KP

87th Congress
1st Session

COMMITTEE PRINT

PATENT PRACTICES OF THE DEPARTMENT OF AGRICULTURE

PRELIMINARY REPORT

OF THE

SUBCOMMITTEE ON PATENTS, TRADEMARKS, AND COPYRIGHTS

OF THE

COMMITTEE ON THE JUDICIARY

UNITED STATES SENATE

EIGHTY-SEVENTH CONGRESS, FIRST SESSION

PURSUANT TO

S. Res. 55

Printed for the use of the Committee on the Judiciary

U.S. GOVERNMENT PRINTING OFFICE

73412 WASHINGTON : 1961

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington 25, D.C. - Price 45 cents

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FOREWORD

Does the Department of Agriculture's policy of retaining for the United States the domestic title to inventions resulting from employee and contractor research for the Department retard or promote the use of such inventions? This report, prepared by Herschel F. Clesner, assistant counsel, under the supervision of Robert L. Wright, former chief counsel of the Senate Subcommittee on Patents, Trademarks, and Copyrights, reveals that in the view of the Department, this policy effectively promotes such use. As the report notes, this view has been confirmed by an outside appraisal made by Dr. Roy C. Newton, former vice president in charge of research of the country's largest food processor.

The present Agriculture patent policy has evolved from 80 years of experience in dealing with inventions arising out of its research. Originally, the Department allowed employees and contractors to retain title to such inventions. However, after congressional criticism, suits by the Attorney General, and studies made by its own officials and outside committees, the Department adopted its present policy as the one which would best serve the public interest and effectively carry out the Department's legislative mandate to make the fruits of its research freely available to the farmer, food processor, consumer, farm product manufacturer, and all other members of the general public.

The Department's patent experience is particularly pertinent at this time as the subcommittee is considering S. 1084 and S. 1176. These bills would, in substance, formulate an overall Government patent policy similar to the existing Department of Agriculture policy.

I am gratified to learn that the results of the Department of Agriculture's research are being widely utilized and that its present patent policy appears to have promoted this objective. However, publication of this report should not be construed as an endorsement of the Department of Agriculture's patent policy by the Subcommittee on Patents, Trademarks, and Copyrights. Whether this or any policy should be the basis of an overall uniform patent policy for the Federal Government is a matter presently under study by the subcommittee. The report is being printed as a contribution to our knowledge of how one important agency of governmental research has disposed of patent rights in its inventions and how that agency appraises its own experience.

JOHN L. MCCLELLAN,
Chairman, Senate Subcommittee on Patents, Trademarks, and Copyrights, Committee on the Judiciary.

SEPTEMBER 15, 1961.

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The present Agriculture patent policy has evolved from 50 years of experience in dealing with inventions arising out of its research. Originally, the Department allowed employees and contractors to retain title to such inventions. However, after unsuccessful suits for the ... [illegible] and similar abuses by officials and contractors, the Department adopted its present policy as the one which would best serve the public interest and effectively carry out the Department's legislative mandate to make the fruits of its research freely available to the farmer, food processor, consumer, farm product manufacturer, and all other segments of the general public.

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SEPTEMBER 15, 1961.

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PATENT PRACTICES OF THE DEPARTMENT OF AGRICULTURE

Introduction

The first titled Commissioner of Patents, Henry L. Ellsworth, was the first Federal official who attempted to promote agriculture. In late 1836, the year that patent examination commenced, Ellsworth, on his own initiative and without congressional authority or appropriations, began to distribute plants and seeds of value to farmers. He also promoted the publication of agricultural statistics. By 1839 the Congress discovered the public value of Commissioner Ellsworth's agricultural program—possibly due to the great interest of their constituents, and granted the Commissioner the right to expend $1,000 for agricultural purposes out of current income derived from the sale of patent copies. This was the first authorized Federal expenditure for agriculture. With this stimulus the Patent Office's agricultural endeavors were steadily expanded as were their appropriations for this purpose. Shortly thereafter, an agricultural division was established within the Patent Office. When, in 1862, the Congress created an agricultural agency with bureau status, the Assistant Commissioner of Patents in Charge of Agricultural Affairs, Issac Newton, became the first Commissioner of Agriculture. The bureau's personnel and library were drawn from the Patent Office and the Patent Office Library and the Department and the Patent Office have continued their close association ever since.

I. Legal Authority as to Patents

A. Review of applications for plant patents

The Townsend-Purnell Plant Patent Act, an amendment to the general patent law, enacted on May 23, 1930, states:

> Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefor, subject to the conditions and requirements of this title.[1]

Furthermore, the patent grant, with certain exceptions, gives—

> the right to exclude others from asexually reproducing the plant, selling or using the plant so reproduced.[2]

The Plant Patent Act provides that the Commissioner of Patents may request the assistance of the Department of Agriculture:

> The President may, by Executive order direct the Secretary of Agriculture, in accordance with the requests of the

[1] 35 U.S.C. 161.
[2] 35 U.S.C. 163.

> Commissioner, for the purpose of carrying into effect the provisions of this title with respect to plants (1) to furnish available information of the Department of Agriculture, (2) to conduct through the appropriate bureau or division of the Department research upon special problems, or (3) to detail to the Commissioner officers and employees of the Department.[3]

Such an Executive order was issued by President Hoover following the enactment of the Townsend-Purnell Plant Patent Act on October 17, 1930.[4]

An application for a plant patent is made to the Commissioner of Patents and must include (1) a written document which comprises a petition, a specification (description and claim), and an oath; (2) a drawing in those cases in which a drawing is possible, and with reference to the drawing, when color is a distinguishing characteristic of the new variety, the drawing must be in color and two copies must be submitted to provide an original and a duplicate; and, (3) the Government filing fee of $30; (4) the application papers must be filed in duplicate. A description of the plant variety given in the specification must be complete and detailed and expressed in botanical terms in the general form followed in standard botanical textbooks.

The reason for requiring the application to be filed in duplicate and in complete and detailed botanical terms is to provide the Patent Office with an original and duplicate file, for in the examination of the application the duplicate file is utilized for submission to the Department of Agriculture for an advisory report on the plant variety, the original file being retained in the Patent Office at all times.

The duplicate file of a plant application is submitted by the Commissioner of Patents to the Agriculture Research Service, Department of Agriculture, for report. The Agriculture Research Service is directed to act for the Department of Agriculture in reviewing the plant patent applications referred to the Department and is required to furnish the Patent Office with such information as is available in the Department of Agriculture within the knowledgeable scope of the specialists of the Agriculture Research Service, who are skilled in the different phases of the horticultural sciences. The report rendered by the Agriculture Research Service to the Commissioner of Patents is only advisory, but in practically all instances it is adopted in toto as the basis for determining whether the subject matter is patentable.

B. RESEARCH AND DISSEMINATION OF RESULTS (INVENTIONS, PATENTS, AND KNOW-HOW) TO THE PUBLIC THROUGH DEDICATION OR ASSIGNMENT TO THE GOVERNMENT

The Department of Agriculture is required to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture, in the most general and comprehensive sense of that word and further, to procure, propagate, and distribute among the people new and valuable seeds and plants.[5]

Congress has declared that it is the policy of the United States to promote the efficient production and use of products of the soil as

[3] 35 U.S.C. 164.
[4] App. E.
[5] 5 U.S.C. 511, Organic Act of 1862.

essential to the health and welfare of our people and to promote a sound and prosperous agricultural and rural life as indispensable to the maintenance of maximum employment and national prosperity. It is the expression of Congress to assure agriculture a position in research equal to that of industry in order to maintain an equitable balance between agriculture and the other sections of our economy.

To attain the above objectives, the Department of Agriculture must conduct and stimulate research into the laws and principles underlying the basic problems of agriculture in its broadest aspects.[6] This includes, but is not limited to, research relating to the production, marketing, distribution, processing, and utilization of plant and animal commodities at all stages from the original producer through to the ultimate consumer; research into the problems of human nutrition and the nutritive value of agricultural commodities, with particular reference to that which may be found necessary for the health of the consumer and to the gains or losses in nutritive value that may take place at any stage in their production, distribution, processing, and preparation for use by the consumer; research relating to the existing and potential uses and markets for agricultural commodities and by-products either as food or in manufacture or worldwide trade with emphasis as to those foods and fibers for which our capacity to produce exceeds or may exceed economic demand; research to encourage the discovery, introduction, and breeding of new and useful agricultural crops, plants, and animals, particularly for those crops and plants which may be adapted to utilization in chemical and manufacturing industries; research relating to new and more profitable uses of soils, plants, animals, and equipment; research relating to the conservation, development, and use of land, forest, and water resources for agricultural purposes; research relating to the design, development, and construction of farm buildings, farm homes, farm machinery, including the application of electricity and other forms of power; research relating to the diversification of farm enterprises, both as to the type of commodities produced, and as to the types of operations performed; research relating to any other laws and principles that may contribute to an effective agricultural industry and such other researches, investigations or experiments bearing on the agricultural industry or on rural homes of the United States having due regard to the varying conditions of the country.[7]

The expressed intent of Congress is that the Department of Agriculture shall make the maximum use of existing research facilities owned and controlled by the Federal Government, State agriculture experiment stations, and of the facilities of the Federal and State Extension Services, in carrying out the agricultural research and development program.[8] It is the policy of Congress to continue agricultural research, investigations, and experiments at State agricultural experiment stations which have been operated, encouraged, and supported since 1887.[9]

The Department also has established, equipped, and must maintain regional research laboratories—utilization, research, and development

[6] 7 U.S.C. 427, 427(i); 5 U.S.C. 514.
[7] Ibid.
[8] 7 U.S.C. 427, Bankhead-Jones Research Act (1935) as amended by title I of the Research and Marketing Act (1946).
[9] 7 U.S.C. 361(a), part of Agricultural Experiment Station Act originally enacted in 1887 and reenacted in 1955.

divisions—one in each of the four major farm producing areas.[10] These laboratories are primarily concerned with new scientific, chemical, and technical uses for and new and extended markets and outlets for farm commodities; products and byproducts. To carry out this work the Department has been authorized to cooperate with other departments and agencies of the Federal Government, States, counties, municipalities, as well as business organizations, associations, universities, scientific societies, and individuals.[11]

To promote the dissemination of results of research and experiments conducted by the State agricultural experiment stations, the Government allows the stations the privilege of free mailing bulletins, reports, periodicals, reprints of articles, and other publications.[12] The Agricultural Extension Service's working association with the experiment stations further assures that the results of research are funneled through the county extension agents to the potential users of the research and development with a minimum of delay.

The Department of Agriculture may enter into contracts with qualified public and private organizations or individuals to carry on research work when the Secretary feels that this work can be performed more efficiently, more rapidly, or at a less cost than if performed by the Department of Agriculture.

These contracts may cover work for a maximum period of 4 years from the date of the contract and the Secretary of Agriculture may make advances, progress, or other payments. However, the projects conducted under contract with public and private agencies must be supplemental and coordinated with research of the laboratories of the Department of Agriculture and all contracts made must require that the results of the research and investigation be made available to the public through dedication, assignment to the Government, or such other means as the Secretary of Agriculture shall determine. This is done pursuant to a specific directive from Congress that—

> Any contracts made pursuant to this authority shall contain requirements making the results of research and investigations available to the public through dedication, assignment to the Government, or such means as the Secretary shall determine.[13]

The Department is authorized to provide for continuous research to improve the marketing, handling, storage, processing, transportation, and distribution of agricultural products.[14]

Under the Soil Conservation and Domestic Allotment Act of April 27, 1935 the Department is authorized to carry on surveys, investigations, and research relating to the character of soil erosion and the preventive measures needed, and to disseminate information concerning such work.[15]

The Department is empowered to conduct fire, silvicultural, and other forest research investigations and experiments at the many forest or range experiment stations, the Forest Products Laboratory, or elsewhere.[16] This includes research into diseases of forest trees

[10] 7 U.S.C. 1292.
[11] 7 U.S.C. 1292(c), sec. 202(c) of the Agricultural Adjustment Act of 1938.
[12] 7 U.S.C. 361(f).
[13] 7 U.S.C. 427(i), 7 U.S.C. 1624(a).
[14] 7 U.S.C. 1621–1628, title II of the Research and Marketing Act, 1946.
[15] 16 U.S.C. 590(a).
[16] 16 U.S.C. 581 (McSweeny,McNary Act, 1928).

and of diseases causing decay and deterioration of wood and other forest products, forest insects injurious or beneficial to trees or wood products, and for developing methods for their prevention and control.[17] The Forest Service may also research forest birds, animals, and wildlife and develop the best and most effective methods for their management and control.[18] Research is conducted into methods of management of forest ranges,[19] into the physical and chemical properties and the utilization and preservation of wood and other forest products, fibrous material for pulp and papermaking.[20] To aid in carrying out this program, funds may be received from any State, other political subdivision, organization, or individual for establishing or operating any forest research facility.[21] Furthermore the Department may advance funds to a cooperator in order to stimulate or facilitate cooperative research.[22]

The Department conducts research regarding the causes, cure, and prevention of contagious, infectious, and communicable diseases among domestic animals and poultry.[23] In this connection the Department has established research laboratories and is authorized to make research contracts under the authority of 7 U.S.C. 427(i)(a).[24] As a result extensive work is conducted in the preparation of viruses, sera, toxins, antitoxins, and other analogous products.

The Department also engages in technical and scientific research in American-grown cotton and its byproducts regarding present and potential uses.[25] Furthermore, research is carried on through the establishment of experimental ginning plants and laboratories to develop improved ginning machinery and the use of new and improved methods.[26]

The Department's foreign agricultural and forest research program is conducted under the authority of sections 104a and 104k of Public Law 480, 84th Congress, Agricultural Trade Development and Assistance Act of 1954. Research includes agricultural utilization projects designed to help develop new markets for U.S. farm commodities in foreign countries and also research in crop and animal husbandry, forestry, marketing and utilization of foreign plants for both food and nonfood purposes that might be suitable for introduction into the United States as new market crops and thus replace crops that we produce in surplus.[27]

The Department of Agriculture may make grants to land-grant colleges and universities,[28] and the Department is also authorized to make grants to foreign organizations for utilization research under the Agriculture Trade Development and Assistance Act of 1954. Under Public Law 934 of the 85th Congress, the Department of Agriculture, together with other Government agencies, has the authority to issue basic research grants to nonprofit organizations.

Thus, the Department of Agriculture in order to carry out its functions carries on extensive research and development projects in its own

[17] 16 U.S.C. 581(b), (c).
[18] 16 U.S.C. 581(d).
[19] 16 U.S.C. 581(f).
[20] 16 U.S.C. 581(g).
[21] 16 U.S.C. 581(a-1).
[22] 16 U.S.C. 581(a-2).
[23] 7 U.S.C. 391.
[24] 21 U.S.C. 113(a).
[25] 7 U.S.C. 423.
[26] 7 U.S.C. 424.
[27] 7 U.S.C. 1704.
[28] 7 U.S.C. 361.

facilities and also contracts or may provide grants for numerous projects which may produce inventions. Furthermore, due to the statute directive of the Research and Marketing Act, 7 U.S.C. 427(i) set out at page 4, infra, and 7 U.S.C. 1624(a) and the Swenson case which is referred to in detail at page 9, infra, the Department has adopted the policy of taking assignments of all patented inventions owned by the Government and in some instances dedicating these patents to the public.

Department employees, as a result of their duties, have extensive opportunities to invent and innovate, and most of the inventions resulting from the Department's research expenditures flow from employee endeavors. Of all the patents resulting from the Department of Agriculture's research and whose title has been assigned to the Government, only 18 were derived from contract research.

II. Present Practice

A. ADMINISTRATION

1. Personnel

There are four full-time patent attorney positions in the Office of the General Counsel of the Department of Agriculture, although at times only three have been filled. There are also four full-time patent advisory positions in the Agricultural Research Service, one at each of the Utilization Research and Development Divisions. These regional advisors furnish the patent attorneys in the General Counsel's Office with invention disclosures and technical aid in preparing and prosecuting the patent applications concerning inventions developed in their respective divisions. The administrative offices of all the other agencies of Agricultural Research Service, and the administrative offices of Agricultural Marketing Service, Soil Conservation Service, Rural Electrification Administration and the Forest Service, submit all data, information, and recommendations in accordance with departmental regulations to the Office of the General Counsel for consideration. The patent attorneys in the Office of the General Counsel have the responsibility of prosecuting the applications in the Patent Office. The above eight patent positions require the usual clerical and draftsman assistance.

Various specialists on the staff of the Agricultural Research Administrator have the task of establishing and administering patent policies on utilization and licensing on the many patented inventions obtained by the Department. As a result, the Agricultural Research Service has also been assigned most of the Secretary's administrative functions relating to patents. These also include, for example, making certifications to the Commissioner of Patents for filing patent applications under the No Fee Act (issue of patents without fees to Government employees, 35 U.S.C. 266); requesting the Commissioner of Patents to make applications special; signing an abandonment or consent to abandonment of an application filed under the No Fee Act, or of an application assigned to the Government or dedicated to the public and administered by the Department; signing of, or of a consent to an abandonment of contest, a concession of priority, or a disclaimer, or a termination to interference proceedings.

The Department of Agriculture, as a result of its long experience, takes the view that the Department and the agency which conducts

the research is the best equipped to carry out the technical aspects of patenting and administer its own inventions in order to best adapt them to the departmental and agency needs and statutory directive.

The Department of Agriculture maintains a departmental Committee on Patent Policy which is composed of representatives from the Office of the Administrator of Agricultural Research Service, key administrative scientists from the Agricultural Research Service, Forest Service, Agricultural Marketing Service, Soil Conservation Service, and representatives from the Office of General Counsel. The following is a list of the present members:

Dr. W. D. Maclay, Chairman, Agricultural Research Service.
Mr. F. A. Spurr, Agricultural Research Service.
Dr. F. B. Cullinan, Agricultural Research Service.
Dr. J. R. Matchett, Agricultural Research Service.
Dr. H. L. Haller, Agricultural Research Service.
Mr. J. W. Rockey, Agricultural Research Service.
Dr. M. N. Krider (Philadelphia), Agricultural Research Service.
Mr. G. E. Ryerson, Soil Conservation Service.
Mr. J. J. Byrne, Forest Service
Mr. W. H. Elliott, Agricultural Marketing Service.
Mr. T. A. Seegrist, Office of General Counsel.

The Department Patent Committee was established on March 23, 1939, with the purpose of making a study of how foreign governments handle patents arising from research carried on by government employees, and to make policy recommendations with respect to patents arising out of research in the Department of Agriculture. Futhermore, Departmental Memorandum No. 813, by which Henry A. Wallace, the then Secretary of Agriculture, established the Department Patent Committee, stated:

> That with the establishment of the four regional laboratories for studying chemical and technical uses of agricultural products, it is felt desirable to have an appraisal of the present patent policy and to develop procedures to encourage the use of new processes and the production of new materials in such a way as to lend maximum benefits to American agriculture.

The present Agriculture patent policy largely reflects the recommendations of this study.

The original membership of the Department Patent Committee consisted of the following:

Mastin G. White, Solicitor, Chairman.
Milo Perkins, Federal Surplus Commodities Corporation.
George W. Trayer, Forest Service.
Eric Englund, Bureau of Agricultural Economics.
James T. Jardine, Director of Scientific Work.
Milton S. Eisenhower, Land Use Planning.
Henry G. Knight, Bureau of Chemistry and Soils.

The membership of the Department of Agriculture's present Department Patent Committee as contrasted with the original committee reflects: (1) The departmental reorganization of 1952–54 and (2) the placing of individuals from departmental agencies on this Committee who as a result of their duties are directly concerned with the working problems and procedures relating to research and development, contracting, and patent problems.

2. Performance statistics

The following is a breakdown by fiscal years subsequent to fiscal year 1937 of patents applied for and patents granted by the Department of Agriculture:

Prior to about 1930 practically all Department of Agriculture patents were dedicated to the public. However, at present the Department dedicates very few of the patents it obtains. The greater number of the patents are assigned to the Government and are freely licensed.

Fiscal year ending—	Patents granted				Patents applied for			
	Assignment	Dedication	Commercial rights [1]	Total	Assignment	Dedication	Commercial rights [1]	Total
1938	6	34	8	48	18	75	17	110
1939	13	36	12	61	23	49	25	97
1940	10	52	8	70	30	28	25	83
1941	10	17	12	39	48	33	20	101
1942	26	22	8	56	48	26	19	93
1943	33	9	7	49	90	10	17	117
1944	49	7	11	67	143	14	9	166
1945	59	8	8	75	140	10	8	158
1946	45	10	4	59	93	15	9	117
1947	43	4	1	48	99	12	19	130
1948	65	7	3	75	94	10	8	112
1949	108	11	6	125	76	9	6	91
1950	79	11	5	95	122	15	11	148
1951	87	10	5	102	97	7	12	116
1952	101	9	7	117	95	3	6	104
1953	68	7	5	80	113	17	8	138
1954	55	3	1	59	81	12	7	100
1955	41	2	7	50	93	9	11	113
1956	90	7	3	100	68	12	5	85
1957	59	8	4	71	82	6	3	91
1958	57	9	8	74	84	11	5	100
1959	88	6	5	99	105	3	8	116
1960	83	5	2	90	95	2	3	100
Total	1,275	294	140	1,709	1,937	388	261	2,586

[1] Exclusive commercial right retained by inventor; right to manufacture and use the invention anywhere in the world for governmental purposes obtained by the Government.

The Department aids the Patent Office in the examination of plant patent applications. Since the Plant Patent Act has been enacted the Department of Agriculture has rendered advisory opinions on over 2,000 plant patent applications. The statistics are:

Year	Number of plant patent applications filed	Year	Number of plant patent applications filed	Year	Number of plant patent applications filed
1930 [1]	16	1940	91	1950	105
1931	39	1941	75	1951	71
1932	46	1942	52	1952	84
1933	27	1943	47	1953	96
1934	28	1944	42	1954	95
1935	72	1945	52	1955	120
1936	66	1946	72	1956	105
1937	45	1947	92	1957	101
1938	50	1948	59	1958	138
1939	74	1949	70	1959	116
				1960	132
				1961	[2] 16
10-year total	463	10-year total	652	11-year total	1,179

[1] Act passed May 23.
[2] As of Apr. 4, 1961.

Total applications filed as of Apr. 4, 1961 2,294
Total number of plant patents as of Apr. 4, 1961 2,044
Total number of applications abandoned or forfeited as of Apr. 4, 1961 250

If one considers the number of pending plant patent applications and the total number of plant patents issued as to the total number of plant patent applications, that practically all plant patent applications issue as patents.

B. POLICY AS TO RETENTION OF TITLE

The objective and purpose of research conducted by the Department of Agriculture as directed by statute is to benefit the public directly by, for example, the development of new consumer and industrial uses for agricultural commodities. Thus, the dominant proportion of the Department of Agriculture's research is of a public service nature. Many useful and patentable inventions have come into being as a result of this research which have been freely used by the public.

Most of the inventions patented by the Department, therefore, result from research intended primarily to promote private agriculture and industry, rather than to benefit the Government through acquiring the right to make use of inventions by the Government. Here, use by the Government of new developments resulting from its research projects is of little or no value in carrying out the statutory intent. As a consequence, it is established departmental policy that an invention which results from Department of Agriculture research may not be patented in the United States by private interests.

The Department of Agriculture was one of the first Government agencies to initiate a program of scientific research which began shortly before 1880. This was due, in part, to the lack of comprehensive agricultural research by private interests.

At that time the Department had no regulations relating to inventions by its employees. Consequently, when research resulted from inventions the patents were obtained by employees engaged in the research. The object of the research was to benefit the agricultural industries and any direct benefit to the Government was a very remote possibility. Therefore, any attempt by the patentees to commercialize their inventions led to adverse criticism of the Department by Members of the Congress. It was contended that inventions made by employees under funds appropriated by Congress for continuing research should be in the public domain and that the instances where such employees successfully commercialized their inventions and the public had to pay the cost of such a development was inconsistent with the purposes for which the funds were originally appropriated.

Swenson case.—The question of ownership and patent rights of inventions made by departmental employees first arose back in the 1880's. This came about when the Department of Agriculture appointed a Professor Magnus Swenson to act as the agent for the Commissioner of Agriculture to superintend experiments to secure a successful method and to devise machinery to obtain sugar from sorghum. In the process of his work Professor Swenson made certain suggestions which were adopted and incorporated into the project. After the expiration of his services with the Department of Agriculture Professor Swenson filed an application for a patent on an improvement in the manufacture of sugar which was granted.

Shortly thereafter a resolution was passed by the U.S. Senate on December 7, 1887, inquiring of the Commissioner of Agriculture

whether any Department employees had obtained a patent on a process connected with sugar experiments conducted under the auspices of the Government. On December 10, 1887, the Commissioner reported to the Senate that the patent covered a suggestion which Swenson had made in the line of duty and while specially employed in experimentation; that the suggestion had been adopted during his employment; that:

> Mr. Swenson is now threatening to prosecute all persons who shall use the method described and covered by his patent, and this Department, still being engaged in experimentation for the manufacture of sugar, will be liable to Mr. Swenson in damages for using a process discovered by itself, if the patent aforesaid is rightfully the property of Mr. Swenson.

The Commissioner of Agriculture concluded that the patent—

> is held by Mr. Swenson in trust for the use and benefit of the Government and its citizens * * *

because—

> Congress having authorized the making of these sugar experiments at public expense, they are made for the benefit of the public at large, and the results that spring from them become the property of the Government, to the free use of which all citizens are equally entitled. Persons employed in the carrying on of such experiments, so authorized, by the acceptance of the employment waive all personal right to any discoveries they may make in the course of their employment, and by implication contract that such discoveries shall become the property of the Government. It would be incompatible with the object of the act of Congress authorizing the making of experiments, that any personal property to discoveries made by persons employed under the law should be retained by them, for, if so, then the end had in view, the general benefit of the public, would be destroyed, and public moneys would be expended merely to enable private persons to make discoveries for their own personal use and advantage, and not for the general welfare of the people. Congress would be granting public moneys for private use, and this it cannot constitutionally do.

The effects of the privately owned patents were described as follows by the Commissioner:

> The possession by Mr. Swenson of this patent has a serious and damaging effect on the progress of the manufacture of sugar from sorghum cane in this country. It is a cloud on the title of the people of this country to make use of a discovery which the Government has at public expense made. Congress in authorizing the expending of $225,000 to promote this manufacture was mindful of its great importance, and the benefits to arise from utilizing sorghum cane, which could be grown over an immense area of this country, and make valuable thousands of acres of land, and at the same time cause the production of the home supply of sugar.

> This new enterprise has received a damaging blow, and it is desirable that the law department of the Government should take all necessary steps to protect this enterprise, to remove the cloud that today prevents the free use of this manufacture as perfected by the Department of Agriculture, and secure to the people the full benefit of all its works.[29]

On December 15, 1887, the U.S. Senate passed another resolution requesting the Attorney General to investigate the situation and to take appropriate action against the patentee, Professor Swenson. In compliance with these requests the Attorney General instituted suit to enjoin Professor Swenson from using his patent upon the ground that the patent belonged to the United States. On June 12, 1891, the Court issued an injunction permanently restraining the patent owner, Natural Sugar Refining Co., which had acquired title to the patent by assignment from Swenson after the suit was filed, from asserting any right or claim to the patent.[30]

About the turn of the century, the Department again experienced difficulty in connection with certain patents developed by its employees and contractors.

The Department had in 1900 entered into a contract through the Weather Bureau, which was then in the Department of Agriculture, for the express purpose of experimenting with improvements in the field of wireless telegraphy. All expenditures for the contract were borne by the Government and under the contract the inventions or improvements which were developed were owned by Fessenden the contractor, subject only to a free license for the use of the Weather Bureau.[31] No other Government agency could freely use inventions developed under this contract.

Due to public criticism of the above contract and several other employee incidents similar to the *Swenson* case, the then Secretary of Agriculture on May 8, 1905, promulgated what was apparently the first patent regulation issued by any Government department as Department Circular No. 3. The circular provided that whenever any employee of the Department makes any new and useful discovery or invention of any machine, device, or process connected with the work of the Government through the expenditure of Government time and money, the employee is directed to cause a patent to be applied for on the invention through the law officer of the Department. Also, that the patent is to be taken out in the name of the inventor without any expense to him and will allow any citizen of the United States the use of the patented product or process without payment of royalty. It further prohibited any employee from securing a patent on any device, process, or discovery connected with the work of the Department except in the manner stated. Under this regulation any invention connected with the work of the Department was, in effect, to be dedicated to the public whether or not it was related to the employee's own assignment or the work of his bureau. It appears that the term "employee" as used in this regulation is intended to cover situations such as the *Fessenden* case, and therefore

[29] Quoted from the letter from the Commissioner of Agriculture to the Senate, to be found as Senate Ex. Doc. 24, 50th Cong., 1st sess. (Dec. 10, 1887).

[30] "Investigation of Government Patent Practices and Policies," report and recommendations of Attorney General to the President, vol. II, pp. 6 and 7, Department of Justice, 1947.

[31] H. Rept. 8147, 59th Cong., 2d sess., "Expenditures in the Department of Agriculture," pp. 4-12.

equates regular employees and individuals whose employment is derived through a contract with the Department.

In 1907 the Committee on Expenditures in the Department of Agriculture of the House of Representatives rendered a report to the House disapproving of the disposition of patent rights under the Weather Bureau's contract with Fessenden and stated that in the committee's opinion "that patents developed * * * should be dedicated to the use of the public," and so approving the policy of the Department of Agriculture's 1905 Department Circular No. 3.[32]

From 1905 to about 1931 all patents of the Department of Agriculture as a result of the 1905 regulation and its revisions were dedicated to the public.

Employee antagonism toward the policy and the *Dubilier* case (289 U.S. 178 (1933)) led the Department to determine employee patent rights on the basis of whether the invention was made as a result of a specific job assignment and without regard to its relationship to the Department's activities or the expenditure of Government funds and time. Department Regulation No. 1561, 1936, expressed this policy:

> If the invention involved is found to be within the specifically assigned duties of an employee, he will be required to dedicate it to the public, or, in the event it is desired to retain administrative control of the subject matter in the Department, such invention will be assigned to the Secretary of Agriculture. When an invention does not come within the scope of employment of the inventor-employee and where the subject matter is of interest to the Government, a patent application will be filed through the Department, under which the Government retains or obtains a shop right or right of free use and all other commercial rights remain in the inventor.

Consequently, many inventors retained commercial rights to their inventions under this regulation which remained in effect for about 10 years.

Many Department administrative officials felt that this policy would lead to the type of adverse criticism previously leveled at the Department, for it was possible for an employee engaged in research for public benefit to produce an invention outside his specific job assignment but nevertheless at Government expense and in the purview of Department activities and yet retain commercial rights.

As a result the regulation was amended to read:

> Any invention made by an employee of the Department that (1) falls within the assigned duties of the employees or (2) was developed with the substantial use of Government time, funds, expendable materials, or unpublished information shall either be dedicated to the public or, in the event that it is desirable to retain control of the invention in the Department, shall be assigned to the United States as represented by the Secretary. The fact that an idea that leads to an invention occurs to an employee when he is on duty shall not in itself be sufficient to require such dedication or assignment.

[32] Ibid., p. 12.

The regulation has since been amended twice, but for procedural and not substantive changes to clarify the regulation relative to Executive Order 10096 (issued January 23, 1950) (15 F.R. 389).[33]

At present the Department usually takes an assignment, but dedicates the patented invention only under exceptional instances. The Department's belief is that the securing of patents on these inventions serves to protect the public by insuring that others do not secure patents on the same inventions and also provides a widespread disclosure of the inventions. For if the Department does not obtain a patent on an invention resulting from its research, someone else may obtain the patent. This is true even if the Department were to dislose the invention in a publication, because a publication is not a bar to the granting of a patent to another if the application is filed in the Patent Office within a year of the publication date and the applicant can show that he made the invention prior to the publication date. Such circumstances are not infrequent, for independent workers often make the same invention at about the same time, especially in rapidly advancing arts. The fact that the one who disclosed his invention in a publication may actually have made the invention before the applicant for the patent would not prevent the issuance of the patent to another, because there is no mechanism or provision in the Patent Office procedure to establish priority of invention under such circumstances. So dedication by publication can be an ineffective mechanism of making the invention available to the public for manufacture or use, whereas either dedication of the patented invention or assignment to the Department of Agriculture would carry the purpose of making the invention available to the public.

Furthermore, by taking assignment to the patented inventions the Department may if necessary also carry out the following policy: It may institute some measure of quality control over the products manufactured under the patent when the subject matter of the invention is such that it may be in the public interest. It may also obtain information through license requirements as to the utilization of the invention. The taking or the assignment of title will allow the Government to grant exclusive licenses if anticipated legislative authority to do so is obtained.

The Government-owned patent also serves other purposes. It affords prospective users the chance to obtain royalty-free licenses, or if appropriate enabling legislation is passed, a royalty-bearing exclusive license.

The Department feels that a patent license relationship stimulates further independint invention and discovery on the part of the licensee for it brings about efforts by the parties concerned to exchange technical information in a spirit of mutual cooperation. Consequently, the greatest number of the patents issued as a result of the Department's research are assigned to the Government and administered by the Department.

The Department also believes that, in any event, it is better to patent an invention rather than to publish information concerning invention. The Government-owned patent, as distinguished from a publication of the invention, also presents in a published form a more

[33] Found as App. A on p. 17 of the "Patent Practices of the Government Patents Board," report of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U.S. Senate, 86th Cong., 1st sess.

accurate description of the invention and a delineation of its scope than would be available without a Patent Office examination. Thus, the patents as technical literature are better contributions to existing technical knowledge and provide wider dissemination of research than mere publication of the same invention would supply.

October 14, 1960, Newton report.—This report is an appraisal of the utilization research carried on by the Department of Agriculture. The purpose was to obtain recommendations to improve the application of science to the solution of problems related to the use of agricultural commodities. This study and the report included the handling of domestic and foreign patents resulting from the Department's utilization research.

The report came about during fiscal year 1960 when former Secretary of Agriculture, Ezra Taft Benson, appointed a representative of the agricultural industry, Dr. Roy C. Newton, retired vice president for research of Swift & Co., to make a special study of the Department's program of utilization research in addition to the appraisal of such a program made each year by the Department's Agricultural Research Policy Committee and the 24 commodity and functional advisory committees. Dr. Newton's report was based on almost a year of work in which he visited each of the major utilization installations and conferred with key personnel throughout the utilization research organization, and on discussions with nine major organizations, leading representatives of the farm press, the staff of seven State experimental stations and more the 50 of the leading industrial scientists whose activities are related to agriculture.

In his discussions with industry representatives, two complaints commonly were expressed regarding the Department's patent policy. The first related to domestic patents and the second dealt with the disposition of foreign patent rights to inventions developed through the expenditure of Government funds. To quote Dr. Newton:

> The first of these complaints has to do with domestic patents and arises from the fact that a company cannot get even a temporary exclusive license to compensate it for the expense of commercializing the product of the invention. These people will say that this inhibits the very objective of the research which is to market new products of agriculture, because no one will put up the risk capital for such a new venture without some exclusivity to protect it. A few leading questions, however, usually develop the fact that they will go into the venture if their competitors are making a success of it and if the invention is good enough to be very promising to their competitors, they will try to beat him to it. It is doubtful, therefore, if this policy is a serious handicap to the commercialization of new developments by utilization research.

The complaint relating to the handling of foreign patent rights, together with findings and recommendations may be found under "C. Foreign Filing, 3. Government," page 24. He also stated that successful research of an applied nature often results in patents which describe the new processes and products and that these patents under the Department policy are available to industry.

Dr. Newton concluded that "the patent policy with respect to domestic patents is adequate but the policy with respect to foreign

patents is a hazard to the entire program and should be changed." As a result, the Department undertook a detailed study of its handling of foreign patents rights resulting from utilization research. On April 20, 1961, the Department reported its conclusion to the subcommittee that the Department acquire the foreign patent rights, together with the domestic rights.

1. By employees

The Agricultural Research Service of the Department of Agriculture conducts about 90 percent of the research work on which patents are sought by the Department of Agriculture. The greater part of this work is conducted at the five major agricultural research laboratories: Eastern Utilization Research and Development Division, Wyndmoor (Philadelphia), Pa.; Southern Utilization Research and Development Division, New Orleans, La.; Northern Utilization Research and Development Division, Peoria, Ill.; Western Utilization Research and Development Division, Albany, Calif.; and the Agricultural Research Center, Beltsville, Md. The balance of the research work on which the Department seeks patents is conducted by the Forest Service, Soil Conservation Service, Agricultural Marketing Service, other agencies of the Department and their research facilities. Accordingly, the greatest proportion of the Department of Agriculture's research and development is conducted by its own facilities and is carried out by its employees.

In the Department of Agriculture the present Department patent regulations are of particular interest to research employees, who are most likely to make inventions in connection with their work. The purpose of these regulations is to provide a patent policy pertaining to the inventions of employees and describing procedural rules to carry out such a policy relative to the adminstration of all the inventions. Whether the Department will take an assignment of the patent or dedicate the patent depends on the subject matter of the inventions. Usually assignments of all U.S. rights, title, and interest are made to the Government in and to all inventions made by any Department of Agriculture employees. The Department follows the guidelines set by Executive Order 10096 and the interpretation it has been given by the Chairman of Government Patents Board.

The employee-inventor, under Agriculture's regulations, is required to submit promptly to his supervisor information concerning the invention. The supervisor, in turn, is required to forward this information to the Office of General Counsel along with recommenadtions and information why patent protection should be obtained, whether domestic patent rights should be dedicated or the application assigned, whether the invention is used or likely to to be used in the public interest and other pertinent material.

The patent attorneys in the Office of the General Counsel prepare the patent application on the invention, have it approved by the Administrator, and prosecute it in the Patent Office. The employee-inventor is required to disclose the invention, prepare a brief statement of the most pertinent recent prior art and how his invention distinguishes over what was previously accomplished and also an abstract of the invention for the benefit of the patent attorney who is to prepare the patent application.

When an employee of the Department of Agriculture makes an invention under circumstances that do not require assignment or dedication, he is entitled to retain commercial rights. In this instance, he is the patent owner except that in accordance with regulations the Government may have a license to manufacture and use the invention or other rights arising from law.

The Department regulations require the submission of inventions to the Office of the General Counsel for a determination of ownership as between the Government and the employee-inventor, in any case in which the Government may have a right. This determination formerly was subject to review by or appeal to the Chairman of the Government Patents Board pursuant to Executive Order 10096. The functions of the Chairman of the Government Patents Board now have been transferred to the Secretary of Commerce [34] and delegated to the Commissioner of Patents. Departmental regulations set forth the procedure for the employee-inventor to request commercial rights (title) to an invention. Thus, the inventor through his supervisor is required to submit a detailed statement of the circumstances under which the invention was made (conception, construction, or carried out and tested), including information as to the extent it was made during working hours and the extent use was made of the Government facilities, equipment, materials, or services of other Government employees on official duties and information as to the inventor's own contribution relative to these items as may be pertinent. He must also submit a statement of his duties and their relation to the invention, why he believes he is entitled to commercial rights in the invention and whether or not he desires to obtain a patent under the provisions of the No Fee Act and any other information that the Office of the General Counsel may require. Also, the inventor's supervisor shall give recommendations and reasons as to why patent protection should or should not be obtained, whether patent rights should be dedicated or the application assigned, or whether the invention is used or likely to be used in the public interest. From this information the Office of the General Counsel is required to determine impartially whether or not the inventor is entitled to the commercial patent rights.

Where an employee-inventor is entitled to retain commercial rights (title) he may file a patent application directly in the Patent Office in the same manner as anyone else or he may request that the patent be obtained under the No Fee Act. Whenever the application for a patent is filed through the Department and it is determined that the inventor is entitled to commercial rights, the Department of Agriculture acquires a nonexclusive, irrevocable, royalty-free license to the worldwide use of the invention and the Government also acquires the right to all necessary technical information of the subject matter and know-how of the inventor as an employee and the Department is free to release the information for any official purpose. When the inventor files an application on his own directly in the Patent Office, and if the Government is entitled to license rights, he is required to keep the Department informed regarding the application. He is required to include the license to the Government in the application or give the Government a separate license agreement. However, in the circumstance where the invention is outside the scope of the inventor's employment, the Department may, nevertheless, be en-

[34] Executive Order No. 10930, Mar. 24, 1961, 26 F.R. 2583.

titled to a royalty-free license or shop rights where use was made of Government-owned material or funds or the invention was made during regular working hours of employment.

a. Employee—Plant patents

It is the policy of the Department of Agriculture that plants developed by employees of the Department under circumstances which render the patent rights therein assignable to the Government shall not be patented. Furthermore, the Department of Agriculture's regulations, which are part of the employees employment contract, further state:

> That no employee of the Department shall assist any person in preparing or prosecuting an application for a plant patent. The Department cannot advise members of the public as to the novelty of an alleged invention. Inquiries with respect to plant patents must be referred to the Commissioner of Patents.[35]

2. Contractors, cooperators, and grantees

a. Contractors

(1) *Procurement contracts.*—The Department's procurements are mainly the obtaining of construction, services, supplies and equipment, and generally it is not necessary to design or specify nonstock items. Such contracting does not ordinarily require special precautions relating to developmental knowledge or invention property rights.

(2) *Research contracts.*—The research contracts authorized by law for the Department of Agriculture must provide that the result of the research and investigations shall be available to the public by dedication to the public, assignment to the Government, or such other means as the Department may prescribe. As this research is for public use purposes, practically all departmental contracts with private organizations or individuals (whether profit or nonprofit) contain a standard patent clause. This patent clause provides:

> The patentable results of research and investigations conducted under this contract and all information, data, and findings developed under the terms of this contract, whether apprehended during the period of the contract, or subsequent thereto, shall be made available to the public through dedication, assignment to the Secretary, publication or such other means as the contracting officer shall determine.
>
> Results of research or investigations and information concerning the project, which the contracting officer determines will not form the basis of a patent application, may be made known to the public only at the discretion of the contracting officer or his designated representative, under such conditions as the contracting officer or his designated representative may prescribe and with such credit or recognition of collaboration as he may determine.

The research contracts also contain provisions requiring periodic and/or final reports of progress.[36] The purpose of these reports is to

[35] App. F.
[36] App. I.

give the Department the benefit of the contractors experience, know-how, and knowledge gained from the contract. The Department of Agriculture scientists also visit and confer with the contractor to gain firsthand information of the problems encountered. The knowledge acquired, coupled with information obtained direct from the source such as the Department's own or cooperative research, enables the Department to determine the means whereby the data will be made public, such as publication by the Department or by the contractor through patenting or a combination of publication and patenting. However, special organizations such as universities have a right to publish information concerning nonpatentable innovations resulting from contracts on their own responsibility.

The standard patent clause is modified insofar as public organizations (such as State universities) are concerned to read as follows:

> In accordance with the provisions of the act, the public shall be granted all benefits or any patentable results of all research and investigations conducted under this contract, through dedication, assignment to the Secretary, publication, or such other means as may be determined by the contracting officer.
>
> Results of research or investigations and information concerning the project, which the contracting officer determines will not form the basis of a patent application, shall be made known to the public in such a manner as the parties hereto may agree. In case of failure to agree, results may be made known to the public by either party after due notice and submission of the proposed manuscript to the other with such credit or recognition as may be mutually agreed upon, provided that full responsibility is assumed by such party for any statements on which there is a difference of opinion, and provided further that no copyright shall subsist in any such publication.

Although the language of this clause has been modified from the clause used with private organizations or individuals, the resultant effect of the language relative to proprietary rights appears to be identical.

