and 28 to 1, for patent applications, grants, and those pending, respectively. The unweighted ratios again show an ascending differential ratio with declining income. This regularity is broken only in Group V, for companies not recorded as to their net earnings, especially the differential with respect to patents pending. Again there is the suggestion that size which is associated with aggregate earning appears to be associated with the extent of the differential yield, but this association is only one out of many. The ranking of companies according to aggregate net earning is similar to their ranking according to the volume of sales and gross assets. The coefficient of rank correlation between sales and aggregate earning is .90, and between assets and earning it is .93.

Number of Employees

The number of employees is still another criterion of corporation size. This information was again abstracted from Moody for 1959. As usual, the information was not available for some of the companies on our list, these constituting Group V, on the presumption that they were smaller than companies for which this information was reported.

With respect to average yield, the Government R&D amount per patent is highest for companies not listed in Moody (Group V) ; $5.431 million per patent. It is $3.607, $3.912, and $3.695 million for Groups I, II, and II, and the lowest for Group IV companies, i.e., $1.972 million. For industry-financed R&D, the highest average is for Group I at $0.341 million, and the lowest for Group IV at $0.072 million. There is a downward progression in these averages with each group. However, Group V—companies not reported on in Moody's—show a relatively high average of $0.306 million.

As usual, the averages shown in Table 6 are limited to those companies with sufficient information to compute the differential ratios. These differential ratios are lowest for companies in Group I, those with the largest number of employees. For Group I, these ratios are 9 to 1, 11 to 1, and 6 to 1. The ratios increase progressively with declining number of employees. For Group IV these ratios are 35 to 1, 31 to 1, and 31 to 1 for patent applications, those granted and pending, respectively. But Group V companies — those not listed by Moody — show a comparatively low differential, second only to companies in Group I. With minor exceptions, the unweighted ratios reflecting the differential also increase, and this increase continues for non-listed companies (Group V) as well as with respect to patent applications and patents granted, but not to patents pending. Number of employees, as

TABLE 6

COMPANIES GROUPED ACCORDING TO NUMBER OF EMPLOYEES GIVEN BY *Moody* FOR 1959 SHOWING AVERAGE FEDERAL AND COMPANY R&D EXPENDITURES PER PATENT APPLICATION, PATENT GRANTED, AND PATENT PENDING, ALSO AVERAGE COMPARATIVE FEDERAL R&D PATENT YIELD RATIOS FOR EACH GROUP WEIGHTED BY DOLLAR AMOUNTS AND UNWEIGHTED—GROUP V, COMPANIES WITH NO EMPLYOYEES REPORTED IN *Moody*.

Groups by No. of employees reported in *Moody* or non-reported	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios					
							Weighted averages			Unweighted averages		
(1)	Appli. (2)	Granted (3)	Pend. (4)	Appli. (5)	Granted (6)	Pend. (7)	Pat. Appli. (8)	Pat. Granted (9)	Pat. Pend. (10)	Pat. Appli. (11)	Pat. Granted (12)	Pat. Pend. (13)
Group I	1,811,103	3,606,683	4,486,987	195,326	341,050	728,468	9.3	10.6	6.2	25.2	25.1	17.7
Group II	1,679,406	3,843,588	3,761,191	93,487	180,988	261,872	18.0	21.2	14.4	24.0	40.1	29.0
Group III	1,672,091	3,588,879	3,522,237	70,326	126,005	222,806	23.8	28.5	15.8	50.4	70.8	33.5
Group IV	1,242,565	2,227,110	3,678,438	35,588	72,808	117,540	34.9	30.6	31.3	197.4	274.1	127.5
All Listed Corps.	1,737,790	3,584,647	4,168,642	164,017	292,172	583,096	10.6	12.3	7.1	65.6	86.6	42.6
Group V	2,024,675	5,430,768	4,025,898	134,826	306,181	322,045	15.0	17.7	12.5	280.4	294.8	14.5
Total	1,757,710	3,684,832	4,156,685	163,459	292,383	575,645	10.8	12.6	7.2	88.2	102.3	40.8

one expects, is closely associated with other measures of company size. The rank coefficients obtained for the companies in our sample on which we have information are shown in Table 7, following:

TABLE 7
RANK CORRELATION OF CORPORATE SIZE AS MEASURED BY NET SALES, GROSS ASSETS, AGGREGATE PROFIT, AND NUMBER OF EMPLOYEES, BASED ON DATA DERIVED FROM *Moody's Industrial Manual* FOR 1959.

Attribute (1)	Net Sales (2)	Gross Assets (3)	Aggregate Profit (4)	Number of Employees (5)
Net Sales	—	.97	.90	.98
Gross Assets	.97	—	.93	.95
Aggregate Profit	.90	.93	—	.88
No. of Employees	.98	.95	.88	—

From these, we are led to conclude that size of the company appears to have some association with patent-yield differential. By and large the differential is smallest for large corporations (comparatively more favorable to federal R&D) and tends to become larger with declining size of the corporation.

This is supported by a small but relatively consistent coefficient of rank correlation between these four criteria of company size and the differential ratios for patent applications, grants, and those pending, respectively.

TABLE 8
RANK COEFFICIENT OF CORRELATION BETWEEN DIFFERENTIAL RATIOS AND SIZE AS MEASURED BY NET SALES, GROSS ASSETS, AGGREGATE INCOME, AND NUMBER OF EMPLOYEES

	Coefficients of Rank Correlation		
Index of Size	Patent Applications	Patents Granted	Patents Pending
Net Sales	—.35	—.21	—.30
Gross Assets	—.40	—.25	—.40
Net Income	—.39	—.19	—.41
No. of Employees	—.34	—.23	—.30

We cannot say with any degree of confidence what the full implication of this is, but we are given hunches which could be further pursued, if and when resources and opportunities for more intensive inquiries are found.

AMOUNT OF FEDERAL R&D GRANT

In estimating the differential ratio, one of the most important parameters is the amount of the Government R&D grant. The question

TABLE 9

COMPANIES GROUPED ACCORDING TO THE SIZE OF THEIR REPORTED FEDERAL R&D GRANTS FOR FISCAL YEARS 1949 - 1959 SHOWING AVERAGE FEDERAL AND PRIVATE R&D EXPENDITURES PER PATENT APPLICATION, PATENT GRANTED AND PATENT PENDING, ALSO AVERAGE COMPARATIVE FEDERAL R&D PATENT-YIELD RATIOS FOR EACH GROUP WEIGHTED BY DOLLAR AMOUNTS AND UNWEIGHTED.

Groups by size of Fed. R&D expenditure	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios: Weighted averages			Differential-yield ratios: Unweighted averages		
(1)	Appli. (2)	Granted (3)	Pend. (4)	Appli. (5)	Granted (6)	Pend. (7)	Pat. Appli. (8)	Pat. Granted (9)	Pat. Pend. (10)	Pat. Appli. (11)	Pat. Granted (12)	Pat. Pend. (13)
Group I	1,857,557	3,753,813	4,592,600	177,912	312,333	653,105	10.4	12.0	7.0	36.1	42.5	28.8
Group II	2,281,164	5,061,798	4,946,322	176,998	309,270	575,032	12.9	16.4	8.6	103.7	176.3	74.6
Group III	747,746	2,123,827	1,184,165	68,811	135,028	186,261	10.9	15.7	6.4	175.4	145.3	40.2
Group IV	692,855	1,331,215	1,851,221	81,285	192,284	212,862	8.5	6.9	8.7	13.2	7.5	12.9
Total	1,757,710	3,684,832	4,156,685	163,459	292,383	575,560	10.9	12.6	7.2	88.2	102.3	40.8

arises, therefore, to what extent the size of this amount is directly associated with the differential ratio. Again, the companies which supply this information have been arrayed according to their Government R&D grants for the years 1949 to 1959 and have been divided into four groups. Considering the average expenditure per patent granted, Group II companies show the highest figure; $5.403 million, and Group IV shows the lowest, with $1.591 million. With respect to expenditure of company R&D funds per patent, the largest average expenditure is by companies with largest Government R&D grants (Group I), $0.312 million; and the lowest by companies in Group III, $0.134 million. Table 9 shows these averages for companies providing the information necessary to compute the differential ratio. The weighted ratios show almost no gradient. The unweighted ratios suggest some increase in the differential between Groups I, II and III, but not for Group IV, and limited to the number of patent applications. It would seem that the association between absolute amount of Government R&D grants and the differential ratio is small, if any. This is demonstrated by rank coefficients of correlation. These coefficients are .06, .11, and .10 for patent applications, grants, and those pending, respectively. The slight relationship shown indicates a less favorable Government R&D yield for companies with largest Government R&D grants.

Amount of Industry R&D Outlay

Companies were arrayed according to the amount of company-supplied R&D to see what, if any, association could be observed between this amount and the differential ratios. After arraying the companies, they were again divided into sub-groups. Putting in the fifth sub-group those companies which reported no R&D outlays of their own, we find average expenditure of Government R&D funds per patent by these companies is the highest of all—$5.386 million. The averages are not markedly different for Groups II, III, and IV—$4.988, $4.150 and $4.436 million, respectively. The average is significantly lower for Group I companies, with $2.880 million. In other words, companies with largest R&D outlays of their own have the lowest Government R&D expenditures per patent, while those with no R&D outlays of their own have the highest amount of Government R&D funds per patent. If this can be validated, it seems a very significant relationship.

Considering the company's own expenditures per patent, these are largest for Group I companies at $0.324 million per patent, declining to $0.088 million (the lowest) per patent for Group IV companies. Group III companies are not much more, however, at $0.092 million.

TABLE 10

COMPANIES GROUPED ACCORDING TO THE SIZE OF THEIR OWN R&D AMOUNTS FOR FISCAL YEARS 1949-1959 SHOWING AVERAGE FEDERAL AND PRIVATE R&D EXPENDITURES PER PATENT APPLICATION, PATENT GRANTED, AND PATENT PENDING, ALSO AVERAGE COMPARATIVE FEDERAL R&D PATENT-YIELD RATIOS FOR EACH GROUP WEIGHTED BY DOLLAR AMOUNTS AND UNWEIGHTED.

Groups by size of Co. R&D expenditure	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios					
							Weighted averages			Unweighted averages		
	Appli.	Granted	Pend.	Appli.	Granted	Pend.	Pat. Appli.	Pat. Granted	Pat. Pend.	Pat. Appli.	Pat. Granted	Pat. Pend.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Group I	1,363,113	2,880,191	3,160,713	184,172	324,363	667,835	7.4	8.9	4.7	14.8	18.0	8.8
Group II	2,284,589	4,988,066	5,207,943	78,009	147,621	248,261	29.3	33.8	21.0	26.1	42.6	21.0
Group III	2,196,766	4,149,823	6,081,279	47,998	93,373	134,295	45.8	44.4	45.3	57.7	67.6	52.3
Group IV	2,739,841	6,930,186	6,473,525	30,487	84,044	72,966	89.9	82.5	88.7	355.1	508.1	145.8
Total	1,757,710	3,684,832	4,156,685	163,458	292,382	575,557	10.7	12.6	7.2	88.2	102.3	40.8

Table 10 shows the ratios both weighted and unweighted. The ratios increase consistently and sharply. The smallest differentials are shown for Group I companies. These are 7 to 1, 9 to 1, and 5 to 1 for patents applied for, granted and pending, respectively. These differentials are greater for Group II, greater still for Group III, and greatest of all for Group IV. For Group IV, the differentials are 90 to 1, 82 to 1, and 89 to 1. The unweighted differentials also show a consistent rising pattern from 15 to 1, up to 355 to 1, for patent applications; from 18 to 1, up to 508 to 1, for patents granted; and from 9 to 1, up to 146 to 1 for patents pending, for Groups I through IV, respectively. Of the variables which we have considered, this one shows the most consistent relationship between company outlay of its own funds for research, and the differential ratio. The companies with the largest outlays of their own also have comparatively high patent yield from Government R&D funds entrusted to them, that is, a low ratio. Those with smaller R&D outlays of their own have the highest differential ratios. This would suggest that Government R&D funds going to companies spending a large amount of their own funds for R&D will have a higher yield on the average than the R&D funds going to companies with little or no R&D outlays of their own. This association is confirmed by the rank coefficient of correlation when the rank of companies according to the size of their own R&D outlay is correlated with the differential ratio. These correlations in terms of rank are: —.59 for patent applications, —.42 for patents granted, and —.60 for patents pending.

Proportionate R&D Expenditure

We found the association between Government R&D grants and the differential ratio small, and on balance, negative—that is, companies with the lowest Government R&D grants showing the more favorable ratios. With respect to company R&D outlays, we found that those companies with the highest R&D outlays of their own have the lowest (most favorable) differential ratio. What would the association be if we consider the proportionate expenditure, i.e., Government R&D expenditure divided by the industry's own expenditures, and ranking companies according to the resulting ratios from the highest to the lowest and grouping them into four along this gradient? The relationship of companies grouped according to this ratio with the differential-yield ratio is summarized in Table 11. Group I, that is companies with the highest proportion of Government R&D grants, has the highest differential ratios—most disadvantageous to the Government. These are 67 to 1, 61 to 1, and 63 to 1 for patent applications, grants, and those

TABLE II

COMPANIES GROUPED ACCORDING TO THE SIZE OF THE RATIO OF FEDERAL R&D DIVIDED BY COMPANY-PROVIDED R&D FOR FISCAL YEARS 1949-1959, SHOWING AVERAGE FEDERAL AND PRIVATE R&D EXPENDITURES PER PATENT APPLICATION, PATENT GRANTED, AND PATENT PENDING, ALSO AVERAGE COMPARATIVE FEDERAL R&D PATENT-YIELD RATIOS FOR EACH GROUP—WEIGHTED AND UNWEIGHTED.

Ratio of Fed. R&D	Fed. R&D dollars per patent			Co. R&D dollars per patent			Differential-yield ratios					
							Weighted averages			Unweighted averages		
Co. R&D (1)	Appli. (2)	Granted (3)	Pend. (4)	Appli. (5)	Granted (6)	Pend. (7)	Pat. Appli. (8)	Pat. Granted (9)	Pat. Pend. (10)	Pat. Appli. (11)	Pat. Granted (12)	Pat. Pend. (13)
Group I	2,890,644	6,414,049	6,689,490	43,409	105,640	105,982	66.6	60.7	63.1	306.9	370.6	146.8
Group II	1,578,763	3,012,584	3,884,276	69,734	121,208	240,541	22.6	24.8	16.1	23.4	24.6	15.2
Group III	1,364,539	2,880,892	2,851,038	149,470	292,242	397,651	9.1	9.9	7.2	19.9	30.0	13.6
Group IV	1,239,834	2,625,832	3,168,692	185,011	319,891	736,077	6.7	8.2	4.3	8.3	17.4	5.9
Total	1,743,529	3,658,390	4,116,967	163,587	292,507	575,767	10.7	12.5	7.1	88.2	102.3	40.8

pending, respectively. These differential ratios decline as the Government-financed R&D in relation to company-financed R&D declines. For companies in Group IV, which—with one exception—spend more of their own funds than Government funds for R&D, the differential ratios are 7 to 1, 8 to 1, and 4 to 1. This reconfirms our analysis in Table 9, that companies with large R&D outlays of their own (in this instance, when such outlays exceed the R&D which they get from the Government) show the most favorable differential from the Government's standpoint. This pattern is essentially borne out if one considers the unweighted average ratios. This relationship is confirmed by rank coefficients of correlation between the ratio of Government R&D grants, to company-financed R&D with differential patent-yield status. These coefficients are .71, .57, and .73 for patents applied for, granted, and pending, respectively.

The Federal Government's Propensity to Patent[1]

DONALD STEVENSON WATSON* AND MARY A. HOLMAN**

SUMMARY

HERETOFORE, LITTLE HAS BEEN KNOWN about the patent activities of the Federal Government. This study presents information about the criteria used by the six largest Government patent departments in screening and evaluating inventions for patent applications during the postwar period. These agencies—Agriculture, AEC, NASA, Army, Navy, and Air Force—carry on about 97 percent of the Government's patent activity. Because of differences in their missions, Government agencies employ different criteria in selecting inventions for patent applications, with resulting variations in their propensities to patent. The propensities range from a low of 10 percent for Air Force to a high of 80 percent for Agriculture.

We estimate that about 154,000 inventions have been made by Government employees and by employees of contractors during the post-

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war period. Under the license policy, contractors have filed patent applications on about 38,000 of these inventions. The Government has filed applications on about 32,000 of them. The Federal Government's propensity to patent has declined only slightly during the postwar period. The decline is not enough to explain why patented inventions have not grown as fast as Federal expenditures for research and development.

INTRODUCTION

ONE OF THE PUZZLES ACCOMPANYING the rapid growth of research and development in the postwar period has been the much slower increase in the numbers of patents issued on inventions. In current dollars, total research and development (R&D) expenditures grew about tenfold from 1945 to 1963. The numbers of scientists and engineers engaged in R&D work increased about fourfold. Technical reports and publications in the postwar period have poured forth in an avalanche of unknown, though of agreedly enormous dimensions. But, as Fritz Machlup has shown, the numbers of patent applications per million dollars of R&D expenditures and per hundred R&D scientists and engineers have steadily declined.[2]

About the same is true for that part of all R&D financed by the Federal Government and conducted in its laboratories and in those of its contractors. Federally financed R&D went from about $1 billion in the fiscal year 1946 to about $10 billion in the fiscal year 1962.[3] But between the calendar years 1946 and 1962, the number of patents emerging from that R&D only doubled.[4]

One possible cause of the failure of patents issued to keep pace with R&D is a secular decline in the propensity to patent, i.e., a drop in the proportion of raw inventions[5] that become the subjects of patent applications. Both Fritz Machlup and Jacob Schmookler have speculated to this effect. And so has Simon Kuznets in discussing a possible increase in the number of "inventions for which no patent is sought."[6]

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[2] Fritz Machlup, *The Production and Distribution of Knowledge in the United States* (Princeton University Press, 1962), p. 173.

[3] National Science Foundation, *Federal Funds for Research, Development, and Other Scientific Activities, XII*, NSF 64-11 (Washington, D.C.: U. S. Government Printing Office, 1964), pp. 150-151.

[4] Donald Stevenson Watson and Mary A. Holman, "Patents from Government-Financed Research and Development," *IDEA*, Vol. 8, No. 2 (Summer 1964), p. 207.

[5] The words "invention" and "patented invention" are often employed as exact synonyms. In this article, however, we distinguish them. Thus, an invention might be patented or unpatented, as well as patentable or unpatentable.

[6] Machlup, *op. cit.*, p. 174; Jacob Schmookler, "Comment: Difficulty in Measuring Inventive Activity," p. 78; and Simon Kuznets, "Inventive Activity: Problems of Definition and Measurement," p. 37, both in National Bureau of Economic Re-

To find out if industry's propensity to patent is constant or declining, it would be necessary to know what happens in and between the laboratories and the patent departments of hundreds of large business corporations and to understand the mechanisms and motives in selecting inventions for patent applications. We know at first hand of one industrial giant whose patent attorney chose to file patent applications on one out of five inventions in the early 1960's, in contrast to one out of three in the late 1930's. The sharpening of the teeth of the antitrust laws was one of the causes of the company's declining propensity to patent. But this and other scraps of information do not fill what is a large gap in the knowledge, both qualitative and quantitative, of the economics of invention and patenting.

One part of the gap in knowledge is now, however, closed because we have been able to obtain data enabling us to measure the propensity to patent of the Federal Government in the postwar period. At the end of 1962, the latest year for which such figures are available, the Federal Government had an interest (either title or license, in about 40,000 patented inventions, all of them the products of federally financed R&D. The Government held title to about 13,000 of these patented inventions and had royalty-free licenses on the other 27,000 whose owners are R&D contractors and Government employees.

The question of patent rights, that is, who should own the patented inventions from federally financed R&D is the much disputed question of "patent policy."[7] In general, the Department of Defense follows the license policy permitting contractors to retain title and reserving for itself licenses to the patented inventions. Nonetheless, the Department of Defense does take title to many inventions that contractors do not want to hold for themselves. The other Federal agencies with important patent activities—the Atomic Energy Commission, NASA, and the Department of Agriculture—follow the title policy.[8]

Investigation of the Federal Government's propensity to patent

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search, *Rate and Direction of Inventive Activity* (Princeton University Press, 1962).

[7] On October 10, 1963, President Kennedy issued a Memorandum for a Uniform Government Patent Policy. Although some agencies have issued new regulations under the President's Memorandum, sufficient time has not elapsed to assess their impact. Besides that, there is still no agreed-upon interpretation of the Memorandum. There is some debate as to whether the Memorandum provides for a uniform "title policy," with liberal exceptions for permitting contractors to retain titles, or whether it provides for a "license policy," with exceptions for the Government to acquire titles to inventions vested with "public interest."

[8] Only a few other Federal agencies carry on patent activities. Among these are the Departments of Commerce, of Health, Education, and Welfare, of the Interior, and of the Post Office, the Federal Aviation Agency, and the Tennesse Valley Authority.

serves at least three useful purposes. One is to test the hypothesis that the propensity has been declining and that therefore patent data do not adequately reflect the inventive output of federally financed R&D. Another purpose is to obtain a measure of the numbers of inventions, unpatented as well as patented. Still another is to find out if the inventions from federally financed R&D are made available so that their contributions can be exploited.

THE PROPENSITY TO PATENT

About 97 percent of the Federal Government's patent activity—measured by the numbers of patents licensed to and assigned to the Government from 1945 to 1962—is carried on by six agencies. They are the Department of Agriculture, the Atomic Energy Commission, the National Aeronautics and Space Administration, and the three military departments, Army, Navy, and Air Force. These agencies furnished us with data, not hitherto made public, on their invention disclosures and patent applications.

The patent departments of the six agencies differ from one another in several ways. This fact would hardly be worth mentioning were it not that the size and organization of a Government patent department have, so we learned, a close relation to the department's propensity to patent. Size is the (equivalent) number of patent attorneys engaged full time in patent prosecution. Organization here means the headquarters-field pattern, the liaison, such as it might be, with R&D programs and activities, and the monitoring of contractors.

Inventions are reported—"disclosed"—to Federal patent departments by Government laboratories and other research facilities and by contractors.[9] The inventions from its laboratories are those made by employees of the Government. Contractors are required to disclose the inventions made during the performance of their R&D contracts. Under the title policy, contractors must disclose all inventions. Under the license policy they must disclose those inventions they do not choose to keep and to file on themselves.

Before they become the subjects of patent applications, inventions pass through the screens operated for and by the Federal patent de-

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[9] As used here an invention disclosure has nothing to do with the publication of the relevant facts about an invention when a patent on it is officially granted. One of the traditional justifications of the temporary monopoly conferred by the patent grant is the *public* disclosure of the invention. See Fritz Machlup, *An Economic Review of the Patent System,* Study No. 15, Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, United States Senate, 85th Cong., 2d Sess. (U. S. Government Printing Office, 1958), pp. 21, 24, and 25.

partments. An inventor's creation must first pass the scrutiny of his supervisors, who then launch the papers on the invention into the channels that lead at the end to the headquarters of the patent department in Washington. Along the way the invention is evaluated in field offices by technical experts and by patent attorneys. The final screen is patentability.[10]

In screening and evaluating inventions, each Federal agency applies criteria that are developed from the agency's experience and from its mission, or objective function, as the patent department sees it. Obviously, expected profitability is never a criterion. At the same time, however, "commercial potential" is one of the criteria used by both the Atomic Energy Commission and the National Aeronautics and Space Administration. Both of these agencies have sought to advance particular technologies and to have new methods and improvements adopted beyond the range of the firms they directly work with. And because the fallout and the spinoff from the R&D supported by AEC and NASA have, as is well known, remained far short of hopes, their patent departments are all the more eager to find commercial potential in the inventions flowing in to them.

Another criterion applied by all six agencies is "technological importance," whose meaning to the men who apply it must be less vague than would at first appear. The military departments adduce just one other criterion: "Government use." This expression means, not Government-wide use, but use within the department. More particularly, if it is endowed with Government use, an invention is one of a device or process for a weapon or a piece of equipment that the Army, or the Navy, or the Air Force expects to procure in large quantities. With patents on such inventions, the Government avoids the possibility of having to pay for them or of having to defend itself against possible charges of infringement. Royalty-free licenses to such patents would serve the same purpose; for this reason, the military departments see no advantage in obtaining title to all inventions coming out of federally financed research and development. Even if inventions appear to hold commercial potential, the military departments do not file patent applications.

Because of their missions, AEC and NASA both have more criteria than the other agencies. Besides the commercial potential and the

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[10] It is normal to find that some inventions newly submitted had been patented before. Of the inventions disclosed to NASA between 1959 and 1963, it turned out that 12 of them had been patented before the beginning of the First World War and two of them before 1900.

technological importance we mentioned earlier. they judge inventions for their agency—and their Government-wide use. In addition, NASA takes into account the performance of an invention, its potential "contribution to the space effort," as well as an invention's position in NASA's research programs. A disclosure coming out of an abandoned line of research is not likely to be considered for patenting, even if it measures well by other criteria.

In applying their criteria and then in selecting inventions for patenting, four of the six agencies make use of point systems. The inventions earning the required number of points are then put to the final test of patentability. This of course means a search of prior art to determine that the inventions are novel and useful.

The Department of Agriculture stands apart from the other agencies in that patentability is its sole criterion. All inventions coming out of the laboratories are forwarded without further ado to the patent attorneys in Washington.

Table 1 and Table 2 give data on the invention disclosures, the patent applications, and the propensities of the six Government agencies between 1945 and 1963. It is clear from both tables that there has, in general, been a slight decline in the Government's propensity to patent in the postwar period. Three agencies, however, have had a constant or a nearly constant propensity. The principal cause of the decline in the propensity, where it has occurred, is to be found in the numbers of patent attorneys in the agencies. The annual average number of patent applications per attorney is approximately constant.[11] In the early postwar period, both AEC and the Navy had temporarily large patent staffs who handled the inventions coming out of research conducted during the Second World War. In the later years, the growing volume of invention disclosures had to be acted on by patent staffs whose numbers did not increase in proportion.

Between the numbers of invention disclosures and the propensity to patent, there is a rough tendency toward an inverse relation. Several

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[11] Some Government patent attorneys believe that the "shortage" of patent attorneys is the major constraint on the number of applications. Data on the input-output relation between the numbers of Government patent attorneys and the number of patent applications do, in fact, suggest approximately constant proportional returns. In 1957, AEC's and DOD's 232 patent attorneys filed 1,496 patent applications, an average of 6.4 applications per attorney. In 1962, 269 attorneys filed 1,647 applications, about 6.1 each. These figures are not adjusted to reflect the fact that patent attorneys do more than prepare patent applications. Data on the numbers of patent attorneys come from the U.S. Civil Service Commission, *Occupational Survey G. S. Groups: Occupation by Grade and Agency* (unpublished internal reports).

TABLE 1

PATENT ACTIVITIES OF SIX MAJOR FEDERAL AGENCIES

By Periods, Fiscal Years 1945-1963
except for the totals, the numbers are annual averages

Agency	Invention Disclosures, Number	Patent Applications, Number	Applications in Percent of Disclosures
Agriculture			
1945-1954	151	121	80.0
1955-1963	140	112	80.0
Total: 1945-1963	2,770	2,217	80.0
Atomic Energy Commission			
1945-1954	916	292	31.9
1955-1963	1,785	255	14.3
Total: 1945-1963	25,228	5,218	20.7
National Aeronautics and Space Administration			
1959-1963	343	69	20.0
Total: 1959-1963	1,717	344	20.0
Air Force			
1948-1954	638	84	13.2
1955-1963	1,807	179	9.9
Total: 1948-1963	20,730	2,198	10.6
Army			
1945-1954	1,999	506	25.3
1955-1963	1,489	388	26.1
Total: 1945-1963	33,382	8,553	25.6
Navy			
1945-1954	1,608	718	44.6
1955-1963	1,898	697	36.7
Total: 1945-1963	33,163	13,452	40.6
TOTAL, Six Agencies			
1945-1954	512	170	33.2
1955-1963	7,308	1,668	22.8
TOTAL	116,990	31,982	27.3

Note: The patent application data do not include the patent applications filed by contractors on inventions from Government-financed R&D.
Sources: Data furnished by patent counsel of the agencies.

sets of data reflect this inverse relation. For example: From 1930 to 1933, when it received about 152 new disclosures each year, the Department of the Navy's propensity to patent was 78 percent. But from 1937 to 1942, the average annual number of new disclosures rose to 220, the propensity falling to 69 percent. During the 19 years between fiscal 1945 and 1963, the Navy received about 1,745 disclosures annually; its average annual propensity was 41 percent. Similarly, in 1944 the Army Air Corps received 210 inventions having a propensity of 65

TABLE 2

PATENT ACTIVITIES OF SIX MAJOR AGENCIES OF THE FEDERAL GOVERNMENT[a]
1945 TO 1963

Fiscal Year	Invention Disclosures	Patent Applications Filed by Government	Applications in Percent of Disclosures Col. (2) ÷ Col. (1)	Patent Applications Filed by Contractors	Total Number of Inventions Col. (1) + Col. (4)
	(1)	(2)	(3)	(4)	(5)
1945	7,005	2,908	41.5	1,429	8,434
1946	6,253	3,974	63.5	1,512	7,765
1947	4,284	1,335	31.2	1,510	5,794
1948	5,070	1,096	21.6	1,417	6,487
1949	4,821	936	19.4	1,216	6,037
1950	4,876	1,092	22.4	1,285	6,161
1951	3,904	1,121	28.7	1,105	5,009
1952	4,835	1,298	26.8	1,222	6,057
1953	5,172	1,644	31.8	1,846	7,018
1954	4,994	1,563	31.3	1,862	6,856
1955	6,751	1,647	24.4	2,155	8,906
1956	6,239	1,641	26.3	2,291	8,530
1957	6,543	1,583	24.2	2,615	9,158
1958	6,576	1,361	20.7	2,734	9,310
1959	7,316	1,641	22.4	2,528	9,844
1960	7,786	1,703	21.9	2,611	10,397
1961	8,138	1,641	20.2	2,611	10,749
1962	8,330	1,880	22.6	2,611	10,941
1963	8,097	1,918	23.7	2,611	10,708
TOTAL	116,990	31,982	27.3	37,171	154,161

[a] Atomic Energy Commission; Departments of Agriculture, Air Force, Army, and Navy; and National Aeronautics and Space Administration.

Sources: Column (1): For Air Force, NASA, and Navy the data come from the Offices of Patent Counsel. The AEC data, converted from calendar to fiscal years, come from the Office of Patent Counsel and from U.S. Congress, Subcommittee on Legislation of the Joint Committee on Atomic Energy, *Hearings, Atomic Energy Patents*, 86th Cong., 1st Sess., 1959, p. 28. The numbers of disclosures for Army are extrapolated from information supplied by the Patent Counsel of the Army Materiel Command. The data for Agriculture are extrapolated from patent application data supplied by Patent Counsel.

Column (2): For Air Force, Army, and Navy the data come from the Offices of Patent Counsel and from U.S. Congress, Senate, Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, *Preliminary Report, Patent Practices of the Department of Defense*, 87th Cong., 1st Sess., 1961, pp. 5-7. The data for Agriculture and for NASA were supplied by Patent Counsel. For AEC the data come from Patent Counsel and from U.S. Congress, Joint Committee on Atomic Energy, *Selected Materials on Atomic Energy Patents*, 86th Cong., 1st Sess., 1959, Vol. I, p. 115.

Column (4): Extrapolated from the numbers of patents licensed to the Government by Government contractors; data from the files of the Assignment Branch of the U.S. Patent Office. The patent data are lagged 3½ years.

percent.[12] Between 1951 and 1963, the United States Air Force received about 1,500 invention disclosures annually, its propensity falling to 10 percent. The Department of Agriculture has received relatively few invention disclosures each year—about 150; its propensity to patent is high, 80 percent.

We have also found an inverse relation between the propensity to patent and the rate of use of patented inventions.[13] By use, we mean Government use as well as commercial use. The rate of commercial use of Government-owned patented inventions is low—about 15 percent.[14] This compares with the estimated rate of commercial use of privately developed and privately owned patented inventions of between 50 and 60 percent.[15] In view of its research missions, Agriculture's inventions should be expected to have a much higher rate of commercial use than the inventions flowing in to AEC and Defense. But the rates of commercial use of Government-owned patented inventions do not differ much among these agencies. For AEC, the estimated rate of commercial use is 16 percent; for Defense the rate is 13 percent; and for Agriculture the rate is 15 percent.[16]

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[12] Department of Justice, *Investigation of Government Patent Practices and Policies: Report and Recommendations of the Attorney General to the President* (U. S. Government Printing Office, 1947), Vol. II, p. 318 and p. 410.

[13] The rate of utilization of patented inventions must vary inversely with the propensity. It does so regardless of the numbers of invention disclosures and of patented inventions and regardless of the size of the rate and of the propensity. Proof: Let I be the number of invention disclosures, P the number of patented inventions, and U the number of those utilized. Let k be the propensity to patent and r the rate of utilization. Assume that the application-issue ratio is constant and that the values of k and r lie between 0 and 1.

$$(1)\quad k = \frac{P}{I}$$

$$(2)\quad r = \frac{U}{P}$$

Therefore,

$$(3)\quad r = \frac{U}{kI}$$

[14] Mary A. Holman, "The Utilization of Government-Owned Patented Inventions," *PTC J. Res. & Ed., (IDEA)*, Vol. 7, Nos. 2 and 3 (Summer and Fall, 1963), pp. 149-155.

[15] Otto J. Bachman, *et al., Patents and the Corporation* (2d ed., Bedford, Mass., 1959), pp. 111-112; and Joseph Rossman and Barkev Sanders, "The Patent Utilization Study," *PTC J. Res. & Ed. (IDEA)*, Vol. 1, No. 1 (June, 1957), p. 90 and p. 100.

[16] Holman, *op. cit.*, pp. 149-155.

The low rate of commercial use of Government-owned patented inventions coming out of AEC's and DOD's research can be explained by the fact that these inventions are defense oriented and have little commercial potential. But why the low rate of commercial use of Agriculture's patented inventions? The research of that agency is designed to expand market outlets for farm products by establishing new uses for crops, by developing new crops, and by improving the qualities of agricultural products. The low rate of commercial use of Agriculture's inventions must be due to the agency's high propensity to patent. The much lower propensiites of AEC and Defense to patent are reflected in much higher rates of Government use of the patented inventions administered by these agencies—about 75 percent for both AEC and Defense.[17]

The Numbers of Inventions

Our investigation of the Federal propensity to patent yielded the important by-product of an estimate of the numbers of inventions from federally financed R&D. For the period between 1945 and 1963, we estimate that the total number was about 154,000 inventions. Our annual estimates, shown in column 5 of Table 2, do not reflect inventors' ideas and inspirations or the blind alleys they run into. Rather, the estimates are of pieces of paper on which invention disclosures are submitted formally through established channels.

We have complete data on the numbers of inventions disclosed to AEC, Air Force, NASA, and Navy. For Agriculture we have figures on patent applications only, but it is clear that with a propensity of 80 percent throughout the entire postwar period, Agriculture's inventions are a constant multiple of its applications. For Army, we calculated the average propensity to patent for the several major Commands for which we obtained data and then assumed that the same propensity is Army-wide. The numbers of Army patent applications divided by the propensity (expressed as a fraction) thus became our estimate of the numbers of inventions disclosed to Army.

The data in column 1 of Table 2 show the inventions disclosed by Government employees and by contractors. The other inventions coming out of federally financed R&D are those retained by contractors under the license policy (Column 4). To these inventions, contractors give royalty-free licenses to the Government at the time of filing patent applications.

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[17] *Ibid.*, pp. 359-364.

There are no complete public records on the numbers of patent applications filed by contractors on inventions financed from Federal funds. But we can estimate these numbers fairly closely. First it is necessary to convert the data on patents licensed to the Government by contractors into estimates of patent applications filed by contractors.[18] This is done by multiplying the numbers of patent applications by 10/6.[19] The next step is to lag the estimated patent applications by 3½ years. Thus patents issued in the calendar year 1955, for example, are (multiplied by 10/6) the estimated number of patent applications filed in the fiscal year 1952. We assume that the inventions were also made in 1952.

Our estimate of about 154,000 inventions from federally financed R&D between 1945 and 1963 identifies and measures one, but only one, of the outputs of that R&D. During the last decade, there has been much discussion of inventive activity and how to measure it.[20] Inventive activity cannot be anything else than the activity of inventors, who are persons who make inventions. Thus the number of inventions must be a better measure of inventive activity than the numbers of patents issued or the numbers of patent applications.

Data on the numbers of inventions do not contain the biases, resulting from fluctuations in propensities to patent and from delays in processing patent applications in the U.S. Patent Office, that frequently result in random bunching of patents. Statistics on the numbers of inventions have, however, their own shortcomings, such as (1) the problems of weighting the average input of inventive activity per invention, (2) undisclosed inventions because formal reports remain unwritten, (3) secrecy, and (4) the divisibility of some inventions.

We call the proportion of inventions retained by contractors their "propensity to select." This propensity applies only to contractors of agencies following the license policy. The estimated propensity to select is $\frac{Lc}{Lc + Tc/k}$, where Lc is the number of lagged patent applications filed by contractors on inventions from federally financed R&D; Tc is the number of lagged patent applications filed by the Govern-

[18] Watson and Holman, *op. cit.*, p. 221.

[19] About 60 percent of the patent applications filed by DOD contractors between July 1, 1950 and December 31, 1957 resulted in patents. See Donald S. Watson, Harold F. Bright, and Arthur E. Burns, "Federal Patent Policies in Contracts for Research and Development," *PTC J. Res. & Ed., (IDEA)*, Vol. 4, No. 4 (Winter 1960), p. 321.

[20] See National Bureau of Economic Research, *The Rate and Direction of Inventive Activity, op. cit., passim.*

ment on inventions disclosed by contractors; and *k* is the Government's propensity to patent, expressed as a fraction.

Our estimates of the propensity to select by contractors for the Department of Defense show that the propensity has been remarkably stable. For 1945-1949, it was 41 percent; for 1950-1954, it was 40 percent; and for 1955-1959, the propensity was 44 percent. The validity of our estimates of the propensity to select is confirmed by data furnished by the Air Force. Of the military departments, only the Air Force has records distinguishing inventions disclosed by employees from those disclosed by contractors. These data show similar propensities to select for the 1950-1954 and 1955-1959 periods. The propensity of Air Force contractors, however, dropped to 37 percent in 1960-1963.

The significance of the propensity of R&D contractors to select lies in the way the license policy has been operating. Contractors do not take all of the inventions coming out of the research they do for the Federal Government. They seem to have been taking about 40 percent of them.

Is the total of 154,000 inventions a large or a small number? We think that this number must be looked upon as being relatively small. In the postwar period the Federal Government has provided more than half the total funds for "industrial R&D performance."[21] But the 154,000 inventions must be far less than one-half the total of all inventions in the postwar period. Although we do not know what this total is, we do know that total patent applications in *each* year since 1954 have been more than one-half the total of inventions from federally financed R&D in the *entire* period from 1945 to 1963. Thus, no matter what is the private propensity to patent, the number of private inventions must be at least ten times the number of inventions from Federal research. Yet no one should expect that a million dollars of Federal R&D will yield as many inventions as a million dollars of private R&D. Federal R&D is not motivated by the goal of obtaining patents; they are by-products, and incidental at that. Much Federal R&D consists of development and testing, activities resulting in few inventions.

Of the total of about 117,000 inventions disclosed to the Federal Government in the period 1945-1963, about 85,000 did not become the subjects of patent applications (column 1 minus column 2 of Table 2) Although we know little about these inventions, we believe it would be wrong to dismiss them all as worthless simply because the Government

[21] National Science Foundation, *Research and Development in Industry, 1961,* NSF 64-9 (U. S. Government Printing Office, 1964), p. 7.

chose not to file patent applications on them. Some undoubtedly are worthless, now if not forever more. Others, however, must have potential for advancing the technologies of Government and of industry. This conjecture follows easily from the variations in the propensity to patent from agency to agency. It seems most unlikely that the inventions reported to Agriculture would be uniformly better than those reported, say, to the Air Force. With different criteria and with different propensities, some agencies must reject what others would accept. It follows that some of the rejected inventions are patentable. Are these patentable inventions, lying in the limbo of forgotten filing cabinets, worth anything? Conceivably, a few are; but we think most are not. One indication is that, subject to the approval of the Government Patents Board, employee-inventors may file applications on inventions rejected by the Department of Defense. But few do.

Two agencies are doing something about the matter of rejected inventions. The Atomic Energy Commission attempts to see to it that rejected inventions are described in technical reports, which in the Commission's excellent system for disseminating information, are then made widely available. NASA now publishes many of the inventions that NASA will not patent. No such programs exist in the military departments. Officials in DOD believe that it is beyond the mission of that Department to disseminate information about inventions (patented and unpatented) merely because the inventions might have commercial potential.[22]

Findings and Conclusions

Even though it declined slightly in the postwar period, the Federal Government's propensity to patent of about 27 percent cannot be made to explain the discrepancy between the growth of federally financed research and development and the much slower increase in the number of patented inventions emerging from that R&D. Thus what seemed to be a promising hypothesis crumbled when we assembled the data on inventions and patent applications. The gap between the input of R&D and the output of patented inventions is probably to be explained, we think, by something as conceptually simple as diminishing returns.

The propensity to patent varies, and not just slightly among the Federal agencies. They apply different sets of criteria in selecting inven-

[22] The Institute of Applied Technology (formerly the Office of Technical Services) in the Department of Commerce publishes technical reports, some of which probably describe inventions rejected by the Department of Defense.

tions for patent application. They follow no standard practice in publishing the inventions they reject. It seems entirely possible to us, therefore, that among the 85,000 rejected inventions of 1945-1963 there would be a few thousand whose potential contributions remain unexploited. Even if there is a loss or a slippage here, we doubt however if it is at all large.

In view of the sizes of postwar federally financed R&D programs and of the volumes of private patent applications, our estimate of 154,000 inventions is that of a comparatively small number. But such data are a far better measure of inventive activity than statistics on patent applications and issues.

The disposition of patent rights between the Federal Government and its R&D contractors continues to be a subject of controversy. Where the Government confines itself to taking licenses to patents, that is, where contractors retain ownership, about 40 percent of all of the inventions are filed on by contractors. Upon receiving the other 60 percent of the inventions, the Government files on about a quarter of them. In contrast, where the Government takes title to all contractors' inventions, relatively fewer are written into patent applications. As quantitative generalities, these facts were not hitherto known. We think they should be given weight in any future changes in policy on the patent rights in contracts for research and development.

EDUCATIONAL ACTIVITIES

We are bringing the following "analysis of patent functions and values as they affect corporations" to the attention of our readers to provide information for those companies which may be contemplating the development of their own patent departments or a review of the effectiveness of their patent policies and practices.

Patents and the Corporation

THEODORE L. BOWES*

SUMMARY

EVERY CORPORATION MUST CONSIDER, from time to time, whether patents are worthwhile and, if so, to what extent. To facilitate such a review, an analysis of patent functions and values as they affect corporations is presented below, with particular reference to carrying out the patent function through an internal Patent Department.

INTRODUCTION

EVERY PRODUCT, PROCESS, OR SERVICE has an evolutionary pattern and passes through (1) a development and design phase which is typically a period of high prices, relatively poor quality, a reaching for a sound design, and standardization; (2) a production phase during which efforts are concentrated on manufacturing methods, choice of materials, and standardization of quality; (3) a period of consolidation emphasizing cost reduction and improved quality; (4) an improvement stage where further improvements in quality, cost, features or combinations of these are made; and finally (5) a period of liquidation and elimination of the product, process, or service from the scene.

The nature of the patent problem changes similarly. In the development phase, the patent aspects are painted with a wide brush. Basic

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patent protection is an important consideration and infringement of a broad patent is an important danger. During this period, extensive searching and patenting are important, and details are frequently overlooked.

In the production phase, detail inventions directed to the best mode of accomplishment are significant or at least advantageous.

During the consolidation period, patent problems are usually minimal but royalty income or outgo based on earlier success may materially affect profit.

The improvement stage is again important from a patenting standpoint, not only in protecting a company's own production but also in maximizing recognition of its work by others. A patent trading position may be of great value at this time.

During the liquidation period, the patent problem usually disappears and the value of patents declines—unless the life of the product is shorter than the life of the basic patent which also covers other products. During this period, patents allow maximum benefits to be realized from what is left.

At this point it is well to recognize that the Patent Department, in most corporations, has responsibilities extending beyond patents and including trademarks, copyrights, unfair competition, and proprietary data and know-how. However, since the major function relates to inventions, the following discussion will emphasize inventions and patents covering rights to them. The group handling the function will be referred to as the "Patent Department."

A complete corporate patent program has four aspects which may be identified as the four "P's": patenting, protecting, prosecuting, and promoting. More specifically, the primary functions of the Patent Department are to: (1) *patent* inventions, (2) *protect* the company against trespass on the patent rights of others, (3) *prosecute* infringers, and (4) *promote* the use of inventions covered by patents, including licensing for royalty.

The following discussion of these four functions pays particular attention to the values which patents offer a corporation, and concludes with a brief reference to secondary functions performed by the typical Patent Department.

PATENTING

Because the patenting process is so well known, no reference will be made in this presentation to the "how" of patenting. However, the "why" of patenting will be discussed.

Patents on inventions offer a number of competitive tools or advantages:

1. *Patents help commercially through increased volume of sales at better profit margins.* Patents help generate increased sales to customers who want the patented feature. Patents also make it possible to realize—through lower product costs or higher sales prices—better profits than are possible when a product is just like that of a competitor. When competing products are similar, competition is based on factors such as quality and price but not on differences in technology, and profits tend to suffer.

Rarely do we know the full cost to competitors of their attempts to design around patents or their omitting patented features they would otherwise like to use. But we do know that copying often follows the expiration of a patent on a particular product or feature. For example:

(a) The market was quickly flooded with tank-type vacuum cleaners when a key patent expired.

(b) Refrigerator manufacturers refrained from using shelves in the refrigerator door until the broad patents expired.

2. *Patents give the holder a trading position.* Patents may offset one or more of a competitor's patents and result in a tacitly accepted stalemate or a cross-license, either free or at reduced royalties, thereby giving both parties greater freedom of design at minimum cost to their products. A patent filing policy which is too restrictive may result in the payment of an undue amount of royalty.

Although no single patent may be of great significance, a group of patents covering specific details of a product may be valuable to a competitor in providing him with greater engineering freedom.

Adequate and early filing of patent applications is particularly important in complex arts which are difficult and expensive to check for infringement, and in new, fast-moving arts. Where an art is developing rapidly, important inventions which may be pending in the Patent Office will not be disclosed, of course, by a search, which can only be made of issued patents. Substantial investments may be jeopardized by the later issuance of patents to others on such inventions. This danger is minimized by patenting contributions made to the art.

3. *A patent provides insurance against issuance of a patent on the same or a similar invention to a later inventor.* The first inventor and his employer may have a legal defense in an infringement suit or a right to seek an interference and may attempt, belatedly, to obtain a patent. However, strict and corroborated proof of prior completion of the invention is required and the risk of having inadequate records is

great. The outcome of infringement suits and interferences is not only uncertain, but can be costly, win or lose.

4. *A patent on a commercially successful product increases a competitor's product cost.* Such a patent may cause competitors to spend research and development money to design around the patent, develop patentable improvements for trading purposes, take a license or defend an infringement suit. Any of these approaches can be expensive and thus a deterrent to competitors.

5. *Patents provide a basis for stopping piracy of designs.* In view of present uncertainties about the availability of unfair competition principles to an aggrieved designer, design patents covering the appearance of the product seem more important than ever before. Even very detailed design patents have competitive value in foreclosing to competitors the precise design covered by the patent and compelling competitors' expenditure of time and money to create a different design.

Failure to patent detailed designs, often considered "unimportant," allows competitors to copy unpatented designs. This provides very inexpensive engineering for such competitors. For example, a transformer case and cover was duplicated by a competitor after it had been on the market for several years. The competitor apparently did no research or development and may have taken the dimensions directly from the article after purchasing it. No application had been filed for the inventor because there were "no outstanding features." As a result, the inventor's company provided free engineering work for the competitor.

6. *Royalty income from patents is an important advantage.* From a manufacturer's point of view, royalty income is not and should not be the primary purpose of obtaining patents, although it is a desirable and welcome by-product. However, manufacturing corporations do not do engineering work primarily to produce royalty income and their patent programs should not be established and evaluated primarily as income-producing assets. Many companies which file extensively make little or no effort to license others.

The preventing or minimizing of royalty *outgo* is just as important as royalty income. This involves checking proposed products for infringement of the patents of others, and then, if infringement is found, helping to find economically sound non-infringing changes, attempting to invalidate infringed patents, and looking for patents usable as trading material.

7. *Recognition resulting from the obtaining of patents is important to engineers and is probably a factor in stimulating their creativity.*

Since corporate leadership requires continuous creativity, and market position benefits from invention activity, inducements to spur creativity and invention activity are worthwhile. Patents and the recognition they bring are one form of inducement.

8. *Inventions frequently are usable in more than one area of a corporation's business.* When a patented invention is useful to several divisions of a company, its corporate value is obviously multiplied.

9. *Patents on inventions resulting from Government contracts are of value.* It might seem that a department devoting most or all of its time to Government contract work cannot gain much by patenting inventions if the Government is its only foreseeable customer. Even here, one or more of the foregoing considerations will apply. In addition, since *patents demonstrate competence* and capability to advance the technology, an inventive contractor will give a better return for Government R&D dollars. Moreover, the Government looks with some favor on contractors who file freely on such inventions. Many companies regularly identify inventions made by their people when bidding for Government contracts.

The competitive values discussed above apply mainly to patents covering products that are already in commercial production. But patents can also have long-run competitive values. It is essential to obtain patents based on long-range objectives, even though use of the invention may be speculative or uncertain when the application is filed. Nearly everyone knows that a United States patent is good for 17 years. What is less well known is that the 17-year period does not begin until four or five years after the invention is made, so that thoughts about obtaining patents should be projected to something over 20 years. If applications are filed on the basis of present use only, the tendency is to file on details and some broad protection may be lost. This policy leads to a relatively weak patent position.

This long-range aspect of obtaining patents should be considered when determining, on a case-by-case basis, the amount to be spent by each department on its patent program.

Among the factors to be considered in determining a patent program are the state of development of the products involved and the number of new products contemplated. Moreover, consideration should be given to the degree of novelty in each case, in order to decide whether the potential patent strength may lie in numbers (often the case in well-developed arts), or in a relatively few basically new inventions, or in some intermediate area (usually the case if there are no basic developments and the type of development effort is uncertain).

This long-range nature of patent work means that current success in obtaining patents will affect the competitive position of the assignee for the next 20 years or more. The same holds true for competitors, of course.

It is dangerous to decrease suddenly and materially the patent effort. While an abrupt decrease in engineering and development work can cause a corresponding decrease in future product improvement, decreasing the patent effort at the same time will additionally result in failure to obtain protection on engineering and development work done in immediately previous years.

It may also be dangerous to maintain the same level of patent activity when the size of the engineering staff grows, the complexity of the technology increases, and the number of patents and other forms of prior art are enlarged. Growth of an engineering staff usually means a higher rate of disclosure. As the range of products and operations expands, so do patent problems.

Good patent administration also involves the promotion of inventing and a favorable inventive climate. Tools such as award systems, lectures, and contacts with engineers and scientists are helpful.

Protecting

Although obtaining patents is a major function of a Patent Department, substantial problems would exist even if no patent applications were filed. Infringement of competitors' patents is one such problem. The Patent Department should determine the infringement status of all new designs, changes and improvements. In deciding how much effort is desirable, the attorney should weigh the size of the risk with the cost of an investigation. If the risk is very small, it may actually be cheaper to run the risk than to incur investigation expense.

To be of value, an infringement protection program justifies substantial efforts to locate infringement situations—usually at the engineering level. Close cooperation enables engineers to keep the Patent Department informed of the status of product development and improvement projects, and allows the Patent Department to alert the engineers and other interested persons to any potential patent infringement liability.

To be effective, the program requires a careful review of every new engineering design and design change, and a search of issued patents. Attorneys experienced in a particular art can do much of this quickly and effectively on the basis of their knowledge and intuition, even though the responsibility is heavy when a large corporate investment is involved or substantial damages may be awarded.

An adequate infringement protection program requires the attorney to work closely with the engineers, not only to determine infringement but to avoid it by redesign whenever feasible and to determine the validity of infringed patents. The attorney then negotiates licenses where valid and infringed patents are encountered and redesign is not feasible, or where it is less expensive to accept a license than to argue about infringement or validity.

It is also necessary, in protecting from infringement, to review new patents issued by the Patent Office in order to pick up any infringed patent which had not issued at the time of previous investigation.

Whether for budget or other reasons, neglect or casual treatment of the infringement function can be very costly. Infringement can subject an infringer to the payment of royalties for a license. The license terms may be onerous if the infringer's bargaining position is weak and infringement is discovered after completion of tooling and special production equipment. The alleged infringer may have to stand suit—an expensive situation. Finally, if the patent owner does not wish to grant a license and infringement is established, an injunction may issue. This misfortune may result in expensive re-tooling, destruction of inventory, redesign, and loss of market position.

Knowledge of structures patented by others often enables the attorney to point out clear routes which can be taken by design engineers, or areas where additional development work can be undertaken—leading to superior product designs free of patent complications. As patents of others are reviewed, ideas for new products may appear. In some cases, these new products may be protected by securing licenses or purchasing the patents.

The infringement aspect may be very important in situations where it seems least important to take out patents. For example, in the national defense area where the Government is the only likely customer, patents may not seem to be important tools, but the Government contractor is usually required to indemnify the Government against infringement. In view of the costly nature of infringement and the large scale requirements of the Government, damages awarded the patent owner may be substantial.

Prosecuting

An important part of the patent operation is to detect infringement of patents by others. Patent owners who do not police the unlicensed use of their patents may be throwing away much of their value. Infringements are uncovered largely through observation—of advertisements, catalogues, technical papers, trade shows, exhibitions and products on the market.

Alert engineers and salesmen can often bring possible infringements to the attention of management. After the existence of infringement is reasonably established by the Patent Department, the infringer can be notified and requested to cease infringement or, if management approves, he can be offered a license. Continuous follow-up is usually necessary to achieve resolution. Since the assertion of patents leads to license negotiations or to litigation, factors that must be considered include customer relations, effect on other divisions and departments, antitrust laws, extent of the infringement and its effect on the patent owner's business, and the strength of the patents involved.

When management's decision is to license a patent or a group of related patents, the patent attorney, working with management and engineering, learns as much as he can about the infringing product—its structure, sales price, annual sales volume and benefits derived by the infringer from the infringing use of the patent. The attorney also determines the strengths and weaknesses of the patent and works with management in arriving at the license terms to be offered. The terms offered vary with each situation and may include down payment, settlement for past infringement, minimum annual royalties and the running royalty rate. Perhaps the most important term is the royalty rate to be charged. This is arrived at by considering such factors as the royalty usually charged in the industry, the cost saving achieved by the patent and the increased sales appeal.

The attorney seeks to accomplish management's objective in licensing through his negotiating skill, aided by knowledge of the patent, the device which infringes it and the prospective licensee. He must also observe the royalty limits and other negotiating terms established by management. If aggressive and skillful negotiation fails to resolve the problem, litigation must then be considered.

It is unlikely that any companies believe in litigation just for its own sake; instead, they rely on it as a last resort to resolve a dispute. In the first place, litigation is costly. Secondly, adequate presentation of a case in court requires a large expenditure of time, not only of Patent Department personnel but also of technical people and executives who are required to participate in strategy decisions, give depositions and, at times, give testimony in court. Furthermore, the outcome of most patent litigation is uncertain, not only because the subject matter is complex and technical, but also because litigation usually deals with marginal or border-line patents. Strong patents and weak patents rarely get into litigation since infringers do not challenge the obviously strong patents and owners of weak patents do not often assert them through litigation.

It is desirable, of course, to avoid a reputation of softness. To instill in others the proper respect for a good patent position, one must negotiate aggressively and resort to litigation if negotiation fails to achieve the desired result.

PROMOTING

Prospective licensees may be discovered while pursuing the "prosecuting" functions described above. It is also possible to analyze patents in the company's patent portfolio for worthwhile products, to seek out manufacturers who might be interested in making and selling the products involved, and to negotiate licenses under both patents and related technical information if they seem to be valuable to prospective licensees.

Such a program of promotion means analyzing the strength and importance of each patent, determining the infringement status of the product involved, making a market survey to identify possible licensees and fixing fair royalty rates.

Technical information or "know-how" is often an important commodity which can be licensed to others. Such information cannot be protected against copying unless it is used secretly or is covered by patents. Although it is usually only a matter of time until others learn or duplicate such information, it may be of value to a purchaser by giving him lead time over others and thus a long-run competitive advantage. Even patents of minor importance may clinch a deal for "know-how" and increase substantially the value of this information.

OTHER PATENT DEPARTMENT ACTIVITIES

In addition to the foregoing, a typical Patent Department is involved in other areas, including the following:

1. *Company policy on patent matters.* The patent function is a general management function which touches in one way or another all other corporate activity. Company patent policy must keep pace with changes in product lines, advances in technology, changes in Government patent policies, changes in the laws applicable to patents (both U. S. and Foreign) and changes in Patent Office rules.

2. *Trademarks.* Problems relate to the selection, acquisition and

protection of trademarks—protecting a company's marks from infringement or misuse by others, avoiding infringement and misuse of competitors' marks, and licensing of trademarks when appropriate. These matters usually arise in sales, advertising or licensing situations.

3. *Unfair competition.* The doctrine of unfair competition has recently been severely limited by the courts so that copying of products for the purpose of increasing competition is encouraged. The importance of patenting the appearance of a product is, therefore, greater. The Patent Department can help protect against copying by seeking design patent protection on new or redesigned products.

4. *Copyright.* This function pertains to the registration and enforcement of copyrights to protect authorship. From a manufacturer's standpoint it relates mainly to catalogues, papers and other publications.

5. *Technical information.* Protection of certain information developed by employees (engineering, manufacturing and other personnel) may be warranted. The Patent Department can help set up conditions for protecting proprietary information which is disclosed to others, and help determine conditions for others to receive such information. Advising about rights and suggesting how to avoid liability and loss are related functions.

6. *Release of technical information.* Premature release can create problems, including loss of patent rights. By reviewing articles, papers, Government reports, etc., the Patent Department can advise about disclosures and suggest how to avoid problems.

7. *News releases.* Technical releases and certain other public relations efforts should be reviewed to detect patent and trademark problems. Proposed releases can often be modified to accomplish the desired purpose without risking the loss of rights.

8. *Advertising.* Because advertising may disclose patentable information, give evidence of infringement or make incorrect use of trademarks, reviews of proposed advertisements are desirable.

9. *Packaging.* Patent infringement, trademark and copyright problems may result from the functional aspects of packages and the text and illustrations used on them.

10. *Government contracts.* When these contracts include provisions relating to inventions, patents, technical data, indemnity, royalty, reporting of inventions and filing of royalty reports, they should be reviewed, negotiated and administered by the Patent Department.

11. *Purchase order contracts.* These order contracts and order acknowledgments usually include indemnity provisions. The Patent

Department should advise on appropriate contract language and should review the provisions of orders and acknowledgments from others.

12. *Submitted ideas.* The receipt of outside ideas can create serious and costly problems. Proper handling by the Patent Department is necessary to avoid liability and still maintain good customer relationships.

STUDENT PAPERS

By making available student papers, students will receive an incentive and our readers will appreciate the evidence of scholarly development in the fields of interest. These papers are carefully reviewed by the Editorial Committee and other specialists, and helpful suggestions are made to the students as part of the educational function of *IDEA*. The Research Institute invites educational and research institutions to submit informative student manuscripts on the patent, trademark, copyright, and related systems.

Microbiological Plant Patents**

DONALD G. DAUS, ROBERT T. BOND AND SHEP K. ROSE*

SUMMARY

THIS PAPER IS A CRITICAL EXAMINATION and re-evaluation of present patent practise in the field of microbiology. This field has been dominated for 26 years by the decision of the C.C.P.A. in *In re Arzberger*, 46 *USPQ* 32, 1940 C.D. 653, 521 O.G. 272, 112 F 2d 834 (C.C.P.A. 1940). It is the position of the writers that the *Arzberger* case is unsound from legal, economic, and policy viewpoints.

INTRODUCTION

IN A SINGLE FAR-REACHING DECISION, the Court of Customs and Patent Appeals held in *In re Arzberger*[1] that bacteria are not patentable subject matter within the meaning of the Townsend-Purnell Plant Patent

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** This study has resulted in part from the work of Messrs. Daus and Bond in a trial practice case in The George Washington University Law School. Much counsel and useful information was given by persons in the patent profession, both in and out of Government. The authors are Assistant Examiners in the U.S. Patent Office and the opinions expressed in this paper represent their personal views and not the official view of the U.S. Patent Office.

[1] 46 *USPQ* 32, 1940 C.D. 653, 521 O.G. 272, 112 F2d 834 (C.C.P.A. 1940).

Act of 1930.[2] Arzberger had developed a bacterial strain[3] with improved characteristics for the manufacture of acetone, butanol and ethanol, important commercial solvents.

The Primary Examiner had rejected the claim to the bacterium as not within the plant patent provisions. The Patent Office Board of Appeals sustained this rejection adopting the Examiner's excellent answer by reference.

The Court of Customs and Patent Appeals affirmed the Patent Office Board of Appeals. The court held that the meaning of "plant" as employed in the statute did not encompass bacteria.[4] It based its holding on two basic grounds. These grounds were the legislative history of the plant patent statute and canons of statutory construction. The court, in reviewing the legislative history of the statute, found that bacteria were never mentioned and that the basic purpose of the statute was to aid agriculture to an extent equal to the protection granted to manufacturing industry by the usual mechanical or utility patent. The court held that bacteria for the purpose of producing organic solvents by fermentation were not an aid to agriculture. The court further held that bacteria are not produced by any of the methods which Congress discussed.[5]

This paper will discuss the reasoning of the court, raise questions concerning the court's conclusions, and point out an apparently little recognized alternative to patenting micro-organisms as plants, namely, the possibility of claiming living micro-organisms as compositions of matter.

Reconsideration Is Necessary

The lapse of 26 years since the *Arzberger* decision without any reported challenge requires the demonstration of a necessity for its re-

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[2] 35 U.S.C. 161-4, previously R.S. 4886 (35 U.S.C. 31).

[3] "*Clostridium saccharo-butyl-acetonicum-liquifaciens.*" Plants are classified into four phyla: Thallophytes, Bryophytes, Pteridophytes and Spermatophytes, the latter two, pines and seed-bearing plants sometimes classified together, comprise the great majority of all plant patents (Plant Patents 27 and 2050 are drawn to mushrooms).

Thallophytes comprise: Bacteria, fungi (yeasts, molds and mushrooms) and algae. Algae are morphologically similar to fungi except that they additionally possess chlorophyll. Intermediate between algae and fungi are lichens, combinations of algae and fungi living together symbiotically. Sometimes bacteria are included as fungi. Separate sciences of bacteriology and mycology have evolved, tending to favor their separate classification. See Robbins, L. J., 42 *JPOS* 830 (1960).

[4] For contemporary analyses see Parker, C. B., 22 *JPOS* 622 (1940) and Kegan, A. I., 18 Ind. Eng. Chem. (News Ed.) 852 (1940).

[5] "Grafting, budding, cutting, layering, division and the like."

consideration. Does this decision aid and serve the purpose of the patent system, namely to promote the sciences and useful arts?

A recently publicized theft of valuable antibiotics-producing cultures shows the inadequacy of the protection afforded by the law of trade secrecy.[6] A further example of such inadequacy may well be the decline of the industry directly concerned with the *Arzberger* invention itself, that of fermentation-produced acetone.

In 1940, the year *Arzberger* was decided, the relatively young fermentation-acetone industry[7] produced 60 million pounds of acetone, 20 percent of the total.[8] In 1960, the overall market tripled, but the fermentation acetone comprised only 1½ percent of the total.[9] The results are tabulated as follows:

TABLE 1
ACETONE PRODUCTION[10]

Years		Fermentation	Synthetic	Percentage of fermentation	Price
	(Million lbs./yrs.)	(Million lbs./yr.)	(Million lbs./yr.)	(%)	(¢/lb.)
1940	300	60	240	20	
1945	349	42.4	307.4	12.1	7
1950	482.5	23.7	448.8	4.9	7.5
1955	436.8	27.4	409.4	6.2	7
1960[11]	761.3	11.7	749.6	1.5	8

In spite of steady prices and expanding consumption, the fermentation-market share declined disproportionately.

It is a temptation to consider the *Arzberger* decision the major factor in the decline of a relatively unprotected, agriculturally based in-

[6] American Cyanamid v Fox, 244 N.Y.S. 2d 91 (1964), the facts of which are set out in 42 *Chemical and Engineering News* 22 (Jan. 20, 1964) and 44 and E.N. 14 [Jan. 31, 1966]). See also *Chemical Engineering,* April 25, 1966, pp. 148-150.

[7] During World War I, acetone was needed in the manufacture of cordite explosives and airplane "dope." Chaim Weizmann was induced by the British government to aid in the development of a commercial process. The U. S. Government established a plant at Terre Haute, Indiana. Since the by-product, butanol, was then unsalable, the industry closed at war's end. At subsequent stages butanol became the major product for use in automotive lacquers. Presently the demand for acetone somewhat exceeds that for butanol.

[8] Kirk-Othmer, Vol. I, *Encyclopedia of Chemical Technology* 91 (1947).

[9] Calculated from Kirk-Othmer, Vol. I, *Encyclopedia of Chemical Technology* 63 (2d. Ed. 1963). (The major source of synthetic acetone is isopropyl alcohol. Hatch *Isopropyl Alcohol* 26 (McGraw Hill, 1961).

[10] *Ibid.*

[11] By 1960, fermentation capacity had declined to 4.5 million pounds of acetone.

dustry[12] in contrast to the growth of a synthetic organic-chemical production which has not been denied patent protection. However, it should not be forgotten that the decline of the fermentation-acetone industry may be due in part to support prices for raw materials.[13] Even in 1960, the fermentation-acetone industry was a significant consumer of agricultural products.[14]

An additional reason for reconsideration of the *Arzberger* case is the fact pattern disclosed in the tetracycline case before the Federal Trade Commission.[15] The Commission found that the organisms placed on public deposit when Cyanamid obtained some of its Aureomycin patents were very weak and would not produce antibiotics in any commercially significant amount. In actual practice other bacterial strains were employed which yielded a commercially successful product and process. This Aureomycin patent will expire shortly and yet the public will not be enabled to practice the invention described in the patents since the commercially successful organism, a most critical part of the invention, has been withheld as a trade secret. Were patents allowed on the actual organism as such, it is submitted that this could be avoided. If the effective organisms could be protected by patent, trade secrecy would not be necessary to protect these valuable advances. Patenting of micro-organisms as such would tend to favor a more complete disclosure of inventions in this field and the public would ultimately benefit.

Another reason for the re-examination of *Arzberger* is that some new technologies involving microbiology[16] have been developed since the

[12] The fermentations produce 65-85% butanol, 3-25% acetone and 1-10% ethanol, depending on the bacterial strain and substrate. Prescott and Dunn, *Industrial Microbiology* 250-5 (3rd Ed. McGraw Hill, 1959) 312-6, 320 (2d. Ed. McGraw Hill, 1949). It should be noted that the bacteria used, while isolated originally from soil, require special heat "shocking" in order to produce commercial amounts of solvents. The process organisms are not found as such in nature and are truly "domesticated."

[13] It may well be that, as in nylon, agricultural-support prices have put a floor under agricultural competition minimizing risks of decreased prices for the synthetic chemical producers.

[14] The acetone production could consume 60 million bushels, almost twice as much corn as the two second largest corn refineries combined.

[15] See "In the Matter of American Cyanamid, et al.," FTC Docket No. 7211, Opinion Accompanying Final Order, Footnote 14, bridging pages 10-11. The order requires Cyanamid to make the organism available. The order has been appealed to the Sixth Circuit and was argued in December, 1965. As of the time of this writing, there has been no decision by the court.

[16] Examples are food from petroleum and paper-making wastes (yeasts); life-support systems in spore capsules (algae) and microbiological fuel cells. It is conceivable that specialized strains may be critical in developing new technologies.

Arzberger decision. The impact of the decision on these new technologies should be considered.

Interpretation of the Word "Plant"

The *Arzberger* court gives a very narrow interpretation of both Congress' language and intent. In a statute relating to the arts and sciences, the court applied the popular meaning of the word *plant* rather than the scientific, or technical meaning. The court cited a tariff case to justify its interpretation.[17] Tariffs deal with goods as they are identified and used generally in commerce. In tariff cases commercially accepted terms should be used, since the purpose of a tariff statute is to regulate trade and commerce.