The Department in recent years has spent between $1½ and $2 million annually on contract research as contrasted with the much larger amount ($88 million, fiscal year 1959) spent for employee research.

From fiscal year 1954 through fiscal year 1961, the Department has acquired 20 patents derived from research contracts. These may be found at Appendix D. Several of the Department's patented inventions obtained through contractor derived research have had extensive exploitation.

REA research contracts.—The Rural Electrification Administration [37] has entered into research, testing and development contracts. In two instances in 1952 they used patent clauses which differ from the regular agricultural patent contract clauses.

Under Public Law 600, approved act of August 2, 1946, 5 U.S.C. 55a, and a special provision in the appropriations acts, REA has authority to use administrative funds to finance a research and development

[37] App. J.

program on a contract basis. This authority is distinguished from the Research and Marketing Act of 1946 and, as amended in 1954.

The two contracts negotiated in 1952 had patent clauses which, if any patentable inventions occurred, would have vested title in the contractor. In one instance the Government retained a license to manufacture and use the invention and in the other the Government obtained a license to use the invention for a period of 3 years. The contracts, which were negotiated after 1952 have contained patent clauses which were similar to the regular patent clauses used by the Department of Agriculture.

b. Cooperative research

Some research is also conducted by the Department of Agriculture with outside institutions under cooperative agreements. A copy of the standard patent clause used in cooperative agreements and memorandums of understanding may be found at appendix H. These agreements generally provide that the rights in inventions made by Department employees will be governed by the Department employee regulations, and inventions made by the cooperator or cooperator-employees may be disposed of according to the policies of the cooperator.

Due to special circumstances there have been exceptions to the above general rule. For example, at the request of the Southern Extract Co., Forest Products Laboratory (Forest Service) of the Department undertook to investigate the possible use of chestnut chips in the manufacture of pulp and paper as a means of reducing wood waste. The company assumed the major cost of the investigations which were conducted without expenditure of Government funds. The enabling statute allows the Forest Products Laboratory to accept moneys from industry and other non-Federal Government sources. The company was also cooperator with the Government in the research. The initial experiments failed to yield the specific results contemplated, but instead led to the development by the Forest Products Laboratory employees of a product, a process, and machinery for making a chestnut board from the chips and this attracted the attention of extract manufacturers and others. After the Laboratory had worked out the process the company carried on the development work which led to a commercially utilizable process. Under these circumstances, with the Secretary of Agriculture's approval, the resulting U.S. patent rights to the inventions were assigned in trust to the Fidelity Trust Co. of Knoxville, Tenn., and the Southern Extract Co., was exclusively licensed by the Trust Co. for 5 years with the right to sublicense and to sue for infringement. The company financed the cost of filing applications and obtaining patents on the inventions. The company also agreed to put a plant in full operation to manufacture the chestnut wood products within 28 months of the agreement. After this 5-year period the patents were assigned outright by the Trust Co. to the Government.

At present the amount of work done under cooperative agreements is very small. Patents on inventions derived from such work are few in numbers and concern the Department only in the event an employee of the Department was the inventor. The disposition of the patent rights are then handled in the same manner as all other employee inventions.

c. Direct grants

About 30 percent of the funds appropriated to the Department of Agriculture for research and development are given to State experiment stations as direct grants to be expended under their supervision.[38] This amounted to $31 million in fiscal year 1959 out of total expenditures of $110 million. Under departmental practice the State experiment stations set their own guidelines for the disposition of any inventions and information which might be developed under such grants. There have been in several instances conflicts as to the ownership of the patent rights which may arise between the State experiment stations and their employee-inventors.

In the past the State of Florida was involved in several such controversies in court. These involved the patent rights to new varieties of sugarcane developed by an employee of the Florida State Experiment Station who had been working on such a project at the station and the ownership of a process to use dried citrus waste as a dairy feed.

Steenbock-Wisconsin Alumni Research Foundation case.—The most notable case involving a State experiment station employee is the *Steenbock* case. Dr. Steenbock, a staff employee of the Agricultural Experiment Station in Wisconsin, obtained patents on a process to produce vitamin D. The research work was undertaken as part of the work with funds furnished by the State and Federal Governments. Dr. Steenbock turned his patents over to the Wisconsin Alumni Research Foundation, which was created for the purpose of commercializing his process on a widespread scale. The foundation collected substantial royalties ($14 million) from the public for the use of these inventions prior to the entry of a decree dedicating the patents to the public.[39] The decree resulted from intervention by the Department of Justice in an infringement suit brought by the foundation to enforce the patents. The Department charged the foundation and its licensees in the chemical, drug, packaged foods, and evaporated milk foods fields with conspiracy to restrain and monopolize interstate commerce in violation of the Sherman Act, by maintaining unreasonable prices on such products, and by so limiting the potency of vitamin D food products as to prevent them from competing with vitamin D pharmaceutical products. On January 14, 1946 a consent judgment was entered canceling the restrictive patent agreements, enjoining the foundation from instituting infringement suits or collecting royalties on the patents and dedicating the vitamin D patents to the public. The Department of Justice intervened only after testimony disclosing this patent misuse was given before the subcommittee of the Committee on Military Affairs of the Senate dealing with S. 702, 78th Congress, 1st session.

One of the reasons why the Department of Agriculture allows the State experiment stations to set their own rules for the disposition of any information and inventions which may be developed under Federal grant funds is that the Hatch Act, as amended, which consolidated earlier Federal-grant funds to State experiment station legislation, does not have a section governing patent rights. Thus, the Department's position has been that Federal patent policies applicable to Government employees or to Government contracts do

[38] 7 U.S.C. 361.
[39] "Administration and Utilization of Government-Owned Patent Property" Contract Report NAS-177 of National Aeronautics and Space Administration, p. 39, Dec. 23, 1960.

not apply to funds provided by the Federal grants to State agricultural experiment stations legislation.

Another reason is that a Comptroller General decision (28 Comp. Gen. 54) ruled that Federal-grant funds allotted to a State become institutional funds.

As a result, the State agricultural experiment stations, since the inception of this program, have established policies regarding the acquisition of patents on research conducted through use of these funds within the framework of applicable State laws. However, as the State experiment stations are public institutions and are tax supported, it has been generally the administrative policy of most of the stations for more than 70 years that the individual researcher conducting patentable research may not obtain title (commercial rights) in the patents which result from his work.

d. Foreign contracts and grants

The Department of Agriculture's policy regarding foreign agricultural research is that the U.S. public shall be granted all benefits and information of any patentable results of the research conducted through dedication, assignment to the Secretary of Agriculture of the United States, publication or such other means as may be determined by the authorizing agriculture officer. The rights to patentable results in countries other than the United States shall be in accordance with the policy of the grantee or contractor, however, providing that an irrevocable, nontransferable and royalty-free license to practice such invention throughout the world is issued to the U.S. Government.

If any patentable results do flow from such a grant or contract, the grantee must cooperate in the preparation and prosecution of any U.S. patent application which the Department may decide to file. If the results of the research, investigations, and information are determined not to form the basis of a U.S. patent application, the authorizing agriculture officer shall make known the research results to the U.S. public through publication. The publication of such results in any country other than the United States is in accordance with the policy of the grantee, reserving the right to the U.S. Government to publish such results in any country should the grantee fail to do so. Manuscripts prepared for publication by either party must be submitted to each other for suggestions prior to publication and the credit or recognition of the contribution made by other party is assumed by the party publishing the material.

Under foreign agricultural research grants, the Department requires that the grantee shall furnish Agricultural Research Service as soon as possible after each 4-month report period, a brief but descriptive narrative progress report of the scientific aspects of the research clearly indicating significant factors with respect to the progress of the work. Also, in addition to any records and reports specifically mentioned in the grant, the grantee must furnish an annual progress report satisfactory to the authorizing agriculture officer summarizing the work done, emphasizing any important technical developments accomplished during the year, and outlining plans for future work and a final report in a form suitable for publication, including all pertinent technical data satisfactory to the authorizing officer, summarizing the work done, the results accomplished, and the conclusions therefrom. The grantee maintains such record as is required and must furnish

reports with respect to the status and progress of the project as the authorizing officer shall require. Furthermore, any accredited representative of the U.S. Government shall have access, at any reasonable time, to the plant, laboratories or other facilities utilized in connection with the project for the purpose of inspection and observation of the status and progress of the project, and all data, information, records, reports, and accounts of the grantee relating to the project are available to such representative. In most instances, assigned Department of Agriculture scientists will work with the foreign research grantee to assure the capture of essential know-how and technical information.

Under this special foreign currency program in fiscal year 1959, the Department's obligations were $1,651,828 for market development research, and $1,700 for agricultural and forest research.

Appendix J is the listings of foreign research projects for which agreements have been executed or negotiated relating to utilization, forestry farm, and marketing research and the specific purpose of each grant.

C. FOREIGN FILING

1. Employees

The Department of Agriculture has no official records regarding foreign patents obtained by employee-inventors who retain commercial rights (title) in the inventions and/or the use made of any such patented inventions.

2. Contractors, cooperators, and grantees

There are no official records of the Department of Agriculture regarding foreign patents obtained by Department contractors, cooperators, and grantees.

3. Government

At present the Department of Agriculture does not apply for any patents in foreign countries.

Historically the Department has not acquired assignment of foreign patent rights in employee inventions. In 1943 general departmental Circular No. 4 [40] provided for the Government to obtain a worldwide license in such inventions as made by departmental employees. This was canceled immediately after issuance of Executive Order 9865 on June 14, 1947.

Since Executive Order 9865 [41] (12 F.R. 3907) the Department has acquired options to the foreign rights in all inventions in which a U.S. application is filed and in which the domestic patent rights are assigned or dedicated. In all inventions filed under the No Fee Act, a worldwide license is acquired by the Department.

Executive Order 9865 states that:

> All Government departments and agencies shall, whenever practicable, acquire the right to file foreign patent applications on inventions resulting from research conducted or financed by the Government * * * The Department of Commerce shall determine whether, and in what foreign jurisdictions, the United States should seek patents for such inventions and, to the extent of appropriations available therefor,

[40] App. G.
[41] Found in "Patent Practices of the Government Patents Board." Report of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U.S. Senate, 86th Cong., 1st sess., app. B, pp. 21-22.

> shall procure patent protection for such inventions, taking all action, consistent with existing law, necessary to acquire and maintain patent rights abroad * * * The Department of Commerce shall administer foreign patents acquired by the United States under the terms of this order and shall issue licenses thereunder in accordance with law under such rules and regulations as the Secretary of Commerce shall prescribe.

As a result, the language of paragraph No. 892, section 3, chapter 15 of title 1, "Administrative Regulations," [42] "Patents on Inventions of the Department" states:

> No employee of the Department shall file or cause to be filed an application for patent in any foreign jurisdiction (except on behalf of and at the direction of the Government) on any invention on which the Government has acquired the patent rights or holds an unexpired option to acquire the patent rights in that jurisdiction, or take any steps to preclude the filing of an application on behalf of the Government.

The Chairman of the Government Patents Board did furnish funds to underwrite costs, select, and file a few foreign applications on four inventions of Department of Agriculture employees in various countries.[43] However, all were abandoned as the Office of Technical Services of the Department of Commerce has never had a continuing program or been granted funds to obtain or maintain foreign patents. Therefore, as a result of Administrative Order No. 6 of the Government Patents Board, issued on June 29, 1954 [44] the Department has felt that it is not necessary to exercise its option to the foreign patent rights in any employee inventions because the option is a worthless one without appropriated funds and a program to carry out the purposes. Thus, the employee-inventor obtains all rights to foreign patents if at the end of 6 months the U.S. Government has not exercised its option.

The worldwide licenses to use inventions that the Department obtains are customarily included in the patent by the following statement as the first paragraph of the specification:

> A nonexclusive, irrevocable, royalty-free license in the invention herein described, throughout the world for all purposes of the U.S. Government, with the power to grant sublicenses for such purposes, is hereby granted to the Government of the United States of America.

By such a license clause the Department attempts to control inventions developed as a result of the Department's expenditures for governmental use in jurisdictions other than the United States.

The Department of Agriculture has no official information regarding foreign patent rights obtained by employee-inventors and the use made of patented inventions. The employee-inventors may freely exploit their foreign patent rights to their own financial benefit without any requirement to report except to the Bureau of Internal Revenue.

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[42] App. F.

[43] Memo received from John Green, Director of Office of Technical Services by H. F. Olesner, Assistant Counsel, Patents Subcommittee.

[44] 19 F.R. 3937.

However, it is common knowledge in the Department that Andrew J. Moyer, a Department of Agriculture employee, assigned his foreign rights to the vat fermentation submerged culture process for the production of penicillin [45] to Commercial Solvents Corp. for a substantial amount. Cording and Willard, Department employees, have also successfully sold their foreign patent rights to their potato flake invention (new form of dehydrated mashed potatoes).[46] Other employees also have been successful in exploiting the foreign rights to their inventions.

4. Newton report

Appraisal of the Department's handling of foreign patent rights resulting from utilization research.—Dr. Newton found that industry complained about the reversion of foreign patent rights to the employee-inventor inasmuch as the inventions were paid for by public funds. He noted that in several instances the employee-inventor negotiated for the sale of his foreign patent rights even before such potential rights had accrued to him. So those firms which did not have a chance to bid on the foreign patent rights were dissatisfied. Dr. Newton believes that this practice exists because:

1. Foreign patent applications must be filed promptly as the filing date is the invention priority cutoff date (except for Canada and the Philippines). However, applications can be filed in foreign countries which are signatories to the International Proprietary Rights Convention on behalf of employee-inventors or their assignees up to 1 year of the filing date in the United States and still receive the benefit of the U.S. filing date.

2. Most employee-inventors do not possess the finances to file in foreign countries.

3. The employee-inventor does not know which countries to file in until he knows what company is interested in the patent and in what countries that company does or intends to do business.

4. With the lapse of 6 months (the time of the Government's option to file in foreign countries) before the employee-inventor can possess these potential foreign rights he would only have 6 months to attempt to negotiate and sell the invention prior to the filing deadline. This is not much time and as the Government hardly ever exercises such an option the employee-inventor often does the negotiating before he possesses such potential rights.

Another finding was that laboratory employees consider this reversion of ownership an added incentive.

Dr. Newton recommended against employee-inventor ownership of foreign rights for two reasons:

> 1. The rights were accumulated at public expense and any financial return should accrue to the public. If it is not practical for the Government to negotiate the sale of these rights by competitive bids then they should be allowed to lapse so that all persons will have equal opportunity to use them.
>
> 2. When developments are made by a team of scientists working together, it is often impossible to determine who are the actual inventors. If a few members of the team get substantial returns from the invention, it will lead to dissatisfaction of the others and destroy teamwork. It will lead to secrecy among the workers when there should be free ex-

[45] App. A, pp. 55–57.
[46] Ibid., pp. 70–71.

change of ideas to make the most rapid progress. Furthermore, it could lead to the selection of projects having large economic possibilities in foreign countries, but little or no possibility of using agricultural commodities of this country.

As a result of these findings, recommendations, and Dr. Newton's conclusion that the patent policy with respect to foreign patents is a hazard to the entire utilization program and should be changed, the Department began a detailed study of the problem. The Department concluded that its experience in the last few years and the recommendations of the Newton Report indicate that it is desirable for the Government to acquire the foreign patent rights, along with the domestic patent rights in the employee inventions. The Department has indicated that it would be glad to cooperate with the other Government agencies in obtaining such changes that would secure for the Government the foreign patent rights.

D. USE OF PATENTS BY PARTIES RETAINING TITLE

1. Employees

The Department of Agriculture has no official records relating to the use of inventions held by employee-patentees. However, the records of the Department do disclose the employee-inventors who have obtained title (commercial rights) to their patented inventions in the United States. At present there are about 100 such patents held by employee-inventors.

For the purpose of this study, a brief case history of such an invention comprising four patents and one pending patent application has been prepared with the aid of the Agricultural Research Service and the Soil Conservation Service. The invention selected has had a successful commercial development and the Department has benefited from its use. Furthermore, the study discloses under what circumstances the employee-inventor obtains the exclusive commercial rights and title to the invention or inventions and the Government earns its right to a license to manufacture and use such an invention.

Deep earth core sampler.—As with most operable commercial mechanisms the "Deep Earth Core Sampler" of this study is protected by more than one patent.

Patents involved are:

Patent No.: 2,540,096.
Name of inventor: Almond D. Bull.
Title: Automatic Recording Infiltrometer.
Date of issuance: February 6, 1951.

Patent No.: 2,701,121.
Name of inventor: Almond D. Bull.
Title: Automatic Soil Coring Machine.
Date of issuance: February 1, 1955.

Patent No.: 2,868,019.
Name of inventor: Almond D. Bull.
Title: Hydraulic Soil Sampler and Penetrometer.
Date of issuance: January 13, 1959.

Patent No.: 2,881,933.
Name of inventor: Almond D. Bull.
Title: Coring Tube Cleaner.
Date of issuance: April 14, 1959.

Patent application Serial No.: 675790.
Name of inventor: Almond D. Bull.
Date of issuance: Pending.

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History and purpose of the invention.—In 1951, Almond D. Bull, then a soil scientist with the Soil Conservation Service at Woodward, Okla., invented an electrically powered soil sampler which he later converted to a hydraulic powered soil sampler. The purpose of the invention was to mechanize the examination of soil profiles in classifying and mapping soils. The conventional method of digging into the soil with hand tools was slow and laborious.

Operation and use of the invention.—The sampler of the invention is mounted on a pickup truck. Hydraulic power forces a soil tube into the ground and extracts the tube filled with soil. The soil tube is open on one side for most of its length and the soil layers can be examined in this undisturbed condition and decisions can be made as to the classification of the soil using depth, texture, structure, color, and other soil characteristics. This information is then recorded on an aerial photograph as part of the process of making a soil survey. Some agriculture experiment stations now use the soil sampler for moisture determination. The soil sampler is also used to examine the soils at proposed site locations to determine the suitability of the soils for farm ponds.

Apportionment of invention and development cost and time.—A.D. Bull, the inventor, did most of the work of invention, design, and building of the first machine on his own time. He had to underwrite the cost of the machine. The inventor spent 925 hours of his personal time, and a cash outlay of $289.70. The Department filed and prosecuted the patent applications. The Government also purchased the original soil sampler for $640 after it was proven successful. The cost of the invention to the Government was 80 hours of a GS–7 soil scientist's time (about $190). The Department of Agriculture believes that the cost to the Department in this instance, in effect, represents a procurement cost rather than a cost of invention. For the value of the official time spent by the inventor is negligible in comparison to the value of the developed invention to the Government.

Value of the invention.—The value of the use of this mechanism to the Department can be estimated on the basis of the use of 18 machines during 1955 as 27 man-years of soil scientist time or an equivalent savings of $121,500 (average salary of soil scientist in Government $4,500 per year in 1955). Furthermore, over the years these savings have multiplied many times.

Since 1955 there are an increasing number of these machines in use over a wider area of the United States and they continue to increase the efficiency and speed of soil surveys. In addition, more thorough examinations are made of the soils, so that better quality and more accurate soil surveys result.

2. Contractors, cooperators, and grantees

a. Contractors

As the research and development contracts authorized by the Department provide that title to inventions developed as a result must be assigned to the Government, the Department has no information as to any such inventions to which the contractors have obtained title.

b. Cooperators

The Department has no official records relating to patented inventions held by a cooperator derived from Department cooperative agreements as the Department feels that such patented inventions are of concern to the Department only where a Department employee was the inventor.

c. Grantees

The Department has no official records concerning patented inventions obtained by State Agricultural Experiment Stations and their employees-direct grantees of the Department—as the Department believes that the patent policies applicable to its employees or to contractors do not apply to the State Agricultural Experiment Stations and their employees.

3. Government

Agricultural research is conducted at more than 330 Federal and cooperative State Agriculture Experiment Stations and research laboratories. The Agricultural Research Service carries on extensive research, development, and engineering in the entire field of agriculture.

The Government held as of July 1, 1960, title to about 1,177 unexpired U.S. patents developed by the Department's research and approximately 121 others have been dedicated by it to the public. The Department grants upon request royalty-free, nonexclusive license under the patents owned by the Government. Any of its inventions may be used without such a license because the Government does not prosecute infringers of its patents. As a result the Department's licensees are principally those users of these inventions who desire technical assistance from the Department in exploiting them. While the Department does not ordinarily require its licensees to report the extent of their use of the patents, it actively encourages the widest possible commercial use of all of them and has informally obtained a substantial amount of reliable data as to their commercial use, both by licensees and others.

For the purpose of this study the Department's research laboratories were asked to supply samples of inventions developed by them which have had a wide commercial use or which may now have a potential commercial use. The Agricultural Marketing Service, which lets a substantial number of research contracts, was also asked to submit similar examples. These examples are set forth in appendix A, with a description of each invention, the number and date of the patent, the name of the inventor and the Department's estimate as to the nature and extent of its commercial use. There are 67 examples of such developments for which 180 patents have been obtained by the Department. In the following section of this report we have briefly summarized some of these examples to illustrate the extent of commercial use of patents which the Government owns. These summaries have been grouped under headings indicating the source of the development and the pages of appendix A where a more complete account of these developments appears.

a. Divisions of the Agricultural Research Service

(1) *Northern Utilization Research and Development Division.*—This Division's research and development projects include work on penicillin, polymers from vegetable oils, starch sponge, dextran, batter

process of separating starch from wheat flour, processes for the production of fungal amylase, development of a corn zein textile fiber, processes for the production of riboflavin-vitamin B_2, dimer acid derivatives, periodate oxidized starch (dialdehyde starch), ketogluconic acids, and methods to produce vitamin B_{12}. As a result of Agricultural Research Service's Northern Utilization Research and Development Division work, the Department obtained 55 patents relating to these projects which are described fully in the appendix A, pages 49–63.

Penicillin.—This Division developed and patented the vat fermentation submerged culture process of producing penicillin. The Division also found the high yielding penicillin mold strain and that the yield could be increased more than tenfold by adding corn steep liquor derived from the wet milling of corn and lactose (milk sugar) to the culture medium. It was the Department's effort that brought about large-scale inexpensive methods of producing penicillin. Improved methods for recovery and purification of pencillin were also devised by the Division.

The submerged culture process developed by the Division, in its basic approach, is still used by all manufacturers of penicillin, although the drug has been synthesized. The strain of the penicillin mold, or mutants developed from it, discovered by the Division's employees has been and is the principal source of all penicillin now produced except the synthesized forms. Corn steep liquor is the basic ingredient in culture medium for the production of all antibiotics and not merely penicillin.

This research, which cost the Government approximately $100,000, created new markets for corn and corn products, milk and milk products aided in making penicillin inexpensive and available as an animal feed supplement, and created pronounced public health benefits.[47]

The eight patents issued to the Department relating to penicillin have been used by industry on a royalty-free basis and the value of their use is beyond estimate.

Riboflavin (vitamin B_2).—The Division developed several vat fermentative processes using different organisms to produce riboflavin. The Government holds title to three patents concerning this subject matter. The process using the organism, Ashbya Gossypii, has been licensed and is used commercially. Riboflavin is widely used in fortifying foods, poultry, and animal feeds, and as a pharmaceutical and in pharmaceuticals. It is the belief of the Division and the Department that the availability of the use of their research, patents and development of know-how aided to some extent in bringing about a decrease in the price of riboflavin from $62 to $18 per pound in the period of 1948–57.[48]

Periodate oxidized starch.—The production of dialdehyde starch is commercially feasible today because of an electrochemical process developed by the Division, by which periodic acid could be regenerated and reused repeatedly. There are many potential uses for this starch such as leather tanning, adhesives and binders, oil-well drilling muds, wet-strength paper additives, gelatin conditioner and film hardener, and as an intermediate for other chemical derivatives. This develop-

[47] Ibid., pp. 55–58.
[48] Ibid., pp. 49–50.

ment may become one of the most significant contributions made in recent years in the field of creating new uses for farm commodities.[49]

Batter process.—This process separates ground wheat or wheat flour into starch and gluten. The advantages of the batter process lie in the speed and simplicity of operation, the lack of process chemicals, quality of products, and the practically complete recovery of the wheat gluten.

It is felt that the use of this process would find extensive commercial exploitation if the price ratio of wheat to corn were to drop even slightly. The potential contribution would then even accrue through the exports of gluten, and the use of the process would provide potential markets for more than 25 million bushels of wheat for domestic and industrial uses.[50]

Dextran.—This carbohydrate of a very large molecular weight, is similar to starch and is produced when certain species of bacteria are grown on sucrose. The product is used as a satisfactory blood plasma extender and was used successfully in Korea as a substitute for human blood plasma. During the Korean war Dextran became the material of choice due to the fact that there was a rather serious incidence of fatal cases of infectious hepatitis incurred by administration of blood plasma carrying a virus. Furthermore, Dextran can be administered without specific blood type knowledge, stored in a dry form for a long time and made ready for use very quickly. Its production has created an entirely new outlet for cereal-derived products. Recently there has been renewed interest for industrial uses and it is believed that further developments can be expected which will further extend the product's development and use.[51]

(2) *Eastern Utilization Research and Development Division.*—Six utilization research and development projects that this Division has worked on appear in the appendix. They include a new process to increase maple sirup flavor; a process to improve oleic acid made from animal fats; a process to recover flavor essence for restoration to fruit products; research to provide new drugs; research on fats and oils used in making plasticizers; and potato flakes (a new form of dehydrated mashed potatoes).[52] On the above 6 projects the Department obtained 25 patents. These developments are fully described in appendix A, pages 63–71.

Maple sirup.—As a result of this research, maple sirup is moving into wider commercial markets because this new process produces high-flavored maple sirup simply, inexpensively, and it is adaptable. It has led to the wider use of maple sirup, blended sirups, and other products. This process overcomes former deficiencies, provides the requisite intensity of color and flavor, and allegedly creates a superior blended sirup. At present it is used by the major U.S. producers.[53]

Improved oleic acid made from animal fats.—Seventy to eighty million pounds of unimproved oleic acid (red oil), is produced annually in the United States. It is used in the making of liquid soaps, textile lubricants and greases. The Department's research made possible the manufacture of a product consisting of 90 percent oleic acid with a very small content of polyunsaturated acids, which caused the red

[49] Ibid., p. 50.
[50] Ibid., p. 53.
[51] Ibid., p. 61.
[52] Ibid., p. 70.
[53] Ibid., p. 65.

oil to darken and become rancid and become unsuitable as a chemical intermediate. This process is now being used by the major producers of fatty acids and 10 percent of oleic acid presently used is produced by this process.[54]

Recovery of flavor essence for restoration to fruit products.—This Division developed a practical process for recovering in essence form the volatile aroma of fresh fruit juice. The process has been applied to the processing of apple, grape, peach, cherry, strawberry, red raspberry, blackberry, and blueberry juices and to the recovery of volatile flavor usually lost in the making of preserves, jams, and jellies. The essence finds use in many fruit products used in jelly manufacture, beverage use, sirups, ics cream, flavoring extracts, and candy. The value of this process lies in that it provides a new outlet for sound cull fruit. It enhances the palatability of food products made from fruit and fruit drinks and provides a new source of revenue to processors of fruit juices. Practically every major producer of essence and concentrated fruit juice is believed to be using this basic essence process.[55]

Research on tobacco and buckwheat to provide new drugs.—Two new drugs, rutin and quercetin, have been made available to the medical profession as a result of this work by this Division. (Rutin was originally called vitamin P.) Initial rutin was first derived from tobacco, then it was found that it could be obtained more cheaply from buckwheat. Later departmental researchers found that the flavonol portion, quercetin, is the effective therapeutic agent for disorders alleviated by rutin. Since they have become available commercially, usage has increased steadily. The current annual retail value of rutin and quercetin is about $4 million and the total since the beginning of their development has been about $45 million.[56]

Potato flakes.—By this relatively new process, dehydrated mashed potatoes can be made from potatoes grown in all major producing areas. It provides growers in the area with an assured market at a contract price for at least part of their crop. Presently there are 10 or more companies now manufacturing the potato flakes. At present estimated production per year takes up about 5 million bushels of potatoes. Furthermore, the development has created a new and more convenient means of utilizing potatoes for the hurried housewife. Full value of the patented invention relating to this development is impossible to estimate as its value is still to be determined by further use. However, for this development the utilization research group involved received the 1959 Institute of Food Technologists first industrial achievement award for "Outstanding Advances in the Application of Food Technology to Food Production."

(3) *Western Utilization Research and Development Division.*—Six utilization research and development projects from this division are described in appendix A, pages 71–78. They include the rapid heating of fluid food products; stabilization of dehydrated forage; walnut hull loosening process; development of a continuous belt-trough drier; a process to dehydrofreeze to preserve foods; ethylene coloring of citrus fruit; and a process to produce fruit and vegetable juice powders.

[54] Ibid., p. 64.
[55] Ibid., p. 66.
[56] Ibid., p. 68.

Nine patents were obtained by the Department for the work relating to these projects.

Fruit and vegetable juice powders.—This invention concerns the vacuum dehydration of fruit and vegetable juices to form a material which has a porous texture and dissolves instantaneously when combined with water to prepare a reconstituted juice. The powder reconstitutes readily to form beverages comparable to the original fruit juice, in flavor, color, and vitamin content. Orange and grapefruit powders are commercially made by this puff-drying process. The present annual production of fruit juice powders is conservatively estimated to exceed 1 million pounds or the equivalent of 1 million gallons of fresh juice. This represents only the infancy of this development. The development creates savings because the juice powders are in a dehydrated stage and there is no water to take up weight or space. The powders can be held at ordinary temperature and need not be stored under refrigeration in contrast to juice concentrates. It is expected that this invention will create greater markets for fruit and vegetable products through savings in transportation, storage costs, and through extending the marketing area since these products require no refrigeration.[57]

Stabilization of dehydrated forage.—The nutrient value of dehydrated alfalfa and other forage feeds whose value is dependent on their content of vitamin A (beta-carotene), vitamin B (xanthohpyll) is stabilized by this method. Natural oxidation usually burns up these components. However, the Department found that 6-ethoxy-2,2,4-trimethyl-1, 2-dihydroquinoline was discovered to be an effective antioxidation agent when applied at the rate of about one-half pound per ton and at a cost of not over $1, and that about three-fourths of the labile nutrients are retained over a storage period of 6 months as compared to only one-fourth retention for untreated forage. Furthermore, the retention of natural vitamin E in the forage prevents chick encephlomalacia. It is impossible to evaluate the value of this invention in monetary benefits as derived by the farmer or the resultant gain to the consumer. However, more than 40 forage dehydrating companies, representing the greater portion of the dehydrated alfalfa production capacity have been granted licenses to use this development.[58]

Continuous belt-trough drier.—The operations of fruit and vegetable processors are broadened and improved by this dehydrator. It provides a method of fast, uniform drying of fruits and vegetables in piece form and is the key element in the commercial success of two new processes, dehydrofreezing and dehydrocanning, in which partial dehydration precedes freezing or canning. The device is likely to replace all older types of driers in the annual processing of over 160 million pounds of apples, a like quantity of potatoes, and substantial quantities of other fruits and vegetables currently handled in less efficient dehydration equipment. Total value of these products exceeds $50 million per year. The new drier has proved highly successful in the drying of apples, carrots, potatoes, and bell peppers. Driers have been installed in many food processing companies and are being manufactured by more than one manufacturer.[59]

Dehydrofreezing to preserve foods.—Dehydrofreezing, a new process for preserving fruits and vegetables, involves partial dehydration of

[57] Ibid., p. 77.
[58] Ibid., p. 74.
[59] Ibid., p. 76.

the fresh produce followed by freezing. For example, fresh peas are blanched with steam, dehydrated until their weight is cut about one-half (due to elimination of moisture), then packaged and frozen. The ensuing food products possess substantial advantages over those produced by conventional methods of dehydration and freezing. For example, individual portions can be removed from the container without thawing the entire pack as is required with ordinary frozen foods, and there is no exudation of juice or drip when the product is thawed. The product contains a predetermined, uniform moisture content and the bulk and weight is only one-half that of ordinary frozen foods. Thus, the preparation and distribution involves substantial economies in charges for refrigeration, packaging, storage, and transportation. The process offers a potential saving of 2 to 5 cents per pound of food as compared with conventional freezing. Dehydrofrozen pimiento cheese and other cheeses, dehydrofrozen apples, peas, carrots, and Kadota figs are available commercially. Dehydrofrozen baby foods are being test marketed. As of the moment, it is difficult to estimate the full benefit of this invention to the consumer.[60]

(4) *Southern Utilization Research and Development Division.*—Eleven utilization research and development projects are described in appendix A at pages 79–89. They include a new fiber-testing device; turpentine derivative for use in synthetic rubber; a loom for weaving water- and wind-resistant fabrics; a fiber-cutting machine; vegetable oil extraction process; process for pine gum refining; cotton carding apparatus; frozen orange juice concentrates; chemically modified monoglycerides; conforming cotton bandage; and cotton opener-cleaner. The Division obtained 23 patents for its work relating to these projects.[61]

Cotton carding apparatus.—Time magazine declared this invention to be the "first major improvement in cotton carding equipment in 60 years." This carder has many advantages over the old. The plates surfaces will not accumulate fiber and there are no unopen tufts or fibers to remove. Elimination of the revolving flats of the conventional carding machine has resulted in a saving of from 2 to 5 percent of the fibrous material being carded or about 50 percent of the usual waste. Limited mill evaluation indicated a potential saving of over $40 million annually by the entire U.S. cotton textile industry. Many mills have already placed such a machine in operation.[62]

Frozen orange juice concentrate.—This is a method of preparing full-flavored fruit juice concentrates from citrus fruits, particularly oranges. The current annual production of orange juice concentrates prepared by this method is about 80 million gallons. Since its inception, more than a half billion gallons of orange juice concentrate have been prepared commercially. Manufacture of frozen concentrated orange juice has shown a phenomenal growth since its origin.

The development and use of this invention has had a tremendous impact on the Florida orange use. In the 1958–59 season, over 60 percent of the total Florida orange crop was used for production of frozen concentrate, amounting to 79 million gallons or a delivered value of $183 million and a net return to growers of approximately $121

[60] Ibid., p. 71.
[61] Ibid., pp. 79–89.
[62] Ibid., p. 83.

million. The cumulative value of the concentrate at the manufacturers' level is estimated to have exceeded $1½ billion. Currently there are 26 citrus concentration plants in Florida alone which utilize this development.[63]

Cotton opener-cleaner.—This machine processes staple textile fibers. The machine functions to open entangled masses of fiber and to remove more than one-third of the dirt, trash, and other nonfibrous materials that may be mixed with the fiber at a production rate of 1,500 pounds per hour. Although developed primarily for use with cotton, the opener-cleaner also is being used to process flax and ramie. This machine is now being produced by more than four manufacturing concerns. Excellent results are being achieved through its use and on the basis of the $2 per bale saved by mill results, the industry could realize about $18 million annually should the entire 9 million bales of annual mill consumption be processed through these machines.[64]

Conforming cotton bandage.—This invention is a new type of cotton surgical bandage which contains self-fitting and self-tightening properties. It is especially suitable in orthopedic surgery, and is excellent for head dressings, and dressings for burns and skin grafts. The bandage is available to the general public and is being produced by more than one company. This important development has strengthened the competitive position of cotton against synthetic fibers in the surgical bandage field.[65]

Turpentine derivative for use in synthetic rubber.—This involves the development of an initiator or catalyst which is used in the conventional polymer process mix to trigger the linking or chain-forming reaction. The use of these products is particularly advantageous in the production of synthetic rubber by the low-temperature ("cold rubber") process. These catalysts are also excellent for producing rubber from isoprene or isoprene-styrene mixtures. One of these catalysts is now being produced commercially at the rate of over 2 million pounds per year or a market value of over $1 million. Virtually all synthetic rubber for automobile tire treads is made using this catalyst. Three companies have obtained licenses and a considerable number of other companies are believed to be using the catalyst in the production of synthetic rubber, without obtaining a license.[66]

Loom device for weaving water- and wind-resistant fabrics.—This is an attachment for standard cotton looms which makes possible the weaving of high-density fabrics that resist the passage of wind and water but retain the ability to "breathe" and other comfort properties. This high-pick attachment aids in meeting the needs of defense agencies by enabling or facilitating the production of new types of cotton fabrics. A monetary value cannot be assigned to this development at the present time because it is too early. The loom attachment should improve the competitive position of cotton for use in wearing apparel, tents, awnings, and industrial fabrics where resistance to water and wind is an important requirement. At least two or more manufacturers of textile machinery presently produce this attachment.[67]

[63] Ibid., p. 79.
[64] Ibid., p. 81.
[65] Ibid., p. 80.
[66] Ibid., p. 84.
[67] Ibid., p. 85.

Process for pine gum refining.—Numerous naval stores processors have stated that the gum naval stores industry would probably not be in existence today had it not adopted this process of pine gum cleaning, frequently referred to as the Olustee process. The process has made pine gum an excellent cash crop for the farmers of the naval stores region. The process makes it possible for low-grade, high-trash content, nonuniform resin formerly produced from pine gum to be replaced with a clean, high-grade product which can compete favorably with wood resin and tall oil resin. Conservative estimates have set potential production and use of maleopimaric acid derived by this process at several million pounds. This resin acid finds utility in the photographic industry, in dyes, alkyd resins, and for sizing. The total savings since the introduction of the new process is estimated at about $12 million and at present the estimated savings are about $500,000 per year. Many producers have obtained licenses under these patents.[68]

Vitamin B_{12} processes.—There are instances whereby the work done at the above-named utilization divisions overlaps. The Northern Utilization Research and Development Division, the Eastern Utilization Research and Development Division, and the Western Utilization Research and Development Division have all successfully devised new methods for the production of vitamin B_{12}. In this instance the Department obtained six patents relating to improved methods for the production of commercializing vitamin B_{12}.

The process developed at the Northern Utilization Research and Development Division has made primary vitamin B_{12} fermentation economically feasible. Previously commercially available vitamin B_{12} products had usually been obtained as secondary products from antibiotic fermentations. In the first few years in which vitamin B_{12} was produced by fermentation, it is estimated that the Northern Division process accounted for about one-third of the production. In an effort to increase yields and concurrently decrease costs, commercial producers have continued their research and have ultimately found higher producing organisms. It is not known to what extent the Department's patents are currently applied. However, it is believed that the basic approach devised by the Department is still being used in the search for still higher producing organisms. Industry has also indicated considerable interest in the Eastern Utilization Laboratories and the Western Utilization Laboratories methods for the production of vitamin B_{12}, but there is no practical way to estimate their industrial value.[69]

(5) *Animal Disease and Parasite Division.*—Two research and development projects are described at appendix A that this Division worked on and from which patented inventions resulted. They include research on hog cholera antitoxins and the poultry pullorum disease test. The Department has obtained nine patents on inventions as a result of this work.

Hog cholera antitoxins.—This Division found through its research that swine could be immunized against hog cholera by means of protective antitoxin serum. The serum is prepared by injecting large cholera-immune hogs with blood obtained from a pig sick with that disease. After a period of time the treated hog is bled and the

[68] Ibid., p. 89.
[69] Ibid., p. 87.

obtained blood which contains large quantities of protective antibodies is used to produce a clear product that is pasturized to destroy any live disease-producing organisms. The Department's research policy made these processes available to all. In the period 1941–52, the expenditures for the purchase of only biological agents for immunization of swine average $25 million annually in the United States. It has been conservatively estimated that the use of these products has resulted in the annual survival and marketing of additional swine in the United States valued at five times the cost of immunization or about $125 million. The value of these inventions relating to sera as a result of information available covering only the period 1941–52 has proven to be not less than $125 million annually or a $1.5 billion over the 12-year period. As a result a more plentiful supply of pork is available, a decrease in the risk of producing this meat is present, and the price of pork and ham to the consumer in turn has become reasonable in contrast with other meats.[70]

Pullorum disease test.—This development of a crystal-violet-stained pullorum disease antigen is widely used in the United States in State pullorum disease eradication programs. Since the use of these antigens the incidence of the disease has been reduced from approximately 5 to 7 percent in chickens or poultry to a present low incidence varying from 0.5 to 0.0125 percent. Considering the potential dollar losses from eggs and chickens to be a conservative 10 percent per year before the antigen came into use and the losses averaging 0.5 percent for eggs and chickens for the years 1942 to 1958, inclusive, it is apparent that the dollar value to the poultry industry has averaged approximately $10 million per year for that period. The Department believes the savings for this period could be estimated as $150 million and since the general adoption of the test as over $200 million. There were more than 37 licensees using this invention before expiration of the patent.[71]

(6) *Entomological Research Division.*—Two projects relating to the development of aerosol bombs and allethrin—insecticide which this Division researched are more fully described in appendix A. Three patents were obtained by the Department concerning these two projects.

Aerosol bombs (insecticidal aerosols).—The invention of liquid gas propelled insecticide aerosols by the Department scientists of this Division has resulted in the spectacular rise of several new industries. The aerosols were introduced at the beginning of World War II and were immediately adopted by the Armed Forces for protection of military personnel. They have proved highly effective against the many disease-carrying insects, especially malaria-carrying mosquitoes in military barracks, tents, foxholes, open air and over all possible forms of conditions. These aerosol insecticides were promptly put to creative use at the close of the war. Furthermore, the liquefied-gas propelled, pressurized formulations proved to be so efficient, convenient and well accepted that this type of packaging was adopted for numerous other products. At present more than 200 different kinds of products are prepared based on this invention. The number of such pressurized units produced in the United States in 1960 was 730 million, at a value of about $880 million. The growth of this

[70] Ibid., p. 91.
[71] Ibid., p. 92.

invention has resulted in the appearance of related new auxiliary industries and the expansion of others. For example, there are now at least in the United States 4 manufacturers of chloroflourohydrocarbon propellents, 16 manufacturers of aerosol and pressurized spray cans, makers of aerosol valves, and 14 makers of aerosol loading equipment as well as numerous packaging companies. Aerosol products are now being manufactured in 22 or more countries and the manufacturers purchase the bulk of their valve components, containers, and practically all loading equipment from manufacturers in the United States. More than 125 companies have applied for and obtained licenses under the Department's patent. Numerous others are operating under the Department's patents but have not obtained such a license.[72]

Allethrin (insecticide).—The synthesis of allethrin, an insecticide of very low mammalian toxicity, highly effective against flies, mosquitoes, and other household pests, is the result of this Division's work. This development followed the extensive research of the Department chemists on the structure of the active constituents of pyrethrum. Allethrin is used extensively commercially. In 1956 its annual sales were reported at about 20,000 pounds with a sales value of $640,000. Approximate total sales of this insecticide since its introduction probably have amounted to more than about $6 million. However, its strategic value far exceeds the monetary value for the discovery of allethrin freed the United States of dependency on foreign sources of supply for pyrethrum.[73]

(7) *Soil and Water Conservation Research Division.*—The research developments of this Division are described in the appendix A, pages 96–97. Under the two developments two patents were issued to the Department relating to noncaking granulated fertilizers and to granulated fertilizers.

Granulated fertilizers.—This process transforms finely divided fertilizer materials into pellets or granules under the action of a rotating cylinder with the use of heat and moisture. The inventive features of this patent are widely used in sundry combinations by the industry for fertilizer granulation. The blending of various innovations renders it impossible to give a reliable estimate of the commercial value of the specific process covered by the patent. However, all the large manufacturers of mixed fertilizers in the United States now produce granulated fertilizers and use the features of this patented invention to some degree.[74]

Noncaking fertilizer.—This invention relates to treating granulated fertilizers with finely pulverized insoluble materials to prevent the fertilizer from caking during shipment and storage. Commercial application of this process began about 1945. At present one or more of the process' features are known to be used by many manufacturers of granular fertilizer throughout the country.

(8) *Animal Husbandry Research Division.*—The single development selected for this study from this Division is a project which produced four patented inventions and is fully described at appendix A, pages 97–98. A brief summary follows:

Hardy cross-section fiber device.—These devices enable technicians to obtain information on the internal structure of hair, fibers, and furs

[72] Ibid., p. 93.
[73] Ibid., p. 95.
[74] Ibid., p. 96.

quickly and accurately. They are used in the detection of questionable or fraudulent practices in the labeling of products made of animal, vegetable, or manmade fibers. As a result technicians are able to identify and determine the fineness and variability of hairs and fibers and in studying pigmentation. These devices are conservatively estimated to have an annual value of $8 million to the industry and an incalculable value in crime detection to the police, Federal Trade Commission, manufacturers, and consumers.[75]

(9) *Agricultural Engineering Research Division.*—Five development projects were selected from the work of this Division, which have resulted in five patents. These projects concern cottonseed drying apparatus; seed dusting machine; fluid velocity measuring instrument; lint cotton cleaner; and seed cotton cleaner.[76] They are described in the appendix A, pages 98–101.

Cottonseed drying apparatus.—This equipment and process is the well-known Tower drier which is commercially available from most manufacturers of ginning equipment. This has resulted in reducing mechanical and rough hand harvesting practices and effected labor and cost savings. The process has made it possible to clean longer stapled fibered cottons. Its worth as estimated is $100 million to cotton-growers up to and including the 1958 season and its development also created another new and marketable product for cotton processing machinery manufacturers.[77]

Fluid velocity measuring instrument.—This machine is used extensively as a research instrument and is available from three or more instrument companies. It is effective in measuring air velocities from 0 to 1,000 feet per minute but it is the only satisfactory method for measurement of air velocities below 50 feet per minute.[78]

Lint cotton cleaner.—This machine is used to clean cotton after it is ginned but before it is pressed and baled. The invention is incorporated in most of the lint cleaners which are now available from gin lint cleaner manufacturers and are in general use throughout the Cotton Belt. In 1958 about 4,000 of the 6,500 operating gins in the United States had one or more lint cleaners. The accumulative benefit to the farmers from 1952 to 1958, inclusive, approximates $75 million. The invention has also created another new and marketable product for gin machinery manufacturers.[79]

Seed cotton cleaner.—This seed cotton cleaner is used for the ginning of trashy seed cotton from stripper type harvesters and hand snapping. Such cleaners have been in widespread use for about 4 years and the improvement in grade of cotton and other benefits to cotton producers exceeds $15 million up to and through the 1958 ginning season.[80]

b. U.S. Forest Service

The U.S. Forest Service conducts extensive research and development and engineering in the entire field of forestry including forest research and research to develop new and improved products from wood and to increase efficiency of utilizing forest products. The Forest Service conducts its research mainly in the Forest Products Laboratory and also through its forest and range experiment stations.

[75] Ibid., p. 97.
[76] Ibid., p. 100.
[77] Ibid., p. 98.
[78] Ibid., p. 99.
[79] Ibid., p. 100.
[80] Ibid., p. 99.

(1) *Forest Products Laboratory.*—Extensive research is conducted by this Laboratory whose broad aim is to develop new use outlets for thinnings, unpopular species of lumber, logging and milling residues, and give better service in a wide variety of uses of lumber, paper, chemicals, and other products derived from wood. Projects of recent progress developed by this Laboratory include book papers from northern hardwoods and balsam fir, earthquake-resistant wood construction, bin pallets for agricultural products, methods for cutting wood, use of hardwoods in liner board for corrugated boxes.

Eight research and development projects were selected from work which has been done by the Forest Products Laboratory. In connection with these projects the Department has obtained 21 patented inventions. These projects concern process for making woodpulp; process for plasticizing wood products; wood moisture indicator; prefabricated building construction; reversible circulation internal fan kiln; dry kiln for drying lumber and other moisture-bearing substances; plywood process; and compressed resinated paper sheets and are fully described at appendix A, pages 101–108.

Reversible circulation internal fan kiln.—The development of the basic principles of the reversible circulation internal fan lumber dry kiln constituted a very significant contribution to the lumber producing and wood using industries. Major dry kiln companies are now designing and building dry-kiln equipment based on the patented inventions developed by the Department. The basic invention and its subsequent improvements have enabled industry to produce kiln dried material with greatly improved moisture quality control. Seasoning degrade has been reduced and drying time shortened. About 40 percent of the total lumber produced in the United States is being dried by these kilns. The basic invention and its improvements created a new product for kiln manufacturers and produced a benefit to the purchaser, builder and consumer of lumber.[81]

Plywood process.—This process relates to an impregnating veneer with a resin forming solution in the fine structure of the wood, and for polymerizing the resin after impregnation. The product resulting from this process has been named "impreg" and the same product compressed has been named "compreg." The impreg process had little commercial use until it was demonstrated to auto manufacturers that its use for models from which to cut steel dies for stamping auto parts could save them large amounts of money. The manufacture of impreg is now a multimillion dollar industry. Compreg has been used to make trainer-plane adjustable pitch propellers, motor test propellers, antenna masts, spar and connector plates, refrigerator blocks for ships, and tooling jigs. It is also useful for aluminum drawing and forming dies, drilling jigs, jigs for holding parts in place for welding, knife handles, picker sticks in looms, silent gears, pulleys, water-lubricated bearings, fan blades, shuttles, instrument bases and cases, electrical insulators, tool handles and other novelties. Both products and processes are used extensively by industry.[82]

Wood moisture indicator.—Physical and mechanical properties of wood generally vary with its moisture content, and the proper use of wood is related to its moisture content when fabricated or installed. This original instrument demonstrated that electrical resistance of

[81] Ibid., p. 101.
[82] Ibid., p. 102.

wood could be measured on a portable meter by means of electrodes driven into the wood and the resultant moisture content reading would be accurate, instantaneous and nondestructive. Following this development electrical instrument companies, using the principles described in this patent, have developed the moisture meters that are now widely used by lumber producers and wood using industries.[83]

Dry kiln for drying lumber and other moisture-bearing substances.—This kiln provides humidity control during the drying of wood. After 7 to 10 years of very intensive commercial use this design became obsolete due to further research at the Forest Products Laboratory that resulted in the invention of the reversible circulation internal fan drying kiln. However, during its period of use it significantly aided the lumber industry.[84]

Process for making woodpulp.—This is the neutral sulfite semichemical pulping process for softening chipped wood with a chemical solution under relatively mild temperature for a short period of time. By this process, good quality pulp can be obtained from woods which were once regarded as unsuitable for papermaking. The use of the process is spread throughout the country in 36 mills and accounts for approximately 7 percent of the total pulp production. Its tangible product value in 1958 was approximately $200 million. The largest use is for making the corrugated board used in the manufacture of shipping containers. The properties of board made by the process are superior to those made from other materials. The process is also applicable to the pulping of wood and writing paper. Its use accounts for over 1½ million cords of hardwoods, most of which are too low in quality for other purposes. This created a market for these woods which did not exist earlier.[85]

(2) *Forest and range experiment stations.*—The U.S. Forest Service conducts also research engineering development through its nine regional forest and range experiment stations in the United States and in centers in Alaska and Puerto Rico. The following development was selected and appears at appendix A, page 108. One patent was issued to the USDA resulting from this work.

California Forest and Range Experiment Station—Soil moisture meter.—This fiberglass electrical soil moisture meter operates on the principle of measuring electrical resistance in a porous dielectric that is in moisture equilibrium with the surrounding soil. It is used in determining site quality for both forest and rangeland; for analyzing the response of vegetation to environmental conditions or treatments; for determining the water reservoir capacity of soils at any given time as an indication of anticipated runoff or infiltration of water; and for determining the suitability of soils as media for developments of diseases or insect populations. Its results have made possible large savings in the time of agricultural research workers and improved the reliability of soil moisture determinations.[86]

(3) *Southeastern Forest Experimentation Station.*—The following project concerning an acid sprayer resulted in three patented inventions, more fully described at appendix A, page 109.

Acid sprayer.—This work was done at the Lake City Research Center, a unit of the Southeastern Forest Experiment Station. This

[83] Ibid., p. 105.
[84] Ibid., p. 106.
[85] Ibid., p. 107.
[86] Ibid., p. 108.

research unit developed the first operational model of an all plastic, acid-resistant sprayer for applying sulfuric acid to the naval stores wounds. The sprayer operates by hand pressure obtained by squeezing a plastic bottle. The spray is now being used on about 80 percent of all naval stores faces being worked in the gum naval stores industry and has resulted in about a 50 percent reduction in the labor requirement for wounding the trees or an annual monetary saving of over $3 million. The operation is the same as that involved in the use of underarm deodorant and other sprays that appeared on the market after the first model of the acid sprayer was developed and disclosed to the public. This development created a new concept in packaging, use, consumer demand, and a market for our synthetic chemical (plastic) products.[87]

c. Agricultural Marketing Service.

The Agricultural Marketing Service conducts some research in its own facilities but the greatest percentage is done by contract with land-grant colleges, public and private agencies and contractors. Marketing research is directed among its other objectives toward the development of expanded markets for agricultural products, reduction of marketing costs through improved marketing efficiency and organization, the resolution of problems at each stage of marketing such as in assembly points, terminal or central markets, and retail markets. Recent progress includes an electronic scanning device for measuring cotton, establishment of a pilot cotton spinning research laboratory, loading methods for fruit, box handling and storage devices for apples, and the public acceptance of dehydrofrozen peas. Nine research and development projects were selected for this study. They include the development of the duplex cotton fiber sorter; an egg grader; a method for rapid determination of oil in cottonseed and soybeans; moisture testing of grain and seed; checkout counter for retail grocery stores; a dump basket; an automatic box filler for fruit; a bag filling device for fruits and vegetables and a cotton fiber blender. For its work on these projects the Department obtained 11 patents, more fully described at appendix A, pages 110–117.

Egg grader.—This research has been in part done in cooperation with the Agricultural Research Service. The purpose is to study efficient means of measuring and detecting the qualities and defects of shell eggs. A method for detecting blood which can be adapted to automatic egg sorting was developed. This method gives an accuracy of 80 percent at a speed of 20 cases per hour. This process is based on the spectrophotometric measurement of the blood absorption in an intact egg. This development is being slowly adapted to commercial use and as yet is being used on a trial basis. However, the full use of this development may save the egg industry more than $1 million a year in labor cost and produce saved. Another development resulting from this program is an automatic machine to sort eggs into six different shell color classes. A photoelectric device operates the reject mechanism of the instrument and places the eggs in a collecting tray according to the measured shell color. It is not possible to state the value of the development at the present time because eggs are not sorted into color classes. The above devices are manufactured by one or more food engineering companies.[88]

[87] Ibid., p. 109.
[88] Ibid., p. 111.

Bag filler.—This development was the result of a contract of the Transportation and Facilities Branch of the Marketing Research Division, AMS, with the inventor. An operator can pack more than 400 bags an hour of fruits and vegetables such as apples and oranges with this device. Soon after publication of the description of the device, a commercial firm requested advice on the manufacturing and distributing of this bag filling machine for commercial use. Three years later the firm informed the Department that it had produced and sold some 4,000 packaging machines in various models incorporating the principles of this patented invention. These packaging devices with an estimated value in excess of $2 million are now widely used by growers, shippers and distributors for packaging onions, potatoes and citrus fruits. The development has contributed materially to the commercial adoption of the prepackaging of apples in film bags which also came about as a result of this same project. Accordingly, apple producers in the country now market a major portion of their crops in consumer size bags. Labor savings in the packaging of apples alone amounts to about $4 million annually. Furthermore, it has greatly stimulated the marketing of small size apples and oranges. The annual value to farmers of small apples otherwise nonmarketable is now estimated at more than $2½ million per year. Somewhat similar benefits are gained by growers of other fruits and vegetables. The adoption of this device has created a new product for equipment manufacturers, a market for fruit and agricultural products formerly not marketable; created a market for plastic films and it is hoped a savings was passed on to the consumer due to decreased costs.[89]

Automatic box filler.—This work was done as a result of a research contract negotiated with the Fruit Industries Research Foundation by the AMS. As a result no labor is required except to supply empty boxes for the filling of fruit. In 1954, when the box filler was developed, the piece rate for manually loose packing boxes of fruit was $52.50 per 1,000 boxes. When this automatic box filler was substituted, the labor cost dropped to a maximum of $7 per 1,000 boxes. Equipment costs added roughly $0.50 per 1,000 boxes and brought the total to $7.50 per 1,000 boxes by use of the new device. The savings amounted to $45 per 1,000 boxes. One firm in the Pacific Northwest, alone, manufactured and sold 300 automatic box fillers during the summer of 1955 to apple houses in that area. The total number of units sold far exceeds 2,000. Today improved models of the box filler are widely used. As a result, lower grade apples and peaches may be used, packed and shipped. The automatic box filler is manufactured by four or more equipment manufacturing companies. It cuts down labor costs and increases the efficiency of the operation of fruit packinghouse, benefits which in turn ought to accrue to decreasing the food distributors' cost and ultimately a decreasing cost to the consumer.[90]

Rapid determination of oil in cottonseed and soybeans.—This method and equipment determines the oil content in less than 10 minutes. It allows buyers to purchase on actual value of graded soybeans, thereby rewarding growers of high oil content and penalizing those of low oil content. The Department estimates that savings of 50 cents per ton on cottonseed and 1 cent per bushel on soybeans can be effected through the marketing efficiency due to this device. This amounts

[89] Ibid., p. 112.
[90] Ibid., p. 113.

to $2,250,000 per year on cottonseed and $5,500,000 per year on soybeans. A potential market exists for 2,000 units in the soybean industry and 3,000 units in the cottonseed industry. Four commercial-type instruments using this device were field tested in 1958 on cottonseed and will be tested in 1959 on soybeans. It is expected that this device will find rapid commercial utilization.[91]

d. A few of last year's inventive achievements.

The following examples are only a few of the past year's inventive achievements of the Department's research which may find their way into the utilization stream.

ARS agricultural engineers reported experimental success in grain drying with air heated by the sun. Corn was dried more quickly and cheaply with the solar-heated air system than with a conventional unheated air system in tests in Kansas. Fans in the solar heating system used 50 percent less electric power than those in the conventional system. Completely automatic handling of poultry feed from storage bins to feeders was made possible through research by the State agricultural experiment station engineers in Illinois. They devised and adapted facilities using both experimental and commercial equipment operated by electric controls to automatically blend, grind, convey, and distribute feed, and maintain a constant supply in the poultry houses. Furthermore, an electronic instrument that simultaneously determines the changing shape of the water surface and bottom of sandbed streams was developed through the Department's sponsored research. This device operates on the same principle as Sonar, developed during World War II for submarine detection, and will allow automatic recording of water level and streambed changes. Soil scientists at the U.S. Salinity Laboratory, Riverside, Calif., developed an instrument that can measure differences in relative humidity of soil samples as small as one two-thousandth of 1 percent. This apparatus gives some of the quantitative measurements needed to determine the factors influencing availability of water to plants. As these influences become better understood, scientists hope to develop means toward more efficient use of water in agriculture.

As a patent licensee the Department of Agriculture has paid royalities for a license to use DDT as an insecticide when DDT is not acquired from the owner of the patent involved. The amount of the royalty payment was small as the Department did not use DDT extensively.

III. Agency Viewpoint

A. JUDGMENT AS TO EFFECTIVENESS OF PRESENT POLICY

The Department of Agriculture has informed the subcommittee that it knows of no instance under the present law in which a patent policy different from its present policy would have proven useful to the Government or in the public interest except that, as an addition to this policy, the authority to issue exclusive licenses might prove advantageous, as well as the means to secure for the Government foreign patents.[92]

[91] Ibid., p. 116.

[92] Statement of Dr. W. D. Maclay, Assistant Administrator, Agricultural Research Service, U.S. Department of Agriculture, before the Subcommittee on Patents, Trademarks, and Copyrights of the Senate Committee on the Judiciary on May 31, 1961.

As the Department research leads to varied inventions, the majority of which can be easily commercially developed and introduced, the Department believes that its inventions are and should be made readily available to the free use of the people of the United States, either by dedication of the patent rights, by licensing the patents on a nonexclusive, royalty-free basis or by placing the invention in the public domain by publication or other means. In the view of the Department this policy generally provides for and encourages the maximum commercial use of discoveries arising out of Department research.

A recent public expression of the views of the Department on the disposition of patent rights arising from research contracts were stated in a letter, dated October 20, 1959, from Marvin L. McLain, Acting Secretary, to Hon. Emanuel Celler, chairman of the House Committee on the Judiciary, in reply to a request by Chairman Celler that the Department express its views on H.R. 5448 (86th Cong., 1st sess.):

> The bill would leave title rights to inventions, improvements, or discoveries resulting from research or development contracts entered into by the Federal Government with the contractor. The United States would be awarded a royalty-free, nonexclusive license to practice or have practiced the invention, improvement, or discovery. It further provides that for each research or development contract awarded by the United States, the Federal Government shall receive a percentage, determined by negotiation as provided in the contract, of the income from the commercial utilization of the invention, improvement, or discovery patented.
>
> Proposed subsection (a) of section 268 would leave title rights to inventions, improvements, or discoveries resulting from research or development contracts entered into by the Federal Government with the contractor. Since research or developmental contracts entered into by the Federal Government are paid for with public funds, the benefits should accrue entirely to the public. In addition, any discoveries resulting from such contracts should also belong to the public.
>
> The nature of the research carried out by this Department, whether in its own laboratories or in private laboratories under contract, is predominantly of a public service and utilization nature, as for example, to discover new uses for agricultural products, in contrast to the procurement-type of research with which the Defense agencies are concerned. A mere license to the Government in any patent resulting from an invention or discovery made in the course of a research project of this Department would in most instances be a hollow gesture if the public itself did not have free access to the invention.
>
> Furthermore, while the cost of the research might be reduced by permitting the Government to share in the

royalties, we believe that it would actually tend to increase the cost to the public since the contractor who had title to the patent could well arrange to recover from the ultimate consumer the share of the royalties which he paid to the Government.

In addition, the Subcommittee on Patents, Trademarks, and Copyrights of the Senate Committee on the Judiciary, pursuant to Senate Resolution 236 of the 85th Congress, 2d session, is making a comprehensive study of the U.S. patent system. From this action there will probably emerge legislation setting up a more detailed patent policy and for this reason we have also made the above recommendation.

The Bureau of the Budget advises that there is no objection to the submission of this report.

The Department reaffirmed these views at the recent hearings on May 31, 1961, of the subcommittee.[93]

B. FUTURE RECOMMENDATIONS

The Department reports that its research has occasionally produced inventions which may require a considerable amount of venture capital to develop for commercial use. In such instances it may be difficult to secure such development of the inventions in the absence of an exclusive license for a period long enough to give the licensee a chance of recouping the necessary venture capital investment before he is faced with competition. The Department has long considered it desirable that it should have authority to issue exclusive licenses, provided that such exclusive licenses are issued for the shortest time required to secure commercial development of the inventions.

However, Department officials' opinions on the matter have not been unanimous. There is some feeling that application or development of research results, which would be to the ultimate benefit of the public might be expedited by such exclusive licenses or otherwise have the Government dispose of its interest in the patents for exclusive use, while others feel this would not be so and that in any event the administrative problems posed could more than offset the advantages of rapid development.

This diversity of opinion within the Department stems from the fact that the Government has had no substantial experience in exclusive licensing of its patents, so that individual judgments on the matter must be made without the aid of adequate precedent. The Department feels that a trial operation under exclusive licensing authority would be invaluable in judging the practical value of the procedure. Therefore, the Department suggests that consideration be given to the enactment of authorizing legislation so that Government officials and Congress would obtain the experience needed to judge the desirability and need of such legislation.

As a result of the Department's experiences in the last few years and the recommendations of the Newton report, the Department recommends that it is desirable for the Government to acquire the foreign patent rights, as well as the domestic patent rights of employee inven-

[93] Ibid.

tions. Therefore, the Department favors enactment of legislation which would provide for the worldwide acquisition of employee invention rights. In the absence of legislative change and as the Department is presently operating under the provision of Executive Order 9865 and Administrative Order No. 6, the Department indicates it would be glad to cooperate with other Government agencies in obtaining such changes in the orders as would secure for the Government the foreign patent rights.[94]

[94] Ibid.

APPENDIXES

APPENDIX A

Utilization of Department of Agriculture Government-Owned Inventions

The following utilization reports were prepared by Herschel F. Clesner with the cooperation and aid of the Agricultural Research Service, General Counsel's Office, U.S. Forest Service, and the Agricultural Marketing Service of the Department of Agriculture. The 67 reports cover more than 70 projects from which the Government has obtained more than 180 patents. The number of patents involved in these reports constitute slightly less than 10 percent of the number of patents held by the Department of Agriculture.

1. Agricultural Research Service:
   Northern Utilization Research and Development Division:
   - Riboflavin (Vitamin B_2).
   - Periodate oxidized starch (dialdehyde starch).
   - Starch sponge.
   - Polymers from vegetable oils.
   - Batter process.
   - Fungal amylase.
   - Penicillin.
   - Corn zein textile process.
   - Dimer acid derivatives.
   - Ketogluconic acids.
   - Dextran.
2. Agricultural Research Service:
   Eastern Utilization Research and Development Division:
   - Fats and oils used in making plasticizers.
   - Improved oleic acid made from animal fats.
   - New process increases maple sirup flavor.
   - Flavor essence recovered for restoration to fruit products.
   - Research on tobacco provides new drugs.
   - Potato flakes.
3. Agricultural Research Service:
   Western Utilization Research and Development Division:
   - Dehydrofreezing to preserve foods.
   - Walnut hull loosening process.
   - Ethylene coloring of citrus fruit.
   - Stabilization of dehydrated forage.
   - Rapid heating of fluid food products.
   - Continuous belt-trough drier.
   - Fruit and vegetable juice powders.

4. Agricultural Research Service:
   Southern Utilization and Development Division:
   - Frozen orange juice concentrate.
   - Conforming cotton bandage.
   - Cotton opener-cleaner.
   - Cotton carding apparatus.
   - Turpentine derivative for use in synthetic rubber.
   - New fiber testing device.
   - Loom device for weaving water- and wind-resistant fabrics.
   - Fiber cutting machine.
   - Process for pine gum refining.
   - Vegetable oil extraction process.
   - Chemically modified monoglycerides.

5. Agricultural Research Service:
   - Northern Utilization Research Development Division.
   - Eastern Utilization Research Development Division.
   - Western Utilization Research Development Division.
     - Improved methods for commercial production of vitamin B_{12}.

6. Agricultural Research Service:
   Animal Disease and Parisite Division:
   - Hog cholera antitoxins.
   - Pullorum disease test.

7. Agricultural Research Service:
   Entomological Research Division:
   - Aerosol bombs.
   - Allethrin insecticide.

8. Soil and Water Conservation Research Division:
   - Granulated fertilizer.
   - Noncaking fertilizer.

9. Animal Husbandry Research Division:
   - Fiber devices.

10. Agricultural Engineering Research Division:
    - Cottonseed drying apparatus.
    - Seed dusting machine.
    - Fluid velocity measuring instrument.
    - Lint cotton cleaner.
    - Seed cotton cleaner.

11. U.S. Forest Service:
    Forest Products Laboratory:
    - Reversible circulation internal fan kiln.
    - Plywood process.
    - Compressed resinated paper sheets.
    - Prefabricated building construction.
    - Wood moisture indicator.
    - Processes for plasticizing wood products.
    - Dry kiln for drying lumber and other moisture-bearing substances.
    - Process for making woodpulp.

12. California Forest and Range Experiment Station:
    - Soil moisture meter.

13. Southeastern Forest Experimentation Station:
    - Acid sprayer.

14. Agricultural Marketing Service:
Cotton fiber blender.
Duplex cotton fiber sorter.
Egg grading.
Bag filler.
Dump basket.
Moisture testing of grain and seed.
Automatic box filler.
Rapid determination of oil in cottonseed and soybeans.
Checkout counter for retail grocery stores.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Riboflavin (vitamin B_2)

Patent No.: 2,424,003.
Names of inventors: Fred W. Tanner, Jr., and James M. Van Lanen.
Title: Methods for the Production of Riboflavin by *Candida Flareri*.
Date of issuance: July 15, 1947.

Patent No.: 2,445,128.
Names of inventors: Fred W. Tanner, Jr., Lynferd J. Wickerham, and James M. Van Lanen.
Title: Biological Process for the Production of Riboflavin.
Date of issuance: July 13, 1948.

Patent No.: 2,578,738.
Name of inventor: Thomas G. Pridham.
Title: Biological Production of Riboflavin.
Date of issuance: December 18, 1951.

Riboflavin, or vitamin B_2, is widely used in fortifying food, poultry, and animal feeds, and in the preparation of pharmaceuticals. Work in the Northern Utilization Research and Development Division resulted in a fermentative process using the organism *Candida flareri* to produce riboflavin. The medium was mainly corn sugar, corn steep liquor (byproduct of corn wet-milling), and animal stock liquor (a packinghouse byproduct of wet rendering). As a further improvement to the process, it was found that changes in nutrient and addition of corn sugar during the fermentation give still higher yields of riboflavin. By evaporative concentration to about 30 percent solids, a syrup is obtained which is suitable for enriching poultry and livestock feeds. Alternatively, the syrup can be converted by drum or spray drying to a dry powder. Pure crystalline riboflavin can be recovered from the fermented solution. Patents were obtained on these processes, but only the processes using the organism *Ashbya gossypii* have been licensed. Work by the Northern Utilization Research and Development Division on this product was terminated in 1951.

It is estimated that during the period 1950–57, the production of riboflavin consumed the corn sugar equivalent to 270,000 bushels of corn. The present rate of production of riboflavin is a little over 300,000 pounds per year, and it is estimated that about half is produced with *Ashbya gossypii*. The value of this total production is over $5 million; however, in view of the dietary importance of vitamin B_2, it is difficult to define its merit solely in terms of dollars. During the 10-year period, 1948–57, the total production of riboflavin was 1,840,000 pounds with a wholesale value of $68,591,000 (U.S. Tariff

Commission). The value per pound decreased during this period from over $62 to about $18; this decrease was accompanied by an approximately threefold increase in production in the same period. It is difficult to appraise completely the effect of the Northern Utilization Research and Development Division's work on riboflavin production except to comment that the price decrease noted above undoubtedly resulted in part from the Northern Division's research, patents, development of know-how, and publications.

The cost of this development to the Department of Agriculture is estimated at approximately $215,000 based on salaries and expenses.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Periodate oxidized starch (dialdehyde starch)

Patent No.: 2,648,629.
Names of inventors: William Dvonch and Charles L. Mehltretter.
Title: Electrolytic Preparation of Periodate Oxypolysaccharides.
Date of issuance: August 11, 1953.

Patent No.: 2,713,553.
Name of inventor: Charles L. Mehltretter.
Title: Electrochemical Production of Periodate Oxypolysaccharides.
Date of issuance: July 19, 1955.

Patent No.: 2,770,589.
Name of inventor: Charles L. Mehltretter.
Title: Electrolytic Production of Alkali Salts of Iodic Acid.
Date of issuance: November 13, 1956.

Patent No.: 2,783,283.
Names of inventors: John W. Sloan, Bernard T. Hofreiter, Charles L. Mehltretter and Ivan A. Wolff.
Title: Hydrogenolysis of Dialdehyde Starch to Erythritol and Ethlyene Glycol.
Date of issuance: February 26, 1957.

Patent No.:2,788,546.
Names of inventors: Russel L. Mellies and Ivan A Wolff.
Title: Method of Molding Oxystarch.
Date of issuance: April 16. 1957.

Patent No.: 2,796,447.
Names of inventors: John W. Sloan and Ivan A. Wolff.
Title: Hydrogenolysis of Dialdehyde Starch to Erythritol and Ethylene Glycol.
Date of issuance; June 18, 1957.

Patent No.: 2,830,941.
Name of inventor: Charles L. Mehltretter.
Title:Electrolytic Process for Making Periodic Acid Solutions.
Date of issuance: April 15, 1958.

NOTE.—Additional patent applications in this field have been filed.

For many years it was known that periodic acid (HIO_4) would oxidize two ring carbons in an anhydrous glucose unit with little change in the molecular size. However, the cost of the periodic acid was so great as to limit the use to research purposes only. An electrochemical process was developed in the Northern Utilization Research and Development Division by which the periodic acid could be regenerated and reused repeatedly. This made the production of dialdehyde starch commercially feasible.

To date there are two companies who are producing dialdehyde starches of various oxidation levels in semicommercial quantities. Selected derivatives as laboratory preparations are also available.

By controlling the extent of oxidation, a wide range of dialdehyde starches can be produced.

Potential applications are in leather tanning, adhesives and binders, oil-well drilling muds, wet-strength paper additives, gelatin conditioner and film hardener, and as an intermediate for other chemical derivatives. If success is realized in most of the proposed applications, the market might reach 25 million pounds a year within a reasonable time. It is believed that this development is one of the most significant contributions made by the Northern Division in recent years in the field of creating new uses for farm commodities.

This program is still continuing; however, it is estimated that the cost of this development to date is approximately $650,000 for salaries, supplies and equipment.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Starch sponge

Patent No.: 2,423,475.
Names of inventors: Claude W. Rice and Majel M. MacMasters.
Title: Internal Surgical Dressing.
Date of issuance: July 8, 1947.

Patent No.: 2,442,928.
Names of inventors: Majel M. MacMasters and Guido E. Hilbert.
Title: Food Products and Method of Making Them.
Date of issuance: June 8, 1948.

Patent No.: 2,597,011.
Names of inventors: Majel M. MacMasters and Virginia E. Hoaglund.
Title: Preparation of Starch Sponge.
Date of issuance: May 20, 1952.

Patent No.: 2,635,943.
Name of inventor: Majel M. MacMasters.
Title: Sterilization of Starch Sponge.
Date of issuance: April 21, 1953.

Starch sponge, developed at the northern division for medicinal use, has proved to be a useful hemostatic agent and is now on the market for hospital use.

Starch sponge is made by slow freezing of a starch paste. With cornstarch the paste should contain between 7 and 10 percent starch to give the optimum product. The paste acquires spongy characteristics during freezing. When thawed, much of the water can be removed by squeezing. When this is followed by controlled oven drying, the product has excellent storage stability. Oven-dried sponge absorbs about 16 times its own weight of water. It similarly absorbs blood and facilitates clotting. After therapeutic use it can be removed without pain to the patient. Any shreds left are absorbed by the body and converted to glucose sugar which is always naturally present. No adverse reaction of body tissues to starch sponge has been observed. Medicaments can be incorporated into starch sponge for controlled absorption in the body.

It is believed that only one company (the Panray Corp.) is currently manufacturing this product and no information is available on the annual production. Periodically inquiries are received at the Northern Utilization Research and Development Division from surgeons,

hospitals, etc., on the availability of starch sponge. It is believed that with time this product will find a greatly expanded market.

As a sideline, a patent (2,442,928) was obtained on incorporating food or flavoring ingredients in starch sponge and producing a crisp food item. One company (the Panray Corp.) took a license on this development but nothing is known regarding its commercial success.

The cost of this development is estimated at approximately $75,000 for salaries and expenses.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Polymers from vegetable oils

Patent No.: 2,373,015.
Names of inventors: John C. Cowan and Waldo C. Ault.
Title: Process for Producing Polymeric Materials.
Date of issuance: April 3, 1945.

When fatty oils, such as tung, linseed, corn, cottonseed, soybean, etc., are thermally polymerized, the polymerization takes place by intermolecular attachments at the double bond yielding mixtures of polymeric products. The fatty acids are usually present as glycerides which are the esters of glycerol, a trihydroxy alcohol. When these fatty oils are polymerized to high molecular weights, the products are insoluble gels with limited industrial utility. When the gels are converted to the esters of a monohydric alcohol such as methanol, it was found that they were almost entirely monomeric, dimeric, and trimeric forms containing 1, 2, or 3 fatty acid units, respectively. It was concluded that insolubility of the gels was caused by the trifunctional nature of glycerol which permitted cross-linking to form three-dimensional polymers.

A process was developed for converting the polymerized glycerides into the free acids followed by esterification with a dihydric alcohol, such as ethylene glycol with simultaneous or concurrent conversion of these esters into polyesters. These ployesters are highly viscous liquids which are soluble in chloroform and similar solvents. Products ranging from extremely tacky, liquid, soluble substances to elastic, solid, insoluble materials can be obtained by sulfurization (vulcanization) of the polyesters.

It is estimated that during World War II from 1.5 to 2 million pounds of these polyesters were manufactured. At 60 cents a pound this represents between $900,000 and $1,200,000. This operation was essentially discontinued by restrictions on nonfood uses of edible fatty oils. No information is available on the extent to which the licensees are currently exploiting this development. It is possible, however, that the basic principles have been coordinated into their overall research programs, since all three are in the polyester field.

The cost of this development to the Department of Agriculture is estimated at approximately $140,000 for salaries and expenses.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Batter process

Patent No.: 2,504,962.
Name of inventor: Everett M. Burdick.
Title: Separation of Starch from Wheat Flour.
Date of Issuance: April 25, 1950.

During World War II, there was a shortage of corn for use in manufacturing starch, corn sugar, and corn sirup. Although there are known processes for separating wheat flour into starch and gluten, they are time consuming and the more valuable gluten was degraded or lost. The Northern Utilization Research and Development Division developed the batter process for separating ground wheat or wheat flour into starch and gluten. The advantages of the batter process lie in the speed and simplicity of operation, no requirements of process chemicals, quality of products, and the practically complete recovery of the wheat gluten.

In this process, flour is mixed with warm water into a thin, smooth batter which is broken up mechanically under a water spray that quickly washes out the starch, leaving small lumps or curds of gluten, the protein fraction of the flour. The slurry of starch, water, and gluten is run across a vibrating screen and the gluten coagulates into a lumpy mass which is easily removed.

The mixture of starch and water that passes through the screen, can be fermented to industrial alcohol or converted by acid to glucose sirup or dextrose sugar. Pure starch can be obtained by ordinary methods of tabling or centrifuging. Treating the mixture with malt will produce a maltose table sirup.

The crude gluten taken from the screen is washed again and when dried at low temperatures, the gluten is not denatured and can be used to fortify low-protein flours, making them more nutritious. Drying at high temperatures does denature the gluten, and in this form it is suitable for conversion to glutamic acid, which can be made into monosodium glutamate.

Even though only one company took out a license, it is known that during World War II a number of companies (Doughnut Corp. of America, American Sugar Refining Co., Keever Starch Co., Corn Products Refining Co., Midwest Solvents, and a joint operation of International Mineral & Chemicals Corp. and Boeckler Associates) used the process to produce starch, dextrose sugar and syrup, and gluten. The starch was also converted into alcohol, which was in short supply. According to the patent literature, some modifications were made to improve the batter process by commercial companies adopting it. One of the chief values of the process is its adaptability to beet-sugar factories, for use when sugarbeets are not being processed. It is estimated that during the period 1944–57 the flour from 25 million bushels of wheat was utilized by the batter process to produce dextrose sugar, syrup, and wheat gluten. At an average selling price of 10 cents per pound, the product value was over $100 million. When corn became available after World War II the use of the batter process was mainly discontinued on an economic basis due to cheaper price cost of corn as contrasted to wheat.

The Northern Utilization Research and Development Division, in connection with efforts to promote industrial utilization of wheat flour and its components, continued work on improving the batter process. It was found possible to operate the process on a continuous basis to produce gluten containing 75–80 percent protein and a starch containing less than 3 percent protein. Methods were developed for obtaining the gluten in undenatured form for food uses. One company has recently built a pilot plant to test the new process and probably will use it in a new plant now under consideration. The use of this process could even find greater use if the price ratio of wheat to corn were to drop even slightly.

The greatest potential contribution might accrue through exports of gluten, or other products derived from the fractions produced by this process. It is estimated that large scale adoption of the batter process would provide potential markets for more than 25 million bushels of wheat for domestic industrial uses.

The cost of this development is estimated at approximately $300,000 for salaries, equipment, and supplies.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Fungal amylase

Patent No.: 2,451,567.
Names of inventors: Elmer H. LeMense and James M. Van Lanen.
Title: Process for Preparing Starch Hydrolyzing Enzyme with Aspergillus.
Date of issuance: October 19, 1948.

Patent No.: 2,557,078.
Name of inventor: Julian Corman.
Title: Enzyme Production.
Date of issuance: June 19, 1951.

Patent No.: 2,676,905.
Names of inventors: Julian Corman, Henry M. Tsuchiya, and Harold J. Koepsell.
Title: Starch Saccharifying Enzymes High in Maltose Activity.
Date of issuance: April 27, 1954.

The fermentative conversion of starch into ethyl alcohol requires the preliminary conversion of the starch into fermentable sugars, which is traditionally done by malt. During World War II, an acute shortage of malt developed and the Northern Utilization Research and Development Division made a search for a new source of starch-converting agent or amylase. A survey of more than 350 fungi revealed several that were promising. Continuation of this work resulted in the selection of *Aspergillus niger* as the best mold.

In the developed process the mold organism is put into a nutrient solution. Air is pumped in to keep the mold growing and to agitate the solution. Optimum conditions were developed for utilizing the fungal amylase so that the maximum quantity of fermentable sugars may be obtained from the starch contained in the grain. Pilot-plant work showed that alcohol yields from grain mashes converted with fungal amylase were at least as high as those converted with malt. In addition, the distillers' dried grains and solubles produced in the fungal amylase process are equivalent in proximate analysis and animal feeding tests to those produced with malt. Furthermore, the quantity of distillers' solubles produced is increased slightly by fungal amylase conversion. Damaged wheat and corn can be used in the production

of fungal amylase. This created a market which did not previously exist for this material.

Unfortunately we have no records of licensees on the above patents, although it is generally known that three companies (Grain Processing Corp., Publicker Industries, and Commercial Solvents) are using or have used the fungal amylase process. One company (Grain Processing Corp.) also has a fungal amylase sirup for sale and it is believed that two distilleries (Hiram Walker and American Distilling) have used this sirup for the production of neutral grain spirits.

No precise data are available on the grain consumed in producing fungal amylase; however, early in 1958 it was estimated that 25 million bushels of corn were used in the 9-year period, 1949–57, for alcohol production via fungal amylase process. On the basis of 2.7 gallons of alcohol per bushel of corn, this 25 million bushels of corn would give 67.5 million gallons of alcohol. The process savings by use of fungal amylase will vary from 2 cents to 5 cents per gallon of alcohol, depending on the price of malt. Assuming an average savings of 3 cents per gallon, the total savings amounted to over $2 million. The industrial members of the Task Group on Industrial Alcohol From Grain of the Presidential Commission (1957) were in agreement that for best efficiency grain would need to be converted through the use of fungal amylase.

The cost of this development to the Department is estimated at approximately $90,000 based on salaries, supplies, and equipment.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Penicillin

Patent No.: 2,399,840.
Name of inventor: Jacques L. Wachtel.
Title: Methods for the Isolation of Penicillin from Aqueous Solutions.
Date of issuance: May 7, 1946.

Patent No.: 2,423,873.
Names of inventors: Robert D. Coghill and Andrew J. Moyer.
Title: Method for Production of Increased Yields of Pencillin.
Date of issuance: July 15, 1947.

Patent No.: 2,432,638.
Name of inventor: Jacques L. Wachtel.
Title: Method for the Isolation of Penicillin.
Date of issuance: December 16, 1947.

Patent No.: 2,442,141.
Name of inventor: Andrew J. Moyer.
Title: Method for Production of Penicillin.
Date of issuance: May 25, 1948.

Patent No.: 2,443,989.
Name of inventor: Andrew J. Moyer.
Title: Method for Production of Penicillin.
Date of issuance: June 22, 1948.

Patent No.: 2,476,107.
Name of inventor: Andrew J. Moyer.
Title: Method for Production of Penicillin.
Date of issuance: July 12, 1949.

Patent No.: 2,504,161.
Names of inventors: Frank H. Stodola, Jacques L. Wachtel, and Robert D. Coghill.
Title: Derivatives of Parahydroxypenicillin G.
Date of issuance: April 18, 1950.

Patent No.: 2,573,741.
Names of inventors: Frank H. Stodola, Jacques L. Wachtel, and Robert D. Coghill.
Title: Derivatives of Parahydroxypenicillin G.
Date of issuance: November 6, 1951.

In 1941, the Northern Utilization Research and Development Division (Northern Division) was requested to cooperate in a program to develop methods for producing penicillin on a large commercial scale. Most of the procedures used at that time depended on growing the organism by surface culture which for volume production made it a very complicated and expensive process. It was absolutely necessary to develop large-scale inexpensive methods as penicillin had already proven its worth clinically. Furthermore, war casualties were mounting and the need to have penicillin available to treat the wounded became urgent.

A submerged culture process was developed at the Northern Division which in its basic approach is still used by all manufacturers of penicillin. This development has played an all important part in the production of other antibiotics since it offered a feasible economic method for their manufacture. In 1957, the total sales of antibiotics for human and veterinary use (U.S. Tariff Commission) were 1,986,000 pounds valued at $323,546,000. About one-fourth of this was used in animal feeds. The creation of the antibiotics industry was due in large part to the work of the Northern Division in developing the submerged culture technique in this field.

One of the early discoveries at the Northern Division was that by adding corn steep liquor (from wet milling of corn) and lactose (milk sugar) to the submerged culture medium the pencillin yield was increased more than tenfold. This discovery probably was the greatest single factor in making the commercial production of penicillin feasible. In efforts to find higher yielding strains, molds from many parts of the world were tested but the highest yielder was a mold found growing on a cantaloup in a Peoria, Ill., market which could grow submerged in the nutrient broth as well as on the surface. This strain, or mutants developed from it, is the principal source of all penicillin excepting the chemical synthesized form, now produced. Corn steep liquor had been found useful in other fermentative processes by the Northern Utilization Division. Also, isolation of the micro-organism from the moldy cantaloup was part of a systematic search for a wider variety of penicillae. Other accomplishments by the Northern Division were improved methods for recovery and purification of penicillin.

The Northern Division discontinued work on penicillin in 1945 after the close of World War II. However, by then the industry was well established and commercial organizations have continued research. At that time U.S. production was around 50,000 pounds per year, as compared to 694,000 pounds in 1957. It is noteworthy that corn steep liquor is a basic ingredient in the medium for the production of all antibiotics. It has the merits of low cost, wide availability, and ease of assimiliation and high nutritive value.

It is difficult to define in dollars the contributions penicillin has made during World War II and to our national welfare in saving hu-

man lives. However, in the 11-year period from 1947 to 1957, inclusive, the total production of penicillin was over 5 million pounds with a production value of $748 million (U.S. Tariff Commission). The value per pound decreased from over $1,400 to about $110 during the same period. In terms of 1 million Oxford units, the corresponding values are $2.35 in 1947 and about $0.19 in 1957.

Another important field for antibiotics, including penicillin, is in animal feed supplements. In 1951 their use was a little over 200,000 pounds; this had increased to about 800,000 pounds in 1956, a nearly fourfold increase. It is believed that this market will continue to expand. The use of antibiotics in feeds has been very important in growing chickens and turkeys, especially the latter, and in swine. The incorporation of antibiotics in feeds is believed to be in part responsible for the rapid growth of the broiler industry and for decreased production costs since it decreased chick mortality and increased feed efficiency. The increased feed efficiency also has been observed in swine feeding. It also has been found desirable for ruminants, which was contrary to expectations.