The constitutional purpose of patent laws is to promote the sciences and useful arts. Therefore, the correct use of the canon of statutory construction, that the words of a statute should be interpreted by the purpose or intent of the statute, would require that the words of the Plant Patent Act (as well as all of the patent statutes) be interpreted in their scientific and technological meaning. The court in *Arzberger* clearly erred in its application of this canon. The statute expressly states that all provisions of the patent statute apply to plants, with the exception that the requirements of 35 U.S.C. 112 are relaxed.[18] Presumably these provisions include the standard of invention, "would have been obvious . . . to a person having ordinary *skill in the art* to which said subject matter pertains."[19] It is far more reasonable that Congress intended that the term *plant* should be interpreted by its scientific and technical meaning just as the terms in the remainder of the patent statutes are interpreted. Congress explicitly requires plant patents to comply with the other patent sections[20] as far as possible.[21]

The definition of a "plant" should, therefore, be determined only by technical considerations. The Plant Patent Act was directed to protect workers in the art of developing new plants, technical people skilled in the biological sciences, not the public at large.

A still further insight into the scope of the term *plant,* as employed in the plant-patent statute, comes from the reading of the statute itself.

17 Nix v. Hedden, 149 U.S. 304, 13 S.Ct. 831, 832.

18 35 U.S.C. 161. See also *In re* LeGrice 301 F2d 929, 133 *USPQ* 365 (C.C.P.A., 1962).

19 35 U.S.C. 103 (underlining added).

20 Except 35 U.S.C. 112 where compliance is to be to the extent possible. 35 U.S.C. 162. The writers recognize description problems will arise if bacteria are held patentable. That is not insurmountable, but is outside the scope of this paper.

21 A discussion of the then current law on statutory interpretation appears in Brief for Appellant, pp. 12-15, *In re* Arzberger, 46 *USPQ* 32 (C.C.P.A. 1940).

The statute specifically excludes from its protection tuber propagated plants and plants found in an uncultivated state. Congress intended some plants to be excluded from protection and it has enumerated two categories specifically. It would appear clear that the intent of Congress was to *include* rather than *exclude* all other categories of plants since, if Congress really intended to exclude other categories, it would have specifically so provided.[22, 23]

The Legislative Record Implies That Manual Manipulation Is a Necessary Part of Asexual Reproduction.

The legislative history of the plant patent statute indicates the Congress intended that the process of asexual reproduction of a patentable variety of plant should at some point be caused or aided by some manual act. Otherwise, it is argued, where is the inventive act or acts whereby the invention can be said to have been made?

Modern fermentors are generally equipped with agitators to (1) disperse sterile air into fine bubbles to provide oxygen more efficiently, and (2) to break up clumps of micro-organisms so that there is a greater surface-area-to-weight ratio, favoring transfer of nutrients into the bacterial cells and thereby stimulating growth.[24] It is apparent that Congress intended to limit asexual reproduction to *manually aided* reproduction.[25]

The use of agitators to break apart the growing bacterial fungal, algae or yeast cells is division by human agency.[26] The commercial propagation of micro-organisms in fermentors is asexual reproduction on a large scale.[27] In *Arzberger* the size of bacteria is mentioned as a possible distinction between patentable and unpatentable plants. However, it is almost axiomatic in patent law that a difference of size or in degree is not a patentable distinction.

The *Arzberger* court relied on the stated purpose of Congress in enacting the Plant Patent Act which was to benefit agriculture. The court stated that bacteria do not generally benefit agriculture and

22 See Appendix I.

23 In view of the fact that all statutes are prospective in their effect rather than retrospective, Congress probably intended the statute to cover varieties of plants which were not specifically mentioned.

24 Also it is postulated that the agitator reduces the thickness of stagnant films on the cells, stimulating growth.

25 There is little patentable distinction in the process use of mechanical means to accomplish what can be done manually.

26 It would appear that asexual reproduction of higher plants, if it could be done mechanically, would not be without the purview of the Plant-Patent Act.

27 See Appendix II, "Industrial Asexual Reproduction."

accordingly are outside the scope of the Act. If Congress intended to allow discriminations between patentable novel economic plants on the basis of their ultimately intended roles variously found by horticulturists, agronomists, mycologists, and bacteriologists, or on the ground that, to be patentable under the Act, the plant must be tillable in the ordinarily recognized sense to grow a crop, Congress did not express its purpose.[28] It would appear that Congress did not intend that discrimination be permitted between types of plants which would be granted patent protection[29] on either botanical, social[30] or economic grounds. The Congress did not leave the Patent Office or the courts free to discriminate as to the ultimate uses of new plant varieties, but created a new category of patentable subject matter: plants.

Bacteria Are Within Congress' Intent to Aid Agriculture

The U. S. Department of Agriculture maintains extensive facilities at the Northern Research Laboratories, Peoria, Illinois, for the development of new micro-organisms and processes useful for converting agricultural products into other marketable materials, such as antibiotics, et cetera, through the use of fermentation.[31] In view of the extensive support given by the Congress to the Department of Agriculture for the purpose of carrying out this type of research and development work, it must be concluded that Congress considers this type of activity consistent with the overall purpose of the Department of Agriculture, namely, advancing and aiding agriculture.[32]

Proposed Alternative Protection: Composition of Matter

There is some belief that living matter cannot be patented because such subject matter would fall within the doctrine of the unpatentability of "principles of nature." Justice Douglas stated in *Funk Bros. Seed Co.* v. *Kalo Innoculant Co.*,[33] that "the qualities of these bacteria, like the heat of the sun, electricity or the quality of metals, are part of the storehouse of knowledge of all men." It is important to note, however, that the varieties of bacteria involved in the *Kalo* case were all old, well-known varieties, not a new variety produced by the interven-

[28] Congress did intend that new plants of drug and medicinal value be protected by this Act. H.R.Rep. No. 1129, 71st Cong. 2d. Sess. 9 (1930).

[29] Save for those specifically excluded, as tubers.

[30] Except as limited by 35 U.S.C. 101 to "useful."

[31] Sen. Report 448, 87th Cong. 1st Sess. 124 (1961).

[32] See Appendix III, "The Research Work of The U.S.D.A. as Evidence."

[33] 333 U.S. 127. The Court decided the case on aggregation, not whether living bacteria can be patented. Had the Court wished to state that bacteria cannot be patented, it had opportunity to so state. Its silence may be significant.

tion of the inventive skill of man. In *Kalo* the Court had to decide whether the claimed compositions containing these old varieties were really proper combinations or whether they were merely aggregations of old, noncooperating elements or subcombinations. The Court held the compositions to be mere aggregations and not proper combinations. Justice Douglas stated, "We think the aggregation of species fell short of invention." Had the Court wished to state that living matter could not be the proper subject of a mechanical or utility patent, it could have. The fact that it did not so state is deemed significant. After all, as was so aptly stated by Justice Frankfurter in his concurring opinion in *Kalo*, "Everything that happens may be deemed the work of nature."

No record has been found of an attempt to claim industrially useful micro-organisms as compositions of matter. There is no requirement in the statute that a composition of matter be nonliving in order to be patentable. Living as well as nonliving bodies have mass, occupy space, et cetera. "Composition of matter," as employed in 35 U.S.C. 101, includes living matter unless some rule of statutory construction or decision gives a narrower interpretation to the term. No such rule or decision has been found. Thus, living matter is believed patentable under 35 U.S.C. 101 provided the remaining statutory requirements for patentability are satisfied.[34] The existence of patents drawn to living organisms and cultures used in foods, insecticides,[35] et cetera, is indicated in the footnote below.[36]

[34] The requirements of 35 U.S.C. 112 are particularly troublesome.

[35] No reason is seen why such patents do not include cultures for fermentation.

[36] The following are typical of living matter patented as compositions of matter and are by no means exhaustive: (The number of the patent, its month of issue, the patentee and the Patent Office classification are given in that order).

1) Bacteria
   3,133,066 12-1963 Emond 167-13
   Claims 1 and 2 are drawn to composition containing oil and *Bacillus thuringiensis* spores. Reference to the patent file indicates emphasis on the living character of the composition, and of synergistic effects.
2) Yeasts
   2,919,194 12-1959 Johnston 99-96
   Claim 21 is drawn to dry baker's viable yeasts comprising the yeast, less than 8% moisture.
3) Yeast and Bacteria
   1,894,135 1-1933 Torok *et al.* 99-96
   Claim 10 is drawn to "a yeast preparation containing lactic acid separated from their nutrient medium."
4) Mushroom mycellia ("spawn")
   2,262,851 11-1941 Lescarboura 47-111
   Claims 1-10 are drawn to pulps overgrown with mushroom mycellium.
5) Virus
   2,271,819 2-1942 Green 167-78

It is also interesting to note that former Commissioner of Patents Watson testified before a congressional committee which was considering a proposed revision of the Plant Patent Act, that "patents are granted on cultures."[37]

CONCLUSIONS

We conclude:

1. A need for a change exists. The fate of the acetone-fermentation industry, regression in an expanding market, might have been altered had the *Arzberger* decision held bacteria patentable as plants.

2. Presently used protection, patent claims drawn to the uses of novel organisms and to processes for their isolation, is inadequate. Trade secrecy as indicated by the recent *American Cyanamid* v. *Fox* case cited, *supra,* results in inadequate protection of valuable microbiological cultures. Furthermore, one of the purposes of the patent laws is the discouragement of resort to trade secrecy. If this purpose of the patent laws is a valid one, and it is deemed so by all supporters of the patent system, then full disclosure and patent protection to the inventor advances the public interest more than nondisclosure and trade secrecy.

3. Congress' support of the excellent microbiological work of the United States Department of Agriculture indicates that the narrow

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Claims 3 and 4 are drawn to a distemper virus vaccine described by the process for its production.
2,518,978 8-1950 Cox *et al.* 167-80
Claim 5 is drawn to a hog cholera virus developed by a specified process.
2,966,433 12-1960 Cox 167-78
Claims 1 and 2 are drawn to live polio viruses made by a specified process.

6) Plant seeds
3,080,285 3-1963 Openwald, *et al.* 167-65
Claims 1-4 are drawn to seed covered with medication.

7) Eggs
3,088,865 5-1963 Wernicoff *et al.* 167-531
Claim 8 is drawn to an egg treated by the method of addition of hormones.

8) Eggs plus bacteriophages
2,851,006 9-1958 Taylor *et al.* 119-1
Claims 1-8 are drawn to eggs inoculated with *Salmonella* phages (a virus which attacks *Salmonella* bacteria), providing resistance thereto.

Two mushrooms have been patented under the plant statute:
Plant Patent 27 9-1932 Lambert 47-59
Plant Patent 2,050 4-1961 Robbins 47-59
It is noteworthy that 2050 issued subsequently to *In re* Arzberger, yet the Patent Office did not cite it. It is also noted that these appear to violate the policy of not permitting patenting of the edible portion of the plant, the stated reason for exclusion of potatoes under the plant statutes.

[37] S. Rep. No. 932 86th Cong. 1st Sess. 7 (1959), in support of a bill to remove the provisions excluding tuber propagated plants.

interpretation of the intent of Congress by the court in *Arzberger* is not justified.

4. Plant protection is appropriate, since industrial fermentation is mechanical asexual reproduction on the grand scale.

5. Alternatively, the use of utility claims to the micro-organisms as composition of matter is suggested. This form of claim has been allowed for foods and nonindustrial products, generally with a "carrier." No reason is seen to exclude industrial micro-organisms since one of the purposes of the patent system is to advance industry as well as agriculture.

6. During the 26 years since the narrow interpretation of intent of Congress in the *Arzberger* case, we have noted the shrinkage of an agriculturally based industry, the acetone-fermentation industry. During this same period of time we have described increasing amounts of work in the field of microbiological fermentation by the U. S. Department of Agriculture. This work has been an attempt to relieve, at least partially, the oversupply of grain and other farm products in this country. The rewards of this work have been remarkable, but in view of the problem of vast surplus products confronting agriculture today, is it not time to attempt a broader policy and encourage private incentive as well as Government in this field?

7. "Plant" should be interpreted in its scientific sense as would be expected in a statute drawn to a scientific, technical subject.

8. Improvements in synthesis of chemicals are patentable. What would happen if agriculturally based industry were given the incentive to develop new strains of micro-organisms such that fermentation would be enabled to compete with the synthetic processes? Assuming that patents form any valid function by stimulating business and inventive activity to generate available technical know-how (which must be assumed to justify any patents for any inventions), the grant of a patent under the Plant Patent Act for micro-organisms would clearly fulfill both the constitutional[38] purpose of the patent statutes in promoting science and useful arts and carry out Congress' specific intent to aid agriculture. No reason is seen why such an approach should not be given a full and fair trial.

9. In considering the scope and effect of the Townsend-Purnell Plant Patent Act of 1930, as amended in 1954, should it not be interpreted to include plant breeder-microbotanists as inventors on a par with mechanical, electrical and chemical artisans, as well as the plant breeder-botanist? We believe the answer to be affirmative.[39]

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[38] U. S. Constitution, Article I, Section 8, Clause 8.

APPENDIX I

Legislative History of the Plant-Patent Act

On February 11, 1930, identical bills were simultaneously introduced in the Senate by the Hon. John G. Townsend, Jr. of Delaware (S. 3530) and in the House of Representatives by the Hon. Fred S. Purnell of Indiana (H.R. 9765). These bills were referred to the respective committees on patents in the Senate and House, and to the Secretaries of Agriculture and of Commerce. The proposal was to grant patents on:

"Any new and distinct variety of asexually reproduced plant other than a tuber-propagated plant or a plant which reproduces itself without human aid," and that "The words invented and discovered as used in this section, in regard to asexually reproduced plants, shall be interpreted to include invention and discovery in the sense of finding a thing already existing and reproducing the same as well as in the sense of creating."

The Secretary of Agriculture on March 17, 1930, reported back that "the proposed legislation would appear to be desirable and to lend far-reaching encouragement to agriculture and benefit to the general public."

The Secretary of Commerce referred the bill to the Commissioner of Patents and reported back his general approval although questioning (March 12, 1930) the constitutionality of the proposal to grant patents on mere "finds."

On March 24th, Senator Townsend introduced new S. 4015, still including provision for patents on newly found varieties of plants. On April 30th, the Senate Committee on Patents, apparently without public hearing, filed its reports and recommended that its bill (4015), but with Amendments eliminating newly found plants, be passed.

On April 3rd, Mr. Purnell introduced new H.R. 11372 omitting the "mere finds." On April 9th, the House Committee on Patents held a public hearing on H.R. 11372 and added a section barring patents on plants which had been "introduced to the public prior to the approval of the act." On April 10th, the House Committee made its report and recommended passage of the Act.

On April 14, 1930, Senate Bill 4015 was called on the calendar with an amendment offered by Senator McKellar of Tennessee, and approved by Senator Townsend, barring plants that had been "introduced to the public" prior to the approval of the Act.

The discussions which took place show that Senator Dill had grave doubts as to the wisdom of the legislation, especially as to plants of a food-producing nature. Senator Caraway also questioned the practicability of the scheme, and on objection of Senator Black the bill was passed over for the day.

On April 17th, the bill (S. 4015) was again called up, and again passed over. Senator Copeland introduced a number of letters from agronomists favoring the bill.

On May 12th the bill was again called and amendments agreed to, striking out the provision to protect a "newly found variety of plant." The endorsements of various agriculturists and societies were noted on the record and the bill then passed by the Senate without a record vote.

The House Bill 11372 was called on the consent calendar May 5, 1930. Mr. Stafford remarked, "This is establishing a precedent to provide for a patent to those who develop a rare species of cattle or chicken."

Mr. Fiorello LaGuardia (of New York) objected to immediate consideration and

[39] "The tremendous forces of plant life have not yet been fully harnessed by man, but the advances made so far by the plant breeder clearly indicate that his contribution may some day be greater and more important than the services of steam or electricity." J. Rossman, 13 *JPOS* 11 (1931).

there was quite an interesting informal discussion indicating that Mr. LaGuardia had reviewed the report of the House Committee and appreciated the great importance of the bill and the "difficulties in carrying out the provisions of this bill." He further stated, "I will go further and state that I consider Luther Burbank the Outstanding American of his time." But he did not "believe it possible to protect him by patent rights." (Mr. Burbank died in 1926.)

It was pointed out that the bill had the approval of the Commissioner of Patents, but at Mr. Stafford's request it was "passed over without prejudice."

On May 13th, Mr. Vestal, Chairman of the House Patent Committee, asked unanimous consent to take up Senate Bill 4015, which he said was in the exact language of the House bill, as reported by his committee. There was no discussion and the bill was passed without a record vote. The House bill was then laid on the table.

The bill was approved by President Hoover on May 23rd, 1930, as the Townsend-Purnell Plant Patent Act of 1930.

The Act has been amended once, in 1954, to broadly include newly found discoveries, cultivated sports, induced and discovered mutants and seedlings.

The original statute of 1930 did not specifically preclude the grant of patents on the latter categories of the 1954 amendment. The law appears to have been intended to cover only such inventions or discoveries as have been made as the result of some act of creation on the part of the inventor. The act may have been an accident. The inventor may not have had any specific intention except that of experimentation, but if a new plant is produced having distinguishing characteristics, such a plant is patentable.

If, on the other hand, the alleged inventor merely found the sport or freak product of unaided nature, under the Act of 1930, prior to amendment in 1954, no amount of reproduction could have sufficed to develop patentable novelty. It is undoubtedly true that if the Act of 1930 had been passed as originally proposed there would have been justification for the grant of patents on mere finds or accidental discoveries of freaks of nature, and now the 1954 amendment gives statutory recognition of the right to such claims, provided that the varieties of plants newly found by plant explorers or other varieties growing in an uncultivated or wild state are not found in cultivated areas.

An attempt in 1959 to remove the exclusion of tuberous plants was unsuccessful.

APPENDIX II

Industrial Asexual Reproduction

Plant patents carry the right to exclude others from asexual reproduction of the protected plant. This has particular significance to the fermentation industries.

Bacteria and fungi reproduce by cell division, fungi at a considerably slower rate. When a sterile tube of nutrient medium is inoculated with a bacterium, typically a lag of several hours, days, or even weeks takes place until the cell divides. Once it starts, it divides at a rapid rate until it reaches a certain level characteristic of the particular conditions in the medium. This cell division produces an increase in numbers which gives a straight line on semilogarithmic graph papers. This rapid rate is called the "log phase." It is characteristic of most species that a transfer of cells growing in log phase produces a minimum lag time. Once the log phase stops, the organisms become unstable regarding production of antibiotics and other products, since many of the cells become "old."

In expensive installations such as the 40,000 gallon fermenter used for penicillin, it is not economical to introduce a single cell into such a volume. It would take too long to get started and to find if the proper organism is growing. Accordingly, serial transfers in the log phase are made in successively larger tanks, each 5 to 10 percent of the volume of the next tank. This permits rapid utilization of the larger fermenter at reasonable cost, with an identity check run at each transfer. The material transferred is called the "inoculum." It takes weeks from the initial transfer to the inoculation of the large fermenter and its harvest.

This growth in inoculum is asexual reproduction on a grand scale. The right to exclude others from this is a much broader right than the right to exclude others from a process of using the given strain, since (1) the difficulty of proving identity of a process of use is greater than that of proving the identity of two microbiological strains, and (2) the typically narrow process claims may readily be avoided by those skilled in the art.

The measure of protection given the inventor would be considerably greater if it covered the sole right to asexually reproduce the organism.

APPENDIX III

The Research Work of the U. S. Department of Agriculture as Evidence of Congress' Intent

A casual survey of the work done by the Northern Research Laboratories (N.R.L.), Peoria, Illinois, indicates just how active the U. S. Department of Agriculture is in the area of industrial fermentations and microbiology. A major repository of cultures is maintained at Peoria.

During the years of World War II, the Northern Regional Research Laboratory played a very large role in the successful development of the antibiotic penicillin by fermentation using molds called Penicillia. The classic reference work on these molds (at least at that time) is Thom, *The Penicillia,* (Williams and Wilkens, 1930). Florey and Heatley, who had conceived the idea of producing penicillin as an antibiotic for medicinal use and had carried this idea out on a small scale in England, came to the United States where more extensive facilities, free from the war ravages of England, were available. They consulted with Mr. Thom, who was then the principal mycologist of the USDA (Raper, *USDA Yearbook,* [1943-47] p. 700). Florey and Heatley went to these famed laboratories to have penicillin production started, in view of N.R.L.'s previous work on fermentation for industrial chemicals (Sen. Rep. 448, 87th Cong., 1st Sess., 124 [1960]). Subsequent results indicated the justification of this choice (USDA Research Achievement Sheet 52 [c], March 4, 1946).

Subsequent work led to patents on mushroom culture, (Humfeld, Pat. No. 2,693,665; yeasts, Wickerham *et al.,* 2,764,487; penicillin derivatives, Stodola *et al.,* 2,573,741).

Considerable work has been done by the USDA on commercialization of citric-acid manufacture, lactic-acid purification, glutonic and fumaric-acid fermentations, as well as other processes not yet commercial (Stodola *et al., USDA Yearbook* [1950-51] pps. 86-91).

Some commercially used antibiotics have been developed by N.R.L., e.g., hydroxystreptomycin, polymixin and subtilin (Raper *et al., USDA Yearbook* [1950-51] pps. 734-41).

Work on commercialization of riboflavin by fermentation is also reported (Tanner, *USDA Yearbook* [1950-51] pps. 762-3).

Recent USDA work is reported for raising the nutritive value of wheat and other grains (New York Times, April 13, 1966, describing the work of Dr. Wang of N.R.L.).

It is noted that none of these patents have claims drawn to the organisms. E. L. Peterson, Assistant Secretary, USDA, has stated the Department's policy that no patents are filed on any plant material eligible for patenting (Sen. Rep. No. 932, 86d Cong., 1st Sess. 8 [1959]). The Department of Agriculture opposed expansion of the Plant Act to embrace potatoes (S. Rep. No. 932, 5) in view of its own activity in potatoes. This is in interesting reversal of the original situation in which the USDA proposed and the Patent Office opposed the original Plant-Patent Act.

In view of the continued extensive activity of the USDA in microbiology, it is submitted that Congress' intent to aid agriculture reflected in annual appropriations as well as the plant-patent statute, must be interpreted as embracing microscopic plants such as yeasts, molds and bacteria.

Phonograph Records and the Copyright Compulsory License*

JAMES N. DRESSER

SUMMARY

ONE OF THE MORE CONTROVERSIAL ASPECTS of the present United States copyright law is the compulsory licensing provision under which the owner of a copyright in a musical composition is required to grant a recording license to anyone who seeks it once the owner has permitted one recording of the composition to be made.[1] With a general revision to the copyright laws under discussion, parties on both sides of the debate are making themselves heard. Whether the provision should be retained intact or completely eliminated is the frequently argued question.[2] It is the purpose of this paper to compare the compulsory license provision of the proposed statute[3] with the provision of

* This paper, prepared under the supervision of Professor L. James Harris, was submitted in fulfillment of the requirements for a course in Legal Writing in The George Washington University Law School.

[1] See generally Henn, *The Compulsory License Provisions of the U. S. Copyright Law,* and Blaisdell, *The Economic Aspects of the Compulsory License* (Copyright Law Revision Studies No. 5 and No. 6, Comm. Print 1960).

[2] See *Hearings Before Subcommittee No. 3 of the Committee on the Judiciary,* 89th Cong., 1st Sess.; H.R. 4347, H.R. 5680, H.R. 6831, H.R. 6835.

[3] H.R. 4347, H.R. 5680, H.R. 6831, H.R. 6835, S. 1006. Hereinafter referred to as the bill.

the present law and to determine some of the changes which will result if the bill becomes law. A brief look is taken at some of the effects of the provision and at some of the arguments for and against it. Lastly, an alternative is suggested which, it is thought, might be a compromise satisfactory to both sides of the debate.

Background

IN 1908 THE UNITED STATES SUPREME COURT held that a copyright in a musical composition did not permit the copyright proprietor to prevent another party from manufacturing and selling player piano rolls which, when utilized with a player piano, played the composition.[4] To provide songwriters with this protection, Congress included among the rights available to them under the 1909 general revision to the copyright law[5] the right to exclude others from recording their copyrighted musical compositions. But, fearful that a monopoly would arise in the recording industry,[6] Congress qualified that right by requiring that, when the owner of a copyright in a musical composition did permit a recording of it to be made, then he must permit any and all others who desire to make recordings of the work to do so, with the requirement that these subsequent recorders pay to the copyright owner a royalty of two cents per recording made. Thus was born the compulsory license of today's phonograph record industry.

To obtain a copyright in his musical composition under the present statute, a composer must fulfill the same requirements which the statute places upon other "authors" in order to get copyright protection; that is, the composer must publish his composition with the notice of copyright on it;[7] and, to secure registration of that copyright, he must deposit with the copyright office two copies of the work together with the necessary formal papers and fees.[8] In return, the copyright proprietor is given the right to exclude others from copying, vending, giving a public performance for profit, making an arrangement or adaptation,

[4] White-Smith Music Publishing Company v. Apollo Company, 209 U. S. 1, 28 S. Ct. 319 (1908).

[5] Now Title 17 of the United States Code.

[6] H.R. 2222, S. 1108, 60th Cong., 2d Sess., pp. 4-9 (1909).

[7] 17 U.S.C. §10.

[8] 17 U.S.C. §§13, 215; 37 C.F.R. §202.16.

and recording the copyrighted work, subject to the compulsory license.[9]

The requirements of the compulsory license provision are not many. When the copyright owner permits a recording to be made of his work he must file a notice of that "use" in the copyright office, and failure on his part to do so is a complete defense to a suit for infringement by other recordings.[10] A third party wanting to avail himself of the compulsory license need only send the copyright owner a notice of his intention to do so, with a copy to the copyright office,[11] and he can be required to submit to the copyright proprietor a monthly accounting, together with the royalty.[12] Failure by the licensee to meet any of these requirements can make him liable for treble royalties.[13] The compulsory license has been held to give the licensee the right to make an arrangement of the composition suitable for his own style,[14] and payment of the statutory royalty frees the recording from further royalties unless it is played publicly for profit.[15] Under the present statute a composer may obtain a copyright in his musical composition, but a performing artist is not able to obtain copyright protection for his recorded rendition of that composition. Consequently, another person, utilizing a compulsory license to the copyrighted musical composition, could duplicate recordings made by that performer, or by the copyright owner himself, and vend them without infringing any copyright. This record piracy may, however, give rise to a cause of action for unfair competition.[16]

THE 1965 GENERAL REVISION BILL

The bill introduced into the 89th Congress for the general revision of the copyright law[17] proposes to retain the compulsory license provision; however, many aspects of the provision now existing under the statute and case law will be affected if the bill is adopted.

Sound Recordings

One of the major changes proposed by the bill is the addition of

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[9] 17 U.S.C. §1.

[10] 17 U.S.C. §1 (e).

[11] 17 U.S.C. §101 (e).

[12] 17 U.S.C. §1 (e).

[13] 17 U.S.C. §§1 (e) and 101 (e).

[14] Marks Music Corp. v. Foullon, 171 F. 2d 905 (1949); Manners v. Famous Players-Lasky Corp., 262 F. 811 (1919).

[15] 17 U.S.C. §1 (e).

[16] It may, however, be urged that the Supreme Court decisions in Sears, Roebuck & Co. v. Stiffel Co., 376 U. S. 225, 84 S. Ct. 784, 11 L. Ed. 2d 661 (1964) and Compco Corp., v. Day-Brite Lighting, Inc. 376 U. S. 234, 84 S. Ct. 779, 11 L. Ed. 2d 669 (1964) weaken this. But subsequent to these cases the New York Supreme Court

sound recordings to the categories of copyrightable works. This will permit a recording artist to copyright the sound recording of his rendition of another person's copyrighted musical composition. The performer's copyright will be in the *sound recording* and not in the *record* which he makes of that sound recording. The distinction is subtle, but for this purpose a "record" can be defined as a material object in which sounds are fixed by any process and which, when activated mechanically, electronically, or otherwise, enables the sounds to be made audible. A "sound recording" can then be defined as the aggregate of the sound fixed in a record. Thus, phonograph records, tape, wire, and film recordings, motion picture sound tracks, the audio portion of video tape recordings, and perforated rolls, disks, and tape all fit this definition of a record.[18] The rights of a recording artist under a copyright in his sound recording are independent of the rights of a composer to his composition. While a third party may have a right to make sound recordings of a particular composition, a copyright in a sound recording will prohibit duplication of that sound recording. Consequently, record piracy will give the proprietor of the copyright in the sound recording a statutory cause of action for copyright infringement. Since the proprietor will not have to rely solely on a common-law unfair-competition complaint, the *Sears* and *Compco* cases[19] will not bar relief. Because the copyright is in the sound recording and not in the record, the record pirate cannot avoid infringement by producing another form of the sound recording, for example, by copying the sounds of a phonograph record onto a tape recording. If merely the record were copyrighted, such copying would not be infringement since it would not be copying the record.

Section 112 of the bill imposes limitations upon the exclusive rights of the proprietor of a copyright in a sound recording. The copyright owner has the exclusive right only to reproduce the copyrighted sound recording and to distribute copies or phonorecords of the work to the public by sale, rental, lease, or lending. In addition, the bill expressly states that the right to reproduce the work is limited to the duplication

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held that duplication of phonograph records still gives rise to a cause of action under the New York unfair competition doctrine (Capital Records, Inc., v. Greatest Records, Inc., 142 USPQ 109 (1964). See also *Nimmer on Copyright,* by Melville B. Nimmer, Matthew Bender & Company, Inc. (1963, with 1964 and 1965 supplements), §35.

17 *Supra,* note 3.

18 However, the bill specifically excludes motion picture sound tracks from its definition of a record.

19 *Supra,* note 16.

of the sound recording in the form of phonorecords that directly or indirectly recapture the actual sounds of the recording. Thus, if another performer makes a phonorecord in which he deliberately imitates the sound of the first artist, no infringement exists. This reiterates the rule that a copy is only an actual copy of the original work and not an independently reproduced work of the identical subject,[20] and it emphasizes the fact that the recorder's copyright is in his sound recording and not in his arrangement of the composition. The copyright owner is expressly denied the right to exclude public performance of his work. It would appear, therefore, not necessary for radio broadcasters and others to obtain licenses to each of a number of recorded renditions of the same musical work. This codifies and adapts the rule of *RCA Manufacturing Company* v. *Whiteman*[21] to the situation which will exist when the sound recording itself is the subject of a copyright.[22]

The Compulsory License

By Section 113 of the bill a copyright in a musical composition is subject to a compulsory license as it is under the present statute. A compulsory license under this provision gives the licensee the right to repeat the composer's contribution, but it does not affect any rights a performing artist may have in his sound recording of that composition. Consequently, obtaining a compulsory license will not permit duplication of existing sound recordings. The compulsory license provision of the bill is different in many respects from the provision of the present statute; however, several of the differences are merely codifications of existing case law. Again, the copyright owner has the right to exclude all persons from making a phonorecord of his composition, but once he has permitted one phonorecord to be distributed to the public[23] any person may make and distribute phonorecordings of the work by complying with the requirements of the bill. However, the bill requires that a person seeking a compulsory license must have as his primary purpose in making phonorecords the distribution of them to

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[20] Allegrini v. DeAngelis, 59 F. Supp: 248 (1944); affirmed 149 F. 2d 815 (1945).

[21] 114 F. 2d 86 (1940).

[22] In practice, most composers assign their broadcasting rights to the American Society of Composers, Authors and Publishers, to Broadcast Music, Inc., or to SESAC, Inc., and most broadcasters have licenses permitting the broadcasting of any compositions in the libraries of these organizations. Thus broadcasters can use most copyrighted musical compositions. However, if recording artists had performing rights, they might not choose to assign them to such an organization.

[23] As distinguished from "used . . . to mechanically reproduce" as provided in the present statute.

the public for private use. Therefore, a recording which is intended only for commercial use, as in jukeboxes or radio transcriptions, and not for sale to the public, would violate a compulsory license as well as possibly leading to infringement of the composer's performing rights.

The holding of *Marks Music Corp.* v. *Foullon*[24] is incorporated into the bill in that it specifically provides that the compulsory license carries with it the privilege of making a musical arrangement of the copyrighted musical work to the extent necessary to conform it to the style and manner of interpretation of the licensee. Nothing is stated in the bill about the right of a licensee to make an instrumental recording of the musical portion of a composition that is covered by a copyright in both music and lyrics. However, the *Foullon* case would seem to permit this, and elimination of the lyrics might be considered an arrangement.

Effect of Licensee's Failure to Comply

One of the most significant changes which the bill proposes is on the effect of the failure of the licensee to meet the requirements of the compulsory license provision. The present statute requires the licensee to file a notice of his intention to use the compulsory license[25] and it requires the monthly payment of royalties, together with a monthly accounting if requested by the copyright proprietor.[26] However, the statute imposes virtually no penalty on the licensee for failure to comply with these requirements. The most that the copyright owner can be awarded is three times the statutory royalty.[27] No time is specified in the statute for the filing of the notice of intention, but the wording "intends to use"[28] in the present statute would seem to imply that this notice should be sent before recordings are made of the copyrighted work. However, filing the notice after manufacture has been allowed, one case going so far as to permit the filing after the infringement trial but before the defendant's appeal.[29]

Failure of the manufacturer of records to make royalty payments or to obtain a compulsory license under the present statute has been held

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[24] 171 F. 2d 905 (1949).
[25] 17 U.S.C. §101 (e).
[26] 17 U.S.C. §1 (e).
[27] 17 U.S.C. §§1 (e) and 101 (e). It has been argued that the provisions of these two sections are cumulative and in addition to the regular royalty, thus resulting in a maximum award of 26 cents per recording (See Nimmer, *op. cit., supra,* note 16 at §155); however, no case has been found making such an award.
[28] 17 U.S.C. §101 (e).
[29] G. Ricordi & Co. v. Columbia Graphophone Co., 263 F. 354 (1920).

to make the vendor of the records liable for the statutory royalties.[30] Since the records were infringing, the vendor was found liable for selling infringing copies. However, the vendor cannot be made to pay treble royalties, since these can only be assessed against an infringing manufacturer.[31]

Section 113 (b) of the bill requires that a notice of intention to use the compulsory license be served upon the copyright owner within 30 days after making and before distributing any phonorecords, or, if the copyright owner cannot be found, that the notice be filed in the copyright office within that time. Failure to do so within the period provided forecloses the possibility of obtaining a compulsory license and renders the making and the distributing of the phonorecords actionable as infringement, in the absence of a negotiated license. In addition, Section 113 (c) (4) of the bill provides that if the licensee fails to make the royalty payments within 30 days after the copyright owner has given him notice of default, the compulsory license is automatically terminated, and the making and the distribution of any phonorecords for which the royalty has not been paid becomes fully actionable as infringement. Thus, an infringer can no longer risk being caught, while planning to file his notice of intention only if he is caught. In addition, since unlicensed manufacture is fully actionable as infringement, the amount which can be awarded to the copyright owner is not limited only to treble the statutory royalty. These provisions should provide incentive for obtaining a license in a timely manner. In addition, the copyright owner will have a statutory cause of action against the vendor of infringing records if he needs it.

Action Required of the Copyright Owner

The bill simplifies procedures for the copyright proprietor by eliminating the notice of use; instead it merely requires that he be identified in the copyright office. In the event that phonorecords of a musical composition have never been distributed to the public, and so the composition is not subject to the compulsory license provision,[32] a notice of intention to record under such a license would not grant any rights to the person filing it. Presumably, in such a case, the copyright owner would inform the would-be licensee that no compulsory license could

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30 Shapiro, Bernstein & Co. v. Goody, 248 F. 2d 260 (1957); see also Nimmer *op. cit. supra,* note 16, at §108.452.

31 17 U. S. C. §§1 (e) and 101 (e).

32 F. A. Mills v. Standard Music Roll Co., 223 F. 849 (1915); affirmed 241 F. 361 (1917). Also, the bill, Sec. 113 (a) (1).

be had. The bill might be improved by requiring this. If there is no known address for the owner of a copyright in a composition of which phonorecords have not been distributed, and which, accordingly, is not subject to the compulsory license, an innocent would-be licensee might file his notice of intention in the copyright office and think he had a valid license, not knowing that such a license was not available. By Section 113 (c) (1) of the bill such unauthorized recording would not subject the recorder to liability. This section states that the copyright owner must be identified in the copyright office in order to be entitled to receive royalties under a compulsory license.

The section goes on to state that the owner is entitled to *royalties* for phonorecords made[33] after he is so identified but he is not entitled to *recover* for any phonorecords previously made. This implies a difference between receiving royalties and being allowed to recover. Section 504 (b) of the bill states that the copyright owner is entitled to *recover* damages and profits resulting from infringement. Reading "recover" in Section 113 (c) (1) the same as "recover" in Section 504 (b), the unauthorized recorder would not be held liable for records made before the copyright proprietor is identified in the copyright office. The bill is unclear as to whether the recorder would then be free to distribute these phonorecordings. Although the phonorecordings would not subject the recorder to liability when made because the copyright owner was not then identified in the copyright office, if he is identified at the time the records are distributed, he might find a court that would permit him to recover against the vendor. When the proprietor is delinquent in identifying himself in the copyright office, it would not seem unduly burdensome to require him to notify the unauthorized but innocent recorder of the unavailability of a compulsory license at the same time that he is making his identity known. Otherwise, the recorder would have to inform himself when the proprietor's identity is made known in the copyright office in order to ensure that the song he was recording was subject to the compulsory license provision.[34]

The Statutory Royalty

Section 113 (c) of the bill changes the royalty rate under the compulsory license from the present two cents per record[35] to either three

[33] Not "distributed to the public."

[34] As a practical matter, this potential problem is probably small since the would-be licensee could ascertain whether other recordings had already been distributed. If he could not find such a recording, he would appear to have notice of the unavailability of the compulsory license.

[35] 17 U.S.C. §1 (e).

cents or one cent per minute of playing time or fraction thereof, whichever is greater. The chief effect of the compulsory licensing provision on the royalty rate is to set the upper limit paid by record manufacturers. In practice, most licensing agreements entered into in the phonograph industry are consensual agreements rather than agreements under the compulsory licensing provision of the statute.[36] The statutory royalty applies to records manufactured rather than to records sold, thus preventing a gambling manufacturer from making a large quantity of records in hopes of having a hit, while paying the royalty only if his hopes come true. There has been debate as to how much effect, if any, an increase in the statutory royalty rate will have on the price of phonorecords at the consumer level. Most licenses will continue to be freely negotiated, rather than coming under the compulsory license provisions of the bill. The mark-up between manufacturer and consumer may absorb part of any increase, particularly considering the large number of highly competitive "discount" dealers who retail records. However, since this is such a competitive area, these dealers may have absorbed all they can, thus the increase will have to be passed on to the consumers.[37]

The large number of persons and companies involved in the entertainment business has resulted in the growth of numerous organizations which handle the details of the licensing agreements. Most major music publishers are members of the Music Publishers' Protective Association (MPPA), while many songwriters belong to the American Guild of Authors and Composers (AGAC). MPPA bargains with AGAC for publication rights, and MPPA acts as agent for its members in the licensing of recording rights. MPPA has a set of standard contracts which provide for royalty rates ranging from one-and-a-fourth cents per selection to the statutory rate, depending upon the manufacturer's suggested retail price. Thus, the statutory rate does not flatly determine the royalty on all records.[38] While an increase in the royalty rate might be justified by the increase in living costs since the present statute was passed in 1909, it must be remembered that in 1909 one phonograph record contained one musical composition and so returned a royalty of two cents on an item that cost the consumer between $1.50 and $7.00, whereas today, with 33⅓ records containing up to a dozen compositions, the royalty can be 24 cents on an item with a

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[36] See Henn, *op. cit., supra,* note 1, pp. 60-61.

[37] See the comments of John D. Glover in the "Hearings," *supra,* note 2, pp. 769-922.

[38] Kaplan and Brown, *Cases on Copyright,* The Foundation Press 1960, p. 448.

list price of $3.98 but frequently costing the consumer $3.00 or less. Furthermore, the quantities of phonorecords sold today are many times those of 1909.[39]

Arguments For and Against the Compulsory License

Opponents of the compulsory license frequently state that it unjustly denies composers the exclusive rights which are given to proprietors of copyrights in other forms of works.[40] Indeed, the suggestion has been made that the provision is unconstitutional because it provides for nonexclusive rights, while the Constitution gives Congress the power to secure to authors exclusive rights to their writings. But if Congress has discretion in whether to give any right or not, it would seem illogical to hold it to the extremes of granting totally exclusive rights or no rights. Instead, Congress must have the power to grant any rights between these extremes. In addition, the composer should give something to the public in exchange for the rights given him. A patentee is given exclusive rights, but for only 17 years. His patent may provide the basis for improvement patents. At the end of the 17 years his monopoly ends, and the public is free to use his invention. The writer of a book is given exclusive rights by the copyright statute, but his work may educate the public, or it may inspire a subsequent writer to create a related work. While the songwriter's work may relax and inspire, it does not add to the storehouse of public knowledge, and it cannot readily provide the basis of another work. Thus, the compulsory license requires the songwriter to give something to the public in exchange for the rights being given him for what may be longer than his lifetime.[41]

Proponents of the compulsory license claim that it is necessary to prevent a monopoly situation from arising in the phonograph industry. While this was a leading argument for inclusion of the provision in the 1909 copyright statute, remedies available under the antitrust laws have

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[39] The different groups interested in the controversy put forth claims ranging from one that the music publishers are losing money with the present two-cent royalty and so are in need of more, to one that an increase would ruin recording companies because they would have to pass it on to the consumers who would then buy fewer records. See the "Hearings," *supra*, note 2. See also Henn, *op. cit.*, *supra*, note 1.

[40] See "Copyright Law Revision, Part 2, Discussion and Comments on Report of the Register of Copyrights on the General Revision of the U. S. Copyright Law," (Feb. 1963), pp. 56-72.

[41] While under the existing law a copyright can last for at most 56 years, the bill proposes to make its duration the life of the author plus 50 years. Thus, the author would secure exclusive rights not only for himself but also for his heirs.

been claimed to be sufficient to prevent monopolies from arising.[42] The compulsory licensing provision does ensure the availability to the public of a variety of recordings of those musical compositions which prove to be big sellers.[43] In addition, if the first recording of a song does not develop its full potential, another recording company may put out a more popular arrangement. This can help the owner of the copyright in the song which is recorded, but it may hurt the small composer by reducing the number of different songs which are recorded. It may also discourage record companies from making the first recording of a new song because, if the first recording makes the song a hit, other companies can then put out records of it in order to cash in on the promotional efforts of the first company.[44] In particular, large record companies with many well-known recording artists may flood the market after a smaller company has established a song as a hit. Opponents of the compulsory license also point out that the provision results in a songwriter losing control over his work once he has allowed one recording to be made. He no longer can control who records it or the quality of the recordings. He may become a victim of financially irresponsible record makers who exploit the recording but are unable to find the money for the statutory royalty.[45]

Complete elimination of the provision would mean that all recording licenses would be freely negotiated. While this might result in an increase in the royalty rate, such an increase, reached in arms-length negotiations, would indicate that the present upper limit of two cents per record denies the composers and publishers the compensation to which they are entitled. Removal of the compulsory license would not necessarily mean that only exclusive licenses would be granted in the future, but economic imbalance might permit large record companies to dictate such a license from an unknown composer. Hopefully, elimination of the compulsory license would leave the copyright owner free to enter whatever type of agreement he deemed most advantageous. Certainly, many nonexclusive licenses would still be made, and many

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[42] See "Discussion," *supra,* note 40, p. 58.

[43] As of July 2, 1956, the 10 most popular songs were available in the following recordings: Tune #1, 10 arrangements on 8 labels; #2, 9 on 5; #3, 5 on 5; #4, 12 on 11; #5, 3 on 3; #6, 4 on 3; #7, 2 on 3; #8, 9 on 8; #9, 5 on 4; #10, 3 on 3. (From the comments of Ernest Meyers appended to the Henn study, *op. cit., supra,* note 1). The composition "I Believe" was distributed in at least 207 releases by 62 American companies between 1953 and 1965; 145 of these releases were by 48 artists for 9 companies. (From the comments of John D. Glover in the "Hearings," *supra,* note 2, p. 784.)

[44] See "Discussion," *supra,* note 40, p. 63.

[45] *Ibid.,* p. 64.

of the benefits resulting from the compulsory license would be continued under nonexclusive licenses. However, the position of the copyright owner would be improved because he would be free to refuse a license to those whom he felt were likely to be financially irresponsible or likely to produce a poor quality recording, and the royalty rate would not be subject to the statutory upper limit.

An Alternative Proposal

Chief arguments of the opponents to the compulsory license are that it fixes the maximum royalty and that it requires the giving of licenses to irresponsible recorders. Proponents of the compulsory license argue that its elimination would result in exclusive licenses to the detriment of the public and to the injury of small record companies and unknown composers.[46] Besides retention of the compulsory license provision or complete elimination of it, alternative provisions might be found which would satisfy both sides to the argument.

One such alternative might be the elimination of the compulsory license, but an express prohibition of exclusive licenses and of licenses attempting in any way to restrict the copyright owner's right to grant other licenses. This would not require that the owner grant more than one nonexclusive license, but it would prevent an imbalance of bargaining position from permitting a recording company to insist that it be given an exclusive license or that the nonexclusive licenses granted be limited to those of the recording company and its associated companies. It would aid the copyright owner by leaving him in a position to pursue whatever course of action seemed best to him.

Recording companies might complain that once they have spent money promoting a song into a hit, the composer would be free to permit another recorder to exploit it. However, the recording companies would be no worse off in this respect than they are under the compulsory license provision by which not even the composer can prevent another recording company from capitalizing on the first company's investment. It would prevent any possibility of a monopoly arising as a result of one company tying up all the major composers or music publishers with exclusive contracts. Smaller companies could still gain access to songs originally recorded by the larger companies. Should a licensor feel that his present license was not providing the best possible return on the composition, he would be free to grant an-

[46] For a more comprehensive listing of the arguments see "Copyright Law Revision, Part 1, Report of the Register of Copyrights on the General Revision of the U. S. Copyright Law" (July 1961), pp. 32-36.

other license, but he would not be compelled to give a license to anyone who came along. Although not guaranteed as wide a selection of arrangements of a hit song, the public would likely still have considerable choice. Since fewer licenses might be granted to each song, more different songs would likely be recorded, helping the unknown composer.

Royalty rates would be freely negotiated. Certainly the first licensee would want to have included in his license a "most favored nation clause" under which his royalty would be reduced in the event a subsequent license were issued at a more favorable royalty. In addition, the first licensee might insist on including a clause in the license to provide that, in the event *any* subsequent license were given, the first licensee's royalty rate would be reduced to some amount less than the later licensee's rate. By having this more favorable royalty rate the first licensee would to some extent be compensated for his expense in promoting the song to the benefit of the subsequent licensees.[47] Such a provision might increase the accounting required by MPPA and would make it necessary for the first licensee to police the actions of the copyright owner to determine whether any subsequent license had been granted. The many detailed considerations of such a provision would require extended study; however, a new statute could provide a framework within which the phonograph industry could operate.

CONCLUSION

All areas in which there are competing interests present problems which cannot be reconciled to the complete satisfaction of each side, and the relationship between music composers and the phonograph industry is no exception. While the compulsory license provision of the present copyright statute satisfies some interests, it annoys others, and rightly so. Elimination of the provision could open the door to exclusive licenses which again, would satisfy some parties but not others. It appears that alternatives which would compromise the desires of the different parties are available, and such alternatives should be investigated. While the alternative of elimination of the compulsory license together with prohibition of exclusive licenses may not cure all the complaints of parties to the controversy, it does provide a compromise which may be worth consideration.

[47] Such a clause might have to be carefully drafted to avoid causing antitrust or unfair competition problems. Perhaps a provision in the bill could expressly permit such royalty provisions.

This section will include biographies and other reviews of careers, discussion and documentation of events important to the history of inventions and discoveries, and anecdotal or historical material pertaining to judicial opinion and legislation.

Opportunities Afforded an Independent Inventor by the Patent System*

SAMUEL RUBEN

Inventor of the Year Award Address

I AM VERY APPRECIATIVE OF THE HONOR bestowed upon me today in designating me the "Inventor of the Year, 1965." To my associates must go a share of this recognition, for any achievement represents the integrated efforts of many, from the time of experimental proof of the imaginative concept to the completed reality. I am particularly gratified to note that this award is given in the spirit of recognition of an inventor, for in these days of massive organized research and development the work of an individual can be readily obscured.

Recognition and encouragement is a necessary factor for stimulating imaginative rather than merely memory-oriented thinking. In review of my own efforts, the attempts at imaginative thinking extend back more than 50 years of my life.

I was born in New Jersey in 1900, and shortly thereafter my family moved to New York, where I attended public schools. From an early age I was an avid reader of scientific literature and had an almost compulsive desire to read and to analyze what I read. I owe a great debt to the public libraries. Next was the great pleasure derived from chemical and electrical experimental work, particularly stemming from my interest in radio as a licensed amateur for several years prior to World War I. These interests helped materially to develop experimental methods and persistence for translating imaginative thoughts into practical realities.

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*A speech delivered by Samuel Ruben upon his acceptance of the Inventor of the Year Award presented to him by The PTC Research Institute at a reception held in his honor on April 14, 1966, at the Shoreham Hotel in Washington, D.C.

Since adverse personal economic conditions required means for support not only for myself but also for family assistance, I could not plan formal college training. This was supplanted by constant home study and later, non-credit evening courses on such basic subjects as mathematics and chemistry.

The most important event in the development of creative endeavour came after I had acquired my first job in the winter of 1917 as an assistant in a laboratory of the Electrochemical Products Company. This development company was engaged in perfecting a patented process for the fixation of atmospheric nitrogen by high frequency electrical discharge.

I obtained this job because of my familiarity with high frequency radio transmitters. My amateur radio transmitter experience was directly applicable to the understanding of one phase of the work. The project had been started in a Brooklyn laboratory under the direction of the inventor of the process, but in order to progress they engaged the services of an authority in the field of electrical discharges; namely, Professor Bergen Davis of the Physics Department at Columbia University. Professor Davis was the technical consultant, and he directed the experimental work. To allow him to devote more time to this war effort work, the laboratory was moved, by arrangement with the University in 1918, to the basement (Room 110) of Fayerweather Hall which housed the Physics Department. Professor Davis took a keen interest in me during the time I was associated with this process and for many years thereafter, up to the time of his death in April, 1958. During these 40 years he was always interested in my progress, giving me valuable and appreciated counsel. In the earlier days he spent considerable time in guiding my studies, and in our many hours of discussion I learned a great deal. He arranged for my attending some of his lectures relating to electrical discharges through gases, and the use of the Physics Department library in the same building. Professor Davis' life and career were themselves a great inspiration to me.

The understanding and appreciation of the electronic structure of matter and its relation to chemical and physical properties was an important result of my relation with Professor Davis. Its application to practice can be noted in my early rectifier patents (1925) in which I classify the desirable electrode materials in accordance to their valence position as elements in the Periodic Table. The nature of materials, particularly of the elements, has been a guiding factor in all my work, and so essential to the successful solution of problems involved in my inventions. In my recent book entitled *The Electronics of*

Materials, the stress is on the importance of the electron configuration in relation to the valence electron potential arrangement of the Periodic Table of Elements so as to supply a quantitative character to electric parameters. This concept, arranged in chart form, has been useful in our laboratory since 1940.

The honorary degree "Doctor of Science" was conferred on me in 1959 by Butler University for my work in electrochemistry, and on June 9, 1966, the honorary degree "Doctor of Engineering" will be conferred by the Polytechnic Institute of Brooklyn.

Besides encouragement, an inventor needs financial support in carrying out his development to completion. I was fortunate in obtaining such support, for in 1922 Professor Davis suggested to Malcom W. Clephane, (incidentally a former Washingtonian) a patent attorney who had been president of the development company, that he set up an independent laboratory for the investigation of several of my patentable ideas. In 1923 a laboratory was established in New York City, after a temporary set-up in my home. Since 1930, the laboratory has been in New Rochelle, N. Y. Mr. Clephane's support and enthusiastic cooperation contributed greatly to the success of the laboratory.

In order for the inventor to obtain commercial realization of his work, it is desirable to gain the support of a company that has the courage, imagination, and foresight so necessary in carrying an invention to a production stage through the trials and tribulations that most inventions incur before the product has production stability and is commercially sought after. In this matter I was fortunate to contact the P. R. Mallory Company and particularly its founder, P. R. Mallory, whose interest in reasearch and development is inherent to his make-up. My relationship as licensor and consultant to the company has been maintained over the years with a number of products manufactured on a large scale.

The time and state of the technology are most important, for one can experience the limitations of acceptance if ahead of the art and find that at or after the expiration of a patent, large-scale use is made of one's development. I have experienced both the advantage of having developments at a time when a need existed, and others which went into large volume use after expiration of my patents. My solid state magnesium rectifier was introduced at a time when charging storage batteries to operate the radio set of the early twenties was a problem. The use of the rectifier as a continuous trickle charger eliminated the necessity of removing the storage battery from the living room for charging. However, my development of the dry electrolytic condenser or capacitor eliminated the need for the storage battery entirely.

The further development of the capacitor for higher voltages later eliminated the need for the B-batteries. In 1928, the use of the A-eliminator was supplanted by the introduction of the indirectly heated A.C. tube. This tube was constructed with a ceramic rod which insulated the heater from the electron emitter and had some limitations, such as a rather long time to heat the element, and thermoconductive effects which limited the operating life of the tube. The introduction by the industry of the indirectly heated A.C. tube materially reduced the royalties received from A-eliminators. In order to meet this challenge, the integral heater element tube was developed, and rapidly reached large-scale production. I accomplished this by coating and sintering to the heater wire a pure nonconductive oxide which reduced the heating time from several minutes to seven seconds. The elimination of unstable ceramic materials increased the operating life several fold. Development of the refractory insulated copper wire followed. This refractory wire coating was the forerunner of an electrodeposition process which I developed for multilayer wire-wound resistors which were in large production during World War II. These resistors were capable of withstanding military test requirements which could not be met by any of the previous types.

Timing was again important when the sealed alkaline cell was developed at the onset of World War II. This provided the miniature high capacity mercury cell capable of withstanding severe storage and operating conditions that could not be met by the standard dry cell which had been manufactured for about 60 years. It will be noted that there has been a sort of chain reaction between the first commercially successful invention and those that followed.

I believe the independent inventor will always be important because he is in the position of being able to think away from or independently of popular trends with respect to a given project; he does not have the problems of possibly jeopardizing his position if he is wrong. An employee in an organization, unless he is in the top echelon of research and development, may fear to be wrong and thus affect his record or status with his associates and with the company.

The advantage of independent operation is that it forces one to more thoroughly study the problem and allows the freedom to concentrate on a project without interference or the need to utilize time on unrelated matters. It requires a more practical consideration of the problem in order to obtain the necessary data with a minimum amount of equipment; it forces one to depend upon a certain amount of ingenuity to use what he has to the best advantage.

The disadvantages, in respect to technological processes, are that in an organization it is possible to obtain assistance on some phase of the development from sources more competent in some specialty and to have available more complete equipment.

One hurdle an independent inventor sometimes has to overcome, even with demonstrable models or data, is the inherent reluctance of the technical staff of his prospective licensee to accept outside ideas. In industry this is know as the N.I.H. (not invented here) factor. Some managements will override the opinions of their engineering department and depend entirely on trial results.

The recognition and encouragement of the organizational inventor is going to grow in importance for many reasons. The philosophy today seems to be to obtain the safest job with all insurances until death, and many individuals become permanent organization men at an early age. In the years prior to World War I, the opportunities for obtaining employment in research and development projects were very limited. Individuals endowed with that inner sense of direction, with persistence to carry imaginative thinking to practical reality, were willing to take the risks to acquire the rewards of a successful invention.

The American patent system is a basic source of encouragement to the inventor, for it provides him with a means of protecting the practical results of his imaginative thinking by the issuance of a patent which can give him the hope for recognition and reward. This system has enabled me to function as an independent inventor and maintain a development laboratory for the past 43 years with support, except for the first three years, entirely derived from the license or sale of patents. I am most grateful for the opportunities afforded to me by our American system.

David Sarnoff Proposes Applying a World Patent System in Kettering Award Address

Brigadier General David Sarnoff was presented the Charles F. Kettering Award for Meritorious Work in Patent, Trademark, and Copyright Research and Education by President Lloyd H. Elliott of The George Washington University at a dinner in his honor highlighting the Institute's Tenth Annual Public Conference held on June 16-17, 1966, at the Shoreham Hotel, Washington, D. C.

In his Award address, General Sarnoff proposed a "global patent system" which would utilize the most sophisticated communications techniques in order to share the fruits of our tremendous technological growth with all of mankind. He stated:

"When we can transmit an idea around the world in less than one-seventh of a second, why must years elapse before that idea can be validated within or outside the country of origin? Why must an inventor still make separate application in every country where he wishes to protect his idea? Why should some countries make no provision at all for patent filings, or impose severely restrictive conditions upon the inventor?

"The answers lie in the fragmented array of national patent systems, most of them working in isolation from the others. This condition inhibits the swift and equitable worldwide distribution of patent benefits—through new technology, new industry and expanded markets. The consequences are unfortunate enough in the industrialized nations, but they are even more damaging to the underdeveloped members of the world community. . . ."

General Sarnoff stated further: "One of today's principal challenges is to design an international patent structure that can accommodate the revolutionary changes in technology and spread its benefits more evenly around the world. Through the tremendous advances that have been made in one aspect of this technology—in communications—the physical means are available to accomplish this purpose. It is now technically feasible to establish a universal patent system, utilizing the latest communications devices and concepts, to bring swiftness, order, and reasonable uniformity to the entire patent structure. . . ." The General added, "And a global patent system could now be accommodated technically in a worldwide communications service just as readily as global television, global weather reporting, and global computer services.

"A new generation of electronic

data processing systems is emerging, capable of storing up to 100 million bits of information and retrieving them in fractional millionths of a second. These systems are beginning to provide central computing and reference services for subscribers scattered over large areas.

"Other new electronic devices are being joined to computers to transmit, store and retrieve information by sight or sound, and by the display of words, diagrams, or pictures. It will become commonplace, for example, to speak directly over any distance to a computer and to receive the answer within seconds in either sound or sight, on a display screen or in electronically printed form.

"These various systems can be combined to perform all of the technical functions for a world patent center that could receive and process applications from inventors everywhere. This center would be the focus of the world patent system, linked to all countries by high capacity satellite communications and built around a large data-processing and information-storage system.

"Incoming data on inventions, appropriately coded in the country of origin, would be compared with key data on prior patents in the same field, retrieved from the computer memory. The novelty and patentability of the idea could be determined within an infinitely shorter time than is now the case—and it could be determined on a worldwide rather than simply on a national basis. In addition, the means of instant access to all data could speed immensely the comparison and adjudication of conflicting claims. . . ."

He went on to state that "In a project of such magnitude, with its many potentialities for service, we cannot expect universal operation to begin overnight. Practical experience suggests that nations will move slowly toward the concept of a single world patent system. But it should be possible to begin applying such a concept on a limited scale among a few major patent countries, sophisticated in the use of technology and conscious of the need. Later, as its advantages became evident, other nations could join the project and its services would correspondingly expand."

The complete text of General Sarnoff's Kettering Award Address will be published in the 1966 Conference issue of *IDEA*.

1966 Conference Issue of IDEA Available in Hard Cover

The Institute is considering an innovation this year, the publication of the 1966 Conference issue of *IDEA* in hard-cover book form in addition to the customary soft-cover binding. This 1966 Conference Book, which answers an expressed need for a sturdy, permanent desk, library or office volume of the Institute's Conference proceedings, may be purchased in addition to, or as an alternative to the paper-back edition. The price of the hard-cover volume will be from $6.80 to $8.70, depending on the number of orders received. The price of the regular paper-back edition is $5.00.

Non-subscribers may order *IDEA's* Conference issue in hard or soft cover by writing to The PTC Research Institute of The George Washington University, 708 22nd Street, N.W., Washington, D. C. 20036. Checks should be made payable to The PTC Research Institute and mailed to the above address.

The theme of the Institute's Tenth Annual Public Conference, held at the Shoreham Hotel on June 16-17, 1966, was SPOTLIGHT ON U. S. INDUSTRIAL AND INTELLECTUAL PROPERTY SYSTEMS: CRITIQUE, OUTLOOK, AND RECOMMENDATIONS. This year's Conference, as last year's, was specifically directed to contributing toward a data base for the President's Commission on the Patent System. Attendance was excellent and the proceedings provided two days of stimulating discussion as well as an occasion for contact among participants, members, and guests working in varied related fields.

Digest Features American Inventor

The Institute's most recently published *Digest* is devoted to "The American Inventor – What He's Like and How He's Doing." It presents a brief profile of the American inventor—his activities, earnings, opportunities, and possible rewards under the United States patent system. It is based upon Institute reports published in *IDEA* by members of the Institute's Research Staff. Copies of the *Digest* are available at the Institute Office.

New *Report to Members* Distributed

The Institute's latest *Report to Members,* No. 17 (June 1966), features the Tenth Annual Public Conference, including a complete program of the Conference, and a biographical story on David Sarnoff, recipient of the Institute's 1966 Charles F. Kettering Award. Also featured are information on reports appearing in *IDEA,* and news items concerning the Institute and its membership.

Numerical-Control Technology: Antecedents, Development, Diffusion

IRVING H. SIEGEL* AND EDGAR WEINBERG**

SUMMARY

NUMERICAL-CONTROL TECHNOLOGY has many historical sources, and the concept may be traced back at least a half century in the patent literature. Only modest diffusion has as yet occurred, but the concept is expected to find extensive application in the design of machine tools and to influence manufacturing technology more generally.

NATURE OF NUMERICAL CONTROL

THE PAST 15 YEARS HAVE WITNESSED the development and modest commercial application of a significant new principle of metal-working technology—the "control of machines or processes from recorded or self-generated intelligence expressed in an interpretable language of

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discrete numerical symbols."[1] This principle is called "numerical control," which is often abbreviated as N/C or NC.

Less abstractly described, the principle involves the use of an electronic control unit and of changeable coded tapes for the automatic operation of machine tools (and other kinds of equipment too). The tape instructions, prepared by a programmer, are "read" by the control unit, which directs the tool through the prescribed sequence of tasks (such as boring, drilling, grinding, milling, and turning). The system also permits the automatic adjustment of speeds and feeds, of coolant flow, and of the distance and movement of the tool or workpiece; and it may provide for selection of the cutting tool appropriate to each task.[2]

THE HISTORICAL MATRIX

Like other new departures in technology, numerical control fits into a long tradition which may be regarded as both compatible and preparatory. To overlook this background of pertinent cultural experience, to represent numerical control as a radical industrial discontinuity, is journalistically appealing; but realism requires recognition of the influence of past metalworking accomplishments and of related technical trends too.[3]

In broad retrospect, numerical control may be counted as a major achievement in the endeavor of generations of toolmakers to transfer the craftsman's skill to equipment used by persons with lesser abilities, training, or work experience. Progress in this direction tends to reduce the burden on an operator's capacity for observation, concentration, coordination of eye and hand, discrimination, and decision-making.

One of the historically important paths of machine-tool development traces back to Eli Whitney's popularization (rather than origination)[4] of the concept of interchangeability of manufactured parts. In (tardily) executing a governmental contract for 12,000 muskets during a period of shortage of gunsmiths, Whitney sought ways to incorporate the skill of the craftsman in the dies, jigs, and fixtures of specially de-

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[1] H. W. Mergler, "Numerical Control: Here Is the Patent Situation," *Control Engineering* (February 1962), p. 100.

[2] *Outlook for Numerical Control of Machine Tools*, Bulletin No. 1437, U. S. Bureau of Labor Statistics (March 1965), p. 1.

[3] See I. H. Siegel's remarks on a paper by W. R. Maclaurin in *Capital Formation and Economic Growth* (Princeton University Press, Princeton, 1955), pp. 572-578, for an earlier statement on alternative ways of historically treating innovation.

[4] L.T.C. Rolt, *A Short History of Machine Tools* (M.I.T. Press, Cambridge, 1965), p. 14[illegible].

signed machines. Through these departures from conventional practice, he aimed, in his words, "to make the same parts of different guns . . . as much like each other as the successive impressions of a copper engraving."

Whitney's remark serves as a reminder, incidentally, that the printing arts, which had developed relatively early, indicated plausible directions of technological advance for metalworking and for manufacturing in general. The example of printing thus suggested to men like Whitney and Babbage the idea of production as the repetitive "copying" of a physical model. It also suggested to them the reducibility of many kinds of production to one "alphabet" of basic, more or less standard, unitary activities—a concept that has proved valuable not only in the mechanical arts but also in chemical processing and in high-speed computation. A complex productive effort, according to this concept, is at least a "word" composed of many elementary "letters" or processing stops, some of which may be repeated.

The Whitney approach—the so-called "American system" of manufacture—was extended progressively from muskets to other military and to civilian fabrications. In civilian applications, cost normally must receive great weight, and it decisively influences the size of the market through the lower limit that it sets on price. Among the durable products for peacetime use that were early affected by Whitney's concept were clocks, sewing machines, typewriters, bicycles, and divers agricultural implements. The automobile, which has in our own century come to symbolize the mass production of parts and components for high-speed assembly, provides an attractive eventual target for numerical control—as we shall note again later.

Some other early lines of development helped to set the stage for numerical control. In the 19th century, the varieties of technically and economically eligible machine tools multiplied, and designs significantly improved. Thus, Whitney's milling machine was complemented by others for drilling, grinding, sawing, planing, boring, punching, and shaping. Operating speeds and horsepower ratings increased, and better cutting bits became available. Individually controlled machines became practicable with the replacement of steam power by electrical energy, which reduced the dependence of plant organization on central shafts and multiple belts.

A significant advance toward automatic operation of machine tools was evident in Maudslay's screw-cutting lathe (introduced in England just before 1800) and in Blanchard's copying lathe for turning gunstocks (built in 1818 and installed in the Springfield Armory, where it remained in use for half a century). A Connecticut Yankee, C. M. Spencer, received a patent in 1875 for a completely automatic turret lathe for turning wood screws. The key feature of this lathe, the "brain wheel," was quickly appropriated by competitors as a strange oversight by Spencer's patent attorney deprived this feature of effective legal protection.[5]

An impetus toward automatization of machine tools was doubtless given by trends primarily affecting other areas of industrial activity. Two of the classics of the history of "automation" must have offered inspiration: the Jacquard knitting machine, operated with punched cards, and the flour mill designed by Oliver Evans. A stimulus of example and of demand must also have been contributed by the development and widening application of assembly-line production.

Feedback control, which has become a familiar idea with the attainment by cybernetics of the status of a major modern interdiscipline, was incorporated in the Keller machine as early as 1921. This machine was used in the automobile industry for metal-shaping and for die-making. Its automatic tracing system and electrical sensing devices permitted the copying of models having complex shapes. The Keller machine, however, was costly and not widely imitated. Its objectives may nowadays be achieved more easily as a result of progress made in electronics, including the development of numerical control itself.

Progress of Numerical Control

The aircraft industry after World War II proved particularly hospitable to the development and early commercial use of numerical control. An interested Government sponsor was available, and technical conditions in the industry were ripe.

The first major explicit steps toward numerical control were taken outside the machine-tool industry. In 1949, the U. S. Air Force supported research by a small aircraft-parts producer in collaboration with the Servomechanism Laboratory of M.I.T. The company withdrew from the project in 1951, but the school maintained its interest, and M.I.T. engineers completed an experimental milling machine in 1952.[6]

In aircraft manufacture, many intricate metal parts have to be produced in relatively small quantity. This situation contrasts with the one that dominates automobile manufacture—viz., long production runs. The aircraft parts, made of high-grade steel or aluminum alloys,

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[5] *Ibid.*, pp. 83-91, 163, 166-169.

[6] A brief statement on the history of numerical control may be found in *Outlook for Numerical Control of Machine Tools*, pp. 9-10.

have to be machined to extremely close tolerances. The size of a batch is often so small that the use of special-purpose tools is uneconomic. On the other hand, use of general-purpose automatic high-speed machine tools would involve prohibitively costly downtime since fixtures have to be changed frequently for the manufacture of the many different parts.

The electronic controls of the first laboratory system were room-size, but their performance promised eventual economic acceptability in addition to proving technical feasibility. One of the engineers in charge of the pioneer efforts summarized the advantages of numerical control in this manner:

> By inserting a new reel of tape for each job to be performed, the milling machine can be converted from one manufacturing task to the next with little more effort than is required to change a phonograph record. And for every job that a given machine has ever performed, there is left a permanent record, in the shape of a tape containing full instructions. Another great advantage of the machine is that it produces continuously; unlike a machine tool run by a human operator, it does not need to be stopped for periodic measurements and adjustments.[7]

Refinements came rapidly as makers of machine tools and electronic controls also undertook research. A study made under The PTC Research Institute's auspices in 1960 indicated that firms in all size groups were then engaging in research on "machine-tool automation—numerical and electronic controls."[8] At the 1955 National Machine Tool Show, seven companies exhibited models of numerically controlled equipment. By 1964, over 50 companies, including the largest ones in the field, were selling such tools. On the other hand, most of the machine-tool builders did not venture directly into the production of electronic controls, preferring to obtain such units from established firms in the electronics industry.[9] The contemporary wave of mergers will financially link many tool-making and electronic organizations.[10]

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[7] William Pease, "An Automatic Machine Tool," in *Automatic Control* (Simon and Schuster, New York, 1955), p. 62.

[8] See Murray Brown and Nathan Rosenberg, "Patent, Research and Technology in the Machine Tool Industry," *PTC J. Res. & Ed. (IDEA)*, Vol. 5, No. 1 (Spring 1961), p. 6.

[9] *Outlook for Numerical Control of Machine Tools*, p. 21.

[10] According to *American Machinist* (April 11, 1966), p. 47: "Almost every machine tool builder admits to being actively seeking acquisitions at the present time. Most privately held firms receive an average of at least one offer a week. . . . Most active searchers for acquisitions are the large, diversified companies that are forming substantial machine tool building divisons."

PATENTS

The progress of numerical control is well reflected in patent annals. In addition to pertinent information issued by the Patent Office, there are occasional press reports on patent litigation and licensing agreements. For example, in the spring of 1966, it was noted that two prominent companies, Kearney & Trecker and Cincinnati Milling Machine, were engaged in a suit involving the validity of patents owned by the former. According to the account, these patents, covering tool changers used with numerical controls, yield "substantial revenues in license fees from other machine builders."[11]

A survey published in 1962 revealed that 340 patents relating to numerical control had been issued between 1916 and 1960 and that 226 were of substantial technical interest. Some of these 226 refer to systems of control. The others refer to six detailed aspects of such systems: analog-to-digital conversion, digital-to-analog conversion, scaling, comparison, synchronization, and interpolation. The main Patent Office classes represented by these patents are: 33, 82, 90, 178, 192, 235, 250, 307, 315, 318, 332, and 340. The author of the survey emphasizes that "the present NC patent situation" is favorable to interference proceedings on the ground of anticipation:

> Most current numerical control patents were filed five or more years ago, so the techniques that characterize today's [1962] advanced systems have not yet appeared as issued patents. This lag between current technology and patent technology limits the patent history. The available patent history of NC serves best to show anticipation of later inventions. . . .
>
> Stated more simply, when both patent and engineering literature falls short of expressing the actual state of the technology, the interference value of the patent literature is enhanced.[12]

An examination of the list of 226 patents (1) confirms the continuing importance of single inventors, a phenomenon that has been noted in many earlier articles in *IDEA* (82 percent of the numerical-control patents are identified with sole patentees) and (2) also reveals that the concept of numerical control was already deemed practicable by World War I. With respect to the latter point, we refer to a patent filed by Scheyer in 1912 and issued in 1916. Although the disclosure relates specifically to automatic control of a cloth-cutting machine for the garment industry, it does "anticipate the gross philosophy of most contemporary numerical control systems." Scheyer's language follows:

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[11] *Ibid.*

[12] H. W. Mergler, *loc. cit.*, p. 100.

> The object of my invention is to provide a means for controlling motion in any direction or space, either in one plane or several, for angular motion by means of a previously prepared record such as a perforated sheet of paper or other material, an embossed sheet or cylindrical or flat record of the general forms such as are used in phonographs. In fact, any form of record may be used where the recorder in whatever form it is used can be made to retravel its original path.
>
> In order to demonstrate the practical application of my control mechanism, I employ it in the control of cutting machine for cloth or other materials, but it may be employed in controlling motions of many other machines.[13]

This quotation points up the importance of careful drawing of claims and specifications—a matter vividly stressed in the recent court decision in the *Kaiser Industries-McLouth* case regarding the oxygen process for steelmaking. It also gives a hint of the legal battles that may erupt in the area of numerical controls as adoption proceeds and as surer identification can be made of especially profitable future applications.

DIFFUSION: FACTORS AND PROSPECTS

The actual rate of adoption of numerically controlled machine tools seems to have lagged behind the expectations engendered by enthusiastic trade and technical commentators—and, happily, also behind the fears expressed by journalistic and other Cassandras of "cybernation." This apparent sluggishness in the installation rate, however, may simply be typical of a new technology's early commercial life. A judgment of slowness made without reference to the history of other technical novelties, furthermore, may merely reflect the disappointment felt by "provincial" watchers of a concept that has been well publicized from the cradle. In addition, the apparent lag is likely to be exaggerated nowadays against the background of rising Government and academic research interest in the needs and problems of rapid horizontal "technological transfer" (i.e., between firms and industries). Such exaggeration is aided by the deceptiveness of many of the published case studies of the diffusion process for other technologies; they are really confined, as a rule, to a comparatively short period of active imitation within only a part of an industry (e.g., in the subuniverse of dominant firms—rather than the totality of firms—and, moreover, firms that are located in a restricted geographic area). At a later stage, as eligible firms become better informed with regard to costs and technical performance, and as they feel increasingly obliged to respond in new ways

[13] *Ibid.*, p. 101.

to pervasive competitive pressures, the adoption of numerical control may yet acquire an epidemic quality.

The outlook for numerically controlled machine tools is generally regarded as favorable, but only a very small part of the potential market has as yet been penetrated. Fewer than 7,000 such tools had been sold by 1965, and 12,000 installations have been foreseen by 1967. From the standpoint of capacity (but not necessarily in terms of actual use), one such tool may replace several conventional counterparts. On the other hand, the stock of machine tools in place exceeds 2 million units, so numerical control obviously is still but a minor factor in metal-working as a whole.

Although the aerospace industries can often use numerical control to advantage, automobile production does not yet extensively employ the technique. The sheer volume of annual automobile output makes this industry an attractive one for future exploitation. Next to the aircraft industry, the makers of metalworking equipment themselves have the largest stock of numerically controlled tools. Such tools are also employed in the production of a wide variety of equipment for manufacturing, construction, electrical supply, and communication.

A recent paper on Ford Motor Company's experience with numerical control indicates some of the current and prospective practical applications in the automobile industry. Recognizing that the concept is not appropriate at the "present stage of development" to "machining operations for high-volume production," the company has pursued current advantages in "such areas as low-volume production, manufacture of experimental and prototype parts, construction of certain tooling, and selected production operations." Indeed, numerical control may contribute to "a long-overdue breakthrough in body tooling construction methods, and in the mechanics of styling, body engineering and related functions." Although "certain details" are considered "proprietary" for the time being, a good enough idea of the opportunities already grasped and envisaged is obtainable even from the abstract of the paper:

> Ford Motor Company has developed and put into operation original computer programs and numerical control systems for computing nonanalytical automobile body surfaces, and numerically machining such surfaces on dies and other body tooling.
>
> Thousands of templates, hundreds of wood models and many lines of dies have been surfaced through the new systems. Quality, accuracy and symmetry of numerical surfaces are superior to those produced conventionally.
>
> In combination with computer-aided design developments, N/C systems will be employed to perform or assist in a number of oper-

> ations now performed conventionally in styling, product engineering, manufacturing engineering and tooling, to improve tooling accuracy and product quality, and to minimize lead-time from clay models to production of new cars.[14]

The recent prolonged boom in capital-goods demand has greatly boosted machine-tool production and had provided what, at least in the gross, is a good setting for adoption of numerical controls. Machine-tool builders habitually talk of their trade as one affected by "feast or famine"; and grumbling is still heard nowadays, but it is about the "unhealthy" superaddition of military orders to plentiful civilian bookings, the difficulty of keeping backlogs in check, and the shortage of needed skilled personnel. A revival of orders from commercial airlines, the growth of military requirements, and intensive development work on the supersonic transport would seem especially to benefit numerical control, since the aerospace industries already have experience with, and are convinced of, the merit of the concept.

While a climate of brisk business activity is conducive, on the whole, to technological innovation and diffusion, it also contains some specific inhibiting elements. For example, for meeting urgent early materiel requirements for Viet Nam, a contractor who has already had long and satisfactory experience with conventional equipment might well be reluctant to venture into numerical control. In the first instance, furthermore, a shortage of skilled workers may also discourage a consideration of new techniques; the programmers and maintenance electricians needed for numerical control may be no more plentiful than trained machinists. On the other hand, contractors already convinced of the cost and performance advantages of numerical control may invest more heavily in it as large military orders provide occasion for replacement or expansion of existing equipment. It is also true that, as a national crisis extends, or if civilian demand persists over a long period, the logic of introducing new methods to reduce backlogs or to maintain profit margins may become compelling, whatever the initial reluctance.

Something should be said here about the "costs of change," which are so important to analysis of diffusion but often go unrecognized or are simply ignored. Numerical control, like any other new technology, cannot make headway unless an expectation of its profitability complements the demonstration of its workability. This expectation depends upon a blend of knowledge, judgment, forecasting ability, attitude toward risk-taking, and so forth. Advance calculation of sales, costs, and

[14] N. W. Hopwood, "Numerical Control at Ford Motor Company," a paper presented at the Third Annual Meeting and Technical Conference of the Numerical Control Society, New York, April 3, 1966.

prices is fraught with uncertainty, and imagination and confidence are needed to fill gaps in information. Decision-making may not only be hampered by this uncertainty but it also may be discouraged by the very magnitude of the indicated investment for the optimum amount and mix of equipment. Diffusion may be deterred too by a clear appreciation of the supplemental costs and adjustments that a major revision in a company's physical plant may entail. Thus, old knowledge has to be surrendered and new knowledge to be acquired; the same people may not be able to participate equally in the unlearning and the learning, and managers in particular are aware of the danger of loss of control and status in these reshufflings. Furthermore, new costs may have to be incurred for training and retraining operators and other personnel, and these need not be negligible in time and money. Unsettling of labor-management arrangements may also become a barrier to a contemplated technical change. Thus, the impediments to innovation and diffusion are more varied than, and not necessarily so baleful as, the well advertised devils of antitrust lore. The problem is not simply one of, say, entrenched patent positions, or of Veblenian "vested interests" that deliberately "sabotage" the efficiency of the engineers for pecuniary gain.

Closer Look at Diffusion Factors

To amplify and give concreteness to the preceding observations on factors influencing diffusion, we turn to three recent studies that deal entirely with machine tools. These studies make clear, for example, the importance of knowledge concerning the unique performance capabilities of numerical control and its advantages in comparative cost. Information on both the effectiveness and cost of numerical control is widely available, but mere availability of information need not prove persuasive.

First, we cite a report submitted in November 1965 by a metal trade association to a Presidential commission inquiring into the general technological outlook and the implications of this outlook for employment.[15] The report observes that "in the last year or two tool and die companies have begun to adopt numerical control" as "most profitable for short runs and prototypes"--their typical business.

Two major deterrents to past adoption by tool and die makers themselves are noted, and the lessening force of these deterrents is anticipated:

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[15] *Report to National Commission on Technology, Automation and Economic Progress by the National Tool, Die & Precision Machining Association* (Processed; November 8, 1965).

> Whatever reluctance there may have been to employ numerically controlled tools has usually been traceable to one or two factors: (1) legitimate desire to learn more about the technique before using it; and (2) the cost of the machines, which can run two, three, or four times as much as a similar machine without the control system.
> Both of these factors are easing off in importance. Educational seminars, the business press, and other communication mediums have brought information about numerical control within the reach of most. And machine prices have been reduced, either absolutely or relatively.

The report of the trade association nevertheless foresees a modest pace of adoption by the tool and die industry:

> Electrical discharge and numerically controlled machines are being introduced into the industry at an evolutionary pace. These machines and other forms of technological change have increased productivity and enabled the industry to perform productive tasks not previously possible. However, mechanization will come relatively more slowly for this segment of the metalworking industry because of (1) the all-around machinist skills which will be required, and (2) the high cost of mechanization to relatively small companies.

Also of interest in the trade association's report is the following observation on automobile prospects:

> The tool and die industry is also beginning to feel . . . similar pressure from the automobile industry, which, to satisfy customer demands for more and more models and options, is moving toward automated production of its tooling. Since the automakers and their suppliers represent the number 1 market . . . of the tool and die industry, it will have to react in kind to retain that market.

The second illustrative study was published in September 1965 by the British Machine Tool Trades Association.[16] The report is actually an abridged and edited graduate thesis that "concentrates upon some important factors which have usually been given insufficient emphasis hitherto when the economic potentialities of numerically controlled machine tools have been evaluated." A simple comparison of "direct production costs" of the conventional and new equipment may, according to the author, be most inadequate for choice; and production engineers often find it difficult to convey to management the relevancy of other factors. The report mentions the following "indirect costs and other factors" that ought to be given due weight in a multidimensional decision-making process: lead time required before start of production, cost of introducing modifications, precision of costing and scheduling, scrap reduction, concomitant effects of accuracy of production, inspection costs, tool-room requirements (including space for tool storage),

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[16] H. A. Van Raalte, *Numerically Controlled Machine Tools: A Review of Some Economic Factors*, Machine Tool Trades Association (London, September 1965).

machine utilization, handling costs of components, ease of transferring production from one department or plant to another, feasibility of making parts not conventionally producible, variety of manufacturing operations that can be accommodated, handling costs and costs of delays involving jigs, fixtures, and equipment, assembly and fitting times in subsequent operations, cost and feasibility of making holes that are very close together, and reduction of inventories and of paper work.

Some of the other observations made in the British report are pertinent to an appraisal of the prospects of numerical control in the United States as well as abroad. Thus, it is stated that, although a single new unit may offer little or no cost advantage over a conventional machine tool, the reckoning may alter drastically when replacement of a whole battery is considered: "While each conventional machine normally requires an operator, several numerically controlled machines can be kept in full production by a single attendant with consequent large savings in labor costs." An inquiry made of 30 British firms that had adopted numerical controls disclosed frequent failure to: install more than one eligible type of machine, deviate from the standard practice of assigning one operator to a machine, and employ the new equipment in ways permitting replacement of several conventional units. The survey also disclosed that "overall positioning speed is relatively low"; and this factor, together with heavier depreciation charges, leads to no advantage over conventional units with respect to direct machining costs. In short, numerical control promises important performance improvements and cost gains in tooling, lead time, scrap, jig storage, and so forth; but these benefits are not realizable without appropriate adjustments, such as the use of less than one operator per machine, multishift operation, attainment of high positioning speeds, cooperation for effective programming, employment of (resident or commercial) computer services, and proper supporting use of conventional tools as required. This very recital suggests that "slow" diffusion ought not to be very surprising.

The third recent report that contributes to an understanding of diffusion problems and prospects was published by the U. S. Bureau of Labor Statistics in March 1965.[17] According to this report, "diffusion is being speeded by increased familiarity with the use of numerical control and greater knowledge of its economic advantages, increased outlays for plant and equipment (particularly automated) planned by metalworking industries, tax provisions favorable to new investment, and the Federal Government's encouragement of the use

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[17] *Outlook for Numerical Control of Machine Tools*, already cited.

of numerical control in defense work." High capital costs have been an obstacle to adoption in the past, but unit prices may be expected to decline with increasing volume and less expensive models are also being introduced.

The BLS report gives some attention to the problems of labor compatibility and job adjustment required in the transition to numerical control. Occupational patterns are necessarily altered by such a change, and a higher order of knowledge and responsibility comes to be required in maintenance and operation. Formal classroom training is needed, as well as one-the-job instruction, for programmers and maintenance electricians. To assure a sufficient supply of adequately trained personnel in general, revisions are needed in established vocational and apprenticeship curricula. Labor leaders and management have to find new answers to the problems of bargaining, wage determination, incentive payment, jurisdiction, retraining, and layoff that emerge in a new setting.

BEYOND MACHINE TOOLS

Just as numerical control was influenced by many earlier developments not literally in the same line, it will contribute to the future evolution of equipment other than machine tools. The remaining paragraphs of this paper comment on this second-order diffusion of numerical control to additional manufacturing operations, processes, and products.

The BLS report already cited refers briefly to the extension of the principle of numerical control:

> Operations most frequently mentioned as already being successfully adopted . . . include drafting, assembling, riveting, welding, inspecting, testing, tube forming, molding, wire wrapping, and steel rolling. In these applications, tapes or cards, on which numerical data about the dimensions, sequence and timing of operations are recorded, are used to control production equipment. Numerical control thus has far-reaching implications for other operations in metalworking and for other industries.[18]

In an interview published in July 1966,[19] a corporation engineer who has grown up in the "dirty-hands" tradition cited the importance of numerical control in the future design of systems to replace batch processing by continuous processing. Numerically controlled equipment offers a flexibility originally not found in such special-purpose equipment as transfer machines. But transfer lines are now being

[18] *Ibid.*, p. 13.

[19] "Thinking Ahead with Thomas J. Murrin: The Art of Manufacture," *International Science and Technology* (July 1966), pp. 82 ff.

adapted through numerical control for the rapid shift from one output to another in truck manufacture: "You just make a punched tape, put the tape into the control unit, and the machine goes through any combination of operations you have instructed it to." Customer choice, in his view, is dictating this eventual change in automobile production—and in his own business too (electrical equipment).

More extensive industrial use of the computer in conjunction with numerical control will doubtless be inspired by successes being achieved in efforts to render more automatic (and thereby to speed) the preparation of tapes for "continuous-path" machining (as in lathing and milling). The combination of processing with constant monitoring of results, with the accommodation of inputs of new information, and with feedback adjustment of the process will be incorporated into larger "systems"—into multiple-operation equipment or "centers" and into aggregates of equipment or "shops." The engineer cited above, recognizing the potential of the on-line, real-time computer, asserts that "the two outstanding developments in manufacturing in the last decade are numerically controlled machine tools and the introduction of computer technology into our factories."[20] Thus, as the term "automatic factory" continues to fade in the popular vocabulary after an initial period of exaggerated overuse, the concept will continue to progress selectively toward economic reality.[21]

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[20] *Ibid.*, p. 88.

[21] The authors regard as most improbable this statement made in *Fortune* (July 1966), p. 222: "By 1975, robots may run 40 percent of machine tools." This remark implies a diffusion rate grossly incompatible with the showing to date, and it takes insufficient cognizance of the economic, informational, and other factors conditioning diffusion. A much more modest pace of acceptance is likely for punched-tape control and automatic tool-selection, the two "robot" systems that *Fortune* finds dramatically combined in new "machining centers" designed to perform in one place all the work required on a part.

Patent Policy for Government-Sponsored Research and Development **

ROBERT A. SOLO*

SUMMARY

THIS STUDY, WHICH IS DIVIDED INTO THREE PARTS, deals with Government policy in promoting inventiveness and the disclosure of inventions under Government-sponsored R&D, and with aspects of the transfer into commercial applications of technologies developed through such special-purpose Government-sponsored R&D. The first part covers the evolution of a patent policy for inventions made under Government-sponsored R&D. The second part will examine the relevant experience of the National Aeronautics and Space Administration in respect to the rate of invention and the disclosure of invention, to the patenting of disclosed invention, and to the commercial application of patented invention. The third part, in the light of the analysis which has gone before, will make certain policy recommendations for

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**EDITOR'S NOTE: *Since the material published in this paper may be of a controversial nature, we invite our readers to send us their comments. Selected comments will be published in the Forum Section of a subsequent issue of IDEA.*

promoting the outflow of invention from Government-sponsored R&D and for promoting the transfer of technologies produced through special-purpose Government-sponsored R&D into application in the non-governmental sector.

PART I

EVOLUTION OF PATENT POLICY FOR GOVERNMENT-SPONSORED R&D

THE PRESIDENTIAL DIRECTIVE OF OCTOBER 10, 1963

Diverse Policies of Federal Agencies

Prior to the 1963 Directive, each federal agency had its own independently formulated policy for the patenting of inventions arising under the R&D that it sponsored. Contractors for the Department of Defense were given the option of taking title and exclusive commercial rights to virtually all inventions arising out of Government R&D contracts. For R&D contracts with the Atomic Energy Commission pertaining to the field of nuclear technology, that agency took title and retained all rights. And the National Aeronautics and Space Administration followed a costly and complex practice of evaluating each invention, whenever its R&D contractors petitioned for a waiver of commercial rights, to determine whether or not the granting of such waiver would be in the public interest. Besides the patent practices of these agencies, the Department of Health, Education and Welfare, the Central Intelligence Agency, the United States Department of Agriculture, the National Science Foundation, the Veterans Administration, the Department of Commerce, the United States Treasury, the Tennessee Valley Administration, the Federal Aviation Administration, the Department of Interior, had each its own and sometimes its unique patent policy and practice.

The Pressure for Consistency

There was a pressure on Government agencies to achieve, if not uniformity, then at least a greater consistency of patent policies and practices. This pressure arose from two different sources: possibly from contractors who sought to obtain terms as favorable in dealing with one agency as they were offered in dealing with another, and from congressional critics of what appeared to them to be contradictions in the policies and practices of Federal agencies. Hence, Federal agencies with patent responsibilities were brought together to produce a policy which, if not uniform for all agencies, could be defended with mutually consistent arguments and claims. The results of this inter-agency confrontation are embodied in the Presidential Directive of October 10, 1963—which has two explicit purposes; (1) to achieve a sufficiently consistent Federal patent policy, and (2) to promote the commercial utilization of inventions produced through Government R&D contracts. Consider these two.

Consistency in Patent Policy and Practice

The Administration itself took no "position" on patents, except that contradictions in agency policies should be eliminated or reconciled. What emerged, therefore, was a rationalization of existing practices by reference to criteria which had been tailored specifically to justify the policies of the different agencies. To state this as a fact is not intended to suggest that the differences in the policies and practices of agencies were not justified, nor that the continuation of these differences is contrary to the public interest.

Agencies like the United States Department of Agriculture, which services particular sectors of the civilian economy with R&D oriented toward the development of commercially valuable products or techniques (e.g., a better seed, an improved fertilizer, or new storage equipment for agricultural produce), normally take title to inventions arising as a consequence of such contracted-for research and development and dedicate these inventions to the public. Therefore, the Presidential Directive held that

> the Government shall normally acquire . . . the principal or exclusive rights throughout the world in and to any invention made in the course of [a contract] where a principal purpose of the contract is to create, develop or improve products, processes, or methods which are intended for commercial use by the general public at home or abroad, [and that] Government-owned patents shall be made available . . . in the shortest time possible through dedication or licensing.

The Federal Aviation Administration enters into R&D contracts intended to produce devices and techniques to be used in airfields and in aircraft for the purpose of greater safety and more effective traffic control. The FAA normally takes title to patented inventions which arise as a consequence of such R&D and possibly requires, under its regulatory powers, that the invention be used in aircraft or in air-traffic control. Therefore, the Presidential Directive provides that

> the Government shall normally acquire . . . principal or exclusive rights . . . to any invention [where] a principal purpose of the contract is to create, develop or improve products, processes or methods . . . which will be required for . . . use by governmental regulations.

It was the normal practice for the National Institutes of Health in the massive medically oriented research which they support, to take title to any inventions which arise as a consequence of such research and to dedicate such inventions to the public. Therefore, the Presidential Directive provides that

> the Government shall normally acquire . . . the principal or exclusive rights throughout the world in and to any invention [where] a principal purpose of the contract is for exploration into fields which directly concern the public health or public welfare.

The Atomic Energy Commission normally takes title and reserves to itself, principal or exclusive rights throughout the world on all patented inventions arising as a consequence of its R&D contracts in the field of nuclear technology, which was initially created in-house and which was subsequently developed almost exclusively through research carried out or subsidized by Government. Therefore, the Presidential Directive provides that

> the Government shall normally acquire . . . the principal or exclusive rights throughout the world in and to any inventions [where] the contract is in the field of science or technology in which there has been little significant experience outside of work funded by the Government or where the Government has been the principal developer of the field, and the acquisition of exclusive rights at the time of contracting might confer on the contractor a preferred or dominant position.

The Department of Defense, which normally gives to its contractors title to inventions arising under R&D contracts (reserving a royalty-free license for governmental uses) conceives itself as procuring its research and development from established enterprises which have proven their competence in the competitive market. Therefore, the Presidential Directive provides that

> where the purpose of the contract is to build upon existing knowledge or technology, to develop information, products, processes or methods for use by the Government, and the work called for by the contract is in the field of technology in which the contractor has acquired technical competence (demonstrated by factors such as know-how, experience, and patent position), directly related to an area in which the contractor has an established non-governmental commercial position, the contractor shall normally acquire the principal or exclusive rights through the world in and to any resulting inventions, subject to the Government acquiring at least an irrevocable non-exclusive royalty-free license throughout the world for governmental purposes.

Research and development contracted for by the National Aeronautics and Space Administration is generally in fields of technology too novel to be considered as one "in which the contractor has acquired technical competence . . . directly related to an area in which the contractor has an established nongovernmental position." NASA has normally waived commercial rights to its contractors after a determination that such waivers are in the public interest, particularly by reference to the contractor's capability for bringing the invention to a point of commercial application. Therefore, the Presidential Directive provides that

> where the commercial interests of the contractor are not sufficiently established [as falling clearly in the category described in the paragraph immediately above, then] the determination of rights shall be made by the agency after the invention has been identified, in a manner deemed most likely to serve the public interest . . . taking particularly into account, the intentions of the contractor to bring the invention to the point of commercial application [and elsewhere that] greater rights may also be acquired by the contractor after the invention has been identified, where the invention . . . is not a primary object of the contract, provided the acquisition of such greater rights, . . . is a necessary incentive to call forth private risk capital and expenditure to bring the invention to the point of practical application.

The fact that criteria were tailored to justify the prior practices of the different Federal agencies does not mean that the directive will not have the effect of modifying these practices. The very confrontation of the agencies seems to have stimulated internal policy changes. Moreover, while criteria of choice are tailored to permit the continuation of normal policy and practice for each agency, for those instances where the particular situation confronted by an agency deviates substantially from its norm then, presumably, it would be constrained to modify its practice. For example, inasmuch as the Department of Defense engages in R&D contracts in a "field of technology where the Government has been the principal developer," or where its contractors have no "established non-governmental commercial position," then their traditional practice of surrendering title and all commercial rights to their R&D contractors would no longer appear tenable. Conversely, the Presidential Directive gives to officials a wider leeway of choice than existed under agency regulations and hence facilitates the adaptation and internal evolution of agency policy.

In fact, the Presidential Directive has not yet caused a discernible difference in the disposition of the patented inventions arising under Government R&D contracts as indicated by currently available statistics.[1] For example, it appears in connection with the Army, Navy, and Air Force, both in 1963 and 1964, that substantially all disclosures of inventions were made under contract clauses which gave to the contractor an option to retain title by filing a patent application. Since 1965, however, there seems to have been a significant change in contract provisions currently being entered into. In this regard, Mr. John M. Malloy, Deputy Assistant Secretary of Defense for Procurement, reports

> . . . Operating under the old defense policy, 17 Research and Development contracts in FY-1963 contained a clause acquiring title to the patents for the Government. In FY-1964 the number of such contracts increased to 29, making a total of 46 such contracts in FY-63 and 64. The remainder, more than 99%, contained the license clause. In contrast, under the ASPR implementation of the President's statement, for the month of April 1965 alone, out of 695 Research and Development contracts awarded, 68 contained a title clause, 505 the license clause, and 119 a clause which defers the allocation of rights on inventions until disclosure, . . . these figures demonstrate the marked swing from what was substantially a 100% license policy to the more balanced result which was intended by the President's statement.[2]

In the National Aeronautics and Space Administration, change has been in the opposite direction, toward the norm of the Department of Defense. NASA, to develop a substitute for the costly and complex invention-by-invention evaluation of petitions for waivers, has set in motion procedures to consider petitions for automatically waiving exclusive commercial rights on all inventions made by R&D contractors, i.e., for granting "blanket waivers," when such grants can be justified in terms of the criteria enunciated in the Presidential Directive.

Equivocal Criteria

The various criteria proposed in the Presidential Directive to guide the patent practices of Federal agencies are no doubt useful for lawyers as a reference to certain sets of precedented practices. But from the point of view of the social scientist, judging them as tools for analytically distinguishing between circumstances in which a different patent policy can be justified, these criteria are so equivocal as to be valueless.

The Directive proposes two opposite poles. At the one extreme exclusive rights clearly must be taken by Government; on the other

[1] *Second Annual Report on Government Patent Policy* (June 1965), by the Patent Advisory Panel to the Federal Council for Science and Technology.

[2] Statement before the Subcommittee on Patents, Trademarks, and Copyrights, of the Committee of the Judiciary, United States Senate, July 6, 1965.

extreme exclusive commercial rights should normally belong to the contractor. Between these two, there is a gray area for an *ad hoc* determination according to a new "rule of reason" by the governmental agencies. It is laid down as a key criterion, that all rights must be taken by the Government whenever inventions arise out of R&D contracts in fields of science and technology where

> there has been little significant experience outside of work funded by the Government or where the Government has been the principal developer of the field and the acquisition of exclusive rights at the time of contracting might confer on the contractor a preferred or dominant position.

The final phrase is hardly meaningful since it is impossible to conceive of a situation where the acquisition of exclusive rights on any significant invention might not confer on the contractor a "preferred position" or a "dominant position" insofar as the exercise of that invention was concerned. Moreover, every field in which the AEC, the DOD, or NASA, is now heavily engaged, whether missilry, rocketry, aeronautics, data-processing or even electronics, *could* be interpreted as one where Government, through the R&D which it has supported, has been the "principal developer." Hence, one reasonable interpretation of this criterion, would vest in Government, title and exclusive rights to patented inventions arising under virtually all Government-sponsored R&D.

At the other extreme, exclusive commercial rights are supposed normally to accrue to contractors

> where the purpose of the contract is to build upon existing knowledge or technology, to develop information, products, processes or methods, for use by the Government and the work called for by the contract is in a field of technology in which the contractor has acquired technical competence . . . directly related to an area in which the contractor has an established non-governmental commercial position.

All R&D in every field of technology, whether missilry or nuclear energy or rocketry or aeronautics, or electronics or data-processing, can be understood as building upon "existing knowledge or technology to develop information, products, processes or methods." And, if one considers *not* corporate affiliation but *actual operating organizations,* few if any major contractors to the Department of Defense or to the Atomic Energy Commission or to the National Aeronautics and Space Adminstration has "an established non-governmental commercial position." Virtually all major R&D contractors to NASA, the DOD or AEC are set apart by their organization, their business orientation, their technical competence from non-governmental operation in the commercial market. Thus understood, none or virtually none of the major

R&D contractors to DOD or the AEC or NASA would qualify as recipients of title or of exclusive commercial rights in inventions made under Government contract on the grounds that they have an "acquired technical competence . . . directly related to an area in which the contractor has an established non-governmental commercial position." A policy which considered as "the contractor" not the integral organization which performs the R&D but the corporate umbrella under which that organization operates would simply discriminate against such a contractor as North American, which is an independent aero-space company, and in favor of such a contractor as Aerojet, which is an aero-space subsidiary of General Tire and Rubber, or in favor of the Aerospace Divisions of Philco and General Motors, though all of these are likely to be equally involved in Government business and equally isolated from commercial operations. As the second part of this study will show, there is no discernible difference in the way that major R&D contractors having corporate affiliations to commercial operations, and those without such affiliations, either seek to or succeed in developing commercial applications for inventions they have made under Government-sponsored R&D.

The Promotion of Commercial Applications

A second purpose of the Presidential Directive was to promote the commercial application of inventions made under Government R&D contracts. In this regard, the Directive proposed a significant innovation. Following NASA practice, it held that a grant of exclusive commercial rights to a contractor must be *conditional* on the proven commercial application of the invention or on the demonstrated effort by the contractor to develop the invention for commercial use and to promote its application. Exclusive rights would be revocable where commercial application or the effort to promote such application was not demonstrated within three years after the grant of a patent. A means for the surveillance of this policy was also established. Where companies are recipients of principal or exclusive rights, it was required that they report at reasonable intervals on the actual or intended commercial use of inventions made under Government contracts. A general report concerning the effectiveness of this policy is to be prepared at least once annually by the Federal Council for Science and Technology in consultation with the Department of Justice. Under the Federal Council for Science and Technology a Patent Advisory Panel was formed to carry out these directives.

While clearly the *intent* of the Directive is that grants of exclusive or principal rights should be conditional on an effective effort on the part of the contractor to promote commercial application, the words of the Directive are so equivocal that the intention may be nullified in practice. The key section reads as follows:

> . . . where the principal or exclusive (except as against the Government) rights in an invention remain in the contractor, unless the contractor, his licensee, or his assignee has taken effective steps within three years after a patent issues on the invention to bring the invention to the point of practical application *or has made the invention available* for licensing royalty free or *on terms that are reasonable in the circumstances,* or can show cause why he *should* retain the principal or exclusive rights for a further period of time, the Government *shall have the right* to require the granting of a license to an applicant on a non-exclusive royalty free basis. [my italics].

Title on, or exclusive commercial rights to inventions which have arisen under their Government R&D contracts are accumulating in the portfolios of R&D contractors. Characteristically, as will be shown in the second part of this study, contractors have not promoted the commercial utilization of those inventions: What is now to happen with these unpromoted and unutilized inventions three years after the issue of the patent? Will the patent attorneys and vice presidents of companies which hold such inventions simply shrug and reply that inventions were "available for licensing . . . on terms that are reasonable in the circumstances" but that no one came to demand them on those terms—and thus let the matter pass into limbo? The key section of the Directive provides that the "Government shall have the *right* [my italics] to require the granting of a license to an applicant on a non-exclusive royalty-free basis" but it is *not* required that Government agencies exercise that right. Nor given the temper and tradition of the Department of Defense, is it likely that that agency (which accounts for about half of all Government R&D) will be inclined to do so. And if a Government agency does follow the intent and spirit of the Presidential Directive, and does revoke exclusive rights wherever a contractor has failed to demonstrate the commercial application of an invention, or the effective effort to develop and promote that invention for commercial application—have alternative means been devised effectively to develop and promote their commercial application? The third part of this study will respond to some of these policy questions.

Policies and Hypotheses

There remain two policies for the disposition of commercial rights on inventions produced under Government-sponsored R&D. The one grants exclusive rights to R&D contractors, and the other offers such rights for the free use of the public. Each has its rationalization; each might claim on a priori grounds that it will optimize the commercial utilization of such invention, and hence, yield the greater social benefits. In the second part which follows, by reference to the record of NASA experience, these claims will be tested against facts.

PART II

INVENTION UNDER NASA-SPONSORED R&D

NASA Experience and the Evaluation of Alternative Patent Policies

Since 1958 NASA has accumulated two sets of inventions, both drawn from the same universe of technology. One set of inventions, produced by private contractors and by NASA research centers, is offered to the public for non-exclusive, royalty-free licensing. The other set consists of inventions where exclusive commercial rights have been waived to the R&D contractors who produced them. Thus NASA has followed both of the two controverted paths, and has kept a record of what has happened along the way. An examination of that record offers a basis, so far the best available, for comparing the efficacy of the two alternative patent policies, freely offering patented inventions to all or of granting exclusive commercial rights to individual contractors, as means of promoting the commercial application of the inventions produced through Government-sponsored R&D.

Patent Policy and the NASA Technology Utilization Program

The benefits that might justify the patenting of inventions produced through Government-sponsored R&D are, conceivably, of two sorts.

Patents on inventions made under Government-sponsored R&D may have a *defensive* value, protecting the Government against infringement suits when those inventions are used for governmental purposes. A Government agency can fail to take out a patent on an invention made through its own research or through the R&D of its contractor. Conceivably that same invention could be patented by another party, and suit could be brought against the Government and its agents if they should attempt to use that invention without a license from the patent holder. These alleged "defensive" values in Government patenting will be critically examined later.

Secondly patent policy for Government R&D could conceivably have a positive value in promoting the applications of inventions, *not* in the uses towards which the R&D was directed—but in "spillovers" into unintended commercial applications. The positive (or promotional) values of such patent policy, hence, is in its efficacy in transferring invention arising out of research for the special purposes of the Government, into the mainstream of industrial, commercially oriented uses.

If the positive value of such patent policy must be found in its efficacy in transferring special-purpose technology into commercial application, patented inventions constitute but a small part of the capabilities that might be transferred. Patent policy, therefore, ought reasonably to be integrated with a more general policy for increasing the uses, disseminating the knowledge of, and extending the area of application of the technical advances achieved through Government-sponsored R&D. Actually patent policy operates independently under agency legal staffs, both in NASA and elsewhere. But among all Federal agencies, only NASA is now able to integrate patent policy into the larger frame of a general policy and strategy for the transfer into commercial application of special Government-purpose technologies. Indeed only NASA has such a general policy with the Technology Utilization Program as an instrument for its implementation. For that reason also NASA experience and the NASA record deserves special attention.

In what follows, this paper will examine the relationships: (1) between inventiveness and the form for organizing R&D by comparing the number of disclosed inventions as a consequence of in-house and of out-of-house R&D, (2) between the rate of patenting and the form for organizing R&D, by comparing the patent to disclosure ratio for in-house and for out-of-house inventions, and (3) between the commercial application of NASA inventions and the alternative patent policies under which those inventions are made available by comparing the actual commercial applications consequent upon the granting of exclusive commercial rights to R&D contractors with those consequent upon the offering of commercial rights to the public for free non-exclusive use.

Inventiveness

In-House and Out-of-House Inventiveness

Besides the great volume of R&D contracted out with private companies and universities, NASA has a large, well-established research and development program carried on in its own centers, i.e., has both "out-of-house" (contracted out) and "in-house" (NASA center) R&D programs. The NASA record reveals not only the numbers of inventions patented, but also (which is an entirely different matter) the number of inventions reported—or, in the agency's terminology, the numbers of inventions "disclosed." Further the quality of every disclosed invention has been evaluated, and the record of the evaluations is also available. Hence it is possible to compare the inventiveness of in-house with out-of-house R&D by reference to the numbers, and conceivably even of the quality of the inventions produced.

Invention and the disclosure of invention transcends any question of patent policy and commercial applications. To raise the level of inventiveness and to encourage the disclosure of invention relates directly to the objective of accelerating the advance of the space technology as well as to any side effects in commercial application that such advances might have.

Inventiveness and the Disclosure of Inventions

It is surely a primary task of NASA leadership to raise the level of inventiveness and to encourage the disclosure of inventions by its own and by its contractor's employees. Inventiveness and disclosed invention are part of the motor force of technological advance. A knowledge of the comparative inventiveness and disclosure rates of the in-house and out-of-house R&D should be correspondingly important. But, here as always, the interpretation of such data requires an implicit or explicit hypothesis embodying a conception of the relationships that the data can serve to test. There must be an idea of the *process* of invention and disclosure as it is organized in-house in NASA centers and out-of-house among NASA contractors. In either case, there would seem to be three critical levels of choice and activity related to the output and disclosure of invention. These are at levels of the motivation, interest and choice (1) for research personnel, (2) for research supervision, and (3) for company (or agency) management. The question is: Are there likely to be significant differences affecting invention and disclosure, at these three levels, depending on whether the R&D is carried on in Government centers or in private companies?

Among the R&D personnel that constitutes the pool of potential inventors, there may be a difference of inventive capabilities as between those who work for the Government and those who work for private companies. It has been contended, for example, that the form of contractual arrangement permits the private companies to outbid the public agencies in recruiting talented scientific personnel. It has also been contended that a significantly greater proportion of the time of the Government's scientific personnel is devoted to proposal evaluation, project supervision, monitoring and contractor training—tasks which are supposed not to offer the same opportunity for invention as are open to the bench researcher. On the other hand in this large universe of R&D activities, including marginal contractors and well-established companies, qualitative difference between these two categories of R&D personnel may tend to wash out. Moreover, inventiveness is very hard to recognize before it has proven itself, and correspondingly it is difficult systematically to recruit the more "inventive" science and engineering graduates. Finally, against the greater part of their time that allegedly they must devote to monitoring and evaluation NASA scientists have the opportunity to contract-out the routine and gap-filling aspects of their inquiries and to reserve the more provocative and, perhaps, more invention-provoking element for themselves. Taking these counterbalancing considerations into account, it would seem reasonable to hypothesize, in the first instance, that motivation, capabilities and the work-stimulus to invention are randomly distributed with no significant and systematic difference to be anticipated as between the scientific employees of Government and those of contractors.

There are also the interests and pressures of research "supervision" acting as a spur to or a barrier against inventiveness and the disclosure of invention. Whether exercised in private companies or in Government centers, supervision's task is in seeing to it that an R&D assignment is promptly and adequately carried out. Certainly an invention made in confronting the focal problem can contribute to the solution of that problem and be embodied in the hardware or report that the R&D produces. Nevertheless an invention per se is never pre-specified as a requirement in fulfilling an R&D contract nor any form of R&D assignment. It cannot be. It is rather an unanticipated, creative idea that occurs along the way, and the subsequent independent pursuit of that idea in an effort to realize upon its general values will probably conflict with the objective of supervision—which is to fulfill the specifics of an assignment to the letter, and as quickly as possible. To explore and develop the *general* values of an invention, to test and explain it so that others can comprehend, appreciate and apply that invention must surely require an expenditure of time and effort aside from and in addition to that which contributes to the satisfactory completion of the current R&D assignment. In this sense the development of the general implications and values of an invention, and its reporting to those outside the R&D activity is a diversion of the employee's time and efforts away from, and at the expense of the R&D task at hand. Supervision, following its functional imperatives, would seek to minimize these inventive excursions and diversions from the R&D task-at-hand. There would seem, however, no a priori reason to suppose that this check on invention and disclosure would be intrinsically different or more or less severe for in-house than for out-of-house R&D.

Finally there is the interest of the company or of NASA *qua* agency, manifested in the policies and pressures of top management which would tend to encourage or to discourage inventiveness and the disclosure or invention. Here there are a priori reasons to anticipate significant differences in the environment related to invention and the disclosure of invention, for in-house and out-of-house R&D.

NASA is clearly motivated to encourage the development and disclosure of inventions. This is evidenced by NASA's Technology Utilization Program. A high official is assigned to every NASA research center with the job of encouraging the flow of disclosed inventions. NASA has an incentive system to encourage its employees to invent and to develop and to disclose their inventions. Every invention by a NASA employee is examined by the NASA Inventions and Contributions Board, and the inventor is rewarded in proportion to the supposed contribution of his invention to the space effort. Indeed it is enough that the invention of a NASA employee be considered worth patenting, that he be given some reward.

The "company" interest of the contractor in the inventiveness of its personnel working on Government contracts and in the disclosure of inventions made by such personnel, is equivocal.

On the favorable side, there are defensive values to the company in the disclosure of inventions made under Government contract. Publishing or patenting such invention protects the company, other companies and the Government against the possibility of future patent infringement suits.

When exclusive commercial rights on a disclosed invention are granted to the contractor, the "company" might benefit through the commercial exploitation of the invention. This could encourage disclosure. The record of commercial applications to be examined later suggests that this motivation to disclosure should be discounted as of small significance.

On the other hand, under the existing system of Government R&D procurement, a company is not rewarded for the quantity or quality of its inventive contributions. Inasmuch as the concern of management is for income from or a position within the Government R&D market, there is nothing to be gained from inventions made and disclosed under Government R&D contracts. This must militate against the aggressive promotion of inventiveness and against the disclosure of inventions made under Government contract.

Disclosed inventions can be quickly assimilated and freely used by the company's competition for Government business. Therefore, by the disclosure of invention, the company risks a loss of competitive advantage. This must positively discourage disclosures.

There may be a company motivation to siphon off inventions or researchers who have conceived and are on the verge of reducing invention to practice, or even of researchers who have proven their creativity, from Government-supported programs to R&D on company account since, no matter where an invention was germinated, so long as it is "born" in the company's own research program it serves to strengthen the company's position in its bargaining with Government or in its relationships with its rivals. How much of this in fact occurs is not readily determinable and certainly has never been determined. Since a company is legally obliged to disclose the inventions that it makes under Government contract, there are risks in any effort to siphon off invention or inventive personnel that might make the game not worth the candle. While this obligation must be very difficult to police, nevertheless there are substantial penalties for its evasion. Moreover, such manipulation would risk debilitating the morale of the company's scientific (and, indeed, its managerial) personnel.

Even if it is indifferent to the inventions made under Government R&D contracts, an enlightened management might promote such invention as an incident of its efforts to increase the creativity capabilities of the company. On this account, management would value (and reward) an inventor for what he had proven himself able to do. What would matter to the inventor (and what would count for company management) would be that he had established himself as possessing certain exploitable capabilities, regardless of whether the company was in a position to profit from the inventions through which he had proven his worth. Correspondingly it would be in the employee's self-interest to invent, thereby establishing a reputation for inventiveness among his peers, whether or not the company could cash in on those inventions—which is to say whether or not he is engaged on a Government contract or is working on the company's own research.[3]

Company employees may invent and report on their inventions. But they do not report their inventions directly or concurrently to NASA. This seems a grave weakness of R&D procurement. Rather their inventions are reported to company research supervision and infiltrated upwards to be processed and examined by the company's patent lawyers and disclosed only at the volition of company management. It is here that managerial indifference or antipathy to disclosures can be most easily and concretely manifested, not only through checks positively imposed but also in the failure to provide sufficient legal personnel to process and release more than a trickle of the inventions reported.

The Quantity and Quality of Invention

We intend to compare the *numbers* of inventions produced per R&D employee, as between particular R&D contractors, and as between two aggregates: NASA contractors on the one hand, and NASA research centers on the other. This comparison of numbers of inventions may be misleading. Many inventions are trivial, a few are significant. One company may disclose a large number of inventions because it passes on anything that its employees report, while another company may disclose far fewer inventions because it carefully processes inventions reported to eliminate those of dubious novelty or of trivial value. Hence quality could be the inverse of numbers, with a larger number of inventions signifying not greater inventiveness but simply an inventiveness that is more shallow and diffused. It is even conceivable that there may be some systematic difference in the quality of inventions emanating from in-house and out-of-house R&D. A study at greater depth than has been possible here might check specifically to determine the degree to which there are systematic variations in the quality of inventions, by reference to the record of the evaluation

3 Made in a different context the comments of Mr. Jack Rabinow, himself a well-known inventor, casts light on the role of self-interest as an incentive to invent: "It is not true that inventors in industry don't get paid for their patents. This is a fiction. I know many people who have risen to high positions in industry and Government because they are inventors. The fact is that a man who produces inventions consistently gets paid for it. . . . One should consider the total productivity of a man and his relationship to his group. This is generally done in industry, and the inventors do very well indeed." From *Government Patent Policy*, Hearings before the Subcommittee on Patents, Trademarks and Copyrights, of the Committee on the Judiciary, U.S. Senate, 87th Cong., 1st Sess., Pursuant to S. Res. 55 on S. 1084 and S. 1176, Part 2, May 31, June 1 and 2, 1961, pp. 490-491.

made by NASA referees of the quality of all disclosed inventions; just as a study in greater depth might examine the character of the work-loads and inventive opportunities of NASA and contractor scientific personnel, to determine whether the results of a comparison of invention-outputs are distorted by systematic variations in the research configurations characteristic of in-house and out-of-house R&D.

Here we shall not try to take quality variations into account. We will assume, but only as first approximation, that variations in the number of inventions disclosed provides a useful measure of relative inventiveness. This implies (not unreasonably in so large a universe of diverse activities focused on common or similar problems and based on the same technologies, as is under study here) that quality variations are random and balance out, so that comparable norms emerge for in-house and out-of-house disclosures.

Comparative Inventiveness of In-House and Out-of-House R&D.

We propose to compare the numbers of inventions produced per scientific employee working for NASA contractors with the numbers of inventions produced per scientific employee working at NASA's own research centers. These comparisons do not apply to *patented* inventions. As will later be shown, there is a great gap between the numbers of inventions disclosed and the numbers on which patents are applied for, and the magnitude of this gap is very different for in-house and out-of-house invention. Nor is this necessarily a comparison of the numbers of actual inventions made, since, as has been explained, not all inventions made need be reported to company officials and not all inventions reported to company officials need be disclosed to NASA. It compares the inventions disclosed to NASA from its own research centers and by its R&D contractors.

Inventions Disclosed to and Docketed by NASA (1958-1965)	6542
NASA employees inventions	1787
Contractor employee inventions	4755

Comparing the ratio of disclosed inventions to ratio of researchers employed:

Ratio of NASA employment to contractor employment of scientists and engineers (1958-1965)	1 NASA employee to 4.16 contractor employees.
Ratio of inventions disclosed by NASA employees to inventions disclosed by contractor employees (1958-1965)	1 NASA invention to 2.66 contractor inventions.

For the period covered, using outputs of disclosed inventions as the measure, the productivity of NASA employees is nearly double that of contractor employees. The statistic is impressive, but probably misleading. At the start of the major American space effort in 1958, the in-house research at the NASA research centers was a continuation of the R&D programs of substantial Government establishments with many inventions already in their pipelines. On the other hand the private companies brought into the program had either to start from scratch—or, at least, they had no obligation to disclose to NASA any of the inventions that were already in their R&D pipelines. Thus in the early years of the space program the circumstances favored the flow of disclosures from NASA centers in contrast to those from R&D contractors, regardless of the comparative rates of current invention. Therefore recent (1965) data (rather than the cumulative 1958 to 1965 record) probably provides a more reasonable basis for comparison of the output of inventions by contractors and by NASA centers.

Ratio of NASA employment to contractor employment of scientists and engineers (1965)	1 NASA employee to 5.4 contractor employees.
Ratio of inventions disclosed by NASA employees to inventions disclosed by contractor employees (1965)	1 NASA invention to 5.48 contractor inventions.

Thus, measured by current (1965) rates of disclosure, the output of inventions per scientist and engineer is almost exactly the same for NASA employees as it is for the employees of NASA's R&D contractors. The degree of equivalence is certainly surprising. It is, of course, the result of but a single "experiment," but one that encompasses research-inputs and invention-outputs of more than 50,000 scientists and engineers, including a wide diversity of R&D organizations in a program where annual R&D expenditures are in the neighborhood of five billion dollars.

As a gauge of comparative inventiveness, the measure is subject to all of the qualifications and questions that have already been raised. And even if it measured productivity in inventions with perfect accuracy, "inventions" are not the only manifestation of inventiveness. The creative accomplishment of an agency may be great in organizational and technical achievement, although its output of inventions is small. Hence, at best, the finding offers not a basis for definitive judgment, but, possibly, a useful clue.

The findings can be variously interpreted. It conforms with the hypothesis that for scientists and engineers in the American cultural milieu there exists a strong, autonomous drive to invent and to seek recognition for invention; that among large, representative groups the force of this drive and the capability for invention is approximately uniform; and that over the whole, the "policy environment" of NASA centers and of private companies is neutral with respect to it.

The Inventiveness of R&D Contractors

To further explore the comparative inventiveness of R&D contractors, Table II indicates the output of inventions for the 18 largest and certain other selected NASA contractors, as a ratio of R&D expenditures by those contractors in 1965. Data are from Table I, appended.

TABLE II

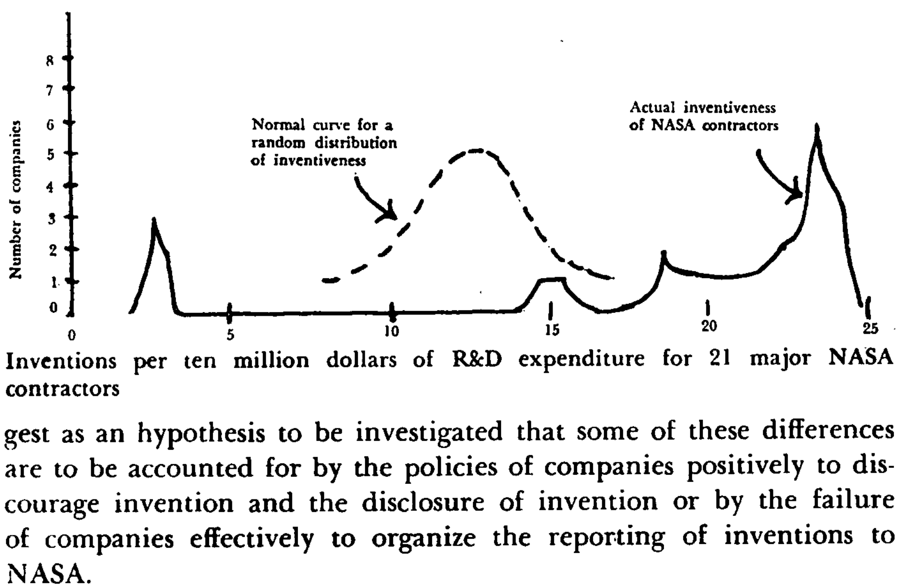
INVENTION PRODUCTIVITY OF NASA CONTRACTORS

Contractor	Rank 1965	Inventions (cumulative)	Prime contract awards in thousands of dollars (1961-65)	Index of inventiveness*
North American	1	811	2,816,616	287
Boeing	2	90	619,769	145
Grumman Aircraft	3	26	507,570	51
Douglas Aircraft	4	96	734,052	130
General Electric	5	180	410,183	438
McDonnell Aircraft	6	73	737,658	98
I.B.M.	7	100	263,883	378
Aerojet-General	8	86	492,124	174
General Dynamics	9	109	392,538	277
R.C.A.	10	182	273,303	665
Chrysler	11	59	305,032	193
General Motors	12	22	126,268	174
Bendix	13	24	166,396	144
T.R.W.	14	147	154,777	949
United Aircraft	15	377	164,123	2297
Sperry Rand	16	40	57,364	697
Lockheed Aircraft	17	113	106,757	1058
Collins Radio	18	25	46,733	534
. . .				
Honeywell, Inc.	22	102	44,754	2279
Hughes Aircraft	23	158	70,040	2255
. . .				
Union Carbide	26	5	58,601	85

*Output of invention per dollar expenditure, as an index, 100=one invention per ten million dollars of R&D expenditures.

There are many things wrong with this "index of inventiveness." It is based on the measurement of the quantity of inventions, and takes no account of quality. Quality may vary inversely with quantity. And the number of inventions per contract dollar received from NASA may vary for reasons that have nothing to do with relative inventiveness, e.g., the proportion of work that is subcontracted or the relative size of the development component in contrast to the research component in particular contracts. These important variables are not taken into account. Nor is account taken of the spread of contractor expenditures over the years of the program. This also may be important inasmuch as there is a time lag between the award of a contract and the reporting of inventions based on the contracted-for activities. Hence a contractor whose work for NASA was concentrated in the earlier years would have a reporting advantage on one whose work was concentrated in later years. In this sense, the "index of inventiveness" is a model of what is susceptible to measurement rather than a definitive measurement. Nevertheless, all this said, the present index indicates such extreme differences, and such non-random variations in company performance (shown in Chart One) as to sug-

CHART ONE



Inventions per ten million dollars of R&D expenditure for 21 major NASA contractors

gest as an hypothesis to be investigated that some of these differences are to be accounted for by the policies of companies positively to discourage invention and the disclosure of invention or by the failure of companies effectively to organize the reporting of inventions to NASA.

The inference that variations in company policy and in company organization for the reporting of invention is an important parameter determining the rate of disclosed inventions is strongly supported by a current experiment. Recently, on the Administrator of NASA's initiative, a grant was made to the largest NASA contractor to re-enforce its system for reporting inventions. Since then, with the grant money and the NASA Administrator's manifest interest in its effect on performance, the rate at which inventions have been disclosed by that contractor seems approximately to have doubled.

Disclosure of Invention to Government Agencies

Data made available recently indicates interesting uniformities and variations in number of inventions per R&D dollar produced under the aegis of the different Government agencies.[4] Among the major contracting agencies, disclosures of invention per billion dollars of R&D expenditure for fiscal years 1963 and 1964, were highest for the Navy (1482), approximately the same for the Atomic Energy Commission (1423), somewhat lower for the Army (1257) and relatively very low for the Air Force (675). Nothing in this suggests that policies for granting exclusive commercial rights to R&D contractors (contrasting the liberality of the defense agencies with the restrictiveness of the AEC) significantly affects the rate at which inventions are disclosed. The NASA rate of disclosure is considerably lower than the others, but this must be accounted for by the uniquely rapid increase in NASA R&D expenditures during those two years. Currently (in the first quarter of 1966) NASA disclosures are running intermediary between those of the Air Force and the other named agencies of Government (at about 800 inventions per billion dollars of R&D expenditure). Perhaps the lower level of performance by NASA and the Air Force is to be accounted for by the "way out" technology on which these two agencies focus, emphasizing the development of complex and integral systems, rather than those incremental developments that can more easily be expressed as a stream of patentable inventions.

The more significant and, indeed, the startling discrepancy is not between the rates at which inventions are disclosed to the various Government agencies, but rather as between the rates at which inventions are made under Government contract and when R&D is on private account.

Inventiveness Under Government R&D and R&D on Private Account

A test to determine the influence of company policy on the output and disclosure of inventions would be to compare the rate at which inventions were made and disclosed by companies doing R&D under Government contract with the rate of disclosure by those same companies doing comparable research on private account. Information

[4] Federal Council for Science and Technology *Annual Report on Government Patent Policy* (June 1965, G.P.O., Washington, D. C.)

is not publicly available on the rate at which inventions are reported *internally* to company management as part of the companies' own R&D programs. However information is available on the magnitude of company programs and on patents applied for based on inventions made through those company-financed R&D programs. Using this information, Christopher Freeman has compared inventiveness under Government contract and under private R&D account, of 10 leading electronics firms in the United States (all of whom happen to be major NASA contractors) for the period between 1951 and 1959.[5] He found that a billion dollars of R&D expenditures on private account yielded 9000 patent applications and a billion dollars of R&D for Government by these same companies yielded 760 patent applications. Patent applications are not the same as reported inventions (the former can be only a fraction of the latter), and, for reasons which will be developed in the section that follows, the rate at which reported inventions are patented will, under a reasonable public or private choice, be substantially higher when inventions are made under private account than when they are made under Government-sponsored R&D. Guessing that patents are applied for on 80 percent of the inventions produced through company R&D and (following current usage in the defense agencies to whom those companies were then under contract) on 30 percent of the inventions disclosed under Government contract, a billion dollars of R&D could be equated to 11250 inventions on company account and 2280 on Government account.[6] In any case there is evidently a quite enormous difference in comparative inventiveness of corporation R&D when made under public and private account. All the usual qualifications must be made in appraising this finding. Particularly it should be recalled that even though performed by the same companies and related to the same technology, there may be very important differences in the relative magnitude

[5] Christopher Freeman, "Research and Development in Electronic Capital Goods," *National Institute Economic Review* No. 34, (November, 1965), pp. 72-73. Mr. Freeman deals with the following companies "Sperry, W. Electric, ITT, GE, RCA, IBM, Westinghouse, Collins, Litton, Raytheon, Hazeltine, Motorola, Texas Instruments, TRW." His data is from annual company reports and from *Patent Practices of the Department of Defense*, Preliminary Report of the Sub-Committee on Patents, Trademarks, Copyrights of the Committee on the Judiciary, U.S. Senate, 87th Cong., 1st Sess., pursuant to S. Res. 55 (1961, G.P.O., Washington, D.C.) For these companies during the period under study, five billion dollars of Government R&D produced 3800 patent applications, and four billion of R&D expenditures on private account produced 36,000 patent applications.

[6] Even considering the rise in the costs of research, i.e., in the salaries of scientists and research engineers since 1951-59, this output of disclosed invention is rather on the high side compared with the 675-1482 range of disclosures per billions of defense agency R&D reported for 1963-64.

of the development (in contrast to the research) component or in other aspects of the research configuration, which are not taken into account in this comparison. All this said, variations of this magnitude should not be easily dismissed. Eventually, they may be explained and justified, but until they are, the presumption is raised either that inventions or inventive manpower are siphoned off of Government programs, or that on account of the relative lack of competitive pressures and profit lures, the inventive level of contracted-for R&D (as well as in-house R&D, which seems equally unproductive of invention) is far below the optimum.

Processing Disclosed Inventions

Each disclosed invention produced through NASA R&D, whether it is made by a NASA employee or by a contractor employee, is reported on a standard form with supporting specifications and drawings. It is then evaluated by NASA referees, who grade its performance as "highly satisfactory," "satisfactory," "partially satisfactory" or "unsatisfactory." The referees also designate each invention as either a "pioneer discovery," a "substantial improvement in the arts" or as a "somewhat routine improvement" and assign a priority to each invention. Evaluated inventions are forwarded to the Office of the General Counsel and to the Technology Utilization Program (TUP).

An invention made by a NASA employee can be published immediately in a *Tech Brief* and offered for general use. Information on some 300 inventions was thus made available in 1965. Recently some of the inventions made by contractor employees have also been published in *Tech Briefs*, though, inasmuch as exclusive commercial rights have been or might be waived to the contractors, these inventions cannot, in the same sense as with inventions made by NASA employees, be freely offered to the public.

PATENTING

Patenting NASA Inventions

When inventions are made by the employees of NASA R&D contractors, the company can, at its option, ask that commercial rights be assigned to itself. To do this it files a brief justifying the "waiver" of commercial rights as in the public interest. Petition and brief are considered by a NASA Board, which may hold hearings and listen to oral arguments. This can become a complex and expensive procedure on both sides. Contractors ask for waivers on only a fraction of the inventions made by their employees. Some 78 percent of the waivers requested have been granted.[7] When exclusive commercial rights to an invention are waived, it is for the contractor receiving the waiver to apply for a patent.

The NASA Office of the General Counsel applies for patents on those inventions of NASA employees and of unwaived inventions of contractor employees which it considers as patentable and worth patenting. For this decision, it relies in part on the evaluations previously made by NASA referees. The inventions patented by NASA (and also, with qualifying provisos, those on which patents have been applied for) are offered to all who request them for royalty-free, non-exclusive licensing.

Thus NASA produces two categories of patented inventions: those offered for the free non-exclusive use of the public and those on which exclusive commercial rights have been waived to private contractors. By December 31, 1965, 251 waived inventions were outstanding. Inventions available for the free non-exclusive use of the public number 836 including 224 made by contractor employees and 612 made by NASA employees. Of these, however, only about 500 have been issued as patents or published in *Tech Briefs* so that their availability can be understood as having been effectively advertised.

Comparative Patenting of NASA and Contractor Inventions

Earlier, the number of inventions disclosed per contractor employee was compared with the number of inventions disclosed per NASA employee. Now, by comparing the number of patent applications per NASA employee with the number of patent applications per contractor employee, the rate at which the inventions of NASA employees are patented will be contrasted with the rate at which the inventions of contractor employees are patented.

Ratio of patent applications to inventions
disclosed by NASA employees (1958-1965)—1 patent application to 2.91 reported inventions.

Ratio of patent applications to inventions
disclosed by contractor employees (1958-1965)—1 patent application to 10.5 reported inventions.

[7] Since September 28, 1964, contractors have been offered the option of requesting blanket waivers. The significance of this is considered below. Prior to this change of regulations, there had been 225 petitions for waivers. Of these, 176 were granted, 22 were denied and 27 were withdrawn. In two prior instances, more than one invention was covered by a single waiver—so that "waivers" and "inventions waived" are not exact equivalents.

Thus while the productivity of Government and contractor employees, measured by the number of reported inventions, is almost exactly the same, the rate at which the inventions of NASA employees is patented is almost five times greater.

If one considers the number of patent applications made at the initiative of the companies on inventions of their employees working on Government contracts, the difference is even more striking. The rate at which NASA seeks patents on the inventions of its employees is approximately 10 times greater than the rate at which companies seek patents (through petitions for waiver) on the inventions of their employees made under NASA R&D contracts.

Agency Policy and the Rate of Patenting

As a measure of the variations in agency policies on the comparative rates at which disclosed inventions are patented, Table III compares the rate at which patents are applied for on inventions disclosed to the major R&D agencies.[8]

The statistics in Table III strongly suggest that the more liberal policy of the Department of Defense, in making exclusive commercial rights automatically available to its R&D contractors, serves, for good or ill, substantially to raise the rate at which disclosed inventions are patented.

Thus extreme differences as between the rates at which categories of disclosed inventions are patented have been observed: differences between Government agencies, differences between the patenting rates on the inventions disclosed by Government employees and on the

TABLE III

PATENTING OF INVENTIONS DISCLOSED TO SELECTED AGENCIES

Agency	Year	Inventions disclosed	Patent applications	Inventions per patent applications
AEC	FY 1963, 1964	3351	551	6.08
NASA	1958-1965*	6542	1061	6.17
Army	FY 1963, 1964	3606	1037	3.47
Navy	FY 1963, 1964	5188	1518	3.41
Air Force	FY 1963, 1964	5349	1508	3.54

* To minimize distortions that might be caused by the novelty and rapid growth uniquely characteristic of the NASA program, the comparison was made for inventions disclosed and applications over the longer time period.

8 Data for NASA from NASA files, for other agencies from *Annual Report on Government Patent Policy, op. cit.*, note 4.

inventions disclosed by R&D contractors. Great differences must also be presumed to exist between the rate of patenting under Government programs and when R&D is on private account. All of these gaps of greatly varying magnitude between the rates of invention and the rates at which inventions are patented underline the danger of counting numbers of patents as an omnibus index of inventive activity.

Some of these differences in patenting rates need to be explained, and their implications for policy explored.

Patenting in the Business Strategy of R&D Contractors

A low rate at which R&D contractors seek to patent the inventions made by their employees working under Government contracts, in contrast to a higher rate at which they seek patents on inventions made by those same employees working in company research programs, is easily understood. Patents owned by a company on an invention made on private account are valuable instruments of business strategy. They protect against infringement suits. They fortify the position of the company in its chosen field of operations. They produce royalty income. They serve as a gambit in negotiating concessions from others. On the other hand to patent an invention made under a Government contract, even though exclusive commercial rights have been waived to the company, is likely to have little, if any value to the R&D contractor. A patent may protect against infringement suits, but substantial protection is provided simply by allowing the Government to publish the invention, and in any case, should an infringement suit succeed, the greater cost of using the invention on Government work would be shifted to the Government. Exclusive commercial rights are obtained. But, as the record to be examined later will show, successful applications of such invention outside the Government sector are extremely rare, either because of the limited technical possibilities of transference or because contractors, wholly concentrated on Government business, are unwilling to re-orient themselves in searching out and exploiting opportunities outside their accustomed sphere of activities.

The Government R&D contractor, as an effective decision-making, invention-generating, technology-developing agency, whether an independent company like North American Aviation, or subsidiary like Aerojet-General, or an aero-space division of a corporation, usually is completely geared into the Government market and correspondingly is detached from those industries that serve the civil sector. Inasmuch as it is Government business that the contractor is concerned with, to petition for a waiver and to take out a patent on an invention made under a Government program might serve merely to highlight a technical advance so that it can be more easily noticed and quickly used by the competition.

A comparatively low rate of patenting for inventions made under Government contracts is therefore entirely consistent with rational business strategy. A radical difference between the rates at which a contractor seeks to patent the inventions made by its employees on Government and on company account is to be expected as the consequence of reasonable entrepreneurial choice.

A Rational Patenting Strategy for Government

What is puzzling and difficult to explain as a choice based on a rational balancing of cost against anticipated benefits is not the low rate at which the R&D contractor seeks to patent inventions made on Government account, but is rather the high rate at which Government agencies patent inventions made by their employees or disclosed by their R&D contractors (aside from those instances where exclusive commercial rights are given to contractors and, hence, where patenting is left to contractors). Inventions that are patented by Government agencies are offered to the public for royalty-free, non-exclusive licensing. Inasmuch as this is the way that NASA (and other agencies of Government) dispose of patented inventions, there appears to be no *positive* advantage in patenting (as against simply publishing) inventions. A patent gives its possessor positive advantages in exploiting a monopoly position on the market, in receiving royalty income from its licensing and in its use as a gambit in inter-organizational negotiations. But Government agencies derive no such benefit from their patent portfolio. They use their patents neither to secure monopoly advantage nor for royalty income nor as a ploy to be traded off against concessions from others. Inasmuch as exclusive commercial rights are not granted but inventions rather are offered for non-exclusive royalty-free licensing, there are no positive advantages from the possession of a patent to justify the costly and time-consuming patenting process. This is true for any agency of Government.

NASA ties in the application for a patent with the recognition of worthy inventions and the granting of bonuses to inventors. But worthy inventions could be just as well recognized, and the contribution of the inventors rewarded, without patenting.

If given the present mode of disposing of Government-owned inventions, there are no positive advantages, there are alleged to be defensive values in patenting such invention. This allegation needs to be examined.