As mentioned above, corn steep liquor is one of the essential components for the nutrient medium. On the basis of a yield of 3 pounds of corn steep liquor solids per bushel of corn, it is estimated that the 1957 production of 694,000 pounds of penicillin consumed the corn steep liquor from upward of 5 million bushels of corn. This represents around 3.5 percent of the corn wet milled in 1957. The production process of other antibiotics also uses corn steep liquor as the basic ingredient in the medium, therefore this percentage is further increased. The other main nutrient is lactose which is recovered from nonfat dry milk. For the 1957 production, it is estimated that about 11 million pounds of lactose were consumed. This is about 1 percent of the total production of nonfat dry milk. These represent new markets for both lactose from milk and corn steep liquor from corn.

A number of patents resulted from the Northern Division's researches. These have been used by industry on a royalty-free basis and have been of the highest importance to the growth of the penicillin industry. The decrease in cost with the years has made penicillin widely available and widely used. This has had a very pronounced benefit on public health concerning humans and also on the mortality rate of animals especially those which are raised for food purposes.

Since penicillin first came into general use in 1945 most infants and mothers survive the hazards of childbirth, deaths from infections between the ages of 1 to 4 are virtually eliminated, overall life expectancy has been increased, fatalities from major infectious diseases such as whooping cough, meningitis, scarlet fever, pneumonia, and syphilis, have been reduced more than 60 percent. The value of penicillin in this area is beyond an estimate in monetary or economic terms.

The cost of the penicillin program to the Department of Agriculture is estimated at approximately $100,000 based on salaries and expenses.

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AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Corn zein textile fiber

Patent No.: 2,478,248.
Names of inventors: Clarence B. Croston and Cyril D. Evans.
Title: Method of Producing Prolamine Filaments.
Date of issuance: August 9, 1949.

Patent No.: 2,521,704.
Names of inventors: Cyril D. Evans, Chester W. Ofelt, and Allan K. Smith.
Title: Fibers from Zein.
Date of issuance: September 12, 1950.

Patent No.: 2,524,042.
Names of inventors: Clarence B. Croston, Cyril D. Evans, Leonard L. McKinney, and John C. Cowan.
Title: Curing Prolamine Fibers with Aldehyde in Liquid Organic Medium.
Date of issuance: October 3, 1950.

A process was developed in the Northern Utilization Research and Development Division for making a textile fiber from zein which is the portion of the corn protein soluble in aqueous alcohol. This alcohol solution is extracted with hexane to remove gluten oil and xanthophylls, and the zein is then precipitated by dilution with cold water. The zein, dissolved in an alkaline solution, is formed into fine threads by being forced through a spinnerette into an acid-coagulating bath. The wet threads are gathered as a tow, precured with formaldehyde to toughen and strengthen them, stretched to 4 to 6 times their original length and dried. They are then given a second formaldehyde bath to stabilize the stretched length and dried as finished fibers. The resulting fibers have good resilience, do not shrink, and have adequate wet strength. The finished fiber has a cashmere "feel," takes dye well, and adds suppleness and draping qualities when blended with other fibers. It is not attacked by moths as are natural protein fibers. Work on this fiber was done between 1944 and 1949.

The Virginia-Carolina Chemical Corp. exploited this process and marketed the product under the trade name Vicara. This fiber had many technical merits but failed to receive wide enough acceptance to warrant continued manufacture, and its production was suspended some time in 1958. Contributing factors to this suspension may have been that there is only one commercial source of zein, it is a byproduct of the cornstarch industry and its supply is associated with the production of cornstarch, and the highly competitive situation in the fiber field. However, it is believed the technical merits of the fiber will justify eventually its continued production. It is estimated that a total of around 45 million pounds was produced from 1948 to time of discontinuance. At an average estimated selling price of $0.90 per pound, this represents over $40 million. Assuming 0.8 pound of zein is recovered per bushel of corn, the above pounds are equivalent to over 58 million bushels of corn.

The cost of this development to the Department is estimated at approximately $100,000 for salaries and expenses.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Dimer acid derivatives

Patent No.: 2,384,443.
Names of inventors: John C. Cowan and Howard M. Teeter.
Title: Plastic Composition and Method of Preparing Same.
Date of issuance: September 11, 1945.

Patent No.: 2,429,219.
Names of inventors: John C. Cowan and Donald H. Wheeler.
Title: Process of Making Linear Superpolyesters.
Date of issuance: October 21, 1947.

Patent No.: 2,435,478.
Names of inventors: Howard M. Teeter and John C. Cowan.
Title: Polyamides from Polyoctadecapolyenylamine.
Date of issuance: February 3, 1948.

Patent No.: 2,450,940.
Names of inventors: John C. Cowan, Lee Falkenburg, Howard M. Teeter, and Philip S. Skell.
Title: Polyamides from Polymeric Fat Acids.
Date of issuance: October 12, 1948.

Patent No.: 2,477,116.
Names of inventors: John C. Cowan and Howard M. Teeter.
Title: Protective Coating Compositions and Methods for Producing the Same.
Date of issuance: July 26, 1949.

Patent No.: 2,550,682.
Names of inventors: Lee Falkenburg, Arthur J. Lewis, and John C. Cowan.
Title: Coating Compositions.
Date of issuance: May 1, 1951.

Patent No.: 2,641,593.
Names of inventors: Howard M. Teeter and John C. Cowan.
Title: Polyamide Resins.
Date of issuance: June 9, 1953 .

Ways have been sought to develop commercially important derivatives of vegetable oils such as soybean and linseed. Polyunsaturated oils, for example linoleic and linolenic, are constituents in these oils of particular interest since they can be converted to polymers containing 2 or 3 molecules of the original acid or acids. These are termed "dimer" and "trimer" acids, respectively. Research in this field was initiated shortly after this Northern Utilization Research and Development Laboratory opened and was continued until 1952. Studies emphasized methods of preparation of these acids, particularly dimer acid since that was the preferred product, and the preparation of derivatives, such as alkyd resins, polyamide resins, rubberlike polyesters, polyesters, polymerizable allylic esters, and heavy metal soaps. These products have a wide area of applications, such as plasticizers and plastics, flexible and rigid foams, glass fiber laminates, lubricants and greases, lubricant additives, protective coatings, resins, and many others.

Although only one patent has been licensed, it is known that General Mills has achieved extensive commercial success with its Versamids. These are polyamides prepared by condensing polymerized linoleic acid with polyamines. The linoleic acid is obtained from fatty oils, such as soybean, linseed, etc. It has taken years for this company to develop this market to a significant volume.

It is estimated that the annual volume of dimer acids is around 10 million pounds, with most of it being used in polyesters and poly-

amides. At an average value of $0.60 per pound this represents around a $6 million per year market. The soybeans required to supply the polyunsaturated acids for this amount of dimer acids will be around 2 million bushels.

The cost of this development to the Department of Agriculture is estimated at approximately $70,000 for salaries and expenses.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Ketogluconic acids

Patent No.: 2,006,086.
Names of inventors: Orville E. May, Horace T. Herrick, Andrew J. Moyer, and Percy A. Wells.
Title: Method of Carrying Out Oxidative Fermentations by Molds or Fungi.
Date of issuance: June 25, 1935.

Patent No.: 2,277,716.
Names of inventors: Lewis B. Lockwood, George E. Ward, Joseph J. Stubbs, Edward T. Roe, and Benjamin Tabenkin.
Title: Fermentation Process for the Production of 2-Ketogluconic Acid.
Date of issuance: March 31, 1942.

Patent No.: 2,318,641.
Names of inventors: Joseph J. Stubbs, Lewis B. Lockwood, Edward T. Roe, and George E. Ward.
Title: Fermentation Process for the Production of 5-Ketogluconic Acid.
Date of issuance: May 11, 1943.

Patent No.: 2,351,500.
Name of inventor: Andrew J. Moyer.
Title: Process for Gluconic Acid Production.
Date of issuance: June 13, 1944.

Gluconic and ketogluconic acids were well known fermentation products; however, the surface-growing methods used prior to the work at Northern Division were not designed for volume production. Since it appeared that they might have commercial possibilities, methods were developed for producing gluconic acid, 2-ketogluconic acid, and 5-ketogluconic acid as the calcium salts by a submerged culture growth process. These processes could not only be operated on a commercial scale, but the fermentation time was decreased from 20 days and above to 30 to 50 hours. For all acids the culture medium was chiefly corn sugar with a minor amount of corn steep liquor and calcium carbonate to neutralize the acids as they were formed. It was also necessary to add organic nitrogen (urea) and inorganic salts when producing 2-ketogluconic acid.

In producing 2-ketogluconic acid using a selected strain of the Pseudomonas organism, the conversion to gluconic acid and 2-ketogluconic acid proceed simultaneously. However, in producing 5-ketogluconic acid, the glucose (corn sugar) is converted almost completely to gluconic acid which then is converted to the 5-ketogluconic acid. The organism in the latter case is *Acetobacter suboxydans*.

Reliable production figures on these products are not readily available. However, it is estimated that the production to calcium gluconate is about 500,000 pounds per year. Pharmaceutical or food-grade calcium gluconate sells for about $0.66 per pound, and this production represents a product value of about $330,000. The main uses are in pharmaceuticals, veterinary applications, and as a readily available and nutritive source of calcium in cake mixes. The production of sodium gluconate is estimated to be around 4 million

pounds a year. The technical grade of sodium gluconate sells at about $0.35 per pound, and this production represents about $1,400,000. The principal uses of sodium gluconate are in bottle-washing compounds and aluminum-etching compounds. The production of calcium 2-ketogluconate amounts to around 1 million pounds per year with the main known use in the production of isoascorbic acid. Since this is mainly consumed in a captive market no sales prices are reported. No production data on 5-ketogluconic acid are available.

The total production of calcium and sodium gluconates and calcium 2-ketogluconate is 5½ million pounds per year. Assuming a 60-percent weight yield, the corn sugar required is about 9,200,000 pounds. At 30 pounds corn sugar per bushel of corn, the annual corn equivalent is about 300,000 bushels. It is believed that this is a conservative estimate and represents a new outlet for corn sugar and thus for corn.

The cost of this development is estimated at approximately $85,000 for salaries and expenses.

AGRICULTURAL RESEARCH SERVICE—NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Dextran

Patent No.: 2,587,623.
Names of inventors: Allene R. Jeanes and Carl A. Wilham.
Title: Acylation of Dextran in Formamide.
Date of issuance: March 4, 1952.

Patent No.: 2,660,551.
Names of inventors: Harold J. Koepsell, Henry M. Tsuchiya, and Nison N. Hellman.
Title: Method for the Production of Dextran of Relatively Low Molecular Weight.
Date of issuance: November 24, 1953.

Patent No.: 2,673,828.
Names of inventors: Harold J. Koepsell, Anna Kazenko, Allene R. Jeanes, Eugene S. Sharpe, and Carl A. Wilham.
Title: Preparation and Use of Polysaccharide-Producing Enzyme.
Date of issuance: March 30, 1954.

Patent No.: 2,686,147.
Names of inventors: Henry M. Tsuchiya, and Harold J. Koepsell.
Title: Production of Dextransucrase.
Date of issuance: August 10, 1954.

Patent No.: 2,712,007.
Names of inventors: Ivan A. Wolff, Russell L. Mellies, and Carl E. Rist.
Title: Fractionation of Dextran Products.
Date of issuance: June 28, 1955.

Patent No.: 2,719,147.
Names of inventors: Ivan A. Wolff, Paul R. Watson, and Carl E. Rist.
Title: Thermal Modification of Dextran.
Date of issuance: September 27, 1955.

Patent No.: 2,724,679.
Names of inventors: Henry M. Tsuchiya, Nison N. Hellman, and Harold J. Koepsell.
Title: Synthesis of Dextran and Dextran Analogues of Predetermined Molecular Weight.
Date of issuance: November 22, 1955.

Patent No.: 2,726,190.
Names of inventors: Harold J. Koepsell, Nison N. Hellman, and Henry M. Tsuchiya.
Title: Modification of Dextran Synthesis by Means of Alternate Glucosyl Acceptors.
Date of issuance: December 6, 1955.

Patent No.: 2,726,985.
Names of inventors: Nison N. Hellman, Henry Tsuchiya, Seymour Peter Rogovin, Richard W. Jackson, and Frederic R. Senti.
Title: Controlled Enzymatic Synthesis of Dextran.
Date of issuance: December 13, 1955.

Patent No.: 2,742,399.
Names of inventors: Henry M. Tsuchiya, Allene R. Jeanes, Helen M. Bricker, and Carl A. Wilham.
Title: Production of Dextranase.
Date of issuance: April 17, 1956.

Patent No.: 2,776,925.
Names of inventors: Julian Corman and Henry M. Tsuchiya.;
Title: Enzymic Production of Dextran of Intermediate Molecular Weights.
Date of issuance: January 8, 1957.

Dextran is a carbohydrate similar to starch of very large molecular weight that is produced when certain species of bacteria are grown on sucrose. Because of the vital need of the Armed Forces and civilian defense for a satisfactory blood plasma extender that could be used for the treatment of casualties in the event of atomic bombing or other national emergency, a comprehensive program for the development of a plasma substitute for dextran was initiated at the Nothern Utilization Research and Development Division in 1950. As a result of this work and cooperation with other governmental agencies (for example, National Research Council, National Institutes of Health, National Bureau of Standards, Blood and Blood Derivatives Group of Armed Services Medical Procurement Agency) and industrial corporations (such as Commercial Solvents, Baxter Laboratories, Cutter Laboratories, Refined Sugars and Syrups, Inc., J. T. Baker Chemical Co., etc.) production of clinical-grade dextran on a commercial scale and its use in hospitals and on the battlefields of Korea as a substitute for human blood plasma became a recognized accomplishment in approximately 1 year's time. Some of the outstanding accomplishments of this major undertaking were: Further characterization of a bacterium which produced dextran giving favorable results in clinical treatment of shock; development of processes for making clinical-type dextran; development of analytical methods to determine if clinical-grade dextran was produced; and development of extensive basic information on the structures and properties of the dextrans produced by a wide variety of micro-organisms.

During the Korean war there were five commercial companies (Commercial Solvents, R. K. Laros Co., Refined Sugars and Syrups, Vitamin Corp. of America, and J. T. Baker Chemical Co.) producing clinical-type dextran using the organism and developed techniques by the Department of Agriculture. Currently there is only one manufacturer (R. K. Laros Co.) of clinical-type dextran and its production is not high. The present low production of dextran for clinical uses is due largely to inadequate promotion and some troubles experienced with other types of plasma extenders. However, the trend is toward expanded usage. It has been estimated that between 1951 and 1957, about 3 million pounds of cane sugar were consumed in dextran production. This is a new market for sugar.

It is difficult, if not impossible, to place a dollar value on the importance of the development of clinical dextran since human life is involved. Dextran was named the material of choice by the Army in January before the Korean armistice was signed. This action was

based on the rather serious incidence of fatal cases of infectious hepatitis incurred by administration of blood plasma carrying the virus. In cases of immediate need for restoration of blood volume in accidents in civilian life where time and facilities do not permit blood typing, dextran is administered. In the event of atomic bombing or similar national emergencies, the availability of dextran may save countless lives. A stockpile of clinical dextran is maintained by the civilian defense agency in addition to that held by the military.

In an address, given on May 13, 1955, to the graduating class of the Army Medical Service Officers Advanced Course, Brooke Army Medical Center, Dr. George E. Armstrong, major general, Medical Corps, U.S. Army, stated: "The development of dextran as a substitute for blood plasma afforded the first effective, cheap, and relatively safe plasma expander. Every unit of dextran procured in lieu of human plasma represents an average saving of $20." A conservative estimate of the total consumption of dextran to date is over 3 million units. This represents a national savings in excess of $60 million.

A further practical advantage of dextran is that its production can be increased very rapidly in a short time to meet an emergency demand. In addition, it can be stored in the dry form for a long time and be made ready for use very quickly.

The work on dextran showed that it is economically feasible to convert carbohydrates into isomeric-polymeric forms by microbial action. To accomplish this by chemical reactions would be practically impossible. This discovery has resulted in the application of micro-organisms for the production of other polysaccharides with industrial possibilities. Since the nutrient media in these cases are largely derived from starch, they represent an entirely new outlet for cereal-derived products.

At the present time there are three companies (R. K. Laros Co., Commonwealth Engineering Co., and Cherokee Laboratories) producing dextran. Two are producing an industrial grade only. Total production data are not available, but one of the industrial quality producers is making about 2 tons a day and is designing a plant to produce 25 tons a day. This production is intended mainly for oil-well drilling muds. It has been reported that this crude dextran is being sold at about 47 cents per pound. There has recently been renewed interest in dextran for industrial uses and further developments are to be expected in which the Northern Utilization Research and Development Division probably will participate.

The cost of this development to the Department of Agriculture is estimated at approximately $1,100,000 for salaries and services.

AGRICULTURAL RESEARCH SERVICE—EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Fats and oils used in making plasticizers

Patent No.: 2,457,328.
Names of inventors: Daniel Swern and Geraldine N. Billen.
Title: 1,2-Epoxides and Process for Their Preparation.
Date of issuance: December 28, 1948.

Patent No.: 2,567,930.
Names of inventors: Thomas W. Findley and Daniel Swern.
Title: Preparation of Epoxy Compounds by Oxidation of Cis-Monoolefine Compounds.
Date of issuance: September 18, 1951.

Patent No.: 2,569,502.
Names of inventors: Daniel Swern and Thomas W. Findley.
Title: Epoxidized Oils.
Date of issuance: October 2, 1951.

Chemically modified animal fats and vegetable oils are now extensively used in a new market as plasticizers in the manufacture of vinyl plastics.

Plasticizers are used to make plastics pliable and tough, so that they can be molded and worked without cracking, and remain flexible throughout their life—a characteristic especially important for raincoats, garden hose, gaskets, draperies, floor coverings, tablecloths, shower curtains, and other household articles.

Since fats and oils have many of the characteristics desired in a plasticizer, chemists of the Agricultural Research Service's Eastern Utilization Research and Development Division saw in them a raw material that might be adapted for their purpose. The chemists succeeded in converting natural oils to epoxidized oils which, acting as plasticizers, blend well with commercial vinyl plastics, and are not lost readily through evaporation.

The new plasticizers also make chlorine-containing plastics last longer by stabilizing them when they are exposed to heat and light. Their use minimizes the need for such stabilizers as salts of lead, barium, and cadmium, which make the plastic opaque or hazy.

About 30 million pounds, valued at some $10 million, of epoxy-type plasticizers are now being used annually in the manufacture of sheetings and films, molded and extruded products, and resins for treating textiles, paper, and protective coatings. Production and sales are increasing steadily. This rapidly expanding market should increase the use of inedible animal fats and vegetable oils, abundant farm commodities. Sales since the development was commercialized total about 200 million pounds, valued at about $65 million.

The development cost to the Department was about $100,000.

At present more than a dozen companies have taken licenses under the Government's patents.

AGRICULTURAL RESEARCH SERVICE—EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Improved oleic acid made from animal fats

Patent No.: 2,457,611.
Names of inventors: Daniel Swern and Waldo C. Ault.
Title: Process for the Preparation of Monoethenoic Acids and Their Esters.
Date of issuance: December 28, 1948.

An improved grade of oleic acid is being made commercially as a result of research carried out by chemists of the Agricultural Research Service's Eastern Utilization Research and Development Division. This important industrial chemical is prepared from inedible animal fats by an economical new process, which converts undesirable constituents (polyunsaturated acids) into useful ones (singly unsaturated acids) by hydrogenation. The improved oleic acid is more stable

than the product previously available commercially, and therefore is better suited for use in the chemical industry.

From 70 to 80 million pounds of unimproved oleic acid, known also as red oil, is produced annually in the United States. It is used primarily in making liquid soaps, textile lubricants and greases. Red oil consists of 60 to 75 percent oleic acid, 10 to 20 percent saturated acids and 10 to 20 percent polyunsaturated acids. It is this rather large content of polyunsaturated acids which causes red oil to darken and become rancid and hence unsuitable as a chemical intermediate.

In research aimed at preparing oleic acid substantially free of polyunsaturated acids, the chemists found that these acids could be converted to singly unsaturated acid by selective hydrogenation of inedible animal tallow or grease. Hydroysis followed by crystallization makes possible the recovery of a product consisting of 90 percent oleic acid, 1 to 3 percent of polyunsaturated acids and 7 to 9 percent of saturated acids. By fractional distillation, the oleic acid content can be raised to 98 percent.

As a result of the stimulation provided by this development, purified oleic acid is now made by several large producers of fatty acids, including Emergy Industries, Inc., Armour & Co., Wilson & Co., and A. Gross & Co. Annual production is estimated at 6 to 10 million pounds, with an annual value of over $1 million. Sales of purified oleic acid have amounted to about 50 million pounds valued at about $10 million.

The research and development cost to the Department was about $60,000.

AGRICULTURAL RESEARCH SERVICE—EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

New process increases maple sirup flavor

Patent No.: 2,549,877.
Names of inventors: Charles O. Willits and William L. Porter.
Title: Process of Producing Maple Sirup Concentrate.
Date of issuance: April 24, 1951.

Patent No.: 2,715,581.
Names of inventors: Charles O. Willits and William L. Porter.
Title: Production of Maple Sugar Products Having Enhanced Flavor.
Date of issuance: August 16, 1955.

Patent No.: 2,760,870.
Names of inventors: J. Naghski, C. O. Willits, W. L. Porter and J. R. White, Jr.
Title: Maple Honey Spread and Process of Making the Same.
Date of issuance: August 28, 1956.

Patent No.: 2,880,094.
Names of inventors: Joseph Naghski and Charles O. Willits.
Title: Process of Enhancing Flavor of Maple Sirup.
Date of issuance: March 31, 1959.

Patent No.: 2,895,833.
Names of inventors: Charles O. Willits, and Joseph C. Underwood, Harry C. Lento.
Title: Process for Making Maple Product of Intensified Maple Flavor.
Date of issuance: July 21, 1959.

Maple sirup is moving into wider markets as a result of a new process that intensifies the flavor of the sirup; the process was developed by the Eastern Utilization Research and Development Division, Agricultural Research Service.

In this work to improve maple sirup quality, it was discovered that the natural reaction that causes the often unwanted browning of foods is responsible for the desirable color and flavor of maple sirup. A process in which the browning reaction is used to increase the maple flavor was therefore developed.

The new process, which produces high-flavored maple sirup, is simple, inexpensive and adaptable. It is leading to wider use of maple sirup in blended sirups and other new products, thereby expanding the market for maple sirup. Moreover, through use of the process, the delicious flavor associated with pure maple sirup is now accessible to thousands of new consumers at low cost.

In the United States, blended maple sirup is now the principal outlet for the maple sirup crop marketed at wholesale. The blends account for 25 percent of the table sirup consumed in the country, and represent a $75 million business. In the past, these blends were prepared from the darker, lower grades of maple sirup. Fortunately for farmers, however, most of the pure maple sirup currently produced is of the top two grades. These are excellent pure sirups, but are unsuited for blending because they lack the intensity of color and flavor necessary to withstand dilution by cane sugar sirups. The high flavor process meets this increasingly serious problem by providing processors with a product not only of the requisite intensity of color and flavor, but one which makes possible blended sirups much superior to those made in the past. The volume of maple sirup going into the high flavor process has not been disclosed by industry, but the process is used by major U.S. processors, including Mille Lacs Maple Products Corp., Gene A. Van Gemert and Union Starch & Refining Co.

The cost of this development to the Department is estimated at approximately $18,000.

AGRICULTURAL RESEARCH SERVICE—EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Flavor essence recovered for restoration to fruit products

Patent No.: 2,457,315.
Name of inventor: Howard P. Milleville.
Title: Volatile Flavor Recovery Process.
Date of issuance: December 28, 1948.

Patent No.: 2,479,745.
Names of inventors: Richard P. Homiller and Edward L. Griffin, Jr.
Title: Process for the Production of Apple Essence.
Date of issuance: August 23, 1949.

Patent No.: 2,572,846.
Names of inventors: Richard P. Homiller and Nelson H. Eisenhardt.
Title: Process for the Preparation of Full Flavored Fruit Concentrates.
Date of issuance: October 20, 1951.

Patent No.: 2,573,699.
Names of inventors: R.K. Eskew, R.P. Homiller, and G.W.M. Phillips.
Title: Process for Making Frozen Concentrated Fruit Juices.
Date of issuance: November 6, 1951.

A practical process for recovering in essence form the volatile aroma, of flavor, of fresh fruit juices has been developed by the USDA's Eastern Utilization Research and Development Division, Agricultural Research Service. The essence contains all the aroma

in a concentration 150 or more times that of the fresh juice. It is a clear stable water-white solution.

In the ordinary processing of fruit juices to make jellies, beverage concentrates and other products, the volatile flavors of the fresh fruit are largely lost. The essence process eliminates this loss.

The new process developed by the Department is radically different from the earlier steam distillation method. In the new process, freshly pressed juice passes through a special evaporator that strips off volatile flavors with such speed that no flavor change occurs. The juice is sterilized by the operation and can be concentrated under vacuum by conventional methods. The vaporized portion is concentrated in a fractionating column to give an essence that contains all the volatile flavor of the juice.

In the most recent version of the process, a special high-speed evaporator concentrates the juice simultaneously with essence recovery, and the need for expansive vacuum equipment is eliminated.

The essence process has been applied to the processing of apple, grape, peach, cherry, strawberry, red raspberry, blackberry, and blueberry juices, and to the recovery of volatile flavor usually lost in the making of preserves, jams, and jellies. The essence finds use in many food products, to which it adds the zestful aroma and flavor of the fresh fruit. These concentrates are used in jelly manufacture, for beverage use, and in sirups, ice cream, flavoring extracts, and candy.

The Quartermaster Corps purchases fourfold and sevenfold concentrated apple juice and Concord grape juice which have been processed in accordance with these developments. These concentrates require no refrigeration. Sevenfold apple and Concord grape juice concentrates traveled with the submarine *Nautilus* on its famous polar cruise. The report of the *Nautilus* was "Apple juice outstanding; grape juice very good. Very heavily consumed by the crew at all hours."

The monetary value of the essence process over the 15-year period of its commercialization cannot be estimated. Its value lies in providing a new outlet for sound cull fruit, in enhancing the palatability of food products made from fruit and fruit drinks and in providing a new source of revenue to processors of fruit juices. Thus, farmers, food processors, and consumers, all benefit from the use of these processes.

The following companies are among major producers of essences and concentrated fruit juices believed to be using the basic essence process: A. F. Murch Co., Paw Paw, Mich.; Keystone Cooperative Grape Association, North East, Pa.; Knouse Foods Co-op, Inc., Peach Glen, Pa., Empire Fruit Products, Inc., Marlborough, N.Y.; Welch Grape Juice Co., Westfield, N.Y.; Sodus Fruit Exchange, Inc., Sodus, Mich.; Seneca Grape Juice Corp., Dundee, N.Y.; Driscoll Strawberry Associates, Inc., San Martin, Calif.; Silveira and O'Connell, Sebastopol, Calif.; Bedford Products, Inc., Dunkirk, N.Y.; Sodus Foods, Inc., Sodus, N.Y.; Prosser Packers, Inc., Prosser, Wash.; Clermont Fruit Packers, Inc., Clermont, N.Y.; H. J. Heinz Co., Chambersburg, Pa.; Old Virginia Packing Co., Front Royal, Va.; Kerr Conserving Co., Portland, Oreg.; North Pacific Canners & Packers, Inc., Portland, Oreg.; Van Amerigen-Haebler, Inc., Elizabeth, N.J.; Polak's Frutal Works, Inc., Middletown, N.Y.; F. Ritter & Co., Los Angeles, Calif.;

Dragoco, Inc., New York, N.Y.; Fritzsche Bros., Inc., New York, N.Y.

Development cost to the Department of Agriculture is estimated at $350,000 based on research work, engineering development, and commercial advancement. Yet the licenses that have been issued by the Department of Agriculture on these patents are:

2,457,315 Volatile Flavor-Recovery Process:
Apple Growers Association, Hood River, Oreg. (January 18, 1950).
Fritzsche Bros., Inc., New York, N.Y. (April 21, 1950).

2,479,745 Process for the Production of Apple Essence:
Fritzsche Bros., Inc., New York, N.Y. (April 21, 1950).

Thus it is apparent from this example that there is greater utilization of the Department of Agriculture patents than indicated by the licenses issued by the Department.

AGRICULTURAL RESEARCH SERVICE—EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Research on tobacco provides new drugs

Patent No.: 2,425,094.
Name of inventor: Edward L. Griffin, Jr.
Title: Process for Obtaining Rutin from Buckwheat.
Date of issuance: August 5, 1947.

Patent No.: 2,448,175.
Name of inventor: Roderick K. Eskew.
Title: Extraction of Rutin.
Date of issuance: August 31, 1948.

Patent No.: 2,453,305.
Name of inventor: James F. Couch and Charles F. Krewson.
Title: Process for Removing Fats from Rutin Extracts.
Date of issuance: November 9, 1948.

Patent No.: 2,478,168.
Name of inventor: Roderick K. Eskew.
Title: Process for Obtaining Rutin from Buckwheat.
Date of issuance: August 9, 1949.

Patent No.: 2,500,930.
Names of inventors: James F. Couch, Charles F. Krewson, and William L. Porter.
Title: Process for Refining Rutin.
Date of issuance: March 21, 1950.

Patent No.: 2,520,127.
Names of inventors: James F. Couch, Joseph Naghski, and William L. Porter.
Title: Method of Purifying Rutin.
Date of issuance: August 29, 1950.

Patent No.: 2,534,175.
Names of inventors: Charles F. Krewson, Joseph Naghski, and William L. Porter.
Title: Method of Refining Rutin.
Date of issuance: December 19, 1950.

Patent No.: 2,543,783.
Name of inventor: Charles F. Krewson.
Title: Method of Purifying Rutin.
Date of issuance: March 6, 1951.

Patent No.: 2,587,600.
Names of inventors: James F. Couch and Charles F. Krewson.
Title: Purification of Rutin.
Date of issuance: March 4, 1952.

Patent No.: 2,637,725.
Name of inventor: Charles F. Krewson.
Title: Colloidal Flavonol System.
Date of issuance: May 5, 1953.

Two new drugs, rutin and quercetin, have been made available to the medical profession as a result of research work on tobacco and buckwheat by scientists of the Eastern Utilization Research and Development Division, Agricultural Research Service.

Although rutin was discovered in 1842, in the plant known as garden rue, it remained a laboratory curiosity for a hundred years. Other discoveries, however, finally brought rutin to the attention of medical workers, beginning with the 1936 discovery of a substance in citrus extract which restored weakened capillaries and remedied various hemorrhagic conditions. Initially called vitamin P, the extract was subsequently found to be a mixture of flavonoids.

In 1942, while studying tobacco composition, Dr. James F. Couch and his associates at the eastern division isolated rutin from Flue-cured tobacco. The properties of rutin suggested to Dr. Couch that it might be the long-sought vitamin P, or at least might have the same therapeutic effects. This surmise was confirmed when tests by physicians showed that rutin restored weakened capillaries to normal in 85 percent of the cases, and use of the drug was adopted by the medical profession. It subsquently became clear that tobacco was too expensive a source, and for a few years rutin was obtained from green buckwheat plants, thus creating a new market for buckwheat. Later, plant materials in other countries became the source. In the period that buckwheat was the source, growers in the United States netted about $100,000 from the crop grown for rutin production.

Chemically, rutin is a flavonol glucoside, and investigators at the eastern division found that the flavonol portion, quercetin, is effective therapeutic agent for disorders alleviated by rutin, as well as additional disorders.

From the time that rutin became available commercially, usage has increased steadily. Total sales from the beginning of the development are estimated at 100,000 kilograms; current annual sales are about 10,000 kilograms. Total sales of quercetin are estimated at 2,500 kilograms; current annual sales are about 500 kilograms. The current annual retail value of rutin and quercetin is about $4 million, and the total since the beginning of the development, about $45 million.

At one time 15 manufacturers produced rutin, but at present there are only two major producers in this country: S. B. Penick & Co. and Karl B. Rosen & Co. Quercetin is manufactured by these two companies and Weyerhaeuser Timber Co. Although there have been 15 manufacturers of rutin only the following licenses have been issued by the Department:

2,425,094 Process for Obtaining Rutin from Buckwheat:
Ernest Bischoff Co, Inc.. Ivoryton, Conn., March 31, 1947.

2,500,930 Process for Refining Rutin:
Ernst Bischoff Co., Inc., Ivoryton, Conn., March 31, 1947.

2,448,175 Extraction of Rutin:
Ernst Bischoff Co., Inc., Ivoryton, Conn., March 31, 1947.
The Associated Laboratories, Inc. (also known as The Dallas Labs.), Dallas, Tex., September 15, 1949.

2,478,168 Process for Obtaining Rutin from Buckwheat:
Ernest Bischoff Co., Inc., Ivoryton, Conn., March 31, 1947.

Again this is an example where the Department's official list of licensees is not sufficient to disclose the extent of utilization of the patents for example the present manufacturers are not licensees.

AGRICULTURAL RESEARCH SERVICE—EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Potato flakes

(New form of dehydrated mashed potato)

Patent No.: 2,759,832.
Names of inventors: James Cording, Jr., and Miles J. Willard, Jr.
Title: Drum Drying of Cooked Mashed Potatoes.
Date of issuance: August 21, 1956.

Patent No.: 2,780,552.
Names of inventors: Miles J. Willard, Jr., and James Cording, Jr.
Title: Dehydration of Cooked Potato.
Date of issuance: February 5, 1957.

Patent No.: 2,787,553.
Names of inventors: James Cording, Jr., and Miles J. Willard, Jr.
Title: Method for Control of Texture of Dehydrated Potatoes.
Date of issuance: April 2, 1957.

For the potato flake development, the utilization research group received the 1959 Institute of Food Technologists first industrial achievement award for "Outstanding Advances in the Application of Food Technology to Food Production."

Potato flakes, a new form of dehydrated mashed potatoes developed by the USDA's Eastern Utilization Research and Development Division, Agricultural Research Service, are now in commerical production.

By this newly developed process, dehydrated mashed potatoes can be made from potatoes grown in all major producing areas. The establishment of a processing industry in a potato growing area can provide growers in the area with an assured market at a contract price for at least part of their crop, and also can provide a cushion for growers in time of surplus production.

The process is as follows: raw potatoes are peeled with steam or with lye solution. They are hand-trimmed to remove blemishes, and sliced into slabs which are precooked for 20 minutes at 160° F. The next step is cooling, followed by cooking in steam until the potatoes are soft enough to mash. After mashing, antioxidants, sodium sulfite and emulsifier (to tie up free starch) may be added, and the mash is dehydrated on a single-drum drier in 20 seconds (less than one revolution of the drum) the moisture content is reduced to 5 percent or less, and the sheet of dehydrated mashed potatoes is continuously removed and broken to the desired size for packaging. The process is designed to keep the free starch content to a minimum, as it is free starch that makes mashed potatoes pasty.

At least 10 companies are now manufacturing potato flakes: Snowflake Canning Co., Hartland, Maine; Rogers Bros. Seed Co., Idaho Falls, Idaho; Maine Potato Processing Co., Island Falls, Maine; Valley Farm Foods, Inc., Wayland, N.Y.; Red River Valley Potato Flake Co., Grand Forks, N. Dak.; Polar Potato Products, Inc., Park River, N. Dak.; and Instant Potato Products Corp., Detroit, Mich.

Some important characteristics of potato flakes are:

1. They can be made from varieties from all major growing areas.
2. Their flavor and texture can be varied to satisfy regional preferences.

3. Flake size can be tailored to meet retail and institutional package requirements.

4. The rapid processing facilitates retention of nutritive value.

5. The rapid drying insures preservation of fresh potato flavor.

From the start of production in early 1958, it is estimated that a minimum 70 million pounds of potato flakes have been made (fresh equivalent: slightly over 8 million bushels). Estimated production from the processing season October 1, 1958–June 30, 1959, is 25 million pounds of flakes (fresh equivalent: about 3 million bushels). This development creates a new and a more convenient means of utilizing potatoes which is proving beneficial to a hurried housewife. The full value of these patented inventions is impossible to estimate as its value is still to be determined by future use.

The cost of the development of potato flakes to the Department was about $375,000.

AGRICULTURAL RESEARCH SERVICE—WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Dehydrofreezing to preserve foods

Patent No.: 2,477,605.
Names of inventors: Louis B. Howard, William D. Ramage, and Clyde L. Rasmussen.
Title: Process for Preserving Foods.
Date of issuance: August 2, 1949.

Dehydrofreezing, a new process of preserving fruits and vegetables, is an invention of USDA's Western Utilization Research and Development Division, ARS. The process involves partial dehydration of the fresh produce followed by freezing. For example, fresh peas are blanched with steam, dehydrated until their weight is about halved (due to elimination of moisture), then packaged and frozen.

Dehydrofrozen food products present substantial advantages over the same foods preserved by conventional dehydration or freezing. As compared with ordinary dehydrated foods, the dehydrofrozen products are markedly superior in retaining the original texture, flavor, and vitamin content of the fresh produce. Also, they will more readily absorb water required for rehydration when prepared for consumption. Dehydrofrozen foods are equal in quality and convience to the best conventional frozen foods while offering added advantages. For example, with dehydrofrozen foods, individual portions can be removed from a container without thawing the entire pack as required with ordinary frozen foods. Furthermore, there is no exudation of juice or "drip" when the dehydrofrozen products are thawed. Important in remanufacture is the fact that dehydrofrozen products have a predetermined and uniform moisture content.

The main advantage of dehydrofrozen foods is that, by removal of moisture, their bulk and weight is only about one-half that of ordinary frozen foods. This means that the preparation and distribution of dehydrofrozen foods involves substantial economies in charges for refrigeration, packaging, storage, and transportation. It is estimated that dehydrofreezing offers a potential saving of 2 to 5 cents per

pound of food as compared with conventional freezing. The savings are particularly high where the products must be shipped considerable distances, for example, in shipping apple products from the Pacific Northwest to eastern consuming areas.

In the cheese industry, dehydrofrozen pimiento is preferred to the canned or frozen products because it permits close control of the moisture content of pimiento cheese. Annual production of dehydrofrozen pimiento by three California companies to fulfill the needs is in the neighborhood of 1 million pounds, equivalent to about 3 million pounds of fresh pimientos. The value of the product is estimated to be $1,200,000 per year.

Dehydrofrozen apples are also in commercial production, between 2 to 3 million pounds, and it is expected they will jump to about 12 to 15 million pounds per year. They are used exclusively by one of the largest food chains—American Stores Co. (Acme Markets), Philadelphia, Pa.—in their apple pies.

Dehydrofrozen peas, carrots, and Kadota figs are available commercially. A major vegetable processing company has just installed equipment to dehydrofreeze 2 tons of peas per hour. During the past processing season this company produced 1.5 million pounds of dehydrofrozen peas—enough to satisfy only about one-half the orders received. "Frozen Foods" recently published the information that the "first ever" shipment of dehydrofrozen peas to Britain is due to arrive soon and one company there will receive regular annual shipments of 100 tons, the maximum tonnage available.

Indications are that the market for dehydrofrozen carrots may quickly outstrip the market for dehydrofrozen peas. One major user of processed carrots is considering a complete shift from fresh carrots to the dehydrofrozen product. This would amount to over 100 million pounds per year for this one company.

Birdseye Division of General Foods Corp., New York, N.Y., is presently market-testing dehydrofrozen baby foods. This concern has recently announced plans to build a 280,000-square foot processing and refrigeration plant for the manufacture of retail packs of dehydrofrozen baby foods. Seventeen items are included in the present line of fruits, vegetables, soups, high-meat dinners, and pudding. This line will be expanded to 23 items in the near future.

It is estimated that the value of all products preserved by dehydrofreezing currently exceeds $2 million per year, with a total of about $6 million for the last 5 years that the process has been used in industry. Additional products such as dehydrofrozen baby foods have a potential market many times greater than this.

It is difficult to estimate the full benefit of this invention to the consumer but the consumer does obtain improved food products at either no additional or possibly at reduced cost. Food processors have an improved method developed for them. The new method and food product could result in increased markets for farm products.

The cost to the Department of Agriculture in making this development was about $125,000.

AGRICULTURAL RESEARCH SERVICE—WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Walnut hull loosening process

Patent No.: 2,010,780.
Names of inventors: E. M. Chase, D. G. Sorber, D. H. Rudle, and M. H. Kimball.
Title: A Process for Treating Unhulled Nuts.
Date of issuance: August 8, 1935.

In 1934 scientists at a USDA field establishment in Los Angeles (now in Pasadena, Calif., one of the laboratories of the Western Utilization Research and Development Division, ARS) discovered a novel method for loosening the hulls on walnuts to facilitate removal of the hulls. The process was demonstrated to the walnut industry and was quickly adopted. The development provided improved methods for preparing the walnut crop for market and enabled the protection of the crop from kernel discoloration and molding.

The method involves treating those portions of the crop called green sticktights with ethylene gas. This causes the hulls to become friable so that they may be easily removed from the nuts. In this ethylene process, the hull-loosening effect is obtained without detriment to the nuts—there is no kernel discoloration or molding. In prior processes the sticktights were treated by a sweating method which involved exposing piles of the nuts to cool temperatures and high humidity for several days. This method was laborious and failed to control mold.

The ethylene method is of particular usefulness in central and southern California where the hot, dry autumn weather normally delays the ripening (loosening) of hulls 10 to 30 days after the kernels are fully mature. The discovery of the ethylene process enabled processors in these areas to avoid this long delay and made it feasible to harvest nuts from the trees at an early date. This had the added advantage of assuring the production of nuts with light-colored kernels.

The value of this development to American agriculture is estimated to be about $750,000 to $1 million. This estimate is based on surveys indicating that the ethylene-treated portion of the crop was increased in value by at least 3 to 4 cents per pound. The increased value stems from the high percentage of light-colored kernels and the low fraction of moldy kernels from sticktight walnuts subjected to the ethylene process. At least 25 million pounds of walnuts have been treated by the process since it was announced in 1934.

The cost to the Department in making this development was less than $8,000. The patent covering this method (2,010,780) was dedicated to the public so that anyone could use the process without charge. No license or other formality was required.

AGRICULTURAL RESEARCH SERVICE—WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Ethylene coloring of citrus fruit

Patent No.: 1,475,938.
Name of inventor: Frank E. Denny.
Title: Method of Coloring Citrus Fruits.
Date of issuance: December 4, 1923.

Oftentimes citrus fruits when harvested have a green skin coloration even though the edible portions are at proper maturity. In prior practice, such fruit had to be stored for long periods in sweating rooms to develop natural skin coloration.

About 35 years ago, scientists at USDA field station in Los Angeles (now in Pasadena, Calif., one of the laboratories of the Western Utilization Research and Development Division, ARS) discovered an efficient method for hastening the development of natural color. The method involves subjecting the fruit to an atmosphere containing a minute amount of ethylene gas. Ethylene accelerates the disappearance of chlorophyll (the green-coloring substance) and brings out the bright natural color of the fruit. The color change is not a matter of dyeing but a hastening of the biological processes which control the balance of natural pigments in the fruit skin. Depending on ethylene concentration in the atmosphere, the process is completed in 5 to 14 days as contrasted with 30 to 60 days required by previous methods.

The ethylene process was immediately adopted by the citrus industry in the early 1920's and has been used continuously ever since. The process is employed in the three major citrus producing areas—California, Florida, and Texas—and is applied to grapefruit, lemons, and oranges. It is estimated that the minimum value of this development to American agriculture has been about $50 million. This estimate is based on the increase in value of the total amount of fruit treated by the process since 1925. That is, fruit which would ordinarily be suitable only for processing is effectively put into condition for sale on the fresh-fruit market where it commands a higher price. The fruitgrower and processor also receive a saving in the decrease of necessary storage space and equipment which resulted from the use of this developed process.

The cost to the Department of Agriculture in making this development was about $10,000. The patent covering this process (1,475,938) was dedicated to the public so that anyone could use the process without charge. No license or other formality was required.

AGRICULTURAL RESEARCH SERVICE—WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Stabilization of dehydrated forage

Patent No.: 2,562,970.
Name of inventor: Chester Ray Thompson.
Title: Preservation of Forage Crops.
Date of issuance: August 7, 1951.

A practical method stabilizing the nutrient value of dehydrated alfalfa and other forages has been developed by the Western Utilization Research and Development Division, Agricultural Research Service.

The principal value of dehydrated forages as ingredients of mixed feeds is dependent on their content of provitamin A (B-carotene), vitamin B, and xanthophyll. Unfortunately, when the forage is stored for winter use, these valuable components are rapidly destroyed by natural oxidation. Of several hundred chemicals screened as stabilizing agents for these components, 6-ethoxy-2,2,4-trimethyl-1, 2-dihydroquinoline (sold under the trade name of Santoquin) was found to be effective.

Applied at a rate of about one-half pound per ton and at a cost of not over $1, about three-fourths of the labile nutrients are retained over a storage period of 6 months as compared to only one-fourth retention for untreated forage stored under the same conditions. Considering that present annual U.S. production of dehydrated forages exceeds 1 million tons, this represents a very substantial savings in nutrient value. In addition, by preserving natural vitamin E chick encephalomalacia is prevented.

In the USDA development of methods for applying the antioxidant, additional advantages have been gained. Inedible animal fats have been found to be suitable vehicles for carrying the antioxidant (oxidation preventive) to accomplish uniform application to the dehydrated material, thus providing another outlet for this agricultural commodity. In turn, the oiling treatment aids in maintaining the uniform, green color of the fresh forage, and, still more important, reduces the nuisance of dustiness during processing and handling of dehydrated forages.

It is impossible to evaluate the value of this invention in monetary terms as to the benefits derived by the farmer in that he is now assured that his forage contains the necessary valuable nutrients for animal feed or the resultant gain to the consumer.

Over 40 forage dehydrating companies, representing a large proportion of the dehydrated alfalfa production capacity, have been granted licenses to use this development under the Department's public service patent.

The cost involved in making the development is estimated to have been about $100,000. Of this sum, the greatest part was spent in conducting extensive cooperative animal feeding tests to demonstrate the safety of the antioxidant, which has been accomplished to the satisfaction of the Federal Food and Drug Administration.

AGRICULTURAL RESEARCH SERVICE—WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Rapid heating of fluid food products

Patent No.: 2,625,488.
Names of inventors: Theodore Wasserman and Melvin E. Lazar.
Title: Processing of Heat Sensitive Fluids.
Date of issuance: January 13, 1953.

Patent No.: 2,636,430.
Names of inventors: Melvin E. Lazar, Paul W. Kilpatrick, and Amon H. Brown.
Title: Apparatus for Heating Fluids, Particularly Foodstuffs.
Date of issuance: April 28. 1953.

These patented inventions include processes and equipment for heating liquid-form foods, such as juices, by direct contact with steam. Steam is injected into a stream of the liquid food under turbulent flow conditions so that the temperature of the food is raised to a high level

in an extremely short time. Foe example, a continuously flowing stream of juice can be brought to temperature as high as 250° to 300° F. in a fraction of a second. By avoiding the usual long heating times, damage to flavor and color of the food products is minimized. The steam-injection process can be and is utilized in many areas of food processing, for example, in pasteurizing or sterilizing milk and juices, in stripping volatile flavoring agents from fruit juices, in inactivating enzymes in various liquid food products, in concentrating fruit and vegetable juices, etc. In short, the process is adapted to be used in any step where it is desirable to attain a rapid heating effect with a minimum alteration of the natural characteristics of the food.

The unique equipment and methods involved in this development of USDA's Western Utilization Research and Development Division, ARS, have found wide use in the production of fruit juice concentrates and other liquid-form products. The value of this development is demonstrated by the benefits derived on applying the system in the preparation of concentrated frozen orange juice. The industry has been faced with the problem of gelation of product in the can and cloud instability after reconstitution. This problem is especially acute where the fruit is so processed as to obtain high juice yields. Steam-injection heating prevents gelation and increases cloud stability. The value of the increase in yield made possible by steam-injection heating is now several million dollars per year. Just the value of the extra juice production has totaled at least $50 million since steam-injection heating was first used for this purpose in 1951–52.

The development is potentially applicable in the preparation of any liquid-form food products; for example, fruit juices, vegetable juices, milk, pureed baby foods, soups, etc., preserved by freezing, canning, concentration, or dehydration. The annual production of these items is at the enormous level of over 16 billion gallons with a value of at least $5.7 billion.

There is also a benefit here to the equipment manufacturer who has a new product to supply a ready market. There is gain to the processor as the problems of gelation and cloud instability are solved and thus the processor can make his raw material go further. The consumer also receives gains through a better product, a savings gain as a result of greater utilization of natural product by processor. With greater consumer acceptance of such products, greater demand has arisen for the natural fruit, vegetable, and other farm products needed for processing.

The cost to the Department of Agriculture in making this development was approximately $100,000.

AGRICULTURAL RESEARCH SERVICE—WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Continuous belt-trough drier

Patent No.: 2,745,194.
Names of inventors: Edison Lowe and William C. Rockwell.
Title: Continuous Belt-Trough Drier.
Date of issuance: May 15, 1956.

Patent No.: 2,876,558.
Names of inventors: Edison Lowe and Everett L. Durkee.
Title: Apparatus for Treating Particulate Material with Gaseous Media.
Date of issuance: March 10, 1959.

The new type of dehydrator developed by the Western Utilization Research and Development Division, ARS, is improving and broadening the operations of fruit and vegetable processors.

The drier includes an endless, flexible, perforated belt which is supported so as to form a trough. The material to be dried is fed into one end of this trough and, as the material traverses the trough, the individual particles in the bed of material constantly circulate from the bottom of the bed to the top thereof and back down again. Hot air is blown through the bed of material. The continuous circulation of the particles insures uniform and rapid dehydration with a minimum of breakage of individual particles. Heat efficiency is high.

The new dehydrator gives fast, uniform drying of vegetables and fruits in piece form and is the key element in the commercial success of two new processes, dehydrofreezing and dehydrocanning, in which partial dehydration precedes freezing or canning. Eight of the new driers have been installed to replace tray-drying operations in the plants operated by Gentry Division of Consolidated Foods Corp. at Oxnard, Calif.; California Vegetable Concentrates Co. at Modesto, Calif.; and Valley Evaporating Co. at Chelan Falls, Wash. Five more of the driers are under construction by Valley Evaporating Co. and Diamond Manufacturing Co., Oakland, Calif.

Knowledge of the advantages of the new drier is still so recent that only a beginning has been made in its commercial application. Eventually, the device is likely to replace older types of driers in the annual processing of over 160 million pounds of apples, a like quantity of potatoes, and substantial quantities of other fruits and vegetables currently handled in less efficient dehydration equipment. Total value of these products is over $50 million per year. The objective was to increase the use of agricultural products through dehydration rather than to aid machinery manufacturers.

The belt-trough dehydrator insures both uniform and rapid drying. Both are important. A product that is uniformly dried will rehydrate quicker and more uniformly, performing in about 1 hour the dehydration which takes from 4 to 5 hours by the older method. Users also say that the new drying method results in better natural color and flavor in the product and these qualities are better retained in storage.

Although intended originally for the uniform partial drying of fruit and vegetable pieces in dehydrofreezing and dehydrocanning, the new drier has proved highly successful in the complete drying of apples, carrots, potatoes, and bell peppers.

The cost to the Department in making this development was approximately $60,000.

AGRICULTURAL RESEARCH SERVICE—WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Fruit and vegetable juice powders

Patent No.: 2,854,343.
Names of inventors: Sumner I. Strashun and William F. Talburt.
Title: Full-Flavored Dehydrated Food Products.
Date of issuance: September 30, 1958.

This invention, developed by research workers in USDA's Western Utilization Research and Development Division, ARS, concerns the

dehydration of fruit and vegetable juices. In essence, the process involves subjecting a liquid juice concentrate to vacuum dehydration under conditions controlled to obtain an expansion or puffing of the material under treatment. As a result, the dry product has a porous texture and dissolves almost instantly when contacted with water to prepare a reconstituted juice. The powders not only reconstitute readily but also form beverages comparable to the fresh juices in flavor, color, and vitamin content. These products also provide several-fold savings in weight and volume when compared with fresh, canned, frozen, or other usual forms. Unlike frozen products, the juice powders do not require refrigeration and are relatively stable at temperatures as high as 100° F. In short, the puff-dried powders are very convenient stable source materials for preparing juices whenever desired for consumption.

The process described in the patent is concerned mostly with a batch-type procedure. Later, the process was extended to continuous operations. A patent application on this further phase of the development, in the names of the same inventors given above, is still pending.

Orange and grapefruit powders have been made commercially by this puff-drying process by Orange Crystals, Inc., Plant City, Fla., since January 1955. The Thornton Canning Co., Thornton, Calif., has installed equipment for producing tomato juice powder and is presently testing this equipment and making necessary modifications.

The present annual production of fruit juice powders by this process is estimated to exceed 1 million pounds, equivalent to over a million gallons of fresh juice. This, however, represents only the infancy of a development. Powders of good color and flavor have been made from the juice of tomatoes, apricots, prunes, pineapples, apples, grapes, and oranges; and from coffee, prune whip, chicken broth, and macerate, lemonade, and various pureed vegetables. Potentially, a large proportion of the high-quality fruit and vegetable juices can be processed and distributed in this way, with consequent savings in storage and transportation costs amounting to many millions of dollars. These savings would accrue because the juice powders are in a dehydrated state, that is, there is no water to take up space and weight. (Fruit juices normally contain about 85–90 percent water.) Also, in contrast to conventional juice concentrates which must be stored under refrigeration, the juice powders can be held at ordinary temperature. These features of the products make them especially desirable for military feeding programs as well as for home and institutional use. It is expected that this invention will create greater markets for fruit and vegetable products through savings in transportation and storage costs and through extending the marketing area since these products require no refrigeration. The development of this invention is too recent to make estimates of its potential economic effect. Additional development work is underway to provide information needed for commercial application.

The cost to the Department of making this development is estimated to have been $150,000.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Frozen orange juice concentrate

Patent No.: 2,453,109.
Names of inventors: Louis G. MacDowell, Edwin L. Moore, and Cedric D. Atkins.
Title: Method of Preparing Full-Flavored Fruit Juice Concentrates.
Date of issuance: November 9, 1948.

This invention is a method for preparing full-flavored fruit juice concentrates from citrus fruits, particularly oranges.

The patented method consists in preparing a fivefold to eightfold concentration of juice followed by adding to the resulting concentrate from 6 to 25 percent of fresh, deaerated, single-strength juice to enhance the flavor. The product obtained in this manner is sealed under vacuum and frozen for storage or shipment. The basic process for the manufacture of frozen concentrate was developed at the U.S. Citrus Products Station, Winter Haven, Fla., in cooperation with the Florida Citrus Commission.

The current annual production of orange juice concentrate prepared by this method is about 80 million gallons. Since its inception, more than a half billion gallons of orange juice concentrate have been prepared commercially. The new market for oranges afforded by frozen concentrate has had a profound effect on the development and economy of the citrus industry, particularly in Florida. At the time of first commercial manufacture in 1945–46, Florida's orange crop had reached a level of some 50 million 90-pound boxes, with heavy increases in prospect. The outlets for fresh fruit and existing processed products were indicated to hold their own, but increases in proportion to the increasing production were not in prospect. Severe recessions in prices, both for fresh sales and processing, occurred in the 1946–47 and 1947–48 seasons. By 1948–49, however, frozen concentrate began to have its effect. Since 1949 the frozen product has more than absorbed the increase in Florida's orange production, with maintenance of generally satisfactory prices and low differentials between prices for fresh sales and processing.

In 1945–46, 260,000 boxes of Florida oranges, about 0.5 percent of the total crop, were used for frozen concentrated juice, with a cannery-door value of some $750,000 and a net return, over and above production and delivery costs, of nearly $500,000 to the growers. Manufacture of frozen concentrated orange juice has shown a phenomenal growth since that time. In the 1958–59 season, over 60 percent of the total Florida orange crop was used for production of frozen concentrate, amounting to 79 million gallons with a delivered value of $184 million and a net return to growers approximating $121 million. The cumulative value (1945–46 through 1958–59) of the concentrate at the manufacturers' level (delivered cost of oranges, plus processing cost, profit, and sales expense) is estimated to have exceeded $1½ billion dollars. The retail value of frozen concentrated orange juice now probably amounts to some $300 million or more a year.

Currently, there are 26 citrus concentration plants in Florida alone which are understood to utilize this development.

Adams Packing Association, Inc., Auburndale.
B. & W. Canning Co., Inc., Groveland.

Bartow Growers Processing Corp. Bartow.
Birdseye Division, General Foods Corp. Florence Villa.
Evans Packing Co., Dade City.
Florida Citrus Canners Cooperative, Lake Wales.
Florida Food Products, Inc., Eustis.
Fosgate Citrus Concentrate Cooperative, Forest City.
Fruit Industries, Inc., Bradenton.
H. P. Hood & Sons, Inc., Dunedin.
Lakeland Highlands Canning Co., Inc., Highland City.
Lauric-Massey Citrus Products, Inc., Lakeland.
Libby, McNeill & Libby, Ocala.
Minute Maid Corp., Auburndale.
Minute Maid Corp., Frostproof.
Minute Maid Corp., Leesburg.
Minute Maid Corp., Plymouth.
Pasco Packing Co., Dade City.
Plymouth Citrus Growers Cooperative, Plymouth.
Ridge Citrus Concentrate, Inc., Davenport.
Sheriff-Horsey Corp., Ltd., Plant City.
Snively Groves, Inc., Winter Haven.
Southern Fruit Distributors, Haines City.
Stokely-Bordo, Haines City.
TreeSweet Products Co., Fort Pierce.
Winter Garden Citrus Products Cooperative, Winter Garden.

Yet Purpura Bros. of Ocala, Fla., is the only Department licensee under the patent in Florida. Thus again the number of licenses is not a full indicator of utilization as the Department supplies know-how and information even without the issuance of such a license. Furthermore, the Department's policy is to freely license anyone and not to prosecute nonlicensees for infringement. However, the issued licenses do disclose potential utilization by companies in States other than Florida, such as California, New York, and Pennsylvania.

The cost of this development to the Department was approximately $70,000 including salaries and expenses.

Licenses Issued

2,453,109 Method of Preparing Full-Flavored Fruit Juice Concentrates.
Blaw-Knox Co., Buffalo, N.Y. (October 28, 1948).
Purpura Bros. Inc., Ocala, Fla. (November 17, 1949).
Golden Citrus Juices, Inc., Fullerton, Calif. (March 24, 1950.)
H. J. Heinz Co., Pittsburgh, Pa. (September 22, 1958.)

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Conforming cotton bandage

Patent No.: 2,379,574.
Name of inventor: Charles F. Goldthwait.
Title: Method of Producing Surgical Bandages with Improved Elastic Properties.
Date of issuance: July 3, 1945.

Patent No.: 2,404,837.
Name of inventor: Charles F. Goldthwait.
Title: Method of Making Cotton Fabrics with Differential Elastic Properties.
Date of issuance: July 30, 1956.

This process for making a new type of cotton surgical bandage treats an open weave cotton fabric or gauze with a caustic soda solution of 20 to 25 percent concentration without applying tension to the fabric. As a result, the fabric shrinks in all directions and there is imparted to the individual yarns of the fabric many small springlike crimps. After washing out the caustic, the fabric is dried in the nontensioned state. The crimps and kinkiness imparted to the yarns by the slack caustic treatment allows the bandage to stretch in both directions, thus giving rise to self-fitting and self-tightening properties. The improved bandage conforms readily to the contours of the body, yet is sufficiently elastic to permit freedom of movement. These properties make it much superior to ordinary gauze bandages. For some types of surgical dressings it is the only bandage that can be used successfully. It is especially suitable in orthopedic surgery, and is excellent for head dressings, and dressings for burns and skin grafts.

Commercial production for the Armed Forces was begun in 1952. The bandage is now available for use by the general public. At the present time, Johnson & Johnson and Medical Fabrics Co., Inc., are producing a consumer product which amounts to approximately 6 percent or more of the total elastic surgical bandages produced in this country. Annual usage of approximately 4,000 bales of cotton with a product value of $5 million and cumulative value of over $30 million has resulted from commercialization of this bandage. This important development has strengthened the competitive position of cotton against synthetic fibers in the surgical bandage field.

The new type cotton bandage was developed at an estimated cost of $75,000 to the Department.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Cotton opener-cleaner

Patent No.: 2,780,839.
Names of inventors: Ray C. Young and Ralph A. Rusca.
Title: Cotton Opener-Cleaner.
Date of issuance: February 12, 1957.

Patent No.: 2,365,793.
Names of inventors: Clarence M. Asbill, Jr., and Ray C. Young.
Title: Cotton-Working Machine.
Date of issuance: December 26, 1944.

Patent No.: 2,607,958.
Names of inventors: Ralph A. Rusca and Ray C. Young.
Title: Fiber Doffing Device.
Date of issuance: August 26, 1952.

Patent No.: 2,712,162.
Names of inventors: Ray C. Young and Ralph A. Rusca.
Title: Fiber Conveyor and Cleaner.
Date of issuance: July 5, 1955.

Patent No.: 2,745,144.
Names of inventors: Ray C. Young and Ralph A. Rusca.
Title: Fiber Deflector.
Date of issuance: May 15, 1956.

Patent No.: 2,825,097.
Name of inventor: George J. Kyane.
Title: Fiber Cleaner.
Date of issuance: March 4, 1958.

Patent No.: 2,848,754.
Names of inventors: Mayer Mayer, Jr., and James I. Kotter.
Title: Fiber Cleaner.
Date of issuance: August 26, 1958.

Patent No.: 2,867,850.
Names of inventors: Mayer Mayer, Jr., and James I. Kotter.
Title: Fiber Cleaner.
Date of issuance: January 13, 1959.

Patent No.: 2,893,064.
Names of inventors: R. A. Rusca and Ray C. Young.
Title: Self-Feeding and Self-Doffing Opener Cleaner for Textile Fibers.
Date of issuance: July 7, 1959.

Patent No.: 2,931,071.
Names of inventors: Ray C. Young and R. A. Rusca.
Title: Fiber Cleaner.
Date of issuance: April 5, 1960.

Patent No.: 2,934,793.
Names of inventors: James I. Kotter and Mayer Mayer, Jr.
Title: Fiber Cleaner.
Date of issuance: May 3, 1960.

Patent No.: 2,951,265.
Names of inventors: James I. Kotter and Mayer Mayer, Jr.
Title: Fiber Cleaner.
Date of issuance: September 6, 1960.

This is a machine for processing staple textile fibers. Although it is particularly applicable to cotton, any natural or synthetic fiber with individual fiber lengths of from ¼ to 2½ inches in length can be processed using this machine. The machine functions to untangle or "open" tangled masses of fibers and to remove more than one-third of the dirt, trash, and other nonfibrous materials that may be mixed with the fibers at a production rate of 1,500 pounds per hour.

The machine has a horizontal belt conveyor that carries a matted mass of fibers up to and pushes the mass continuously against a series of adjacent toothed cylinders rising up from and curving back toward the conveyor belt. The rotating cylinders (cleaning and beating cylinders) continuously pick up and carry a thin layer of opened fibers away from the compacted fiber mass. The opened fibers carried by the rotating cleaning and beating cylinders are removed by doffing cylinders which centrifugally discharge the opened and doffed fibers into suction flue ducts. The ducts carry the opened fibers on to the next operation.

Although developed primarily for use with cotton, the opener-cleaner also is being used to process flax and remie.

The requisite use of low grade cotton and the superior cleaning performance of the opener-cleaner make this machine particularly valuable in wartime. By virtue of the cleaning features of the opener-cleaner, this machine could be used in wartime in conjunction with the cutting machine (U.S. 2,370,129—assigned to the Department of Agriculture) to produce cotton for nitrating.

The opener-cleaner, publicly announced in October 1957, is now produced by four machinery manufacturers: the Carolina Machinery Co., Kirkman & Dixon Machinery Co., Cen-Tennial Cotton Gin Co., Inc., and the Davidson-Kennedy Co.

Excellent results are being achieved with the cotton opener-cleaner and, on the basis of $2 per bale saved as shown by mill results, the industry could realize about $18 million annually should the entire 9 million bales of mill consumption be processed through these machines.

The opener-cleaner is reported to increase the grade of fabric by one full grade, thereby making cotton more competitive with trash-free synthetic fiber fabrics.

The estimated cost to the Department for development of the cotton opener-cleaner was about $290,000.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Cotton carding apparatus

Patent No.: 2,879,549.
Names of inventors: August L. Miller, Roger S. Brown, and Ralph A. Rusca.
Title: Carding Apparatus.
Date of issuance: March 31, 1959.

Time magazine in its April 13, 1959 issue declared that this invention is the "first major improvement in cotton-carding equipment in 60 years." This new 300-pound rotary carder will replace a bulky 1,100-pound carding flat.

This carder has replaced the "revolving flats" and its entire accompanying assembly of accessories with a series of stationary plates contoured to match the surface of the card cylinder and secured to the flexible bend on either side of the carding machine. The plates extend over the entire width and over approximately one-half the circumference of the card cylinder as a cover spaced adjustably from the surface of the card cylinder. The plates present a continuous granular surface to the carding cylinder. The granular surface may vary in roughness depending on the type of fiber being carded. Thus, the modified card is applicable to fibers other than cotton.

The advantages of this carder are many. When properly selected for the type of material being carded, the granular surface of the plates will not accumulate fiber, i.e., load up. The granular surface therefore presents 100 percent of its working surface at all times to open and aline the fibers being carded. The carding action of this large nonloading working area is so complete that there are no unopened tufts or fibers to be removed such as are deposited on the flats of a conventional carding machine. Elimination of the revolving flats results in a saving of from 2 to 5 percent of the fibrous material being carded, or about 50 percent of the usual waste. An additional saving of fibrous material results from the fact that with the granular card surface, fibers being conveyed on the main cylinder are not forced down into the card wires as happens with cards carrying the conventional revolving flats. Sliver delivered from the granular card contains fewer neps than sliver from conventional card. Limited mill evaluation (this development was released publicly March 31, 1959) indicates a potential saving of $40 million annually by the entire U.S. cotton textile industry and be an aid to the U.S. cotton textile industry.

Machines are in operation at several mills: Avondale Mills, Alexander City, Ala.; Quaker Meadows Mill, Hildebran, N.C.; Celanese Corp., Charlotte, N.C., and Chicopee Manufacturing Corp., Walhalla S.C. From the interest expressed in this development by the industry, it is expected that a number of additional mills will install machines at an early date.

The cost of developing the granular card was about $150,000.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Turpentine derivative for use in synthetic rubber

Patent No.: 2,775,578.
Names of inventors: Gordon S. Fisher and Leo A. Goldblatt.
Title: Polymerizations Initiated by Saturated Cyclic Terpene Peroxides.
Date of issuance: December 25, 1956.

Patent No.: 2,735,870.
Names of inventors: Gordeon S. Fisher and Leo A. Goldblatt.
Title: Peroxides of Saturated Cyclic Terpenes and Method of Producing Same.
Date of issuance: February 21, 1956.

The chemical process involved in the production of synthetic rubber and other elastomeric polymers requires organic starting materials (monomers) of no more than 10 carbon atoms linked together in chain fashion for the production of the complex final elastomeric product (polymer).

The processes of U.S. patent 2,775,578 use materials (certain saturated cyclic terpene peroxides) derived from naval stores products as the catalyst or the initiator for the production of rubberlike polymers. U.S. patent 2,735,870 assigned to the Department by the same inventors discloses processes for preparing these peroxides. A few hundredths of 1 percent by weight of the initiator is incorporated into the conventional polymer process mix to trigger the linking or chain forming reaction.

The use of these initiators derived from naval stores products is broadly applicable to virtually any polymerization process that is capable of being initiated by a free radical mechanism. The use of these products is particularly advantageous in the production of synthetic rubber by the low temperature (cold rubber) process. They are superior to cumene hydroperoxide, the conventional cold rubber catalyst which is prepared from cumene, an important ingredient in high-octane aircraft fuels and hence a critical material in times of national emergency. They are also excellent catalysts for producing synthetic rubber from isoprene or isoprene-styrene mixtures.

One of the new cyclic terpene peroxides (paramenthane hydroperoxide) is now being produced commercially at the rate of some 2 million pounds per year with a market value of over $1 million. Virtually all synthetic rubber for automobile tire treads is made using this catalyst. Three companies have licensed the invention, and a considerable number of other companies are believed to be employing the catalysts in the production of synthetic rubber without obtaining licenses. It is understood that over 90 percent of the synthetic cold rubber is now being produced using the new catalysts.

The estimated cost of developing the process to the Department of Agriculture is approximately $40,000.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

New fiber testing device

Patent No.: 2,706,403.
Name of inventor: Kenneth L. Hertel.
Title: Fiber Tester.
Date of issuance: April 19, 1955.

This apparatus is for testing the strength and the elongation propensity of fibers. Cotton or any other material having properties of strength and elongation similar to cotton can be tested with this apparatus.

The apparatus ("Stelometer," from *St*rength, *elo*ngation, and *meter*) is used for testing flat bundles of fibers to determine the strength per unit weight and the amount of elongation the fibers can tolerate before breaking.

The testing apparatus comprises a fiber bundle clamp which holds the fibers under a uniform and a reproducible tension while they are being moisture equilibrated.

After equilibration, force is applied to the fiber bundle at a uniform rate by means of a gravity actuated pendulum. The loading rate of the pendulum is controlled by air escape from an attached piston-cylinder component. The force required to break and the elongation of the fibers at break are both registered by the apparatus.

The Stelometer has proved its worth to breeders in selection of cottons for useful properties other than strength, and in selection of cottons, by their properties, for special products. The Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, is using the tester to measure strength and elongation of cottons which are to be processed into yarns. The instrument enables breeders to evaluate elongation, a physical property of cotton previously ignored in the selection of new strains. Research laboratories, manufacturers, and designers of fabrics use the Stelometer to determine the effects of elongation on abrasion resistance, flexibility, endurance, and appearance of special textile products and to select and blend cottons most suited for specific uses. The value of this invention as an aid in cotton selection and in the use of cotton cannot be estimated.

The estimated cost of this development to the Department is approximately $24,000 including salaries, supplies, and equipment.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Loom device for weaving water- and wind-resistant fabrics

Patent No.: 2,649,864.
Names of inventors: Mayer Mayer, Jr., and George J. Kyame.
Title: Attachment for Weaving High Density Fabrics.
Date of issuance: August 25, 1953.

This invention is an attachment for standard looms which makes possible the weaving of high-density fabrics that resist the passage of wind and water but retain the ability to "breathe" and other comfort properties. This loom has standard components but modified as follows: a vertically movable, horizontal push bar for dividing the warp strands into two groups, each containing half of the total number of strands and half of the strands passing through every two consecutive dents in the reed; a cam-driven push bar actuating mechanism arranged to raise and lower the push bar so that the warp strands passing above and below the push bar are respectively deflected as the reed reaches each extreme beatup position; two horizontal bars rigidly mounted transversely above and below the warp strands and positioned between the push bar and the drop wires so that the deflection

imparted to the warp strands does not deflect the strands from the plane of the normal warp line as they pass forward along the loom.

The high-pickage attachment aids in meeting the needs of defense agencies by enabling or facilitating the production of new types of cotton fabrics. These high-density fabrics meet the needs of the Armed Forces for lightweight fabrics that permit air circulation but shut out wind and water. Extra dense cotton fabrics have been evaluated by several branches of the Department of Defense and one lightweight dense fabric is now under limited procurement.

Although a monetary value cannot be assigned to this development at the present time, the loom attachment should improve the competitive position of cotton for use in wearing apparel, tents, awnings, and industrial fabrics where resistance to water and wind is an important requirement. The loom attachment is available from two manufacturers of textile machinery.

The cost of this developement to the Department was approximately $75,000. This figure includes salaries, supplies, and equipment.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Fiber cutting machine

Patent No.: 2,370,129.
Names of inventors: Clarence M. Asbill, Jr., and Grover B. Hill.
Title: Cutting Machine.
Date of issuance: February 27, 1945.

This cutting machine is useful for cutting fibrous materials such as cotton fibers, corn stalks, tobacco leaves, etc. into short lengths and for shearing sheet material into strips. The machine was designed for and is particularly well suited to cutting cotton fibers into the short lengths (approximately one-tenth of an inch) required for nitrating and the ultimate production of smokeless powder.

The cutting machine has two rotatable, parallel mounted, coacting cutter rolls. Each roll is composed of a main shaft to which is keyed a plurality of cutting discs, each spaced from its immediate neighboring discs by a "spacer" disc of lesser diameter. The coacting cutter rolls are so positioned that the cutting discs on one roll stand opposite the spacer discs of the other roll and the cutter disc peripheries of both rolls overlap. Cutting is accomplished at the first peripheral intersection of cutter disc overlap.

Auxiliary cutter attachments consist of clearing rolls for each cutter roll and "in place" grinding wheels for sharpening the cutter discs during operation. The cutter, when operated as a cotton fiber cutter in conjunction with a fiber opening machine developed at SU (U.S. patent No. 2,365,793 assigned to the Secretary of Agriculture) exhibits remarkably high production capacities. One model built for a World War II cellulose-purification plant was capable of operating continuously at the rate of 10½ tons of cotton lint or linters per hour. The cutter was declared surplus after the emergency, but complete drawings, plans, and personnel familiar with the equipment are immediately available for any future need.

Although the cutter was developed as an adjunct to the war effort, a full-scale model of the modified opening and feeding unit has been constructed by a textile manufacturer for use in opening cotton.

A paper-pulp manufacturer has utilized the cutter as a means of using waste cotton in the production of fine paper pulp.

The estimated cost of this development is approximately $200,000. This total represents about $55,000 for salaries and for miscellaneous research expenses and $145,000 for material and construction costs. A special congressional appropriation of funds for the first machine followed by allocation of $120,000 by the War Production Board, made completion of the wartime research on this project possible.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Process for pine gum refining

Patent No.: 2,254,785.
Names of inventors: Wiley C. Smith, Jesse O. Reed, Fletcher P. Veitch, and George P. Shingler.
Title: Process for Gum Refining.
Date of issuance: September 2, 1941.

Patent No.: 2,598,684.
Names of inventors: Leo Goldblatt and N.C. McConnell.
Title: Pine Gum Distillation.
Date of issuance: June 3, 1952.

Patent No.: 2,846,430.
Names of inventors: R.V. Lawrence and V.N. Loeblich.
Title: Processing Pine Oleoresins.
Date of issuance: August 5, 1958.

In this process for cleaning and refining pine gum, a controlled quantity of freshly distilled turpentine is added to the gum before, during, or after the gum is melted. The heated mixture is strained and filtered, and then a stream of hot water is run through it to remove water-soluble material. Upon standing, water and thinned gum separate and the water can be drained off and the refined gum recovered. A modification of the process, whereby a small amount of oxalic acid is added to the crude gum in the melting step, has been found to effectively remove iron contaminants which frequently introduce a serious color problem in gum refining.

Numerous naval stores processors have stated that the gum Naval Stores industry would probably not be in existence today had it not adopted this process of pine gum cleaning, frequently referred to as the "Olustee" process. The central gum-cleaning plants that have resulted from the development of the cleaning process have made pine gum an excellent cash crop for the farmers of the naval stores region. The low-grade, high trash content, non-uniform rosin formerly produced from pine gum has, as a result of the Olustee process, been replaced with a clean, high-grade product which can compete favorably with wood rosin and tall oil rosin.

The Olustee process, introduced in the middle thirties, is used in the production of approximately 98 percent of all pine gum rosin made in this country. It not only increases the yield of rosin by 2 to 5 percent, but upgrades the rosin from 2 to 6 grades. An added dividend is the fact that the cleaned gum is well suited to the direct production of maleopimaric acid from the gum. This valuable resin acid finds utility in the photographic industry, and in dyes, alkyd resins, and sizing agent. Conservative estimates set potential production and use at several million pounds of maleopimaric acid annually.

The total savings to the industry since introduction of the new process is estimated to be about $11.5 million. At the present time, the estimated savings are $500,000 per year.

The development cost of the gum cleaning process is estimated at $170,000.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Vegetable oil extraction process

Patent No.: 2,726,253.
Names of inventors: Edward A. Gastrock, Henry L. E. Vix, Esler L. D'Aquin, James J. Spadaro, and Angelo V. Graci, Jr.
Title: Cottonseed Oil Extraction Process.
Date of issuance: December 6, 1955.

Patent No.: 2,857,411.
Names of inventors: Esler L. D'Aquin, Henry L. E. Vix, Angelo V. Graci, Jr., Edward A. Gastrock, and James J. Spadaro.
Title: Double Soak Filtration-Extraction of Vegetable Oil-Bearing Materials.
Date of issuance: October 21, 1958.

In this improved oil extraction process called filtration-extraction, the oil-bearing materials are first heat treated and crisped under controlled moisture conditions to produce a granular material eminently suitable for oil removal. This granular material is soaked with an oil-solvent mixture in a continuous mixing vessel for 15 to 20 minutes to dissolve the oil. Then the slurry is deposited continuously on a rotary vacuum filter. There the oil-solvent mixture is separated from the meal and refiltered through the meal bed to reduce its "fines" content. The resulting meal is solvent washed and successively drained several times, and is then removed from the filter—all in less than 3 minutes' time. The solvent is removed from the oil and from the oil-free meal in conventional equipment. The resultant oil and meal are of high quality.

Filtration-extraction is especially suitable for small- to medium-sized oil mills, since it eliminates the need for prepressing high oil content seeds and thus reduces initial installation and power costs. It makes possible economical year-round operations where several different oilseed raw materials are available. At the present time, the process is used commercially to process cottonseed, soybeans, and other oilseeds by at least two plants in this country. These known plants are the Greenwood and Hollandale, Miss., plants of the Mississippi Cottonseed Products Co. In replacing hydraulic pressing, operating economies amounting to as much as $200,000 per year have been achieved for an installation. The accumulated value of this development to U.S. industry is estimated at about $1,8000,000.

The development cost to the Department is estimated at $350,000.

AGRICULTURAL RESEARCH SERVICE—SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Chemically modified monoglycerides

Patent No.: 2,745,749.
Names of inventors: Reuben O. Feuge, Earl J. Vicknair, and Klare S. Markley.
Title: Glyceridic Mixtures Exhibiting Unique Properties and Process for Their Production.
Date of issuance: May 15, 1956.

This process chemically modifies glyceridic mixtures, particularly naturally occurring vegetable fats and oils, so that the chemically modified mixtures will exhibit varied properties of texture, melting point, and flexibility, as desired for a specific use. Since the degree of chemical modification of the glyceride mixture is variable over wide limits and since the glyceride mixtures so modified are miscible with a great many organic compounds, products can be obtained that display extremely divergent chemical and physical properties. The products of this invention provide a broad spectrum of utility ranging from additives useful in the formulation of lubricants to cosmetic components.

The modification process involves the introduction, by esterification reaction, of short chain fatty acid groups (2 to 6 carbon atoms) into monoglyceride mixtures previously prepared from the glyceride mixtures of naturally occurring fats and oils. Products ranging in monoglyceride content 10 to 30 percent by weight are possible. One of these products (acetoglycerides) is being marketed in the United States (Distillation Products Industries) and England (A. Boake, Roberts & Co., Ltd.) for use in cosmetics. A number of organizations have expressed a desire to use the acetoglycerides with and in foods as soon as such use is approved by the Food and Drug Administration; several organizations have pilot plant facilities for producing these new materials. The acetoglycerides could open up markets for up to 100 million pounds of domestic oils yearly. The value of such products could be as much as $50 million per annum.

The cost of developing these unique glyceridic products and process for their production is estimated at $100,000.

AGRICULTURAL RESEARCH SERVICE—NORTHERN, EASTERN, AND WESTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISIONS

Improved methods for commercial production of vitamin B_{12}

Patent No.: 2,643,213.
Name of inventor: Harlow H. Hall.
Title: Method for the Production of Vitamin B_{12} by *Streptomyces olivaceus*.
Date of issuance: June 23, 1953.

Patent No.: 2,561,364.
Names of inventors: Harlow H. Hall and Henry M. Tsuchiya.
Title: Method for Producing Vitamin B_{12}.
Date of issuance: July 24, 1951.

Patent No.: 2,715,602.
Names of inventors: Robert E. Hargrove and Abraham Leviton.
Title: Process for the manufacture of Vitamin B_{12}.
Date of issuance: August 16, 1955.

Patent No.: 2,753,289.
Name of inventor: Abraham Leviton.
Title: Process for the Microbiological Synthesis of Vitamin B_{12} Active Substances.
Date of issuance: July 3, 1956.

Patent No.: 2,764,521.
Name of inventor: Abraham Leviton.
Title: Process for the Preparation of Concentrates of Vitamin B_{12} Active Substances.
Date of issuance: September 25, 1956.

Patent No.: 2,576,932.
Names of inventors: John A. Garibaldi, Kosuke Ijichi, James C. Lewis, and James McGinnis.
Title: Fermentation Process for Production of Vitamin B_{12}.
Date of issuance: December 4, 1951.

A number of organisms have been found which are reported to be capable of producing vitamin B_{12}. A process was developed at the Northern Division which made a primary vitamin B_{12} fermentation economically feasible. Heretofore, commercially available vitamin B_{12} products had usually been obtained as secondary products from antibiotic fermentations. The organism used in the new process was *Flavobacterium devorans* and the medium was corn sugar, soy meal, corn-steep solids, and inorganic salts. Continuation of the work resulted in a still higher yielding process in which *Streptomyces olivaceus* was grown on a medium containing distillers' dry solubles, corn sugar, calcium carbonate, and cobalt chloride. The culture liquor may be evaporated to a sirup and this used to fortify food or feed materials. A dry product rich in vitamin B_{12} can be obtained by further drying of the sirup to give a dry powder.

As a part of the research program at the Eastern Utilization Research and Development Division to develop more efficient processing of dairy products, methods have been devised for producing vitamin B_{12} by fermentation with species of *Propionbacterium*. These procedures are covered by U.S. Patents 2,715,602, 2,753,289 and 2,764,521. Research at the Western Utilization Research and Development Division has resulted in U.S. Patent 2,576,932 covering a method for producing vitamin B_{12} by the culture of a particular strain of *Bacillus megatherium*.

One of the most striking effects of vitamin B_{12} in animal nutrition has been to extend the supply of animal and fish products ordinarily used in animal feedstuffs. While not a complete replacement of the above products, this vitamin brings about more efficient utilization of feeds, faster growth of animals, and more economical production of meat products. Along with antibiotics, vitamin B_{12} is particularly effective in promoting faster growth of chicks, turkeys, and swine during the first few weeks of life.

The production of vitamin B_{12} is very small, being about 790 pounds in 1957; however, the unit value is very high, over $89 per gram. The value of the product sold in 1957 was nearly $22 million. In the first few years in which vitamin B_{12} was produced by fermentation, it is estimated that the Northern Division process (U.S. Patents 2,643,213 and 2,561,364) accounted for about one-third of the production. In efforts to increase yields and concurrently decrease costs, the other producers continued their researches and ultimately found higher producing organisms. It is not known to what extent these patents are currently applied; however, it is believed that this basic approach has been used in the search for still higher yielding organisms. Industry also has indicated considerable interest in the methods and processes developed at Eastern Utilization Laboratories and at the moment Western Utilization Laboratories for the production of vitamin B_{12}, but there is no practical way to estimate their industrial value.

The cost of these developments to the Department of Agriculture is estimated at approximately $340,000 based on salaries, equipment, and supplies.

AGRICULTURAL RESEARCH SERVICE—ANIMAL DISEASE AND PARASITE DIVISION

Hog cholera antitoxins

Patent No.: 823,110.
Name of inventor: M. Dorset (dedicated to the public).
Title: Manufacture of Hog Cholera Antitoxin.
Date of issuance: June 12, 1906.

Patent No.: 1,264,285.
Names of inventors: M. Dorset and R. R. Henley.
Title: Process of Separating Serum from Corpuscles of Mammalian Blood.
Date of issuance: April 30, 1918.

Patent No.: 1,270,270.
Names of inventors: M. Dorset and R. R. Henley.
Title: Process for Refining Defibrinated Blood Antitoxin.
Date of issuance: June 25, 1918.

Patent No.: 1,270,271.
Names of inventors: M. Dorset and R. R. Henley.
Title: Process for Separation of Blood Serum.
Date of issuance: June 25, 1918.

Patent No.: 1,475,580.
Name of inventor: R. R. Henley.
Title: Clarified Serum and Antitoxin and Process for Making Same.
Date of issuance: None listed.

Patent No.: 1,784,928.
Name of inventor: M. Dorset.
Title: Vaccines for Hog Cholera and Processes for Manufacturing Same.
Date of issuance: December 16, 1930.

Patent No.: 2,102,235.
Name of inventor: M. Dorset (deceased) by Virgil Jackson Dorset, Administrator.
Title: Vaccines and Processes for Manufacturing Vaccines.
Date of issuance: None listed.

Patent No.: 2,369,267.
Name of inventor: Frank W. Tilley.
Title: Method of Preparing Hog Cholera Vaccines.
Date of issuance: June 1, 1943.

Between 1903 and 1905, M. Dorset, B. M. Bolton, and C. N. McBryde, members of the Biochemical Division of the Bureau of Animal Industry established that a filterable, ultramicroscopic virus was the cause of hog cholera, a highly infectious disease, which is usually fatal in up to 90 percent of the susceptible swine in naturally occurring outbreaks, and which at that time was threatening to eliminate the greater part of the swine industry.

In 1906 the Biochemical Division of the Bureau of Animal Industry published results of research and proved swine could be immunized against hog cholera, by means of protective antitoxin serum. The serum is prepared by injecting large cholera-immune hogs with blood obtained from a pig sick with that disease. After a suitable interval the treated hog, called a hyperimmune, is bled. The obtained blood contains large quantities of protective substances, antibodies. Originally the blood was defibrinated and preservative added. The preserved blood serum was administered either alone or in combination with hog-cholera virus. Later, based on continued research, a method was developed for producing a clear product that may be pasteurized to destroy any live disease-producing organisms.

During the periods 1906–18 and 1930–43, inclusive, eight patents were obtained on several processes for the production and refinement of products for use in the immunization of swine against hog cholera.

The use of serum alone confers only a temporary immunity, but a usually permanent immunity is obtained when the protective serum and disease-producing virus are given simultaneously. Under Department of Agriculture policy these processes became available to all, thus creating new products for an anxious market. The estimated cost related to the development of these processes is approximately $277,500.

During the period 1941–52, expenditures for the purchase only of biological agents for immunization of swine averaged $25 million annually in the United States. It has been conservatively estimated that the use of these products has resulted in the annual survival and marketing of additional swine in the United States valued at five times the cost of immunization ($125 million). Although accurate figures from which the value of the inventions covered by the claims of these patents can be derived do not exist, one can safely state, as a result of the information available covering only the period 1941–52, that their values have proved to be not less than $125 million annually, or a billion and half over the 12-year period.