Defensive Patenting of Government-Owned Invention[9]

The Government is concerned to protect itself from legal harassment or from the need to compensate others for allowing it or its agents to use inventions that were made by Government employees or Government contractors. It can thus protect itself either by patenting such inventions or by publishing them and thereby establishing that its own employees or agents were the inventors. And presumably, aside from any question of patenting, the prompt, complete publication and wide dissemination of knowledge concerning new technology is itself in the public interest. Then why not simply publish? Indeed many inventions are simply published, by scientists and individuals who wish to dedicate their inventions to the public, by Government agencies and by private business corporations for those inventions in which they have only a defensive interest.[10]

But protection through publication is not complete. Supposing that NASA should publish an invention. Within a year after the publication of that invention, another party could still apply for, and could obtain a patent on that invention claiming that he was the first inventor, that his was the original conception and that he sought to reduce his invention to practice with a reasonable diligence. If these claims of the patentee are honest and his priority of conception can be established, then there should be no issue. A Government agency such as NASA is not a private business seeking competitive advantage. It is in accord with the public interest that a public agency should honor the rights of the true inventor. But what if the Government agency examines the record and believes that priority of conception and reduction to practice belongs to its own employee or to the employee of its contractor? Then, if the patentee persists in his claim, the issue may be settled in the courts. The court *will* take into account the dates of conception and of reduction to practice, both of the claimant who has published and of the claimant who patented, in

[9] We rely for legal background on two articles, William J. Bethurum, "Defensive Patenting and Some Proposed Choices," *Federal Bar Journal*, Vol. 25, No. 1, (Winter 1965); and Gunter A. Hauptman, "Publication Instead of Filing," *JPOS*, Vol. 45, No. 11, (November 1963).

[10] Cf. Hauptman for a description of the policies and practices of the Radio Corporation of America, the International Business Machine Corporation and the U. S. Department of Health, Education and Welfare.

deciding the issue of priority.[11] In other words, within a year after its publication, another than the author of the published invention may, by filing a patent application, claim to have been the true inventor. In this instance the law would require that the issue as to priority of conception et cetera be settled not in the Patent Office but in the courts. What then is to be deduced about the advantages of defensive patenting versus publication by a Government agency?

The only defensive advantage of a patent application vis a vis a publication is that the former allows date of conception to be taken into account in the settlement of conflicting claims administratively in the Patent Office rather than in the courts. It would certainly be entirely in accord with the public interest if date of conception and of reduction to practice on inventions published by Government agencies could be taken into account administratively in the examination of patent applications. Efforts have been made to change the law in this direction. In 1962 the Patent, Trademark and Copyright Section of the American Bar Association approved the principle of a program for the publication of inventions having this as its objective. It was proposed that patent applications on inventions by Government agencies be published by the Patent Office, with such published applications having the defensive status of issued applications. This proposal is quite properly confined to the inventions of Government agencies where the motivation fully to disclose and disseminate can be presumed, rather than that which must be guarded against in the instance of private companies. The latter, seeking monopoly advantage, could be motivated deliberately to obscure the information revealed concerning an invention and to minimize the distribution of that information thereby to gain the defensive advantages of publication without the degree of disclosure required in a patent application. Accepting this difference in the motivation of Government and business entities to reveal and disseminate, and taking the issue for what it is, there would seem to be an alternative preferable to the proposed system for the publication of patent applications. An administrative interagency Government board might be constituted, of which the Commissioner of Patents would be a member, charged with the task of setting standards for the general publication and dissemination of information on Government inventions, (aside from any patent applications) and ruling upon whether publication and reporting by Government agencies conformed with those standards.

[11] This is consistently and equivocally so in the cases cited by Bethurum, e.g., Corona Cord v. Dovan 276 U.S. 358 (1928), Armour and Co. v. Wilson and Co. 168 F. Supp. 353, 119 *USPQ*, 365 (N.D. Ill. 1958).

Going beyond the requirements of the Patent Office, it rather would serve the positive obligation of Government to optimize the dissemination of new technology. This would include minimizing the time between the disclosure and the publication of inventions, the full, clear explanation and description of invention, the provision of supporting information pertaining to their practical evaluation and application, and the widest feasible distribution of the published information. Certainly it would require that dates of conception and of reduction to practice be included in the published information. Given such standardized and supervised reporting, it could then simply be enacted that the Patent Office should consider dates of conception and of reduction to practice on Government inventions appearing in board-approved publications as a valid basis for determining the priority of invention in the processing of patent applications. From the side of the Government agency publishing the inventions, the task would become an editorial and not a legal one. There would no longer be any justification for defensive patenting by Government agencies. Consequently a considerable burden might be lifted from the already greatly overloaded Patent Office.

Even without such reform, the question remains as to whether the considerable costs to the public of defensive patenting (in the efforts and expenditures of the agency in taking out the patent and of the Patent Office in processing it) are justified in view of the degree of protection currently available through publication. A lawyer must protect his client against all sorts of hypothesized contingencies but a Government agency surely should choose between alternative policies by an evaluation of comparative risks and by a weighing of the costs and the benefits of alternative courses of action. One does not build a vault to protect a penny even if that is the most certain way of protecting the penny: protecting a penny is not worth the cost of the vault. The whole, complex, costly apparatus of defensive patenting (as an alternative to publication) is designed to protect the Government against one particular contingency; namely, that within a year after publication a conflicting application might be filed and a patent might be issued even though the patented invention was first conceived and first reduced to practice by an agency of the Government, which chose to publish rather than to patent it. How frequently during the past half century or more have such conflicting claims arisen with respect to the existing mass of published invention? Evidently very rarely. Bethurum cites only one truly analogous case, *Corona Cord* v. *Dovan* and but a handful of related cases. He cites none at all (and I must presume there never has been any) involving conflicts with the publication of inventions by an agency of the United States Government. In the rare instances when such a conflict occurs or could occur: what then? The issue of priority might then be settled in the courts, where the Government is in no sense disadvantaged by having published rather than having applied for a patent. Thus a whole, vast, complex, costly apparatus of patenting has been created to avoid the the possibility of an occasional and rare court case in which the Government's rights and the cause of justice would be in no way prejudiced! Surely a mountain has been raised to fend off a mouse. It is my impression that the costs of defensive patenting wholly outweigh any conceivable benefits, and that there is no justification for patenting rather than publishing invention to satisfy the defensive purposes of Government agencies today.

Indeed one can hardly understand present patterns of patenting as rational defensive strategy. How, for example, could one reconcile the radical variations in the rates of patenting the inventions of NASA employees and of contractor employees as the expression of a rational defensive strategy?

Even though, *given the present disposition* of Government-owned inventions, the costs of patenting cannot be justified either by defensive or by promotional benefits, nevertheless conceivably the Government agency's patenting powers could be used as they are not now being used to promote the transfer of technology. Then a high rate of patenting on invention by Government agencies might, indeed, be justified. That possibility in relation to NASA's policy and strategy in promoting the transfer of technology will be explored in the third part of this study.

COMMERCIAL APPLICATIONS

The Commercial Application of Waived Invention

For one set of NASA inventions, exclusive commercial rights have been waived to NASA contractors. These are a highly selective group of inventions, chosen specifically because they were considered by NASA contractors to have a potential commercial value. They were petitioned for at some cost by the contractor on his pledged intention to exploit their commercial potentialities. Consider then, these "waived" inventions. What applications have in fact been made of them? What values have they had outside the Government sector?

Table I (appended) details the record in the commercial application of the inventions waived to the 100 largest NASA business contractors (ranked in 1965) and to universities having in 1965 a million

TABLE IV

Year	(1) Number of inventions waived	(2) Number on which promotional or developmental effort, but no commercial application was reported. From 1959-1965	(3) Number successfully applied commercially. From 1959 to 1965
1959	38*	(For 1959 waivers) None	(For 1959 waivers) None
1960	3	(For 1960 waivers) None	(For 1960 waivers) None
1961	15**	(For 1961 waivers) 2	(For 1961 waivers) None
1962	11	(For 1962 waivers) 3	(For 1962 waivers) 1
1963	27	(For 1963 waivers) 5	(For 1963 waivers) 3
1964***	66	(For 1964 waivers) 8	(For 1964 waivers) 3
Total	160	18	7

* Carried over from a Government contract with United Aircraft.

** During 1961, 24 waivers were made to A.T.&T. covering the development of Telestar. Only four of the waived inventions were patented, and only these four patented inventions are included among the number of inventions waived for 1961.

*** Waivers granted in 1965 are not shown because no official report on utilization is requested until a year after the grant of waiver. No commercial utilization of this most recent group of waived inventions has been indicated.

or more dollars in NASA R&D contracts. It shows for each contractor (1) the number of inventions disclosed by that contractor between 1958 and 1965, (2) the number of waivers requested by that contractor between 1958 and 1965, (3) the total number of waivers granted to each contractor, (4) the number of waived inventions on which the contractor reported some effort to promote or develop for commercial use, but no successful commercial application, and (5) the number of waived inventions successfully applied by the contractor commercially outside the Government sector.

Table IV summarizes the record of commercial development and application for all NASA's waived inventions. Column 1 shows the number of inventions waived for each year from 1959 to 1964. Column 2 shows, for the waivers made in the indicated year, the numbers on which some developmental or promotional effort but no successful commercial application was reported. Column 3 shows, for the waivers made in the indicated year, the number that were successfully applied commercially. Thus, for example, in 1964, there were 66 inventions waived, and of these some as yet unsuccessful promotional or developmental effort was reported on eight, while three were applied commercially.

What emerges from the record?

Benefits to the economy at large from the commercial non-space application of waived inventions have not been significant. Some 15 billions in R&D contracts, producing through 1964 more than 2600 inventions by contractor employees, involving a complex and costly apparatus for waivers and patents, results after six years in the commercial application of six inventions,[12] none of them important: an ionization gauge, a seisometer sold mostly to Government agencies, an element of a fuel cell that has been sold for demonstration purposes to universities, a damped accelerator, a subcomponent in a magnetometer (2 waivers), a temperature probe with sales more or less confined to aerospace industries.

Commercial Application of Inventions Offered for Free Use to All

Alternatively to those inventions where exclusive commercial rights are waived to R&D contractors, NASA offers to the public another set of inventions for non-exclusive, royalty-free licensing. What commercial application has been made of these? What impact have they had outside the Government sector?

One measure of the public's interest in these inventions is the number of licenses requested. However, since a license costs nothing and there is no penalty for its non-use, the application for license need signal no serious intent to use. On the other hand, it is always possible that some inventions offered for free licensing are used without bothering to request a license since the Government has never prosecuted for such a transgression. There are reasons to suppose that any firm which intended to make a significant commercial use of an invention offered by NASA for non-exclusive licensing involving a substantial investment of funds or effort would take out a license. The license costs nothing and NASA might supply with it, either directly or by arranging contact with the inventor, useful supplementary information. Taking out a license for an invention that a firm intends to use, moreover, provides that firm with a protection that could prove important. NASA is uniquely empowered in its enabling legislation to grant exclusive commercial rights on an invention which has previously been offered for non-exclusive, royalty-free licensing, when that invention is not known to have been "worked" within two years after the issuance of a United States patent. By taking out a license and reporting on the use of an invention, a firm

[12] Ten, if one chooses to include a kit of brazing tools whose uses have been so far confined to sales to aerospace firms.

protects itself against the possibility that NASA might subsequently grant exclusive rights to a competitor.

NASA offers for non-exclusive royalty-free use not only those inventions on which a patent has been issued, but also, with appropriate provisos, a qualified license to use inventions on which a patent has only been applied for. The number thus available is as follows:

NASA Inventions on which patents are issued or applied for (as of Dec. 31, 1965)	836[13]
Based on inventions by NASA employees	612
Based on inventions by contractor employees	224
Number of Inventions Licensed	48 (5.7% of total)
Licensees	118

Inasmuch as one can judge from the record of their licensing, there is no difference in the relative attractiveness for commercial application of the inventions produced by NASA employees and by contractor employees. Thus, for the NASA inventions offered for non-exclusive, royalty-free licensing the following ratios can be found:

Ratio of Contractor employee inventions to NASA employee inventions	1 contractor employee invention to 2.73 NASA employee inventions
Ratio of contractor employee inventions licensed to NASA employee inventions licensed	1 contractor employee invention licensed to 2.69 NASA employee inventions licensed

In December 1965, a letter survey was made from the Office of the NASA General Counsel to determine the extent to which the licensed inventions had been commercially applied. Eventually replies were forthcoming from about half of the licensees. Considering the character of the licensee in a situation where a license could be obtained by anyone at the cost of a postage stamp, those who replied to repeated solicitation, probably constituted substantially all of those who might seriously have intended to develop the licensed invention for commercial use. Only one very minor instance of commercial application was reported.

Thus the effort to transfer technology by offering inventions for non-exclusive, royalty-free licensing has been as sterile of benefits to the economy as have been the efforts to promote the transference of invention through granting exclusive commercial rights to R&D contractors.

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[13] A smaller number, approximately 500, have been publicized through *Tech Briefs* or as issued patents, and hence might be considered as effectively offered for licensing.

Results Contrasted with those of Earlier Studies

The NASA record is incomparably the most complete and authoritative so far available. Nevertheless the results in respect to the commercial application of inventions produced through special-purpose Government R&D will be in no way surprising to those familiar with previous studies covering the non-governmental application of the patented inventions of other Government agencies. They are consistent with the findings of Professor Donald Watson in his pioneering efforts, and with those of his colleagues, particularly of Professor Mary Holman, at George Washington University, as well as with the work of the Senate Subcommittee on Patents, Trademarks and Copyrights covering the patent practices of the Department of Defense and other Government agencies.[14]

In general these studies have found that while more than half of the privately owned patents of business corporations are used in the commercial activities of those companies, and an even larger proportion of the patented inventions produced by special-purpose Government R&D are used in the Government-supported activities to which that R&D relates, only a small fraction of the patented inventions produced through Government-supported R&D, (whether they are offered for free non-exclusive licensing, or with exclusive commercial rights vested in R&D contractors) have had any commercial application. Moreover, the qualitative importance of transferred inventions and their impact on the private sector has generally not been significant.

Thus Professor Watson in his study of the commercial application of inventions where title was vested in R&D contractors to the defense agencies found that "the rate of commercial utilization of privately owned patented inventions originating under Federally financed R&D contracts [*equivalent to NASA-waived inventions*] is about 13

[14] *Cf.* Donald S. Watson, Harold Bright, Arthur E. Burns, "Federal Patent Policies in Contracts for Research and Development," *PTC J. Res. & Ed. (IDEA),* Vol. 4, No. 4 (Winter 1960). *Patent Practices of the Department of Defense,* Preliminary Report of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U.S. Senate, 87th Cong., 1st Sess., pursuant to S. Res. 55 (1961, G.P.O., Washington, D.C.). Donald S. Watson, "New Information on the Operation of the License Policy in Federal Contracts for Research and Development," *PTC J. Res. & Ed. (IDEA),* Vol. 5, No. 4 (Winter 1961-62), p. 287. Other hearings and reports of this Subcommittee are relevant. *Cf.* also Donald S. Watson and Mary A. Holman, "Patents from Government-Financed Research and Development," *IDEA,* Vol. 8, No. 2 (Summer 1964), p. 199; Mary A. Holman, "The Utilization of Government-Owned Inventions," *PTC J. Res. & Ed. (IDEA),* Vol. 7, No. 2 (Summer 1963), p. 109; and Mary A. Holman, "Government Research and Development Inventions: A New Resource?," *Land Economics,* (August 1965).

percent. In contrast, privately developed and privately owned assigned patented inventions are utilized at a rate of between 55 and 65 percent."[15] The Senate Subcommittee found that 7 percent (rather than 13 percent) of the patents deriving from Department of Defense contracts in which contractors were given exclusive commercial rights were utilized commercially. Professor Holman found that 75 percent of the patented inventions owned by the AEC were used in the activities of the AEC, but that only 16 percent of the patented inventions owned by the AEC and offered for non-exclusive royalty-free licensing were used outside the Government sector. Professor Holman also found that 74 percent of the patented inventions owned by the DOD were used for DOD purposes but only 13 percent of the patented inventions owned by the DOD and offered for non-exclusive royalty-free licensing were used outside the Government sector.

The NASA record suggests a considerably lower non-governmental utilization than earlier findings both of those inventions where exclusive commercial rights are waived and where inventions are offered for free non-exclusive licensing. For this there are several possible explanations. The NASA technology may be considerably more esoteric, systems-oriented, with less overlap into activities equivalent to those found in the non-governmental sector. The NASA technology is newer; its inventions are more recently forthcoming, and hence have not yet had the time to make the same penetration into civilian practice. But also, the NASA record is much more complete than the sample data from which earlier conclusions were drawn, and being more tightly controlled, the NASA record does not permit the same broad leeway of interpretation to inventors or to company patent attorneys answering questionnaires. Inventors asked about the use made of their own inventions are not wholly disinterested in their replies. Patent attorneys passionately committed to a Government policy of granting exclusive rights to their companies on inventions made under R&D contracts are not likely to be indifferent when asked what commercial applications have been made on those inventions where exclusive commercial rights were so granted. Certainly there is room for "interpretation." Evidently, for example, some of that which is claimed as commercial utilization seems to consist merely in commercial sales to agencies serving the governmental sector. In any case, comparing Watson's 13 percent to the Senate Subcommittee's 7 percent and NASA's much lower figure, it is curious to note that, while none claims a significant rate or quality of non-governmental

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[15] Watson, "Federal Patent Policies . . .," *op. cit.* note 14.

utilization, optimism varies inversely as reporting is official and data are controlled.

Inference for Policy

It is perfectly clear that there has been no significant transference of patented inventions produced through NASA-sponsored R&D into non-governmental uses. This is true even though NASA has, in our view, more than any other Government agency, been intelligently experimental and constructive in its efforts to promote, through patent policy and otherwise, the transference into industry-at-large of technologies produced for special public purposes.

The record shows to be fallacious some of the conceptions that would seem to underlie existing policies. Thus the policy of waiving exclusive commercial rights to R&D contractors is based on the theory that private companies, given a profit incentive in the commercial exploitation of inventions produced under Government contract and thenceforth left to themselves, will automatically and spontaneously develop those inventions for commercial application and disseminate the use of those inventions through industry at large. The record refutes that theory.

In 1963 a Presidential Directive, now being implemented by NASA, ruled that when an R&D contractor has an "established commercial position," that is, itself, to be considered as grounds for granting to that company a "blanket waiver." A blanket waiver gives exclusive commercial rights to the R&D contractor on all of the inventions disclosed by that company, automatically, without question or request. Underlying this criterion for blanket waivers, is another theory, namely that when a corporation is both an R&D contractor and has an "established commercial position" it will therefore be in a position to develop and promote, and will be motivated to exploit the commercial potentialities of inventions made under governmental R&D contracts. The record (as shown in Table I, appended) refutes this theory.

Consider the record of such large NASA contractors with powerfully "established commercial positions" as Chrysler Corporation, General Motors, Bendix, Philco, Honeywell Inc., Transworld Airlines, Union Carbide, Thiokol Chemical, Raytheon, American Machine and Foundry, Motorola, Minnesota Mining and Manufacturing, Pennsalt Chemical, Sylvania Electric Products, Dow Chemical. Not only have they a zero record of commercial application: none of these companies throughout the whole period of the space effort has ever even troubled to request a waiver.

The strongest impression to be gotten from an examination of the record of waived invention is of the *indifference,* the general, pervasive sometimes the absolute indifference on the part of the contractor to the commercial potentialities of inventions made under Government R&D contracts. Evidently it is very rare that these contracting companies have any internal mechanism to develop and to promote—or even to examine and evaluate the commercial potentialities of inventions made under Government contracts.

This general indifference is also suggested by the response of companies to NASA's offer to consider requests for blanket waivers. From Oct. 1, 1964, to Dec. 31, 1965, out of the 9430 NASA contractors and subcontractors eligible to request blanket waivers, only 224 or .023 percent troubled to do so either at the time of writing contracts or by separate petition.

Considered in terms of rational entrepreneurial choice, the indifference of R&D contractors to the commercial potentialities of inventions made under Government contracts may be entirely justified. These major R&D contractors are huge, complex organizations which, regardless of their corporate status, are integral decision-making entities wholly absorbed in competition for Government business. Their competence is in the space-military technology. An attempt to re-orient themselves into commercial markets in order to exploit the heterogeneous scattering of the inventions in their possession would require a change in the locus of effort and a diversion of executive talent that might debilitate their dynamic force—with no clear prospect of any significant payoff in profits.

But if waiver policy has failed, this does not mean that the offering of inventions for the free use of the public has succeeded. Both of the two controverted approaches have been tried. Both have been found wanting. The evidence suggests not that one side is right and the other wrong but that the controversy is irrelevant. The problem evidently, needs to be differently understood.

A new technology can be conceived as a new capability for purposeful action. Patentable inventions constitutes one element, and perhaps only a small and trivial element, of a new technology. It sometimes can happen that a patentable invention moves from one technology to quite another technology. But evidently this movement of invention between technologies is rare and not ordinarily of importance. More significant are the possibilities that a new "whole" technology produced in the Government sector can be extended and adapted to reach different sets of activities and to serve other purposes outside the Government sector. Patent policy for inventions produced under

Government-sponsored R&D, as it has hitherto been conceived by lawyers and economists, and as it has been activated by Government agencies, has had to do only with an effort to encourage the flow of patentable invention between technologies. The evidence suggests, nevertheless, that there has been no significant movement of patentable invention from the new special-purpose technologies produced through Government R&D into the different technologies oriented towards civilian-industrial objectives.

Aside from the movement of patentable inventions between *different* technologies, it might also be expected that when there had been achieved a significant extension, adaptation, re-orientation of the technologies developed through Government R&D to serve non-governmental purposes, that that transfer of basic technology would then carry many patentable inventions in its wake. In other words, patentable inventions like flotsam and jetsam on the surface, may be clues to the movements of larger currents. Inasmuch as the flow of patentable inventions does provide such a measure, the evidence it gives concerning the tranfer of Government-produced technologies into servicing objectives in the non-governmental sector, though not decisive, is certainly negative.

Rather than promoting the transfer of patentable inventions and bits and pieces of information as isolated, independent elements moving between technologies, Government policy should rather emphasize the adaptation and extension of technologies (understood as total capabilities for purposeful action) to serve new purposes or existing objectives in the economy at large. Part III of this study develops this argument and will try to show how patenting might fit into such a strategy.

PART III

PROMOTING INVENTIVENESS, TRANSFERRING INVENTION, EXTENDING TECHNOLOGY

INVENTIVENESS

No Instrument to Promote Inventiveness

In this section positive steps will be recommended to promote inventiveness and creativity in contracted-for R&D. Are these recommendations being made to the Government? Surely. To NASA? Yes. But the Government is vast and its powers are diffused; so also are NASA's. And it would seem that there is not now a locus of responsibility in the Government or in NASA organized to respond and able to act upon the recommendations that will be made. Everyone is in favor of creativity and inventiveness, and different authorities have responsibilities which bear upon the matter. NASA's Office of the General Counsel is charged with enforcing the obligation of R&D contractors to disclose "new technology" produced under contracts with that agency. NASA's Technology Utilization Program (TUP) is concerned to encourage disclosures since these are inputs in its information-dissemination pipelines. But nowhere is there the specific responsibility and, hence, nowhere has there yet been developed the interest in and competence to study, to compare and to promote inventiveness and creativity among NASA R&D contractors or in its research centers. That responsibility has yet to be assigned.

By the Record

Part II, above, covered the record of the inventions per scientific employee or per dollar spent in R&D in NASA centers or under NASA's contracts. It was shown that the rate at which inventions are produced and reported in Government R&D is far below the rate at which inventions are produced and reported in private company R&D, and that the self-same R&D contractors to Government produce vastly more inventions when working on private account than when working for Government. It was shown also that there are extreme differences in the rates at which inventions are made and reported by particular R&D contractors. All of which suggested that company policy and company organization may be an important variable in promoting or in inhibiting inventions and the disclosure of invention. Hence, possibly, by influencing the policies of its R&D contractors, NASA might support inventiveness and radically raise the rate at which inventions are disclosed.

The record examined in Part II was far from complete. In order to evaluate comparative performance, more needs to be known about the quality of invention and the variations in R&D tasks assigned to particular contractors and research centers. Certainly it can be assumed, if there comes to exist in NASA an office with the promotion of inventiveness as its task, that then a more complete record will be developed as a basis for the analysis of performance and the comparative evaluation of performers.

A general rule of political life is to leave well enough alone. Reform will not ordinarily be undertaken so long as the spontaneous flow of events satisfies reasonable expectations. The importance of the record examined previously is in the gap it reveals between reported invention and the level of inventiveness that might reasonably be expected. It forces us to examine the process through which invention and the reporting (or disclosure) to NASA of invention, takes place. And even a very broad and general analysis indicates two grave weaknesses which are part of the structure of procurement in relation to encouraging creativity in R&D and the disclosure of invention.

No Payoff for Invention

As a general rule the large R&D contractor (referring to the operational policy-making entity, whether nominally a division or a subsidiary of a corporation, or an independent company) is solely interested in Government business. For that contractor there is no payoff whatsoever from a contribution to the general advancement of technology achieved through inventions or otherwise, aside from and in addition to the effects it might have in expediting the achievement of specific obligations written into a contract. As there is no payoff, correspondingly there must lack a managerial motivation to encourage inventiveness in Government-sponsored R&D or to promote creative contributions with values beyond the fulfillment of specified contractual obligations under Government R&D programs. And if there are no positive advantages in producing inventions under Government-sponsored R&D programs, there are net disadvantages to the contractor in disclosing the inventions and other creative achievements of general value that happen to be made as part of Government R&D programs. This lack of any built-in incentive to invent or to disclose invention is weakness number one.

Indirect Reporting

The individual scientist and research engineer has a self-interest in inventing and in disclosing invention, indeed in the general acceptance and widespread application of what he has invented, whether he produces that invention under a Government-sponsored program or whether his work is on company account. It is not only that he derives personal satisfaction from an accomplishment and its recognition. Also, whether or not the company is in a position to profit by his invention, the achievement establishes his capability and enhances his reputation among his peers, and, hence, his status and earning capacity in the company and in the industry.

The scientist and research engineer working for an R&D contractor on a Government contract does not report his inventions directly to those in the Government agency whose interest (corollary with that of the inventor) might be in promoting the general acceptance and widespread use of his creative contribution. Instead he reports it to his immediate supervision, and his report moves through the echelons of management and through the processing of patent lawyers where the objective is likely to be not to maximize dissemination but to minimize disclosure.

This is to say simply that those who invent and who are motivated to disclose their invention do not have the opportunity to report directly to those who have paid for their invention and are responsible for promoting its general use. Rather their reports must filter through intermediaries who are motivated not to disclose but to minimize disclosure. This indirect reporting, for which there can be no functional justification, is structural weakness number two.

The Source Evaluation Board

The first weakness in the structure of relationship of the Government agency and its R&D contractor, in respect to the promotion of creative R&D, is the lack of any incentive to produce invention or otherwise to contribute to the advance of technology beyond that which relates to satisfying contract specifications. The first task therefore is to build incentive into the procurement system. As a background for our recommendation as to the means for doing this, first the method of R&D procurement and, particularly, the role of NASA's Source Evaluation Board must briefly be described.

In the traditional approach to Government procurement, the public agency specifies what it wants and asks for bids. Independent business concerns submit bids, specifying what they propose to deliver and the price at which they offer it. The contract then is awarded presumably to the low cost bidder. The Government has tried to use this procedure in procuring research and development, asking companies for "proposals" and awarding contracts to the company whose proposal is preferred.

As a consequence of two decades of experience, it has become clear that the traditional "bids and buy" approach to Government purchasing is not satisfactory when used for the procurement of R&D. An R&D proposal refers not to a product but to an aspiration, to a statement of intentions and hopes. Between proposal and performance there need be only a tenuous relationship. Hence what needs to be evaluated is not so much the proposal as the proposer; what must be judged is a capacity to perform, and that judgment requires an evaluation of past performance. Here, where powerful corporate "images" are bound to distort the superficial view of the hasty observer and where performance is obscured by the great complexity and immense diversity of the elements of achievement, it is of the utmost importance that the data of performance be systematically accumulated, quantified and measured, and evaluated with all possible detachment and objectivity.

A system for the accumulation of the data of performance and for the detached measurement and objective evaluation of that data provides a basis for rational choice in the future procurement of R&D. And the existence of such a system for the evaluation of past performance and its use as a basis for future contract awards, gives to contractors a powerful motivation, which does not otherwise exist, for effective performance.

Agencies involved in R&D procurement have moved in this new direction, particularly since the so-called "Bell Report" of 1962.[16] The focal point of NASA's effort systematically to gather the evidence and objectively to evaluate past performances and present capabilities as a basis for the award of R&D contracts is that agency's Source Evaluation Board. In 1963 the Department of Defense established a Program of Contractor Performance Evaluation, including a data bank for the accumulation of information relevant to such evaluation. The system for the accumulation of such data, described in the *Department of Defense Guide to the Evaluation of the Performance of Major Development Contractors,* matches contractual commitments with recorded achievements in respect to completion time, costs and end-product specifications. What is missing here, and elsewhere, is systematically accumulated evidence useful in the evaluation of inventiveness and creative achievement that transcends specific contractual obligations. An investment in research is always a bet on the unknown, and the big winnings are not in competent, quick performance but in creative achievements that propel forward the whole technology. Surely that capability for a creative contribution should also be taken into account in contractor evaluation and R&D awards. We will recommend that there be integrated into the process of source evalua-

[16] *Report to the President on Government Contracting for Research and Development,* prepared by the Bureau of the Budget and referred to the Committee on Government Operations of the U. S. Senate, (May 17, 1962, G.P.O., Washington, D. C.).

tion the means for systematically gathering and evaluating the data of inventiveness and creative contribution as a basis for the award of R&D contracts.

Integrating the Data of Invention into Source Evaluation

Ours will be a very simple recommendation, requiring no significant change in NASA organization and no significant expenditure of NASA funds. It is recommended that a NASA office be assigned the responsibility for promoting invention in, and the creative contribution of, NASA-supported R&D. Whenever an award of an important R&D contract is under consideration by the Source Evaluation Board, a representative from that office would prepare and would present in writing and orally before the Source Evaluation Board a brief covering the invention and other forms of creative contributions of each of the companies being considered for the award. The Source Evaluation Board would take the information and evaluation thus presented into account in its deliberations and in recommending the award of the contract.

The brief would report on the numbers and qualities of inventions disclosed per dollar of R&D expenditures and per man-year of research effort by each of the competing contractors under Government R&D contracts. It would describe other general advances of technology attributable to the competing contractors' R&D efforts. It might compare invention rates and technological achievements under the company's own R&D with those made by the company under Government programs. The cooperativeness of management in disclosing and in promoting the dissemination of new technology would also be indicated. On the basis of this information the potential for a creative contribution by each of the competing contractors would be evaluated.

A considerable amount of information relevant to the evaluation of creative performance is currently available and needs only to be systematically organized and presented. The numbers of inventions disclosed to NASA by each of its R&D contractors is known. Every one of those inventions has been evaluated by NASA referees for its quality, and those evaluations are readily available. Other information could be gotten from project supervisors, and from voluntary or required submissions by contractors. It is in NASA's interest that the contractor be allowed a continuing opportunity to elucidate his creative contributions or to explain his relative failures, since a primary objective here is to promote a greater awareness of these matters on the part of company management.

Thus much might be accomplished with a very small effort by NASA. If contractors feel obliged to present and justify (and hence be induced to develop) their creative credentials, that itself would be most salutary.

The survey and study of creative contribution as a basis for the evaluation of creative potentials might be carried to any degree of depth and subtlety. How far it should be carried must be left to experience and judgment. Going beyond the evaluation of referees, the qualities of inventions might be judged by a study of their subsequent dissemination, application and impact in practice. It would be useful to record the inventive achievements and creative contributions not only of companies but also of research teams and individuals within contractor organizations since individuals move and teams dissolve. Creative capabilities might be related to particular fields of endeavor. And the survey might seek to cover not only R&D contractors, but also those currently outside the R&D establishment who might later be brought into it.

Certainly the information thus gathered should be made available to all the agencies of Government as an aid in their contractor evaluations in R&D awards.

Direct Reporting by Inventors

A second structural weakness in promoting creativity and in encouraging the disclosure of invention through the contractor-contractee relationship is the indirect reporting of invention. Reporting is not from those who invent and are motivated to disclose to those who are motivated to maximize dissemination and application. Rather reports from inventors come to NASA through intermediaries who are motivated to minimize disclosure. This structural weakness probably cannot be easily and simply remedied. There are conflicts between the public and the private interest built into the Government-contractee private-contractor relationship that may not be wholly resolvable within its frame.

It is in the public interest not only that inventions but all information produced through Government-supported R&D be made available for general dissemination. Such dissemination will not be in the contractor's self-interest. The R&D contractor may fear, and sometimes with good reason, that the release of information will be to his competitive disadvantage. This loss of competitive advantage is hardly likely to be decisive, any more than the publication of books by Harvard professors permitting their findings and ideas to be taught elsewhere in likely ipso facto to mean a loss of Harvard's competitive advantage versus other universities. Nevertheless, inasmuch as the fear of loss is there, the disclosure of invention and of other information will be variously resisted. The Government, on the other hand, can use its power as a buyer of R&D to enforce institutional arrangements favorable to the systematic disclosure of information. It can also, as was suggested earlier, place the quantity and quality of disclosure into the scale of contractor evaluation as a basis for future R&D contract awards and thus build the motivation to disclose into the self-interest of the company.

It seems not unreasonable, and it is recommended as an objective, that, for each major R&D contract award, a representative of NASA's Scientific and Technical Information Division (STID) should meet with a representative of R&D management to review together the planned system of *internal* company reporting and data accumulation. The STID representative would require that any category of *internal* reports or files or sets of data collections which he conceives to have a general or referential interest be simultaneously reproduced and copies forwarded to the Scientific and Technical Information Division. It would always be required in contracted-for R&D that a copy of a report on any invention made by a company researcher working under Government contract be simultaneously forwarded to a designated office of NASA. Subsequently, the company evaluation and the patent lawyer's report on that invention would be forwarded also. It is not conceivable that such direct reporting of inventions would subvert any prerogatives required for effective management.

Direct Relationships with Inventors

It would be in the public interest to cultivate direct relationships between company inventors and the NASA office responsible for promoting inventiveness and the general application of invention. This could be achieved in a number of ways. Awards and commendations might be made by NASA to company employees for their inventions or other forms of creative achievement, thus adding to the inventor's incentive to develop and to disclose his invention. By pre-arrangements negotiated with the contractor, NASA might engage inventors for short periods as consultants to advise on the relevance, applicability and application of their technical contributions for Government purposes or for utilization in the private sector. It is particularly recommended that NASA develop a program of "inventor fellowships." This would require that R&D contractors previously agree to allow "leaves of absences" with assured job security for a year or more to a limited number of their research personnel who are granted fellowships. Research personnel would then be free to apply for an inventor's fellowship. They would submit a project which would have as its objective to develop an invention, or an aspect of space-related technology, or a theoretical conception on the grounds that there appears to be potential general values in this for space exploration and/or for science and/or for commercial application. Fellows would be renumerated at some fraction (say 80 percent) of their regular salary plus a grant to cover the use or procurement of experimental equipment, travel, and other costs related to the project. The fellow could work freely at a university or in a Government research center. If he wished, he would receive exclusive commercial rights on any inventions he developed, or if the outputs of his research were of another order, NASA would support their publication. Later in this paper the value of a program of inventor fellowships in the transfer of technology will be suggested.

Dissemination of Information and Spread of Knowledge

Knowledge and Technology Through the University Nexus

The production, publication and dissemination of *information* difficult as this is, is simple and straighforward compared to the production and, through education, the dissemination of *knowledge*. The transformation of the elements of technologies into knowledge, interacting with academic science, transmitted through the university nexus in support of an advancing technology is a most complex and highly variable process that is only very partially comprehended and has not yet been submitted to rigorous and continuing analysis. The decision-making powers and innovating capabilities related to it are extremely diffused as between universities (and within universities between independent disciplines and multitudes of autonomous personages) and Government agencies and business firms.

There is an urgent need to understand and hence to promote from within the academic community the effort to understand the roles of the university and its potential contributions in the larger social system of producing and advancing technology. Especially is this need acute for an agency such as NASA as a producer of technologies to be transformed into teachable knowledge; and as a consumer of the knowledge, borne to it by oncoming generations of scientists and engineers, that has been accumulated, organized and shaped well or badly by Academia.

Organizing and Disseminating Information

All of those agencies of Government which conduct significant R&D programs have expert services for disseminating the technical information which the agency produces and for accumulating and organizing for ease of availability the technical information of interest to its R&D personnel. NASA's Scientific and Technical Information Division (STID) collects from all over the world reports and publications, including NASA's own R&D outputs, related to aerospace research and engineering. Its central collection now numbers some 460,000 items. It disseminates this information, organized and summarized in two massive indexing and abstracting journals, to NASA scientists and engineers, to the scientific community and to industry at large. It has located microfiched libraries and computer tapes for searching the literature in centers of aerospace activity. Three Regional Dissemination Centers, located in universities, are geared to the computerized searching of this accumulated information for that which might relate to the functional activities and technical interests of industrial subscribers.

Thus NASA, like other agencies of Government, possesses a complex and powerful instrument for collecting information, for organizing that information so as to make it more readily available for search and use, and for disseminating such information among those who might have use for it. Characteristic of NASA is the great range and variety of the technologies it covers, and of its efforts to promote dissemination outside the Government sector.

Two categories of information of interest here are not currently being fed into STID's dissemination pipelines:

(1) descriptive data related to the evaluation of inventions and incorporated into patent applications, and

(2) the *internal* reports, files and data collections of R&D contractors related to R&D activities.

Most of the internal reports and data collections of R&D contractors are, surely, only of transitory interest and of local relevance, so that no public purpose would be served by making them generally available. However, some of this information might be of great value in developing the understructure of choice and in building the information-basis of technical advance. Negative results of experiments, for example, or tests that have served to narrow the range of choice, while not susceptible to broadside dissemination, might, if properly organized, provide a useful reference base for future research choice. In order to bring selected parts of this universe of information into the public domain, it was earlier recommended as a NASA objective, that a representative of the STID working with the company's research administration (or project direction) on all major R&D awards, should review the system of internal reporting and data collection related to the contracted-for activity, and should select those categories of reports or data collections which appear to have a general value, requiring that those items should simultaneously be reproduced and forwarded to STID.

Inventions disclosed to NASA are evaluated and evaluations are reported on. Detailed descriptive information on inventions selected for patenting is assembled and incorporated into patent applications. Such information, produced at considerable cost and presumably having a general relevance deserves also to be microfiched and abstracted, and fed into STID's dissemination pipelines.

In Part II above, Government policy for the "defensive patenting" of inventions produced under Government-sponsored R&D was examined. It was there recommended, in order to promote publication as an alternative to defensive patenting, that an intra-Governmental board be created with members drawn from agencies having major R&D responsibilities and including the Commissioner of Patents. It would be the task of this board to formulate standards for the disclosure of information on inventions produced through Government-sponsored R&D including standards of presentation, completeness, supporting data, and breadth of distribution. By evolving higher standards for disclosure and distribution, by the inter-agency development and coordination of procedures in the organization and dissemination of the information, the board would seek to increase the general utility of such information.

It would be enacted in the law that when the board's standards of disclosure and distribution were met, and with the board's approval of the agency's system of disclosure and dissemination, the publication of inventions made through Government-sponsored R&D would have the same defensive status as patent applications on those inventions. This would remove any justification for defensive patenting on the part of the Government, and would therefore eliminate a drain on legal manpower and a burden upon the overloaded Patent Office. It would besides serve the public interest in promoting a more effective dissemination of technical information throughout the Government.

Transferring Invention and Extending Technology

By the Record

The record of the commercial applications of the inventions produced through NASA-sponsored R&D was examined earlier. Whether offered to the public for non-exclusive royalty-free licensing or whether exclusive commercial rights were granted to R&D contractors, no significant commercial application was made of such invention. In either case there was no measurable impact on productivity in industry. This was in conformity with the experience of other Government agencies. Benefits, such as there were, seem not yet even to approach the costs of the efforts by scientific and legal manpower in the evaluation of inventions, in their examination for patenting, in the procedure for waiving commercial rights, in patent applications, in the dissemination of licenses, et cetera.

Certainly it is true that patented or patentable invention constitutes but one element of new technologies. Yet, since they are an element, one might expect that the transfer of patented invention into commercial applications would provide a clue to the broader flows into use in the commercial sector of these technologies produced through Government-sponsored R&D. Inasmuch as the commercial application of such patented invention does provide such a clue to the strength of the cross-flow of technology, it is certainly a discouraging one.

The record of commercial applications of such inventions is a record of sterility. At least the record has this value: it suggests that nothing is to be lost by abandoning the old approach and attempting new, experimental uses of the patenting power.

Technology and Invention

New technology is not the same as invention. For what follows it is important that the difference between the two and the relationship of the two be understood.

Technology means here a transferable capability for some purposeful action. A capability (say, for automotive transportation and travel) may include a great many sub-capabilities (traffic control, road construction, fueling and servicing capacities) and these in turn could be further divided into sub-capabilities down to the competence of the service station attendant in changing a tire. Any capability or sub-capability could be conceived of as a technology, and there is perhaps no precise way to draw the line between the small and the large—but here "technology" will mean a capability for purposeful action that is substantial in scope and is significant in the scale of social values. In contrast to technology, which is the sum of all that contributes to a capability for purposeful action, a patentable invention in a novel element of action that can be compacted and expressed in a formula or device. A technology, then, may include a changing multitude of patentable inventions, and a multitude of old and new ideas that are not patentable, and a body of information systematically organized as a basis for choice, and the acquired skills and knowledge of those engaged in operations and in the organization of operations, and the accumulation of capital equipment, and the infra-structure of services and utilities.

Through R&D and operations related to it, the Government evolves new technologies. These embody an evolving complex of conceptions and theories, of organized information and of learned knowledge and acquired skills, of organizations and control systems, of capital equipment, of techniques and mechanisms and of institutions. Such technologies developed for the special purposes of Government also embody numerous inventions.

The Transfer of Inventions between Technologies

It is possible that bits and pieces of technologies, in the form of inventions or reports, or mechanisms or devices or methods of organization and management controls, can be detached from the special-purpose technologies in the Government sector and shifted into use in other existing technologies in the non-governmental sector. This is what ordinarily is meant by "spillover" or "transference into commercial application." It is this movement of information, technique and device *between* co-existing technologies that NASA's TUP is primarily designed to promote. Similarly the positive objective of NASA patenting policy is to encourage the movements of isolated inventions, detached from the special-purpose technologies in the Government sector, into application in technologies in operation elsewhere. This transference of bits and pieces—of inventions, of information, of devices—developed as part of the special-purpose technologies of Government, into other technologies in the non-governmental sector, is certainly not to be ignored. Transferences of this sort can bring benefits and, no doubt, should be encouraged. Yet such transferences are very difficult; successful and significant instances of such transference are hard to find. They are like looking for uses of a spark plug or a car tire or a piston ring other than in an automobile.

The Extension of Technologies into New Applications

There is another avenue for increasing the benefits from the special-purpose technologies produced through Government R&D. What has developed through such R&D are capabilities for purposeful action. Rather than searching these technologies for bits and pieces that can be detached for use elsewhere, the technologies themselves might be re-oriented and adapted, their scope extended, to service other social objectives, to serve another clientele, to encompass new activities. It is in this *extension* of technologies to new areas of activity and not the transfer of inventions between technologies that has historically been of primary significance.

Once a technology developed in the Government sector has been successfully extended to activities in the non-governmental sector, then inventions made in respect to that technology in either sector will flow easily and spontaneously to the other.

The computer is the heart of an electronic data-processing technology that was first developed to process military data and was subsequently adapted and extended to process data of many other sorts. With electronic data-processing operating in a number of sectors, technical advances achieved in the one can flow easily and quickly into application in the others.

"Aviation" refers to a capability for transporting heavy objects via air routes. That technology was developed first for military purposes where high marginal values justified very high average costs. Subsequently that technology was extended into the transportation of commercial freight and passengers. The extension of the technology of airborne transportation required great efforts and expenditures under public subsidy, the adaptation and development of aircraft and control devices, the building of a vast nation-wide then world-wide infrastructure of airfields, feeder roads, servicing facilities, the evolution of viable producing and operating organizations, the training of technicians, the overcoming of consumer fears and inhibitions and the cultivation of new tastes and habits.

The spillover of information and invention into commercial application from the activities and technologies of the Atomic Energy Commission has been trivial. What has been most significant is the extension of the use of nuclear reactors, at great cost and involving an enormous adaptive, developmental and promotional effort, to fuel power stations and ships. And the AEC created a new radioisotope technology as an offshoot (or extension) of its capability for producing fissionable materials.

Similarly NASA's most significant transference into commercial application has been in the extension of its booster technology, the capability for putting heavy objects into space, first to put Telestar and then other communication satellites into earth orbit.

Rather than by transfers *between* technologies, the significant social benefit from NASA-sponsored R&D, aside from the intrinsic values of space exploration, will be brought about through the extension of constituent technologies to encompass other activities, to serve new purposes, to service a different clientele. To promote such extensions of technology requires a different strategy of search and promotion than has prevailed hitherto.

How to Promote the Extension of Space-Related Technologies

How to discern among the great and evolving complexities of NASA-produced technologies, those that might be re-oriented, adapted, built into the private sector there to serve a different set of social purposes? Assuming that potentialities for extension exist among them, to comprehend the technologies requires technical sophistication, to conceive the opportunities for their extension requires imagination, to evaluate those opportunities requires study, and to achieve the innovationary thrust that converts an idea into a concrete operation requires motivation and resources.

From the level of this analysis it is not possible to examine specific technologies or to pinpoint opportunities for their extension. It can be said, however, that the successful extension of technology will not happen (1) unless the evolving complex of NASA-produced technologies are scrutinized by technically sophisticated observers self-interested in, or charged with, the task of exploiting potentialities for their extension; (2) unless someone, an individual scientist or engineer or entrepreneur, working within his own firm, within the company where he is employed, or in the agency, commits himself (in Donald Schon's term) as a "champion of innovation" to the concrete achievement of what exists as a potentiality; and (3) unless there are resources available to back efforts at innovation. Correspondingly a program that would encourage the extension of NASA-produced technologies should encourage or insure the continual scrutiny of NASA-produced technologies in the search for potential extensions, and should support or itself engage in the process of their adaptation, development and extension.

The program of "inventor fellowships" recommended earlier would have obvious values in developing "champions of innovation." The very opportunity to submit projects and to apply for fellowships would induce those closest to the emerging technologies to scrutinize them continuously for capabilities that might profitably be developed and extended in scope and purpose. In the year or two years covered by the fellowship, the fellow would not only have acquired a unique expertise in the special field of his endeavor, but, also, by the very investment of his effort and thought, he probably would commit himself to seek the practical fruition of the potentiality he had explored and the possibilities he had developed. He would return to work within a company or in the agency, or by entrepreneurial efforts in a firm of his own, where possibly with NASA support, he would champion an innovation and spearhead the extension of a technology created through space-related R&D and adapted through his efforts.

Patents in the Strategy of Technology Utilization

There are two ways in which the patenting power could be used as an instrument of strategy in promoting the extension of special-purpose technologies or the transference of invention between technologies.

The record examined previously suggested that in spite of the right to petition for waivers of commercial rights or of blanket grants of such waivers, there exists a pervasive, seemingly universal indifference on the part of R&D contractors to the possibilities of gain through the extension of special-purpose technologies or through the commercial application of inventions made under Government-sponsored R&D. Conceivably the Government's power to grant or withhold exclusive commercial rights on patented inventions, in conjunction with other pressures and influences, could shake some contractors from this indifference and induce aggressive efforts on their part to extend the scope of special-purpose technologies or to transfer inventions into commercial applications. When a company fails to petition for exclusive commercial rights on the inventions made by its employees under NASA contracts, or fails to make any visible effort to develop or promote the application of inventions on which it possesses exclusive commercial rights, conceivably it might be stimulated to consider and seek what it now forgets and ignores by the threat or the fact that exclusive rights on inventions produced by its employees might be or are being turned over to a competitor who will attempt to exploit such inventions commercially.

Remembering again that the record has shown there to be virtually no social benefit from the solicitude for the privileged position of R&D contractors in claiming exclusive rights on inventions made by their employees, and no benefit either from reserving invention for the free use of the public, it is recommended that a maximum possible flexibility be allowed in the power to grant or withhold exclusive commercial rights in promoting the transfer of inventions and the extension of technology. It is immediately and concretely recommended that exclusive commercial rights on inventions waived to contractors should be promptly voided at the end of the time period stipulated by regulations unless there is by then clear evidence of significant commercial application or of a substantial expenditure on development for commercial application; and that all equivocation and ambiguity on this point be removed. It is likewise recommended that before any waiver of exclusive commercial rights on an invention is made to any large R&D contractor, there must be established in the operations of that contractor a competent group, whether a branch, or a department, or a division, or an office, or a subsidiary, not including the company's patent counsel, assigned the specific task of evaluating such inventions for their commercial potentialities, of developing such inventions and of promoting their commercial applications. It is useless to waive commercial rights to a company that has not organized itself to promote commercial applications. Further it is recommended that blanket waivers of commercial rights on all inventions made by R&D contractors be granted automatically whenever, and for so long a time as that company achieves a 20 percent or better rate of commercial application on the waived inventions in its possession. Otherwise no blanket waivers should be granted. Aside from influencing the policies of R&D contractors, another, and in the long run, a more significant use could be made of the patenting power in promoting the wider utilization of special-purpose technologies. This would be in supporting champions of innovation.

Exclusive commercial rights to sets of related inventions grouped together to afford springboards to innovation might provide strong initial positions in an effort to create a new market, to produce a new product or service, or otherwise to extend a NASA-produced technology beyond the scope and purpose of space exploration. In fact, NASA already has the legal right to grant exclusive licenses on inventions offered for free licensing and not worked. In two chance instances such licenses were negotiated. Certainly it would be desirable if greater flexibility and maneuverability were allowed. It is immediately recommended that the interim period before such exclusive commercial rights can be negotiated be shortened from two years after a United States patent has been received to two years after a United States patent has been applied for, and the availability of the invention published. It also should be unequivocally ruled that when exclusive commercial rights on an invention have been waived and that waiver is voided for failure to apply the invention, then immediately NASA should be privileged to grant the voided exclusive commercial rights on that invention to another. Significant change, however, will come about not through new regulations but by a different official attitude and promotional orientation. The powers exist and the powers could be sharpened, but those powers must be used aggressively and imaginatively with the objective of promoting innovation. NASA must go out after the business. The universe of disclosures must be scrutinized to select those inventions for patenting which might constitute viable sets, affording a position of market security and strength, to be offered to those who are willing to commit themselves to the effort to launch significant innovations.

A National Role for TUP

Among all the Federal agencies, NASA first established the waiver principle. Exclusive commercial rights were to be granted to R&D contractors only on the condition that contractors applied waived inventions commercially, within a stipulated time period, or at least demonstrated a significant effort to do so. Otherwise the waivers would be voided. The Presidential Directive of October 10, 1963, generalized this principle. It now applies, nominally at least, to grants of exclusive commercial rights on invention by all Federal agencies. The day of reckoning approaches. For groups of inventions the stipulated time period approaches expiration. Will the waivers be voided? And if they are voided, what then will happen to those inventions? Will they join their brethren to languish on the sterile bed of the Patent Registry, offered for non-exclusive royalty-free licensing, and left unused?

This is not only an issue for NASA invention. It concerns also the (non-nuclear) inventions where exclusive commercial rights have been given to contractors by the Atomic Energy Commission. And especially it is a problem for the vast numbers of inventions where exclusive rights have been granted to R&D contractors by the Department of Defense. In fact the AEC and the DOD will certainly do nothing to use these inventions in promoting the wider utilization of special-purpose technologies. But NASA might.

These three agencies, NASA, the AEC and the DOD, together control about 90 percent of all Government-sponsored R&D. Each has a distinctly different, mission-based orientation vis a vis the disposition of inventions related to special-purpose Government technologies. The Department of Defense with the largest R&D program and by far the greatest number of accumulated inventions, is quite indifferent to the disposition of those inventions for non-military use and has no interest itself in promoting either the transfer of invention or of extensions in the utilization of special-purpose technologies outside of military objectives. The Atomic Energy Commission promotes the general extension of nuclear technologies and tightly controls all inventions related to these, but is not concerned with technologies and related inventions of other sorts that might incidentally be created through the R&D it sponsors. Only NASA is mission-oriented to promote the general extension and commercial application of an unbounded range of technologies and related inventions produced through Government-sponsored R&D. NASA uniquely has developed an instrumentality for such generalized promotion and dissemination, the Technology Utilization Program. And, while certainly this has nowhere yet been accomplished, for NASA alone it is conceivable that the licensing and control of patented inventions could be deliberately used in a promotional strategy for encouraging the extension of technology and the transfer of invention.

Supposing the TUP, following the recommendations of this paper, organizes itself to make strategic use of patented inventions as instruments of promotion, for example in influencing the policies of R&D contractors or in granting exclusive rights on selected sets of inventions in support of innovation. Should only NASA-produced inventions fall within the scope of TUP control? In fact the TUP would have a task of nation-wide, not of agency-wide urgency. It would be building a bridge between the governmental and the non-governmental sectors (the only bridge) and the inventions made and the technologies created through the research sponsored by any Government agency should properly be enabled to take passage across that bridge. Why shouldn't the control over DOD patents as well as the control over NASA patents be used to influence the policies of (the same) R&D contractors towards a more vigorous promotion of commercial applications? Why shouldn't the exclusive licensing of DOD as well as of NASA patents be used to fortify market positions as a base for launching those innovations that might extend the application of the special-purpose technologies produced through Government-sponsored R&D? And why shouldn't the information packaged in DOD patent applications as well as the information packaged in NASA patent applications be fed into industry through the TUP's channels of dissemination?

It is therefore recommended, not as a NASA but as a national objective, that all of the special-purpose technologies and related inventions produced through Government-sponsored R&D be brought within the scope of a rational and, where feasible, an integral control, in promoting their extension into new spheres of application and use.

APPENDIX
TABLE I
DISCLOSURE AND PATENTING RECORD OF THE 100 LARGEST NASA CONTRACTORS (BUSINESS FIRMS) LISTED ACCORDING TO NET VALUE OF DIRECT AWARDS BY NASA** FISCAL YEAR 1965

Contractor & place of contract performance	Rank as NASA contractor in FY '64	Net Value of Awards: Thousands of $	Net Value of Awards: % of Total awards to business	(1) Inventions disclosed 1958-65	(2) Waivers requested 1958-65	(3) Waivers granted (total)	(4) Develop. or promo. effort reported but no comm'l application	(5) Inventions successfully applied commercially (through Dec. 31, 1965)
Total Awards to Business		$4,141,434	100.00					
1. North American Aviation, Inc. *Downey, Calif.	1	1,099,448	26.55	811	32	13	2	None
2. Boeing Company *New Orleans, La.	4	305,988	7.39	90	None	None	None	None
3. Grumman Aircraft Eng. Corp. *Bethpage, N.Y.	5	267,226	6.45	26	None	None	None	None
4. Douglas Aircraft Co., Inc. *Santa Monica, Calif.	3	251,668	6.08	96	3	3	1	None
5. General Electric Company *Huntsville, Ala.	7	181,472	4.38	180	3	3	None	None
6. McDonnell Aircraft Corp. *St. Louis, Mo.	2	166,670	4.02	73	8	7	1	None
7. I.B.M. *Huntsville, Ala.	10	128,312	3.10	100	8	7	None	None
8. Aerojet-General Corp. *Sacramento, Calif.	8	123,186	2.97	86	2	1	None	None
9. General Dynamics Corp. *San Diego, Calif.	6	111,148	2.68	109	1	None	None	None
10. Radio Corp. of America *Princeton, N.J.	11	106,552	2.57	182	1	1	None	None
11. Chrysler Corporation *New Orleans, La.	9	85,986	2.08	59	None	None	None	None
12. General Motors Corp. *Milwaukee, Wis.	13	72,531	1.75	22	None	None	None	None
13. Bendix Corporation *Teterboro, N. J.	12	66,100	1.60	24	None	None	None	None

15. United Aircraft Corp. *West Palm Beach, Fla.	17	43,330	1.05	377	14	1	None	None
16. Sperry Rand Corp. *St. Paul, Minn.	28	39,401	.95	40	4	1	1	None
17. Lockheed Aircraft Corp. *Sunnyvale, Calif.	15	35,796	.86	113	1	None	None	None
18. Collins Radio Company *Richardson, Texas	51	31,532	.76	25	4	2	None	None
19. Brown Engineering Co., Inc. *Huntsville, Ala.	14	30,850	.74	26	None	None	None	None
20. Philco Corporation *Houston, Texas	18	30,029	.73	14	None	None	None	None
21. Hayes Internat'l Corp. *Birmingham, Ala.	22	28,496	.69	1	None	None	None	None
22. Honeywell, Inc. *St. Petersburg, Fla.	40	27,068	.65	102	None	None	None	None
23. Hughes Aircraft Company *Culver City, Calif.	25	26,457	.64	158	2	2	None	None
24. Catalytic Construction Co. *Merritt Island, Fla.	44	25,296	.61	0	None	None	None	None
25. Trans World Airlines, Inc. *Various	--	20,862	.50	0	None	None	None	None
26. Union Carbide Corp. *Fontana, Calif.	21	19,954	.48	5	None	None	None	None
27. LTV Aerospace Corp. *Dallas, Texas	20[b]	15,118	.37	8	None	None	None	None
28. Fairchild Hiller Corp. *Hagerstown, Md.	31	14,720	.36	12	None	None	None	None
29. Mason-Rust New Orleans, La.	27	13,097	.32	1	None	None	None	None
30. Westinghouse Electric Corp. *Baltimore, Md.	45	12,647	.31	256	1	1	None	None
31. Radiation, Inc. Melbourne, Fla.	30	12,056	.29	10	None	None	None	None
32. Control Data Corp. *Minneapolis, Minn.	24	11,808	.29	None	None	None	None	None
33. Bellcomm, Inc. Washington, D. C.	37	9,804	.24	17	None	None	None	None
34. Pacific Crane & Rigging Merritt Island, Fla.	--	9,280	.22	None	None	None	None	None
35. Martin Marietta Corp. *Baltimore, Md.	38	8,389	.20	35	None	None	None	None

TABLE I (cont'd)

DISCLOSURE AND PATENTING RECORD OF THE 100 LARGEST NASA CONTRACTORS (BUSINESS FIRMS) LISTED ACCORDING TO NET VALUE OF DIRECT AWARDS BY NASA** FISCAL YEAR 1965

Contractor & place of contract performance	Rank as NASA contractor in FY '64	Net Value of Awards		(1)	(2)	(3)	(4)	(5)
		Thousands of $	% of Total awards to business	Inventions disclosed 1958-65	Waivers requested 1958-65	Waivers granted (total)	Develop. or promo. effort reported but no comm'l application	Inventions successfully applied commercially (through Dec. 31, 1965)
36. Lear Siegler, Inc. *Anaheim, Calif.	73	8,260	.20	1	None	None	None	None
37. Air Products & Chemicals *Long Beach, Calif.	33	8,135	.20	4	None	None	None	None
38. Republic Aviation Corp. *Farmingdale, N. Y.	35	7,537	.18	5	1	None	None	None
39. Thiokol Chemical Corp. *Brunswick, Ga.	69	7,441	.18	5	None	None	None	None
40. Northrop Corporation *Hawthorne, Calif.	36	7,297	.18	11	1	None	None	None
41. Garrett Corporation *Los Angeles, Calif.	57	7,179	.17	34	None	None	None	None
42. Scientific Data Systems *Santa Monica, Calif.	53	6,800	.16	None	None	None	None	None
43. Amer. Machine & Found. Co. *York, Pa.	66	6,614	.16	6	None	None	None	None
44. Dynatronics, Inc. (S) *Orlando, Fla.	–	6,436	.16	5	None	None	None	None
45. Spaco, Inc. (S) Huntsville, Ala.	46	6,308	.15	9	None	None	None	None
46. Avco Corporation *Wilmington, Mass.	52	6,299	.15	15	None	None	None	None
47. Electronic Associates, Inc. *West Long Branch, N.J.	63	6,025	.15	None	None	None	None	None
48. Motorola, Inc. *Scottsdale, Ariz.	76	5,830	.14	10	None	None	None	None
49. Sanders Associates, Inc. Nashua, N. H.	–	5,830	.14	None	None	None	None	None
50. Fed.-Mogul-Bower Bearings, *Los Alamitos, Calif.	32	5,603	.14	None	None	None	None	None

51. Documentation, Inc. (S) *Bethesda, Md.	39	5,240	.13	7	None	None	None	None
52. Blount/Chicago Bridge (joint venture) Sandusky, Ohio	–	5,178	.13	None	None	None	None	None
53. Ball Bros. Research Corp. Boulder, Colorado	43	5,036	.12	15	3	2	None	1
54. Keltec Industries** (S) *Alexandria, Va.	–	4,749	.11	None	None	None	None	None
55. Ampex Corporation *Redwood City, Calif.	48	4,747	.11	7	5	4	None	None
56. Norair Engineering Corp. Greenbelt, Md.	–	4,736	.11	None	None	None	None	None
57. Electro-Mech. Research, Inc. *Sarasota, Fla.	47	4,615	.11	11	None	None	None	None
58. Vitro Corporation of Amer. *Huntsville, Ala.	72	4,435	.11	6	1	None	None	None
59. Dynamic Corp. of Amer. Garden City, N.Y.	–	4,358	.11	None	None	None	None	None
60. Minnesota Mining & Mfg. Co. *Camarillo, Calif.	–	4,257	.10	None	None	None	None	None
61. Graham Engineering Co. (S) Houston, Texas	–	4,063	.10	None	None	None	None	None
62. Brown/Northrop (joint venture) Houston, Texas	–	4,060	.10	None	None	None	None	None
63. Beckman Instr., Inc. *Fullerton, Calif.	77	3,997	.10	22	2	None	None	None
64. Computer Control Co. *Framingham, Mass.	–	3,908	.09	7	1	None	None	None
65. Wolf Res. & Dev., Corp. (S) *Houston, Texas	–	3,882	.09	None	None	None	None	None
66. Clark David Co., Inc. Worcester, Mass.	–	3,839	.09	20	None	None	None	None
67. Taag Designs, Inc. (S) College Park, Md.	–	3,790	.09	None	None	None	None	None
68. Zia Company Las Cruces, N. M.	91	3,779	.09	None	None	None	None	None
69. Allis Chalmers Mfg. Co.	–	3,701	.09	5	1	1	None	1

TABLE I (cont'd)

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71. Consolidated Systems Corp. *Monrovia, Calif.	81	3,555	.09	2	None	None	None	None
72. Calumet & Hecla, Inc. Bartlett, Ill.	–	3,418	.08	None	None	None	None	None
73. Aero Spacelines, Inc. (S) Van Nuys, Calif.	–	3,387	.08	None	None	None	None	None
74. MSI Corporation Greenbelt, Md.	–	3,386	.08	None	None	None	None	None
75. Bell Aerospace Corp. *Buffalo, N. Y.	49	3,328	.08	3	None	None	None	None
76. Space-General Corp. El Monte, Calif.	64	3,293	.08	11	None	None	None	None
77. Hathaway, E. A. & Co. (S) Mountain View, Calif.	–	3,216	.08	None	None	None	None	None
78. Systems Engr. Labs, Inc. (S) *Ft. Lauderdale, Fla.	89	3,019	.07	None	None	None	None	None
79. Electronic Comm., Inc. *St. Petersburg, Fla.	–	2,952	.07	4	None	None	None	None
80. Consol. Electrodyn. Corp. *Pasadena, Calif.	58	2,938	.07	7	None	None	None	None
81. Kiewit/Leavell (joint venture) Sandusky, Ohio	–	2,820	.07	None	None	None	None	None
82. Electro Optical Sys., Inc. Pasadena, Calif.	84	2,808	.07	29	4	3	None	None
83. Sylvania Elec. Prod., Inc. *Waltham, Mass.	–	2,652	.06	21	None	None	None	None
84. Washington Tech. Asso., Inc. Rockville, Md. (S)	–	2,615	.06	3	None	None	None	None

85. Wise Contracting Co. (S) *Hampton, Va.	–	2,561	.06	None	None	None	None	None
86. Sun Shpbldg. & Dry Dock Co. Chester, Pa.	–	2,554	.06	None	None	None	None	None
87. Litton Industries, Inc. *College Park, Md.	–	2,449	.06	3	1	1	1	None
88. Virginia Electric Power Co. Hampton, Va.	–	2,421	.06	None	None	None	None	None
89. Western Union Tele. Co. Various	–	2,397	.06	None	None	None	None	None
90. Universal Marion Corp. Marion, Ohio	–	2,341	.06	None	None	None	None	None
91. Swenson, Carl N. Co. Mountain View, Calif.	–	2,324	.06	None	None	None	None	None
92. Whittaker Corporation *Van Nuys, Calif.	83	2,297	.06	9	None	None	None	None
93. Consultants & Designers, Inc. Arlington, Va.	–	2,207	.05	None	None	None	None	None
94. Raytheon Company *Wayland, Mass.	19	2,200	.05	4	None	None	None	None
95. Canoga Electronics Corp. (S) *Van Nuys, Calif.	95	2,172	.05	None	None	None	None	None
96. Int'l Teleph. & Telegr. *San Fernando, Calif.	71	2,153	.05	6	None	None	None	None
97. Dow Chemical Co. Various	–	2,070	.05	None	None	None	None	None
98. Melpar, Inc. *Falls Church, Va.	–	2,069	.05	22	None	None	None	None
99. Dortech Corporation Various	–	2,064	.05	None	None	None	None	None
100. Management Services, Inc. (S) *Huntsville, Ala.	74	2,061	.05	None	None	None	None	None
Total			90.55					
All other business			9.45					

* Awards during period represent awards on several contracts which have different principal places of performance. The place shown is

TABLE IA

RESEARCH AND DEVELOPMENT CONTRACTS WITH EDUCATIONAL AND OTHER NON-PROFIT INSTITUTIONS
(Exclusive of grants, where single contracts are of $1 million or over)

Institution	Award in 1965	Cumulative awards under existing contracts	Inventions disclosed 1958-65	Waivers requested 1958-65	Waivers granted (total)	Develop'al or promo. effort reported but no comm'l applic'n	Successful commercial application
	(In millions of dollars)						
Calif. Inst. of Tech.							
Operation of JPL*	247	2.5	290	15	9	1	1
Other	1.6						
Mass. Inst. of Tech.	19.2	49.0	44	None	None	None	None
Smithsonian Institute	7.7	27.9	2	None	None	None	None
Univ. of Wisconsin	2.8	6.3	None	None	None	None	None
Univ. of Calif. at L.A.	1.7	3.3	6	None	None	None	None
Univ. of Calif. at Berkeley	1.7	2.7		1	1	None	None
New Mexico State Univ.	1.7	—	1	None	None	None	None
Princeton University	1.2	4.9	2	2	2	None	None

* *Contract With California Institute of Technology for Operation of Jet Propulsion Laboratory*:

The Jet Propulsion Laboratory (JPL) is a Government-owned-research and development facility, operated for NASA by the California Institute of Technology. The Laboratory carries out research programs and flight projects and conceives and executes advanced development and experimental engineering investigations to further the technology required for the Nation's space program. The primary emphasis of the Laboratory's effort is on the carrying out of unmanned lunar, planetary and deep-space scientific missions.

Net awards during Fiscal Year 1965 totalled $247 million. Of this amount, $188 million was placed through subcontracts or purchases with business firms; $59 million constituted in-house effort.

The Significance of Use-Rates of Patented Inventions

NORMAN J. GHARRITY*

SUMMARY

FOR SEVERAL YEARS *IDEA* HAS BEEN PUBLISHING progress reports on a comprehensive study entitled "The Patent Utilization Study" made by Joseph Rossman and Barkev Sanders with the cooperation of L. James Harris.[1] The primary objective of this study was to estimate the overall use-rate of patented inventions in the United States. This author became interested in the question of use-rates of patented inventions a few years later and also made some efforts to calculate use-rates.[2] Time will not be taken here to summarize the methods used or the results of that study, nor to critically analyze the methods and results of the Rossman-Sanders-Harris study in any detail. The question being raised is that of the significance of any use-rate of patented inventions, for the economy or for a single firm. The author fears that

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[1] The initial article was published in 1957. See Joseph Rossman and Barkev Sanders, "The Patent Utilization Study," *PTC J. Res. & Ed.* (*IDEA*), Vol. 1, No. 1 (June 1957), p. 74.

[2] The results are to be found in his doctoral dissertation entitled "The Use and Non-Use of Patented Inventions," made under the direction of Professor Fritz Machlup.

too many unfounded conclusions will be drawn from use-rate estimates, particularly that of the Rossman-Sanders-Harris study. In an effort to forestall this and to provide a framework for further discussions the following analysis is submitted to those interested in this field.

A USE-RATE IS A RATIO. Therefore, the first step in appraising the significance of a use-rate is to carefully define the numerator and the denominator of the ratio. The denominator is a cohort of patents, e.g., all United States patents in the case of the Rossman-Sanders-Harris study. Each of these patents covers an "invention," the latter being defined by the patent laws (and by the application of these laws). The numerator is that fraction of the patents that covers "commercially used" inventions. This author suggests that a good definition of "commercial use" would be "the making or selling of the patented product or the utilization of the patented process, only if the seller or user would be liable to infringement under the claims of the patent if the patent were adversely held."