However, as the basic discovery has been in practical use for more than 50 years, over $5 billion appears to be a very low and reasonable estimate for the worldwide value of these products and processes. As a result of these inventions a more plentiful supply of pork is available, a decrease in the risk in producing this meat, and thus the price of pork and ham to the consumer has become reasonable and very competitive.

AGRICULTURAL RESEARCH SERVICE—ANIMAL DISEASE AND PARASITE DIVISION

Pullorum disease test

Patent No.: 1,816,026.
Name of inventor: Jacob M. Schaffer.
Title: Process for Preparing Antigens.
Date of issuance: July 28, 1931.

In 1931 the Biochemic and Pathological Divisions of the Bureau of Animal Industry published on the development of a crystal-violet-stained pullorum disease antigen for field use for the control or eradication of pullorum disease in chickens. Crystal violet pullorum diagnostic antigen is a biological product prepared from the organisms which cause pullorum disease in chickens and has been used for many years in the detection of carrier (infected) birds. These carrier or infected birds, when detected, are removed from the flock and thus the disease is controlled. This product is very widely used in the United States in State pullorum disease eradication programs and the Federal National Poultry Improvement Plan. Since the use of crystal violet pullorum diagnostic antigens was begun the incidence of the disease has been reduced from approximately 5 to 7 percent in most of the poultry-growing States to a present low incidence varying from 0.5 to 0.0125 percent.

To make the test, a drop of a specially prepared biological product, known as stained antigen, is placed on a glass plate. The staining ingredient is a violet dye, which makes reactions clearly visible. A sample of blood—the amount that adheres to a small wire loop—is then taken from the chicken to be tested and added to the antigen on

the plate. The antigen and blood are next stirred together and further mixed by slight tilting of the plate and a gentle rocking motion. A clumping, or agglutination, of the mixture signifies that the bird carries the infection of pullorum disease and should not be used for breeding. A mixture free of clumping is a sign that the bird is not infected. The test usually can be made in about a minute. A sample of each lot of produced antigen is submitted to and approved by the Bureau of Animal Husbandry before its use is permitted.

From the inception of the work in 1928 to its consummation in 1931 the cost to the U.S. Government was approximately $40,000. Considering the potential dollar losses of eggs and chickens caused by the disease to be a conservative 10 percent per year before the antigen came into use, and the losses averaging 0.5 percent for eggs and chickens for the years 1942 to 1958, inclusive, it is apparent that the dollar value to the poultry industry has averaged approximately $10 million per year for that period. The savings for this period could be estimated as $150 million and since the test's adoption to general use as over $200 million.

To date there are 37 licensees representative among whom are:

Clemson Agricultural College, Clemson College, S.C.
Colorado Springs Vaccine Laboratory, Inc., Colorado Springs, Colo.
Cutter Laboratories, Berkeley, Calif.
E.K. Glover Laboratories, Kansas City, Mo.
Live Stock Sanitary Service Laboratory, College Park, Md.
Poultry Service Laboratories, Petaluma, Calif.
Sharp & Dohme, Inc., Philadelphia, Pa.

AGRICULTURAL RESEARCH SERVICE—ENTOMOLOGICAL RESEARCH DIVISION

Aerosol bombs (insecticidal aerosols)

Patent No.: 2,321,023.
Names of inventors: L. D. Goodhue and W. N. Sullivan (assigned to Secretary of Agriculture).
Title: Method of Applying Parasiticides.
Date of issuance: June 8, 1943.

Patent No.: 2,517,555.
Names of inventors: R. A. Fulton and J. H. Fales (dedicated to the free use of the people in the territory of the United States).
Title: Aerosol Dispensing Nozzles.
Date of issuance: August 8, 1950.

Invention of liquefied-gas propelled insecticide aerosols in 1941 by Bureau of Entomology and Plant Quarantine scientists at Beltsville has resulted in the spectacular rise of a new industry.

This invention is based on the principle of suspending tiny droplets of the active ingredient in the air in the form of a smoke, fog, or spray. It is generated by allowing the active ingredient, an insecticide, which is dissolved in a liquefied gas held under pressure in a container, to escape into the air. When a valve is opened the sudden change in pressure allows the contained solution to boil violently. The escaping liquid forced through a small opening, turns to vapor as it hits the air. Thus the active ingredient, in this instance an insecticide, is dispersed as a fine evenly colloidal suspension in the air.

Introduced at the beginning of World War II, insecticide aerosols were immediately adopted by the Armed Forces for protection of military personnel. These insecticides proved highly effective against many disease-carrying insects especially malaria-carrying mosquitoes in military barracks, tents, foxholes, under open air and quiet conditions and military transport planes. The Department of Agriculture was commended by both the Army and the Navy for this important contribution to the control of disease-carrying insects affecting their personnel. At the close of the war insecticide aerosols were promptly put to use by the civilian population. These liquified-gas propelled, pressurized formulations proved to be so efficient, convenient, and well accepted that this type of packaging was adopted for many other products. Department workers and industry have cooperated in developing various improvements in cheaper, lightweight containers, more efficient valves, etc., which have made these products standard household items. Cost of the original aerosol development by the Department was about $90,000.

Aerosol and related pressurized products based on this invention now include more than 250 different kinds of products as diverse as insecticides, room deodorants, mildew preventives, paints, hair sprays, shaving soaps, perfumes, glass cleaners, lubricants, and whipped cream. The total number of such pressurized units produced in the United States in 1960 was 730 million, with a value of about $880 million. Approximately 670 million pressurized units were used for nonfood purposes and 60 million such units for pressurized packaged foods, for example, whipped cream and starch. The following are some of the nonfood aerosol uses: Hair sprays, 116.9 million units; room deodorants, 81.8 million units; shaving creams, 68.2 million units; paints and coatings, 68.2 million units; space insecticides, 52.1 million units; cologne and perfume, 42 million units; glass cleaners, 19.7 million units; shoe and leather dressings, 17.4 million units; auto deicers, 14 million units; dental creams, 2.8 million units. Last year aerosol starch totaled 25 million units. In addition, several aerosol million units were exported.

The growth of the aerosol idea has resulted in the appearance of related new auxiliary industries and the expansion of others. For example, there are now (as of 1958) in the United States 4 manufacturers of chlorofluorohydrocarbon propellants, 16 manufacturers of aerosol and pressurized spray cans, 20 makers of aerosol valves, and 14 of aerosol loading equipment, as well as the numerous packaging companies. In addition to new domestic markets that have been created, foreign markets are tapped. Aerosol products are now being manufactured in 22 countries. These foreign manufacturers purchase the bulk of their valve components, many of their containers, and practically all loading equipment from the United States. Their plants also are usually designed and construction supervised by American Companies.

About 130 U.S. companies have applied for and obtained licenses under 2,321,023. There are easily another 130 companies who utilize the invention but have not applied for a license. Representative companies among these which have obtained licenses are:

E. I. du Pont de Nemours & Co.
General Chemical Division, Allied Chemical Co.
Pennsalt Chemical Corp.
Esso Standard Oil of New Jersey.

Gulf Oil Co.
Airkem, Inc.
Midland Laboratories.
Cook Chemical Co.
Chase Products.
Fuld Bros.
Regal Chemical Co.
Guardian Industries.
Aerosol, Inc.
Aerosol Corp. of the South.
A–M–R Co., Inc.
Shulton, Inc.
Western Filling Corp.
Chase Gardens.
Edco Corp.
Virginia Smelting Co.
Plant Products Corp.
A. S. Johnson.
American Home Products.
Lever Bros.
Colgate-Palmolive Co.

Licenses have not been required under patent No. 2,517,555 but it, too, has been widely utilized by industry.

AGRICULTURAL RESEARCH SERVICE—ENTOMOLOGICAL RESEARCH DIVISION

Allethrin (insecticide)

Patent No.: 2,603,652.
Names of inventors: M. S. Schechter and F. B. LaForge.
Title: Cyclopentenolone Esters of Cyclopropane Carboxylic Acids
Date of issuance: July 15, 1952.

The synthesis of allethrin, an insecticide of very low mammalian toxicity, that is highly effective against house flies, mosquitoes, and other household pests, is an example of an important practical development resulting from basic chemical research.

In March 1949, chemists of the Bureau of Entomology and Plant Quarantine at Beltsville, following extensive research on the structure of the active constituents of pyrethrum, announced the synthesis of insecticidal esters similar to natural pyrethrum. This announcement brough a flood of requests from industry for technical data and advice on the method of synthesis. By the fall of 1951 allethrin, the most important of these new esters, was in commercial production by the Fairfield Chemical Division of Food Machinery & Chemical Corp., and by Venzol Products Co., and a third plant for its manufacture was under construction by Carbide & Carbon Chemicals Co. In 1956 the annual sales of allethrin were reported as about 20,000 pounds, with a sales value of $640,000. Approximate total sales of allethrin since its introduction probably have amounted to about $6 million. The cost to the Government of research and development of this insecticide was $70,000.

The strategic value of allethrin far exceeds the monetary value of current production. Used primarily in insecticidal aerosols and space sprays, allethrin was quickly adopted by the Armed Forces as a

replacement for pyrethrum. During World War II there had been a critical shortage of pyrethrum, which had to be imported, and there was great difficulty in obtaining sufficient quantities for the protection of military personnel. All pyrethrum supplies were taken over by the Armed Forces for the duration of the war. The discovery of allethrin freed the United States of dependence on foreign sources of supply for this strategic material.

Since patent 2,603,652 is dedicated to the free use of the people, no licenses are required.

AGRICULTURAL RESEARCH SERVICE—SOIL AND WATER CONSERVATION RESEARCH DIVISION

Granulated fertilizers

Patent No.: 2,287,759.
Names of inventors: John O. Hardesty, William H. Ross and Kenneth D. Jacob.
Title: Process for the Granulation of Fertilizers.
Date of issuance: June 23, 1942.

This process transforms finely divided fertilizer materials into pellets or granules under the action of a rotating cylinder by first adding a measured amount of liquid and heating the moistened mass at a temperature of 60° to 100° C.—which produces a viscous condition sufficient to hold the fine particles together as stable pellets or granules when they are subsequently dried.

The granulation of mixed fertilizers minimizes segregation of the constituents, reduces caking during storage, decreases loss by dusting, and facilitates application of the fertilizer in the field. It makes possible the production of mixed fertilizers containing much larger proportions of plant nutrients than otherwise would be feasible—thereby reducing transportation and handling costs per unit of nutrients—and it enables the manufacturer to use higher proportions of low-cost, high-analysis materials, such as anhydrous ammonia and nitrogen solutions, in their preparation.

The inventive features of this patent are widely used in sundry combinations with other ideas by the industry for fertilizer granulation, the blending of the ideas is such as to render impossible a reliable estimate of the commercial value of the specific process covered by the patent. It is estimated, however, that the overall net benefits of granular mixed fertilizers, as compared with similar grades of nongranular mixtures, average at least $3 per ton, or $12 million per year on the current annual domestic consumption of some 4 million tons of granular mixtures. The total benefit from granular mixtures during the period 1950 to 1958 is estimated to have been about $35 million.

The development cost to the Department of Agriculture was about $25,000.

The commercial application of this product began about 1950.

The Bureau of Plant Industry, Soils and Agricultural Engineering, a predecessor of the Soil and Water Conservation Research Division was responsible for the development.

All of the large manufacturers of mixed fertilizers in the United States now produce granulated mixtures, and thus use the features of this patent in some degree.

AGRICULTURAL RESEARCH SERVICE—SOIL AND WATER CONSERVATION RESEARCH DIVISION

Noncaking fertilizer

Patent No.: 2,307,253.
Names of inventors: Jew Y. Yee and Royall O. E. Davis.
Title: Process for the Production of Noncaking Fertilizer Materials.
Date of issuance: January 5, 1943.

This invention is a method of treating granular fertilizers with finely pulverized insoluble materials to prevent the fertilizer from caking during shipment and storage. The fertilizer is agitated in the presence of gaseous ammonia with added pulverized peat, or other ammonia-insoluble material, until an adherent coating is firmly attached to the fertilizer granules. The method is applicable to various granular fertilizer products, including ammonium nitrate, urea, sodium nitrate, and mixed fertilizers. The processing of granular fertilizers by this method also improves the drillability of the fertilizer and enables more uniform distribution in the field.

Commercial application of this mathod began about 1945. The total benefit from the production of such fertilizers during the period 1945 to 1950 is estimated to have been around $4.5 million.

Although no licenses have been issued under this patent, one or more of its features are known to be used by many manufacturers of granular fertilizers throughout the country. It is estimated that the overall, net benefits of granular fertilizers made with the aid of one or more features of the patented invention average about $0.50 per ton and total some $700,000 for the current annual production.

The development cost of this product to the Department of Agriculture was about $5,000.

AGRICULTURAL RESEARCH SERVICE—ANIMAL HUSBANDRY RESEARCH DIVISION

Fiber devices

Patent No.: 1.957,886.
Name of inventor: J. I. Hardy.
Title: A Device for Determining Wool Fineness.
Date of issuance: October 29, 1932.

Patent No.: 1.940,590.
Name of inventor: J. I. Hardy.
Title: A Device for Determining Fiber Fineness and Cross Sectioning Fibers.
Date of issuance: December 14, 1932.

Patent No.: 2,011,444.
Name of inventor: J. I. Hardy.
Title: A Device for Cross-Sectioning Fibers.
Date of issuance: April 23, 1935.

Patent No.: 2,048,335.
Name of inventor: J. I. Hardy.
Title: A Device for Making Thin Cross-Sections of Fibers.
Date of issuance: June 7, 1935.

The Hardy cross section devices in use in commercial mills and laboratories enable technicians to obtain information on the internal structure of hair, fibers, and furs quickly and accurately. They are especially valuable in the detection of questionable or fraudulent practices in the labeling of products made of animal, vegetable, or manmade fibers—actually they have made the work of the Federal Trade Commission possible in this area. They also enable technicians

to determine the fineness and variability of fibers which are to be used for quality fabrics or to determine characteristics essential for use in the blending of fibers for specialty fabrics. The devices also aid in the identification of materials of various kinds which might be connected with the detection of crime. The invention of these devices opened to others a new field for development of instruments which aid in the use and study of fibers. Modifications of the cross section devices and improved devices for studying length and other characteristics of fibers have resulted from these basic inventions.

The basic Hardy cross section device consists of two thin pieces of metal, a slotted piece and the other having a tongue the width of the slot. The fibers are placed in the slot, the tongue is inserted and hand pressure is applied so that the two pieces of metal form a "slide." The fibers are cut flush with one side of the metal slide and cut on the other side so that they extend slightly above the metal. A black base liquid is applied. The fiber section is then cut and the cross sections of the fibers in the slot of the metal slide are observed in the microscope or projector. Charts have been provided so that fiber fineness can be determined from the number of fibers within a 125 sq. cm. area and the measured diameters of four of these fibers. A further addition has been a filmstrip so that the slide can be compared with a picture of known fineness and standard deviation.

There is a similar device made of a slightly thicker metal which, in addition, has a plunger, the exact measurements of the slot. This plunger is moved by a knurled screw and the fibers are extruded as the plunger moves upward. The extruded fibers are coated with a cellulose acetate solution, which dries in a thin film, holding the fibers in place. A section is then cut and prepared for observation. This method and device have been useful in studying pigmentation and identifying hairs and fibers.

In addition, there is a larger device which uses the above principles and is used for mounting wool top for fineness determinations based on cutting of many fibers to exact lengths, floating them in mineral oil and measuring diameter of individual fibers. This device is also used for cross sections of bristles, horsehair, or other hairs too large in diameter for the smaller devices.

These cross section devices are manufactured by A.M. de La Rue, 3406 Lancer Drive, Hyattsville, Md.

Today these devices are conservatively estimated to have an annual value of $8 million to the industry and an incalculable value in crime detection to the FTC, manufacturers, and consumers. The instruments have been in use for approximately 30 years, with an estimated total value of at least $200 million.

The cost of this achievement was approximately $5,000.

AGRICULTURAL RESEARCH SERVICE—AGRICULTURAL ENGINEERING RESEARCH DIVISION

Cottonseed drying apparatus

Patent No.: 1,871,773.
Name of inventor: Charles A. Bennett.
Title: Apparatus for Drying Seed Cotton.
Date of issuance: August 16, 1932.

This is the most important patent on seed cotton drying equipment and process obtained by Mr. Bennett. This is the well-known tower

drier which is commercially available from most manufacturers of ginning equipment. The tower has horizontal shelves arranged for zigzagged travel of the seed cotton from top to bottom of the chamber. The cotton is moved through the drier by hot air which also does the drying. The air moves faster than the cotton. The drier has no moving parts.

Proper drying of seed cotton is the foundation upon which has been built the improved ginning equipment and techniques which are solving the ginning problems resulting from (1) the trend toward longer staple, finer fibered cottons more difficult to clean and more difficult to gin without damage than the varieties replaced, and (2) the introduction of labor and cost reducing mechanical and rough hand harvesting practices.

It is estimated that about $75,000 was spent in developing seed cotton driers and that the apparatus has been worth at least $100 million to cottongrowers up to and including the 1958 season and it also created another new and marketable product for cotton processing machinery manufacturers.

AGRICULTURAL RESEARCH SERVICE—AGRICULTURAL ENGINEERING RESEARCH DIVISION

Seed dusting machine

Patent No.: 2,026,499.
Names of inventors: W. M. Hurst and F. D. Fulton.
Title: Seed Dusting Machine.
Date of issuance: December 31, 1935.

This seed dusting machine uses the weight of the seed to actuate a feeding device for automatically adding fungicides or other dusts at a predetermined rate for treating. Equipment using this principle has been widely used. Several seed processing companies constructed and used these dusters and at least two companies have manufactured machines using the seed in some fashion for operating the dust-feeding apparatus. The machine does, however, save considerable labor in treating seed with dust and in some cases resulted in the sale of treated seed by a seed processor at no increase in price. However, it is evident that they greatly exceed the cost of development. Equipment of this type was in considerable demand for about 10 years, but decreased with the increased adaptation of the slurry method of treating seeds.

It is estimated that the development costs about $15,000. Information is insufficient to provide reliable estimate as to the value of the development.

AGRICULTURAL RESEARCH SERVICE—AGRICULTURAL ENGINEERING RESEARCH DIVISION

Fluid velocity measuring instrument

Patent No.: 2,061,941.
Name of inventor: William V. Hukill.
Title: Device for Measuring Fluid Velocity.
Date of issuance: November 24, 1936.

This device is extensively used as a research instrument and is available from three or more instrument companies. It is also known

as a thermocouple anemometer, is an effective instrument for measuring air velocities from 0 to 1,000 feet per minute. It consists essentially of a thermocouple both junctions of which are exposed to the airstream and with one junction heated. The difference in temperature between the junctions depends upon the cooling effect of the moving air. With suitable calibrations, voltage readings may be translated to air velocity. It is particularly suitable for velocity below about 200 feet per minute and is still the only satisfactory method for measurement of velocities below about 50 feet per minute.

It is estimated that the instrument cost about $10,000 to develop. It is estimated that benefits exceed the cost several fold.

AGRICULTURAL RESEARCH SERVICE—AGRICULTURAL ENGINEERING RESEARCH DIVISION

Lint cotton cleaner

Patent No.: 2,569,501.
Names of inventors: V. L. Stedronsky and C. S. Shaw.
Title: Lint Cotton Cleaner.
Date of issuance: October 2, 1951.

Lint cleaners are used for cleaning cotton after it is ginned, but before it is pressed and baled. The subject patent covers a machine which uses sawteeth to engage the lint for rubbing against gridbars for loosening and removing trash entangled in the fiber. This development has been an important factor in effective ginning of seed cotton from mechanical and rough hand harvesting methods.

This invention is incorporated in most of the lint cleaners which are now available from most gin machinery manufacturers and in general use throughout the Cotton Belt. During the 1952 ginning season about 800 gins in this country had lint cleaners as a result of this development. In 1958 about 4,000 of the 6,500 operating gins in the United States had 1 or more lint cleaners. Gins equipped with lint cleaners handled about 80 percent of the cotton ginned from the 1958 crop.

It is estimated that the cost of development of the flow-through lint cleaner approximated $75,000. The accumulated benefit to farmers from lint cleaners from 1952 to 1958, inclusive, approximates $75 million. The invention has also created another new and marketable product for gin machinery manufacturers.

AGRICULTURAL RESEARCH SERVICE—AGRICULTURAL ENGINEERING RESEARCH DIVISION

Seed cotton cleaner

Patent No.: 2,836,856.
Name of inventor: Gerald N. Franks.
Title: Seed Cotton Cleaner.
Date of issuance: June 3, 1958.

The seed cotton cleaner is of particular importance for the ginning of trashy seed cotton from stripper-type harvesters and hand snapping. It has horizontal cyclinders with peripheral teeth which engage the seed cotton for sling-off cleaning aided by gridbars. This USDA-developed stick remover is especially effective in removing limbs and

large trash. Cleaners using this sling-off principle are available in some form from practically all manufacturers of ginning machinery.

It is estimated that the cleaner cost about $50,000 to develop. Such cleaners have been in widespread use for about 3 years and the improvement in grade of cotton and other benefits to cotton producers approximate $15 million up to and through the 1958 ginning season. This amount does not include the value of the product as a marketable manufactured item.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Reversible circulation internal fan kiln

Patent No.: 1,466,518.
Name of inventor: Rolf Thelen.[1]
Title: Reversible Circulation Internal Fan Kiln.[2]
Date of issuance: August 28, 1923.

Patent No.: 1,499,627.
Date of issuance: July 1, 1924.

Patent No.: 1,509,849.
Date of issuance: September 30, 1924.

Patent No.: 1,536,735.
Date of issuance: May 5, 1925.

Patent No.: 1,539,817.
Date of issuance: May 26, 1925.

Patent No.: 1,541,294.
Date of issuance: June 9, 1925.

Patent No.: 1,541,443.
Date of issuance: June 9, 1925.

Patent No.: 1,543,344.
Date of issuance: June 9, 1925.

Patent No.: 1,543,459.
Date of issuance: June 23, 1925.

Patent No.: 2,001,001.
Date of issuance: May 14, 1935.

[1] Name of inventor same in each instance.
[2] Title same in each instance.

The development of the basic principles of the reversible circulation internal fan lumber dry kiln represented by these patents was a very significant contribution to the lumber-producing and wood-using industries. The major dry-kiln companies are now designing and building dry-kiln equipment based on the fundamental principles described in the patents. Other types of dry-kiln equipment, such as natural circulation and external blower forced-air circulation kilns, are not now being installed in any important commercial productive capacity. It is estimated that 12,000 internal fan dry-kiln installations are now in use. Since the capacities of the installations vary from 25,000 to 100,000 board feet, the estimated investment in this dry-kiln equipment is at least $600 million.

The basic invention, and subsequent improvements by dry-kiln engineers and manufacturers, has enabled industry to produce kiln-dried material with greatly improved moisture quality control. Seasoning degrade has been reduced and drying time shortened. About 40 percent of the total lumber produced in the United States is being

dried in reversible circulation internal-fan-type kilns. This means that 16,000 million board feet of lumber, dimension stock, finish and other lumber items with a market value in excess of $1.5 billion are being dried better, faster, and more economically in dry kilns whose design and operational features are described in the original patents.

This basic invention and its improvements created a new product for kiln manufacturers, an improved product which increased demand, and a benefit to the purchaser, builder, and consumer of lumber.

The cost to the Government of research leading to these patents is estimated at about $65,000.

This patent was dedicated to the public.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Plywood process

Patent No.: 2,321,258.
Names of inventors: Alfred J. Stamm and Raymond M. Seborg.
Title: Process for Making an Improved Plywood.
Date of issuance: June 8, 1943.

Patent No.: 2,354,090.
Names of inventors: Alfred J. Stamm and Raymond M. Seborg.
Title: Plywood.
Date of issuance: July 18, 1944.

These patented inventions describe a procedure based on research at the U.S. Forest Products Laboratory, Madison, Wis., for impregnating veneer with a resin-forming solution in the fine structure of the wood, and for polymerizing the resin after impregnation, that is, to change it into another compound having the same elements in the same proportions but with a higher molecular weight and different physical properties. The resin used is soluble in water, which can be converted by heat to a water-insoluble material.

The inventions also relate to simultaneous compression and polymerization, and for combining the materials produced with untreated wood.

The product resulting from the impregnation-polymerization process has been named "impreg" while that involving compression has named "compreg." The process results in a reduction, to as little as one-third of the original, of the dimensional change that ordinarily occurs in wood with changing moisture content, thus largely overcoming one of the basic difficulties in the use of wood.

The impreg process had little commercial use for some years until it was demonstrated to auto manufacturers that its use for models from which to cut steel dies for stamping auto parts could save them large amounts of money. Models made from impreg change dimension relatively little in storage and require little reworking prior to reuse. The manufacture of impreg is now a multimillion dollar industry, since virtually all auto manufacturers are using it for making die models.

Compreg was used chiefly during World War II for trainer-plane adjustable-pitch propellers, motor-test propellers, antenna masts, spar and connector plates, refrigerator blocks for ships, and tooling jigs. Compreg was found extremely useful for aluminum drawing and forming dies, drilling jigs, and jogs for holding parts in place for welding because of its excellent strength properties, dimensional stability, low thermal conductivity, and ease of fabrication.

Compreg is being used to a considerable extent for knife handles and for picker sticks in looms. It also shows promise for use in silent gears, pulleys, water-lubricated bearings, fan blades, shuttles, instrument bases and cases, electrical insulators, tool handles, and various novelties.

Compreg and semicompreg also show promise for future use as facing materials for ordinary plywood. These facing materials may find external use in house, trailer, and boxcar panels and in boat siding, and internal use in panels, furniture, and flooring. The original finish of compreg can be restored by sanding with fine sandpaper and then buffing.

These patents were assigned to the Secretary of Agriculture.

Cost of the research leading to these patents is estimated as about $160,000.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Compressed resinated paper sheets

Patent No.: 2,482,142.
Names of inventors: Gardner H. Chidester, Parker K. Baird, George E. Mackin, Forrest A. Simmonds, Clarence O. Seborg, Mark W. Bray, and John N. McGovern.
Title: Structural Material of Compressed Resin Impregnated Paper Sheets.
Date of issuance: September 20, 1949.

Research at the U.S. Forest Products Laboratory, Madison, Wis., which resulted in this invention was motivated by the scarcity of aluminum for aircraft manufacture during the early years of World War II and the desire for materials having high strength for their weight. Modification in the properties of the paper gave a plastic that was comparable in tensile strenth on a weight basis to that of aluminum. Being of lower density than aluminum, the paper plastic material would necessarily have a larger cross-sectional area than an aluminum piece of equal strength.

Strength properties can be made relatively the same in all directions in the plane of the sheet, or directional characteristics can be had depending on the needs of design. Moderate double-curvature sections and tubular sections or slight taper variations are readily achived with this material. Special purpose items such as springs of various geometrical shapes have been designed having desired load-deflection characteristics under drastic atmospheric conditions. It is superior to other laminates owing to its high chemical and abrasion resistance, uniform density, and low ash content.

During the war this high-strength plastic found numerous uses, most of them for various parts of military aircraft and proximity fuses. Since the war the demand for a high-strength paper plastic is not great. However, there is a greater demand than before the war for paper plastics of moderate strength. Therefore, some of the companies that manufactured the high-strength material during the war have continued to manufacture paper plastic (papreg) for decorative and other uses. Papreg has been used to some extent for heavy-duty truck floors, industrial processing trays for nonedible materials, and in combination with melamine-treated papers for decorative tabletops. It also is suitable for pulleys, gears, bobbins, and many other objects for which fabric laminates are used. The principal

markets at the present time are decorative wall paneling, aluminum foil and siding, tabletops, and other furniture applications and special products.

Production data are not available for estimating the economic worth of this development. However, its technical value is important because of its suitability for highly specialized uses, especially those of a military nature, various construction purposes, and its potentialities for space age applications.

The cost to the Government in developing this product is estimated to have been about $100,000.

This patent was dedicated to the public.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Prefabricated building construction

Patent No.: 2,148,575.
Names of inventors: John A. Newlin and George W. Trayer.
Title: Prefabricated Building and Building Construction.
Date of issuance: February 28, 1939.

This patented invention relates to the stressed-cover construction developed at the U.S. Forest Products Laboratory, Madison, Wis.

This invention pertains to cover plates of plywood or a suitable building board glued to wooden framework to form a box girder. The panels are designated as stressed-cover panels because the glued joint between the covers and the framework forces the panel to act as a unit. Thus, when load is applied to a panel, each element, including the covers, is under stress and contributes to support of the load. This is in contrast to the usual construction in which the coverings (flooring and ceiling) contribute nothing to support of the load.

The stressed-cover principle is based upon the engineering concept that all material in a structure should contribute directly to its strength. The stressed-cover principle gives opportunity to design more closely and with greater economy of material.

The stressed-cover construction described in the patent probably did not create a new market potential for wood, for its use is essentially restricted to homes and it is doubtful that more homes were built because of its introduction. However, this principle did contribute to more efficient use of wood in housing and thus is important in promoting better wood utilization.

The prefabricated house industry came into being because of the stressed-cover principle, and this principle in one form or another is the basis for most of the panelized construction in the industry today. During the past 20 years the industry has grown steadily until today about 1 house in 10 is prefabricated. Thus nearly 100,000 houses a year are constructed according to the principles of this patent.

The estimated cost to the Government of this development is $85,000, including the building, under contract, of two complete demonstration houses.

This patent was dedicated to the public.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Wood moisture indicator

Patent No.: 1,875,395.
Names of inventors: Chauncy G. Suits and Matthew E. Dunlap.
Title: Moisture Indicating Instrument for Wood.
Date of issuance: September 6, 1932.

Physical and mechanical properties of wood generally vary with its moisture content, and proper utilization of wood is related to its moisture content when fabricated or installed. Prior to the discovery of this invention and issuance of this patent, wood-moisture determinations were destructive and time consuming. Research had disclosed the species moisture content electrical resistance relationships which became the basis for the development at the U.S. Forest Products Laboratory, Madison, Wis., of the instrument described in the patent.

The instrument demonstrated that electrical resistance of wood could be measured on a portable meter by means of electrodes driven into the wood and the resultant moisture content readings would be accurate, instantaneous, and nondestructive. Electrical instrument companies, using the principles described in the patent, developed moisture meters that are now widely used by lumber producers and wood-using industries to provide for better moisture quality control and thus for improved utilization of wood.

This cost of development is estimated as about $25,000.

This patent was dedicated to the public.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Processes for plasticizing wood products

Patent No.: 2,298,017.
Name of inventor: William Karl Loughborough.
Title: Process for Plasticizing Lignocellulosic Materials.
Date of issuance: October 6, 1942.

Patent No.: 2,313,953.
Name of inventor: William Karl Loughborough.
Title: Process for Resinifying Lignocellulosic Materials.
Date of issuance: March 16, 1943.

The above patented inventions are for a process for plasticizing, hardening, and reducing the shrinkage and swelling of wood by means of impregnating the wood with urea or water soluble ruea-formaldehyde resin-forming compounds. The urea-formaldehyde compounds are subsequently converted into resins within the wood.

This plasticization process arose from an observation that oak treated with urea to ease seasoning difficulties became thermoplastic. It was hoped that urea treatment, followed by heating in the dry condition, would plasticize wood for bending. Plasticization had previously been accomplished by steaming. The resinification treatments arose from general knowledge that urea and formaldehyde polymerize upon heating to form thermosetting compounds. The aim here was to provide dimensional stability, increased hardness, and wear resistance to wood. Since the resin-forming solutions were buffered to stay in an unpolymerized state during treatment, it was possible to treat green solid wood of large dimensions to a consider-

able depth. Previous treatments with phenol-formaldehyde resins required thin veneer and pressure treatment.

Although a number of licenses were granted to use the processes shortly after the patents were issued, commercial development was not extensive. For some time a basket manufacturer used a combination urea and steaming treatment to plasticize hoop stock. He reduced breakage considerable. For general wood bending, some tests have shown that urea-treated stock is more subject to breakage than a steamed stock, so steaming is still the commercially used method of plasticizing bending stock.

The patented urea-formaldehyde resinifying treatment was never used commercially in the original form, but it stimulated a chemical manufacturer (Du Pont) to develop a process whereby sizable items of some of the more permeable woods were treated with a urea-formaldehyde solution by pressure. This development was used commercially by two or more firms. At one location, roughly 1 million board feet per year of southern pine, white pine, basswood, and maple were treated for use as clear strips on belts and other parts that moved in and out of water or solutions, handling textiles. When carding wool with equipment made from treated wood, the wool did not ballup as when untreated wood was used.

So far as is known, the processes, either in the original patented form or in commercial modification, are not being used commercially at this time. For dimensional stabilization and some of the other improvements possible through resinification, the phenol-formaldehyde processes, (see patents 2,321,258 and 2,354,090) proved to be superior. These processes are being used commercially. However, the urea-formaldehyde method still has the ability to form uncolored or lightly colored products and may yet develop commercial polsibilities.

The cost of research to the Government leading to these patents is estimated as about $40,000.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Dry kiln for drying lumber and other moisture-bearing substances

Patent No.: 1,228,989.
Name of inventor: Harry D. Tiemann.
Title: Dry Kiln for Drying Lumber and Other Moisture-Bearing Substances.
Date of issuance: June 5, 1917.

This patented invention is a water spray lumber dry kiln which was invented at the U.S. Forest Products Laboratory, Madison, Wis. The dry kiln provides good control of relative humidity during the drying of wood. This design became obsolete after 7 to 10 years of intensive use due to further research at the Forest Products Laboratory that resulted in the invention of the reversible circulation internal fan dry kiln. However, its use during World War I demonstrated that kiln drying of even the more difficult to dry hardwood species could be accomplished with a minimum of seasoning degrade, and enabled industry to meet the tremendously increased demand for seasoned wood during this critical time. The Tiemann water spray kiln was used to kiln dry green walnut for gun stocks, thick oak for wagon parts, and Sitka spruce and other woods for an expanding aircraft industry.

The hundreds of water spray dry kiln installations that were constructed to meet these wartime demands confirmed the belief that rapid seasoning of green hardwoods could be accomplished properly and efficiently. The invention of the water spray lumber dry kiln and its operation during the war period significantly aided the lumber industry in its World War I commitments and paved the way for significant advances in the technology of kiln drying wood.

The cost of this development to the Government is estimated as about $35,000.

This patent was dedicated to the public.

U.S. FOREST SERVICE—FOREST PRODUCTS LABORATORY

Process for making woodpulp

Patent No.: 1,859,845.
Names of inventors: John D. Rue, Sidney D. Wells, and Francis G. Rawlings.
Title: Treatment of Wood for the Production of Pulp.
Date of issuance: May 24, 1932.

Patent No.: 1,859,846.
Names of inventors: John D. Rue, Sidney D. Wells, and Francis G. Rawlings.
Title: WoodPulp and Process of Making the Same.
Date of issuance: May 24, 1932.

Patent No.: 1,859,847.
Names of inventors: John D. Rue, Sidney D. Wells, and Francis G. Rawlings.
Title: Pulped Material and Process of Preparing the Same.
Date of issuance: May 24, 1932.

These inventions relate to the neutral sulfite semichemical pulping process developed at the Forest Products Laboratory about 1925 and studied intensively since then at the Laboratory.

Semichemical pulping is a process for softening chipped wood with a chemical solution under relatively mild temperature and short duration of time compared to complete chemical pulping. The softened chips are fiberized, or reduced to a pulp, by mechanical processing, usually with a disk mill. Several chemicals can be used. The most common one is a neutral solution of sodium sulfite. Since it is the chemical most commonly used, the term "semichemical process" without further description is generally understood to mean the "neutral sulfite semichemical process."

With this process, pulps of high quality for specific uses can be produced in the yield range of 55 to 85 percent in contrast to the yield range of 40 to 50 percent which is typical of fully cooked chemical pulps. With this process, good quality pulp is obtained from even the oaks, which were once regarded as the poorest of woods for papermaking.

Semichemical production is spread throughout the country in 36 mills and accounts for about 7 percent of the total pulp production. Its economic importance in the United States has grown to a tangible product value approaching $200 million in 1958. A positive but less tangible value relates to improved forest management resulting from stand improvement through the removal of timber which would have had little or no economic value without the availability of the semichemical pulping process.

The woodland owner and consumer alike have benefited by this development. The largest use of the process is for making the corru-

gating board used in the manufacture of shipping containers. The properties of this board are superior to those made from other materials. It can be made from low-grade cheap wood. The cost of the shipping container is low in comparison with wooden containers. The process is also applicable to the pulping of wood for the manufacture of writing and printing paper, and this practice is growing. The process accounts for the use of over 1½ million cords of hardwoods, most of which is too low in quality for other purposes. This is a market which did not exist earlier.

An estimate of the cost to the Government of the work done as a basis for the patents is about $10,000 per year for about 5 years or a total of $50,000. In addition, about $16,750 in commercial cooperative funds (Southern Extract Co., Knoxville, Tenn.) were spent on the project. Since 1945 the semichemical pulping of numerous hardwoods has been an important part of the Forest Products Laboratory pulp and paper research program. Though much of this work has been supported by private industry, a considerable amount has been done with Government funds. The exact amount contributed by the Government cannot be estimated because the allocation of funds has been distributed among species and regional wood studies as well as pulping process studies.

These patents were assigned to the Secretary of Agriculture.

U.S. FOREST SERVICE—CALIFORNIA FOREST AND RANGE EXPERIMENT STATION

Soil moisture meter

Patent No.: 2,526,636.
Name of inventor: Edward A. Colman.
Title: Moisture Measuring Instrument.
Date of issuance: October 24, 1950.

This is a fiberglass electrical soil moisture meter which operates on the principle of measuring electrical resistance in a porous dielectric that is moisture equilibrium with the surrounding soil.

The moisture meter was developed during World War II while Dr. Colman was an employee of the Forest Service at the California Forest and Range Experiment Station, Berkeley, Calif. It is of interest that effort of several conscientious objectors with electronics or electrical engineering backgrounds was also utilized in its development.

The instrument is particularly useful for field and laboratory research, or in situations where soil moisture determinations are significant. Such determinations are important in determining site quality for both forest and rangeland; for analyzing the response of vegetation to environmental conditions or treatments; for determining the water reservoir capacity of soils at any given time as an indication of anticipated runoff or infiltration of water; and for determining the suitability of soils as media for developments of diseases or insect populations.

Although it is not possible to estimate the monetary worth of this development under the free use patent, the instrument has made possible large savings in time of forestry and agriculture research workers and greatly improved the accuracy and reliability of soil moisture determinations.

The direct cost to the Government of this invention is estimated at about $5,000. The patent was assigned to the Secretary of Agriculture.

U.S. FOREST SERVICE—SOUTHEASTERN FOREST EXPERIMENTATION STATION

Acid sprayer (squeeze-bottle atomizer)

Patent No.: 2,531,745.
Name of inventor: Clifford S. Schopmeyer.
Title: Squeeze-bottle Atomizer for Acid Liquids.
Date of issuance: November 28, 1950.

Patent No.: 2,573,731.
Names of inventors: M. C. Ryberg, H. W. Burney and F. L. Joy.
Title: Acid Metering and Atomizing Nozzle.
Date of issuance: November 6, 1951.

Patent No.: 2,602,191.
Name of inventor: F. L. Joy.
Title: Mold Mandrel.
Date of issuance: July 8, 1952.

In 1933, a technical publication in the Soviet Union reported an increase in yield in oleoresin from tapping Scots pine by spraying a freshly made wound with a strong solution of sulfuric acid. Later work on slash and longleaf pine in the United States by the Southeastern Forest Experiment Station of the U.S. Forest Service showed that a sulfuric acid treatment not only increased the flow rate of oleoresin from these species, but also prolonged the period of flow from a single wound. The potential usefulness of this treatment in lowering production costs on commercial gum naval stores operations was very obvious, but this advantage could not be realized in practice because of the difficulties encountered in applying the corrosive solution in commercial operations.

This bottleneck was broken in 1947 when employees of the Lake City Research Center, Lake City, Fla., a unit of the Southeastern Forest Experiment Station, developed the first operational model of an all-plastic, acid-resistant sprayer for applying sulfuric acid to the naval stores wounds. This work led to the Schopmeyer patent, and, subsequently, to two additional patents (Ryberg, et al., and Joy) that covered certain improvements.

The sprayer operates by hand pressure obtained by squeezing a plastic bottle. The operation is the same as that involved in the use of underarm deodorant, nasal sprays, colognes, cleaners, and other sprays that appeared on the market after the first model of the acid sprayer was developed.

This improved sprayer is now being used on about 80 percent of all naval stores faces being worked in the gum naval stores industry and has resulted in about a 50-percent reduction in the labor requirement for wounding the trees. In 1958, this represented a release of about 400,000 man-days of labor for other types of work in the woods, or an annual monetary saving of well over $3 million.

However this device, an all plastic bottle sprayer, has found great commercial acceptance for other uses. The greater impact of this invention is in areas other than the gum naval stores industry and so the background knowledge is not available to estimate the invention's full industrial value.

The total cost of the research that resulted in these three patents to the Government is estimated as about $18,000.

Patents Nos. 2,531,745 and 2,573,731 were assigned to the Secretary of Agriculture; patent No. 2,602,191 was dedicated to the public.

USDA—AGRICULTURAL MARKETING SERVICE

Cotton fiber blender

Patent No.: 2,734,230.
Names of inventors: William J. Martin and J. E. Larrison.
Title: Cotton Fiber Blender.
Date of issuance: February 14, 1956.

This patentable invention is a mechanical fiber blender made up of a feeding mechanism and a blending cylinder. Approximately 10 grams of cotton are fed slowly by the feeding mechanism to the blending cylinder which revolves at a high rate of speed and thus thinly spreads the fibers. The building up of the thin layers on the cylinder walls blends the fibers in such a manner that three passes through the machine produces a homogeneous sample from a number of pinches of cotton taken from different places in a larger sample. This blender allows a technician to prepare samples for testing in one-fifth of the time required for hand blending. Futhermore, it provides a more homogeneous sample than hand blending and thus gives more accurate results. The device is used primarily in research laboratories.

The development of the blender was done in the Stoneville, Miss., and Washington, D.C., laboratories of the Department of Agriculture. A pilot model and a redesigned model were constructed at Stoneville, Miss., and the evaluation work was performed at Washington, D.C.

It is estimated that the cost of developing this instrument is $5,000.

A redesigned instrument employing the principles of this patent is manufactured by the Custom Scientific Instruments, Inc., Arlington, N.J.

USDA—AGRICULTURAL MARKETING SERVICE

Duplex cotton fiber sorter

Patent No.: 1,932,095.
Name of inventor: Dr. R.W. Webb.
Title: Duplex Cotton Fiber Sorter.
Date of issuance: October 24, 1933.

This invention is a cotton device sorter which is made up of a double bank of parallel combs spaced at approximately ⅛-inch intervals and arranged so that individual combs in each bank can be lowered one at a time and the two banks can be revolved to opposite positions. Thus, the transfer of fibers from one bank of combs to the other in sorting them into different lengths is accomplished with ease. This sorter enables a technician to make an array of fiber lengths in a cotton sample in considerably less time than formerly required.

The sorter has limited commercial use because of the time required to perform a test. The Department of Agriculture uses this device primarily in the preparation of staple standards which must be precise in length and for other research or special purposes.

The development of the sorter was done at the plant of Alfred Suter in New York City based on ideas of Dr. Webb occurring during

the course of his research work on fiber length, strength, and uniformity. The cost of the pilot model was borne by the Suter plant. It was then evaluated by the Department employees in Washington and field cotton laboratories and adapted.

This sorter is manufactured commercially by Aldred E. Suter, textile engineer, New York, N.Y.

USDA—AGRICULTURAL MARKETING SERVICE

Egg grading

Patent No.: 2,700,321.
Names of inventors: A. W. Brant and K. H. Norris.
Title: Method and Apparatus for Detecting Blood in Eggs.
Date of issuance: January 25, 1955.

Patent No.: 2,833,408.
Names of inventors: K. H. Norris and A. W. Brant.
Title: Egg Separating Machine.
Date of issuance: May 6, 1958.

In 1950, a program of research was initiated in the development of egg grading equipment and procedures. This program has been in part cooperative with the Agricultural Research Service. The objective of this work was to study efficient and objective means of measuring internal quality and defects in shell eggs. Scientific information and data of considerable value to the egg industry has been derived from this program. The work was carried through to the development of practical equipment and machines having nondestructive sensing elements that permit automatic sorting. A number of improved and new devices were developed.

The presence of small quantities of blood in eggs represents a serious problem to the egg industry. The sorting of eggs for this defect was done by hand candling and only at an accuracy of about 50 percent. A method for detecting blood which can be adapted to automatic egg sorting was developed by research engineers and poultry scientists of the Department at the Agricultural Research Center, Beltsville, Md., as part of the overall project. This method gives an accuracy of 80 percent at a speed of 20 cases of eggs per hour. The speed could be faster but this rate is that of normal egg handling equipment. This process is based on the spectrophotometric measurement of the blood absorption in an intact egg. The apparatus used for this process is a monochromator, egg holder, special phototube, and recording voltmeter. This development has not been put into commercial use as yet, but it is being used on a trial basis. The full use of this development can save the egg industry more than $1 million a year in labor costs and produce saved.

The estimated value of the market for this machine is $10 million.

The cost of the blood detection development to the Department of Agriculture is estimated at $50,000.

Another development in this overall program was an automatic machine to sort eggs into six different shell color classes. The development has not been used, but may be of considerable value to the egg industry because it makes possible a uniform appearing pack for eggs. The egg separating machine is made up of a conveyor for feeding eggs into the measuring unit where a photoelectric device determines the shell color. The photoelectric device operates the reject mechanism to place the eggs in a collecting tray according to the measured shell

color. It is not possible to state the value of this development at the present time because eggs are not sorted into color classes. This work was also done by research engineers and poultry scientists of the Department at the Agricultural Research Center, Beltsville, Md., as part of the overall project on automatic egg grading.

The estimated cost of this development to the Department of Agriculture is about $10,000.

USDA—AGRICULTURAL MARKETING SERVICE

Bag filler

Patent No.: 2,668,648.
Name of inventor: Earl W. Carlson.
Title: Bag-Filling Device.
Date of issuance: February 9, 1954.

The development of a bag-filling device facilitating prepackaging of fruits and vegetables, such as apples and oranges, is an example of a USDA patentable research development that has been widely adopted by industry.

This development was the result of a contract of the Transportation and Facilities Branch of the Marketing Research Division, AMS, with Earl W. Carlson, the inventor.

As customarily used, a chute is integrated into a bagging machine normally equipped with moving belts to feed the apples into the chute and a set of scales to weigh the apples. When the correct weight of apples is reached, the flow is halted and an operator pulls an open bag of transparent film over the chute and the apples it holds. The apples are then slipped from the chute into the bag, the top of the bag is secured, and the chute returns to normal position to receive more apples. An operator can pack more than 400 bags an hour with this machine.

Soon after publication of the description of the device, a commercial firm requested advice from the Transportation and Facilities Branch on manufacturing and distributing a bag-filling machine for commercial use. Three years later, the firm informed the Department that it had produced and sold some 4,000 packaging machines in various models incorporating the bagging device. These machines, with an estimated value in excess of $2 million, now are widely used by growers, shippers, and distributors for packaging apples, potatoes, onions, and citrus fruit. Although the device was developed primarily for bagging apples, its application to other commodities has been widely adopted.

The development of this bagging device has materially contributed to the commercial adoption of the prepackaging of apples in film bags, also developed under the same project. Apple producers in all sections of the country now market a major portion of their crops in consumer-size bags. An estimated 340 million bags, costing more than $5 million were so packaged during the 1958 season.

Labor savings in the packaging of apples alone is more than 1 cent per bag, or about $4 million annually. The marketing of small size apples and oranges was greatly stimulated by packaging them. The annual value to farmers of small apples now being sold in bags, but which were not otherwise marketable, is estimated at more than $2,500,000. Somewhat similar benefits are gained by growers of

oranges and other agricultural products packaged on various models of this machine.

The estimated annual value of this device, including savings in labor and other marketing costs, and the increased returns to farmers from sales of products such as small-size apples not otherwise marketable, is $10 million.

The adoption of this research development has created a new product for equipment manufacturers, created a market for fruit and agricultural products formerly not marketable, created a market for plastic films, and it is hoped a savings due to decreased costs to the consumer.

The development and evaluation work of this invention cost the Department of Agriculture about $25,000. The domestic patent rights of this invention were dedicated by the Department for free use by the public.

USDA—AGRICULTURAL MARKETING SERVICE

Dump basket

Patent No.: 2,801,126.
Names of inventors: Harold D. White and Rex E. Childs.
Title: Dump Basket.
Date of issuance: July 30, 1957.

In poultry processing plants, fresh-dressed, eviscerated birds are cooled to 40°F. or less, before they are packed, by submerging them in slush ice for approximately 2 hours. Chill tanks are roughly 5 feet long, 3 feet wide, and 2½ feet deep and are of heavy metal construction. When fully loaded with birds, ice, and water they weigh about 1,200 pounds. Because of this weight, the conventional method of removing birds from chill tanks is purely manual involving a 2-man crew and requiring 13.89 man-hours per 1,000 equivalent packed boxes of poultry. To reduce this labor, a dump insert basket, having a hinged bottom, was developed jointly by Department and Georgia Agriculture Experiment Research Station research workers. This basket fitted inside the chill tank. The filled basket was lifted out of the tank either by hoist or track mounted crane and its contents dumped on a poultry packing table by opening the hinged bottom.

The invention cut down the man-hours of labor needed to accomplish this task and as a result the labor cost; however, because of the later development of a hydraulic tank tipper and dumper which made possible the removal of 1,000 equivalent packed boxes of birds from chill tanks with 2.5 man-hours of labor, this dump basket has not come into commercial use.

The estimated cost to the Department of this developmental work was $1,000, and to the Georgia Agriculture Experiment Station $2,500, or a total of $3,500.

USDA—AGRICULTURAL MARKETING SERVICE

Moisture testing of grain and seed

Patent No.: 848,616.
Names of inventors: Edgar Brown and Joseph W. Duvel.
Title: Brown-Duvel Moisture Tester.
Date of issuance: March 26, 1907.

Patent No.: 2,360,108.
Name of inventor: Alfred Christie.
Title: High Frequency Desiccator.
Date of issuance: October 10, 1944.

Patent No.: 2,825,870.
Name of inventor: Joe R. Hart.
Title: Apparatus for Determining Moisture in Seeds and Grain.
Date of issuance: March 4, 1958.

The Brown-Duvel moisture tester is a laboratory device to determine the moisture content in grain and similar commodities. This is done by distillation (heating a specific quantity of the commodity in oil and passing the moisture vapors driven from the commodity through condensing tubes and collecting the condensed water). This device saves time and labor over the oven methods that were in use at the time of discovery. This was the first practical and accurate device developed in the United States for use in the routine testing of grain and similar commodities for moisture content and it was simple to operate. It is still used to some extent in the United States and is used rather extensively in Canada. This device was developed in the Department laboratories at Washington, D.C.

The desiccator is an electrical device which determines the moisture content of grain and other substances. This device saves time and labor in moisture determinations compared with oven methods but not when compared to other electrical methods available at that time. This device did not prove to be practicable because of the relatively high cost of manufacturing it, and because of competition by less expensive practical devices. Work on this device was done in the Department laboratories at Beltsville, Md.

The above patents (No. 848,616 and No. 2,360,108) were issued so long ago that no records are readily available from which an estimate can be made on their developmental cost to the Department.

The moisture content of grain and seeds is one of the most important factors in the maintenance and evaluation of cereal and seed quality. Its measurement is a factor of grade in the mandatory grain standards.

In 1951, a further program of research on the measurement of grain and seed moisture content was initiated. There were two broad phases to this program; the establishment of accurate and precise reference methods for moisture measure and developing equipment for practical moisture determination. The program was successful in devising new, accurate basic methods for moisture measurement and in indicating the variables and limitations of an electronic moisture meter.

The developed moisture tester is essentially a radio frequency oscillator. The coil in the tank circuit of the oscillator is placed inside of the cell into which the grain to be measured is poured. The presence of the grain in the cell causes a change in the distributed capacity of the coil which bears a linear relationship to the moisture content of the grain. The change in distributed capacity has to be compensated for by a corresponding change in the capacity of the variable condenser in the tank circuit in order to bring the oscillator back to resonance. These changes are plotted against the known moisture contents of grain samples to produce a chart.

The invention represents an attempt to produce a machine which would use a definite volume of grain instead of a definite weight. An

attempt was made to make cell and a hopper for delivering the grain into the cell which would cause the grain to flow into the cell at the same rate and produce the same degree of packing for each sample. Another purpose of this invention was to avoid the most time-consuming feature of meters now in use which is the necessity for weighing each sample.

This device has yet to be applied commercially and its value cannot be determined at the present time. The development cost of this device to the Department of Agriculture is estimated at about $1,000.

USDA—AGRICULTURAL MARKETING SERVICE

Automatic box filler

Patent No.: 2,896,384.
Names of inventors: Earl W. Carlsen and Alvin Baum.
Title: Automatic Box Filler.
Date of issuance: July 28, 1959.

In a number of apple packinghouses certain grades and sizes of fruit not needed to fill orders on hand are accumulated in standard boxes at the packing line and returned to storage as loose-packed fruit. The Agricultural Marketing Service negotiated with the Fruit Industries Research Foundation a research contract designed to reduce labor costs and increase the efficiency of packinghouse operations and under which a box filler was developed for automatically accumulating and loose packing this fruit.

To begin an operating cycle, an empty box is fed by a gravity conveyor line onto a cradle. As the empty box falls into a tilted filling position on the cradle, it releases a filling chute that was in a raised position to hold back the flow of fruit. The chute extends into and distributes the fruit as it drops in the box. As the box fills the cradle swings downward to make room for additional fruit. This downward swing is controlled by a counterbalance and two tension springs, so that when the box is almost full it is in a vertical position. When the box is full (by weight) a compression spring contacts a microswitch that activates a solenoid causing the filling chute to swing upward thus blocking the flow of additional fruit and simultaneously ejects the filled box from the cradle onto a second gravity conveyor line. As a result of this device no labor is required for this operation except to supply empty boxes.

In 1954, when the box filler was developed, the piece rate for manually loose packing boxes of fruit was $52.50 per 1,000 boxes. When the automatic box filler was substituted, the labor cost (for supplying empty boxes only) dropped to a maximum of $7 per 1,000 boxes. Equipment costs added roughly $0.50 per 1,000 boxes and brought the total to $7.50 per 1,000 boxes by use of the new device. The savings amounted to $45 per 1,000 boxes.

Following the development of this device, design drawings were made available to equipment manufacturers on request provided they signed a statement agreeing:

1. Not to hold the Department liable for any possible infringement on a prior patent; and
2. Not to set up any interference with the Department's patent application.

One firm in the Pacific Northwest, alone manufactured and sold 300 automatic box fillers during the summer of 1955 to apple houses in that area. The box filler is known to be currently manufactured by Van Doren Equipment Co., Wenatchee, Wash.; Food Machinery & Chemical Corp., Wenatchee, Wash.; Pomano Equipment & Supply Co., Yakima, Wash.; and Rose Equipment Co., Yakima Wash. The total number of units sold is estimated at 2,000. However, improved models of the box filler now are widely used in fruit packinghouses. Utility or lower grade apples and all of peaches now are packed for shipment by these devices. Houses packing other types of fruit also are making extensive use of automatic box fillers.

At an average cost of $1,000 per unit, the estimated value of all units manufactured and sold for the apple packing industry is $2 million. A 100,000 box apple house that uses this device both for packing lower grade fruit and for accumulating fruit to be returned to storage should handle about 30,000 boxes each season by this method with a saving of roughly $1,350. Industrywide, apple houses should save roughly $500,000 annually. No basis is available for estimating savings in other fruit such as peach packinghouses.

This automatic box filler invention cuts down labor costs and increases the efficiency of the operation of fruit packinghouses. This is a gain to the fruit packinghouses and a benefit, in turn, ought to accrue to food distributors cost and ultimately to the consumer.

The estimated contract cost to the Department of this development work was $10,000.

USDA—AGRICULTURAL MARKETING SERVICE

Rapid determination of oil in cottonseed and soybeans

Patent No.: 2,825,026.
Names of inventors: Charles E. Holaday, Harry F. Cooke, John L. Larrison, and Wilbur K. Marble.
Title: Method for Determining the Oil Content of Substances.
Date of issuance: February 25, 1958.

In 1944 the Cotton Branch, PMA, was requested to initiate work to evaluate and improve the existing methods of analysis and grading of cottonseed and to develop a rapid method of grading for use on small-lot settlements between growers and ginners. Present methods of grading are too expensive and time consuming, therefore, farmers generally sell without regard to grade. This system does not provide an incentive to farmers for growing varieties with higher oil content or for careful handling to prevent deterioration.

Work was initiated in 1946 at the Stoneville Laboratory to develop a simple, inexpensive method for determining oil content, the most important factor of grading cottonseed. A method and equipment for rapid oil determination was developed whereby the oil content may now be determined in less than 10 minutes. The method consists of grinding the oil bearing seed with a suitable solvent and a drying agent, filtering the oilseed-solvent mixture, and measuring the dielectric value of the solution.

Although this method was developed for cottonseed, it is equally applicable for use with soybeans. The need for such method is great, since present grading of soybeans does not include oil content.

Means for rapid oil determinations by the grain inspector, the elevator, and oil mill is a requisite for the inclusion of oil content as a factor of grading.

Inclusion of oil as a factor in grading soybeans would allow buyers to purchase on actual value, thereby rewarding growers of high oil content soybeans and penalizing those with low oil content.

Insofar as the marketing efficiency is increased and risks are reduced, it is estimated that savings of 50 cents per ton on cottonseed and 1 cent per bushel on soybeans could be effected. This would amount to $2,250,000 on cottonseed and $5,500,000 on soybeans. These savings would be reflected in part to the producer with the remainder going to the consumer.

A potential market exists for approximately 2,000 units in the soybean industry and 3,000 units in the cottonseed industry. Four commercial type instruments were field tested in 1958 on cottonseed and they will be tested on soybeans in 1959.

The cost to the Department of Agriculture of development of the method to determine the oil content was approximately $90,000.

USDA—AGRICULTURAL MARKETING SERVICE

Checkout counter for retail grocery stores

Patent Application Serial No.: 168,378.
Names of inventors: Harwell and Hassel et al. (filed June 21, 1950, and abandoned after publication in the Official Gazette of the U.S. Patent Office and thus made available to public).
Title: Checkout Counter for Retail Grocery Stores.

This invention is a checkout counter which is designed for use in retail, self-service food stores. It was developed jointly by employees of USDA and the Kroger Co., of Cincinnati, Ohio, in a study undertaken to find methods of relieving the checkout bottleneck and reducing labor costs in this operation which accounted for about 20 percent of food store labor requirements.

This new counter handled about 40 percent more items per hour with the same labor force than the conventional counters and cost per order decreased about 25 percent. The counter was installed in hundreds of retail stores and many of its basic principles are now incorporated in the more recently developed checkout counters of most of the supermarkets in the United States.

This development has greatly increased customer convenience and helped hold down food marketing costs by saving millions of dollars in labor cost. Assuming that 75 percent of the $40 billion annual food sales pass through a modern checkout counter, it costs approximately $420 million annually for labor to operate these check stands. It is estimated that at least 10 percent of labor costs in checking out food in retail, self-service food stores has been saved annually because of the innovation of this invention which has been adopted by the industry.

This innovation has been of benefit to food distributors (food stores) and it is hoped that some of the resultant savings may have been to the benefit of the consumer.

The counter was developed at a cost of not over $15,000 to the Department.

APPENDIX B

Many of the Department of Agriculture patents have had wide application in competitive industry.

There are many inventions of the Department which are being used without a license. This may be due to one of the three reasons, use of the invention being made without a license request, the invention may be patented but the Department has dedicated it to the public, and the invention may not be patented but is put into the public domain, by public use, publication, or by other means.

However, the Department has granted about 1,000 licenses. On 65 or more patents the Department has issued 3 or more licenses. On 1 patent the Department has issued about 130 licenses and there are at least another 130 or more users of the invention who have not obtained such a license. The following is a list of the licenses issued by the Department.