The author found in making his use-rate study that for a firm to determine exactly which of its patents cover commercially used inventions an expensive, time-consuming study is necessary. The reason, in brief, is that use-rate data do not come naturally out of the research, patenting and production activities of firms.[3] Therefore two problems arise in arriving at accurate use-rate estimates. First, a good operational definition of commercial use must be developed. Secondly, this definition must be carefully applied by those making the study. Educated guesses will not do here. The obvious problem in a questionnaire study is how the firms or inventors responding arrived at their answer. For example did the firm's production and patent personnel sit down together and carefully arrive at a decision? If one is satisfied with the definition of commercial use and its application in calculating a use-rate the consideration of the numerator is complete.

Given such a satisfactory definition correctly applied, a certain use-rate will result. The next step is to evaluate it and any evaluation necessitates a consideration of the variables that are major factors in the determination of the denominator of the ratio. The following equation is a concise way of organizing and summarizing this analysis.
$\frac{U}{I} = \frac{D}{I} \times \frac{F}{D} \times \frac{P}{F} \times \frac{U}{P}$ where $\frac{U}{I}$ is the use-rate of inventions, $\frac{D}{I}$ the dis-

[3] The author dealt with this in more depth in his own use-rate study. It is an important point to keep in mind when evaluating the responses of firms to questionnaires concerning use-rate of patented inventions.

closure-rate, $\frac{F}{D}$ the filing-rate, $\frac{P}{F}$ the issuance-rate and $\frac{U}{P}$ the patented invention use-rate.

I = inventions made (by inventors)
D = inventions disclosed (by inventors to those responsible for patenting)
F = inventions upon which patents are filed
P = inventions upon which patents are granted
U = commercially used patented inventions

Clearly the value of $\frac{U}{P}$ in considering many questions can be determined only after considering the value of the other ratios. To go a step further, the use-rate is largely determined by the three previously determined ratios. To illustrate this, briefly consider each of these ratios. It must first be recognized that not all inventions made each year are disclosed by inventors so the disclosure-rate is less than 100 percent. An inventor employed by a firm may not disclose all inventions made, even if it were company policy, either because he may not recognize it as an invention or because he may not wish to take the time to disclose it (he may have decided that the invention could not be patented anyway). Note that the existence of direct rewards for disclosures could have an effect on the disclosure-rate.

Not all inventions disclosed by inventors result in patent applications. It goes without saying the filing-rate depends largely on the patent attorney's judgment of the patentability of the inventions reported. The patent attorney will usually "drop" those inventions that he feels do not meet minimum standards of patentability. But this is often only one of several criteria. For some firms this filing-rate is the result of a consideration of a whole complex of business and legal factors. One basic decision a firm's patent attorneys and engineers make with regard to a patentable invention is whether to patent it or keep it a "trade secret." Actually this simplifies a complex decision as to the relative economic value of these two types of protection. Usually it is not an either-or proposition. "Know-how" associated with the invention is also involved. The question is really how much inventive information to patent and how much to keep a trade secret. Some of the more important factors that will likely be considered are listed here:

(1) The estimated rate of obsolescence of the invention. The more rapidly the invention becomes obsolete, the less opportunity to

take advantage of patent protection, and the more probable it is that it can be kept secret long enough to be exploited. Thus, the filing-rate would tend to be lower the faster the rate of obsolescence.

(2) The extent of exclusive business control. The stronger the firm's exclusive control over the area of the invention, the higher will be the filing-rate. If the Government is automatically licensed, or can automatically license others, or if the field of invention is already licensed by a consent decree, the filing-rate will tend to be lower.

(3) The amount of investment required in developing, producing and selling the invention. The greater the cost of getting the invention into use relative to the resources of the average member of the industry involved, the less the need to patent the invention, hence the lower the filing-rate.

(4) The prevalence or likelihood of copying. The greater the likelihood of copying in the field of the invention, the greater is the need for patent protection. Where each competitor has its own product development organization and its own distinctive product line, there is less need for patent protection.

Not all patent applications result in patents granted. A patent application can be abandoned by the firm or it can be rejected by the Patent Office. The proportion not granted for the latter reason depends on how closely the patent attorney's minimum standards compare with Patent Office standards and both can vary over time. Patent Office practice can vary, given the law, because of such factors as changing personnel, overworked personnel, and a changing classification system. Patent attorneys' standards may not be entirely independent of the above factors so that, for example, knowledge that the Patent Office searching staff is overworked might lead them to send more borderline cases to the Patent Office.

Many times a firm will abandon a pending patent application, sometimes even when issuance of the patent is assured. Most patent applications take between one and six years to be issued patents (or rejected). Throughout this period the firm is gaining additional knowledge of the technical workability and the probable extent of commercial use of the inventions covered by the patent application. Whenever it becomes obvious that the invention is worthless, the prosecution of its patent may be discontinued. Obviously this will raise the use-rate of the firm's patented inventions as well as (or maybe one should say "by") lowering its issuance-rate. If it is true that inventions are developed and market-tested more quickly, and that the Patent Office lag at best has remained unchanged in recent years, then a general increase in the use-rate of patented inventions could be at least partially explained.[4]

Several factors that help determine any use-rate of patented inventions, particularly one for a manufacturing firm, have been set forth in the previous pages. In summary, these factors suggest that the use-rate is partly the result of the patent owner's own actions (or those of his employees) as well as partly the result of factors beyond his control. Therefore, in evaluating a use-rate of patented inventions one should really know the values of the other three ratios $\left(\frac{D}{I}, \frac{F}{D} \text{ and } \frac{P}{F}\right)$ and their major determinants. Otherwise conclusions of seemingly great significance about the rate of technological progress, the effectiveness or importance of the patent system in stimulating such progress, and the firm's use or misuse of the patent system might be made without real justification.

Following is an example, using the equation set forth above, that illustrates how conclusions drawn from use-rate data alone can be misleading. Suppose it was found that the use-rate of patented inventions for Firm A was 10 percent while that for Firm B was 50 percent. However, at the same time assume the other ratios for each firm had values as shown in the table below.

	(1)		(2)		(3)		(4)		(5)
	Disclosure-rate		Filing-rate		Issuance-rate		Use-rate		Use-rate of inventions
	$\frac{D}{I}$	$\times$	$\frac{F}{D}$	$\times$	$\frac{P}{F}$	$\times$	$\frac{U}{P}$	$=$	$\frac{U}{I}$
Firm A	.9		.9		.5		.1	=	.04
Firm B	.6		.2		.7		.5	=	.04

The author would ask the following questions. Could not one be misled by drawing conclusions from the use-rate data alone?[5] Can it be concluded that Firm B is somehow better using the patent grant? or Firm A? Are not values of the other ratios helpful in answering these questions, particularly if some of the major factors determining

[4] The author's own study led him to believe such a trend has occurred in recent decades.

[5] Actually this is simply a restatement of the title of this article. What is the significance of any use-rate of patented inventions, regardless of its level?

the values of these ratios are known? Can it be concluded that there is no relation between Firm A's high filing-rate and relatively lower issuance-use-rates (similarly between Firm B's low filing-rate and relatively higher issuance-and use-rate)?

It is admitted that gathering the empirical data necessary to calculate these other ratios would be difficult. Also, it is clear that the Rossman-Sanders-Harris study made, and is making, an important contribution to our knowledge of the utilization of the patent grant. However, it appears that what is badly needed now are in-depth case studies of large patent-owning firms, small patent-owning firms and individual patent owners to attempt to discover more about why a certain use-rate of patented inventions results for any group of patents. Such studies would add significance to the Rossman-Sanders-Harris study.

Foreign Collaborations in India: Problems and Prospects*

ASHOK KAPOOR

SUMMARY

THE OBJECTIVE OF THE STUDY is to analyze the role of foreign collaborations in facilitating the development of domestic industry. This role is to a large measure determined by the factors preventing effective utilization of transferred rights and services and thus reducing the inflow of foreign rights and services (and capital). Changes in business and government policies could lead to a greater inflow of and better utilization of foreign rights and services (and capital).

* A study of the effect of selected features of business relationships between Indian and foreign companies and the effect of the government of India's policies and practices on foreign collaborations. This paper and its sequel appearing in the next issue of *IDEA* comprise (except for the omission of Part III and other minor deletions and changes) a dissertation by the author submitted to the faculty of the University of North Carolina in partial fulfillment of the requirements for his Ph.D. degree in the School of Business Administration. For the assistance accorded him in the preparation of his paper, Mr. Kapoor wishes to include the following acknowledgements:

> The idea for the study first took root nearly three years ago. Since then it has taken the active support and guidance of numerous persons to carry the study to its completion. I want to thank Dr. Maurice W. Lee, Dean of the School of Business Administration, for his en-

Because of the type of issues explored, it was essential to be able to question respondents in detail about their collaboration experiences. Therefore, the research methodology had to be direct interviews with the different parties to a foreign collaboration. A selected sample was used for United States and Indian companies. Interviews were limited to Bombay and Delhi on the Indian side; United States interviews were limited to New York City. A total of 104 interviews were conducted with the following percentage breakdown: United States companies 17; European companies 9; Indian companies 53; Government of India officials 16; others 5. The results of this study are based mainly on direct interviews.

The section on "Negotiation Experience with Foreign Company" explores the process of negotiation with the foreign company. It seeks answers to questions of whether a company's experience in the negotiation process has a significant conditioning effect on project implementation and development. Whether this experience affects the company's outlook toward the Indian market. Whether satisfaction of the parties is due more to profits or managerial compatability. What features lead to greater compatability. Based on past experience, can broad guidelines be developed to facilitate project negotiation, implementation and development experience?

Services of foreign technicians are often necessary to supplement re-

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couragement in pursuing the idea, and for the financial support to complete the study. I also want to thank The Patent, Trademark, and Copyright Research Institute of The George Washington University for its financial support for the study.

My research efforts in India were greatly facilitated by the unhesitating cooperation offered by Mr. James S. Lanigan, Counselor for Commercial Affairs in the United States Embassy in India. I particularly want to thank Mr. Devinder Singh Sahi also of the Commercial Counselor's Office. His comments and whole hearted cooperation helped me very much in my research efforts in India.

I want to express my appreciation to over a hundred respondents —both government officials and Indian and foreign businessmen— for their cooperation. They allowed me much freedom in discussing issues of a "delicate" nature.

I am indebted to Professors Gerald A. Barrett, James C. Ingram, Clement S. Logsdon and Rollie Tillman for their guidance. Their encouragement helped me to overcome anxieties—both imagined and real.

The greatest debt of all I owe to Dr. Jack N. Behrman, Chairman of the dissertation committee. He has provided unstinting assistance in carrying the study to its completion. Through this study, he has introduced me to an outlook toward research—an outlook that emphasizes both the "why" and the "human characteristics" that influence the actions of men and nations.

sources of the licensee. But are they supplied? Is there agreement on the functions and on the stage of operations for which foreign technicians are needed? These and other questions are addressed in the section, "Foreign Technicians." Thus, what is the experience in the use of such technicians and is the licensee satisfied? Why has the government intervened in the use of foreign technicians? What limitations prevent effective utilization of foreign personnel?

The foreign company often represents the only source from which a licensee can secure the benefits of research and development. Given the importance of research and development, what is the nature, extent and anticipated duration of dependence of Indian licensees on foreign research and development? If it is a continuing dependence, what are the implications for the government's policy on duration of technical collaborations? These and other questions are explored in the section on "Research and Development and Product Modifications." Thus, are the government's research and development efforts faced with problems not present for foreign research and development? To what extent have foreign collaborations facilitated the growth of indigenous research and development?

Closely related to research and development is modification of the technical aspects of foreign rights and services. But are the companies (Indian and foreign) and the government aware of the need for modifications? Which party to a foreign collaboration is more qualified to undertake modifications?

Payment for rights and services is a primary consideration in the licensor's decision to collaborate. But does his outlook toward the Indian market have an effect on the licensor's demands? What is the "true" importance of the terms of payment in the overall decision to collaborate? These questions, along with others, are considered in the section "Terms of Compensation for Foreign Rights and Services." Thus, how often is a swap of equity for foreign rights and services used? What is the attitude of companies and the government toward a swap? Does a swap provide the licensee with the necessary resources for satisfactory project development? Should a swap of equity for foreign rights and services be used in combination with other methods of payment?

Part III, "Government-Business Relationship," is omitted from this published paper. The omitted section includes the following topics:

Effect of the Industrial Policy Resolution
Negotiations with the Government
Foreign Ownership: Government Policy and Its Effects

Imports and Import Substitution
Exports and Export Rights

A copy of the complete paper, including Part III, is available for reference in the library of the Research Institute.

The "Conclusions" section assesses the value of the conclusions and recommendations reached by this study for business and government policy. It also suggests areas for additional research.

An appendix elaborates on the research methodology used in conducting the research.

PART I

INTRODUCTION

FOREIGN COLLABORATIONS, by transferring technical and managerial assistance (and foreign capital) from advanced to developing countries, are a direct stimulus to economic growth and can thereby help gain political stability. Conversely, the economic and political setting in the host country (and changes therein) have a direct impact on the contributions that can be made by such collaborations.

ECONOMIC-POLITICAL SETTING

India's efforts at economic growth have been called "the Indian experiment" because they are being conducted under democratic political institutions and under very difficult pressures, both internal and external. The continued adherence to constitutional procedures to stimulate rapid economic changes[1] has been called "the most distinc-

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[1] Professor Lewis elaborates on this point:

> . . . that the electorate, through the instrumentality of parties, legislatures, and elections already wields a considerable veto power over the formation of national policy, even though the great majority of the voters remain illiterate and ill-informed; that the "rule of law" signifies an institution, not just a slogan; that the courts are reasonably independent and even-handed; and that Indians enjoy a broad freedom to dissent and to organize peaceful opposition. They have substantial and reliable personal security against arbitrary government action. . . . The institutions of orderly national and state government probably are the most deeply rooted element of India's

tive feature of the Indian effort."[2] The distinction lies in the fact that India stands virtually alone in continental Asia among developing countries in its reliance on the constitutional process.[3] Because of this feature, the success or failure of the Indian experiment has deep meaning for those countries which wish to seek the spread of democratic political institutions.

China has adopted the Communist route of seeking economic development. India, on the other hand, has chosen the constitutional process. Other developing countries can judge from India's experiences whether foreign techniques and concepts of management, industry and political institutions have relevance for their own experiments in development. India's experiment represents a translation through trial and error of techniques and concepts, both Western and Communist, to the needs of an Asian country.

The Indian setting is a rapidly evolutionary one, or even a revolutionary one.

> Under the wings of change a land inhabited by [480] million people, one-sixth of humanity, is waking up, stretching limbs stiffened with the slumber of centuries. In one sweep India is undergoing all the revolutions which have taken two centuries in the rest of the world. Equality and political rights; industrialization and urbanization; agrarian reforms and agricultural improvements; science and technology; social and personal emancipation are combining to transform a contented, static, rural, ritualistic society into a new and dynamic one where privilege is no longer inherited, where women are men's equals, and where Harijans (untouchables) are as important as Brahmins.[4]

Changes along these lines are needed in other less-developed countries if tradition-bound societies are to change to "dynamic modernity" within the framework of democratic institutions.[5] And the success of

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British heritage, and they are richly fortified by the Gandhian tradition that the means of reform take precedence over the ends.

John P. Lewis, *Quiet Crisis in India: Economic Development and American Policy* (Garden City, New York: Doubleday and Company, Inc., 1964), p. 8.

This detailed description is presented because the Indian experiment is often referred to as "democratic-socialism." Foreign governments and foreign companies have expressed anxiety over the "socialistic" aspect of the experiment. Professor Lewis' detailed description helps to place the "socialistic" aspect in its proper perspective.

[2] *Ibid.*

[3] *Ibid.*

[4] Wilfred Malenbaum, *Prospects for Indian Development* (The Free Press of Glencoe, Inc., 1962), p. 207, quotes from Taya Zinkin, *India Changes* (London: Oxford University Press, 1958), p. xi.

[5] *Ibid.*, p. 9.

the "Indian Revolution" itself depends on satisfactory economic growth, as stressed by Professor Lewis:

> The appetite for material improvement is now such in India—and in most of the other poor countries—that the only government with any chance of adhering to constitutional procedures is one that is *determined to achieve radical economic reform and expansion and that is capable of doing so. This is obvious.*[6] [Emphasis mine.]

If a growth rate of 3-4 percent in real per capita income cannot be achieved, it will be "a dismal omen" for maintaining constitutional procedures of rapid economic change.[7]

The Indian experiment is characterized by uncertainty of outcome. But it is generally agreed that India has reached the "critical juncture" in its long-range program of economic development.[8] Though economic progress is not a "guarantor of democratic political evolution" in other less-developed countries, for India it is because India at present is a "special case"; unlike other less-developed countries, she already has a well-established democratic political evolution.[9]

Economic development leads to a widening of horizons—of knowledge, of wants, of needs and of aspirations. The expanded horizons lead to greater dissatisfaction with what the country (associated with the current administration) can provide. Dissatisfaction leads to progress; but it also leads to problems—conflicts. Conflicts will be reduced if the country is able to meet some minimum level of needs of those dissatisfied. But to meet the needs there must be a greater output.

Foreign Collaborations and Economic Development

In a foreign collaboration the foreign company provides the Indian company with industrial property rights, services and capital. These features facilitate economic growth by stimulating the development of indigenous resources. This is the *main idea* behind foreign collaborations. For example, foreign collaborations give confidence to local investors and thereby encourage the development of a domestic capital market. By providing technical knowledge, foreign collaborations greatly improve a country's ability to undertake domestic manufacture. They facilitate a rapid rate of import substitution compared to what it would be under strictly indigenous efforts. Foreign collaborations add to a country's export potential by helping to establish *new* lines of domestic manufacture. They offer the tools and the concepts

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6 Lewis, *op. cit.*, note 1, p. 10.
7 *Ibid.*, pp. 25-26.
8 *Ibid.*, pp. 1, 361; see also Malenbaum, *op. cit.*, note 4, pp. 11, 208.
9 Lewis, *op. cit.*, note 1, p. 19.

of management leading to more effective utilization of resources, i.e., securing greater output from a given quantity of resources.

In 1949 the government established two conditions that have significantly influenced the pattern of foreign collaborations: majority ownership should be in Indian hands and all levels of production and management should be rapidly Indianized. Also, the government permits investment on a selective basis, i.e., in high-priority industries and only to the extent needed. Foreign investment is regarded as a catalytic agent, or stimulant, for domestic resources. The continuing foreign exchange crisis has made it necessary for Indian companies to seek foreign capital as equity in the Indian project or as a loan. The result of all these features has been the emergence of a new pattern of doing business in India, namely, the foreign collaboration.[10]

At the end of the second quarter of 1965, India had a total of 2,247 foreign collaborations. Table I gives the annual number of foreign collaborations in Indian industry. It shows that during the Second Plan period (1956-1961) there was an increase in the yearly foreign collaborations from 81 in 1957 to 403 in 1961. During 1962-1963 the government approved only 298 foreign collaborations each year. However, 1964 saw an increase in foreign collaboration activity when the government approved 403 foreign collaborations.[11] But foreign collaboration activity was limited to 385 approvals in 1965.[12]

Traditionally, British industry has had considerable investment in India. But the increasing interest in foreign markets, encouragement by foreign governments, and recognition of the size and significance of the Indian market have resulted in attracting licensors from a large number of countries—as reflected in Table I and Chart 1. Ranking of the first 10 countries with the largest number of foreign collaborations (Chart 1) shows that five countries (the United Kingdom, the United States, West Germany, Japan, Switzerland) have more than 100 collaborations in India. The United Kingdom, with 642 foreign collaborations, far exceeds the other countries. While both the United States and West Germany have over 300 foreign collaborations (386 and 327, respectively), Japan and Switzerland have less than 200 foreign collaborations each (179 and 103, respectively).

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[10] Matthew J. Kust, *Foreign Enterprise in India: Laws and Policies* (Chapel Hill: University of North Carolina Press, 1964), p. 66.

[11] Table I covers only three-quarters of 1964. The figure of 403 is for the entire year, i.e., it includes the last quarter. *The Economic Times* (Bombay), October 4, 1965, p. 1.

[12] *Monthly Newsletter: Indian Investment Center* (New Delhi), February 15, 1966, p. 5.

TABLE 1

FOREIGN COLLABORATION IN INDIAN INDUSTRY: COUNTRYWISE
(Cases Approved by the Government)

	1957	1958	1959	1960	1961	1962	1963	Jan.-Mar. 1964	Apr.-June 1964	Jul.-Sept. 1964	Jan.-Sept. 1964	Total 1957 to Sept. 1964
1. U.S.A.	6	4	10	61	77	57	67	18	9	28	55	337
2. U.K.	17	34	52	120	126	79	70	30	23	23	76	574
3. West Germany	2	6	13	58	67	42	48	19	20	19	58	294
4. East Germany	–	–	1	5	4	5	10	5	11	3	19	44
5. France	2	1	2	9	16	14	16	8	–	3	11	71
6. Italy	4	4	4	9	13	11	6	1	–	4	5	56
7. Japan	1	3	8	39	30	24	32	5	11	8	24	161
8. Sweden	1	–	1	13	–	6	1	–	–	2	2	24
9. Canada	–	1	–	1	3	6	–	1	1	–	2	13
10. Pakistan	–	2	–	–	–	–	–	–	–	–	–	2
11. Austria	–	–	1	3	5	4	2	–	2	2	4	19
12. Czechoslovakia	–	–	–	6	5	1	5	–	1	–	1	18
13. Holland	1	–	–	6	10	7	4	3	1	1	5	33
14. Switzerland	–	2	1	13	19	19	19	8	6	3	17	90
15. Belgium	–	–	2	4	2	4	3	4	–	1	5	20
16. Yugoslavia	–	–	–	–	1	1	3	–	–	1	1	6
17. Denmark	–	–	2	6	4	2	3	4	–	3	7	24
18. Finland	–	–	–	2	1	1	–	–	–	–	–	4
19. Panama	–	2	1	–	–	–	–	–	–	–	–	3
20. Poland	–	–	–	1	6	–	3	1	2	–	3	13
21. Hungary	–	–	–	1	2	2	–	2	–	–	2	7
22. Others	47	44	52	23	12	13	6	2	1	2	5	202
Total	81	103	150	380	403	298	298	111	88	103	302	2,015

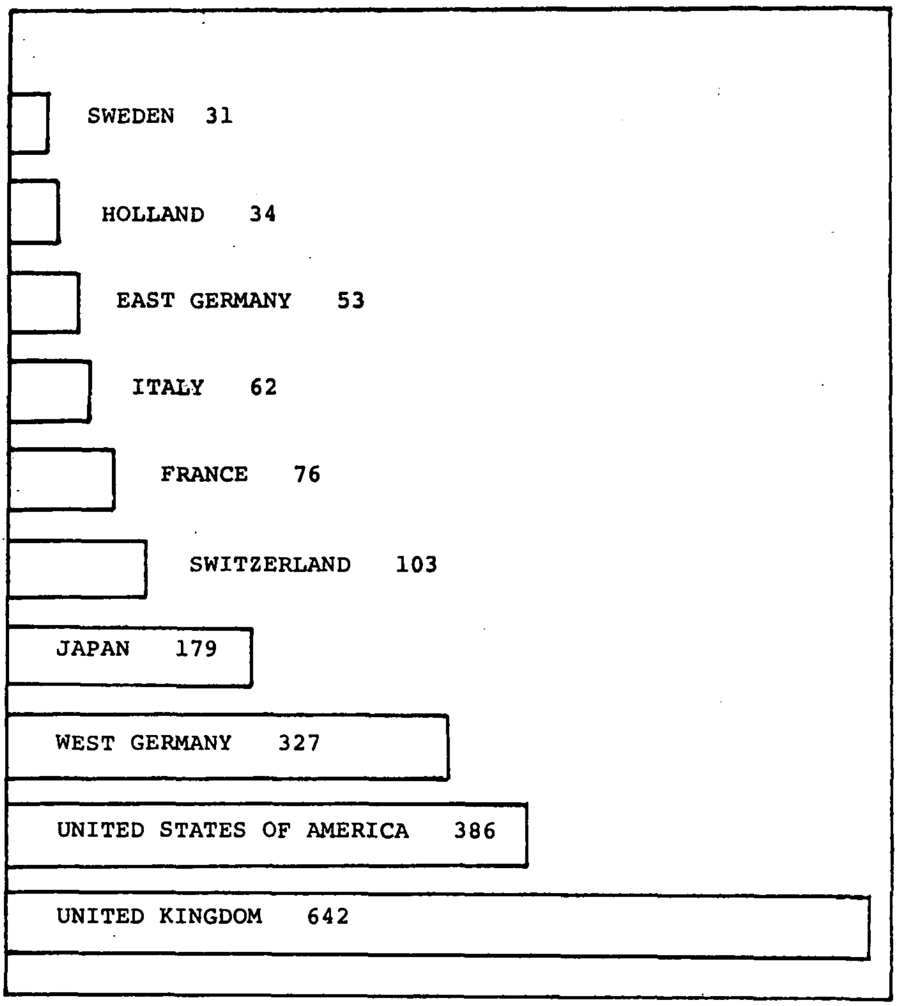
Source: "Foreign Collaborations: 1957-1964," *The Economic Times* (Bombay), November 30, 1964.

A more revealing picture is provided by the percentage rate of growth of foreign collaborations, i.e., the percentage change by country. Keeping 1957 as the base year (1957 = 100), the percentage rate of growth (i.e., the average rate) over the period 1957 to the end of the third quarter of 1964 is much greater in the other four countries than in the United Kingdom. Also, the annual rate of growth is greater in the other four countries than in the United Kingdom.

The rate of growth of foreign collaborations by country shows that

CHART 1
THE RANKING OF FIRST TEN COUNTRIES

Number of Foreign Collaborations
Approved: January 1957—June 1965



Source: *The Economic Times* (Bombay), October 4, 1965.

TABLE 2

NUMBER OF FOREIGN COLLABORATIONS: INDUSTRYWISE
(Cases Approved by the Government)

Industry	1957	1958	1959	1960	1961	1962	1963	Jan.-Mar. 1964	Apr.-June 1964	Jul.-Sept. 1964	Total Jan.-Sept. 1964	Total Jan. 1957-Sept. 1964
1. Plantations	3	6	4	–	–	–	–	–	–	–	–	13
2. Sugar	4	2	2	–	–	–	1	–	–	–	–	9
3. Cotton textiles	9	4	3	2	–	1	3	–	–	–	–	22
4. Jute textiles	1	1	–	1	–	–	–	–	–	–	–	3
5. Silk & Woolens	–	1	5	2	3	1	–	–	–	–	–	12
6. Iron & Steel	2	–	1	1	–	–	5	14	7	7	28	37
7. Transport equipment	4	4	11	20	6	9	14	3	1	5	9	77
8. Electrical machinery, apparatus, appliances, etc.	11	11	12	72	73	44	54	14	8	15	37	314
9. Machinery other than transport & electrical	8	11	26	107	143	81	88	28	19	26	73	537
10. Aluminum	1	1	2	1	1	1	–	–	–	–	–	7
11. Basic industrial chemicals	5	–	4	2	3	3	4	3	3	5	11	32
12. Medicines and pharmaceuticals	4	10	9	6	3	9	2	–	2	2	4	47
13. Other chemical products	6	9	14	21	29	18	11	1	3	8	12	120

14. Cement	3	3	4	3	1	--	4	--	--	--	--	18
15. Rubber & rubber manufactures	2	3	3	5	3	--	--	2	3	--	5	21
16. Paper & paper products	2	2	1	9	8	8	1	--	2	1	3	34
17. Electricity generation & supply	--	--	3	--	--	--	1	--	--	--	--	4
18. Trading	4	1	4	2	1	--	2	--	--	--	--	14
19. Shipping	--	2	1	--	--	--	--	--	--	--	--	3
20. Banks & insurance	3	4	3	--	--	--	--	--	--	--	--	10
21. Others	9	28	38	126	129	123	108	46	40	34	120	681
Total	81	103	150	380	403	298	298	111	88	103	302	2,015

Source: "Foreign Collaborations: 1957-1964," *The Economic Times* (Bombay), November 30, 1964.

British industry is really less active than the United States, West Germany, Switzerland and Japan. If the present rate of growth in foreign collaboration activity for the various countries continues, the gap between Britain and the other four countries (in terms of total number of foreign collaborations) will decrease. British industry will not have the dominant foreign interest in Indian industry.

Through the industrial licensing procedure the government controls the number and industries in which foreign collaborations are to take place. The government periodically publishes a list of industries "in respect of which applications [for an industrial license] will be considered on merits." Another list states the industries "in respect of which applications for licenses may ordinarily be rejected."[13]

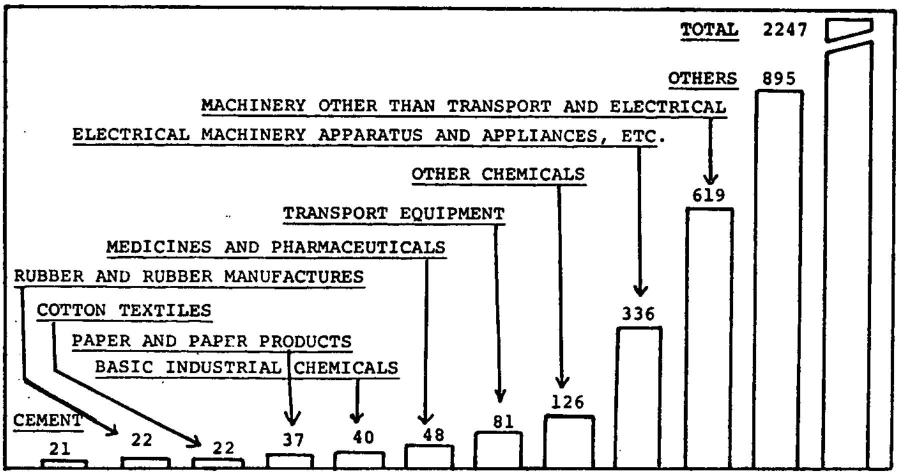
Table 2 and Chart 2 provide a breakdown by industries of the number of foreign collaborations approved. As indicated in Chart 2, the industry of greatest foreign collaboration activity has been machinery manufacture other than transport and electrical with a total of 619 foreign collaborations. Next in number of foreign collaborations is electrical machinery, apparatus, appliances, et cetera, with 314 foreign collaborations. Chemicals, transport equipment, medicines and pharmaceuticals, basic industrial chemicals, paper and paper products, cotton textiles, et cetera, represent industries with less foreign collaboration activity. Foreign collaboration activity has more or less ceased in certain industries (e.g., plantations, sugar, textiles, trading, shipping, banking, insurance) since 1960. In some industries foreign collaboration activity has reached its peak and is now on the decrease in terms of number of foreign collaborations approved in that industry, e.g., transport equipment, machinery other than transport and electricals. In certain industries foreign collaboration activity will increase because of higher priority under the Plans. For example, fertilizer production will be an area of increasing emphasis because of the critical shortage of food and the growing stress on greater food output.

The contribution of capital would add significantly to the closeness of partnership but Kust states that most foreign collaborations do not involve equity participation by the foreign company. Technical collaborations are the most common.[14] In support of his observation Kust

[13] The government periodically publishes "merit" and "banned" lists. They reflect the changing needs (and priorities) of industries as determined by the government. For foreign collaboration purposes, if an industry becomes a high priority industry it is much easier to secure an industrial license. The government is more willing to be "flexible" to accommodate the needs of the applicants. In other words, the companies are in a better negotiation position if they are dealing with a high priority industry than if they are dealing with a low priority industry.

[14] Kust, *op. cit.*, note 10, pp. 65, 68.

CHART 2
FOREIGN COLLABORATIONS IN INDIAN INDUSTRY
January 1957 to June 1965



Source: *The Economic Times* (Bombay), October 4, 1965, p. 1.

refers to the reports of the U. S. Department of Commerce "that of the 178 American companies entering collaboration agreements in India since 1960, 77 are investing capital in the venture."[15] In other words, about 42 percent invested capital while 58 percent did not. Since United States companies invest capital in their projects more often than companies from other countries, the 42 percent may be high for licensors from countries besides the United States. If the 42 percent and 58 percent distribution between technical-cum-financial and purely technical applies to all foreign collaborations, India has 940 technical-cum-financial and 1,300 purely technical collaborations.[16]

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[15] *Ibid.*, p. 467; see also, U. S. Department of Commerce, "Investment Factors in India," *Overseas Business Reports*, December 1962, p. 2.

[16] The percentage breakdown between technical and technical-cum-financial is subject to many qualifications. A difficult problem is defining what is a technical collaboration, i.e., how does one come into being. For example, a turnkey arrangement with a foreign company may be possible because of financing by an international agency. As far as the Indian side of the picture is concerned, it is a technical collaboration. But even this would not be possible had it not been for the international financing agency. The question is whether such an arrangement should be classified as a technical collaboration when it is based on financial support by a foreign source. Another example is of companies which have a financial collaboration before entering into a technical collaboration. The question here is whether the technical collaboration would have taken place if there had not been a financial collaboration in the first place.

It has been suggested that it is not "correct" to classify as technical those collaborations which are based on some sort of a financial interest or support by the foreign party. In other words, the motivating factor is that of financial interest.

India's resource needs are much greater than the resources it can make available. Government-to-government aid has probably reached a peak. The only area of increased foreign investment is *foreign private investment.* The Indian Investment Center estimates that the country needs close to $1 billion to bridge the anticipated foreign exchange gap.[17] And given the government's policy on foreign capital investment, the anticipated increase must take place through foreign collaborations.

PART II

NEGOTIATION EXPERIENCE WITH FOREIGN COMPANY

The negotiation experience is often a traumatic one for foreign companies trying to do business with Indian companies. The more rapidly negotiations can be completed and the goals achieved, the more satisfying is the experience and therefore the better the initial relationship between the parties. The nature of the initial relationship affects both project development and the foreign company's attitude toward the Indian market as an area of investment.

PRE-NEGOTIATION EXPERIENCE

The question of which party initiates negotiations is significant in showing initiative and possibly the bargaining position of the parties. According to this study, there is a wide disparity between Indian and foreign companies. Almost 90 percent of technical collaborations and 80 percent of financial collaborations were initiated by the Indian company. Initiation of negotiations by foreign companies is apparently very limited. And initiation by "new" foreign companies (those entering India for the first time) is still more limited. Most of the initiation that is being done by foreign companies is by those with previous business experience in India.

The very limited initiation activity especially by "new" foreign companies suggests hesitancy on their part to enter India. But the

Only *purely technical collaborations* (where the foreign party has no equity interest at all) should be classified as technical collaborations. All other collaborations should be under financial collaborations. According to this line of reasoning the 42-58 breakdown between technical-cum-financial and technical would need to be revised.

[17] *Op. cit.* note 12, *Monthly Newsletter*, June 15, 1965, p. 4.

very low initiation rate of foreign companies as against the very high initiation rate of Indian companies indicates that in many instances the foreign company is being, and needs to be, convinced by the Indian company to collaborate.

The government through its consulates, embassies and specialized investment counseling organizations (the Indian Investment Center) has undertaken the major burden of convincing foreign companies about investment opportunities in India. But the government's educational and promotional efforts are still limited relative to the country's needs. The very low initiation rate by foreign companies indicates that the Government should undertake a major increase in its overseas promotional and educational efforts directed toward foreign businessmen.

NEGOTIATION STAGE

The nature of the foreign collaboration is the main determinant of whether the foreign company visits India for negotiations. In large projects involving technical collaborations or assistance, the foreign company will visit India. But foreign companies with a financial interest are more likely to visit India than when the collaboration is purely technical. However, nearly 30 percent of the foreign companies that were interviewed (who had a minority equity interest in the Indian operations) did not visit their Indian partner and more than half of these companies had never done business in India before. It appears that the foreign companies that need to evaluate their Indian partners have the least opportunity while the more experienced foreign companies are much more careful to do so.

The actual negotiations are conducted by high officials.[18] The Indian company invariably has its highest officer involved while the foreign company will have a person most directly related to the project being negotiated. The seriousness of purpose of both sides is reflected by the high level (and presumably the competence) of the personnel used for negotiations.

The duration of negotiation varies from a high of two years to a low of two weeks, according to this study. The average is somewhere between five to seven months. This includes the time taken from the first initiation of a proposal until it is presented by the companies to the government.

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[18] The titles of some of the negotiators were as follows: United States companies —director of manufacturing, Far Eastern division; assistant vice president; vice president, international; manager, licensing administration, international division; vice president and manager of engineering, international division. Indian companies—chairman; deputy managing director; managing director; general manager.

The duration of negotiations is determined by knowledge of the foreign company in terms of technical ability and management outlook. Equally important is whether both companies recognize that whatever they agree upon has to be approved by the government. Since the government is very likely to make changes in what is presented to it by the companies, it may be better not to become too definitive about the specific terms of collaboration in negotiating with the foreign company. This reduces the duration of negotiations between companies.

Estimates of duration show a significant variation depending on whether the foreign company has had business experience in India and on the "nature" of the Indian partner. Thus, large foreign companies with previous business experience in India spend less than the "average" time in negotations. Where the Indian company is majority foreign-owned (or is one in which the foreign company has management control) the duration of negotiation is substantially reduced. In some cases it is as little as two months.

But foreign companies entering India for the first time experience a much longer duration of negotiations—in most cases about a year. The reason is lack of business experience in India which affects their ability to select the "right" Indian partner. Also, the uncertainty regarding what the government may approve further hinders the speed of negotiations between companies. Unlike experienced foreign companies, "new" foreign companies are unable to plan for the hindrances resulting from lack of guidelines to companies from the government.

Is the duration time of negotiations satisfactory? It is for the large experienced foreign companies. But it is far too much for the "new" foreign companies. The duration will be reduced only if the companies and the government make efforts in that direction. Companies, both Indian and foreign, should develop much greater knowledge of their prospective foreign partners prior to entering into negotiations. The government should undertake a major educational program aimed at foreign companies with the objective of developing greater knowledge and better understanding of "what is an Indian company." The government should also define and publicize to the companies what it considers to be "guidelines for a foreign collaboration." The government must bear in mind that India needs to attract "new" foreign companies as well as those that are already in India. And the decision of foreign companies to collaborate in India is influenced by the duration of their negotiations.

ASSESSMENT OF SUCCESS

The main determinant of satisfaction and dissatisfaction with project negotiation and implementation experience is "knowledge of the foreign party" in terms of management outlook and practices. This is considered here in terms of internal management policies and procedures and general business objectives.

Internal Management Policies and Procedures

Nearly all Indian companies are against management by the foreign company. Their main argument is that foreign companies lack "knowledge of Indian conditions." Some Indian companies argue that their own management techniques are adequate for their needs and those of the Indian market.

Nearly all foreign companies seek management control over the Indian project but only during the initial stages. Foreign companies feel that because of their greater industrial and managerial experience, they are more likely to achieve better implementation of methods and concepts that will last over the long term. And the experience possessed by foreign managerial personnel is particularly important because of the experimental nature of the Indian project.

Foreign companies argue that the outlook of Indian companies (especially the "average" ones)[19] toward management is unsatisfactory. Because the business could be run by and for the family, hiring is not

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[19] In this study, Indian companies interviewed are categorized as "average" and "large" companies. There are significant differences between the two to justify such a broad categorization. Unlike the "average" Indian companies, the "large" companies possess industrial experience and a certain level of technical sophistication. The "average" companies are very often formed as a result of a move by a trader into manufacturing activity. Directly related to industrial experience is a company's approach toward management. The "average" companies are inclined to approach their manufacturing operations with a strong, if not predominant, "trading attitude." For example, the need for maintaining technical specifications does not have the same significance for the newcomer to industrial activity as it does for the experienced companies. Also, the "average" companies often represent a strong family orientation in contrast to the business orientation of the large companies. Unlike the "average" companies, the large companies represent a much greater "professionalization" of management.

These differences between the "average" and "large" Indian companies indicate that on nearly all bases—management outlook, industrial experience, business orientation—the "large" Indian companies have more in common with foreign companies. The greater the similarity between the Indian and foreign companies, the greater the chances of satisfactory negotiation and project development experience. In brief, though "large" and "average" represent broad categories and the set of considerations on which the categorization is made are themselves broad in nature, the distinction is useful in understanding the relationship between Indian and foreign companies.

likely to be based on merit but whether the applicant is a relative. Such an approach has a very negative effect on employee morale and on the company's ability to secure the better type of Indian personnel.

Problems arise in a family-oriented business if management by "one-man rule" is in the hands of the Indian partner. If management is composed strictly of family members there may not be qualified members to whom authority and responsibility can be delegated. Also, because of the family orientation of the business, the more competent member among the Indian employees is not willing to adopt an aggressive job-oriented approach for fear of hurting the feelings of other family members. If, on the other hand, control over management is with the foreign company many of these problems are overcome. And, once the foreign company has implemented certain management techniques and concepts, it is more difficult to do away with them than if they are never instituted.

Some foreign companies complain that their Indian partners often do not work with reference to the overall organized effort, i.e., they tend to work as individuals. This results in reducing the effectiveness of the organized effort of the foreign company. Control over management by the foreign company would substantially reduce the "individualistic" tendencies of the Indian partners.

The reasons against control over management of internal operations by the foreign company offered by Indian companies leave much to be desired. Inadequate knowledge of Indian conditions is a rather vague statement. But the important question is how much knowledge of Indian conditions is really called for. Of course, foreign personnel will not have the knowledge of local conditions that a national possesses. But management of internal aspects does not call for the extent of knowledge of local conditions that the Indian companies that were interviewed considered to be necessary. Also, the emphasis by Indian companies on knowledge of Indian conditions really reflects a wrong preference. The foreign company offers managerial skills that are not possessed by Indians and it is unlikely that the Indians will be able to develop these skills, at least over the short term. Instead, foreign companies are in a position to meet the Indian companies' needs for effective management.

The argument by Indian companies that their management methods are adequate for their needs is an unsatisfactory one. The operations of most Indian companies are characterized by inefficiency. This inefficiency is tolerated because of the high demand in the Indian market for almost anything. But, this does not mean that the practice of Indian companies is economically or socially justified. As suppliers of goods and services to the Indian community they must attempt to supply the best at the lowest price. And their "own" methods of management do not permit sufficient development along these lines. Foreign management concepts and techniques lead to greater economic efficiency and, therefore, social responsibility and at a rate much faster than what could be expected from Indian companies using strictly their "own" management methods.

The arguments of foreign companies are well taken. In seeking control over management, the foreign company is trying to provide more efficient management for rapid and efficient development of operations. But Indian companies are not under market pressure to seek greater efficiency in management. The high demand assures them a market for their products. Also, a number of businessmen have recently shifted from trading to industrial activity and the different management requirements of industrial activity are not fully appreciated by them at present. The relatively "intangible" nature of effective management makes acceptance all the more difficult. Indian companies are much more inclined to accept (and even then with a great deal of hesitancy) foreign techniques of production because they can "see" how the techniques help to produce more. But when it comes to management, Indians are at a loss to "see" how it offers tangible results. By adopting this attitude Indian companies are forgetting that the efficiency with which the foreign techniques of production are used depends on how well the operations are managed. The techniques cannot be looked at in isolation from the concept. In fact, effective management becomes all the more important once the techniques of production are introduced. In short, the *greatest need in Indian companies is for effective management.* Foreign companies, by control over management, will provide this.

Business Objectives

An area of disagreement between Indian and foreign companies is the family orientation of Indian companies as against the business orientation of foreign companies. Indian companies argue that foreign companies are too much concerned with the economic aspects of operations and do not give sufficient recognition to the non-economic considerations that are particularly important for Indian companies.

Foreign companies argue, and very correctly, that economic efficiency is not everything. The non-economic factors have to be (and are) recognized. But foreign companies are justified in pointing out that it is the Indian company that is seeking greater *economic* development. If they are not achieving the level of industrial development suggested by their foreign partners, the fault lies with the Indian companies because they are not emphasizing the "economic context" as much as they need to. In other words, the foreign company develops a certain "economic context" which is composed of both economic and non-economic considerations. But the balance between the two is maintained in order to secure maximum benefits from its rights and services. Indian companies, on the other hand, do not maintain a balance; they place too much emphasis on the non-economic. Greater emphasis on the economic and business aspects of operations as seen over the long term would facilitate the pace of development of Indian industrial units.

Licensor Dissatisfaction

Response from foreign companies indicates that nearly 10 percent of the companies withdrew from negotiations because of dissatisfaction with the Indian company. In about 30 percent of the cases the foreign company stated that, though it was dissatisfied with its project negotiation and development experience, it decided to stay in India. The reason for dissatisfaction stated most often by companies interviewed is "differences in management" with the Indian company. Not one foreign company stated that it was dissatisfied with the rate of return on its investment. Instead, the "dissatisfied group" stated that it was dissatisfied with the "rate of progress of the Indian company" in terms of developing efficient management practices and concepts.

Certain features of the companies dissatisfied with their negotiation experience could suggest the reasons for dissatisfaction. Less than 10 percent of these companies undertook any formal evaluation of their proposed Indian partner prior to or during the course of negotiations. And nearly 70 percent of the dissatisfied group are companies entering India for the first time. Also, less than 20 percent of these companies visited India personally to "see for themselves" the Indian company they were planning to collaborate with. In short, dissatisfaction is due to insufficient knowledge of the Indian party especially in terms of management outlook by the foreign company.

CONCLUSIONS

The prior analysis suggests the following conclusions:

(1) Most foreign collaborations, both technical and technical-cum-

financial, are initiated by Indian companies. When foreign companies initiate negotiations, it is almost always done by those with previous business experience in India.

(2) Foreign companies with previous business experience in India are more satisfied with their project negotiation and development experience than those that are "new" to the Indian scene. Unlike the "new" foreign companies, the experienced foreign companies are not only more likely to check their prospective Indian partner but also spend less than "average" duration of time on negotiations.

(3) Insufficient knowledge of the Indian partner in terms of management outlook is the main reason why foreign companies are dissatisfied with their Indian partners.

It is recommended that foreign companies, especially the "new" ones least familiar with India, learn more about their Indian partners particularly in terms of management outlook. The government should push this point in its promotional and educational activities overseas. Indian companies should permit control over management by the foreign company during the initial stages of operations in order to secure a rapid and efficient development of Indian operations.

FOREIGN TECHNICIANS

The plant and equipment possessed by any company is only as valuable as the people who can make it run efficiently. The success of an organization, both in terms of administration and technical development, is based on its personnel. In less-developed countries we find a very rapid increase of physical plant and equipment. But these countries lack experienced managerial and technical personnel. Such personnel (foreign technicians) play a very important role in establishing projects in developing countries.

Foreign technicians instruct licensees in the use of foreign rights and services. But foreign companies are very short of technicians, especially the skilled type with knowledge of foreign operations. They are feeling the pinch even in domestic operations. Therefore, foreign companies may be hard put to supply a technician, and if this happens, the foreign rights and services and the physical plant and equipment would be of very limited value to the licensee. We are interested, therefore, in how frequently the services of foreign technicians are provided to licensees—what talents they have, how long they stay and to what effect. We are also interested in other questions such as: What are the areas and reasons for disagreement between Indian and foreign companies regarding the role of foreign technicians in Indian operations? Given the needs of Indian companies, is the government's definition of a foreign technician adequate? Does it provide for the type of personnel Indian industry needs? Are the incentives offered to foreign technicians adequate in terms of amount and duration? Finally, given the emphasis placed on the rapid development of Indian personnel for all levels of production and management, where should Indians be trained: overseas, in India, in both places? Answers to these questions would indicate whether foreign technicians (hereafter referred to as technicians with their foreign origin understood) are being permitted to fulfill their role in Indian operations.

Provision of Technicians

According to this study, in nearly all financial collaborations and the majority (about 60 percent) of the purely technical collaborations, the services of technicians are provided to the Indian company.[20] The remaining 40 percent of the purely technical collaborations are grouped as follows: 20 percent make no provision; 10 percent either send Indians overseas or receive foreign technicians; 10 percent of the licensors train Indians overseas.

Role of Technicians

The technician is the one who actually gets the physical operations going. He looks out for the interests of the foreign company by seeking effective development of operations. The technician is the major (if not sole) link between the foreign and the Indian company. Since the technician is the "eyes and ears" of the foreign company in India, his satisfaction or dissatisfaction with the Indian operations does have a major effect on the attitude of the foreign company. On the other hand, because the technician in India in many ways is the foreign company, at least to the licensee, the licensee's satisfaction or dissatisfaction with the foreign company could be largely determined by its reaction to the technician. In short, satisfaction with the technician is a major reason for being satisfied with a foreign collaboration.

Foreign technicians are used either for specific problems that arise in

[20] *The Economic Times* concluded after an analysis of 88 technical and financial collaborations that "in more than two-thirds of the cases, technical personnel were deputed to India." *The Economic Times* (Bombay), November 30, 1964, p. 1.

the Indian operations and/or for overall technical administration.[21] Nearly 90 percent of the Indian respondents prefer to limit the use of technicians mainly for specific problems. This preference is expressed by nearly all "average" Indian companies and an important percentage of the large Indian companies. The main reason for this attitude is that technicians are not familiar with "conditions of operations in India." They are ignorant of local labor conditions, supplier relationship and technical requirements. In short, they are unfamiliar with "the way of doing things in India."

Foreign companies seek general technical direction and control over the *internal aspects* during the *initial stages* of operations. Their main argument is that Indian companies lack industrial experience and the pace of project development depends largely on the methods and concepts established during the initial stages. By having control over the technical aspects, the technician would make sure that the "right" techniques were established.

Nearly 60 percent of the Indian respondents assert that the technician becomes less important as operations develop. A major reason stated especially by the large Indian companies is that the rate and level of training of Indian personnel is very satisfactory. Also, these companies claim to have developed programs for phasing out use of technicians. However, the "average" Indian companies comprise the bulk of the respondents. These companies state that "new" problems requiring technicians either occur less frequently or are ignored. And with the exception of some of the larger Indian companies, the "average" Indian companies do not seek the more recent or latest developments (mainly because of the nature of the Indian market) that are more likely to require technicians.

Foreign companies, on the other hand, argue that Indian companies tend to overestimate their ability to take care of new developments or tend to ignore the fact that new developments will take place. Even more problematical is the attitude of those Indian companies that insist on regarding themselves as the best judges of what and how much they need to know. In brief, foreign companies feel that their Indian partners do not really know what they claim to know. And therefore, their ability to handle even the "settled" areas (areas in which Indians consider themselves to be competent) is subject to doubt.

The comments made by Indian respondents need to be qualified.

[21] The term "overall technical administrator" applies to all levels above the foreman. It includes the director of manufacturing (overall) or the director of a particular phase of manufacturing.

The argument that technicians become less important because of satisfactory development of Indian personnel is perhaps true for the large Indian companies. But less than 5 percent of the companies claiming reduced importance because of this reason are large companies. In fact, most of the Indian respondents are suggesting by their remarks that the importance of technicians is reduced either because they ignore problems, are not technically qualified to recognize some that they should, or they are dealing with the Indian market and therefore do not have to be up to date. These comments made by nearly 75 percent of the respondents claiming reduced dependence indicate that the Indians are not really trying to perform the type of job performed by the technician. In other words, they are using a much lower set of performance requirements than those established and provided by technicians. (These lower standards adversely affect the country's export performance and the development of indigenous research and development, discussed later.) But contrary to what these Indian companies claim, they have not really reduced their dependence on technicians. They have merely sought much less than that which the technician provides.

In conclusion, Indian companies have changed rather drastically the entire basis of comparison of performance between Indian and foreign personnel; what the Indians do is not even a weak approximation of what technicians can do. But the objective in developing Indians should be to replace technicians. According to this study, Indians have been unable to replace technicians, i.e., reasonably approximate their performance.

Nearly 40 percent of the respondents (licensees) stated that the importance of technicians extends throughout, i.e., it goes beyond the initial stages of operations. These respondents have certain features. For one, the nature of the industry (whether new—petrochemicals, or established—textiles) determines the duration for which technicians are needed. In this group are found the large companies and the relatively smaller Indian companies with owners-cum-managers educated overseas. Though these companies seek a combination of foreign techniques and attitudes, they place special emphasis on foreign attitudes and concepts of industrial activity. And these companies are the ones with industrial experience and/or the active recognition of the need for it. It is argued by these companies that foreign tools and techniques cannot be used effectively unless they are used within the "right conceptual context." Foreign companies agree with these Indian companies. In fact, a major criticism of foreign companies is that Indian companies do not recognize that effective performance of techniques may be secured only if the right conditions (concepts) exist.

It is true that technicians are not as familiar with "local conditions of operations" as Indians are. But the important question is how much familiarity is needed especially in directing the internal technical aspects of operations. If greater overall technical direction means contact with workers, and if Indian companies are afraid of technicians associating with workers, the "problem" is easily solved by having a national deal with the situations requiring "knowledge of local ways of life." There is no reason why the personnel and the purely technical aspects cannot be separated. The gains from overall technical control by technicians in terms of rapid pace of project development are very great while the possible loss from dealing with labor can be effectively eliminated. In brief, know-how of local conditions can be provided by appointing a national, but the technical experience and the skill possessed by the technician can never be provided by a national, at least over the short-term. Indian companies are emphasizing the local know-how point too much without fully recognizing the benefits of overall technical administration in the hands of technicians.

Effective Use of Technicians

Each party to a foreign collaboration has its own particular requirements of what a technician should be able to do. The areas of agreement, but more often disagreement, would suggest shortcomings that each party to a foreign collaboration sees in the technician. And more important, whether the party providing the technicians concurs with the criticism of the recipients. Tentative answers to these questions would suggest areas of improvement.

General Satisfaction

Over 60 percent of the Indian companies interviewed are dissatisfied with the technicians they have secured. Their main reasons are: inadequate technical competence and inadequate familiarity with "Indian conditions"; inadequate disclosures of information to Indians.

Nearly 50 percent of the respondents claiming to be dissatisfied state that their technicians are "technically incompetent" and do not know how to use their knowledge in the Indian context. Some Indian companies feel that India is used as a training ground by the foreign company for its personnel. Also, Indian companies are unable to or cannot afford to evaluate closely the technicians they are to secure because of their urgent need for technical assistance especially during the initial stages of operations. Given the demand for technicians overseas, it is hard to secure any type of a technician—a problem which is particularly acute in complex and highly sophisticated fields. In short, the Indian company has to accept whatever is offered.

The foreign companies interviewed disagree with the Indian companies. Nearly all foreign respondents state that by far the most important consideration in their selection is whether the individual is technically qualified (professionally competent) for job requirements in India. And it is emphasized, technical competence is seen with reference to the ability of the proposed individual to operate under Indian conditions. Previous experience in India or in conditions similar to those in India is a major consideration. Some respondents stated that if they do not have employees with the "right" background, they go to other sources to find the right people for their Indian operations. Foreign respondents insist that they send the best person to India because the Indian project is experimental especially in the initial stages. And because the nature of subsequent developments depends on the efficiency and effectiveness of initial implementation, it is necessary to have the best person at the very beginning.[22] Because a foreign company has only a limited number of technicians it can spare, it has to decide between the importance of smooth implementation and the ability to spare technicians. Nearly 80 percent of the respondents stated that smooth implementation was the determining consideration.

Indian companies are correct in their appraisal that foreign companies are hard put for foreign technicians. But their criticisms have to be qualified to a large extent, especially for financial collaborations. First of all, it is doubtful that Indian companies are themselves technically qualified to make a reasonable appraisal of technicians. Nearly all the companies which made the criticism are "average" Indian companies who lack technical competence. The large Indian companies who possess the technical competence to evaluate the foreign technicians they secure are quite satisfied with them on the basis of technical competence. In short, those companies that are not technically qualified to evaluate are the ones who are criticising their technicians while those that are technically qualified to evaluate are satisfied.

Technical Competence

Those Indian companies who claim that their technicians are tech-

[22] The greater the interest and/or stake of the foreign company in the Indian operations, the more inclined it will be to send the better type of foreign technician. Since a financial collaboration leads to greater stake by the foreign company, one may say (as a broad generalization) that the foreign company is more concerned about the quality of the technician it sends when it has a financial interest in the Indian company.

nically incompetent are contradicting their earlier statements on importance of technicians. The "average" Indian companies comprise the bulk of Indian respondents claiming that their technicians become less important with the development of operations. The same set of respondents claim that their technicians are technically incompetent. But as stated earlier, it is not so much that technicians become less important as it is that the Indian companies do not even attempt to approximate the level of performance of technicians. Indian companies settle for lower standards of performance, and they realize it is a lower standard. They also recognize that the technician's level of technical competence is much higher than that which they are trying to achieve. Given this response, it does not make much sense for a group of "average" Indian companies to claim that their technicians are technically incompetent. Indian companies are exaggerating.

Indian companies argue that foreign companies will provide "less than the best" technicians because of the great demand and because they are short of technicians. However, especially in financial collaborations it is quite logical for the foreign company to provide the best that it can. The foreign company wants rapid and efficient development of the Indian project. It finds that this objective is achieved by sending its better personnel. In fact, this is the best way for the company to enhance its investment.

The foregoing discussion indicates that the criticisms by Indian companies are subject to major qualifications. It is interesting to consider the question of why Indian companies make these criticisms when they are subject to so much qualification. One reason could be that the Indian company hopes to shift the blame for "less than expected performance" to the foreign company. And the technician is the perfect person to blame since he represents the foreign company. It reflects a tendency on the part of the Indian partner to separate its own problems from those occasioned by the technician. And invariably it "happens" that the Indian company's problems would not have developed had it not been for the technician.

Personality

Personality factors are an important consideration. The ways of doing business in India are different from those in the States. A dynamic, aggressive and short-tempered person would create discord in the Indian organization. Along with the personality factors are the personal considerations. The most important is the willingness of the technician to go to India. This proves to be a major problem especially when family considerations are involved. The technician to be sent overseas may regard the overseas assignment as a promotion. But his wife and family may not be so eager. Companies select their personnel with due recognition of the nature and location of the project. If the project is to be located in an out of the way place, the company selects only unmarried personnel. If an extended duration of stay is called for, the company recognizes the value of having the family along and therefore picks only married couples. In brief, foreign companies are aware of both the personal and the professional aspects of an overseas assignment and attempt to develop the best package that they are able to.

Disclosure

Almost all Indian companies claiming to be dissatisfied with their technician stated that he did not disclose the information and know-how that he "should." The technician will solve the problem but will not explain the reasoning behind it. Also, while the technician may be technically competent to solve a problem, he may not be able to teach. In some cases, however, the foreign company places restrictions on the technicians. Or the Indian and foreign company interpret the contract in different ways. While the foreign company is acting according to the contract, the Indian company may want it to go beyond the contract. The Indian company wants satisfaction of needs instead of only fulfillment of contract terms.

Indian companies have offered other reasons for inadequate disclosure. For one, the size of the foreign company is considered to be a major determinant. A large foreign company may be relatively more impersonal than a small company. Since the nature of the relationship between the Indian and the foreign company is a major determinant of the adequacy of disclosure, a small foreign company would be better in terms of disclosure. A few companies feel that regardless of the attitude of the foreign company's management, the technician may retain the "craftsman attitude."[23]

A few Indian companies, mainly the large ones, feel that a major reason for inadequate disclosure lies with the Indian personnel. Indians tend to overstate their knowledge. The technician is likely to accept their word and this results in a significant gap between stated and actual knowledge. It it really the job of the Indians to secure all the knowledge that they can from the technicians. If they are unable

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[23] Margery Perham, "Political and Psychological Aspects of Development," *Restless Nations: A Study of World Tensions and Development* (New York: Dodd, Mead and Company, 1962), p. 13.

to secure adequate disclosure, the fault does not lie with the technicians but with the Indians.

Foreign respondents do not agree with the criticism of Indian companies. Their main argument is that they recognize that nationals must play the major role in their Indian operations. Therefore, their training is of crucial importance. And their technicians in India (and the trainees overseas) train with the objective of replacing the technicians in India at the most rapid rate possible consistent with efficiency. Contrary to what Indian companies claim, foreign respondents state that they emphasize meeting the Indian company's needs. Contract provisions are necessary but are not the basis for a successful relationship.

Comments by Indian companies are subject to qualifications on a number of considerations. Most of the Indian companies criticizing technicians for inadequate disclosure are the ones who lack technical ability. In fact, the large Indian companies who have the technical ability are not complaining about inadequate disclosure. If the "average" Indian company lacks technical ability, it is hard to understand how it can judge the extent of disclosure. Also, it is questionable whether the "average" Indian company really knows what it wants on a technical basis. And comments by Indian companies on the importance of the role of technicians show that they are accepting *less than* what is offered them by the technicians. Instead of inadequate disclosure, it is more a question of inadequate acceptance by the Indian companies. Finally, Indian companies must recognize that the type of technicians they are securing at present is the best that they can expect. The important question for Indian companies is not whether their criticisms of technicians are true or false. The important question is what would Indian companies do if they were not provided with these technicians. The thought is not an attractive one for Indian companies.

Close Company Relations

The response by about 40 percent of the Indian respondents is that they are satisfied with their technicians. It is interesting to note that more than half of these respondents are large Indian companies while most of the others are relatively smaller Indian companies with owners-cum-managers trained overseas. The main reason for satisfaction given by almost all these respondents is what they call the "nature of the relationship with the foreign company." There is an *atmosphere of mutual trust and confidence.* This feature effects the type of technicians they secure. Some of the features of these companies, in rather marked contrast to those of the "average" Indian company, are: Indian management recognizes the importance of integrity and contribution of effort for mutually satisfactory benefits; management is inquisitive and progressive though aware of the particular requirements of the Indian context; management is by long-term objectives and not short-term gains. Another feature of these companies is that they have some technical experience so that they know what is what in a technical sense. Also, many of these companies have financial collaborations.

The main point highlighted by these companies is that the nature of the relationship between the companies really determines satisfaction with the technician. If it is a good relationship, companies are satisfied with their technicians. If the relationship is not exactly satisfactory, then the technician appears to be the person most likely to be blamed or accused for poor performance. In short, the nature of the relationship between companies could be the determining consideration while the actual satisfaction or dissatisfaction with the technician may really be something quite secondary. Recognition of the underlying reason for dissatisfaction with the technician is important because it suggests areas of improvement. In the case of Indian companies criticising their technicians (and in view of the foregoing qualifications of these criticisms), it is suggested that the *real reason* for the comments (criticisms) is more in the "nature of the relationship with the foreign company" than in the technicians.

Adequacy of the Government's Definition of and Incentives for Technicians

If a company wants to have the foreign personnel it intends to secure classified as technicians, it must submit an application to the government. Foreign personnel classified as technicians by the government are offered certain tax concessions. In this manner the government controls the entry of foreign personnel. The government's objective is to encourage the development of Indians by restricting the areas and numbers of foreign personnel it classifies as technicians.

A technician is defined in the Indian Income Tax of 1961 as:

> A person having specialized knowledge and experience in (i) constructional or manufacturing operations, or in mining or in generation or distribution of electricity or any other form of power, or (ii) industrial or business management techniques—who is employed in India in a capacity in which such specialized knowledge and experience are actually utilized.[24]

The selection of the type of skills the foreigner must possess to be classified as a technician is largely based on the government's estimate of

[24] Kust, *op. cit.*, note 10, p. 394.

industry priority and whether the skills in question are available in India. Almost all respondents, both Indian and foreign, consider the definition to be adequate. The definition contains sufficient flexibility —a view that is strongly endorsed by government officials. Government officials are against any hard and fast rules regarding employment of foreign technical staff. The definition has not been a hindrance to securing the type of foreign personnel, both technical and managerial, required by the Indian project.

To make up for the high personal income tax and the more difficult living conditions in India, the technician has to be paid "something more." It has been calculated that "in order to pay an employee a salary in India that would give him an after-tax income equivalent to the one he would receive in the United States, on the basis of a salary of $12,000 (plus 25 percent to compensate for the more difficult living conditions in India), the United States firm would have to pay him $30,910."[25] A United States salary of $15,000 or $20,000 would amount to a salary in India of roughly $43,000 and $53,000, respectively. In order to provide part of this differential the government has granted certain incentives (tax concessions) to technicians. But these incentives depend on whether the technician has been approved by the government and whether he is a technician or an administrator. If the government approves the employment of a foreigner as a technician, "a technician falling in category (i) is exempt for a period of thirty-six month after his arrival in India."[26] And

> if he continues in such employment, any payment of Indian income tax on his salary by his employer directly to the central government is exempt from tax as additional compensation for a period of twenty-four months.[27]

A technician with industrial and business management techniques, in category (ii), is exempt for only 6 months.[28] If a category (i) technician has not secured approval prior to arrival in India, he is still exempt for a period of 365 days after arrival in India.[29] But unless managerial personnel secure prior approval from the government, they are not eligible for any exemption. Some other tax reliefs provided to technicians are: exemption from annuity deposits; lower tax rates; educational rebate; cost of trip home, tax deductible.

Indian and foreign companies regard the amount of the incentive

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[25] *India: Business Problems and Opportunities* (New York: Business International, 1962), p. 17.

[26] Kust, *op. cit.*, note 10, p. 394.

[27] *Ibid.*

[28] *Ibid.*

[29] *Ibid.*

to be quite adequate. But some Indian companies and a large number of foreign companies would prefer greater flexibility of duration for which the incentives are made available. Foreign companies state that the duration of tax exemption is adequate for those technicians dealing mainly with specific problems. But it is at times not adequate for technicians engaged in overall technical administration or a managerial position. Extension of stay may be needed beyond the five-year period of tax exemption. This may be due to unavoidable delays in completing a project. Especially in highly complex industries, it may not be possible to train Indians during the time period. Most companies seeking an extension of the duration of tax exemption really have in mind overall technical administrators. It may be necessary to retain the technically qualified foreign manager to manage the operations of a newly established plant. These foreign companies argue that tax exemption should be provided for whatever period of stay is required for technicians. Also, skilled administrative personnel should be provided with the same tax exemptions as technicians in category (i) and for a longer duration of time.

Government officials recognize the need for greater flexibility. But they feel that incentives in addition to those currently provided would place the technician in a very special position. This would be hard to explain to the Indian public.

It is interesting to note that the companies that favor an extension of duration of tax exemption, especially for their overall technical administrators, have not suffered because of inability to secure the required extension. It appears that regardless of the official statement of policies on duration of tax exemption and the type of technician who would qualify for such an exemption, technicians of category (ii) (administrators) may enter as category (i) technicians. In other words, for practical purposes, the restriction on category (ii) is more on paper than in practice. This is undesirable because the policy conveys the wrong impression to those who do not know what the practice is. The government should make sure that foreign companies are well informed about the difference between the policy and the practice.

Regardless of the practice, the policy is inadequate. India needs experienced people in overall administrative positions, especially technical administration. The one-year duration is highly inadequate. The important thing is not that the Indian government's practice is much more accommodating than its policy. The main point is that the policy suggests insufficient recognition of the importance of skilled administrative personnel. The government should change the policy. The benefits of having experienced top administrators, especially in technical positions, is much greater than the cost of providing the additional incentives. Technicians in top administrative positions will provide faster and more efficient development of Indian industrial units. More specifically, the duration of tax exemption for overall administrators, especially technical, should be *at least* as long as the duration provided to technicians of the first category.

Training of Indians

In nearly all cases there is either a specific provision or an understanding between the companies that training overseas will be provided for the Indian company's personnel.[30] This applies both to technical and technical-cum-financial collaborations but to a relatively lesser extent to the former. Of course, Indian and foreign companies have their own viewpoints on whether the Indian trainee should be trained overseas, in India, or in both places.

About 40 percent of the Indian respondents preferred to have Indians trained overseas. Their main reason is that this method permits the Indian to see the "broad picture," i.e., features of management and organization in an industrial society. Some companies have a policy of sending Indians abroad. This is particularly important when Indians are trained for top management positions. This approach facilitates understanding, acceptance and more effective implementation and utilization of foreign techniques and attitudes in Indian operations. Also, some feel there may be greater permanency and acceptance if an Indian introduces new techniques and attitudes.

The policy of foreign companies on training Indians determines their preference for training methods. The reason expressed most often is the strong conviction on the part of foreign companies of the need for developing a broad underpinning of skilled Indian personnel. Some companies have started active policies along these lines. Others are gradually getting under way. The desire for developing a base of highly skilled Indian personnel is prompted by a variety of considerations. For one, expanding operations require additional personnel. Given the limited ability of foreign companies to provide technicians and the government's policy on using Indians, the foreign company must seek Indians. Also, since companies have entered India for long-term considerations, development of Indians is essential. Many companies feel that business considerations (especially in dealing with

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30 After an analysis of 88 technical and financial collaboration agreements, *The Economic Times* concludes that in slightly less than two-thirds of the cases "Indian personnel were to be trained abroad." *Op. cit.*, note 20, p. 1.

labor, customers and the government) require Indians because they know the system much better than foreign personnel. Foreign companies regard the foreign technicians to be a supplement to (and not a substitute for) Indian personnel. Their main objective is to reach a stage of independence from foreign technicians.

Nearly 60 percent of the foreign companies interviewed stated that they preferred to bring Indians overseas for training. These companies offered various reasons. There is a definite limit to their ability to spare technicians. Receiving Indians reduces the strain. Some companies feel that effective training can be secured only by working side by side with experienced personnel. Since the foreign company cannot always part with such personnel, the only way to let the Indian trainee share in the experience is to bring him over. Foreign companies also feel that training should be given in going operations. In India the plant is in the developmental stage. Thus, if training were to be given in India two functions would have to be undertaken at the same time, namely, effective development of plant and effective training of personnel. It is better, however, if the two functions are separated and training given overseas. This method is particularly useful if the Indian plant is to be essentially the same as the plant overseas. In some cases it has been a problem finding supervisory personnel in India who could help in the training of Indians. Other reasons given are difficulty in finding technicians willing to go overseas and difficulty of such technicians to fit into the Indian environment.

About 60 percent of the Indian respondents preferred to have foreign technicians train Indians in India. By this method more Indians could be trained thereby reducing cost. Also, commercial considerations justify having a foreign technician, i.e., the Indian consumer is more favorably inclined toward a product made under foreign technicians. A few large companies have a reservoir of skilled Indians they can draw so that foreign technicians are needed only for specific problems. Therefore, there is no need for sending Indians overseas. Securing a foreign technician leads to saving of foreign exchange. In a few cases Indian companies decided against sending Indians overseas because of the inadequate foreign exchange granted by the government. (At times foreign companies subsidize living costs of Indian trainees or provide training without cost to the Indian company.) A major reason stated frequently by both Indian and foreign companies is that there are important limitations to having Indians trained overseas especially when conditions in Indian operations tend to be different from those overseas. The main point here is the nature of Indian conditions. Training should be given in the Indian plant under Indian conditions because of the peculiarities of the Indian conditions. It is felt that this method provides better and faster training. Some companies feel that it is better to send an Indian trainee overseas only after he has been exposed to the conditions of the Indian plant for a period of time. In proceeding overseas the trainee would know the requirements of the Indian operations, and instead of adopting a shot-gun approach to his training he can concentrate on essentials.

The comments made by Indian and foreign companies may be broadly divided into two categories: the "broader context" idea of foreign training and recognition of Indian conditions. The foreign company provides both techniques and concepts. They form a package. Even when a foreign company enters into a purely technical collaboration, embodied in the rights and services it provides to the Indian company is a "way of doing things" in the foreign country. Therefore, if the Indian company uses the technique but ignores the context within which the technique was developed, the contribution by the technique is not as much as it would be had the context been recognized. Training of Indians overseas provides exposure to some of this context. And in this way it helps the Indian trainee to understand the technique. More specifically, on the "concept" idea, the larger industrial undertakings require a "certain approach," a "certain way of conducting them" that Indians are not familiar with. The broader cultural-political-social-economic aspects affect the manner in which an organization is conducted. Training overseas is important because it shows the trainee why foreign managers and administrators adopt certain approaches (e.g., the general idea of social responsibility) in running an Indian organization. In short, exposure to the "broader context," especially by Indian trainees designed for top level managerial positions, provides a better appreciation of the foreign company's "way of thinking." Wherever possible, Indian companies should emphasize understanding the "broader context."

Assessment

The contribution of foreign technicians is seen in the range of industrial activity India has undertaken since 1947, and especially since 1957, ranging from heavy industry to pharmaceuticals as indicated in Table II and Chart 2. The foreign technicians helped to translate the various pieces of equipment and materials into productive units. Their contribution is illustrated further by the extent of technical and administrative activity undertaken by Indians themselves. For example, in the petroleum and oil industries (among others), an increasing range of functions performed by foreign technicians in the initial stages of operations have been turned over to Indians. This would not have been possible without the aid of foreign technicians.

The contributions of foreign technicians extend into the non-licensed areas also. The skills acquired by an Indian are carried over into other areas of activity. For example, an Indian trained in a specific area (say a particular stage of operations) is also capable of applying the skills he has acquired in other stages of operations of a licensed or non-licensed project. But the Indian must be willing to apply his knowledge in new areas. The presence of a foreign technician makes him confident to undertake new areas of activity on his own.

Indian companies have not secured the maximum benefits from the use of foreign technicians because they have not tried to achieve a level of performance that is reasonably close to that of foreign technicians. This is due to the nature of the Indian market (high demand in a protected market); Indian companies are not under market pressure for better performance of operations. Also, with the exception of a handful of Indian companies, the others do not have a tradition of industrial activity that would prompt them to strive for a high level of performance for the professional satisfaction it would provide. In brief, there is neither sufficient "internal" motivation nor external market pressure to encourage Indian companies to seek greater approximation of the level of performance of foreign technicians.

Foreign technicians should be permitted overall control over the technical aspects of the Indian project at least during the initial stages of operations. This will provide a level of performance by Indian personnel more similar to that of foreign technicians. Also, the duration of tax exemption should be *at least* as long as the duration provided to technicians of category (i). Finally, training of Indians, especially those designed for top level managerial positions, should emphasize understanding of the "broader context" of foreign industrial activity.

RESEARCH AND DEVELOPMENT AND PRODUCT MODIFICATIONS

RESEARCH AND DEVELOPMENT

Research and development (R&D) helps to reduce a licensee's (or country's) dependence on foreign R&D. Nationalistic considerations and the desire for being self-sufficient in certain selected industries requires indigenous R&D efforts. Also, R&D leads to greater technical knowledge that a company can use to determine what it needs and to evaluate what it secures in the form of rights and services from other companies. At least over the long-run, R&D reduces expenditure of foreign exchange by reducing the areas of dependence on foreign R&D. R&D efforts by companies suggest a certain innovative outlook and dissatisfaction with what is possessed. This leads to progress.

Given the importance of R&D, what is the nature, extent and anticipated duration of dependence of Indian companies on foreign R&D? This question raises additional questions. Is it a continuing dependence? What are the implications of a continuing dependence on the government's policy regarding the duration of a technical collaboration? Given the government's objective of a rapid rate of industrialization, is it worthwhile to reduce the dependence on foreign R&D? The answers to these questions have implications for both government and business policy.

Both the Indian government and foreign companies are engaged in R&D activity. But the important question is which party (the government or the foreign companies) can provide greater acceleration to indigenous R&D efforts, i.e., by Indian companies. The government's R&D efforts are faced with problems not present for foreign R&D, e.g., foreign R&D is both tested and tried. Do these problems restrict the development of indigenous R&D efforts? Since the objective is to develop greater indigenous R&D ability, to what extent have foreign collaborations facilitated this development? Or have foreign collaborations actually restricted the development of indigenous R&D efforts? And what are the implications of these features for business and government policy?

Nature, Extent and Duration of Dependence on Foreign R&D

There is hardly any R&D activity by Indian licensees.[31] Less than 5 percent of the respondents (licensees) claimed to be engaged in any development activity while not even 2 percent were engaged in research. Large Indian companies are only slightly more R&D inclined than "average" Indian companies.

Almost all respondents (licensees) regard the "nature of the Indian market" as the main reason for their very limited R&D efforts. It is characterized by high demand and limited supply in a protected market.

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[31] See *The Economic Times* (Bombay), June 30, 1965, p. 10. See also the August 1, 1965 issue for results of the Council of Scientific and Industrial Research's (CSIR) survey of research efforts of Indian industrial establishments.

Indian businessmen are under no pressure from the market to engage in R&D.[32] Also Indian businessmen do not have a tradition of R&D. Their strong trading background and lack of industrial experience does not provide them with a research-oriented attitude. The 5 percent of the respondents (licensees) engaged in some form of R&D activity are the large companies with an industrial background. The Indian businessmen seek to maximize short-term gains while R&D returns are essentially in the long-term. Nearly 95 percent of the respondents felt that they were too small in size to justify undertaking R&D.[33] Finally because Indian licensees are mainly concerned with domestic markets, they are not under market pressure to be as R&D conscious as they would be in dealing with foreign markets.

The reasons given by Indian businessmen indicate that any serious R&D activity by Indian companies is a long time away. Also, the almost complete absence of R&D efforts by Indian licensees is not due to restrictions by the foreign licensor. It is due to the attitude of Indian businessmen within the context of the Indian market.

A foreign collaboration makes an Indian licensee completely dependent on the licensors' R&D. Nearly 95 percent of the respondents (licensees), who do not engage in any R&D, are *completely* dependent on the licensors' R&D both in licensed and non-licensed areas. Though 5 percent of the respondents are engaged in some sort of R&D, even these licensees become nearly completely dependent on the licensors' R&D in the licensed area. The main reason for the large measure of dependence is that the licensors' rate of development in the licensed area is much greater than what the Indian company could ever hope to develop. In almost all cases (about 95 percent of respondents) after a foreign collaboration has been established, the R&D efforts of the licensee are directed into areas *other than* the licensed area.

The "average" Indian licensee spreads its R&D resources (if it has any) too thin by moving into non-licensed areas. As it is, the licensee cannot acquire sufficient knowledge of the licensed area during the life of a technical collaboration. By moving into non-licensed areas, the "average" Indian company further reduces its ability to develop independence. However, by emphasizing the licensed area, the licensee is in a better position to develop greater technical competence in this area.

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[32] *Ibid.*, August 1, 1965, p. 5 for CSIR survey results.

[33] The meaning of the word "size" has to be seen within the Indian context. Even the 5% of the respondents who are large according to Indian standards are rather small compared to foreign standards, especially United States but also European.

In the case of the large Indian licensees who have the industrial background, the main concern should be to reduce dependence on the foreign company in the licensed area. But since the large licensees already have a certain level of technical sophistication, they should seek to use the skills of the licensed area in non-licensed areas. The objective should be to develop a broad base of technical knowledge.

About 25 percent of the respondents stated that they would like to reduce their dependence on foreign R&D because of the savings in costs it would involve. Though it is a valid consideration, it cannot be accepted at face value. Indian licensees are not really concerned with the extra cost of manufacture due to foreign collaborations because the "extra costs"[34] are passed on to the customer.

Nearly 15 percent of the respondents would like to reduce their dependence on foreign R&D so that they can have greater independence in using R&D.[35] But Indian licensees prefer to use foreign R&D because it provides sure results in a minimum period of time. The desire for independence on the part of the Indian licensee is really quite secondary to the desire for "certainty of outcome in the short-term."

The duration of a technical collaboration agreement is usually 10 years.[36] The licensee is in most cases entitled to future developments in the licensed product or process during the life of the agreement. However, upon termination of the agreement, the licensee is not entitled to any further developments the licensor may make in the licensed product or process. Nearly all licensees have access to future developments by the licensor in the licensed product or process but only during the life of the collaboration agreement.

About 10 percent of the licensees state that termination of their technical collaborations will have an adverse effect on them. They have not been able to develop sufficient technical ability during the course of the technical collaboration to make them independent. They will continue to need future developments made by the licensor especially because of their export markets. Also there is already a large

[34] Of course, "extra cost" as used here means the cash payments made by the licensee. It does not consider the benefits secured from the rights and services. In short, it is an unsatisfactory way of looking at the question of "extra costs" of a foreign collaboration. But it is representative of the attitude of some Indian licensees.

[35] For comments relating to the textile industry, see *The Economic Times*, May 31, 1965, p. 8.

[36] About 80% of the respondents (licensors and licensees) stated that their technical collaborations were of 10 years duration. Nearly all government officials interviewed regarded 10 years as the "average" duration. Kust (*op. cit.*, note 10) also finds 10 years as the "average" duration.

technological gap between Indian companies and companies in the developed countries. Termination of technical collaborations is likely to lead to developing a "hopelessly large gap" between the Indian and foreign companies. However, about 90 percent of the respondents state that termination will not have an adverse effect on them because their efforts are directed solely at the domestic market where *new* R&D requirements are very limited.

Government officials state that extension of technical collaborations beyond the 10-year period will not be permitted.[37] The government makes exceptions only when very complex technology is involved. It hopes that this policy will force Indian licensees to secure maximum benefits from foreign R&D during the course of the collaboration. Also by limiting the duration of a technical collaboration the government hopes to prevent undue dependence on foreign companies. The 10-year duration is adequate because Indian companies do not always need the "more modern techniques." Because of the nature of the Indian market, Indian companies are not under pressure to develop "new" processes and products as is the case in foreign markets. And, by refusing to extend technical collaborations beyond the 10-year duration, the government saves on foreign exchange. Government officials feel that it is too early to assess the adverse effects, if any, of its policy.[38]

But is it unrealistic to expect Indian companies to acquire all "useful" know-how in 10 years? Indian licensees have certain characteristics that affect their pace of acquisition. Indian licensees, particularly the "average" ones, possess hardly any technical ability. A number of businessmen have moved from trading to manufacturing and they will require some time to get used to manufacturing activity. Also the domestic market does not exert pressure on Indian companies to undertake R&D. Changes in the domestic market (e.g., greater competition) will lead to changes in the outlook of Indian businessmen toward R&D.

Whether the Indian licensees have acquired a "useful" level of know-how depends on how the word "useful" is defined. The market in which the know-how is to be used will determine the level of "useful" know-how required by a company. If an Indian company deals

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[37] The joint standing committee for scientific research and industry has expressed the same view. See *The Economic Times*, August 1, 1965, p. 1.

[38] Most foreign collaborations were approved after 1957 with a 10-year average duration for technical collaborations. The technical collaborations would not be presented to the government for renewal until 1967, at the very earliest. Therefore, companies and the government have not had much negotiation experience on this point.

in foreign markets, it needs a level of know-how substantially higher than if it deals only in the Indian market. In brief, a level of know-how much lower in comparison to foreign market requirements is still useful in the Indian market. Another basis of defining the level of useful know-how is whether the licensee is capable of undertaking substantially independent activity in the licensed area.

Indian licensees have acquired know-how from the licensor and the extent of acquisition is significant given their pre-collaboration level of know-how. But in most cases the level of know-how acquired is with respect to the needs of the Indian market. Therefore the government should decide what it considers to be a "useful" level of know-how that the Indian licensee should acquire during the 10-year duration of a technical collaboration.

The government's policy on duration of technical collaborations should recognize the difference between large and "average" Indian companies on the basis of their technical ability, industrial experience, managerial sophistication and "potential for development." But the overwhelming number of technical collaborations of 10-year duration strongly suggest inadequate recognition by the government of the differences between the "average" and large Indian companies.

With respect to the "average" licensee, the initial technical collaboration should be of sufficient duration to permit the licensee to acquire some knowledge from the licensor. The government's objective should be to develop *a broad base* of Indian licensees with at least some technical knowledge. This is the important feature because it permits the licensee to follow a "path of development" in a faster and more efficient manner than it could strictly on its own.

Extension of technical collaborations should be on a selective basis for licensees meeting certain requirements. One requirement should be whether the licensee has made a serious effort to develop its technical ability during the course of the technical collaboration. Over the long-term Indian companies, mainly the large ones, represent a major source of R&D efforts. They must make a start, small as it may be, relative to the country's needs and what the foreign companies can provide. The licensees' efforts can be judged either from their independent steps or from their steps to seek active assistance from the licensor to set up an R&D department.[39] (The latter approach would

[39] A collaboration agreement between a United States and Indian company states that the "licensor will assist the Indian company in establishing a department for research and development work" relating to the licensed product and process. There is greater need for such arrangements with foreign companies. Especially for the large Indian licensees who possess some technical sophistication,

lead to faster implementation and development of an R&D department.)

Another consideration should be the licensee's actual exports or its export potential. Foreign markets are highly competitive with a rapid rate of technological development. Indian licensees must have access to the licensor's developments in the licensed product or process if they are to have any chance of competing in foreign markets. Would extension of the agreement result in greater exports by the licensee? Or would the extension bring the licensee substantially closer to the day when it can undertake exports? If there is a strong chance of increasing actual exports or the potential for exports, the technical collaboration should be extended.

The conditions for extension—viz., technical development by the licensee and export potential—apply mainly to the large companies. Of course, there already exists a "technological gap" between the large and "average" Indian companies. But there is also a gap between the large Indian companies and foreign companies. By a selective policy of extending technical collaborations, large Indian companies are given a good chance to reduce the gap. And when the large Indian companies have acquired "sufficient know-how," they can begin to act as licensors or consultants to other smaller Indian companies.[40] The government is encouraging public sector units to offer their know-how to other Indian companies, both in the public and private sectors.

Accelerating the Development of Indigenous R&D

Indian R&D organizations have made some contributions though there are conflicting views as to the extent and nature of the contributions.[41] However, indigenous R&D efforts are not going to be

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a foreign collaboration should be entered into not only for the sake of production but also for the sake of R&D. Though foreign collaborations started as a means of rapid development of production, of late they are also being used for more specific purposes, e.g., foreign collaborations designed mainly for exports. Similarly, in selected cases, foreign collaborations can be regarded as a means of developing the licensee's R&D department. However, less than 5% of the large Indian licensees conducting R&D had an arrangement with their licensors for helping them establish an R&D department.

[40] Some of the financing agencies in India are asking the larger Indian companies with an established name to act as technical consultants for smaller Indian companies in the same industry. For example, one of the financing agencies in India secured an application from a small Indian company for a project in a particular industry. The financing agency was willing to approve a loan on the condition that a large and well-established Indian company in the same industry act as a technical consultant and also serve on the board of directors of the smaller Indian company. The larger Indian company agreed to such an arrangement.

[41] A number of R&D organizations have been established either by the government or by industries, e.g., Central Chemical Engineering Research Institute

sufficient to meet the country's needs. Indigenous R&D efforts (through the government) are faced with serious problems. Nearly all respondents (licensees) stated that they prefer to use foreign R&D instead of indigenous R&D. Indian companies discount indigenous R&D compared to foreign R&D.[42] The main reason for this attitude is that foreign R&D is proven and guarantees results in the short-term—features that are most important to Indian businessmen and also to government officials.[43] Also the Indian customer and Indian and foreign financing agencies are much more favorably inclined toward projects using foreign R&D.

Only 10 percent of the licensees interviewed claimed to be engaged in any form of R&D activity. They all felt that there is a serious lack of liaison between Indian industry and Indian research organizations. The research efforts of these organizations are "abstract" and unrelated to the needs of Indian industry.[44] In fact given the strong prefer-

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(CCERI), National Chemical Laboratory (NCL), Textiles and Allied Industries Research Organization (TAIRO). These organizations claim to have developed various processes and products that are licensed to Indian companies and awaiting commercial production. *The Economic Times,* June 30, 1965, p. 10, and July 4, 1965, p. 10. For an estimate of the foreign exchange saving as a result of the research efforts by selected Indian research organizations, see the issue of June 27, 1965, p. 4.

[42] *Ibid.,* June 20, 1965, p. 4 for comments by Mr. T. N. Singh, Minister of Industry. See also the issue of August 1, 1965, p. 6 for results of the study on research efforts by Indian companies by the Council for Social and Industrial Research.

[43] For further discussion of Indian government officials' tendency to favor foreign R&D, see Lewis, *op. cit.,* note 1, p. 61. For comments on "foreign orientation" of Indian scientists, see Malenbaum, *op. cit.,* note 4, p. 200.

[44] The need for greater "linking" of indigenous R&D with the requirements of industrial development has been stressed by T. N. Singh, Minister of Industry. *The Economic Times,* August 1, 1965, p. 1. The joint standing committee for scientific research and industry has stressed the need for "strengthening of liaison services of national laboratories with industry;" see the issue of August 1, 1965, p. 1. *The Economic Times* commenting on the National Chemical Laboratory indirectly refers to the need for greater liaison between research organizations and industry. The NCL has technical know-how for certain processes but only on a laboratory or pilot-plant basis. But further development of the processes will be accelerated by bringing industry and research organizations closer to each other. See the issue of June 30, 1965, p. 10.

Malenbaum has referred to the problem of "social scotoma" where scientists in less developed countries work for an "invisible jury" of scientists in England and the United States. Calling this "xenophilia," Malenbaum states that the major disadvantage of this attitude is the "lack of intimacy with the material environment" within which the scientist functions and whose problems he is helping to solve.

Response by the large Indian licensees engaged in some sort of R&D activity indicates that less than 5% of these licensees had ever secured any product or process from a government sponsored or industry sponsored R&D institute.

ence for foreign R&D, indigenous R&D organizations have to make "special efforts" to sell Indian industry on the value of their developments. And the indigenous R&D organizations can do an effective selling job only if they can demonstrate practical ability.

Indian research efforts face various problems in moving from the laboratory stage to pilot plant and finally to commercial production. The project may need engineering skills not available in India. Therefore a foreign company has to be approached. The foreign company is generally unfamiliar with the Indian process and is not sure whether it will work. If a performance guarantee is sought, the foreign company may not be willing to deal with the Indian process. Also the foreign company is likely to be in a position to offer a variety of other processes that may be better than the Indian product and provide faster development of production. Also since projects in India are small compared to the scale in foreign countries, the foreign company may not be geared to meet the needs of a small project.

The main question is where is the initiative for more R&D to come from: the government, the Indian companies, or the foreign companies. At present, Indian companies have very limited ability to conduct R&D on their own. Even the larger Indian companies will require a period of instruction from foreign companies before they can attempt significantly independent R&D activity. Also "independent" activity is relative; foreign companies continue with their R&D efforts while extending rights and services to licensees. The "technological gap" between large Indian companies and foreign companies will continue to exist for quite some time to come.[45]

Foreign companies through foreign collaborations have provided the *basis* for R&D activity by Indian companies. Even though the rate of indigenous R&D activity is rather limited, foreign collaborations have had a stimulating effect in this respect. R&D activity by companies with foreign collaborations compared to R&D activity by companies without foreign collaborations would indicate that the former are more research conscious than the latter. Measures of R&D activity by licensees as against independent Indian companies are not available. However, comments by licensees interviewed provide some broad measures. Indian companies become *more R&D conscious after* they have a foreign collaboration than they were before one. Nearly all large Indian licensees interviewed claimed to have increased their R&D

[45] For comments along these lines see remarks by B. B. Joshi, Honorary Director-Secretary, Textile and Allied Industries Research Organization, *ibid.*, May 31, 1965, p. 8.

expenses by 15-20 percent after entering into a foreign collaboration. Also these large licensees state that though their R&D activity in non-licensed areas is limited, the contributions made by foreign R&D in the licensed areas has made them very aware of R&D need in non-licensed areas.

The "average" Indian licensees are not engaged in R&D. But close to 50 percent of such licensees interviewed stated that their foreign collaboration had provided them with a much better understanding of the very significant role of R&D. Though these licensees will not undertake any appreciable amount of R&D in the near future, their new recognition of the value of R&D will eventually become a stimulus. This increased awareness of the value of R&D generated in the "average" Indian licensee could be more important in the long run than the present increased activity by large companies.

Greater initiative for the development of indigenous R&D will be through greater competition in the domestic market placing new demands on manufacturers. Greater technical ability will encourage more R&D on the part of Indian companies. Foreign companies, through foreign collaborations, have and can continue to provide the technical basis to accelerate the development of indigenous R&D. Indian companies and the Indian government do not have the required technical ability. Without foreign collaborations the rate of development of indigenous R&D (which is not the same thing as the rate of development of domestic production) will be appreciably slower than with foreign collaborations.

If foreign collaborations are stifled by the government, provision of R&D to Indian companies will be appreciably reduced and this will curtail the pace of their technical development. But even more significant will be an increasing unawareness on the part of Indian companies of the role of R&D in accelerating technical development of industrial organizations. Once foreign collaborations are stifled and exposure to foreign R&D restricted, Indian companies are likely to forget rather quickly their new-found recognition of the value of R&D.

EDITOR'S NOTE: This paper will be concluded in Volume 10, Number 3 of IDEA. For the convenience of our readers we list below the remaining contents of the forthcoming sequel:

RETROSPECTIONS

This section will include biographies and other reviews of careers, discussion and documentation of events important to the history of inventions and discoveries, and anecdotal or historical material pertaining to judicial opinion and legislation.

Highlights in the Careers of Inventor Award Nominees for 1965

We are sharing with our readers excerpts from selected letters nominating candidates for the 1965 Inventor of the Year Award. In Volume 9, Number 3 of IDEA *we presented a collection describing the rich backgrounds of a number of the 1964 Award nominees. The following excerpts add considerably to the wide range of contributions and experience previously detailed. Information on the background of Samuel Ruben, the Inventor of the Year for 1965, is contained in his address entitled "Opportunities Afforded an Independent Inventor by the Patent System," published in Volume 10, Number 1 issue of* IDEA *on page 117.*

THE PURPOSE OF THIS LETTER is to nominate Mr. Edwin A. Link for the 1965 Inventor of the Year Award.

Mr. Link has 19 issued United States patents, mostly in the field of aviation training. Mr. Link is well known as the father of simulated

* The above letter was submitted by Richard G. Stephens, attorney of Binghamton, New York, in nomination of Edwin A. Link.

flight training and the inventor of the "Link Trainer." Thousands of allied airmen received flight and navigational training on Link Trainers during World War II. Air Marshall Tedder, wartime head of the RAF, stated that the Battle of Britain could not have been won without the Link Trainer. Mr. Link's accomplishments relating to flight training have been recognized by a number of awards, such as the Potts Medal of the Franklin Institute and the Wakefield Gold Medal of the Royal Aeronautical Society.

Edwin A. Link

Building on the foundation established by Mr. Link's inventions, the flight simulation industry has grown to become a multi-million dollar industry, employing thousands of people. Simulators are being made today to train pilots and astronauts to fly aircraft and spaceships which have not yet even been built. Simulated flight training is an extremely important prelude to each and every trip into space by our astronauts. My client, Link Group of General Precision, Inc., can and would be glad to supply much additional information concerning the flight and missile simulation industry.

Mr. Link had to overcome very many obstacles in order to establish flight simulation on a sound financial basis, and Mr. Link recognizes the important part which patents played in helping him establish this industry. Building a hand-to-mouth flying school business into a 100 million dollar industry took not only great amounts of courage and dedication, but also risk capital, and the temporary monopolies secured by his patents.

Today, some 25 years since flight simulation was first firmly established and well on its way, Mr. Link continues to invent and continues to file patent applications, now in the oceanography field. Historical and scientific expeditions done in cooperation with the National Geographic Society and the Smithsonian Institution led Mr. Link to become an authority on underwater operations. The Navy has consulted him on various occasions, such as the sinking of the submarine Thresher, respecting marine salvage operations. About two years ago Ed Link stated: "If a man can live and work 600 feet under the sea, he can conquer a frontier as big as the African continent and rich in oil, minerals and food." The patent system is still encouraging Mr. Link, and Mr. Link's inventions are still attracting risk capital. Union Carbide Corporation, General Precision Equipment Corporation and Mr. Link formed Ocean Systems, Inc. some months ago "to engage in the commercial development of a broad range of underwater services and supportting systems."

The 30-year history of the flight simulation industry, and the entire

Ed Link story are strikingly good examples, in my opinion, of creative inventorship and the patent system working hand in hand for the benefit of everyone. I know personally that Mr. Link is very patent conscious, and I believe Mr. Link would be the first to acknowledge the help he has received and continues to receive from the patent system.

Theodor H. Benzinger

DR. BENZINGER IS A SCIENTIST OF INTERNATIONAL REPUTE and a dedicated inventor. The characteristic that distinguishes Dr. Benzinger from other scientists of similar standing is his ability to recognize practical applications of his scientific endeavors and to translate these into physical embodiments of great value.

The ear thermometer is an outstanding example of this. Whereas many persons of similar scientific genius may have recognized the value of the ear thermometer as an investigative tool, Dr. Benzinger went much further in envisioning the device as a clinical instrument. He alone recognized the possibilities of the device in this respect and has devoted much time and energy in consideration of the practical aspects of this matter. There is much evidence now that others are following his lead.

The following article appeared in the March, 1963 issue of *Pageant Magazine:*

> An "ear thermometer"—introduced as the first completely accurate means of measuring body temperatures—has recently been invented by Dr. Theodor Hannes Benzinger and his co-workers at the Naval Medical Research Institute, Bethesda, Maryland.
>
> It is claimed that this instrument, made of a disposable plastic, will record human body heat to within one one-hundredth of a degree.
>
> The new thermometer, which will soon be available, is inserted into the ear until it just touches the ear drum, a site selected because of its nearness to the hypothalamus, the "thermostat" in our brain.
>
> Aside from its accuracy, the ear thermometer is easier to use than a rectal thermometer. It is cleaner, does not require a bed or a stretcher, and needs no manipulation under the table in the operating room.
>
> Says Dr. Benzinger: "To continue measuring body temperature in the rectum would be like checking the thermostat in a living room by measuring the temperature in a concrete block in the basement."

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* This material and that which follows is quoted from a letter and enclosure submitted by R. I. Tompkins, Director of the General Patent Services Division, Office of Naval Research, Department of the Navy, Washington, D.C., in his nomination of Dr. Theodor Hannes Benzinger.

Another article appeared in *Science News Letter*[1] for May 2, 1964, as follows:

> Body temperatures will be taken in the future by placing a tickling thermometer inside the ear, a Navy medical researcher predicts.
>
> Dr. Theodore H. Benzinger of the Naval Research Institute, Bethesda, Md., told a session of the Federation of American Societies for Experimental Biology meeting in Chicago that the tickling comes from a feathery "bird," something like a badminton bird, that holds a tiny wire gently against the ear drum.
>
> The new type of thermometer could have use in hospitals where numerous patients could be monitored electronically throughout the day. It also would be useful for astronauts. It is now used at the Institute in the field of temperature regulations and sweating. . . .

Among Dr. Benzinger's inventions are those covered in the following patents:

3,054,397—Method for Measuring Body Temperature

3,156,117—Clinical Ear Thermometer

3,099,923—Thermopile Switching Systems

3,193,357—Miniaturized Reaction Vessel with Reaction Injection Means, and Method of Mixing Small Quantities of Liquids

Dr. Benzinger, born in Germany, obtained his M.D. degree at the University of Freiburg in 1932. From 1934-1944 he was head of the German Air Force Aero Medicine Division at Rechlin. After coming to this country, he became in 1947 Director of the Bio-Energetics Laboratories at the Naval Medical Research Institute. In 1963 he won the Golden Scheele Medal of the Chemical Society in Stockholm.

I SUBMIT THE NAME OF Colonel Price C. McLemore* as a nomination for inventor of the year.

His achievement, in brief, is as follows:

Prior to World War II, McLemore was operating a farm near Montgomery, Alabama on which cotton was the chief crop. A large item of expense was weeding the cotton and particularly removing the weeds

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[1] Reprinted, with permission from *Science News* weekly summary of current science, © 1964 by Science Service, Inc.

* John A. Dienner of the law firm Brown, Jackson, Boettcher and Dienner, Chicago, sent in the above nomination letter.

Price C. McLemore

from the cotton plant rows, which removal is known as chopping. In general, this had to be done by hand. McLemore conceived the possibility of directing a flame onto the ground at the base of the cotton plants. The cotton plants have stems which are sufficiently resistant to the flame that they can tolerate it. The weeds perish. World War II came along and deprived McLemore and his backers of the possibility of promoting this invention which, by trial, had proven highly efficacious and had gone into promising commercial use before war priorities closed down the manufacture of the equipment.

After the war, the development of the idea was again taken up and widespread use of the invention has developed. McLemore took out two basic patents and a number of improvement patents.

The Longstreet Medal of the Franklin Institute of Philadelphia was awarded to McLemore for his invention of the flame cultivator.

Vladimir Haensel

THE PIONEERING INVENTIONS of Dr. Vladimir Haensel* in the field of catalytic refining of petroleum represent such an outstanding contribution to applied chemistry as to qualify him unmistakably as a nominee for the Inventor of the Year Award. From his own creative work and the widespread use under license of the patented processes resulting therefrom, there has arisen a vast technology based on new refining techniques, on novel applications of chemical and engineering principles, and on the manufacture and large scale use of new catalysts. The results have been of inestimable value to many segments of chemical industry and to the health, economy and resources for defense of the free world. Dr. Haensel's achievements constitute one of those rare cases in which one man's inventions were the basis for enormous technological advances in several important industries.

Born on September 1, 1914, in Freiburg, Germany, Vladimir Haensel spent his early youth in Moscow, Russia. After a brief sojourn in Germany, Austria and France, he came to the United States in June of

* Material submitted in a nomination letter by M. P. Venema of the Universal Oil Products Company, Des Plaines, Illinois.

1930 and was naturalized in 1936. He received a Bachelor's degree in general engineering from Northwestern University in 1935, a Master's degree in chemical engineering from the Massachusetts Institute of Technology in 1937, and a Ph.D. in chemistry from Northwestern University in 1941.

In September, 1937, Dr. Haensel joined Universal Oil Products Company as a chemical engineer. Two years later, he was assigned to the Ipatieff High Pressure Laboratory at Northwestern University as an assistant to Professor V. N. Ipatieff, but returned to the laboratories of Universal Oil Products upon receiving his doctorate in chemistry.

From February to July of 1945, Dr. Haensel served as an inspector of German synthetic oil plants with the Technical Oil Mission for the Petroleum Administration for War. In August of the same year he was appointed Coordinator of the cracking research division of Universal Oil Products Company, and 10 years later became Director of Refining Research. In January, 1960, he became Director of Process Research, and in January, 1964 was elected Vice-President and Director of Research.

Dr. Haensel's many valuable contributions have been recognized by the Chicago Junior Chamber of Commerce Award (1944), the Precision Scientific Company Award for Achievement in Petroleum Chemistry (1952), an honorary degree of Doctor of Science from Northwestern University (1957), the Professional Progress Award of the American Institute of Chemical Engineers (1957), and the American Chemical Society Award in Industrial and Engineering Chemistry sponsored by Esso Research and Engineering Company (1964).

Dr. Haensel's many contributions to the chemistry of petroleum hydrocarbons and to petroleum refining technology have resulted in 107 United States patents, as well as many foreign patents and 57 scientific and technical articles. . . . Because of the policy of Universal Oil Products Company of licensing the processes it develops, Dr. Haensel's patented inventions have benefited hundreds of licensees in virtually every country of the free world. . . .

Dr. Haensel's studies on the catalytic upgrading of low octane gasolines derived from natural gas or petroleum led to the development of the Platforming process — a major advance in petroleum refining. Prior to his work, chemists throughout the world for many years had sought a practical, economical process for the clean-cut upgrading of such gasolines; literally thousands of catalysts had been investigated and discarded. It was Dr. Haensel's original concept to incorporate in a single catalyst several separate functions, which could be brought into balanced, cooperative activity by the selection and careful control of operating conditions.

The first commercial Platforming unit went into production in October, 1949, at the Old Dutch Refinery, Muskegon, Michigan. Today, little more than a decade and a half later, over four million barrels per day of naphthas are reformed with platinum catalysts throughout the world, in plants estimated to cost nearly $2 billion, with catalysts valued at over $200 million.

In addition to upgrading low-octane gasoline, the Platforming process is used for the production of benzene, toluene and xylenes, materials which are of great importance to the chemical industry and to the defense program. As a result of this production, petroleum refiners are now able to supply over 1.2 billion gallons of such aromatics annually to the United States chemical industry—over eight times the amount available from the coal tar industry.

Thus, it is apparent that a huge new technological complex involving catalyst manufacture, petroleum refining, and a great expansion of aromatic hydrocarbon and other petrochemical production have all stemmed from the pioneering inventions of Dr. Haensel on the use of platinum-containing catalysts in petroleum refining. It was in recognition of his work on Platforming that Dr. Haensel was given the 1952 Precision Scientific Company Award for Achievement in Petroleum Chemistry.

Dr. Haensel's recent efforts have contributed to the development of unique catalysts capable of effecting nearly complete removal of the unburned constituents of automobile exhaust gases. The Purzaust catalysts are capable of operating for long periods of time, even with motor fuels containing tetraethyl lead—normally a poison which causes rapid deactivation of most oxidation catalysts. The Purzaust device, when attached to the automobile exhaust system, has demonstrated the feasibility of the control of undesirable exhaust gas components which have been shown to be a major factor in the formation of smog in California and other locations.

In summary, Dr. Haensel's creative contributions to the field of petroleum refining have significantly affected chemical industry and the economy of the free world in the following ways:

(1) Refiners are now able economically to raise the quality of their gasoline to hitherto unattainable levels, permitting the use of higher compression automobile engines and greater economy of motor fuel use.

(2) Chemical industry has been provided with a new major source of raw materials in the form of petrochemical aromatics.

(3) Cheap by-product hydrogen has been made available for both refining and chemical uses.
(4) A vast new technology based on the manufacture and large-scale use of platinum catalysts has been created, which has required large capital investments and provided many new jobs.
(5) Extension of the use of rugged multi-functional catalysts to the purification of automotive exhaust gases has opened the way to elimination of urban smog, thereby contributing materially to the health and welfare of urban populations.

THIS LABORATORY* NOMINATES Mr. Frederick C. Alpers of Riverside, California for the 1965 Inventor of the Year Award. Mr. Alpers is employed as Associate Department Head (research) in the Missile Systems Department of this Laboratory.

Frederick C. Alpers

Mr. Alpers has been engaged in guided missile development for over 20 years and in that time he has acquired a background of experience, established a record of productivity and achieved a stature in the field that few can match. Joining the staff of the Massachusetts Institute of Technology Radiation Laboratory upon graduation from Yale in 1943, he was assigned to a group stationed at the National Bureau of Standards which was then initiating a program of guided missile development, one of the first efforts in this country.

During World War II, he was engaged in development of the guidance systems for the PELICAN and BAT missiles. The PELICAN was the first fully automatic homing missile and was guided by a semi-active radar. The BAT was the first active radar homing missile.

After the war, this line of endeavor (anti-ship weapons) was continued at the National Bureau of Standards under Navy sponsorship in the KINGFISHER program. Since establishment of the Naval Ordnance Laboratory in 1953, he has continued to be in the forefront of missile systems development work. He has conceived new missile systems and new guidance systems and directed the development work deriving from these concepts.

His efforts over the years at this Laboratory have culminated in the form of over 50 patent disclosures for specific applications in a variety

* The above nomination letter was submitted by F. S. Atchison, Technical Director of the U.S. Naval Ordnance Laboratory, Corona, California.

of missile systems. . . . This sustained and creative output has been primarily in classified areas, which precludes the publishing of results in the form of papers available to the scientific community. Some major contributions have been in connection with the following:

(1) PETREL (circa 1944) of which his proposal for altimeter control was the basis.

(2) Automatic in-flight target acquisition (circa 1944) for MAGPIE and later PUFFIN.

(3) Invention and development of automatic tracking television guidance (AVOSET circa 1951).

(4) Invention and development of leading edge tracking (PUFFIN circa 1948).

(5) Invention and development of "conopulse" lobing system, CORVUS (circa 1956).

(6) Invention and development of an angle grating system (1957).

(7) Gray-level tracking (1963).

Taken collectively, the above represent outstanding advancement in the field of missile guidance as it exists today. The AVOSET concept is the basis of the WALLEYE system which is in the advanced development stage. The original work carried out for CORVUS has formed the basis for the present development effort as ARM I. Other contributions are now incorporated into existing weapons systems or figure heavily in the most advanced systems development work presently being carried out in the Navy. His selection to serve on the Tripartite Technical Cooperation Program group is one indication of his national and international reputation in the missile field. This working group is composed of members from the United Kingdom, Canada and the United States. As one of two Navy representatives, Mr. Alpers serves on the Panel for Air-to-Surface Missile Guidance and Control.

The development period for modern missiles extends over several years and the evaluation of a new set of ideas is not possible for several years after their origin. Because of this and since current projects are of such a classified nature that they cannot be discussed in detail, the more recent contributions cannot be accurately rated at this time. However, the continuing level of progress is attested to by the fact that 23 inventions have been submitted for patent action since 1962. Five of these have been disclosed this calendar year.

Although Mr. Alpers has consistently done excellent work throughout his career, his work in the recent past has been characterized by a maturity and depth of thought, a novelty in concepts, a profusion of ideas and a thoroughness in execution which marks him as a man of truly outstanding ability and accomplishments. In the field of missile systems design and guidance systems he has no peer. This eminence led to his being awarded the Arthur S. Fleming Award in January 1960 as one of the outstanding young men of the year in Government service for his numerous and valuable contributions in the design of guided missiles. This is indicative of the fact that he has proven to be one of the most original, energetic, and talented scientists in the country today. In addition, he has a keen appreciation and knowledge of Navy strategy and tactics which is a great asset to him in his guided missile efforts.

W. Jerome Peterson

PERHAPS THE ENCLOSED PRINTED INFORMATION* will interest you. I am just a housewife and mother so I hope you will please forgive me if a I have broken all the rules of business by sending my husband's name in for this nomination.

> For more than a year, a stream of men and women hastened to the big red brick house on Central Ave.
>
> Four or five times a day, seven days a week, five minutes at a time, teams of three worked together.
>
> They were waging an endless struggle to free a little boy from the prison of his own body and damaged brain.
>
> The patterning sessions, simulating the crawling and creeping a healthy baby progresses through naturally, were designed to help undamaged brain cells take over the functions of those which had been injured when the child was two months old.
>
> Now, for eight-year-old Kevin Shields, son of Judge and Mrs. Vincent Shields, a machine has taken over most of the work of the volunteers. Massive doses of the patterning therapy can now be given the child without depending on outsiders. Mrs. Shields can buckle Kevin into place and the machine works his arms and legs in perfect synchronization while she moves his head accordingly.
>
> The machine was developed by W. Gerald [sic] Peterson of Staunton, Va., a former aeronautical engineer who made frequent trips to Wright-Patterson Air Force base. The first one was finished in May 1964.
>
> The eight-year-old son of a Monterey, Va. physician who has worked with Peterson was involved in an accident and completely immobilized. The child was given hand-patterning at first, then heavy machine therapy.
>
> "Normally, he'd have gone into an institution," observed Peterson. "Now he's back in school, gets good marks."

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* Mrs. W. Jerome Peterson of Staunton, Virginia sent this letter nominating her husband and enclosed the above news story which is reprinted from the *Dayton Daily News* of August 16, 1965.

A small crew of six builds the machines in a shop near Peterson's home. His wife handles the correspondence. Peterson and a colleague spend considerable time on the road helping to adjust and adapt the device to individual patients. Most of them, he explained, were referred by the Philadelphia Institutes.

"At first, we thought we'd be able to turn out one a month. Now it's two a week."

The machines sell for $3,200 but because of the need for individual adjustment, Peterson admits they're lucky to come out even right now.

A man of deep conviction, Peterson looks at the problem philosophically as he ponders the plight of the 5½ million retarded children in the country.

MR. EDWARD J. SCHAEFER* is the President and Chairman of the Board of Franklin Electric Co., Inc., of Bluffton, Indiana. He entered the Engineering School of the Johns Hopkins University in the fall of 1920 and graduated with the degree of Bachelor of Engineering in Electrical Engineering, having completed the normal four-year course in three years.

Edward J. Schaefer

After several years spent in the design of large synchronous machines in the Alternating Current Engineering Department of General Electric, he transferred to the Fort Wayne plant of that company. He was in charge of the electrical design of the Fractional Horse Power Engineering Department of General Electric Company at Fort Wayne where he resigned in 1942 to organize with a partner the Electric Motors and Specialties Company of Fort Wayne, Indiana.

He withdrew from this partnership in 1943 and, with T. W. Kehoe also of Fort Wayne, Indiana, organized in 1944 the Franklin Electric Company of Bluffton, Indiana as a partnership. This company was then incorporated in 1946 with Mr. Schaefer assuming the offices of President and Chairman of the Board. From the company's founding until 1961 Mr. Schaefer, in addition to his duties as President, also functioned as the Chief Engineer of the company.

Probably the most significant developments by Mr. Schaefer contributing to the growth of the Franklin Electric Co. are those made in connection with submersible motors. The primary use of these

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* Frank R. Thienpont, a Chicago attorney, sent in the above biographical material on Edward J. Schaefer.

motors has been in connection with water systems for powering pumps that supply water.

Franklin Electric's business, of course, was that of designing and manufacturing motors for specialized applications. Mr. Schaefer had long been a proponent of the use of a submersible motor in connection with water well pumps. So in the late 1940's he started a program of investigation, testing and development on submersible motors. Finally in 1950 Franklin introduced the first practical submersible electric motor based on one of Mr. Schaefer's inventions, disclosed in his United States Patent No. 2,654,848. It provided what no submersible motor up to that time had been able to provide—reliability and efficiency. This motor includes a thin metal liner bonded to the inside of the stator to hermetically seal the stator windings against the liquid in which the motor was immersed. Mr. Schaefer's design was able to provide this feature without using a liner that was so heavy that it would destroy the electrical characteristics of the motor. The motor was the starting point for the submersible motor business which has now grown to worldwide leadership and which represents a very significant part of the business of Franklin Electric.

First, however, there were a number of hurdles to get over before submersibles would be generally accepted in the industry. Pump manufacturers, already stung by unsuccessful submersibles were very skeptical. Pump installers, accustomed to rough mechanical work, quite often damaged electrical connections when putting the pump in the well. Even employees in the Franklin plant, somewhat astonished at the idea of running electrical motors hundreds of feet below the ground and water in the well, were doubtful whether they could make production which would work consistently. This meant several years of day and night effort to fully win over the manufacturers, to train the installers through personal demonstration and even through the use of comic book show-how literature, and repeated encouragement and corrections of off-standard conditions in the plant before real success in submersibles began.

Subsequently, Mr. Schaefer made many improvements to the submersible motor and new features were added. Mr. Schaefer holds approximately 20 United States patents on submersible motors alone. Features of more than one-half of this group of 20 patents are used on Franklin's current submersible motors.

These motors have found their primary use in water systems for supplying farms, suburban dwellers and schools, hospitals and industrial users in rural areas. But the use of these motors is now expanding to other areas. Franklin submersible motors are being used in gasoline dispensing systems, secondary oil recovery processes and sealed air conditioning systems.

The basic principles employed in the Franklin submersible motor design have recently been applied to sealed air conditioning systems. Such a system usually is under a vacuum. One of the difficulties in placing a conventional motor in such a system is that the vacuum condition tends to suck the lubricating grease away from the motor bearings. In the Franklin submersible motor, of course, no such lubrication is necessary, the lubrication of the bearings being supplied by the fluid in which the motor is immersed.

Another recent application of Franklin submersibles has been in the secondary oil recovery process. Since many oil wells are at a depth of more than 5000 feet below the earth's surface, additional special problems have been encountered. These include high pressures and temperatures in the area of 250°F. But these and other problems have been overcome and Franklin submersibles are operating successfully at these depths. New developments in this area include the tandem arrangement of a series of motors coupled to each other. This provides the distinct advantage of easier handling in the field of smaller motor units which can be assembled to each other at the well site rather than handling a single large motor unit which sometimes is as much as eight to ten feet in length.

So significant have been the submersible motor developments of Mr. Schaefer and Franklin that today 50 percent of the submersibles sold in the industry are of Franklin Electric manufacture.

Mr. Schaefer's technical achievements have been honored in the past by General Electric's Coffin Award and elevation to Fellow in the American Institute of Electrical Engineers. Starting with an investment of $20,000 he has built an organization which today contributes more than six million dollars annually to the Bluffton Community. The growth of this company has been based on his technical developments, evidenced, in part at least, by the 50 patents he holds on developments made while associated with Franklin and most of which are or have been used on Franklin products.

Here is certainly a prime example of the incentive provided by the American patent system and the part that system has played in contributing to the support and growth of the middlewestern community of Bluffton, Indiana.

On behalf of General Electric Company,* I hereby nominate Dr. W. T. Grubb, Jr. for the 1965 Inventor of the Year Award sponsored by The George Washington University.

Dr. Grubb, who lives at 1800 Hillsdale Avenue, Schenectady, New York, is the inventor of the ion-exchange resin membrane fuel cell, the fundamental unit of the on-board power source for the recent Gemini 5 space flight. He holds the basic patent covering this fuel cell, U. S. 2,913,511, issued November 17, 1959, a copy of which is attached.

W. T. Grubb, Jr.

One of the important advantages of this type of fuel cell is that it is simple, light, reliable, compact, well adapted to gravity-free operation and requires a minimum of peripheral equipment. During the Gemini space flight, the importance of these advantages repeatedly became clear as difficulties in the peripheral equipment (not in the power source) first delayed and subsequently endangered the mission. One of the main attributes of Dr. Grubb's invention is the saving in weight made possible by use of the fuel cell. Future Gemini missions could not be carried out as planned if conventional batteries had to be used because this would entail a prohibitive increase in weight, not only in the vehicle but also in the fuel required to launch it. In addition, the fact that Dr. Grubb's invention contains a virtually solid electrolyte makes for simplicity and reliability in space operation that fuel batteries with liquid electrolytes are not likely to achieve.

Water is a by-product of Dr. Grubb's fuel cell; by slight treatment this water can be rendered potable, thus making possible further savings in weight and space by reducing the amount of water placed aboard a space vehicle destined for long missions. It is expected that Dr. Grubb's invention will eventually make possible a regenerative power source for use in space. Such a power source uses electricity derived from solar energy during the orbital day to generate hydrogen and oxygen that are recombined in a fuel battery to supply electricity needed during the orbital night.

It is expected further that Dr. Grubb's invention will prove useful in sources of ground power, first for military, and subsequently for commercial applications.

A fuel cell invented by Dr. Grubb was first launched and operated successfully in space on October 13, 1960. The successful operation of this fuel cell and batteries made therefrom on the Gemini 5 flight is adequately attested to by numerous individuals associated with this flight.

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* A letter submitted by Joseph T. Cohen, Patent Counsel, Chemistry Research, General Electric Company, Schenectady, New York.

For example, in referring to the above-described fuel cell, Charles Mathews, Gemini Program Manager, NASA, stated: "The fuel cells worked perfectly under some unusual conditions. They would have gone for another thirty days, the way they looked."

Christopher Kraft, Flight Director, NASA, in describing the operation of the fuel cell said: "We should stress that the fuel cells are working perfectly. I wish we could get them back so we could put them on Gemini-7."

In discussing the flight of Gemini 5, the *New York Times* commented, "In a sense, the real hero of the situation is the fuel cell." In addition to being hailed as an important factor in man's ability to explore outer space, Dr. Arthur M. Bueche, Vice President, General Electric Research and Development Center, called the fuel cell "the first practical, major power source to be developed since atomic energy." In addition to the comments cited above, astronaut L. Gordon Cooper, Jr., in an interview, stated that the fuel cell worked "perfectly."

Dr. Grubb is engaged in further research in the fuel cell area and is part of a concentrated effort located in General Electric's Research and Development Center at Schenectady, New York, and in the Direct Energy Conversion Operation at Lynn, Massachusetts (which designed the fuel cell and batteries used in the Gemini 5 flight), in order to improve further this type of electric power generation.

Dr. Grubb, who is 42 years old, received his B.S. "in absentia" from Harvard College in 1946 while serving with the U. S. Navy, subsequently returning to Harvard Graduate School where he received his Ph.D. in physical chemistry in 1949. Later that year he joined the staff of the Research Laboratory of the General Electric Company, in Schenectady, New York. From that period to the present, in addition to his research studies on fuel cells, he has carried out basic research investigations in the fields of electrochemical fluorination, kinetics of silicone polymerization and rearrangement reactions, as well as studies in batteries and other areas of electrochemistry. Dr. Grubb holds seven other patents in the United States and has published 27 scientific papers. He is a member of the American Chemical Society and the Electrochemical Society.

IT IS A DISTINCT PLEASURE FOR ME to heartily recommend Dr. Algirdas L. Nasvytis of Cleveland, Ohio for your award.

As the enclosures will describe, Dr. Nasvytis is a Staff Engineering Specialist at TRW Inc.* His continuing work in the initial invention and subsequent development of the TRW *Roller Friction Drive* has been instrumental in arousing an unprecedented degree of industry-wide interest in this new product.

Algirdas L. Nasvytis

In the fall of 1960, Dr. Nasvytis began a study of the torpedo transmission problem: that of providing a high-speed, high-power transmission at the lowest possible noise level. He conceived the idea of a multi-roller planetary cluster. This simple planetary system, consisting of a sun gear, planets, and ring gear, has a very wide application in planetary gear systems in all roller and ball bearings and in simple planetary friction drives which were described in some European handbooks as far back as one hundred years ago. The simple planetary system has maximum ratio limitations. For higher ratios, a planetary system in series is usually used. The most promising way to reduce the torpedo drive noise problem was a friction drive, but analysis had proven that to use a planetary friction drive in series to obtain high ratios was disadvantageous from various points of view. Therefore, the following idea was explored: To obtain higher ratios in one unit, Dr. Nasvytis inserted many rows of stepped planets between the sun roller and ring. Further analysis has proven that in this type of drive, the necessary preload forces can be balanced by exploiting toggle force amplification. An extensive patent search has proven that this entire field is completely uncovered by any patents.

Dr. Nasvytis further discovered that not only does a multi-roller friction drive offer an advantageous torpedo transmission design, but the kinematical frame of this drive offers high advantages in gear drives, bearings, clutches and brakes. In other words, a multi-roller planetary cluster is a new type of mechanism which will render marked improvements in the power transmission and bearing field, especially for ultra high speeds and temperatures.

From every indication in our own analyses and continuing laboratory tests and in work done for TRW's customers, the Roller Friction Drive (and its associated Roller-Gear Concept) offer really significant improvement in efficiency, in reliability, and in required size and weight, over more conventional planetary transmissions of either roller or gear designs. Those agencies in the Government (U.S. Army's Fort Eustis Labs and the Naval Bureau of Weapons) which have been observing our continuing development have been most enthusiastic

* P. J. Lawlor, Project Engineer of the Accessories Division of Thompson Ramo Wooldridge Incorporated, Cleveland, Ohio, sent in the letter quoted above.

and cooperative in their interest in seeing the Roller System Concept eventually applied to helicopter power trains and other weapons systems power components where weight and reliability are paramount factors.

As the result of Dr. Nasvytis' dedication and efforts, we at TRW are now completing work on four contracts in important defense areas which are directly based on the Roller Drive Concept. . . . Its application to commercial usage is enjoying a similar degree of success and we are looking forward with interest to that time in the near future when Dr. Nasvytis' concepts will be employed in civilian-oriented work ranging from biomedical research to dynamic test machinery.

There is another factor which prompts me to make this recommendation; Dr. Nasvytis has accomplished his level of eminence in the scientific community as a new citizen of the United States, after escaping communist oppression in his native Lithuania and the chaos of postwar occupied Germany. Dr. Nasvytis received the degree in Mechanical Engineering from the University of Kaunas in Lithuania in 1937. He studied at the Technische Hochschule in Berlin and received the Doctor of Engineering degree from the Technische Hochschule in Hanover in 1949.

Dr. Nasvytis served as an instructor and lecturer at the University of Kaunas and was a member of the research staff at the Berlin Technische Hochschule. Coming to this country in 1950, he joined Addressograph Multigraph Corporation as a Product Designer. In 1952, he became Project Engineer at White Motor Company, where he was concerned with the fields of dynamics, stress, and vibrations applied to internal combustion engines. He joined TRW in 1956 as an Engineering Specialist in stress and vibration.

DR. ALBERT ROSE,* a Fellow of the Technical Staff of RCA Laboratories at the David Sarnoff Research Center, Princeton, New Jersey, is credited with a series of important discoveries and applications in the fields of photoconductivity and photosensitivity, including basic contributions to the development of the Orthicon, the Image Orthicon and the Vidicon television camera tubes.

A native of New York City, he attended Middletown High School,

* This background material on Dr. Rose was submitted by Bruce H. Shore, Administrator, Public Affairs, RCA Laboratories, Princeton, New Jersey.

Middletown, New York. In 1931 he received an A.B. degree and in 1935 a Ph.D. degree in physics from Cornell University.

Albert Rose

Dr. Rose joined the Radio Corporation of America in 1935 in Harrison, New Jersey, as a member of the tube research group which was then engaged in an effort to improve the sensitivity of the Iconoscope, the pickup tube of early television systems. This research effort culminated in the initial development by Dr. Rose in 1937 of the Orthicon. Details of the new pickup tube were described in a technical paper by Rose and Harley Iams in 1939. When RCA and NBC introduced television as a new public service at the New York World's Fair in April, 1939, cameras employing the new Orthicon tube were a vital part of the system. Used to record numerous "firsts" in TV history, the Orthicon was later superseded by the far superior Image Orthicon.

When RCA Laboratories was established in 1942, Dr. Rose transferred to Princeton, bringing with him an already completed model of what later became the Image Orthicon. At Princeton he was joined by two RCA scientists from Camden, Dr. P. K. Weimer and Dr. H. B. Law, who had developed what was essentially an electrostatic counterpart of Rose's tube. The three proceeded to combine their efforts to perfect a new pickup tube with increased sensitivity, greater contrast, improved picture quality, and decreased size and weight. The Image Orthicon was turned over to the War and Navy Departments in October 1943 for use in guided missiles. Since 1945, it has been adopted throughout the world as the major source of live television broadcasts.

In 1942 Dr. Rose became interested in the relative limitations in the light sensitivity of photographic film, television pickup tubes, and the human eye. This work resulted in development of a theory of visual sensitivity based on the absolute scale of the noise limitations due to the quantum nature of light.

His studies in the field of solids led to his widely recognized work on the theory and analysis of photoconductivity and related phenomena in insulators and semiconductors. His current work is in the areas of space-charge-limited current flow, injected plasmas in solids and electron-phonom interactions in solids.

From May 1955 to July 1957, Dr. Rose headed the research activity of the then newly established Laboratories RCA, Ltd., Zurich, Switzerland. On his return to Princeton he resumed research relating to the study and application of photoelectric phenomena. In 1959 Dr. Rose was named a Fellow of the Technical Staff.

In 1959 Dr. Rose appeared as a guest lecturer on the subject of "Electron Optics" on NBC's educational science program, CONTINENTAL CLASSROOM. In 1961 he presented a series of four lectures on photoconductivity at the International Summer Course in Solid-State Physics held at the University of Ghent, Belgium, under the auspices of NATO. He has also lectured at summer schools of the University of Illinois (1953), California Institute of Technology (1961), University of Rochester (1963) and the Massachusetts Institute of Technology (1963). During the academic year of 1961-1962, he was a visiting lecturer at Princeton University.

The recipient of two RCA Laboratories Achievement Awards in 1947 and 1951, Dr. Rose has had about 35 United States patents issued in his name. He has published 45 technical papers and articles. He is the author of a book, *Concepts in Photoconductivity and Allied Problems*, published by John Wiley & Sons in 1963.

In 1945 Dr. Rose received the Television Broadcasters Association Award and the Morris Liebmann Award of the Institute of Radio Engineers (now IEEE). The next year he received the Journal Award of the Society of Motion Picture Engineers. In March 1958 he was one of two recipients of the first David Sarnoff Outstanding Achievement Awards in Science and Engineering. He was cited on this occasion "for basic contributions to the understanding and utilization of photoelectric phenomena." In October 1958 he received the David Sarnoff Gold Medal Award of the Society of Motion Picture and Television Engineers for basic contributions to the development of the Orthicon, Image Orthicon, and Vidicon television pickup tubes.

DR. SIDNEY BERTRAM* RECEIVED a B.S. degree (with honors) in Electrical Engineering in 1938 from the California Institute of Technology. From the Ohio State University, he was awarded an M.S. degree in Communication Engineering in 1941 and Ph.D. in physics in 1951.

Sidney Bertram

Prior to joining The Bunker-Ramo Corporation he worked for the System Development Corporation as head of the Engineering Department where he was responsible for engineering aspects of implementation of the Air Defense Training Program including the development of radar simulation equipment. As a staff engineer at the Rand Corporation he conducted studies in radar coun-

* Quoted from a nomination letter sent in by Ralph W. Sheehy, Director of Information Services, Defense Systems Division of The Bunker-Ramo Corporation, Canoga Park, California.

termeasures and antennas, and was a consultant on the development of special electronic equipments.

From 1946 to 1951 he taught electrical engineering at Ohio State University as an Assistant Professor and prior to that worked for Boeing Aircraft where he was responsible for the development of a guidance signal sensor for Beam Riding Missiles. During World War II he was with the Underwater Sound Laboratory of the University of California Division of War Research where he developed special electronic circuits for use in PPI sonar equipment. He received a Certificate of Commendation from the Bureau of Ships for this work. Four patents were granted to him as a result of this work, namely:

(1) Plan-position oscilloscope sweep circuit.
(2) Split-phase servo motor control.
(3) Multiple channel electronic switch.
(4) Multichannel electronic switch.

Dr. Sidney Bertram has been a Technical Consultant for The Bunker-Ramo Corporation (formerly the Computer Division of Thompson-Ramo-Wooldridge) since 1957.

During this period he has made 50 invention disclosures; many of these disclosures are either scheduled to form the basis of a patent application or are now in the patent application stage. One patent has been granted. The disclosures cover a wide range of technical achievements, but Dr. Bertram's most important contributions center around the automatic map compilation systems that have been his chief concern at Bunker-Ramo.

Dr. Bertram's system measures altitudes from stereo pairs of aerial photographs and, using the altitude data, produces a new photograph, an orthophoto, in which the distortions due to altitude variables have been removed. The first operational system, the Automatic Stereomapping System, photographically produces an orthophoto and a chart providing the desired elevation information. A pair of transparencies corresponding to particular aerial photographs is placed in the projection apparatus of a Kelsh plotter and light is directed through them to develop the corresponding stereo image. A precision mechanical scanning apparatus replaces the conventional test surface of the plotter and is moved over the area being mapped. A pair of photomultiplier tubes are utilized to develop control signals for servomotors that are arranged to adjust the elevation as the scanning apparatus is moved over the area of the photograph.

Dr. Bertram next developed the Automatic Map Compilation System. The significant features of this system include the improved efficiency and speed made possible by jointly operating both digital computer and analog elements to solve the map compilation problem of determining accurate elevation levels. A closed loop servosystem, including the digital computer is used, greatly reducing the requirements which would otherwise be imposed on either an all digital or strictly analog equipment.

The system provides for a simultaneous printout of altitude charts and orthophotos from computer controlled equipment. High speed servo operation is achieved using an image motion compensation technique in which the instantaneous errors in the mechanical positions are compensated by an offsetting motion in the trace on the flying spot scanners used to view the photographs. The equipment effectively moves in digitally defined steps over the area represented by the stereo image, making digital altitude measurements to high accuracy at up to 80 measurements per second.

Among the many disclosures Dr. Bertram has made in fields unrelated to map compilation is a Mean Vector Analyzer, a weather station instrument that provides an indication of the vector sum of wind velocity over a specific time period; a neutron detector for detecting the extent of thermal neutron flux out of nuclear reactors; a word searching device to identify letters and words, which, when matched with stored key words, indicates the pages of most interest to the reader. He has also developed a solar sensor for a precision control of a solar telescope; a novel packaging technique for viscous fluids; and a new type of memory plane for computers.

REVIEWS AND ANNOTATIONS

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"Our interest in this meeting had its origin in our studies of possible United States adherence to the Madrid Agreement which have been carried on intensively since June, 1965. . . .

"The purpose of this report is to summarize the results of the meeting in the context of our own studies. . . .

"The most important conclusion from this meeting from the standpoint of the question of adherence was to reassure us that, with the exception of renewals, no significant changes in our substantive trademark law would be required in order to effect adherence. It should be pointed out, as the underlined words indicate, that this does not mean implementing legislation is unnecessary. . . ."

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"The inventor thinks nothing of spending a small fortune in developing a new idea, shrugs off nights of sleeplessness, cheerfully gets into debt—but he shrinks from spending even a small fraction of his time and money preparing his invention for the market place. We return to the main theme of this address again and again: you must prepare your approach to industry in a professional manner."

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"It is suggested that this procedure be revised and the main consideration be given not to the claims in the various applications but the main attention be directed to the disclosure. It is the first disclosure which determines the priority which can be claimed in Great Britain. It is sufficient for creation of a Convention date if the disclosure mentions the inventive features generally in view of the concept of the legitimate development. . . ."

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Krieger, Albrecht, "A New International Organization for Intellectual Property?", *Industrial Property* (February 1966), pp. 37-48.

"On the invitation of the Director of the United International Bureaux for the Protection of Intellectual Property (BIRPI) a Committee of Experts of the Member States of the Paris Union (for the protection of industrial property) and the Berne Union (for the protection of literary and artistic works) met at Geneva from March 22 to April 2, 1965.

". . . The purpose of the meeting was to draft a multilateral Convention for the establishment of a new world-wide international Organization for intellectual property. Through this new agreement it was intended to adapt the organs of the Paris and Berne Unions, which were founded at the end of the nineteenth century, to contemporary international developments, and to create the conditions for universal adherence to the two Unions, with particular reference to coverage of the developing countries. In its discussions the Committee had before it a preliminary draft

prepared in May 1964 by a Working Group consisting of experts from ten Member States.

"After differences of opinion which were sometimes violent and on several occasions brought the meeting to the verge of breakdown, a compromise solution was found. This consisted in the adoption of a Draft Convention on the establishment of a new International Intellectual Property Organization, as well as a Draft Protocol to be appended in the appropriate wording to the two existing Conventions and the Special Agreements under the Paris Union. In addition a joint report was adopted. The adoption of this compromise solution should not, however, conceal the fact that there is no certainty of a unanimous attitude on the part of Member States to the various questions dealt with by the Committee. Although it was only termed a Committee of Experts, whose decisions are not binding on the Governments of Member States, several delegations made general statements reserving their respective Governments' right to reject the whole of the Committee's decisions."

Kupferman, Latman, Schulman, Tannenbaum, Wehringer, "Arbitration of Copyright Problems: A Colloquy Among Members of the New York Patent Law Association," *Arbitration Journal*, Vol. 21 (1966), p. 1.

Ladas, Stephen P., "Additional Memorandum," *The Trademark Reporter*, Vol. 56, No. 5 (May 1966), pp. 361-367.

"Adherence of the United States to the Madrid Agreement in its present form does require important changes of our trademark law, and it is incumbent upon us to consider whether we are prepared to make these changes. . . .

"American trademark owners should also consider what amendments of the Agreement would make it really beneficial to our people.

". . . The only safe way for us to proceed is to suggest that if the changes we desire are made to the present text of the Agreement, we may then give favorable consideration to adherence."

Ladas, Stephen P., "The Madrid Agreement for the International Registration of Trademarks and the United States," *The Trademark Reporter*, Vol. 56, No. 5 (May 1966), pp. 346-360.

"(a) The Madrid Agreement for the International Registration of Trademarks is fundamentally objectionable in the light of present needs of international commerce.

"(b) While American trademark owners may obtain a saving of expense through international registrations, there are serious disadvantages to such registrations as compared with national regis-

trations in individual countries.

"(c) Extension to the United States of many thousand foreign marks by operation of the Madrid Agreement would involve serious difficulties and substantial increase of personnel and expense in the United States Patent Office, and grave prejudice to American trademark owners."

Ladas, S. P., "Problems of Licensing Abroad," *University of Illinois Law Forum, 1965* (Fall 1965), p. 411.

"Legal Protection of Computer Programs," *Journal of the Patent Office Society,* Vol. 47 (December 1965), p. 955.

Leydig, C. F., "Protecting Trade Secrets When Employees Move," *Business Lawyer,* Vol. 21 (January 1966), p. 325.

Loevinger, Lee, "Regulation and Competition as Alternatives," *Antitrust Bulletin,* (1965), Vol. 11, Nos. 1 and 2, pp. 1-40.

"The difficulty in the past has too often been that statutes have been enacted with the imperfections and inadequacies of the competitive system fully exposed to the critical eye of the legislature, while the remedial regulatory agency had the advantage of existing only in the hopeful contemplation of its advocates. The system of regulation through specialized administrative agencies is a recent innovation which has never been systematically rationalized and is yet in the process of development. The regulatory process will inevitably change and inexorably evolve in some manner over the course of time; and our only choice is to leave the direction of evolution to chance or to attempt to guide it by conscious and intelligent effort. The most urgent need in the field of the government in relation to economics is for a theory of regution that is rigorous enough to provide some conception of the regulatory function, the mechanism by which it operates and and the parameters by which its effects may be predicted, that is broad enough to encompass a vision of the goals which regulation seeks and that is precise enough to provide a map of the path to its goals."

Maggs, Peter B. and James W. Jerz, "The Significance of Soviet Accession to the Paris Convention for the Protection of Industrial Property," *Journal of the Patent Office Society,* Vol. 48, No. 4 (April 1966), pp. 242-263.

". . . The following discussion will therefore be limited to a bare outline of the Soviet legislation, plus an analysis of developments since 1960."

Maier, H. G., "New Look at the European Patent: Limited Availability," *Vanderbilt Law Review,* Vol. 19 (March 1966), p. 257.

Meek, M. R., "Overseas Distributorship Agreement," *Business*

Law, Vol. 21 (April 1966), p. 661.

Meier, G. M., "Legal-Economic Problems of Private Foreign Investment in Developing Countries," *University of Chicago Law Review,* Vol. 33 (Spring 1966), p. 463.

Melville, L. W., "Powers of Attorney in Patent Licensing Agreements," *Journal of Business Law 1966,* (April 1966), p. 129.

Merchant, J. H., "Deceptive and Descriptive Marks," *Trademark Reporter,* Vol. 56 (March 1966), p. 141.

Merna, James E., "The American Patent Law Association and Its Leadership," *Journal of the Patent Office Society,* Vol. 48, No. 4 (April 1966), pp. 264-273.

"At this point, let us now delve into the makeup of the American Patent Law Association itself. What type of organization is it? What is its purpose? What is its relationship to the Patent Office and its role in the Patent System? How effective has it been and in what direction is it headed?"

Miles, J. W., "Methods of Law Reform in Regard to Current Problems of Copyright and Related Matters," *Bulletin of the Copyright Society of the U.S.A.,* Vol. 13 (February 1966), p. 171.

"Moral Judge and the Copyright Statute. The Problem of *Stiffel* and *Compco,*" *Copyright Law Symposium (ASCAP),* Vol. 14 (1966), p. 90.

Nelson, G. J., "Copyrightability of Computer Programs," *Arizona Law Review,* Vol. 7 (Spring 1966), p. 204.

Nordhaus, R. C., "Patent License Agreements," *Business Law,* Vol. 21 (April 1966), p. 643.

North, P. M., "Disclosure of Confidential Information," *Journal of Business Law, 1965,* p. 316; (October 1965-January 1966), p. 31.

O'Brien, Gerald D., "The Madrid Agreement Adherence Question," *The Trademark Reporter,* Vol. 56, No. 5 (May 1966), pp. 326-336.

"On balance of these points and others, it seems to us adherence is worthwhile, but we have not yet arrived at a fixed official position because it seems to us important to hear from bar associations, trade associations and other groups who are contemplating or have already made initial studies of this question."

O'Brien, Gerald D., "Our International Patent Program," *Journal of the Patent Office Society,* Vol. 48, No. 5 (May 1966), pp. 283-290.

"Now, our international program has as its long-range objective the development of patent and trademark systems internationally which will improve the protection of industrial property rights to the economic interests of the United States. This involves, of course, the development of an international patent system under which a single patent would be issued which would be effective in many countries.

"We should not consider this an impossible goal. However, we do recognize that it may be many, many years away. Consequently, we must fashion our program so that, while it is directed towards this objective, it way, nevertheless, achieve intermediate goals which are advantageous to United States industry."

Offner, Eric D., "The Madrid Agreement and Trends in International Trademark Protection," *The Trademark Reporter*, Vol. 56, No. 5 (May 1966), pp. 368-390.

". . . It is concluded that the advantages which can be derived by two filings under the Madrid Agreement are already available to knowledgeable American nationals without any of the disadvantages which would arise by United States adherence to this Convention. . . ."

Ordway, G. D., "Choreography and Copyright," *Bulletin of the Copyright Society of the U.S.A.*, Vol. 13 (April 1966), p. 225.

"Patents—Section 103 Obviousness As a Time-Bar Under Section 102 (b)," *North Carolina Law Review*, Vol. 44 (December 1965), p. 208.

"Patents: Supreme Court Holds Post-Expiration Royalty Agreements Unlawful Per Se," *Duke Law Journal, 1965*, (Autumn 1965), p. 836.

Patterson, L. R., "Statute of Anne: Copyright Misconstrued," *Harvard Journal on Legislation*, Vol. 3 (February 1966), p. 223.

Pigott, Charles F., Jr., "Equivalents in Reverse," *Journal of the Patent Office Society*, Vol. 48, No. 5 (May 1966), pp. 291-340.

"This paper will examine the attitude of the courts toward judicial narrowing of patent claims where infringement is the issue, and where validity is the issue. An attempt will be made to determine whether the courts are consistent in their approach to claim interpretation in these two important areas, and whether a generally consistent approach to claim interpretation is desirable, regardless of whether the issue be infringement or validity."

"Piracy Within the Law: A Consideration of the Copyright Protection Afforded Foreign Authors in the United States and the Soviet Union," *Copyright Law Symposium (ASCAP)*, Vol. 14 (1966), p. 226.

Plotkin, M. M.; Mosk, R. M., "Use of Personal Names As Unfair Competition," *Los Angeles Bar Bulletin*, Vol. 41 (April 1966), p. 266.

"Post Expiration Royalty Payments and Mandatory Package Licensing As Patent Misuses," *Villanova Law Review*, Vol. 11 (Winter 1966), p. 382.

Roberts, J. T., "Reappraisal of the American System of Patent Examining," *Journal of the Patent*

Office Society, Vol. 48 (March 1966), p. 156.

Roland, B. I., "Unobvious Properties of a Compound As a Basis for Patentability of Its Precursor," *Journal of the Patent Office Society*, Vol. 48 (February 1966), p. 91.

"Rule 131 Affidavits in Patent Law and Practise: Transformation from Rule to Reason," *George Washington Law Review*, Vol. 34 (March 1966), p. 507.

Schulder, D. B., "Art Proceeds Act: A Study of the Droit de Suite and a Proposed Enactment for the United States," *Northwestern University Law Review*, Vol. 61 (March-April 1966), p. 19.

Schwartz, H., "Common Market Antitrust Laws and American Business," *University of Illinois Law Forum*, (Winter 1965), p. 617.

"Section 184 and 185 of the Invention Secrecy Act—An Ambiguous and Unnecessary Obstruction to Foreign Patenting," *Michigan Law Review*, Vol. 64 (January 1966), p. 496.

"Sleepers in New Foreign Tax Bill; Drastic Changes Require Immediate Planning," *Journal of Taxation*, Vol. 24 (February 1966), p. 108.

Snyder, E. A., "Foreign Investment and Trade: Extraterritorial Impact of United States Anti-Trust Law," *Virginia Journal of International Law*, Vol. 6 (December 1965), p. 1.

Spiegel, I. O., "Sticks and Stones," *Los Angeles Bar Bulletin*, Vol. 41 (May 1966), p. 325.

Spier, L., "Restrictive Business Practices and Competition in the European Economic Community," *California Law Review*, Vol. 53 (December 1965), p. 1337.

Sprudzs, A., "International Trade, Investment and Organization: A Symposium. The Common Market Anti-Trust Laws and American Business."

Schwartz, H., "Common Market for Agricultural Products and Common Agricultural Policy in the European Economic Community;"

Riesenfeld, S. A., "The Right of Establishment of Companies and Free Movement of Capital in the European Economic Community;"

Lang, J. T., "The Montevideo Treaty for a Latin American Free Trade Area;"

Johnson, W. E., "International and Supranational Organizations: Some Problems of Conceptualization;"

Hay, P., "Some Reflections on the Draft Treaty on Execution of Judgments in the European Economic Community;"

Weser, M., "Integration and Economic Development;"

Birmingham, R. L., "The United States and International Unification of Law: The Tenth Session of The Hague Conference;"

Hay, P., "Selected Bibliography

on International Trade, Investment and Organization;"

University of Illnois Law Forum 1965, (Winter 1965), p. 617.

"State and Federal Power in Patent and Copyright," *Copyright Law Symposium (ASCAP)*, Vol. 14 (1966), p. 51.

"Statutory Copyright Protection for Books and Magazines Against Machine Copying," *Copyright Law Symposium (ASCAP)*, Vol. 14 (1966), p. 180.

Stedman, J. C., "Legal Problems in the International and Domestic Licensing of Know-How," *American Bar Association Section of Antitrust Law,* Vol. 29 (1965), p. 247.

St. Landau, N., "Handling of Trademarks Abroad by United States Companies," *Trademark Reporter,* Vol. 56 (April 1966), p. 207.

St. Landau, Norman, "Some Comments on Possible Adherence to the Madrid Agreement," *The Trademark Reporter,* Vol. 56, No. 5 (May 1966), pp. 337-345.

"If industry shows its interest in the adherence of International Protection of Trademarks, it will be possible for United States trademark owners to derive the following substantial benefits therefrom:

(a) reduce substantially the cost of protecting their trademarks in western Europe;

(b) have, through the facilities of the official Geneva International Trademark Registration Office, their United States trademark registrations translated into French and Madrid Agreement registrations originating on the continent translated into English, and brought directly in the United States to the attention of their lawyers.

(c) protect their trademarks in all of Western Europe at a total filing fee not more than the present cost of trademark protection in one or two major western European countries and even prevent trademark raids originating in countries such as Andorra, Egypt, or San Marino, such as the trademark raids from Monaco featured in recent articles;

(d) vest title in United States Madrid Agreement trademarks currently held abroad and thus avoid the undue risk of expropriation directly in United States companies."

Stone, J., "International Consumer Protection by Hallmarks," *New Law Journal,* Vol. 116 (December 30, 1965), p. 280

Surrey, W. S., "Symposium—Counseling Mid-Continent Clients Who Trade Abroad. A Mid-Continent Lawyer's Initial Approach to Foreign Trade."

Hess, F. W., "Industrial Property Rights in International Trade;"

Cooper, J. J., "Tax Considerations for International Operations;"

Slowinski, W. A., "International Litigation and Arbitration;"

Rivkin, D. H., "Financing of Investments Abroad;"

University of Missouri at Kansas City Law Review, Vol. 34 (Winter 1966), p. 2.

"Symposium on Supreme Court Decisions," *APLA Bulletin*, (June 1966), pp. 257-292.

"Our program will be presented by three speakers. The first speaker [Tom Arnold] will trace the history of the requirement of invention or non-obviousness in the patent laws, will discuss how the requirement became a part of our patent statutes and will also discuss the various and differing interpretations of Section 103 by the Courts of Appeals of our ten circuits before the Supreme Court undertook to straighten them all out and give us a simple and easily-understood test. Our second speaker [Virgil E. Woodcock] then has the difficult job of telling us just what is that simple and easily-understood test. Then our third speaker [W. Brown Morton, Jr.] will discuss the Constitutional questions that were raised by and answered by, and perhaps some that might not have been answered by, the Supreme Court in discussing 103."

Thring, M. W., "The Place of the Technologist in Modern Society," *The Inventor*, Vol. 6, No. 1 (February-March 1966), pp. 14-18.

"It is absolutely certain that if Britain is to survive as an economic entity and we are to continue to support education even at the present level, the whole of this academic scale of values must be inverted, as it is in the United States, Russia, Germany, France, the Scandinavian countries and Japan. The only way in which Britain can re-establish her technological lead is through a leavening of the whole of industry by enthusiastic, well trained inventors and originators. This in turn means that it is essential for at least half the brightest young men and women to be trained for creative engineering and technology at the universities."

"Trade Secrets," *Boston College Industrial and Commercial Law Review*, Vol. 7 (Winter 1966). p. 324.

"Trademark Incontestability—Time for the Next Step," *Stanford Law Review*, Vol. 18 (May 1966), p. 1196.

"Trademark Infringement: Accounting of Defendant's Profits in Absence of Direct Competition with Plaintiff," *Columbia Law Review*, Vol. 66 (May 1966), p. 983.

"Unfair Competition and a Private Right of Action," *Utah Law Review*, Vol. 9 (Winter 1965), p. 961.

United States Patent Previews 1965-1970, Bowker Associates, Inc., Washington, D. C., (1966), 1200 pp., $90.00.

"The secrecy surrounding U. S. pending patents became total in September, 1965 when the U. S. Patent Office closed its future assignment records to the public. The only remaining domestic source of information on U. S. pending patents is the open segment of the Patent Office's central Assignment File in Washington D. C., which contains the documents by which employee inventors transfer their patent rights to their employers usually at the time of application. A major cross section of this valuable record—covering applications filed between January 1963 and July 1965 by 800 major U. S. companies—is now available in book form: . . .

"*U. S. Patent Previews 1965-1970* takes its name from the fact that the pending patents it includes are those likely to be issued within the next four years.

". . . Companies are grouped alphabetically—from ACS Industries, Inc. to Zenith Radio Corporation. Within each company entry, the names of its employee inventors are arranged alphabetically, together with the titles of their inventions and the dates the applications were filed. In all, some 60,000 inventions by more than 45,000 scientists and engineers are listed. . . . A general personnel index facilitates finding any individual by name."

Vandenburgh, E. C., "Dilemma of What to Register," *Trademark Reporter,* Vol. 56 (April 1966), p. 214.

Van Panhuys, H. F., and van Emde Boas, M. J., "Legal Aspects of Pirate Broadcasting: A Dutch Approach," *American Journal of International Law,* Vol. 60 (April 1966) p. 303.

Winter, H., "USG International Patent Policy," *Journal of the Patent Office Society,* Vol. 48 (March 1966), p. 143.

NOTES

Nominations for 1966 Inventor of the Year Award Invited

Nominations for the 1966 Inventor of the Year Award are invited by The PTC Research Institute. Closing date for nominations is October 1, 1966. Members of the Research Institute and all other interested persons are asked to submit the names of candidates for consideration by the Awards Board. Submissions should include information to clearly identify the candidate and contain sufficient evidence of his *character* and *contributions* to enable the Board to make an evaluation.

The Inventor of the Year Award honors a journeyman or professional inventor who has made a significant patented invention or inventions even though he may not have had wide public notice. Presented annually, the Award reaffirms the Research Institute's continuing special interest in the accomplishments of creative people by providing a university forum for recognition.

The award program is not necessarily intended to honor the great invention. It affords an opportunity to recognize a relatively unknown dedicated inventor who overcomes obstacles and expends his resources to produce an invention or inventions. The Award is not limited to an inventor's contribution in any one year but will be given for any or all of his achievements to date. Chester F. Carlson was named Inventor of the Year for 1964, and Samuel Ruben won the Award for 1965.

Applications for Edison Fellowship Being Accepted

Applications are now being accepted for the Thomas Alva Edison Fellowship offered by The PTC Research Institute for graduate study of the patent and related systems to students and other qualified professional persons.

The Fellowship of $3,000 is made available annually to the Research Institute by the Thomas Alva Edison Foundation and offers qualified men and women an opportunity to learn by actually doing. The recipient follows an approved program of research under the supervision of a member of the Research Staff of the Institute assigned as counselor to the Fellow.

Applications should be directed to The PTC Research Institute of The George Washington University, Washington, D. C. 20006. Candidates must satisfactorily meet the degree requirements in one of the graduate schools of The George Washington University. The Fellowship may be extended for an additional year to a total of two years should the Institute deem this in the best interests of the Fellowship objectives.

Special assistance from the McGraw Foundation made possible the establishment of the Edison Fellowship.

Trade Secrets in the Context of Positive Competition

L. JAMES HARRIS* AND IRVING H. SIEGEL**

INTRODUCTION

TWO SUBJECTS OF CONTINUING RESEARCH INTEREST to the authors are here brought into conjunction. One of these is positive competition, the nature and implications of which have been explored in three earlier papers on: the patent system, judicial attitudes toward various patent-licensing arrangements, and international transactions in industrial property.[1] The second subject is the protection of trade secrets, a matter that has been, and is still being, investigated under Institute auspices by questionnaire as well as by a review of cases and of other literature.[2]

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** A principal consultant to The PTC Research Institute; member of Senior Research Staff of W.E. Upjohn Institute for Employment Research, which shares no responsibility for the views expressed here.

[1] The three earlier papers by the same authors and the issues of *IDEA* (or its predecessor) in which they appeared are: "Positive Competition and the Patent System," Vol. 3, No. 1 (Spring 1959), pp. 21-32; "Evolving Court Opinion on Patent Licensing: An Interaction of Positive Competition and the Law," Vol. 5, No. 2 (Summer 1961), pp. 103-113; "Positive Competition and Antitrust in Foreign Transactions Involving Industrial Property," Vol. 7, No. 3 (Fall 1963), pp. 253-276.

[2] For an earlier paper by the authors, see "Protection of Trade Secrets: Initial Report," *IDEA*, Vol. 8, No. 3 (Fall 1964), pp. 360-374.

The basic idea informing this paper and the earlier ones that deal with positive competition may be stated as follows: The pluralistic society of the United States tends to generate, through the interaction of its competing elements, constructive conditions for protecting, using, and limiting the varieties of private property that it creates and that it recognizes as beneficial to the general welfare. Widely shared values and attitudes, established customs and institutions, the extant body of law, and the common circumstances and experiences of economic life and of citizenship seem routinely to support the emergence and profitable social application of many different kinds of private property. While encouraging novelty, however, interaction also brings forth safeguards. Individuals and groups that consider a class of property to be either insufficiently[3] appreciated or grossly misused[4] may seek to alter the climate of opinion regarding it and to effect desired adjustments in legal and other pertinent rules. Trade secrets have long been recognized as a valid category of intangible property in our society,[5] and well-publicized efforts are currently being made to improve their functionality and status in the total competitive system in response to new challenges.[6] In this paper, we discuss the character, application, and protection of trade secrets as an element of this system.

NATURE OF POSITIVE COMPETITION

The adaptive system just described is the regime of positive competition. The vigorous pursuit of private interests is a distinctive feature, but also characteristic are an extensive and necessary regard for ex-

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[3] *Report of the Attorney General's National Committee to Study the Antitrust Laws* (March 31, 1955), p. 226.

"This points to the sound rule that monopoly power individually acquired solely through a basic patent, or aggregation of patent grants should not by itself constitute monopolization in violation of Section 2. It would be a paradox to encourage individual invention by grant of a patent and then penalize that temporary monopoly by deeming it 'monopolization.' Hence, violation of the Sherman Act should, as the cases suggest, require abuse of the patent grant or proof of intent to monopolize beyond the lawful patent grants."

[4] For Assistant Attorney General Donald F. Turner's publicly reported negative attitude toward restrictions in licensing agreements, see *Antitrust and Trade Regulation,* Report #231, (December 14, 1965), The Bureau of National Affairs, Inc., pp. 4-17.

[5] In earlier societies, too. Thus, the guilds of the Middle Ages put great store by trade secrets. See Schiller, Arthur A., "Trade Secrets and the Roman Law," *Columbia Law Review,* Vol. 30 (1930), p. 837.

[6] See also concluding section of Harris and Siegel, "Protection of Trade Secrets: Initial Report," *IDEA,* Vol. 8, No. 3 (Fall 1964), pp. 373, 374.

pressed and latent public wants, a sensitivity to governmental criticism and sanctions, and the existence of an evolving and still permissive framework of custom and law. All of these have contributed to unprecedented levels of material welfare and leisure. Despite the expansion of governmental constraints in recent years, great latitude remains for private decision and action in quest of profit. Furthermore, technical innovation and diffusion remain important modes of profitable self-expression. In this regard, the contrast with other industrial nations, whatever their ideological inclination, is striking.[7]

The American style of positive competition retains its special productiveness and progressiveness even though it has "monopolistic" and other blemishes that claim almost the complete attention of various domestic[8] and foreign critics. In principle, at least, these flaws are remediable; and, in practice, considerable and continual effort and experiment are directed toward improvement, with proclaimed doctrine generally subordinated to pragmatics.[9] Although specific avenues of economic and social advance may become clogged, others are kept clear and new ones are opened. The diversity of products, services, and freedoms proliferates as attrition also occurs. We have recently become painfully aware that large numbers of economic and social "dropouts" lose confidence in, or never share, the dominant values of the system, or do not become equipped to garner the advantages offered; yet the size and energy of the competitive majority are awesome.

When we speak of positive competition, we have in mind an order

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[7] Concerning institutional and attitudinal inhibitions to competition as a source of progress, see, for example, "Can Europe Catch Up with U.S. Technology?" *Business Week* (October 29, 1966), pp. 66 ff.; and Stieber, Jack, "Manpower Adjustments to Automation and Technological Change in Western Europe," in *Adjusting to Change,* Appendix Volume III to *Technology and the American Economy,* National Commission on Technology, Automation, and Economic Progress (February 1966), pp. 41-125.

[8] See Assistant Attorney General Donald F. Turner's statements in *IDEA*, Vol. 10, Conference Number (1966), pp. 32-38; and in *A.B.A. Journal* Antitrust Section (August 1965), p. 29; 1961 Hearing before the Senate Antitrust Subcommittee on the bill that passed as the Drug Act of 1962; Section 151 (a) Atomic Energy Act (42 U.S.C. 218 [a]); Brulotte v. Thys Co., 379 U.S. 29 (1964); Walker Process Equipment, Inc. v. Food Machinery and Chemical Corp. 382 U.S. 172; U.S. v. Singer Mfg. Co., 374 U.S. 174.

[9] See the various distinctions with respect to royalty rates made by the courts to the decision of Automatic Radio Mfg. Co. v. Hazeltine Research, Inc., 339 U.S. 827 (1950) in such cases as American Securit Co. v. Shatterproof Glass Corp., 269 F.2d 769 (1954); Brulotte v. Thys Co., 379 U.S. 29 (1964); But see McCullough Tool Co. v. Well Surveys, Inc., 343 F.2d 381 (1965). Also see American Photocopy Equipment Co. v. Rovico, Inc., 148 *USPQ* 631 (1966), for a novel theory advanced by the court which holds that an "exorbitant" rate of patent royalties might be considered a misuse of the patent.

that actually exists, that has demonstrated its merit in ways most people understand, not a theoretical system that ought to be.[10] It is not a textbook model, a matchstick caricature, a simplified abstraction for which claims of perfection and purity may be safely made in a classroom—and for which, alas, practical achievability, acceptability, and viability do not have to be proved. It is a system that is impressively *working,* despite inefficiencies, not merely one claimed to be "workable." It is the competition that almost everyone recognizes to prevail when he uses the noun without a qualifying adjective; or that the antitrust vigilante still acknowledges to be worth protecting even as he daily enlarges his list of observed questionable practices that may "lessen" it or diminish its "potential."[11] It is concerned with the totality of economic behavior—most of which is clearly permissible and some of which is still open to challenge and to reclassification as illlegal.[12] Antitrust is itself part of the apparatus of positive competition, though only a minor part of it; and the forces that push toward "monopoly," including those fostered by Government itself,[13] are likewise to be reckoned as elements of the total system.

The diverse interests that flourish under positive competition and

[10] Our choice of the word "positive" was influenced in part by a famous passage in *Scope and Method of Political Economy,* a book by J. N. Keynes (father of the more celebrated economist). Keynes differentiated between a "positive science," comprising a "body of systematized knowledge concerning what is," and a "normative or regulative science," relating to "criteria of what ought to be." See Friedman, Milton, *Essays in Positive Economics* (Chicago: University of Chicago Press, 1953), p. 3.

[11] See session on "Conflicts Between Patent and Antitrust Laws?", *IDEA,* Vol. 10, Conference Number (1966), pp. 29-65.

[12] The spirit of positive competition in dealing with unsettled issues is interestingly reflected in the Government and company positions disclosed in the press when the Justice Department recently filed its third civil antitrust suit charging General Electric Company with price-fixing and restraint of trade in the sale of light bulbs. Conceding that the challenged practice is half a century old and had been held legal by the Supreme Court as early as 1926, the Department claimed that "those earlier cases were decided erroneously and that more recent court decisions . . . have changed the law." A company official recalled the repeated approvals by the courts and averred that the challenged practice had "served the public well"; but he also pledged full cooperation with the Government "in hope that this new court test will resolve this complicated legal matter once and for all." See, *Wall Street Journal,* September 28, 1966, p. 3.

[13] Professor Fritz Machlup told a Senate subcommittee hearing on administered prices that "the antitrust laws are excellent," but "it happens that our Government has done much more to create monopoly than to destroy monopoly," that "we are still going on doing it, day after day." See Kefauver, Estes, *In a Few Hands: Monopoly Power in America* (Baltimore: Penguin Books, 1965), p. 223. Comparable observations were made in the testimony of C. D. Edwards, H. M. Gray, and E. G. Nourse.

that also produce it naturally opt for contradictory modes and for opposite directions of improvement.[14] Some propose enlargement and sharper definition of the areas of prohibition, interdicted practice, or per se violation;[15] they tend to favor the enumeration and adoption of more explicit proscriptive guidelines and criteria.[16] Others, however, look to a permissive "rule of reason,"[17] call for the weighing of all pertinent circumstances before condemnation of particular practices, point to the multidimensionality and subleties of competition, eye with suspicion the efforts to dispose of cases categorically, deplore the apparent concession of guilt in the pleading of *nolo contendere;*[18] they tend to emphasize the "higher-systems" view in the appraisal of the social benefits and injuries incident to any particular behavior.[19]

The publicity attending litigation exaggerates the significance of an occasional pathological situation and obscures the predominant normal situation.[20] Actually, the regime of positive competition, with its automatic signals, rewards, and punishments, achieves a very large degree of self-regulation. The formal policing function, the explicit resort to law enforcement, is minor in view of the volume and variety

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14 On the disagreement among the experts and the differences among the courts concerning the legality of royalty-free compulsory licensing and dedication, see *Report of the Attorney General's Committee to Study the Antitrust Laws* (1955); Hartford-Empire Co. v. U.S., 323 U.S. 386 (1945); U.S. v. National Lead Co., 332 U.S. 319 (1948); U.S. v. General Electric Co. et al., 82 F. Supp. 753 (1949); and U.S. v. Imperial Chemical Industries, Ltd., 105 F. Supp. 215 (1952).

15 See U.S. v. General Instrument Corp. et al., 87 F. Supp. 157 (1949); U.S. v. Line Material Co., 333 U.S. 287 (1948); U.S. v. General Electric Co. et al., 80 F. Supp. 989 (1948).

16 See Donald F. Turner's statements in *IDEA*, Vol. 10, Conference Number (1966), pp. 32-38.

17 See Standard Oil v. U.S. 283 U.S. 163 (1931); Chicago Board of Trade v. U.S., 246 U.S. 231 (1918). Also see the cogent exposition of a "rule of reason" relating to "Patent Right Transferability" in Recommendation No. XXII, pp. 41-43, of the Report of the President's Commission on the Patent System (1966).

18 Harris and Siegel, "Positive Competition and the Patent System," *PTC J. Res. & Ed. (IDEA)*, Vol. 3, No. 1 (Spring 1959), pp. 21-31.

19 See discussion of patent interchange in *Report of Attorney General's National Committee to Study the Antitrust Laws* (1955).

20 Relatively few patent antitrust court cases decided in the Sixties have received much public notice. The following appear to have had more than passing attention in legal circles: Binks Mfg. Co. v. Ransburg Electro-Coating Corp., 281 F.2d 252 (1960); U.S. v. Columbia Pictures Corp., 189 F. Supp. 153 (1960); U.S. v. Jerrold Electronics Corp., 187 F. Supp. 545 (1960); Dehydrating Process Co. v. A.O. Smith Corp., 292 F. 2d 653 (1961); U.S. v. Lever Bros. Co., 216 F. Supp. 887 (1963); U.S. v. Singer Mfg. Co., 374 U.S. 174 (1963); Berlenbach v. Anderson and Thompson Ski Co. Inc., 329 F.2d 782 (1964); Brulotte v. Thys Co., 379 U.S. 29 (1964); International Mfg. Co., Inc., v. Landon, Inc., 336 F.2d 723 (1964); Preformed Line Products Co. v. Fanner Mfg. Co., 328 F.2d 265 (1964); Atlantic Refining Co. v. FTC, 381 U.S. 357 (1965); Hazeltine Research, Inc. v. Zenith Radio Corp., 239 F.

of business actually transacted. It is not surprising that the dictatorial states of the Soviet bloc have recently come to appreciate the advantages of greater managerial permissiveness for further economic growth and evolution; and it may confidently be assumed that the nations of Western Europe will also seek to loosen the manifold constraints on competition that have seemed in the postwar years to offer economic security but have more surely limited the productivity advance on which this security ultimately depends.

In concluding these brief remarks on positive competition, we refer to two of many recent writings that might be cited to illustrate the esteem in which such competition is really held, by whatever name it happens to be called. In his final book (1961), J. M. Clark, who had pioneered the concept of "workable competition" in 1940, had this to say in the preface:

> . . . I am shifting the emphasis from "workable" to "effective competition" . . . because "workable" stresses mere feasibility and is consistent with the verdict that feasible forms of competition, while tolerable, are still inferior substitutes for that "pure and perfect" competition which has been so widely accepted as a normative ideal. And I have become increasingly impressed that the kind of competition we have, with all its defects—and these are serious—is better than the "pure and perfect" norm because it makes for progress. Some departures from "pure and perfect" competition are not only inseparable from progress, but necessary to it. The theory of effective competition is dynamic theory.[21]

The second item is a published 1966 interview with the current head of the Antitrust Division, who disclosed more than just a preference for guidelines (as an aid to voluntary compliance), a tolerance for no-contest pleas, and a desire to preserve "potential competition" through the discouragement of certain mergers. He expressed himself in favor of the somewhat general and vague wording of the antitrust laws,

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Supp. 51 (1965); Laitram Corp. v. King Crab, Inc., 146 *USPQ* 640 (1965); McCullough Tool Co. v. Well Surveys, Inc., 343 F.2d 381 (1965); U.S. v. Huck Mfg. Co., 147 *USPQ* 464 (1965); Walker Process Equipment, Inc. v. Food Machinery and Chemical Corp., 382 U.S. 172 (1965); American Photocopy Equipment Co. v. Rovico, Inc., 148 *USPQ* 631 (1966).

[21] Clark, J. M., *Competition as a Dynamic Process* (Washington, D.C.: Brookings Institution, 1961), p. ix. Curiously, Clark's new term, "effective competition," was the title of a report made to the Secretary of Commerce by the Business Advisory Council in December, 1952. The term there described "a business community which is characterized by ceaseless striving among competitors, all endeavoring to expand their share of the market—and the total size of the market as well—by producing relatively more and better goods and services at relatively lower prices; provided that there must, of course, continue to be safeguards against unfair or predatory competition" (p. 2). This concept approaches what we call positive competition, but it is less inclusive and seems to have a normative intention.

which makes them "capable of refinement and development as we go along," as economic thought itself evolves. While asserting that certain industries have "essentially noncompetitive" pricing policies, he also recognized the growth of inter-industry competition and the proliferation of competitive products—so "it's not a bad guess that things are at least not getting worse."[22]

CHARACTER OF TRADE SECRETS

A fuzzy penumbra around the concept of "trade secrets" is to be expected. The meaning is not self-evident. The concept, in fact, is like many, many others that are encountered in the world of positive competition and that constantly have to be interpreted and reexamined.[23] Indeed, our concept of positive competition itself has had to be defined here, and this competition is open-ended and still evolving.

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[22] Interview of Turner, D. F., "Guidelines for Fair Competition," *U.S. News and World Report* (February 21, 1966), pp. 76 ff.

[23] Some authorities argue that the Supreme Court has, by implication, questioned the validity of trade secrets in Sears Roebuck and Company v. Stiffel Company, 376 U.S. 225 (1964); and Compco Corporation v. Day-Brite Lighting, Inc., 376 U.S. 234 (1964). See Handler, Milton, "Product Simulation: A Right or Wrong?", *Columbia Law Review*, Vol. 64 (1964), p. 1183.

However, in Schulenburg v. Signatrol, Inc., 212 N.E. 2d 865 (Sup. Ct. Ill. 1965) the court observed:

"The defendants cite [Sears and Compco] for the proposition 'that no state may, by laws dealing with unfair competition, impose damages or enjoin the copying, manufacturing and sale of an article which is protected by neither a Federal patent nor a copyright.' In a proper case, we would concur with this statement. However, a reading of Sears and Compco clearly indicates that they are inapposite here. There, the defendants had copied the plaintiffs' unpatentable products by legal means. No problem concerning trade secrets was present. Plaintiffs here readily concede that their finished products may be copied by legal means (such as acquiring one of the finished products and measuring and analysing it, until a copy can be produced), but maintain that employees in positions of confidence may not surreptiously copy plaintiffs' blueprints while in their employ and subsequently use them to establish a competing business."

Derenberg, Walter, J., in "The Nineteenth Year of Administration of the Lanham Trademark Act of 1946," Part II, 150 *USPQ* 42 (1966), states:

"The gradual whittling away at the pillars of the private law of unfair competition, particularly since the Supreme Court's decisions in Sears and Compco, has already been referred to in previous reports and in Section IV of the present survey. . . .

"As now proposed, the Unfair Competition Act of 1966 [S. 3681 introduced by Senator McClellan on August 2, 1966, in the 2nd Session of the 89th Congress] would take the form of an amendment to Section 43 (a) of the Lanham Act, but would in its most basic provisions follow the predecessor bill. More specifically, S. 3681 includes a 'general clause' in proposed Section 43 (a) (6), providing a civil action for unfair competition against any act or conduct 'contrary to commercial good faith or to normal and honest practices of the business or vocational activity.'

"Trade secrets" encompass every kind of information that a firm would like to keep confidential. The term is not legally transformable, however, into a blanket limitation on the subsequent use of the knowledge that a professional worker acquires, on the future applicability of the technical competence and maturity that he attains while in a company's employ.[24] While most of the published court decisions involve trade secrets of a scientific or technical nature, the term also covers the large bulk of business information that is deemed valuable enough to keep private.[25] The putative financial importance of data to a company's current or future status is a criterion for legal protection of controlled information as a "trade secret."[26]

According to Section 757 of the *Restatement of the Law of Torts*, "a trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competititors who do not know or use it." This definition goes on to state that "generally it relates to the production of goods" and to set forth six criteria "to be considered in determining whether given information is one's trade secret." The six criteria affecting an employer's secret are:

> (1) the extent to which the information is known outside of his business;
> (2) the extent to which it is known by employees and others involved in his business;

This general proviso is preceded by a catalogue of specific practices which will be deemed to constitute unfair competition."

Section 43 (a) (4) of the proposed Act reads as follows:

"[Any person who shall engage in any act, trade practice, or course of conduct, in commerce, which] results or is likely to result in the wrongful disclosure or misappropriation of a trade secret or other research or development or commercial information maintained in confidence by another, or . . . ."

Also see section on "Interplay of Patentability and Trade Secrets," *supra,* note 2, at pp. 366-369.

24 See Fairchild Engine and Airplane Corp. v. Cox, 50 N.Y.S.2d 643 (1944).

25 At the annual meeting of stockholders on July 26, 1966, the president of Sperry Rand Corporation reported that detailed operating information was issued only for Divisions experiencing a loss: "For each Division of our business that has a profit, the amount of that profit and the exact shipping volume would be of great interest to competition to such a degree that the information could be detrimental to the Corporation's interests. Consequently, it is our policy not to reveal such figures." These figures, of course, refer to "trade," are "secret," and may be quite valuable to Sperry. They, therefore, come under the rubric of "trade secrets," but they do not automatically become legally protected.

26 The expenditure by the employer is an important criterion in determining whether a trade secret is established. Sperry Rand Corp. v. Rothlein,, 241 F. Supp. 549 (1964).

> (3) the extent of measures taken by him to guard the secrecy of the information;
> (4) the value of the information to him and to his competitors;
> (5) the amount of effort or money expended by him in developing the information;
> (6) the ease or difficulty with which the information could be properly acquired or duplicated by others.[27]

Evidently, from the foregoing, a trade secret has certain tangible attributes, but it also has intangible, relational, subjective qualities. The more definite characteristics include "formula," "pattern," "device," "compilation of information which is used in one's business"; the less objective notions include "an advantage over competitors," "extent to which the information is known," "extent of measures taken," "the value of the information," "the amount of effort," "the ease or difficulty with which the information could be properly acquired."

The courts have asserted different grounds for the exercise of their jurisdiction. "In some cases it has been referred to as property, in others to contract, and in others, again, it has been treated as founded upon trust and/or confidence. . . ."[28] For example, *Peabody* v. *Norfolk* (1868)[29] considered a trade secret to be a property right, protectable as a contract or confidence against violation or breach. In recent years, the courts have been following the theory advanced in 1917 by Justice Holmes in *E.I. du Pont de Nemours Powder Company* v. *Masland*:

> The word "property" as applied to trademarks and trade secrets is an unanalyzed expression of certain secondary consequences of the primary fact that the law makes some rudimentary requirements of good faith. Whether the plaintiffs have any valuable secret or not, the defendant knows the facts, whatever they are, through a special confidence that he accepted. The property may be denied but the confidence cannot be. Therefore the starting point of the present matter is not property or due process of law, but that the defendant stood in confidential relations with the plaintiffs, or one of them.

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[27] *Restatement of the Law of Torts,* Vol. IV (St. Paul: American Law Institute Publishers, 1939), §757, Comment b., p. 6.

[28] Morison v. Moat, 9 Hare 241 (1851); Robinson, William C., *The Law of Patents for Useful Inventions* (Boston: Little, Brown, and Co., 1890), p. 4: "By the performance of an inventive act the inventor acquires a property in the invention which he thus creates, irrespective of its future protection by a patent. This property vests in him by the law of nature, and by the same law may be divested in any manner which places it in the possession of the public. . . . The property which thus vests in him by the law of nature, enlarged in its enjoyment by the provision of our Patent Law, is recognized as entitled to the same protection as any other form of property. . . ."

[29] 98 Mass. 452. Amedée E. Turner, in his treatise on *The Law of Trade Secrets* (London: Sweet and Maxwell, Ltd., 1962), shows that only in the last hundred years has much law on trade secrets developed in the United States and in England.

> These have given place to liability, and the first thing to be made sure of is that the defendant shall not fraudulently abuse the trust reposed in him. It is the usual incident of confidential relations.[30]

The significance of the theory of a breach of confidence can be better appreciated when an examination is made of the holdings of the courts with respect to protection of the trade secrets after the general public has had access to them. The general rule is that any member of the public may practice the secret without being obligated if the secret falls into the public domain. There are numerous ways in which a trade secret can be dedicated to the public.[31] Dedication may occur, for example, when the subject matter of the trade secret is invalidly claimed in an issued patent. It may also occur when the subject matter is described in a publication or in a patent but is not claimed therein.

To what extent do the courts consider a person who had confidential knowledge of a trade secret prior to its publication a member of the general public with respect to the secret after publication? When the subject matter no longer has unique economic value to the original firm, can it continue to be the basis for a breach of the confidential relationship? This is a test that bears directly on the ethics of the problem.[32]

Generally, the pattern of decisions of the Sixth and Seventh Circuit Courts has been distinguishable from that of the Second. The Sixth and Seventh Circuits seem to have been strictly enforcing confidential information concerning trade secrets received before publication. The different position of the Second Circuit has been succinctly stated by Judge Hand:

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[30] 244 U.S. 100 (1917). The Headnote to §871 of Robinson's excellent treatise *op. cit. supra* note 28 states: "The Disclosure or Misuse of an Inventor's Secret by those to whom it was Confidentially Communicated is a Breach of Trust and Actionable."

[31] Robinson, *op. cit. supra* note 28, p. 31. "In the absence of any provision of positive law relating to the subject, the unrestricted disclosure of his secret by the inventor is destructive to his property therein. His idea of means then passes into the possession of mankind, becomes a portion of the common stock of knowledge, is open to the enjoyment of all who choose to use it, and thus escapes entirely from the ownership and control of the inventor. . . . Nor is the method by which the disclosure is accomplished of any consequence provided that it be complete and voluntary. . . ."

[32] Some take the position that the law of trade secrets should only protect a secret and should not be concerned with the ethical question or the punishment of the wrongdoer. In the Conmar Products case, Judge Hand agrees with this theory, but also expains that the doctrine of the 6th and 7th Circuits, which appears to hold a contrary view, "must rest upon the theory that it is a proper penalty for the original wrong to deny the wrongdoer resort to the patents; and for that we can find no support in principle." However, see Monsanto Chemical Company v. Miller, 118 *USPQ* 74 (1958) on the position that it is the defendant's wrong which should determine the nature of the relief.

> The Seventh Circuit, and apparently the Sixth as well, have however, held that if before issue one has unlawfully obtained and used information which the specifications later disclose, he will not be free to do so after issue; his wrong deprives him of the right which he would otherwise have had as a member of the public. We have twice refused to follow this doctrine, and we adhere to our decisions.[33]

Curiously, when the parties enter into an agreement with no termination date expressed therein, the Second Circuit holds that subsequent public disclosure does not relieve the recipient from payment for secret information. The case of *Warner-Lambert Pharmaceutical Company* v. *John Reynolds*,[34] involving Listerine, is an example. The court here decided in favor of the plaintiff. The public disclosure of the Listerine formula was the fault of neither the plaintiff nor the defendant; but Warner-Lambert, which had already paid almost $25 million, had to continue paying almost $2 million a year, although its competitiors were now free to copy the formula. Thus, after public disclosure of a trade secret, the Second Circuit is more likely to enforce a contract relating thereto than to continue the obligation based on confidentiality of one who had prior knowledge of the secret.

The cases decided in the Sixth and Seventh Circuits against the recipient of confidential information after publication have usually involved improprieties on the part of the recipient.[35] Where breach of confidence or an inequity was not involved, the Seventh Circuit appears to have acted more like the Second.[36]

Moreover, the cases in the Second Circuit that have favored the recipient of confidential information have generally not involved improper conduct on his part.[37] Where the conduct is improper, the

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[33] Conmar Products Corp. v. Universal Slide Fastener Co., Inc., 172 F.2d 150 (2d Cir. 1949)

[34] 178 F. Supp. 655 (S.D.N.Y. 1959), aff'd, 280 F.2d Cir. 1960). A sizable body of law has developed concerning agreements, express or implied, relating to the disclosure of secrets to another for the latter's use. The courts are fully aware that inventors must often sell inventions that are unpatented or unpatentable. This situation may arise, for example, with respect to outside inventors who submit ideas to corporations with the intention that use be made in the corporate business, but confidentially, and with compensation. See Ellis, Ridsdale, *Trade Secrets* (New York: Baker, Voorhis and Company, Inc., 1953), pp. 170-190; *PTC J. Res. & Ed. (IDEA)*, Vol. 3, Conference Number (1959), pp. 82-91.

[35] Shellmar Products Co. v. Allen-Qualley Co., 87 F.2d 104 (7th Cir. 1936); A. O. Smith v. Petroleum Iron Works Co., 74 F.2d 934 (6th Cir. 1935).

[36] Northrup v. Reish, 200 F.2d 924 (7th Cir. 1953); See also Powers, George R. "Relief in Trade Secret Cases after Publication," *PTC J. Res. & Ed. (IDEA)*, Vol. 5, No. 1 (Spring 1961), pp. 70-80.

[37] Conmar Products Corp. v. Universal Slide Fastener Co., Inc., 172 F.2d 150 (2d Cir. 1949); Pennington Engineering Co. v. Houde Engineering Corp., 136 F.2d 210 (2d Cir. 1943); Picard v. United Aircraft Corp., 128 F.2d 632 (2d Cir.

Second Circuit will act against the wrongdoer by assessing damages.[38] The standards for improper conduct may vary among the Circuits. The language in the cases of the Sixth and Seventh Circuits encompasses the innocent in its sweep, although the cases actually deal with commercial improprieties.[39] For the Second Circuit, the language refers to the grossly improper, while the cases are actually limited to instances of proper conduct.[40]

New Circumstances and Challenges

Surely, both the volume of proprietary information classifiable as trade secrets and the traffic in such information have increased prodigiously in the past generation; and the expansion of both has provided new opportunities and new problems for disposition by the forces of positive competition. These interacting forces, which include the government and the courts, are ever determining, ever reappraising, the equities and benefits incident to the creation, ownership, and productive use of the large supply of trade secrets. Thus, trade secrets constitute one of the innumerable fields in which positive competition operates in our kind of society.

The order-of-magnitude increase in the inventory of trade secrets and in transactions involving them is traceable, in large part, to the impressive gains made in research and development activity, under both private and public auspices, since World War II. These gains have been accompanied by significant growth in the number of scientists, engineers, and technical support personnel engaged in industry. Billions of private dollars, in addition to larger sums of public money, have come to be spent annually in the design, realization, and improvement of processes and products destined for business, Government, and households.

The increase in the supply of, and in the dependence upon, trade secrets is not restricted to manufacturing. For example, services—consulting and other—also merit notice. They are often based on, or otherwise involve, sophisticated novel technologies—especially in the

1942); Also see Koehring Co. v. National Automatic Tool Co., Inc., 150 *USPQ* 777 (S. D. Ind. 1966).

[38] Schreyer v. Casco Products Corp., 190 F.2d 921 (2d Cir. 1951). But see the strong negative reaction by Justice Brink of the New York Supreme Court (Broome County) to the defendant's contention that at some time after the breach of confidence he could have obtained the information elsewhere (General Aniline and Film Corp. v. Frantz et al., 151 *USPQ* 136 [1966]).

[39] *Supra* note 35.

[40] *Supra* note 37.

data-processing and communication fields, where patent protection for know-how and for "software" may be difficult or impossible to obtain.

Another point should be made here: The proliferation of trade secrets and the increase in the number of people having legitimate access to them are phenomena ascribable to economic expansion as well as to the enlargement of the scale and scope of research activity. High levels of business investment over a number of consecutive years, the diffusion of processes and products that have already been proved, the establishment and growth of firms and industries, the increase in employment of skilled workers, the mobility of managerial and technical employees—these too have a relation to the amount of confidential business information available, the degree of sharing required, and the problems of protection, control, and remuneration.

In the adjustments being worked out by the processes of positive competition, due account is being taken of custom, traditional values, and the services provided through social and other institutions. Private arrangements seem much more important—in the determination of company, employee, and social roles and benefits—than the active intervention of Government agencies, legislatures, and the courts. This statement does not mean, however, that new legislation or that administrative and judicial clarification will not be sought, forthcoming, or welcome. External correctives are obviously needed in those instances in which unethical behavior by employees or employers is manifested. In the next section, some directions of desirable improvement in public as well as private provisions for trade secrets are indicated.

Happily, the court cases involving disputes over trade secrets seem few, when consideration is given to the huge supply and the heavy traffic. Advance company-employee agreements and the alertness of firms in setting compensation scales have doubtless contributed significantly to the inhibition of litigation. Crowded court calendars, however, may also discourage quests for legal rectification where other modes of settlement have failed. On the whole, positive competition may be expected to achieve a fairly good record with respect to trade secrets; the system, as already noted, is sensitive to opposing demands,[41] is flexible, and contains mechanisms for self-improvement.

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41 The principle of shop rights is an example of the equity involved in the creation of trade secrets and patent rights. The conception of the effort of the employee and of the time and the facilities of the employer are both utilized and therefore the rights are divided. "A shop right, with reference to the employer-employee relationship, is an implied, irrevocable, non-assignable, non-exclusive license of an employer to use in his business, without paying for its use, a trade secret created, discovered, or invented by his employee. The mere fact that the trade secret is discovered, perfected or invented during the employee's hours of employ-

The judgment just expressed about the future record cannot be reached lightly. At every stage of United States history, an acute awareness of the active and latent threats to dominant values, customs, and institutions has encouraged dire appraisals of the plight and prospects of competitiveness. Nowadays, there are many grounds for dismay concerning even more profound relationships than those between employer and employee in the realm of trade secrets. A partial catalogue of these well-advertised grounds would include: Conformity, consensus, attenuation of the two-party system, shifting balance of enterprise toward Government initiative, federal welfarism, declining parental discipline, the waning influence of religion on ethics, civil-rights disorders, crime, urban blight, technological disruption, economic insecurity, undeclared wars, and so forth. Perhaps, our plight is worse than England's when Lord Bacon replied to charges of corruption with a plea that the general *vitia temporis* (the sins of the times) should be differentiated from his own *vitia hominis* (the sins of man).[42] On the other hand, the situation today may only be noisier and seem worse to us because it is the situation with which *we* have to deal.

DIRECTIONS FOR IMPROVEMENT

In our democratic society of positive competition, the law reflects social mores, and the courts tend to evolve a law of trade secrets in directions they believe to be in the public interest, proceeding as far as the public is deemed ready to go. In civil cases at least, the courts seem to have achieved a generally acceptable balance between technical competition (as expressed in personnel transfer) and property rights in trade secrets.[43]

Increased reliance on trade secrets in recent years is sometimes attributed to the time lag in processing patent applications;[44] but this

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ment does not give rise to a shop right; there must be conduct on the part of the employee which will estop him from denying such license." Toner v. Sobelman, 86 F. Supp. 369 (1949).

[42] Bowen, C. D., *Francis Bacon: The Temper of a Man* (Boston: Little, Brown and Co., 1963), p. 196.

[43] See Space Aero Products Co., Inc. et al., v. R. E. Darling Co., Inc., 145 *USPQ* 356 (Md. Ct. App. 1965), where the court seeks to balance the promotion of scientific progress, by protecting the originator, with free competition, by permitting the employee to use skill learned during employment.

[44] See "Clinic on Statutory Requirements of Companies for Protection of Intellectual Creations," *IDEA*, Vol. 8, No. 4 (Winter 1964-1965), pp. 561-573; in an earlier paper *supra* note 2, at p. 366, Harris and Siegel mention factors favorable to company reliance upon trade secrets: ". . . As industrial arts expand and become more complex, the chances of obtaining patents diminish and the danger of

argument is not persuasive.[45] A much more important factor, it would seem, is the vast increase in industrial research activity. Inventions, whatever their quality, are probably being generated at an unprecedented rate in today's setting, and the companies sponsoring them are naturally interested in profitable use. Positive competition encourages early utilization. A company that makes use of an invention more than a year prior to patent application, however, may be able to depend only on secrecy for protection. The temptation to test the market before patenting has always existed, but nowadays it may be stronger as the number of potential patent applications increase due to the extraordinary increase in research. In any case, studies of the Institute indicate that 48.8 percent of the patents used by very large companies are put to use before application for patent is made. The proportion is 31.1 percent for the companies of intermediate size.[46]

Any lag in patent processing should not, of course, affect the degree of reliance upon unpatentable "know-how," which generally has come under the heading of trade secrets. Of prime importance is the fact that the technology represented by this type of know-how could, with proper precautions, remain undisclosed very much longer than the technology included in patent applications.[47] The Patent Office will, in most cases, eventually disclose application information in the form of issued patents.

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invalidity of issued patents increases. Furthermore, the increasing difficulty of reconstruction of products such as chemicals places a premium on secrecy. To be patentable, as is well known, an invention must come within one of the statutory classes of invention: process, machine, manufacture, or composition of matter. Other hurdles have to be negotiated; questions of public use, novelty, utility, and unobviousness must be determined. A company has to decide whether the use of matter disclosed can be policed, whether adequate claims can be obtained, whether the litigation costs incident to enforcement are worth the gain. . . ."

[45] See Commissioner Brenner's reference to the testimony relating to the backlog presented on behalf of the Patent Office to the House Appropriations' Committee in a dinner address before the American Patent Law Association, *APLA Bulletin* (October- November 1966), p. 550. The Commissioner states that ". . . our long-range plans are to add 150 examiners plus the necessary supporting personnel in order to assist us in reaching our goal of 18 months pendency within the next few years.

"Our program calls for adding 75 examiners in fiscal '67 and 75 more examiners in fiscal '68. This additional manpower, according to our studies, combined with our capability of operating with present staff in the range of about 100,000 disposals a year, should enable us to meet this goal of 18 months pendency within the next three or four years."

[46] Sanders, Barkev S., "Speedy Entry of Patented Inventions into Commercial Use," *PTC J. Res. & Ed.* *(IDEA)*, Vol. 6, No. 1 (Spring 1962), pp. 87-116.

[47] "Clinic on Statutory Requirements of Companies for Protection of Intellectual Creations," *IDEA,* Vol. 8, No. 4, (Winter 1964-1965), pp. 561-573.

We should recall that the patent system replaced the system of trade secrets flourishing in the guilds of the Middle Ages. Under the guild codes an innovation remained secret indefinitely; and, in certain instances, the technology died with the last members of the guild. The patent system discloses the trade secret to the public upon the issuance of the patent in return for a "monopoly" right over a limited period of time.[48] The patent idea gradually supplanted trade secrets until every industrial country in the world boasted a patent system. Many writers have attributed the technical progress of their country to the type of incentives and protection offered by the system. In our own country, the system from the very beginning became a part of the apparatus for positive competition. It has always had its critics, who presumably would not be prepared, however, to propose return to a world dominated by technical trade secrets.[49]

It does not appear that much needs to be done legislatively to develop better protection for trade secrets subject to loss as a result of the indiscretion of migrant technical personnel.[50] To increase the protection accorded to trade secrets beyond what the adjudicated cases already provide would involve serious economic, social, and legal issues. Clearly, the antitrust implications alone should discourage action along this line. We should note here that even the patent exception to the antitrust laws, based on a Constitutional mandate, has come under increasing pressure from the courts.

The courts have not been reluctant to provide appropriate means for maintaining a balance between personnel transfer and company investment in trade-secrets cases.[51] Proper precautions in the light of judicial

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[48] *Ibid.*

[49] Machlup, Fritz, *An Economic Review of the Patent System,* Study No. 15 of The Subcommittee on Patents, Trademarks, and Copyrights of The Committee on the Judiciary, United States Senate, 85th Cong., 2nd Sess. ". . . If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it. This last statement refers to a country such as the United States of America—not to a small country and not a predominantly nonindustrial country, where a different weight of argument might well suggest another conclusion."

[50] See *supra* note 47, "Clinic on Statutory Requirements of Companies for Protection of Intellectual Creations."

[51] The courts have made an effort to suit the remedy to the actual need for secrecy. See Sperry Rand Corp. v. Rothlein, 241 F. Supp. 549 (1964); Franke v. Wiltschek, 209 F.2d 493 (1953); B. F. Goodrich Co. v. Wohlgemuth, 137 *USPQ* 389 (1963); E. I. du Pont de Nemours and Co. v. American Potash and Chemical Corp., 200 A. 2d 428 (1964). Judge Kaess, in Allis-Chalmers Co. v. Continental Aviation and Engineering Corp., 151 *USPQ* 33 (Dist. Ct., E. D. Mich, S. Div. 1966),

interpretations, however, have not always been taken by employees,[52] employers, and third parties.[53] Moreover, alleged malfeasances are often of an ambiguous nature. In short, there is adequate legal theory[54] for justice to be done in these cases, and the courts have provided sufficient remedy and imposed satisfactory sanctions,[55] but evidence is often equivocal or difficult to obtain.

The outright theft of trade secrets has been a subject of recent

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states that ". . . the injunction granted is as restricted as possible to protect the secrets involved without undue restraint on Mr. Wolff's right to pursue his chosen vocation, only prohibiting work in the design and developing of distributor type pumps. Mr. Wolff is able to work at Continental in application engineering without limitation as to the field of activity, and to engage in design and development in all kinds of fuel injection systems and pumps except a distributor type pump. Furthermore, the injunction granted is limited in time. Being a preliminary injunction it will last in any event only until final hearing in the action, and it may terminate earlier by its own terms, if the confidential information comes into the possession of Continental by legitimate means." Also see Larx Co., Inc. v. Nicol, 71 *USPQ* 115 (1946) where the court's test was the "reasonableness of the restraint imposed;" Harris and Siegel, *supra* note 2, pp. 362-363.

[52] Injunctive relief prior to disclosure would generally be denied unless disclosure was imminent or a valid provision relating to trade secrets was included in the employment agreement. See H. B. Wiggins Sons' Co. v. Cott-A-Lap Co., 169 Fed. 150 (1909); S. S. White Dental Mfg. Co. v. Mitchell, 188 Fed. 1017 (1911).

[53] For examples of the high standards established by the courts for second employers, see Colgate-Palmolive Co. v. Carter Products, Inc., 230 F. 2d 855 (1955); Monsanto Chemical Co. v. Miller, 118 *USPQ* 74 (1958); Although a bona fide purchaser of the secret for value is protected (Chadwick v. Covell, 151 Mass. 190 [1890]) unless he has changed his position on the faith of his ignorance, the innocent user may not continue to use the secret after notice (Vulcan Detinning Co. v. American Can Co., 75 N.J. Eq. 542). See also Ellis, *op. cit. supra* note 34, at pp. 101-105.

[54] Robinson, *op. cit. supra* note 28, at p. 29: "The remedy for wrongs already committed against an inventor by persons entrusted with his secret is an action at law for damages in the State courts, or, where citizenship confers the necessary jurisdiction, in the Federal courts. This action has been variously regarded as one of tort based on the fraud involved in the breach of trust or as one of contract on the express or implied agreement to respect the reserved rights of the inventor, but in one form or the other adequate compensation is awarded for the injury sustained. Against a future and expected invasion of the inventor's rights equity will interpose an injunction, forbidding the unauthorized use of the knowledge of the defendant or his disclosure to others of the secret of the invention. The latter remedy is open to the personal representatives of a deceased inventor, and to those whose fiduciary relations toward the defendant are derived from and identical with his."

[55] See Minnesota Mining and Mfg. Co. v. Technical Tape Corp., 192 N.Y.S. 2d 102 (1959), aff'd 226 N.Y.S.2d 1021 (1962); Smith v. Dravo Corp., F.2d 369 (1953) for a limited use of the injunction to a specific process or product. In Head Ski Co. v. Kain Ski Co., 158 F. Supp. 919 (1958), the court practically enjoined former employees from engaging in the same business. In Schulenburg v. Signatrol, Inc., 50 Ill. App. 2d 402, 412, the court stated that the injunction may be a drastic remedy, but imposed it nevertheless in order to "give to plaintiffs their just due."

Congressional attention. The McDowell Bill[56] was introduced in the 88th Congress to amend the National Stolen Property Act.[57] Unlike the statutes in foreign countries, our federal statute does not cover the theft of technical information. The McDowell Bill did not receive general industry support since it included non-technical business information and did not clearly distinguish inadvertent disclosure by migrant personnel from actual theft. Thus, although business firms are keenly interested in disclosure of trade secrets by the migrant employee, they seem to want additional legislation mostly to prevent and to penalize outright theft. The responses by companies to the Institute's early questionnaire indicate a similar attitude.[58]

How can companies assist the courts, in our regime of positive competition, to fulfill their proper role with respect to trade secrets? Employers would be well advised to institute security measures that assure sufficient evidence of the factors set forth in the previously mentioned Section 757 of the *Restatement of the Law of Torts.*[59] A company security system ought also to protect the employer against subjecting himself to liability through hiring personnel acquainted with trade secrets of competing companies.[60] Furthermore, the security system should, by advice, help employees and others to avoid inadvertent involvement in trade-secret misunderstandings with employers.[61]

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[56] H. R. 5217.

[57] 18 U.S.C. § 2311-2317.

[58] See section on "Legislative Gaps," *supra* note 2, at pp. 371-373.

[59] *Supra* note 2, at p. 362; see Messrs. McPherson, Williams and Wilson, "Loss of Trade Secrets Through Changes in Employment," *IDEA*, Vol. 8, Conference Number (1964), pp. 36-49. In General Aniline and Film Corp. v. Frantz et al., 151 *USPQ* 136 (1966), Justice Brink of the New York Supreme Court states that "the degree of secrecy . . . required for a trade secret need not be absolutely 100% perfect," that the plaintiff need not "meet the stringent requirements necessary in the case of a patent application." Justice Brink explains: "The reason for this is that the gravamen of this action is breach of confidence and the fact that at some later time after he violated his agreement and trust he could have obtained information elsewhere does not excuse his conduct. Protection is given against the reprehensible means, such as a breach of confidence, employed in gaining the secret."

[60] See "Safeguarding Confidential Information," *Management Record,* Vol. 22, No. 12 (December 1960), p. 26, a study by the Committee on Employment Conditions of the Engineers Joint Council. Information is here set forth on the attitude of, and attention by, employers to their employees' problems with respect to confidential information.

See in "Injunctions to Protect Trade Secrets—The Goodrich and Dupont Cases," *Virginia Law Review*, Vol. 51 (1965), p. 937:

"The real threat came from the nature of the position Wohlgemuth was to occupy for his new employer, and where this, rather than intent, is the source of the threat, substantial probability and inevitability become very difficult to distinguish."

[61] Wohlgemuth was alleged to have said that "loyalty and ethics had their price." 192 N.E. 2d 99, 104.

Procedures should also be designed for avoidance of misunderstandings between the current employer and a previous[62] or subsequent employer.[63] An employer who institutes adequate security precautions permits the courts without strained interpretation to recognize the confidential relationship, to assert the importance of good faith, and to point up its presence in a very practical and ethical way. Such precautions provide an effective learning opportunity and reaffirm high social standards under different combinations of meaningful circumstances.[64]

A carefully worded non-disclosure provision should be included by companies in all employment contracts.[65] It should be simply and clearly worded and explicitly brought to the attention of the employee so that he understands the implications of confidential relationships and is impressed with their importance. Extraneous matter and unusual or unfair requirements, however, should be avoided. A non-disclosure provision is not essential legally in an employee agreement,[66] since courts generally determine a case on the basis of trust, but they may well balk at upholding an unreasonable provision.[67] A written agreement provides a good legal way of putting an employee on notice and also provides an opportunity to deal with him fairly and

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[62] *Virginia Law Review, supra,* note 60, at pp. 940-941:

"That Latex intended to induce Wolgmuth to disclose Goodrich's secrets was suggested by the fact that Wolgemuth had been sought out by Latex, had been offered an increase in salary to manage its space suit department, and was the only one of more then ten applicants who was actually interviewed for the new position. Potash likewise acted suspiciously when it advertised in a newspaper in Wilmington, Delaware, the site of du Pont's home office, for a manager of plant technical services who 'must have TiO_2 experience.' Moreover, Potash had as recently as 1961 been refused a license from du Pont to use the chloride process and had subsequently begun to recruit key technical personnel to develop the process on its own."

[63] See Solo Cup Co. v. Paper Machine Corp., 144 *USPQ* 729 (1965), for action by court where third party competes unfairly with respect to trade secrets possessed by a new employee. Also see Herold v. Herold China and Pottery Co., 257 Fed. 911 (1919), concerning the invocation of the law against those having actual or implied knowledge of a confidential relation of others.

[64] Improvement in employer-employee relations, establishment of courses in professional ethics in universities for scientists and engineers, and avoidance of positions for new employees that may involve the utilization of secret information belonging to a former employer are among the suggestions offered at the 1964 Annual Public Conference of The PTC Research Institute, *supra* note 2, at p. 360.

[65] See McTiernan, Charles E., "Employees and Trade Secrets," 41 *JPOS* 820 (1959).

[66] Obligation not to disclose may rest on implied contract based on employer's great efforts to maintain secrecy and employee's participation in such efforts. See Winston Research Corp. v. Minnesota Mining and Mfg. Co., 146 *USPQ* 422 (Ct. App. 9 1965); Furr's Inc., et al. v. United Speciality Advertising Co., et al., 144 *USPQ* 153 (Tex. Ct. Civ. App. 1965).

[67] Hudson Foam Latex Products, Inc. v. Acken, 82 N.J Super. Ct. 508 (1964).

equitably. In the event of litigation, it provides a sufficiently high standard to which the courts can repair.

Another type of provision that should be included in an employment agreement relates to competition with the employer after separation.[68] It should be drawn with even more care than the non-disclosure type, since an unreasonable restraint of trade and a more serious threat to the employee's future livelihood may be involved.[69] This type of provision may subsequently be considered anti-competitive in nature, and it has features that directly involve the public interest. Since the courts in these cases will generally ground their relief on the actual agreement made between the parties,[70] explicit language should be used and steps taken to do justice to the two parties and provide adequately for the public interest.[71] The courts, in effectuating a fair and reasonable[72] provision of this kind, could significantly contribute to enforcement of ethical standards.

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[68] Blake, Harlan M., "Employee Agreements Not to Compete," *Harvard Law Review*, Vol. 73 (1960), pp. 625-691; Irving Varnish and Insulator Co., v. Van Norde, 138 N.J. Eq. 99, 46 A. 2d 201 (1946).

Ellis, *op. cit. supra* note 34, at p. 128: "For the former employer to have to wait until his former employee has disclosed the secret to his new employer is like telling a man: you cannot lock the stable door until the horse has been stolen.

"There is another difficulty in connection with a requirement that unauthorized disclosure must precede court action and that is the fact that in many cases the trade secrets are of such a nature that the former employer may have great trouble in proving the disclosure of the secret to end its use by the competitor."

[69] Ellis, *op. cit., supra* note 34, at pp. 96-117; McClain, Joseph A., Jr., "Injunctive Relief Against Employees Using Confidential Information," *Kentucky Law Journal*, Vol. 23 (1935), p. 248; *Virginia Law Review*, Vol. 47 (1961), p. 583.

[70] For information on the prospects for obtaining an injunction where there is no actual disclosure or a valid restrictive convenant, see *Virginia Law Review, supra* note 60 at pp. 932-935. In B.F. Goodrich Co. v. Wohlgemuth, 137 *USPQ* 389 (1963) the court pointed out that "without exception . . . where injunctive relief has been granted it has been in a situation where there is a restrictive non-competitive covenant. . . ."

[71] McClain, *supra* note 69, at pp. 246-248:

"Cases involving right of employees to leave and compete are examples of 'balancing interests or equities.' See Cook, *Cases on Equity*, 2 ed. C.3, Sec.4 (1932). . . . On the one hand, we have the desire to encourage competition and to facilitate the exercise by an individual of all his skill and knowledge, and, on the other hand, there is the wish to give reasonable protection against unfair competition to established businesses."

[72] Carpenter, Charles E., "Validity of Contracts Not to Compete," *University of Pennsylvania Law Review*, Vol. 76 (1928), p. 254:

"If the restraint is no more than is reasonably necessary to protect the employer against the deflection of customers or misuse of trade secrets by the employee through the opportunity which his employment has given him, the courts uniformly uphold the covenant and give relief either at law or in equity. But the promise by the employee not to compete will be bad if the restraint is more extensive territorially than is reasonably necessary to protect the employer's business . . . or if

Some suggestions may also be offered for making license agreements relating to trade secrets more effective instruments of positive competition. These agreements allow the licensee to use know-how without restraint by the licensor. There is always the danger that the secrecy of the information might be lost through inadvertent disclosure by one of the parties; and if the trade secret becomes involved in litigation, this danger becomes even greater. Accordingly, it seems prudent, where the hazard warrants, to make an assignment instead of to license, and to provide for sale of the information for a lump sum (or for payment in some other relatively quick manner).[73]

Another precaution is for the licensor to spell out the metes and bounds of the secret information very precisely. The relative lack of statutory protection for trade secrets makes the licensor and licensee dependent on the trade-secret contract to a much greater extent than the parties to other types of industrial-property contracts (e.g., those relating to patents, designs, and trademarks). Also important is the careful preparation of provisions of an agreement when more than one type of industrial property is included to assure separate consideration of these types by the parties and by the courts. Furthermore, attention should be given to the kinds of restrictions included in trade-secret licenses. The restrictions permitted in a trade-secret license may be somewhat different from those in other industrial-property licenses (due to the secret nature of the information and its non-statutory character); yet the courts generally apply tests with respect to the restraint of competition similar to the tests applied to patents.

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the restraint is for a length of time not needed to protect the employer's business . . . [or] where the purpose is to prevent the employee from quitting the employer's service and not to prevent use of detrimental information gained through employment."

[73] See Ladas, Stephen P., "Problems of Licensing Abroad," *The Trademark Reporter*, Vol. 56, No. 7 (July 1966), p. 526. However, Ellis, *op. cit. supra* note 34, at p. 495, states: "Most trade secrets are exploited by their discoverers or their successors in business. Secret processes and formulas are almost always developed by manufacturers for their own use. If they have manufacturing facilities, they have no incentive for licensing competitors. Also, where a process or formula is capable of producing a product which, by examination or analysis, does not reveal the nature of the process or formula by which it is made, it is difficult to check on the operations of a licensee.

"Lists of customers, credit data and commercial material of various kinds are never voluntarily transferred to actual or potential competitors."

A colleague expresses some doubt as to the feasibility of lump sum payments:

"It is always wise in business transactions to get cash on the barrel-head, where this is possible, but there's the rub. In my experience, for what it's worth, trade secret deals typically demand great ingenuity on the part of the lawyers in working out an acceptable payment scheme, and lump sum payment only rarely meets the needs of the parties. . . ."

Know-how licensing to the lesser industrialized nations, which has flourished since the end of World War II, is impeded in some degree by the difficulty of maintaining the secret character of information in agreements. Such licenses afford striking opportunities for these nations to share in the progress offered by modern technology.[74] A pioneer study of foreign licensing conducted by the Institute[75] found that the principal asset often wanted by a foreign company was know-how, sometimes by itself, sometimes to supplement a patent license, and sometimes to support a trademark. A majority of the 180 United States companies replying to a questionnaire, furthermore, reported that know-how was much more important to them as a licensable asset than were patents or trademarks; that know-how was indeed more sought after by potential licensees. In determining its license policy, a company may wish to (1) confine the agreement to non-secret know-how, (2) entrust the secrets to personnel provided by the licensor to the licensee for the duration of the agreement, or (3) press for sale of the secret information at a price taking into account the recipient's (or his government's) ability to pay and the seller's own economic situation (including tax aspects). Care in drawing the contract is at least as important as in domestic licensing agreements. Another comment is made on international licensing arrangements below.

POSTSCRIPT

The foregoing remarks on trade secrets are hardly definitive. The subject, furthermore, is open-ended and evolving, like positive competition itself. The non-legal literature, including trade and professional

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[74] See U.N. General Assembly Res. No. 1713 (XVI), "The Role of Patents in the Transfer of Technology to Under-Developed Countries," U.N. General Assembly Plenary 1084 (December 1961).

[75] See *PTC J. Res. & Ed.* (*IDEA*): Behrman, J. N., "Foreign Licensing" (Project 5a, "Relation of American Patents, Trademarks, and Techniques and American-Owned Foreign Patents to Foreign Licensing"), Vol. 1, No. 2 (December 1957), pp. 220-243; Behrman, J.N., "Advantages and Disadvantages of Foreign Licensing," Vol. 2, No. 1 (March 1958), pp. 137-158; Behrman, J.N., "Licensing Abroad Under Patents, Trademarks, and Know-How by U.S. Companies," Report on a Survey of Problems and Practices and Their Relation to the American Patent and Trademark Systems, Vol. 2, No. 2 (June 1958), pp. 181-277; Behrman, J.N., and Schmidt, W.E., "Royalty Provisions in Foreign Licensing Contracts," Vol. 3, No. 3 (Fall 1959), pp. 272-302; Behrman, J.N., and Schmidt, W.E., "New Data on Foreign Licensing," Vol. 3, No. 4 (Winter 1959), pp. 357-388; Behrman, J.N., "Foreign Licensing Investment, and U.S. Economic Policy," Vol. 4, No. 2 (Summer 1960), pp. 150-172; Behrman, J.N., "Foreign Licensing," Vol. 4, Conference Number (1960), pp. 19-21.

journals, is also giving more attention to trade secrets, so that public consciousness of the subject is expanding. This growing public awareness itself may tend to increase the volume of litigation and legislation. This developing interest was anticipated in our "initial report" in *IDEA*. The present paper emphasizes that the realm of positive competition includes the domain of trade secrets.

In any consideration of the role of trade secrets in the real world of positive competition, it is obviously necessary to include (1) the relationship between employee and employer, (2) their treatment in national and state legislation and by the courts, and (3) their status in international arrangements and agreements. Some additional remarks pertaining to these three levels are offered in the remainder of this section.

A constructive relationship between the employer and employee with respect to trade secrets is essential to progress in invention and innovation under modern circumstances. Such a relationship must derive from a mutuality of interest recognized by the parties. Employer and employee are clearly interdependent in their pursuit of creativity and enterprise. They are well served in dealing with one another by fair and reasonable provisions in agreements voluntarily entered.

Our "initial report" in *IDEA* contemplated that "pressures will be exerted by interested parties to extend, to strengthen, and to render more uniform the state laws covering trade secrets."[76] The business and professional communities are indeed becoming more concerned with problems of loss and protection. Increasing demands for coordination and clarification of state laws, and for systematic testing of the legality of those laws, may accordingly be expected.

The state-federal legal frontier is fluid, and no equilibrium is yet in sight. Recent state legislation has been mostly of a criminal nature.[77] The satisfactory protection of property and of individual rights will require some reduction of the wide variations in state laws. Greater uniformity is required since competition in research and development is national, even international. The interstate and international needs may encourage a quest for federal legislation to cover criminal acts relating to trade secrets. As already noted, it is unlikely that civil federal legislation specifically directed to trade secrets will find sufficient support. On the other hand, the difficulty of determining just what

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[76] *Supra* note 2, at p. 374.

[77] Georgia, Illinois, Minnesota, Nebraska, New York, New Jersey, Pennsylvania, and Wisconsin have in the past few years either introduced bills or enacted important statutes concerned with trade secrets. See Sutton, John P., "Trade Secrets Legislation," *IDEA*, Vol. 9, No. 4 (Winter 1965), pp. 587-607.

trade secrets are will continue to exert pressure against enactment of criminal legislation. It may also imply likelihood of narrow interpretation.

The proposed federal legislation on unfair competition[78] reflects the expanding interest in protection of confidential information. The original broadly phrased legislation has been sharpened specifically to include trade secrets—partly in response, no doubt, to the *Sears* and *Compco* decisions of the Supreme Court. If enacted, federal civil legislation would for the first time be taking account of a species of proprietary information historically left to the common law for protection. Thus, despite the apparent lack of demand for a trade-secret civil law, such legislation may yet be enacted on the national level as part of a more general effort to provide for unfair competition in the federal statutes. A statute relating to unfair competition would indeed seem to be an appropriate place to assert that trade secrets are recognized by federal law. The law of unfair competition is based on the general principles of fairness and equity, principles especially pertinent to the governance of trade-secret relations.

Although increasing account is being taken of trade secrets in international arrangements (generally on a theory of unfair competition), trade secrets have still been less subject to regulation by specific international agreements than patents and trademarks. Moreover, trade secrets have been less subject to national codification than the latter two, so it is not surprising that American companies appear to depend on foreign specialists for expertise on the law concerning confidential information in the different countries. Furthermore, the practical difficulties involved in maintaining the secrecy of technical information licensed abroad places severe limitations upon contracts involving such transfers.

Despite these obstacles, modern conditions require that increasing attention be given to the international role of confidential information. Among these conditions are the advance in communications and transportation, the importance of research for the aspirations of smaller countries, the technological character of national defense, the global effort to industrialize, and intensifying competition for foreign markets. Feasibility, fairness, and public accountability must be considered in drawing trade-secret agreements; but these considerations must be supplemented by an understanding of the foregoing conditions.

In conclusion, in the challenging circumstances of the future and within the context of positive competition, new arrangements for

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[78] See note 23, *infra*.

safeguarding trade secrets will be fostered and instruments already available will be used more extensively. The vigor of positive competition ensures variety and ingenuity in the mechanisms devised or used to meet employer-employee, third-party, national and international needs. The directions of improvement are more readily discernible, of course, than any distant or final pattern of actual arrangements.

The Economic Role of Trademarks and Their Utilization As Business Assets

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SUMMARY

THIS ARTICLE REPORTS ON THE INITIAL PHASE of a study currently being undertaken by the Institute on economic aspects of United States business firms' trademark practices. Within the context of returns from a test questionnaire sent to a selected list of companies, problems of trademark usage, maintenance, and valuation are highlighted. The commercial practicalities of trademark selection and policing, and international considerations in trademark utilization are also indicated.

SCOPE OF AREAS UNDER STUDY

IN MAY 1966, THE PTC RESEARCH INSTITUTE initiated a study

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primarily to develop factual information on the economic implications of trademarks to the American business community. A comprehensive body of statistical and empirical knowledge does not now exist regarding the role of trademarks in our economy and their utilization as business assets. As a corollary objective this study also seeks to provide better insights into commercial factors governing management's trademark policies. Business determinations regarding strategic utilization and profit potentialities of trademarks are among the aspects of this broad subject into which the Institute seeks particularly to inquire.[1]

As the focal points of multimillion dollar advertising and merchandising strategies, trademarks have, of course, become influential forces in swaying public buying and consumption habits. While many firms will readily acknowledge that trademarks are among the most valuable forms of business property they own, these assets are rarely given other than purely nominal values in corporate balance sheets. Although many firms have professed the impossibility of measuring their trademarks in dollar values in terms of the goodwill they represent, it is our view that trademark values are subject to some degree of quantitative measurement and that efforts to obtain this measurement, inexact as they may be, are preferable to the general uncertainty which now exists as to trademark values. We believe that value measurements for individual marks and for company portfolios of these symbols can lead to more precise analyses of their role in commercial activity.

The Institute, in conducting this study, also believes it important to distinguish carefully the activites of large industrial firms from those of small and new companies which are relatively lacking in resources and promotional facilities to develop brand names on a national or even regional basis.

Apart from differences related to size, there are undoubtedly other differences in emphasis which various firms give to trademarks, depending on whether or not they sell consumer goods or industrial products and whether or not their marketing strategy is based heavily or less heavily on product differentiation. Some of these variations are already apparent in the initial responses. A more detailed picture should emerge as additional evidence is collected.

It is against this general background of business policy considerations, including varying marketing practices, that the Institute is developing its inquiry into the trademark field.

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[1] For background information on the initiation of this research project, see the article by Robert B. Bangs, "Trademarks as Business Assets," in the Fall 1965 issue of *IDEA,* Vol. 9, No. 3, p. 435.

PROCEDURAL ASPECTS OF THE INQUIRY

Our overall program involves the conduct of a series of studies touching on all types of manufacturing, retail, and service industries. As an initial step to determine the most practical approach to the problem of fact gathering, the Institute sent a test questionnaire to a selected cross-section of manufacturing companies; this questionnaire sought to determine what changes and refinements would be needed for the more extensive inquiry now being planned.

It was also considered desirable to secure at the earliest possible stage some preliminary assessments regarding availability of the data being sought and of recipients' views on the feasibility of supplying pertinent information.

The questionnaire consisted of four parts and was directed to the corporate trademark officials addressed in the sample survey. The first part consisted of questions to elicit data on the number of marks a company is using at home and abroad. A second part of questions was designed to acquire information on the selection of trademarks, the promotion and expense factors involved, and the practices employed in their policing and protection. A third part of the questionnaire asked for information relative to the value and income factors associated with trademarks. Fourth and finally, the recipients were asked to provide a brief case history of one of their more important trademarks, its selection, promotion, policing, and its economic value to the company, including its role as a contributor to the company's growth.

The test questionnaire was sent to a selected list of companies in eight size categories as measured by total sales on an annual basis. These classes were: $1 billion and above; $100 to $999 million; $50 to $99 million; $25 to $49 million; $15 to $24 million; $10 to 14 million; $5 to $9 million; and $4 million and under.

PRELIMINARY DETERMINATIONS

As previously noted, the basic purpose of our test questionnaire was not to acquire substantive information as such but to determine, by the sampling technique, the type questions that could adequately solicit the information we need while at the same time being capable of a feasible response by manufacturing firms. Within this context, the sampling program brought forth some interesting results. The replies and comments which were received contained some excellent views by manufacturing firms regarding the type of approach that the Institute would find most productive in securing the desired data. The questionnaire now being developed for our contemplated broader survey is incorporating these views.

The more complete and comprehensive reactions to the preliminary survey were, as might have been expected, those submitted by the larger firms, particularly those in the group with sales of trademarked products of $500 million and above. On the other hand, most of the better case histories dealing with the selection and promotion of individual trademarks came from firms in the $100 million to $500 million sales categories.

The comparative lack of response from the sampling of medium sized and smaller groups (annual sales of trademarked products less than $100 million) was disappointing. We had hoped to secure from them the same relative degree of comment and reaction in our survey that was provided by the larger firms. In the context of our limited sampling program, it would be erroneous to conclude that this comparative lack of response is an indication that trademarks are of less significance in their sales activities. Our broader program will continue to include inquiries to these size firms in efforts to develop definitive conclusions on their trademark attitudes.

SUBSTANTIVE EVALUATION OF THE REPLIES

The sampling program served its basic purpose in providing the Institute clearer guidelines for proceeding full scale on this inquiry. In

TABLE 1

NUMBER OF TRADEMARKS USED AND REGISTERED IN U.S. AND ABROAD BY RESPONDENTS TO TEST QUESTIONNAIRE

Total Sales Category ($ million)	Number of Firms Reporting	No. of Marks in U.S.			No. of Marks Reg'd in U.S. Also Abroad	No. Foreign Reg's For Each U.S. Mark	No. of Marks Reg'd Abroad but Not in U.S.
		Used	Reg'd on Prin. Reg.	Reg'd on Supp. Reg.			
$1,000 & Above	7	1639	1129	24	555	10-60	92
$100-999	9	573	256	17	89	15 to over 100	10
$50-99	3	404	392	0	9	4-12	0
$25-49	1	70	63	6	20	6-10	0
$15-24	4	16	15	0	14	4-20	0
$5-14	0						
$1 - 4	2	7	7	0	0	0	0
Totals	26	2709	1862	47	687		102

the meantime, we believe that the subject matter of the replies, although far from conclusive, lend themselves to substantive evaluation and suggest some interesting avenues for future research. Although not necessarily representative of any segment of manufacturing industry as a whole, the replies were most interesting and are worthy of presentation in a preliminary report of this type.

The body of data we have at hand for this report consists of 26 completed questionnaires from business firms owning just over 2,700 trademarks. The largest concentration of these returns (16) was from relatively large companies with annual sales in excess of $100 million each and owning as a group more than 2,200 trademarks.

The balance of the returns (ten) comes from smaller companies owning less than 500 marks in the aggregate. In addition to total sales, respondents were also asked to report their sales of trademarked products according to a slightly different size classification.

A summary of the returns according to the first classification—total sales—is given in Table 1. Another summary, according to the second classification—sales of trademarked products only—is given in the following table:

TABLE 2

Sales Class ($ million annually)	No. of Firms Reporting	No. of Trademarks Used in U.S.
Over 500	12	1,766
100 - 500	4	446
50 - 100	3	404
1 - 50	5	86
Under 1	2	7
Totals	26	2,709

Details concerning each of these returns, including the chief products of each reporting company, are given in Appendix Table A.

As a constant number of questionnaires was mailed to firms in each size class in Table 1, it is plain that the response rate was more than twice as great from the largest firms as from the smaller ones. This may reflect the fact that the large companies are generally better equipped to handle questionnaires relating to proprietary information.

Cost And Selection Of New Marks

Data on trademark selection made available by the respondents to our questionnaire emphasized that every echelon in the company's organizational structure that would be involved in promoting and selling the product had some voice in the process of trademark selection.

For example, a respondent firm with widespread trademark holding in the United States and abroad observed that:

> A product basic to our line was developed after substantial research and was expected to establish a new standard in the industry. Lists of 20 to 30 names were derived in the usual manner by product managers and advertising people and were cleared for use by legal department searches. Each time a list was considered by company executives in conference with product managers, advertising and legal representatives, no name could be agreed upon. After about four lists had been prepared, a mark acceptable to all was selected. The mark was selected as being distinctive in the industry, as adding dignity to a prestige product, as being memorable, as being attractive whether written or oral, and as being of similar character to our other marks. . . .

Most of our respondents indicated that sales personnel had the primary responsibility for originating trademark ideas but that final adoption was a management committee responsibility. Several firms noted that suggestions were welcomed from any source within the company and several others observed their firms had no fixed procedure for trademark selection. Two firms mentioned that computers had been used to coin possible words or letter combinations offering trademark possibilities.

The respondent companies were also emphatic about the need for developing appropriate educational programs on the proper use of a trademark once it had survived the selectivity test. Typical of their attitudes was that expressed by a multinational firm with about 350 trademark registrations in the United States and about 260 abroad. The spokesman for this firm observed that:

> A full-scale advertising campaign is launched when the product is ready for initial distribution to the trade, and the trademark is kept in the forefront of the promotional effort until the name is firmly established in association with the product. Every effort is made to prevent imitation of the trademark through use of similar terms by others in order to avoid dilution of its effectiveness as a selling tool.
>
> Employees and others, including customers and the general public, are schooled in the proper use of the trademark and its generic terms. The trademark is always used in referring to the product and takes its place in assuring customers of a product made with the high quality they have come to expect from the trademark owner.

Several firms submitted copies of their trademark style manuals detailing how to use the mark in correspondence or advertising.[2] The

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[2] For example:

(1) "Sentence structure should be such that there is no implication that the

manuals, among other things, contain admonitions against combining the mark with other shapes or devices or using it as a synonym or as a descriptive adjective. Complete instructions are also provided on how to position the trademark in printed material, advertising and outdoor displays, as well as on products. One firm notes in its manual that the mark "should never be traced or drawn—or its form and proportions changed in any way. Artists or printers should be supplied with approved reproduction proofs of the trademark that can be copied photographically."

As to expenditures for research into the development of new marks, there was little uniformity among the reporting companies within similar sales categories. Most of the companies reported only nominal search expenditures, generally about $100 per mark. It would appear, therefore, that their search was confined primarily to United States Patent Office registration records. The remaining firms, which spent anywhere from several hundred to several thousand dollars per search, were relying not only on the Patent Office records but also on more widespread searches by their representatives into commercial trade directories and similar publications, as well as on the various search services provided by professional specialists. In such instances the search was intended not only to determine the existence of exact or analagous duplicate registrations but also of use of the term by others even though unregistered.

TRADEMARK VALUES

Our respondents generally avoided assigning values to their company's trademark portfolios; those that did calculated these values by methods that varied considerably. Only eight companies gave details concerning valuation methods and estimates of the proportion of advertising and other expenses they would assign to trademark promotion. These allocations ranged from a fraction of 1 percent of advertising outlay, based on the space the trademark occupied in total display, to 100 percent of advertising outlay—on the theory that it all was calculated to advance the sale of trademarked products. Several firms

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word is a generic or dictionary term."

(2) "The reader should always be advised that the word is the property of ______________ as a designation of its products, as distinguished from other brands of the same basic type of product."

(3) "It is not necessary to use the circled R every time the trademark is used, but we hold to the rule that it should be used after the trademark at least once on every page where it appears in printed publications."

assigned from 5 percent to 30 percent of advertising cost to trademark promotion.

In two cases estimates of trademark values were provided by calculating the cost of restoring sales to existing levels if trademark protection should be lost. These figures were respectively $30,000 for a firm with relatively small sales and many trademarks and $17 million for a firm with annual sales about $100 million and relatively few trademarks. Clearly the subjective values placed on goodwill identifiable with trademarks can vary over a wide range.

Although more than two-thirds of our respondents had at some time either bought or sold trademarks along with other assets of a business that were either acquired or spun off, in no case was a specific value placed on these marks in the transaction. Several respondents noted, however, that the marks were extremely valuable and did influence significantly the sale or purchase price.

Those firms that did endeavor to place a value on their trademark portfolios generally placed these in the multimillion dollar range—in two cases above $100 million. Other estimates were from $1 million upward. While none of these estimates was very precise and some may not have been well grounded, they were nevertheless indicative of the substantial investments the companies had made in their marks.

Maintenance Policies And Costs

Firms with total sales in the $1 billion and above class, and with multinational trademark operations, reported expenditures for trademark policing and maintenance of from $10,000 to over $100,000 per year. Virtually, all of those replying in the $100 million to $1 billion sales categories spent from $1,000 to $5,000 annually on maintenance and policing as did several in the $50 to $100 million sales classes. While a number of firms might have spent less than a thousand dollars per candidate to research a new mark in order to rule out risks against lack of novelty, distinctiveness, or infringement, they appeared willing to spend far larger amounts to see that such marks, once they become reputable, were fully protected.

In this connection, the respondents were asked for their views as to whether trademarks are adequately protected under existing United States law. Most of those who replied indicated that they were satisfied with the protection available. Several firms, however, felt that the United States law's prior-use requirement before any registration prospect can be secured militated against their efforts to promote new marks with a reasonable degree of protection against usurpation; others expressed rather strong views that their well-known marks were inadequately protected against degeneration into generic terms by publishers, particularly those of dictionaries.

The replies also dealt with the various methods used by firms in enforcing compliance with proper use and preventing unauthorized use of trademarks. These are too numerous to list and usually depend upon the particular factual situation. However, enforcement ranged from bringing suit—at one end of the spectrum—to advising of an improper use and requesting proper display of the mark at the other end. Among the "nonlegal" approaches were the use (1) of a "clipping service" systematically to screen publications for unauthorized or improper trademark usage and (2) of comparison buying and shopping so as to review a competitor's practices regarding possible employment of confusingly similar marks.

International Considerations

The 16 respondents in the $100 million and above sales group in Table 1 are generally firms engaged in multinational operations. From 40 to 50 percent of their trademarks registered in the United States are also registered abroad. These companies reported anywhere from 10 to over 100 registrations abroad for each United States registered mark they use in foreign trade.

Some of these firms also reported registrations of marks abroad which were neither registered nor used in this country. Among the firms responding to this question, 15 had no marks that were registered only abroad. Eight firms did employ marks registered abroad that were not used in this country, with the number of such marks totalling just over 100.

The responses from firms in the $25 to $100 million sales range indicated little foreign activity in the trademark field. On the other hand, the four firms in the $15 million to $25 million sales categories, which reported a total of only 15 trademarks registered in the United States, indicated that 14 of them were also registered abroad, with each mark being registered from four to 20 times.

The multinational firm respondents noted the desirability of carrying a substantial inventory of registered trademarks abroad not only for use as marketing tools but also as insurance against foreign "piracy". Although in some cases their company names might be well-known in the United States, these names might be virtually unknown in many other countries. In other cases, their trademarks might have been publicized abroad, even without their knowledge, through advertising in magazines and other publications disseminated abroad and on the company's products themselves. Such trademarks were thus already pioneering a number of foreign markets for their products, but at the same time were vulnerable to "capture" and "identification snatching" in countries where no registered protection had yet been obtained.

The responses to our questionnaire indicated the confidence with which certain established multinational firms were willing to undertake widespread trademark protection programs, not only because they have the financial resources, but because they are sufficiently sophisticated and experienced to minimize uncertainties in market pioneering and development. On the other hand, there were certain other respondents with foreign trademark programs who appeared hesitant to undertake any expanded filings.

The 16 multinational respondents (noted in Table 1) with sales of trademarked products over $100 million annually, indicated that they were continuing to develop widescale trademark protection programs abroad, commensurate with the projected growth of their foreign advertising and sales activities. Firms with sales of trademarked products ranging from $25 to $100 million indicated a more conservative attitude towards foreign filings and noted that administrative and expense factors precluded any extensive broadening of their present trademark base. Firms whose annual sales of trademarked products were less than $25 million had comparatively little foreign trademark activity and gave no indication that they were now considering any expanded programs.

Virtually every respondent who reported sales of trademarked products over $500 million noted that his more important marks were registered in almost every trademark jurisdiction of the world. Companies with sales between $100 million and $500 million were generally more selective in their territorial filings—limiting their scope from about 30 to 45 countries, mostly in Europe and the British Commonwealth. One company in this category stated that it filed in "all countries." Companies with sales of between $50 million and $100 million had an expectedly lesser scope of foreign filings, confined primarily to some Western European, Latin American and British Commonwealth countries. Companies with sales below $50 million reported very little foreign activity beyond Western Europe and Canada.

Where respondent firms reported registrations of their trademarks on a world-wide basis, they were of course subject to the national treatment and other protective benefits established under the "Paris Union" Industrial Property Convention and the various Inter-

American Agreements in this field to which the United States is party.[3] Those firms that reported more limited foreign filing programs, saw to it, at the very least, that their marks were registered in the more important "Paris Union" countries where they could obtain a maximum degree of recognized protection. Very few filings among such respondents occurred in countries with which the United States has no agreements pertaining to national treatment vis-a-vis trademarks. A list of countries that are members of the "Paris Union" and Inter-American Conventions appears in Appendix Tables B and C.

Licensing Considerations

Most of the respondents who operate abroad licensed their foreign marks to subsidiaries, largely under "package" type agreements which included, in addition to trademarks, patents as well as technical know-how and in some cases engineering services. They generally did not establish royalty payment solely for use of the trademark; the royalty rate was based on sales of the products if licenses covering patents or unpatented technology were involved.

Five firms reported their trademarks were licensed royalty-free while two utilized royalty fees for the use of trademarks alone; these fees were less than 1 percent of sales. In their trademark licensing agreements, the most important consideration was an "iron clad" commitment by the licensee that his goods bearing the United States owned mark must conform to the licensor's quality and performance standards.

Conclusion

As a preliminary survey in helping the Institute develop a clearer approach to a study of the economic implications of trademarks, the sampling program served its purpose. We now have better insights than before to enable a determination of the type of questionnaire that should be specifically tailored for our broader project. The substantive replies which we received from the 26 respondents, although far from precise and conclusive, do lend themselves to some tentative conclusions and also suggest some interesting avenues for future research, which we hope to follow as time and resources permit.

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[3] For more detailed description of these agreements (as well as others in the trademark field to which U.S. is not party), see the article by Vincent D. Travaglini and Joseph M. Lightman "Department of Commerce Assistance Available to U.S. Firms in Protection Abroad Against Unfair Trade Practices" in *The Trademark Reporter,* Vol. 55, No. 9, (September 1965).

APPENDIX

TABLE A
ABSTRACT OF COMPLETED QUESTIONNAIRES

No. of Company	Principal Products	Annual Sales Trademarked Products ($Million)	No. of Trademarks Used	No. on Principal Register in U.S.
1	Electrical	500+	300	140
2	Aerospace	500+	16	16
3	Bus. Equipment	100 - 250	20	20
4	Instruments	100 - 250	400	100
5	Electronic	—.5	5	5
6	Engine Components	1 - 25	6	6
7	Petroleum	50 - 75	350	350
8	Electronic	500+	100	50
9	Elec. Motors	1 - 25	1	1
10	Chemicals	500+	350	311
11	Rubber	500+	500	400
12	Machinery	1 - 25	3	3
13	Heating	100 - 250	11	11
14	Clay Products	.5 - 1	2	2
15	Metal Products	500+	25	25
16	Auto Parts	1 - 25	6	5
17	Petroleum	500+	375	218
18	Construction Equip.	500+	3	3
19	Steel	500+	53	45
20	Greeting Cards	50 - 75	40	30
21	Machinery	100 - 250	15	7
22	Aerospace	500+	6	4
23	Transport Equip.	50 - 75	14	12
24	Dental Products	25 - 50	70	63
25	Petroleum	500+	30	29
26	Aerospace	500+	8	6
	Totals		2,709	1,862

TABLE B

Member Countries* of "Paris Union" International Convention for the Protection of Industrial Property, signed in 1883; revised in 1911, 1925, 1934 and 1958

Algeria	Indonesia	S. Rhodesia
Argentina	Iran	Rumania
Australia	Ireland	San Marino
Austria	Israel	Senegal
Belgium	Italy	South Africa
Brazil	Ivory Coast	Spain
Bulgaria	Japan	Sweden
Cameroon	Kenya	Switzerland
Canada	Laos	Syrian Arab Republic
Central African Rep.	Lebanon	Tanganyika
Ceylon	Liechtenstein	Tunisia
Chad	Luxembourg	Trinidad and Tobago
Congo (Brazzaville)	Malagasy	Turkey
Cuba	Malawi	Uganda
Cyprus	Mexico	United Arab Republic
Czechoslavakia	Monaco	United Kingdom
Denmark	Mauritania	United States
Dominican Republic	Morocco	Upper Volta
Finland	Netherlands	Vatican
France	New Zealand	Viet-Nam
Gabon	Nigeria	Yugoslavia
Germany	Niger	Zambia
Greece	Norway	U.S.S.R.
Haiti	Philippines	
Hungary	Poland	
Iceland	Portugal	

* Parties to one or more revisions.

TABLE C

MEMBER COUNTRIES OF INTER-AMERICAN TRADEMARK AGREEMENTS

Country	Agreements of		
	1910[a]	1923[b]	1929[c]
Bolivia	X		
Brazil	X	X	
Colombia			X
Costa Rica			
Cuba	X	X	X
Dominican Republic	X	X	
Ecuador	X		
Guatemala			X
Haiti	X		X
Honduras			X
Nicaragua			X
Panama	X		X
Paraguay	X	X	X
Peru	X		X
U. S.	X	X	X
Uruguay	X		

[a] Convention for the Protection of Trademarks signed at Buenos Aires, August 20, 1910.

[b] Convention for the Protection of Commercial, Industrial and Agricultural Trademarks and Commercial Names signed at Santiago, April 28, 1923.

[c] General Inter-American Convention for Trademark and Commercial Protection signed at Washington, February 20, 1929.

Counter Comments on the Significance of Use-Rates of Patented Inventions*

BARKEV S. SANDERS

DR. NORMAN S. GHARRITY'S article entitled "The Significance of Use-Rates of Patented Inventions" (*IDEA*, Vol. 10, No. 2 [Summer 1966], p. 207) is in effect a criticism of the Research Institute's Patent Utilization Study. The Utilization Study was probably the first attempt to approach this question objectively and make it less a guessing game. Dr. Gharrity would return us to the guessing game era permanently.

Dr. Gharrity says that he, too, following the lead of the Utilization Study by the Research Institute, carried on such a study, but he fails to tell us what the findings were, and whether his findings confirmed or contradicted those of the Patent Utilization Study which he criticizes. In my opinion, this would have been useful and probably of interest to many readers of *IDEA* who are acquainted with the Patent Utilization Study.

I heartily agree with the point of view expressed by Dr. Gharrity in his third paragraph[1] about the need for a precisely defined concept as to

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* EDITOR'S NOTE: *Before publication in IDEA, papers are reviewed and suggestions made by members of the Editorial Committee intimately concerned and competent in the aspects of the subject matter discussed therein. The author may include or reject their suggestions. If these suggestions are not accepted by the author, in whole or in part, the reviewer may, if he so desires, publish a comment on the paper. In accordance with this policy, Dr. Barkev S. Sanders, a Principal Investigator on the Research Staff, offers the above comments.*

[1] Dr. Gharrity states:

> A use-rate is a ratio. Therefore, the first step in appraising the significance of a use-rate is to carefully define the numerator and the

what we mean by "use." In our research inquiry, we tried to do this.[2] How well we succeeded is still a moot question.

I also agree, by and large, with Dr. Gharrity's fourth paragraph,[3] though I am not sure just how costly and time consuming it would be for a firm to determine which of its patented inventions had been put to commercial use. I do know that my former associate, Dr. Rossman, had no difficulty in separating patented inventions that were in commercial use for companies whose patent work he handled. Dr. Gharrity might be right that in some marginal cases there could be a question whether or not a specific patented invention is being commercially used (patent litigation is evidence of this), but for the bulk of a company's patents (litigated patents represent less than 2 percent of all patents), the patent attorney who handled the patent would be in a position to determine without much effort or expense whether or not the patented invention had been used commercially.

> denominator of the ratio. .. . This author suggests that a good definition of "commercial use" would be "the making or selling of the patented product or the utilization of the patented process, only if the seller or user would be liable to infringement under the claims of the patent if the patent were adversely held." *IDEA*, Vol. 10, No. 2 (Summer 1966), p. 208.

[2] Our definition of use read:

> Making or selling the patented invention, or using the patented invention in the production of goods or services, or making financial arrangement (s) with a third party (s) for the production, use, or sale of the patented invention. *PTC J. Res. & Ed. (IDEA)*, Vol. 1, No. 1 (June 1957), p. 108.

This definition was first prepared by experts in patent matters, Joseph Rossman, patent attorney, and L. James Harris, Director of The PTC Research Institute. The definition was modified slightly on the basis of experience gained in interviewing 50 or so individual inventors and nearly 30 different assignees.

[3] Dr. Gharrity continues:

> The author found in making his use-rate study that for a firm to determine exactly which of its patents cover commercially used inventions an expensive, time-consuming study is necessary. The reason, in brief, is that use-rate data do not come naturally out of the research, patenting and production activities of firms. Therefore two problems arise in arriving at accurate use-rate estimates. First, a good operational definition of commercial use must be developed. Secondly, this definition must be carefully applied by those making the study. Educated guesses will not do here. [What about baseless guesses which the author is forced to make to illustrate his equation for $\frac{U}{I}$?] The obvious problem in a questionnaire study is how the firms or inventors responding arrived at their answer. For example did the firm's production and patent personnel sit down together and carefully arrive at a decision?. . . *IDEA*, Vol. 10, No. 2 (Summer 1966), p. 208.

Just who answered our questionnaires and with what thoroughness and care is also a moot question. We assume that the procedures and thoroughness varied with different companies. In our Patent Utilization Study perhaps we are open to this criticism in that we do not know who actually answered the questionnaire, nor how consciencious and knowledgeable the respondent was. We do know, though, that for a small subsample the respondents were interviewed face-to-face and the utilization ratio for interviewed replies did not differ significantly from that obtained through mail questionnaires. This is encouraging, but it is no guarantee of high quality response in all instances.[4]

In our interim reports we have from time to time indicated these and other limitations of our pilot study, but apparently these have not come to the attention of Dr. Gharrity. Moreover, for some time now we have assiduously sought resources to better validate the findings from our pilot study, and have also sought funds for a more extensive study of a probability sample of patented inventions that could be followed year after year to ascertain their utilization (that is, repeated short questionnaires to encourage reliability and a higher proportion of returns at shorter intervals, instead of a one-time, cumbersome questionnaire as was used in the first Patent Utilization Study), foreign patenting, the maintenance of foreign patents, and, if possible, to measure economic inputs and outputs associated with the sample of patents studied. To date, this has not been possible.

Given an appropriate definition of "use," and a responsible and knowledgeable respondent, then the proportion of patented inventions which are reported to have been put to commercial use becomes a significant economic fact worthy of determination and study, regardless of anything else. That this is true may be inferred from the literature and from the many Congressional hearings in which many critics of the patent system asserted its uselessness as demonstrated by the avalanche of useless paper patents. This attitude is reflected in the following quote from the report of the Congressional Subcommittee on Patents, Trademarks, and Copyrights[5]:

> Effects upon the patent system and the economy of the issuance of vast numbers of unused patents:

[4] It should be observed here that if we had attempted to preselect, for the company, persons who should have answered our questionnaires, or made other demands designed to upgrade the quality of the response, we would have had fewer returns and would have impaired the value of our study. Therefore, this problem of quality requires newer approaches to elicit this type of information and still assure a high response rate.

[5] Report of the Committee on the Judiciary, U.S. Senate, 85th Cong., 1st Sess., made by the Subcommittee on Patents, Trademarks, and Copyrights, persuant to S. Res. 167, Report No. 72 (G.P.O. 1957, Washington, D.C.), p. 10.

> The accumulation of *vast numbers of unused patents* by some companies and the effects of such accumulation (1) as a deterrent to newcomers attempting to enter these industries and (2) on the conduct of research by others is a matter of real concern. . . . (emphasis added)

It was this type of attack on the patent system in the TNEC hearings that impelled the National Manufacturers Association to carry on a study to determine the proportion of patented inventions which were put to commercial use, but because of the lack of a proper design, no useful findings resulted from the study. Reference was made to this and an earlier effort in this respect by Mr. P. J. Federico in his comments and observations as to the importance of our findings with respect to the proportion of patented inventions that had been put to commercial use. To quote Mr. Federico:

> I'd like to dwell on what has been done before in this same field so as to indicate the value of the work that's now going on. If you ask what's been done before, you can reasonably answer: "Practically nothing." Several years ago I had occasion to investigate what existed in the field on this subject, and I'll give you a brief survey of what there is.
>
> I might go as far back as about 1935. There was a Committee of Congress that conducted hearings that were known as the Pooling of Patent Hearings. They worked out a questionnaire designed to collect data on the utilization of patents and sent it to a large number of companies. I never did find out how many companies they sent it to. Nothing was ever worked out except that there were four volumes of hearings and exhibits printed, containing a miscellaneous, undigested mass of papers that were assembled. Buried in that mass of material are the replies received from the questionnaires, 14 in number which probably explains why nothing was ever done to continue the study.
>
> I might mention that there was another attempt about 1939 to make a study of the utilization of patents by questionnaires to companies, but nothing was finished or published. . . . [This refers to the NMA study.]
>
> Now, we have various guesses that have been made, both respectable and otherwise. These have been made by all kinds of people in different circumstances, ranging from the Commissioner of Patents down to people who hardly know what a patent is.
>
> One of the former Commissioners of Patents is accused of having stated that not more than 15 percent of issued patents are utilized. I have seen the statement in print charging him with the statement, but I have never seen the original statement. This is a prior Commissioner, by the way, not the present Commissioner.
>
> People have guessed from 1 or 2 percent on up to 50 percent. Five percent is a common figure. Ten percent is a common figure. Some say 20 percent. Some try to work out a reason for their guess, to make it look like more than a guess, and some don't. But the results aren't any more reliable in one case than in the other.
>
> Just as a sample of the type of statement that's made, I will read a

remark from a speech that Dr. [Joseph] Rossman happens to have in his briefcase, given on an unknown occasion by an unknown patent attorney, he doesn't know where he got it, so we're not blaming anybody for making this statement.

He talks about the number of patents that were issued last year then, after stating that there are over two and a half million issued, remarks, "It's quite safe to estimate that far less than ten percent of the patents issued are worthwhile or ever will go into production or be utilized in any way. . . ."

This present study [the one to which Dr. Gharrity has addressed himself] *is an attempt to get an answer to this question in a scientific manner, in a manner to yield results, in which there could be some degree of confidence for use in the future for various purposes.*[6] (Emphasis added)

In other words, as Mr. Federico has stated, the question to which our study was directed was what proportion of the United States' patents issued at this time were being put to commercial use. Since Dr. Gharrity has not questioned our specific ratios, I infer that his ratios were not materially different from those we got.

That we have been among the severest critics of our own study is found here and there in many of our interim reports. A few samples of such self-criticism follow, and should suffice.

(1) The Patent Utilization Study is limited to firsthand information derived from inventors and assignees who are, of course, interested parties. A second important limitation is that the patents included in our analysis do not represent a probability sample of the patent population in force. The sample for this pilot study was limited to a 2 percent probability sample of all the patents issued in 1938, 1948, and 1952. To the extent that the "mix" of the patents in these three years approximate the characteristics of patents in force at this time the findings from our sample may be considered equally applicable. The primary purpose of the present Patent Utilization Study has been to *develop a method of approach rather than to obtain definitive findings of general applicability* to all the patents in force at this time or any other specified time. . . .[7] (Emphasis added)

(2) Of course, our objective is not merely to answer whether or not a patented invention is used or not used, but to go much farther and attempt to determine the extent of use, and the technologic and economic consequences of use. We have even attempted to make some kind of cost accounting—to determine what does the production of the patented invention cost, and what the yields from the use of the invention have been. It is incorrect to assume that all we are interested in is whether the patented invention is used or not. That is only the beginning of our exploration.

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[6] Federico, P. J., commenting on the Patent Utilization Study, *PTC J. Res. & Ed. (IDEA)*, Vol. 1, Conf. Suppl. (1957), pp. 75-77.

[7] Sanders, B. S., Rossman, J., and Harris, J., "The Non-Use of Patented Invention," *PTC J. Res. & Ed. (IDEA)*, Vol. 2, No. 1 (March 1958), pp. 1-60. (Paragraph above quoted from pp. 7-8.)

> We have found that many of the patented inventions are used and are used extensively over many years. The economic returns, since they are somewhat partial, and since we don't know much about the accounting processes of reporting companies, we are hesitant to quote, but at least on the face of it, the figures we have obtained would suggest that the average patented invention that is put to use probably over the entire period of its use yields net returns in excess of six place figures.[8]

The preceding two observations are merely examples to show that we have been vitally concerned with the quality of our returns, and have done all within our power to undertake a rigorous validation. Falling short of that, we have done what our limited resources would permit. A sort of replication and some observations on these returns and their implications follow:

> (3) Especially in view of the incomplete returns of the sample of patents used in the Patent Utilization Study this writer has felt strongly the need for a validation study following three lines of approach. First, taking a subsample of inventors and possibly the few assignees that could not be reached for the lack of a current address, to find them, if possible, and obtain completed questionnaires to determine to what extent, the patents held by them differed from the other patents in our sample for which questionnaires were received. Second, to take a subsample of inventors and assignees who failed to return a questionnaire and interview them to obtain the information that we sought with our questionnaires, to determine the extent and nature of the bias introduced by patents for which no questionnaire was returned, even though we were in communication with inventor and assignee. Third, to take a subsample from all those patents for which a completed questionnaire has been obtained at any time, whether by interview or mail, and interview the inventor and assignee, and examine such records and other objective information available to ascertain the accuracy and completeness of the information supplied in completing the questionnaire.
>
> However, the resources of the Foundation have not made it possible to carry out this sort of a validation study.
>
> In 1962, therefore, the Foundation undertook a much more modest attempt to check at least on the reliability of the information supplied by assignees with respect to a few key questions. To achieve this we sent a postal card questionnaire to those assignees who had returned to us completed questionnaires.[9]

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[8] Sanders, B. S., "Patent Utilization," *PTC J. Res. & Ed. (IDEA)*, Vol. 4, Conf. Suppl. (1959), pp. 14-15.

[9] ——————, "The Upgrading of Patented Inventions and Their Use Here and Abroad," *PTC J. Res. & Ed. (IDEA)*, Vol. 7, No. 1 (Spring 1963), pp. 45-83. For the reader who is interested, the continuation of the quote given above goes into an analysis of classification of patented inventions according to their use based on the initial returns as compared with postal card returns, and makes a series of inductions about the quality of replies and why the nature of the replies would be biased to under-report patented inventions in commercial use—especially those in which such use occurred in the past. See especially pages 53-60.

The preceding three examples of self-criticism which apparently were not known to Dr. Gharrity, or else were ignored by him, make the only two meaningful paragraphs in his paper superfluous. I shall attempt to show that what follows next as to how to evaluate the use ratio is ill-conceived.

Starting with the formula which according to Dr. Gharrity is necessary to evaluate use rate we have:

$$\frac{U}{I} = \frac{\cancel{D}}{I} \times \frac{\cancel{F}}{\cancel{D}} \times \frac{\cancel{P}}{\cancel{F}} \times \frac{U}{\cancel{P}}.$$

By cancellation as shown, we run into the meaningless identity: $\frac{U}{I} = \frac{U}{I}$. Turning to the meaning of these symbols:

I = Inventions made (by inventors). The verbal explanation is tautological. More important, we have no practical way of determining when an invention is made, nor how many inventions are made in a day or a year. That is why governments have set up agencies with experts to determine whether applications which are submitted as inventions are truly inventions. Therefore, except for patented inventions, there is no practical way of knowing the total number of inventions. If Dr. Gharrity is right in saying that to know the significance of use-rate we must have a quantitative measure of "I," we can never get the significance of use-rate, since we can never determine "I," the total number of inventions.

D = Inventions *disclosed* by inventors to those responsible for patenting. Again, it is not practical to get a count of all disclosures. Furthermore, the number of disclosures is partly a function of the incentives or disincentives, as the case may be, that may be prevalent at a given time, and for certain inventors. Finally, Dr. Gharrity forgets that "independent" inventors don't have any occasion to submit disclosures distinct from patent applications. Therefore, as with "I," it is not possible to ascertain "D," the total number of disclosures. Furthermore, many of the disclosures (probably far above 50 percent) are found to represent no new inventions—which for society means no invention at all.

F = Inventions upon which patients are *filed*. A significant proportion of what the inventor thinks is an invention and files for turns out to be no invention—nearly 40 percent are not inventions as defined by the U. S. Patent Office. Moreover, the criteria used by the Patent Office, as well as the costs and hardships incident to patenting, undoubtedly influences the proportion of so-called "inventions" for which patent applications are filed by corporations or attorneys working for individual inventors. If there were no criteria and no hardships or costs, many more patents would be applied for, and with time, a growing proportion of these would be things which had been invented already. The formula, therefore, even if it were conceptually meaningful, lacks any pragmatic usefulness.

Furthermore, we do not see that in a static setting (that is, for a specific country at a specific time) this assertion by Dr. Gharrity is significant: "Clearly the value of $\frac{U}{P}$ in considering many questions can be determined only after considering the value of the other ratios." (p. 209)

As long as the proportion of inventions made in a year or any other unit of time which are disclosed remain constant, the ratios suggested in no way affect the significance of $\frac{U}{P}$. And since we have no means of measuring whether this proportion is the same or different from one period to another, or from one country to another, we should either avoid such comparisons or be cognizant that they might not be of true significance unless we have other evidence, such as a higher proportion of patents being maintained in countries where annual maintenance fees are charged, or some other supplementary information which supports our inferences.[10] This is the very logic which has led me to criticize attempts to measure inventiveness by the number of patented inventions over time, or between countries.[11]

We are not told how we are going to know what proportion of inventions are not disclosed, therefore all this statement culminates into is that we cannot give any significance to use-ratio, which we challenge. We have indicated already that many other individuals, such as Mr. Federico, do not agree with Dr. Gharrity. In fact, since the Doctor himself made a study to obtain use-ratios of patented inventions without first determining what proportion of inventions were being disclosed, it might be inferred that at one time he, too, thought, as we still do, that this ratio had a significance, per se.

Then the Doctor proceeds to the following truism: "Not all inven-

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10 *Ibid.*, pp. 45-83. See also, Vol. 7, No. 2 (Summer 1963), pp. 185-228. Also Vol. 6, Conf. Suppl. (1963), pp. 85-88.

11 ————, "Some Difficulties in Measuring Inventive Activity," a report from the Rate and Direction of Inventive Activity, Economic and Social Factors, A Conference of the Universities—National Bureau Committee for Economic Research (1962), pp. 53-77.

tions disclosed by inventors result in patent applications . . ." and he lists a few criteria of selectivity which sound plausible, but there is no way of quantifying these, and there is fundamentally no purpose in it since no one doubts that if you lower the barrier so that a higher proportion of disclosures are converted into patent applications, this could influence the proportion of patents that might be put to commercial use. We stress again that these limitations of "use-rate" become pertinent only if comparisons are made over time, between countries, between companies, and so on, where there is reason to believe the proportion of total possible inventions patented could be significantly different. We have demonstrated, for instance, that for assigned patents, utilization must be higher these days, since a large proportion of inventions are put to commercial use before a patent application is filed. It would be reasonable to assume that many inventions for which the commercial utilization proves disappointing will not become patent applications—which they might have become if there had been no pre-application use. Our observation on this was:

> The preapplication use of patented inventions is limited to corporations, and one of its consequences would be a drastic reduction of patent applications filed by corporations. Many potentially patentable inventions will not be patented if their preapplication use proves economically disappointing. This phenomenon alone could account for the marked decline in the number of patents per unit of population. This relationship gives an additional reason why the number of patent applications or patents issued is not a useful index of inventive effort of a nation.[12]

Dr. Gharrity does admit that these factors which he has emphasized take on significance when one starts comparing use-rates from various sources. He writes:

> If it is true that inventions are developed and market-tested more quickly, and that the Patent Office lag at best has remained unchanged in recent years, then a general increase in the use-rate of patented inventions could be at least partially explained. (p. 210)

On this point, we have already referred the reader to our interim reports on "The Upgrading of Patented Inventions and Their Use Here and Abroad." (Note 9) At the end of that report we have stated:

> Our analysis of known sources of patent survival statistics has revealed with almost no exception a progressive increase in the longevity of patents kept in force through the payment of annual renewal fees.
>
> This evidence runs counter to the generalization by Machlup

[12] ——————, "Speedy Entry of Patented Inventions into Commercial Use," *PTC J. Res. & Ed. (IDEA)*, Vol. 6, No. 1 (Spring 1962), pp. 87-116. (Paragraph above quoted from p. 88.)

without any evidence about the decreasing economic significance of patents because of rapid obsolescence.

The apparent universality and persistence of this phenomenon, both for assigned and unassigned patents could be interpreted most simply one way, the growing significance of patented inventions in the national and international economy, we see no other simple way to account for the fact that more and more corporate and individual patentees are ready to continue annual payment of renewal fees to keep their patents in force longer now than ever before and the apparent indifference of retention of patents to the magnitude of these renewal fees. We attribute this indifference to the progressive upgrading of inventions that are being patented and to increased exploitation of patented inventions and increased economic returns from such exploitation.

The question of particular interest to us and to our readers is with respect to the United States patents. Has there been in the United States a similar upgrading of patented invention? It is believed all the available evidence leads to an affirmative answer to this question. Perhaps none of this evidence would be conclusive by itself, but collectively there seems little doubt that in the United States perhaps more than in most other countries there has been a progressive upgrading of patented inventions.

Evidence in support of this conclusion are as follows:

(1) There has been a progressive shift in the United States from patents of individual inventors to patents by inventors working for corporations. Patent Utilization Study indicates a higher utilization level of assigned patents in comparison to unassigned.

(2) Increasing costs of patenting. In the United States even though the patent fees are much more modest compared with such fees in addition to renewal fees required by most other countries, the cost of professional services necessary for patenting have made patenting progressively costly. Other things being equal, as patenting costs increase inconsequential inventions are less likely to be patented.

(3) A priori consideration, as well as available evidence indicate that patents which are repatented outside of the country of residence are on the average economically the more significant patents. Over time there has been a progressive increase in the proportion of the United States patents patented in one or more foreign countries.

(4) The analysis of comparative longevity of patents in Netherlands shows the preeminence in the mean longevity of U. S. patents despite the fact that the rate of increase in U. S. patents in Netherlands in the years compared was highest of all, rising from an annual average number of 28 for the first five years (1913-17) to 254 in the last four years (1938-41). These averages for assigned patents were 14 to 225 (16 fold increase), and for unassigned patents 14 to 28. What is even more striking is that despite this extremely sharp increase in the number of assigned patents over time, the range in mean duration as obtained in Table 19 (column 9) compares rather favorably with that for other nationals. On the other hand for unassigned patents for which the annual increase was slower this range is extraordinarily high 4.68 compared with the next highest of 1.90 (see column 13).

(5) The Patent Utilization figures which are annual samples with

varying biases are at least not inconsistent with the hypothesis of progressive upgrading of inventions patented in the United States. The percentage utilized is highest for patented inventions issued in 1952, and lowest for those issued in 1938. These differences are not statistically significant, however.

(6) Much more significant in this respect is the utilization ratio of all patents issued to each inventor in the Patent Utilization Study who returned a questionnaire compared with the utilization level for the sampled patents reported by these same inventors. For assigned patents, other than the sampled, the utilization level was about 42 percent as compared with 62 percent for the sampled patents. For unassigned patents there was a similar differential between all patents and the sampled patent, 30 and 43 percent, respectively. By and large the sampled patents represented the more recent patents of these inventors, thus suggesting a progressive increase in the percentage of patented inventions put to commercial use in recent years as compared with earlier years.

(7) In an earlier interim report this author presented extensive evidence that nearly 40 percent of all assigned patents which are put to commercial use, such use began prior to the date of patent application. From this evidence it was inferred:

"Increasing commercial use of inventions prior to application would tend to raise the proportion of patented inventions in commercial use. Since many inventions which prove commercially a flop are eliminated from the universe of patents completely . . ."

(8) Finally, in the same interim report as referred to in paragraph 7, we refer to correspondence received from certain corporations commenting on Frank Howard's paper to the effect that many corporations file a progressively smaller number of possible patent applications than they could file and did file in prior years. That, while the number of disclosures per R&D employee has remained about the same the number of patent application filed per such employee has declined very sharply in the last 15 to 20 years. The Foundation has more recent communications from a corporation with very large patent portfolio stressing this point.

These bits of evidence would lead this writer to infer that there has been a progressive upgrading of the inventions patented in the United States at least since the latter part of the 19th century. A more solid case of such changes in recent years could be made if resources could be found to make an empirical study of the comparative economic significance of United States patents patented here and abroad especially in countries with renewal fee requirement to obtain more precise comparative norms of the economic importance of inventions patented abroad compared with domestic patents of the United States and inventions of other nationals patented abroad and here. It is only through such comparative studies of empirical patent experiences that we can hope to appraise ultimately the economic importance of patents in national and international economic life—and not by speculation from general economic assumptions, or review of what this or that economist has said, sans a bit of empirical evidence about the economic rôle of patented inventions in the world economy today. Admittedly getting these facts requires much more effort, cost, and certain skills not requisite for speculation along stereotyped paths which has character-

> ized much of the past economic thought on patents and patented inventions.[13]

Some of the rather naive statements made by Dr. Gharrity impute to us the belief that there is something immutable about use-ratios. Quotations from our interim reports, especially the preceding quotation with respect to upgrading of patented inventions make it clear that this is not the case. We therefore see no pertinence in statements such as:

> In summary, these factors suggest that the use-rate is partly the result of patent owners own actions (or those of his employees) as well as partly the result of factors beyond his control.

or,

> Otherwise conclusions of seemingly great significance about the rate of technological progress, the effectiveness or importance of the patent system in stimulating such progress, and the firm's use or misuse of the patent system might be made without real justification.[14]

Dr. Gharrity takes some arbitrary figures (since the quantities of I, D, et cetera which he specified could not be otherwise obtained) for a futile equation—confessing that such considerations as he had in mind become relevant only when the use-ratio of one company is compared to that of another—but certainly not when people say that 98 percent of the patents in the United States are paper patents, and we find instead that 50 to 60 percent are *not* paper patents (in that they have been put to commercial use). As we have indicated, it is in the latter setting that the Rossman-Sanders-Harris use-rates were presented and discussed. That use-rates will be different under different circumstances is axiomatic, and no one has denied it—in fact we have given evidence of this in our interim reports, such as those on the upgrading of patented inventions.

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[13] *Supra,* note 10, Vol. 7, No. 2 (Summer 1963), pp. 224-227.
[14] *IDEA,* Vol. 10, No. 2 (Summer 1966), p. 211.

Foreign Collaborations in India: Problems and Prospects*

ASHOK KAPOOR

SUMMARY

THE OBJECTIVE OF THE STUDY is to analyze the role of foreign collaborations in facilitating the development of domestic industry. This role is to a large measure determined by the factors preventing effective utilization of transferred rights and services and thus reducing the inflow of foreign rights and services (and capital). Changes in business and government policies could lead to a greater inflow of and better utilization of foreign rights and services (and capital).

Because of the type of issues explored, it was essential to be able to question respondents in detail about their collaboration experiences. Therefore, the research methodology had to be direct interviews with the different parties to a foreign collaboration. A selected sample was

*The second part of a study of the effect of selected features of business relationships between Indian and foreign companies and the effect of the government of India's policies and practices on foreign collaborations. This paper and the first part of this study which appeared in the preceding issue (Vol. 10, No. 2) of *IDEA* comprise (except for the omission of Part III and other minor deletions and changes) a dissertation by the author submitted to the faculty of the Universtiy of North Carolina in partial fulfillment of the requirements for his Ph.D. degree in the School of Business Administration. Financial support for this study was received from the University of North Carolina and The Patent, Trademark, and Copyright Research Institute of The George Washington University. The author is currently Assistant Professor of International Business at the Graduate School of Business Administration of New York University.

used for United States and Indian companies. Interviews were limited to Bombay and Delhi on the Indian side; United States interviews were limited to New York City. A total of 104 interviews were conducted with the following percentage breakdown: United States companies 17; European companies 9; Indian companies 53; Government of India officials 16; others 5. The results of this study are based mainly on direct interviews.

The section on "Negotiation Experience with Foreign Company" explores the process of negotiation with the foreign company. It seeks answers to questions of whether a company's experience in the negotiation process has a significant conditioning effect on project implementation and development. Whether this experience affects the company's outlook toward the Indian market. Whether satisfaction of the parties is due more to profits or managerial compatability. What features lead to greater compatability. Based on past experience, can broad guidelines be developed to facilitate project negotiation, implementation and development experience?

Services of foreign technicians are often necessary to supplement resources of the licensee. But are they supplied? Is there agreement on the functions and on the stage of operations for which foreign technicians are needed? These and other questions are addressed in the section, "Foreign Technicians." Thus, what is the experience in the use of such technicians and is the licensee satisfied? Why has the government intervened in the use of foreign technicians? What limitations prevent effective utilization of foreign personnel?

The foreign company often represents the only source from which a licensee can secure the benefits of research and development. Given the importance of research and development, what is the nature, extent and anticipated duration of dependence of Indian licensees on foreign research and development? If it is a continuing dependence, what are the implications for the government's policy on duration of technical collaborations? These and other questions are explored in the section on "Research and Development and Product Modifications." Thus, are the government's research and development efforts faced with problems not present for foreign research and development? To what extent have foreign collaborations facilitated the growth of indigenous research and development?

Closely related to research and development is modification of the technical aspects of foreign rights and services. But are the companies (Indian and foreign) and the government aware of the need for modifications? Which party to a foreign collaboration is more qualified to undertake modifications?

Payment for rights and services is a primary consideration in the licensor's decision to collaborate. But does his outlook toward the Indian market have an effect on the licensor's demands? What is the "true" importance of the terms of payment in the overall decision to collaborate? These questions, along with others, are considered in the section "Terms of Compensation for Foreign Rights and Services." Thus, how often is a swap of equity for foreign rights and services used? What is the attitude of companies and the government toward a swap? Does a swap provide the licensee with the necessary resources for satisfactory project development? Should a swap of equity for foreign rights and services be used in combination with other methods of payment?

Part III, "Government-Business Relationship," is omitted from this published paper. The omitted section includes the following topics:

Effect of the Industrial Policy Resolution
Negotiations with the Government
Foreign Ownership: Government Policy and Its Effects
Imports and Import Substitution
Exports and Export Rights

A copy of the complete paper, including Part III, is available for reference in the library of the Research Institute.

The "Conclusions" section assesses the value of the conclusions and recommendations reached by this study for business and government policy. It also suggests areas for additional research.

An appendix elaborates on the research methodology used in conducting the research.

PART II

INTERBUSINESS RELATIONSHIPS

RESEARCH AND DEVELOPMENT, MODIFICATIONS

This section deals only with the technical aspects of the rights and services provided by foreign companies to Indian companies and changes in products or processes necessary to serve the Indian market better. These modifications are similar to product "development" but are often a substantial change in patterns of the licensor. The word "modification" is used, therefore, to include a variety of changes to meet the needs of the different parties to a collaboration. Also considered is the question of which party to a foreign collaboration offers the better combination of features necessary for modification, e.g., technical ability and knowledge of local conditions.

Foreign rights and services are developed to meet a foreign company's particular set of requirements. The nature of the requirements and the available resources (men, money, capital) determine what is developed and for what purpose. The greater the similarity between the stages of development of industrial units, the greater the possibility that developments by one unit are useful for other units.

Because most Indian manufacturing units are far less developed than foreign manufacturing units, the licensors' rights and services are not always suited to Indian needs. Therefore adaptation of foreign rights and services is often required.[1] Professor Millikan stresses that it is not always easy for the developing countries to draw upon the experience of the developed world, for

> . . . *an adaptation of that experience* to the problems of underdeveloped countries requires a process as creative, innovative, and experimental as any we went through.[2]

The parties to a foreign collaboration have different views on what is best for an industrial unit in India. While the foreign company is likely to place emphasis on product quality, the government emphasizes use of indigenous resources even if it means lowering product quality. Again, while the foreign company emphasizes product quality because of its international reputation, the Indian company is satisfied with a much lower quality level because it deals only with the Indian market. These and other differences in outlook affect satisfaction with project development, e.g., what should be the quality level and who should carry out the changes in the product or process to secure the desired quality level. If the needs and areas of modification are recognized during negotiations, conflicts at a later stage would be greatly avoided.

Modifications in products and processes play an important role in how well foreign rights and services are used and how well indigenous production is developed. A significant percentage of the major compa-

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[1] G. L. Mehta, "Interrelated Tensions," *Restless Nations: A Study of World Tensions and Development* (New York: Dodd, Mead and Company, 1962), p. 38.

[2] Max F. Millikan, "Education for Innovation," *ibid.*, p. 134.

nies in most industries in India are using foreign collaborations. The Indian companies use the specifications of their respective licensors. This has created a confusing set of specifications within industries and this hinders standardization and mass production. As a greater number of products are manufactured under foreign collaborations in India using the specifications of various licensors, the problem of "confusing specifications" will become all the more perplexing.[3]

Two aspects of modifications are explored. First, how readily is the need for modification recognized and how extensive are these modifications on the part of the companies and the government. Second, what is the respective ability of the different parties to a foreign collaboration effectively to undertake modifications.

The extent of recognition of the need would indicate the importance attached to modifications. The nature of the reasons would indicate whether they are of a long-term nature and whether Indian companies can undertake modifications on their own. Foreign companies may have the ability but not the inclination (because of inadequate terms of compensation) actually to modify. Also if modification is affected by technical ability and knowledge of Indian conditions, it needs to be determined which requirement plays a more important role. This will assist in the determination of whether the Indian company or the government or the foreign company should modify its position or practice.

Recognition

Indian companies have very limited recognition of the need for modifications of product or process. This is nearly always true for the "average" Indian company. The large Indian companies are more aware of the need. Less than 10 percent of the licensees interviewed seemed to be aware of a possible need for modifications. The lack of recognition was apparent not only during the negotiation stages but also during project development.

Recognition of the need to adapt or modify is limited because Indian companies (especially the "average" ones) have hardly any technical ability to determine what is required for operations under Indian conditions with reference to what the foreign company is supplying. Also the main objective of Indian companies is to secure a foreign collaboration because they know they can sell whatever they produce.

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[3] The Indian Standards Directorate has commented on this area; see *The Economic Times,* (Bombay), June 22, 1965, p. 2. For comments pertaining only to the textile machinery industry, see the issue of May 31, 1965, p. 1.

Because of the general scarcity of goods, especially those made under foreign collaborations, the Indian company is not under pressure from customers to modify its output to meet their particular requirements. However, in some cases, usually the large project, the need for modification is established by a feasibility study.

When such needs are identified, differences have sometimes developed between the licensee and the licensor over whether the latter is supposed to provide modified rights and services. Nearly 50 percent of the licensees recognizing the need for modifications felt that differences developed with their licensors because there was not a clear understanding of this point. Negotiation techniques have been poor in that contract provisions seldom cover the issue of whether modified rights and services are to be provided. Thus differences between the licensee and the licensor lead to later aggravations. Misunderstanding would be reduced by stating in the contract whether modified or unmodified rights and services are to be provided. It should also be made clear whether determination of the areas of modification is to be the responsibility of the licensee or the licensor, making one party more aware of the need to identify problem areas.

The government itself, through a policy of rapid import substitution, presses for modification of foreign rights and services in a manner leading to greater utilization of indigenous resources. Companies have to accept these modifications even if it means alteration of manufacturing process, lowering of quality or higher cost of manufacture. Government pressure along these lines is quite pronounced and becomes particularly obvious during project development.[4] Close to 75 percent of the licensees (who are aware of the need for modifications) feel that the government's requirements are too one sided, i.e., they do not recognize the needs of the licensee and the licensor.

Of course, the country is in a very poor foreign exchange position. But it is doubtful that exerting pressure solves or appreciably reduces the problem. It does make companies take a more serious look at import substitutes. But it is not always feasible to make the modifications the government requires merely by exerting pressure. Pressure by itself is not enough, especially when it is the government exerting the pressure and the technical competence of the government officials is questionable.[5] This makes acceptance of the government's action on technical matters all the more difficult. The government should recog-

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[4] This feature is discussed in detail in the section on imports and import substitution.

[5] The issue of whether government officials are technically qualified to undertake the decisions that they do is also discussed in detail in the above section.

nize that what Indian companies need is technical assistance to carry out modifications. Pressure is hardly of any value without following it with adequate technical support.

About 40 percent of the licensees interviewed and aware of the need for modification of their foreign rights and services claim that the licensor has not paid "sufficient" attention to this point. More specifically, these licensees criticize the licensor for placing too high a quality requirement even though the market does not require such quality, and in general "not recognizing operating conditions in India." Almost 70 percent of these licensees (i.e., of the 40 percent) have purely technical collaborations.

The criticism is not wholly accurate. First, compensation for foreign rights and services is regarded as being inadequate by foreign companies. Modifications to meet Indian needs (when not contemplated in the original agreement) would require greater efforts by the foreign company and therefore better compensation. However, especially in financial collaborations it is to the licensors' benefit to modify according to Indian needs even if the compensation is not regarded as "adequate" because by doing so the licensor improves the Indian projects' operating efficiency. Second, especially in technical collaborations, foreign companies should not be expected to be fully familiar with the nature of Indian needs. This is particularly true in those technical collaborations that involve single transfer of foreign rights and services and very limited continued participation with the licensor. Third, the Indian licensee does not have the technical ability to indicate the type of modifications that he feels are required in the foreign rights and services. The responsibility to seek modifications and indicate the areas to be modified rests with the Indian company. This is particularly necessary because, as Indian companies argue, foreign companies are not adequately familiar with Indian needs and conditions.

Qualified to Modify

Which party in a foreign collaboration is more qualified to modify effectively? Indian companies and the government do not have the technical ability. The government does not have the technical resources actually to help the Indian company to implement the changes it suggests. And the greatest need of Indian companies is not only having someone who can help them implement rights and services but also provide *close* and *continuing* assistance. Finally, the government's efforts at helping make modifications are no more readily accepted than those by indigenous R&D institutes.

In order to modify effectively, the party undertaking modifications must have technical ability and knowledge of the conditions in which the modifications are to take place. For example, for a licensed process, the licensor may be using chemical A. But the government does not permit import of chemical A and therefore the licensed process requires another chemical, say, chemical B. Since the licensor's process is based on use of chemical A, changes may have to be made in the process to use chemical B. Therefore the party undertaking the modification must have the technical ability. But what are the conditions under which chemical B will be used? Thus, what are the prospects of long-term availability? Are Indian personnel available who can utilize chemical B? Are there features of the general operating conditions in the Indian plant that require changes in order to use chemical B effectively? The time taken to acquire sufficient technical ability and knowledge of local conditions will determine the speed with which modifications are made.

None of the three parties to a foreign collaboration is wholly prepared. Indian companies do not have adequate technical ability. The government also is incapable, technically. And while foreign companies have the technical ability, they need to develop greater knowlege of Indian conditions. Given the encouraging rate of progress that foreign companies have already shown in this respect, especially under financial collaborations, they can be expected to develop an adequate combination of the two essential features. And foreign companies will do this in a much shorter period of time than is possible for the Indian government or Indian companies working without foreign collaborations.

Conclusions

Less than 10 percent of the Indian licensees interviewed are aware of the possible need for modifications of their foreign rights and services.

When the need for modification is recognized, differences have developed between the licensee and the licensor over which party is to provide the modification. This source of aggravation should be avoided by specifying in the contract whether the foreign company is to provide modified rights and services, and whether determination of the areas of modification is to be the responsibility of the licensee or the licensor. Companies, both Indian and foreign, entering into collaborations should recognize these features in their negotiation process. The government, through its review and approval process, should see to it that these features are covered before taking action on an application.

The government should recognize that pressure alone is not enough to help Indian companies undertake modifications. Indian companies need close and continuing technical assistance to carry out modification. Therefore, the government should either provide such assistance itself or encourage others (say foreign companies) with the resources to provide such assistance.

Effective modification requires technical ability and knowledge of Indian conditions. Foreign companies offer a better combination of these features than either the Indian companies or the government. In deciding what is to be modified and who is to undertake the modifications, the Indian companies and the government should recognize the better combination offered by foreign companies.

TERMS OF COMPENSATION FOR FOREIGN RIGHTS AND SERVICES

If, as is argued in this study, India cannot avoid a dependence on foreign rights and services if it is to accelerate its economic growth as desired by the government, a central question is whether the "proper atmosphere" is developed to attract a greater inflow of these assets. Adequate compensation is a primary consideration in a foreign company's decision to license in India. But at the same time, the government wishes to minimize the cost of collaboration, especially in foreign exchange.

Some of the questions considered in this chapter are: Do the foreign companies regard the compensation for their rights and services to be adequate? If not, why do some companies still extend their rights and services to Indian companies? What are the characteristics of such companies? How long can these foreign companies be expected to collaborate in India under the "existing conditions"? Will changes in compensation and "atmosphere for foreign collaborations" encourage a greater inflow of rights and services? Answers to these questions will suggest the relative importance of compensation for rights and services in a company's decision to collaborate in India. And the nature of the answers would suggest possible changes in business and government policy on foreign collaborations and compensation.

Taking equity in the Indian company instead of cash is one method of payment for foreign rights and services and it leads to a foreign exchange saving. But what are the advantages and disadvantages of a swap for Indian and foreign companies? Can a swap be used to encourage a greater inflow of foreign rights and services? Will better terms of a swap lead to greater inflow of rights and services? These are some of the questions considered in this section.

Royalties

Despite what Indian and foreign companies consider to be adequate compensation under a collaboration, the government makes the final decision. Its decision on the terms offered is based on a number of considerations, such as industry priority; extent of technical skills required in relation to what is believed to be indigenously possessed; export potential and export promise of proposed collaboration; extent of foreign equity interest; provision for foreign exchange cost by the foreign company; importance to the defense effort. There is no general rule that the government uses. Decisions are made on a case by case basis.

A study by *The Economic Times* (based on 52 agreements pertaining to 44 companies) indicates that there is no uniformity of terms of payment of royalty approved by the government.[6] The study adds:

> In many cases the royalty is fixed as a percentage of gross or net sales, this percentage being in some cases fixed differently for different slabs of sales income. There are also instances of minimum royalty. The royalty ranges from 0.5 percent (Deepak Insulated Cables) to the high figure of 5 percent in as many as 7 cases. There are also instances of royalties fixed as percentage of trading profits (e.g., Isaac Holden: 10 percent; A.P.V. Engineering: 15 percent on profits before tax with a minimum of £2000 per annum) ; net annual ex-factory costs of products (e.g., Prestolite: 4 percent; Engel India: 5 percent) and cost of plant and machinery (e.g., Usha Martin Black: 1 percent).[7]

But "in an overwhelming number of cases, the royalty is based on sales. The largest number fall in the range of 2 to 3 percent of sales."[8]

Most Indian company respondents are indifferent toward the compensation allowed by the government. They argue that the decision is really beyond their control. Also they are not particularly concerned about higher payments because the nature of the Indian market permits them to pass on the additional costs to the customer.

All but 20 percent of the foreign company respondents regard the amount of compensation for their rights and services to be inadequate. Companies have complained that delays and additional costs of trans-

[6] *The Economic Times* (Bombay), November 30, 1964, p. 1.
[7] *Ibid.*
[8] *Ibid.*