Licenses granted under Department of Agriculture patents

Patent No.	Title	Name and address of licensee	Date issued
1,816,026	Process for Preparing Antigens	Fidelity Laboratories, Inc., Oklahoma City, Okla.	Aug. 25, 1941.
		I. D. Russel Co., Kansas City, Mo.	May 17, 1941.
		American Scientific Laboratories, Inc., Polo, Ill.	July 20, 1933.
		Anchor Serum Co., St. Joseph, Mo.	Oct. 12, 1931.
		Ashe Lockhart, Inc., Kansas City, Mo.	Dec. 31, 1931.
		The Biochemical Products Co., Baltimore, Md.	Mar. 8, 1935.
		Clemson Agricultural College, Clemson College, S.C.	Apr. 26, 1932.
		Columbus Vaccine Co. (The) Columbus, Ohio.	Oct. 8, 1931.
		Colorado Springs Vaccine Laboratory Inc., Colorado Springs, Colo.	Sept. 1, 1933.
		Cutter Laboratories, Berkeley, Calif.	Feb. 22, 1932.
		Dr. Salsbury's Laboratories, Inc., Charles City, Iowa.	Oct. 21, 1931.
		Fort Dodge Serum Co., Fort Dodge, Iowa.	1933.
		O. M. Franklin Blackly Co., Amarillo, Texas.	1936.
		Gland-O-Lac Co. (The), Omaha, Nebr.	Nov. 6, 1931.
		Globe Laboratories, Fort Worth, Tex.	June 4, 1932.
		E. K. Glover Laboratories, Kansas City, Mo.	July 15, 1933.
		Jensen-Salsbery Laboratories, Inc., Kansas City, Mo.	Oct. 28, 1931.
		Johnson Laboratories, Kansas City, Mo.	Sept. 15, 1932.
		Kinsley Laboratories, Kansas City, Mo.	Aug. 31, 1932.
		Klusmire Biologic Laboratories, Omaha, Nebr.	Dec. 29, 1931.
		George H. Lee Co., Omaha, Nebr.	Oct. 5, 1931.
		Lederle Laboratories, Inc., Pearl River, N.Y.	Nov. 6, 1931.
		Live Stock Sanitary Service Laboratory, College Park, Md.	Sept. 6, 1934.
		New Jersey Poultry Laboratories, Vineland, N.J.	June 24, 1932.
		New Hampshire Agricultural Experimental Station, Durham, N.H.	Nov. 9, 1931.
		Peters Serum Co., Kansas City, Mo.	Mar. 3, 1933.
		Pitman-Moore Co., Zionsville, Ind.	Oct. 16, 1931.
		Poultry Service Laboratories, Petaluma, Calif.	Dec. 27, 1932.
		W. F. Straub Laboratories, Chicago, Ill.	Mar. 15, 1933.
		Vineland Poultry Laboratories, Vineland, N.J.	Aug. 27, 1932.
		Virginia Department of Agriculture, Richmond, Va.	Mar. 5, 1932.
		Wildmans Laboratory, Springfield, Ohio.	Aug. 4, 1934.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
1,816,026	Process for Preparing Antigens—Continued	Zeller's Laboratories, Millmont, Reading, Pa.	Aug. 1, 1933.
		Quisenberry-Hobbs Co., Kansas City, Kans.	Oct. 8, 1931.
		Schultz Laboratories, Boone, Iowa	1934.
		Sharpe & Dohme, Inc., Philadelphia, Pa.	Not of record.
		Arkansas State Livestock Sanitary Board, Little Rock, Ark.	July 3, 1947.
2,085,794	Urinary Antiseptic	Burroughs Wellcome Co., New York, N.Y.	Jan. 17, 1941
		Cutter Laboratories, Inc., Berkeley, Calif.	Oct. 16, 1939.
		Frederick Stearns & Co., Detroit, Mich.	Nov. 3, 1939
		E. R. Squibb & Sons, New York, N.Y.	Oct. 4, 1939
		Nepera Chemical Co., Yonkers, N.Y.	June 17, 1940
		Koppers Co., Pittsburgh, Pa.	May 1, 1944
2,098,962	Method for Carrying Out Aeration in Biochemical Processes	Merck & Co., Inc., Rahway, N.J.	Mar. 16, 1941.
		Jensen-Salsbery Laboratories, Kansas City, Mo.	Mar. 3, 1938.
		Wallerstein Co., Inc., New York, N.Y.	Not of record.
		The Diversey Corp., Chicago, Ill.	April 7, 1949.
2,121,533	Method for Carrying Out Certain Oxidation Fermentation Processes by Bacteria.	U.S. Vitamin Corp., New York, N.Y.	Jan. 4, 1938.
		Merck & Co., Inc., Rahway, N.J.	Dec. 23, 1938.
		Schwarz Laboratories, Inc., New York, N.Y.	Jan. 31, 1943.
2,130,783	Plastic Compositions	Northwood Chemical Co., Phelps, Wis.	Apr. 29, 1939.
		The Anchor Lumber Co., Parkersburg, W. Va.	Jan. 14, 1939.
		R. W. Kopitsch, Bernamwood, Wis.	Apr. 17, 1940.
		Harry Berns, Brooklyn, N.Y.	Apr. 15, 1939.
		Valentine Sugars, Lockport, La.	Oct. 3, 1939.
		Pitt Plastic Co., Pittsburgh, Pa.	Not of record.
		Himax Plastics Corp., Brooklyn, N.Y.	Jan. 19, 1942.
		Meyer-Hamilton Sailplane Co., Decatur, Ill.	Not of record.
2,137,119	Plastic Composition	Valentine Sugars, Lockport, La.	Do.
		Richard W. Kapitsch, Birnamwood, Wis.	Apr. 17, 1940.
		Niagara Alkali Co., New York, N.Y.	Apr. 24, 1940.
2,153,316	Method for the Production of Plastics.	A. P. Nonweiler Co., Oshkosh, Wis.	Not of record.
		Valentine Sugars, Lockport, La.	Oct. 3, 1939.
		Taylor-Colquitt Co., Spartanburg, S.C.	Aug. 13, 1942.
		C. H. Orbell, Sherman, Conn.	Do.
		Northwood Chemical Co., Phelps, Wis.	Feb. 3, 1940.
		Allied Panel Corp., Oil City, Pa.	Apr. 17, 1940.
		Pitt Plastic Paper Co., Pittsburgh, Pa.	Not of record.
		Himax Plastics Corp., Brooklyn, N.Y.	Jan. 19, 1942.
		The Vulcanized Rubber Co., Morrisville, Pa.	June 22, 1942.
		The Cuneo Press Inc., Chicago, Ill.	Mar. 16, 1944.
2,254,785	Process for Gum Refining	Columbia Naval Stores Co. of Tifton, Savannah, Ga.	Jan. 5, 1942.
		Frank Davis, Nicholls, Ga.	June 18, 1942.
		Gum Turpentine Farmers Cooperative, Association, Vidalia, Ga.	Apr. 20, 1942.
		W. W. Davis, Waycross, Ga.	Aug. 13, 1942.
		The Newton Co., Cogdell, Ga.	May 13, 1944.
		W. R. Flowers & Son, Gardi, Ga.	Mar. 13, 1945.
		W. M. Denton, Nicholls, Ga.	July 10, 1945.
		N. L. Gillis & Sons, Nicholls, Ga.	Do.
		Standard Processing Co., Savannah, Ga.	Jan. 14, 1946.
		Turpentine Farmers Cooperative, Waycross, Ga.	Aug. 26, 1946.
		Standard Processing Co. of Statesboro, Savannah, Ga.	Mar. 14, 1946.
		Palatka Gum Processing Corp., Palatka, Fla.	June 18, 1946.
		Taylor, Lowenstein & Co., Mobile, Ala.	Jan. 10, 1947.
		The Glidden Co., Cleveland, Ohio.	Nov. 10, 1948.
		McRae Processing-Supply Co., Jacksonville, Fla.	Nov. 13, 1948.
		Jacksonville Processing Corp., Jacksonville, Fla.	Do.
		Pearson Gum Processing Corp., Jacksonville, Fla.	Aug. 3, 1949.
		Stallworth Pine Products Co., Mobile, Ala.	Oct. 9, 1953.
2,258,319	Method for the Control of Japanese Beetle	J. A. Ditman, Star Route, Laurel, Md.	Jan. 13, 1942.
		J. J. Parker, New York, N.Y.	July 8, 1944.
		Doggett-Pfeil Co., Springfield, N.J.	Nov. 9, 1944.
		Fairfax Biological Laboratory, Clinton Corners, N.Y.	June 2, 1948.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,277,716	Fermentation Process for the Production of 2-Ketogluconic Acid	Wallerstein Co., New York, N.Y.	Dec. 11, 1940.
		Clinton Co., Clinton, Iowa	Nov. 25, 1940.
		Standard Brands, Inc., New York, N.Y.	Jan. 15, 1941.
		Chas. Pfizer & Co., Brooklyn, N.Y.	Mar. 17, 1941.
		Hoffman-LaRoche, Inc., Nutley, N.Y.	July 11, 1941.
		Schieffelin & Co., New York, N.Y.	Dec. 29, 1942.
		Allied Laboratories, Inc., Indianapolis, Ind.	Aug. 27, 1942.
		American Maize Products Co., New York, N.Y.	Mar. 23, 194
		Miles Laboratories, Inc., Elkhart, Ind.	July 25, 1956.
		Wallerstein Co. Inc., 180 Madison Ave., New York, N.Y.	Nov. 9, 1956.
		The Griffith Laboratories, Inc., Chicago, Ill.	Dec. 17, 1956.
		Merck & Co., Rahway, N.J.	July 17, 1957.
2,287,759	Process for the Granulation of Fertilizers.	Farm Fertilizers, Inc., South Omaha, Nebr.	June 1, 1951.
		Eastern States Farmer's Exchange, Inc., West Springfield, Mass.	Mar. 20, 1952
		Consumers Cooperative Association, Kansas City, Mo.	Sept. 1, 1952.
2,298,017	Process for Plasticizing Lignocellulosic Materials.	American Lumber & Treating Co., Chicago, Ill.	July 4, 1944.
		Federal Mill Supplies Co., New York, N.Y.	Oct. 16, 1944.
		E.O. Johnson, Kissimmee Fla.	Nov. 29, 1944.
		Carlow & Co., Robbinston, Maine	Jan. 24, 1945.
		Standard Furniture Co., 201 South Washington St., Herkimer, N.Y.	Jan. 22, 1946.
		L.B. Ramsdell Co., 170 Mill St., Gardner, Mass.	Sept. 28, 1946.
		Wood Arts, Route 1, Box 536-B, Albuquerque, N. Mex.	Nov. 8, 1946.
		Pressed Wood Corp., Greenfield, Mass.	Dec. 9, 1946.
		Henry Bonhag, Adamston, N.J.	Jan. 17, 1947.
		Lundstrom Laboratories, Inc., Little Falls, N.Y.	June 2, 1947.
		Transmuted Wood Products Co., Hamburg, N.Y.	Sept. 24, 1947.
2,313,953	Process for Resinifying Lignocellulosic Materials.	American Lumber & Treating Co., Chicago, Ill.	July 4, 1944.
		Breining Bros. Inc., Hoboken, N.J.	Aug. 2, 1944.
		L. & M. Engineering Co., Syracuse, N.Y.	Sept. 8, 1944.
		Products Sales Co., Chicago, Ill.	Oct. 25, 1944.
		Federal Mill Supplies Co., New York, N.Y.	Oct. 16, 1944.
		Frank B. Wallace, Phoenix, Ariz.	Nov. 23, 1944.
		E.O. Johnson, Kissimmee, Fla.	Nov. 29,1944.
		West Coast Picture Corp., Portland, Oreg.	Jan. 24, 1945.
		Carlow & Co., Robbinston, Maine	Do.
		Joseph T. Petska, Milwaukee, Wis.	Feb. 23, 1945.
		Norman Greenberg, Denver, Colo.	May 19, 1945.
		Leon H. Hamilton, Hamden Novelty Co., Hamden, Conn.	Jan. 31, 1946.
		William L. Plamondon, West Falmouth, Mass.	Jan. 22, 1946.
		Standard Furniture Co., 201 South Washington St. Herkimer, N.Y.	Do.
		L. B. Ramsdell Co., 170 Mill St., Gardner, Mass.	Sept. 28, 1946.
		Wood Arts, Albuquerque, N. Mex.	Nov. 8, 1946.
		Pressed Wood Corp., Greenfield, Mass.	Dec. 9, 1946.
		Henry Bonhag, Adamston, N.J.	Jan. 17, 1947.
		Lundstrom Laboratories, Inc., Little Falls, N.Y.	June 2, 1947.
		Transmuted Wood Products Co., Hamburg, N.Y.	Sept. 24, 1947.
2,318,641	Fermentation Process for the Production of 5-Ketogluconic Acid	Chas. Pfizer & Co. Inc., New York, N.Y.	Mar. 17, 1941.
		American Maize-Products Co., New York, N.Y.	Sept. 27, 1941.
		Standard Brands, Inc., New York, N.Y.	Feb. 18, 1941.
2,321,023	Method Applying Parasiticides	Armstrong Engineering Co., Los Angeles, Calif.	Dec. 30, 1943.
		Pennsylvania Engineering Co., Philadelphia, Pa.	Jan. 5, 1944.
		Knapp-Monarch Co., St. Louis, Mo.	Nov. 1, 1945.
		Virginia Smelting Corp., West Norfolk, Va.	Nov. 8, 1945.
		Regal Chemical Corp., New York, N.Y.	Do.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,321,023	Method Applying Parasiticides—Continued	Fuld Bros., Baltimore, Md	Dec. 17, 1945.
		Heckethorn Manufacturing & Supply Co., Littleton, Colo.	Nov. 27, 1945.
		Tropical Chemical Co., San Juan, P.R	Dec. 15, 1945.
		Double B Products Co., Hartford, Conn	Jan. 9, 1946.
		Stewart D. Miller doing business as Scotch Tone Co., Oklahoma City, Okla.	Feb. 11, 1946.
		General Chemical Co., New York, N.Y	Feb. 25, 1946.
		Enterprise Industries, New York, N.Y	Do.
		Naco Fertilizer Co., New York, N.Y	Feb. 6, 1946.
		Edco Corp., Brooklyn, N.Y	Feb. 20, 1946.
		Classic Products Corp., Cleveland, Ohio	Apr. 16, 1946.
		McCormick & Co., Baltimore, Md	May 10, 1946.
		Associated Chemists, Inc., Chicago, Ill	Do.
		Bright Light Reflector Co., Inc., Bridgeport, Conn.	July 3, 1946.
		Eston Chemicals Inc., Los Angeles, Calif.	Aug. 26, 1946.
		U.S. Aerosol Co., Pittsburgh, Pa	July 23, 1946.
		J. Beriage Co., Inc., New York, N.Y	Jan. 24, 1947.
		John W. Waterhouse, Seattle, Wash	May 10, 1947.
		Plant Products Corp., Blue Point, N.Y	Sept. 22, 1947.
		W. H. Elliott & Sons Co., Inc., Madbury, N.H.	Do.
		Continental Filling Corp., Danville, Ill	Sept. 26, 1947.
		Rex Research Corp., Toledo 7, Ohio	Nov. 7, 1947.
		Connecticut Chemical Research Corp., Bridgeport, Conn.	Nov. 25, 1947.
		Edward C. Geiger, North Wales, Pa	Dec. 19, 1947.
		Boyle-Midway Inc., New York 16, N.Y	Dec. 22, 1947.
		Michigan Chemical Corp., St. Louis, Mo.	Dec. 17, 1947.
		Smith Equipment & Supply Co., Chicago, Ill.	Mar. 6, 1948.
		Aborn Chemical Industries, Providence, R.I.	Jan. 26, 1948.
		Chase Products Co., Maywood, Ill	Apr. 6, 1948.
		Gude Brothers Co., Washington, D.C	Apr. 27, 1948.
		C. F. Treichler, Inc., Sanborn, N.Y	Apr. 23, 1948.
		Butler & Ullman, Inc., Northampton, Mass.	May 14, 1948.
		A. Gude Sons Co., Washington, D.C	May 1, 1948.
		Elmira Floral Products, Inc., Elmira Heights, N.Y.	May 25, 1948.
		The Montgomery Co., Hadley, Mass	Aug. 12, 1948.
		A. N. Pierson, Inc., Cromwell, Conn	June 23, 1948.
		Watchung Rose Corp., Madison, N.J	Aug. 19, 1948.
		DAO Corp., Terre Haute, Ind	Oct. 1, 1948.
		Woodlets, Inc., Portland, Pa	Feb. 22, 1949.
		White Bros. Rose Corp., Medina, N.Y	May 16, 1949.
		Innis, Speiden & Co., New York, N.Y	Aug. 2, 1949.
		Mikkelsen & Sons Greenhouses, Ashtabula, Ohio.	Oct. 3, 1949.
		American Aerosol Insecticide Corp., Zeeland, Mich.	Oct. 12, 1949.
		M and K Insecticide Spray Service, Kendall, Fla.	Oct. 8, 1949.
		Andre Greenhouses, Inc., Doylestown, Pa.	Nov. 3, 1949.
		Graceland Greenhouse, Grandview, Mo	Nov. 16, 1949.
		G. Barr & Co., Chicago, Ill	Jan. 5, 1950.
		Tobacco By-Products & Chemical Corp., Richmond, Va.	Do.
		Fluid Chemical Co., Inc., Newark, N.J	Feb. 21, 1950.
		United Aerosol Co., Holland, Mich	Mar. 3, 1950.
		Sprayon Products, Inc., Cleveland, Ohio	Apr. 3, 1950.
		L. Perrigo Co., Allegan, Mich	Apr. 21, 1950.
		W. F. Barthel Chemical Co., New Oxford, Pa.	Apr. 18, 1950.
		Puritan Distributing Co., Boston, Mass	June 14, 1950.
		Aeropak, Inc., Chicago, Ill	July 11, 1950.
		Whitmire Research Laboratories, Inc., St. Louis, Mo.	Aug. 16, 1950.
		N. H. Wright, Inc., Cranbury, N.J	Aug. 21, 1950
		John C. Stalfort & Sons, Inc., Baltimore, Md.	Oct. 30, 1950.
		J. H. Thompson's Sons, Kennett Square, Pa.	Dec. 18, 1950.
		Powr-Pak, Inc., Bridgeport, Conn	Nov. 16, 1950.
		L. B. Coddington Co., New Providence, N.J.	Feb. 20, 1951.
		Revlon Products Corp., New Nork, N.Y	Feb. 26, 1951.
		Hysan Products Co., Chicago, Ill	Apr. 24, 1951.
		Stevens Laboratories, Yonkers, N.Y	June 1, 1951.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,321,023	Method Applying Parasiticides—Continued	Aersol Can Co., Zeeland, Mich	June 8, 1951.
		Holton & Hunkel Co., 797 North Milwaukee Street, Milwaukee, Wis.	Aug. 13, 1951.
		Cook Chemical Co., Kansas City, Mo	Jan. 5, 1956.
		Industrial Management Corp., Los Angeles, Calif.	Sept. 12, 1945.
		Coop. GLF Soil Building Service, Inc., Ithaca, N.Y.	Sept. 26, 1945.
		Stratosol Corp., New York, N.Y	Oct. 5, 1945.
		W. R. Grace & Co., New Orleans, La	May 14, 1947.
		Stanco, Inc., New York, N.Y	Oct. 1, 1945.
		H. W. Turney Co., Santa Ana, Calif	Dec. 15, 1951.
		The Dill Manufacturing Co., Cleveland, Ohio.	May 15, 1952.
		Miller Chemical & Fertilizer Corp., Baltimore, Md.	Aug. 25, 1952.
		Fuller System, Inc., Woburn, Mass	Oct. 20, 1952.
		Parr Industries, Inc., Los Angeles, Calif	Feb. 25, 1953.
		Harder Extermination Service, Inc., Hempstead, N.Y.	Aug. 13, 1953.
		McGuire & Co., Oakland, Calif	Jan. 26, 1954.
		Aersol Corp. of the South, Memphis, Tenn.	Jan. 21, 1954.
		A-M-R Chemical Co., Inc., Brooklyn, N.Y.	July 9, 1954.
		Aero-Fil Inc., Franklin Park, Ill	Jan. 10, 1955.
		The Mohawk Brush Co., Albany, N.Y	Apr. 13 1955.
		The Fuller Brush Co., Hartford, Conn	Do.
		Fairfax Biological Laboratory, Clinton Corners, N.Y.	Oct. 6, 1955.
		Petrof Trading Co., Berkeley, Calif	Nov. 13, 1955.
		Colgate-Palmolive Co., New York, N.Y	Nov. 15 1955.
		Fuld Bros., Inc., Baltimore, Md	Sept. 28, 1956.
		Begal Co., New York, N.Y	Jan. 9, 1957.
		Guardian Industries Inc., New York, N.Y	Feb. 20, 1957.
		Wellston Aerosol Manufacturing Co., Wellston, Ohio.	Mar. 14, 1957.
		Arrow Filling Corp., Edgerton, Wis	Apr. 8, 1957.
		Arlenge Laboratories of New York, New York, N.Y. (David M. Lenger).	June 7, 1957.
		Super Pack Corp., York, Pa	June 12, 1957.
		Old Empire, Inc., Newark, N	Jan. 24, 1958.
		Wisconsin Chemical Products Co., Milwaukee, Wis.	Mar. 19, 1958.
		J. R. Watkins Co., Winona, Minn	Oct. 15, 1958.
		Barnett Chemical Products Co., Tullytown, Pa.	May 15, 1959.
		Miller Chemical Corp., Charles Town, W. Va.	Nov. 2, 1959.
		Pressure Products Co., West Chester, Pa	Oct. 30, 1959.
		Southwest Aerosols, Inc., Little Rock, Ark	Dec. 1959.
		Puritan Distributing Co., Inc., Boston, Mass.	Feb. 8, 1960.
		Sifers, Inc., Iola, Kans	Apr. 21, 1960.
2,350,435	Derivatives of Ascorbic Acid	The United Drug Co., Boston, Mass	Apr. 20, 1945.
		E. R. Squibb & Sons, Brooklyn, N.Y	Nov. 1, 1945.
		Merck & Co., Inc., 161 Sixth Ave., New York 13, N.Y.	Sept. 11, 1947.
		Charles Pfizer & Co., Inc., 11 Bartlett St., Brooklyn, N.Y.	Jan. 12, 1948.
		The Griffith Laboratories, Chicago, Ill	Sept. 23, 1944.
		Endo Products, Inc., Richmond Hill, N.Y	Dec. 30, 1944.
		The S. E. Massengill Co., Bristol, Tenn	Mar. 20, 1945.
2,365,793	Cotton-working Machine	Johnson & Johnson, New Brunswick, N.J	Apr. 28, 1950.
		Salisbury Iron Works, Inc., Salisbury, N.C.	Nov. 29, 1950.
		Carolina Machinery Co., Charlotte, N.C	Apr. 23, 1951.
		Honan-Crane Corp., Lebanon, Ind	May 10, 1951.
		Proctor & Schwartz, Inc., Philadelphia, Pa.	June 14, 1951.
		Cen-Tennial Cotton Gin Co., Columbus, Ga.	July 30, 1951.
		Continental Gin Co., Birmingham, Ala	Mar. 20, 1952.
		Whitin Machine Works, Whitinsville, Mass.	July 17, 1952.
		Dewsberry Machine Co., Chicago, Ill	Sept. 5, 1952.
		Moss-Gordin Lint Cleaner Co., Lubbock, Tex.	Nov. 19, 1954.
		Kirkman & Dixon Machinery Co., Greenwood, S.C.	Oct. 26, 1955.
		The Centrif-Air Machine Co., Inc., Atlanta, Ga.	Jan. 5, 1959.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,368,435	Antioxidant	United Drug Co., Boston, Mass	Dec. 3, 1945.
		E. R. Squibb & Sons, Brooklyn, N.Y	Nov. 1, 1945.
		Merck & Co., Inc., Rahway, N.J	Sept. 5, 1952.
		Modern Foods, Inc., Houston, Tex	Apr. 24, 1953.
2,373,015	Process for producing polymeric materials.	Reichhold Chemicals Inc., Detroit, Mich	Dec. 23, 1942.
		American Resinous Chemicals Corp., Peabody, Mass.	Mar. 12, 1943.
		Naugatuck Chemical Division of U.S. Rubber Co., Naugatuck, Conn.	Oct. 26, 1943.
		Cooper Polymers, Inc., Wilmington, Mass.	Nov. 19, 1959.
2,373,192	Antioxidants	Geo. A. Hormel & Co., Austin, Minn	Dec. 23, 1943.
		Armour & Co., Chicago, Ill	June 3, 1946.
		Modern Foods, Inc., Houston, Tex	Apr. 2, 1953.
2,379,574	Surgical Bandages With Improved Elastic Properties.	The Kendall Co., Walpole, Mass	Apr. 22, 1952.
		Medical Fabrics Co., Inc., Paterson, N.J	May 15, 1952.
		Johnson & Johnson, New Brunswick, N.J.	Sept. 1, 1952.
2,404,837	Method of Making Cotton Fabrics With Differential Elastic Properties.	The Kendall Co., Walpole, Mass	Apr. 22, 1952.
		Medical Fabrics Co. Inc., Paterson, N.J	May 16, 1952.
		Johnson & Johnson, New Brunswick N.J.	Sept. 1, 1952.
2,406,395	Process of Dehydrating Meats Containing Fats in a Fluid Current.	The Heil Co., Milwaukee, Wis	Mar. 23, 1944.
		C. A. Shuttleworth d/b/a Salamonie Packing Co., Warren, Ind.	Apr. 15, 1944.
		E. J. Albright Co., Chicago, Ill	July 31, 1944.
		Franklin Machine & Foundry Co., Providence, R.I.	Apr. 29, 1944.
		Harry E. Drews, 110 North Franklin St., Chicago, Ill.	Nov. 1, 1946.
2,423,873	Methods for Production of Increased Yields of Penicillin.	Schenley Laboratories, Inc., New York, N.Y.	Sept. 16, 1947.
		E. R. Squibb & Sons, Brooklyn, N.Y	Aug. 12, 1948.
		Merck & Co., Inc., Rahway, N.J	Sept. 30, 1948.
2,438,209	Reaction Product of Gramicidin and Formaldehyde and Method of Production.	The Wm. S. Merrell Co., Cincinnati, Ohio	June 10, 1948.
		Wallerstein Co., Inc., New York, N.Y	July 13, 1948.
		E. R. Squibb & Sons, Brooklyn, N.Y	Oct. 7, 1948.
2,442,141	Method for Production of Penicillin.	Eli Lilly & Co., Indianapolis, Ind	Dec. 20, 1948.
		E. R. Squibb & Sons, Brooklyn, N.Y	Do.
		Schenley Laboratories, Inc., New York, N.Y.	Do.
2,443,989	Method for Production of Penicillin.	E. R. Squibb & Sons, Brooklyn, N.Y	Aug. 31, 1948.
		Eli Lilly & Co., Indianapolis, Ind	Sept. 30, 1948.
		Merck & Co., Inc., Rahway, N. J	May 24, 1949.
		Abbott Laboratories, North Chicago, Ill	May 3, 1949.
2,445,128	Biological Process for the Production of Riboflavin.	Grain Processing Corp., Muscatine, Iowa	July 12, 1950.
		Gateway Chemurgic Co., Lincoln, Nebr	June 4, 1952.
		Schenley Laboratories, Inc., New York, N.Y.	Aug. 5, 1952
		Fermentation Products, Inc., Newaygo, Mich.	Mar. 6, 1953.
		Nutrilite Products, Inc., Buena Park, Calif.	Jan. 16, 1956.
2,449,340	Vitamin-B Complex Concentrate	E. R. Squibb & Sons, New York, N.Y	May 24, 1949.
		Schenley Laboratories Inc., 350 5th Ave., New York, N.Y.	July 8,1949.
		Schenley Distillers, Inc., 350 5th Ave., New York, N.Y.	Do.
2,450,940	Polyamides from Polymeric Fat Acids.	General Mills, Inc., Minneapolis, Minn	Apr. 14, 1949.
		Dewey & Almy Chemical Co., Cambridge, Mass.	July 30, 1953.
		Superior Varnish & Drier Co., Merchantville, N.J.	Apr. 12, 1957.
		Cooper Polymers, Inc., Wilmington, Mass.	Nov. 19, 1959.
2,453,109	Method of Preparing Full-Flavored Fruit Juice Concentrates	B. B. Chemical Co., Cambridge, Mass	Feb. 1, 1961.
		Blaw-Knox Co., Buffalo, N.Y	Oct. 28, 1948.
		Purpura Brothers, Inc., Ocala. Fla	Nov. 17, 1949.
		Golden Citrus Juices, Inc., Fullerton, Calif.	Mar. 24, 1950.
		H. J. Heinz, Co., Pittsburgh, Pa	Sept. 22, 1958.
2,459,431	Cold Processed Fruit Spread	Campbell Canning Co., Campbell, Calif	June 15, 1949.
		P. E. Yates, Puyallup, Wash	Oct. 20, 1949.
		Processer Packers, Inc., 804 Bennett Ave., Prosser, Wash.	Feb. 29, 1956.
2,476,107	Method for Production of Penicillin	Eli Lilly & Co., Indianapolis, Ind	Aug. 16, 1949.
		Schenley Laboratories, Inc., 350 5th Ave., New York, N.Y.	Sept. 22, 1949.
		Merck & Co., Inc., New York, N.Y	Do.
		E. R. Squibb & Sons, New York, N.Y	Jan. 18, 1951.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,477,605	Process for Preserving Foods	William E. McIntosh Co. Inc., Avenue E, Geneva, N.Y.	July 30, 1953.
		California Vegetables Concentrates, Inc., 2067 Clarendon Ave., Hunting Park, Calif.	May 14, 1955.
		Lamb-Weston, Inc. (Post Office Box 118) Weston, Oreg.	July 8, 1955.
		Waterman Fruit Products Inc., Ontario Center, N.Y.	Jan. 4, 1960.
		J. R. Simplot Co., Boise, Idaho	Jan. 22, 1960.
2,521,738	Process for the Production of Artificial Bristles and the Like from Proteins.	Frederick H. Cone & Co., Inc., New York, N.Y.	Nov. 17, 1944.
		Rubberset Co., Newark, N.J.	Oct. 2, 1946.
		Holtz & Green Co., Philadelphia, Pa.	Aug. 1, 1950.
2,562,970	Preservation of Forage Crops	Elk Valley Alfalfa Mills, Independence, Kans.	Apr. 27, 1954.
		Rohloff Brothers, Inc., Graytown, Ohio	Do.
		Iowa Valley Milling Co., Iowa City, Iowa	Do.
		Luxora Gin Co., Inc., Luxora, Ark.	Do.
		Abilene Alfalfa Sales Co., Abilene, Kans.	Do.
		Sioux Alfalfa Meal Co., Vermillion, S.D.	May 12, 1954.
		Dawson County Feed Products, Inc., Lexington, Nebr.	Do.
		Dewey Alfalfa Dehydrating Co., Inc., Dewey, Okla.	Do.
		Prairie Dehydrating Co., Roanoke, Ill.	Do.
		Sunny Slope Farms, Inc., Nazareth, Pa.	Do.
		The Farm Bureau Cooperative Association, Inc., Columbus, Ohio	Mar. 18, 1959.
		Missouri Valley Dehydrating Co., Henrietta, Mo.	Do.
		Natrona Feed Products Co., Casper, Wyo.	May 27, 1959.
		Carrollton Processing Co., Inc., Carrollton, Mo.	June 10, 1959.
		York Alfalfa Mills, Inc., York, Nebr.	June 19, 1959.
		J. H. Fulmer Estate, trading as Green Acre Farms, Nazareth, Pa.	June 25, 1959.
		Keystone Dehydrators, Bethlehem, Pa.	Do.
		Rich Land Products Co., Blytheville, Ark.	Do.
		West Point Feed Products Co., West Point, Nebr.	Do.
		Avoca Alfalfa Milling Co., Avoca, Iowa	July 9, 1959.
		Belgrade Alfalfa Mills, Belgrade, Mont.	Do.
		Green Products Co., Conrad, Iowa	Do.
		Ohlendorf Milling Co., Inc., Osceola, Ark.	Do.
		Reelfoot Alfalfa Mill, Tiptonville, Tenn.	Do.
		T. E. White Co., Inc., Fort Wayne, Ind.	Do.
		Charles H. Schenk & Sons, Inc., Vincennes, Ind.	July 21, 1959.
		National Alfalfa Dehydrating & Milling Co., Kansas City, Mo.	Aug. 12, 1959.
		David D. Showalter doing business as Cove Dehydrating Plant, Martinsburg, Pa.	Do.
		Madera Milling Co., Madera, Calif.	Do.
		Central Alfalfa, Inc., Lexington, Nebr.	Sept. 29, 1959.
		Sinton & Brown Co., Betteravia, Calif.	May 25, 1960.
		Wraybill Dehydrating Co., Sloan, Iowa	May 26, 1954.
		Northern Drying Co., Olivia, Minn.	Do.
		Arizona Flour Mills Co., Phoenix, Ariz.	Do.
		Bean Bros., Hayt Corners, N.Y.	June 10, 1954.
		Hayward, Inc., Oak Harbor, Ohio	July 20, 1954.
		Red River Alfalfa Co., Crookston, Minn.	Aug. 3, 1954.
		Dixon Dryer Co., 240 West E St., Dixon, Calif.	Nov. 12, 1954.
		San Joaquin Valley Hay Growers Association, Box 327, Tracy, Calif.	July 11, 1955.
		Poultry Producers of Central California, San Francisco, Calif.	Do.
		Barton Mills, Inc., Omaha and York, Nebr.	July 27, 1955.
		A. B. Caple Co., Toledo, Ohio	Sept. 23, 1955.
		Estate of Harry C. Trexler, deceased, 1227 Hamilton St., Allentown, Pa.	Jan. 8, 1957.
2,567,930	Preparation of Epoxy Compounds by Oxidation of Cis-Monoolefine Compounds.	The Baker Castor Oil Co., New York, N.Y.	Jan. 8, 1953.
		Argus Chemical Laboratory, Brooklyn, N.Y.	Apr. 23, 1953.
		Universal Chemicals Corp., Lonsdale, R.I.	May 29, 1953
		Rubber Corp. of America, Brooklyn, N.Y.	Apr. 27, 1954.
		Reichhold Chemicals, Inc., Detroit, Mich.	May 14, 1956.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,569,502	Epoxidized Oils	Rohm & Haas Co., Philadelphia, Pa.	May 5, 1952.
		Archer-Daniels-Midland Co., Minneapolis, Minn.	Dec. 3, 1952.
		Baker Castor Oil Co., New York, N.Y.	Jan. 8, 1953.
		Argus Chemical Laboratory, Brooklyn, N.Y.	Apr. 23, 1953.
		Spencer Kellogg & Sons, Inc., Buffalo, N.Y.	May 29, 1953.
		Universal Chemical Corp., Lonsdale, R.I.	Do.
		Rubber Corp. of America, Brooklyn, N.Y.	Apr. 27, 1954.
		Presto Plastic Products Co., Inc., 11 East 26th St., New York City, N.Y.	June 16, 1955.
		Reichhold Chemicals, Inc., Detroit, Mich. (601–707 Woodward Heights Blvd.)	May 14, 1956.
		The Rath Packing Co., Waterloo, Iowa	June 20, 1960.
		Union Carbide Corp., New York, N.Y.	July 5, 1960.
		Reilly-Whiteman-Walton Co., Conshohocken, Pa.	July 19, 1960.
2,572,071	Metal Resinates and Method of Preparation.	Alkyldol Laboratories, Inc., 3242 South 50th Ave., Cicero, Ill.	Feb. 28, 1952.
		The Shepherd Chemical Co., Norwood, Ohio.	Mar. 20, 1952.
		Onyx Oils & Resins, Inc., 95 Broad St., New York City, N.Y.	June 10, 1952
		The Harshaw Chemical Co., 1000 Harvard Ave., Cleveland, Ohio.	May 5, 1952.
2,585,036	Preparation of Novel Food Products from Rice.	W. R. Caldwell, Jr., Carlisle, Ark.	Feb. 28, 1950.
		Kulana Products Co., Honolulu, Hawaii	Mar. 24, 1950.
		Kuehmann Foods, Inc., Toledo, Ohio	July 11, 1950.
		Ponio Distributing Co., Akron, Ohio	Sept. 22, 1950.
		Mrs. R. S. Oeberst, 507 Gaudet Dr., Marrero, La.	Oct. 16, 1957.
2,643,213	Method for the Production of Vitamin B_{12} by *Streptomyces Olivaceus*.	National Yeast Corp., Belleville, N.J.	Sept. 19, 1952.
		Fermentation Products Inc., Newaygo, Mich.	Mar. 6, 1953.
		Nutrilite Products, Inc., Buena Park, Calif.	Jan. 16, 1956.
2,713,553	Electrochemical Production of Periodate Oxypolysaccharides.	Warner-Lambert Pharmaceutical Co., Morris Plains, N.J.	July 10, 1957.
		N. K. Van Osdol, Macon Creek Mills, 11200 Macon Mills Rd., Tecumseh, Mich.	July 15, 1957.
		Reilly-Whiteman-Walton Co., Conshohocken, Pa.	Aug. 21, 1957.
		Abbott Laboratories, North Chicago, Ill.	July 11, 1958.
		Miles Laboratories, Inc., Elkhart, Ind.	Sept. 29, 1958.
2,726,253	Cottonseed Oil Extraction Process.	Blaw-Knox Construction Co., Chemical Plants Division, Pittsburgh, Pa.	May 16, 1952.
		Bisbee Linseed Co., Inc., Chicago Heights, Ill.	Aug. 15, 1952.
		The French Oil Mill Machinery Co., Piqua, Ohio.	Sept. 19, 1952.
		Vern E. Alden Co., 33 North LaSalle St., Chicago, Ill.	Oct. 27, 1952.
		Wurster & Sanger, Inc., 5201 S. Kenwood Ave., Chicago, Ill.	Dec. 31, 1952.
		Day & Zimmermann, Inc., 1700 Sansom St., Philadelphia, Pa.	Mar. 6, 1953.
2,770,589	Electrolytic Production of Alkali Salts of Iodic Acid.	Warner-Lambert Pharmaceutical Co., Morris Plains, N.J.	July 10, 1957.
		N. K. Van Osdol, Macon Creek Mills, 11200 Macon Mills Rd., Tecumseh, Mich.	July 15, 1957.
		Reilly-Whiteman-Walton Co., Conshohocken, Pa.	Aug. 21, 1957.
		Abbott Laboratories, 14th St. and Sheridan Rd., North Chicago, Ill.	July 11, 1958.
		Miles Laboratories, Inc., Elkhart, Ind.	Sept. 29, 1958.
2,391,480	Laboratory Hammer Mills	Phipps & Bird, Inc., Richmond, Va.	Jan. 28, 1944.
2,132,712	Fermentation Process for the Manufacture of Dextro-Lactic Acid.	Schwarz Laboratories, Inc., New York, N.Y.	Nov. 4, 1943.
2,344,267	Proteinous Compositions and Their Process of Production.	The Griffith Laboratories, Chicago, Ill.	July 11, 1944.
		Dienes Development, Inc., New York, N.Y.	Mar. 24, 1945.
		Cooper Polymers, Inc., Wilmington, Mass.	Nov. 19, 1959.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,295,235	Process for Producing Rosin	Gum Turpentine Farmers Corp. Association, Vidalia, Ga.	May 23, 1944.
2,257,218	Process for the Preparation of Papain.	Wallerstein Co., Inc., New York, N.Y.	Jan. 3, 1942.
2,383,815	Ternary Synergistic Antioxidant Composition.	The Griffith Laboratories, Chicago, Ill.	July 11, 1944.
		Modern Foods, Inc., 1802 Crockett St., Houston, Tex.	Apr. 24, 1953.
2,440,383	Synergistic Antioxidant Composition of the Acidic Type.	The Griffith Laboratories, Chicago, Ill.	July 11, 1944.
		The Associated Laboratories, Inc., Dallas, Tex.	Sept. 15, 1949.
2,408,897	Derivatives of Isoascorbic Acid	The Griffith Laboratories, Chicago, Ill.	Sept. 23, 1944.
2,146,655	Products Obtained from the Hydrogenation of Lignin in the Presence of Suitable Catalysts.	Marathon Paper Mills Co., Rothschild, Wis.	Sept. 20, 1939.
2,212,866	Plastic Chlorinated Vegetable Fibrous Material.	Niagara Alkali Co., New York, N.Y.	Apr. 24, 1942.
1,859,846	Wood Pulp and Process of Making the Same.	Carolina Fiber Co., Hartsville, S.C.	Dec. 16, 1932.
1,859,845	Treatment of Wood for the Production of Pulp.	do	Do.
2,263,971	Stereoscopic Plotter	Harrison C. Ryker, Inc., Berkeley, Calif.	Dec. 8, 1943.
		Philip B. Kail Associates, 2535 Elm St., Denver, Colo.	Feb. 25, 1947.
2,239,832	Insecticide	J. A. Barfoot & Co., Los Angeles, Calif.	Sept. 25, 1941.
2,291,193	do	General Chemical Co., New York, N.Y.	Nov. 18, 1943.
2,306,434	Method of Applying Insecticides	Fuller System, Inc., Woburn, Mass.	June 24, 1943.
2,261,802	Apparatus for Measuring Coarseness of Powders.	Fisher Scientific Co., Pittsburgh, Pa.	Feb. 19, 1942.
2,356,185	Compounds of Nicotine	Jensen-Salsbery Laboratories, Kansas City, Mo.	Feb. 1, 1945.
2,321,250	Process for Making an Improved Plywood.	Federal Mill Supplies Co., New York, N.Y.	Apr. 7, 1945.
2,360,108	High Frequency Desiccator	Fred Stein Laboratories, Atchison, Kans.	June 29, 1945.
		Phipps & Bird, Inc., Richmond, Va.	Feb. 28, 1946.
2,358,986	Combined Insecticide and Germicide.	Industrial Management Corp., Los Angeles, Calif.	Feb. 25, 1946.
2,381,328	Process for the Preparation of Myosmine.	Swope Oil & Chemical Co., 3303 Richmond St., Philadelphia, Pa.	June 25, 1946.
2,323,925	Hardness Testing Tool	Timber Engineering Co., Washington, D.C.	July 17, 1946.
2,280,085	Sugar from Sorghum	Godchaux Sugars, Inc., New Orleans, La.	Oct. 22, 1946.
2,345,079	Process for the Production of Aconitic Acid.	do	Do.
2,359,537	Process for the Extraction of Aconitic Acid from Plant Juices.	do	Do.
2,399,840	Method for the Isolation of Penicillin from Aqueous Solutions.	Eli Lilly & Co., Indianapolis, Ind.	Sept. 27, 1946.
		E. R. Squibb & Sons, Brooklyn, N.Y.	Aug. 12, 1948.
2,463,740	Removal of Coloring Matter from the Skins of Peanuts.	Virginia-Carolina Chemical Corp., Richmond, Va.	Dec. 18, 1946.
2,478,168	Process for Obtaining Rutin from Buckwheat.	Ernst Bischoff Co., Inc., Ivoryton, Conn.	Mar. 31, 1947.
2,500,930	Process for Refining Rutin	do	Do.
2,425,094	Process for Obtaining Rutin from Buckwheat.	do	Do.
2,448,175	Extraction of Rutin	do	Do.
		The Associated Laboratories, Inc., Dallas, Tex.	Sept. 15, 1949.
2,424,184	Tertiary Amino Pentanols and Esters Thereof.	Eli Lilly & Co., Indianapolis, Ind.	Feb. 24, 1948.
2,432,638	Method for the Isolation of Penicillin.	do	Do.
2,450,992	Free-fall Aerial Container	Mathieson Chemical Corp., New York, N.Y.	May 21, 1948.
		Olin Mathieson Chemical Corp., 10 Light Street, Baltimore, Md.	Oct. 5, 1954.
2,527,597	Esters of Oleic Acid with Unsaturated Alcohols.	Nopco Chemical Co., Harrison, N.J.	June 14, 1948.
2,531,745	Squeeze-Bottle Atomizer for Acid Liquids.	Southern Gum Processing Co., Savannah, Ga.	July 17, 1957.
2,436,659	Process of Making d-Saccharic Acid.	High Point Chemical Manufacturing Co., High Point, N.C.	Aug. 26, 1957.
2,526,636	Moisture Measuring Instrument	Berkeley Scientific Co., Oakland, Calif.	Nov. 23, 1948.
		Southern Instruments Ltd., Surrey, England (to practice in the United States.)	Feb. 1, 1961.
2,444,241	Soy Whip	Simpson Chemical Corp., 120 Wall St., New York 5, N.Y.	Mar. 2, 1949.
2,445,931	Process of Extraction from Vegetable Materials.	do	Do.
2,361,151	Cooker and Dehydrator	Lloyd Hintz, Raymond, Minn.	July 12, 1949.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,440,781	Insecticidal Fumigant Composition with Solid Rubber Carrier Particles.	The Associated Laboratories Inc., Dallas, Tex.	Sept. 15, 1949.
2,446,116	Process of Purifying Carotene Contaminated with Chlorophyll and Xanthophyll.	do	Do.
2,447,693	Process for the Manufacture of Esters of Hydroxy Carboxylic Acids.	do	Do.
2,448,153	Process of Making Cotton Textiles Water-Absorbent and Rot-Resistant.	do	Do.
		Abenat Knitting Mills, Inc., Brooklyn, New York.	Do.
2,449,533	Synergistic Insecticidal Compositions.	The Associated Laboratories Inc., Dallas, Texas.	Do.
2,449,816	Plastic Material from Allyl Starch.	do	Do.
		The Baukus Research Laboratory, Saginaw, Mich.	Feb. 23, 1950.
2,560,537	Defrosting Indicator	Aseptic Thermo Indicator Co., 5000 W. Jefferson Blvd., Los Angeles, Calif.	Nov. 4, 1949.
		Vemaline Products Co., P.O. Box 222, Hawthorne, N.J.	Nov. 24, 1953.
2,504,962	Process for the Separation of the Compounds of Wheat and Granular Wheat Flour.	Schenley Industries, Inc., Cincinnati, Ohio.	Apr. 25, 1950.
2,457,611	Process for Preparation of Monoethenoic Acids and Their Esters.	Armour & Co., Union Stock Yards, Chicago 9, Ill.	Jan. 3, 1950.
2,705,679	Production of Potato Food Products.	Nude Foods Co., P.O. Box 266, Moorpark, Calif.	Jan. 5, 1950.
		A. H. Lang 163 Walker Rd., East Orange, N.J.	June 13, 1955.
		Roscoe Enterprises, Watchung, N.J.	Jan. 21, 1959.
2,457,315	Volatile Flavor Recovery Process.	Apple Growers Association., 11 Third St., Hood River, Oreg.	Jan. 18, 1950.
		Fritzsche Brothers, Inc., New York, N.Y.	Apr. 21, 1950.
2,406,369	Preparation of Organic Solvent-Soluble Unsaturated Carbohydrate Esters and Products Produced Thereby.	General Mills, Inc., Minneapolis, Minn.	Feb. 15, 1950.
2,409,987	Microspray Device	Air-O-Spra Corp., Washington, D.C.	Do.
2,460,980	Process for the Preparation of Isocyanate Derivatives of Proteins.	The Baukus Research Laboratory, Saginaw, Mich.	Feb. 23, 1950.
2,453,858	Process for Obtaining Rubber from Goldenrod Leaves.	do	Do.
2,452,092	Rubberlike Product and Process of Preparation.	do	Do.
2,564,685	Halogenated Terpene Addition Compounds.	Hercules Powder Co., Wilmington, Del.	Apr. 18, 1950.
2,479,745	Process for the Production of Apple Essence.	Fritzsche Brothers, Inc. New York, N.Y.	Apr. 21, 1950.
2,442,928	Food Products and Method of Making Them.	The Panray Corp., 340 Canal St., New York 14, N.Y.	July 11, 1950.
		Hemopac Co., Brooklyn, N.Y.	July 23, 1959.
2,423,475	Internal Surgical Dressings	The Panray Corp., 340 Canal St., New York 14, N.Y.	July 11, 1950.
		Premo Pharmaceutical Laboratories, Inc., South Hackensack, N.J.	Apr. 10, 1951.
		Hemopac Co., Brooklyn, N.Y.	July 23, 1959.
2,594,293	Protein Derivatives	Eastman Kodak Co., Rochester, N.Y.	July 14, 1950.
		General Mills, Inc., Minneapolis, Minn.	Do.
		Cooper Polymers, Inc., Wilmington, Mass.	Nov. 19, 1959.
2,443,897	Process for the Production of Sweet Potato Starch.	Associated Laboratories, Inc., Dallas, Tex.	Sept. 15, 1949.
2,502,498	Lignocellulose, Phenol Formaldehyde, and Inorganic Filler Molding Composition.	Harold Helfetz, 7425 Sunset Blvd., Hollywood 46, Calif.	Jan. 8, 1951.
		L. W. Shastock, doing business as L. W. Shastock Co., Cleveland 6, Ohio.	Apr. 10, 1951.
2,399,161	Process for Producing Glues and Adhesives from Keratin Protein Materials.	Andrew A. Keines, town of Thompson, State of Connecticut.	Jan. 25, 1951.
2,520,963	Production of Improved Cellulosic Materials.	D. Robert Erickson, Erickson Research Laboratories, Kalamazoo, Mich.	Apr. 10, 1951.
2,517,572	Process of Utilizing Detergents To Solubilize Keratin Materials.	L. W. Shastock, doing business as L. W. Shastock Co., Cleveland, Ohio.	Do.
2,510,945	N-Cyclohexyl Nicotinamide	E. R. Squibb & Sons, New York, N.Y.	Apr. 25, 1951.
2,534,250	Process of Isolating Quercitrin	Nassau Chemicals, Inc., San Francisco, Calif.	Do.
2,522,504	Gluten Phosphates and Method for Preparing Them.	Holt Mfg. Co., Birmingham, Ala. (A. M. Holt III and A. M. Holt, Jr.).	May 28, 1951.
2,549,877	Process of Producing Maple Sirup Concentrate.	Mille Lacs Maple Products Corp., Onamia, Minn.	July 19, 1951.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,521,704	Fibers from Zein	Julius Siegel, 291 Division Ave., Brooklyn 11, N.Y.	Jan. 28, 1952.
2,640,856	Production of Hexahydrolupulon and the Salts Thereof.	Nassau Chemicals, Inc., 420 Market St., San Francisco, Calif.	Aug. 5, 1952.
2,578,738	Biological Production of Riboflavin.	Schenley Laboratories, Inc., 350 Fifth Ave. New York, N.Y.	Do.
2,578,744	Method and Apparatus for Drying Sized or Otherwise Impregnated Textile Material.	Process Heating Co. Inc., 46 Herkimer Pl., Brooklyn 16, N.Y.	Aug. 15, 1952.
		United States Rubber Co., 1320 Avenue of the Americas, New York City, N.Y.	Oct. 8, 1952.
2,562,191	Process for Coagulating Synthetic Latices.	Adhesive Products Corp., 1660 Boone Ave., New York 60, N.Y.	Aug. 26, 1952.
2,477,812	Microbiological Production of Riboflavin.	Schenley Distillers, Inc., 350 Fifth Ave., New York, N.Y.	Aug. 29, 1952.
		do	Do.
2,375,250	Antioxidant Compositions	Merck & Co. Inc., Rahway, N.J.	Sept. 5, 1952.
		Modern Foods, Inc., 1802 Crockett St., Houston 10, Tex.	April 24, 1953.
2,478,248	Method of Producing Prolamine Filaments.	Virginia-Carolina Chemical Corp., 401 E. Main St., Richmond, Va.	Dec. 24, 1952.
2,573,750	Crystallized Fruit Spread and Process for Making Same.	States Apiaries, Saratoga, Wyo	Feb. 25, 1953.
2,610,918	Preparation of Dried Eggs	Wilson & Co., Inc., 4000 South Ashland Ave., Chicago 9, Ill.	Mar. 6, 1953.
2,383,816	Alkali Compounds Containing Antioxidant Compositions.	Modern Foods Inc., 1802 Crockett St., Houston 10, Tex.	April 24, 1953.
2,610,972	Synthesis of Organic Peroxides	Cadet Chemical Corp., 717 Elk St., Buffalo, N.Y.	Oct. 9, 1953.
2,649,864	Attachment for Weaving High Density Fabrics.	Crompton & Knowles Loom Works, Worcester, Mass.	Oct. 15, 1953.
		Southern Loom Development Co., 2222–2224 Augusta St., Greenville, S.C.	Oct. 18, 1955.
2,517,580	Mildew Resistant Paints	Vemaline Products Co., Post Office Box 222, Hawthorne, N.J.	Nov. 24, 1953.
2,462,803	Fireproofing Compositions	do	Do.
2,433,849	Cork Substitute and A Process for Its Production.	do	Do.
2,427,699	Crown Closure	do	Dec. 18, 1953.
2,461,070	Process to Produce a Stabilized Protein Formaldehyde Dispersion.	do	Do.
2,633,373	Grain Sampler	Corn Products Refining Co., New Jersey	Jan. 8, 1954.
2,445,881	Apparatus for Peeling Onions, Including Jet of Gas.	M. Longo & Sons, Inc., 25 Bath St., Providence, R.I.	Mar. 17, 1954.
2,698,538	Nep Potential Meter	Sperry Rand Corp. (Wright Machinery Co. Division), Durham, N.C.	Apr. 24, 1957.
2,285,059	Process for Preparing Aldehydes	Rubber Corp. of America, 274 Ten Eyck St., Brooklyn, N.Y.	Apr. 27, 1954.
2,304,064	Process for Producing Aldehydes	do	Do.
2,411,762	9,10-Epoxyoctadecanol and Process for Its Preparation	do	Do.
2,443,280	Hydroxylation Process	do	Do.
2,448,602	Glycidyl Esters	do	Do.
2,457,328	1,2-Epoxides and Process for Their Preparation.	do	Do.
2,492,201	Hydroxylation Process	do	Do.
2,572,892	Oxidation of Oleic Acid	do	Do.
2,809,941	Producing Phosphorus Containing Amino Resins and Flameproofing Organic Textiles.	Textiles Proofers, Inc., 181–193 Culver Ave., Jersey City, N.J.	Do.
		Kolker Chemical Corp., Newark, N.J.	June 23, 1959.
2,510,119	Production of Tannin and Soft Grint Blasting Materials from Nutshells.	Border Chemical Co., Post Office Box 61 T.W.C, El Paso, Tex.	May 12, 1954.
2,584,150	Preparation of Nutlike Products from Dry Beans.	Norkay Products Co., 4306 Josephine St., Compton, Calif.	Do.
		Mrs. R. S. Oeberst, 507 Gaudet Dr., Marrero, La.	Oct. 16, 1957.
2,262,422	Protein Plastic Molding Compound and Method of preparing the Same.	Norkay Products Co., 5306 Josephine St., Compton, Calif.	May 12, 1954.
2,494,537	Cold Setting Resorcinol Glue Composition & Process of Preparation.	do	Do.
2,354,090	Plywood	Leo Eagle, 3215 Collingwood, Detroit, Mich.	Do.
2,321,258	Process for Making an Improved Plywood.	do	Do.
2,550,682	Coating Compositions	General Biochemicals, Inc., Laboratory Pk., Chagrin Falls, Ohio.	June 10, 1954.
		Cooper Polymers, Inc., Wilmington, Mass.	Nov. 19, 1959.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,668,096	Flameproof Fibrous Aminoethylated Cellulose Derivatives.	All-American Chemical Co., 5-22 50th Ave., Long Island City, N.Y.	July 9, 1954.
		Scientific Oil Compounding Co., Inc., 1637-1655 South Kilbourn Ave., Chicago Ill.	Sept. 12, 1955.
2,706,403	Fiber Tester	Special Instruments Laboratory, Inc., 1003 Highland Ave., Knoxville, Tenn.	July 2, 1954.
2,602,768	Process for the Manufacture of Sodium Gluconate.	Fermentation Products, Inc., 4800 South Richmond St., Chicago, Ill.	Sept. 10, 1954.
		Fermco Laboratories, Inc., Chicago, Ill	June 20, 1960.
2,594,283	Process for the prepration of Inoculum Use in the Fermentation of Sodium Gluconate.	Fermentation Products, Inc., 4800 South Richmond St., Chicago, Ill.	Sept. 10, 1954.
2,333,134	Principal Point Selector	Robert N. Gordon doing business as Gordon Instruments, 1500 South Broadway, Los Angeles, Calif.	Sept. 22, 1954.
2,607,958	Fiber Doffing Device	Centrif-Air Machine Co., Inc., Atlanta, Ga.	Jan. 5, 1959.
2,617,707	Process of Making Soluble Yarns and Threads of Partially Carboxy-Methylated Cotton.	Abenat Knitting Mills, Inc., Brooklyn, N.Y.	Sept. 27, 1954.
2,531,431	Method of Preparing Calcium Firmed Apple Slices.	Mr. and Mrs. Arthur Mock, Route 4, No. 2 Canyon, Wenatchee, Wash.	Nov. 12, 1954.
2,417,869	Application of Cellulose Ethers to Textiles.	Anniston Manufacturing Co., Anniston, Ala.	Feb. 11, 1955.
2,611,708	Method of Coating Foods with Pectinate or Pectate Films.	Joel S. Gambord, 2093 Bel Air Ave., San Jose, Calif.	Mar. 11, 1955.
2,517,595	Coating Foods with Pectinate Films.	do	Do.
2,435,056	Method of Applying of Plant Response Substances.	E. I. du Pont de Nemours & Co., Wilmington, Del.	Mar. 31, 1955.
		Joseph J. Jones, 121 North Dawson St., Thomasville, Ga.	Sept. 20, 1957.
2,624,680	Plastic Plasticized with Alkyl Alkoxy Hydroxy Stearate.	Presto Plastic Products Co., Inc., 11 East 26th St., New York.	June 16, 1955.
2,709,699	Extracting Hemicelluloses	National Starch Products Inc., 270 Madison Ave., New York.	Aug. 24, 1955.
2,745,194	Continuous Belt Trough Drier	California Vegetable Concentrates, Inc., 2067 Clarendon Ave,. Huntington Park, Calif.	May 16, 1955.
		Proctor & Schwartz, Inc., 7th St. & Tabor Rd., Philadelphia, Pa.	May 28, 1957.
		Gentry Division of Consolidated Foods Corp., 837 North Spring St., Los Angeles, Calif.	Nov. 18, 1957.
		Process & Air Engineering Co., North Monterey Road, San Martin, Calif.	June 18, 1958.
		Nichols Engineering & Research Corp., 70 Pine St., New York, N.Y.	July 11, 1958.
		General Foods Corp., 250 North St., White Plains, N.Y.	Aug. 11, 1958.
		Diamond Manufacturing Co., San Leandro, Calif.	Aug. 22, 1958.
		Idaho Falls Sheet Metal Works, Idaho Falls, Idaho	June 18, 1959.
		Knipschild Dehydrater Co., St. Helena, Calif.	Jan. 6, 1960.
		E. H. Guthier Co. & James A. Nelson Co. (Partnership), Santa Ana, Calif.	June 16, 1960.
		Clock Associates, Sherwood, Oreg.	Aug. 11, 1960.
		Chemet Engineers, Inc., Pasadena, Calif.	Oct. 12, 1960.
		Elliott Manufacturing Co., Inc., Fresno, Calif.	Oct 26, 1960.
2,588,449	Levulose Dihydrate	Grove Farm Co., Ltd., Pahi, Kauai, Hawaii	Aug. 26, 1955.
2,715,602	Process for the Manufacture of Vitamin B_{12}.	Anheuser-Busch Inc., 721 Pestalozzi St., St. Louis, Mo.	Nov. 16, 1955.
2,625,488	Process of Heat Sensitive Fluids	The Girdler Co., 224 East Broadway, Louisville, Ky.	Mar. 23, 1956.
2,636,430	Apparatus for Heating Fluids, Particularly Foodstuffs.	do	Do.
2,711,962	Stabilized Forage Products	Jones Alfalfa Milling Co., 622 Van Buren St., Topeka, Kans.	Sept. 30, 1956.
2,428,844	Fly Sprays	Vernon Johnson Enterprises, Hollywood, Miss.	Mar. 30, 1956.
2,436,919	Fly Sprays Comprising an N-Alkylphthalimide and DDT.	do	Do.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,772,251	Vulcanization of Acrylic Acid Copolymers.	B. F. Goodrich Co., New York, N.Y.	Apr. 13, 1956.
2,735,870	Peroxides of Saturated Cylic Terpenes and Method of Producing Same.	American Cyanamid Co., 30 Rockefeller Plaza, New York.	May 14, 1956.
		Wallace & Tiernan, Inc., 1740 Military Rd. Buffalo, N.Y.	June 4, 1956.
		Phillips Petroleum Co., Bartlesville, Okla.	Feb. 12, 1958.
2,673,160	Method of Preserving Shell Eggs.	Seymour Packing Co., Topeka, Kans.	May 29, 1956.
2,630,397	Method of Bonding Sheet Materials and Coating Compositions Therefor.	The Borden Co., 350 Madison Ave., New York, N.Y.	July 5, 1956.
		Cooper Polymers, Inc., Wilmington, Mass.	Nov. 19, 1959.
2,666,770	Alkaline Cleavage of Pseudosapogenin Oxidation Products.	Root Chemicals, Inc., KM. 2.3, Guaynabo Rd., Guaynabo, P.R.	Mar. 19, 1957.
2,573,731	Acid Metering and Atomizing Nozzle.	Southern Gum Processing Co., Savannah, Ga.	July 17, 1957.
2,610,153	Skin Cleaning Composition.	Joseph J. Jones, 121 North Dawson St., Thomasville, Ga.	Sept. 20, 1957.
2,610,973	Stabilization of Glyceride Oils.	A. E. Staley Manufacturing Co., Decatur, Ill.	July 25, 1957.
2,400,006	Insect Repellent Compositions.	Joseph J. Jones, 121 North Dawson St., Thomasville, Ga.	Sept. 20, 1957.
2,759,832	Drum Drying of Cooked Potatoes.	Red River Valley Potato Flake Co., Grand Forks, N. Dak.	Oct. 28, 1958.
		Polar Potato Products, Inc., Park River, N. Dak.	Jan. 5, 1959.
		Instant Potato Products Corp., Detroit, Mich.	Feb. 5, 1959.
		Fosston Potato Products Corp., Fosston, Minn.	Apr. 1, 1959.
		Idaho Potato Starch Co., Blackfoot, Idaho.	Apr. 23, 1959.
		Gateway Flakes, Inc., Barnesville, Minn.	Nov. 2, 1959.
		Curtice Bros. Co., Rochester, N.Y.	Dec. 28, 1959.
		FMS & Swell, Inc., Perkinsville, N.Y.	Mar. 24, 1960.
		The Borden Co., New York, N.Y.	Sept. 29, 1960.
		Snow Flake Canning Co., Hartland, Maine.	Mar. 7, 1957.
		Rogers Bros. Seed Co., Inc., Idaho Falls, Idaho.	Aug. 30, 1957.
		Bakersfield Foods Co., Inc., 220 Industrial St., Bakersfield, Calif.	Nov. 13, 1957.
		Maine Potato Processing Co., Island Falls, Maine.	Dec. 6, 1957.
		Ore-Ida Potato Products, Inc., Ontario, Oreg.	Jan. 17, 1958.
		Valley Farm Foods, Inc., Wayland, N.Y.	May 15, 1958.
2,787,553	Method for Control of Texture of Dehydrated Potatoes.	Snow Flake Canning Co., Hartland, Maine.	Mar. 7, 1957.
		Rogers Bros. Seed Co., Inc., Idaho Falls, Idaho.	Aug. 30, 1957.
		Bakersfield Foods Co., Inc., 220 Industrial St., Bakersfield, Calif.	Nov. 13, 1957.
		Maine Potato Processing Co., Island Falls, Maine.	Dec. 6, 1957.
		Ore-Ida Potato Products, Inc., Ontario, Oreg.	Jan. 17, 1958.
		Valley Farm Foods, Inc., Wayland, N.Y.	May 15, 1958.
		Red River Valley Potato Flake Co., Grand Forks, N. Dak.	Oct. 28, 1958.
		Polar Potato Products, Inc., Park River, N. Dak.	Jan. 5, 1959.
		Instant Potato Products Corp., Detroit, Mich.	Feb. 5, 1959.
		Fosston Potato Products, Inc., Fosston, Minn.	Apr. 1, 1959.
		Idaho Potato Starch Co., Blackfoot, Idaho.	Apr. 23, 1959.
		Gateway Flakes, Inc., Barnesville, Minn.	Nov. 2, 1959.
		Curtice Bros. Co., Rochester, N.Y.	Dec. 28, 1959
		FMS & Swell, Inc., Perkinsville, N.Y.	Mar. 24, 1960.
		The Borden Co., New York, N.Y.	Sept. 29, 1960.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,780,552	Dehydration of Cooked Potatoes.	Snow Flake Canning Co., Hartland, Maine.	Mar. 7, 1957.
		Rogers Bros. Seed Co., Inc., Idaho Falls, Idaho.	Aug. 30, 1957.
		Bakersfield Foods Co., Inc., 220 Industrial St., Bakersfield, Calif.	Nov. 13, 1957.
		Maine Potato Processing Co., Island Falls, Maine.	Dec. 6, 1957.
		Ore-Ida Potato Products, Inc., Ontario, Oreg.	Jan. 17, 1958.
		Valley Farm Foods, Inc., Wayland, N.Y.	May 15, 1958.
		Red River Valley Potato Flake Co., Grand Forks, N. Dak.	Oct. 28, 1958.
		Polar Potato Products, Inc., Park River, N. Dak.	Jan. 5, 1959.
		Instant Potato Products Corp., Detroit, Mich.	Feb. 5, 1959.
		Fosston Potato Products, Inc., Fosston, Minn.	Apr. 1, 1959.
		Idaho Potato Starch Co., Blackfoot, Idaho.	Apr. 23, 1959.
		Gateway Flakes, Inc., Barnesville, Minn.	Nov. 2, 1959.
		Curtice Bros. Co., Rochester, N.Y.	Dec. 28, 1959.
		FMS & Swell, Inc., Perkinsville, N.Y.	Mar. 24, 1960.
		The Borden Co., New York, N.Y.	Sept. 29, 1960.
2,780,839	Cotton Opener	Carolina Machinery Co., Inc., Charlotte, N.C.	Oct. 16, 1957.
		Kirkman & Dixon Machinery Co., Greenwood, S.C.	Nov. 14, 1957.
		Cen-Tennial Cotton Gin Co., Inc., Columbus, Ga.	Nov. 18, 1957.
		Whiten Machine Works, Whitinsville, Mass.	Mar. 4, 1958.
		Continental Gin Co., Birmingham, Ala.	Mar. 6, 1958.
		Davidson-Kennedy Co., 1090 Jefferson St. NW., Atlanta, Ga.	Mar. 10, 1958.
		Jenkins Metal Shops, Inc., Gastonia, N.C.	May 27, 1958.
		Saco-Lowell Shops, Inc., Biddeford, Maine.	June 12, 1959.
		The Centrif-Air Machine Co., Inc., Atlanta, Ga.	July 21, 1959.
		Sunray Co., Spartanburg, S.C.	Jan. 5, 1960.
		Textile Shops, Inc., Spartanburg, S.C.	Do.
		James Hunter, Inc., Mauldin, S.C.	Jan. 22, 1960.
2,775,578	Polymerizations Initiated by Saturated Cyclic Terpene Peroxides.	American Cyanamid Co., 30 Rockefeller Plaza, New York, N.Y.	May 17, 1957.
		Phillips Petroleum Co., Bartlesville, Okla.	Feb. 12, 1958.
		U.S. Rubber Co., Naugatuck Chemical Division, New York.	Apr. 14, 1958.
2,745,749	Glyceridic Mixtures Exhibiting Unique Properties and Process for Their Production.	Beacon Chemical Industries, Inc., 33 Richdale Ave., Cambridge, Mass.	May 17, 1957.
		Leonard L. Born, 1204 Russ Ave., San Francisco, Calif.	July 10, 1958.
		Eastman Kodak Co., Rochester, N.Y.	June 9, 1959.
2,648,629	Electrolytic Preparation of Periodate Oxpolysaccharides.	N. K. Van Osdol Macon Creek Mills, 11200 Macon Mills Rd., Tecumseh, Mich.	July 15, 1957.
		Reilly-Whiteman-Walton Co. Conshohocken, Pa.	Aug. 21 1957.
		Abbott Laboratories, 14th St. and Sheridan Rd., North Chicago, Ill.	July 11, 1958.
		Miles Laboratories, Inc., Elkhart, Ind.	July 23, 1959.
2,607,958	Fiber Doffing Device	Whiten Machine Works, Whitinsville, Mass.	Mar. 4, 1958.
2,816,035	Manufacture of Sausages	Herman Deile, Inc., 82-86 Jackson St., Hoboken, N.J.	May 23, 1958.
2,812,311	Water Dispersible Solid Nitrilo-Methylol-Phosphorus Polymers.	Beacon Chemical Industries, Inc., Cambridge, Mass.	Do.
		Kolker Chemical Corp., Newark, N.J.	June 23, 1959.
2,700,321	Method and Apparatus for Detecting Blood in Eggs.	Food Systems, Inc., 1980 Mountain Blvd., Oakland, Calif.	June 10, 1958.
2,830,941	Electrolytic Process for Making Periodic Acid Solutions.	Abbott Laboratories, 14th and Sheridan Rd., North Chicago, Ill.	July 11, 1958.
		Miles Laboratories, Inc., Elkhart, Ind.	Sept. 29, 1958.
2,813,892	Calcium Salt of Condensation Product of Citric and Gluconic Acids.	Reheis Co., Inc., Berkeley Heights, N.J.	July 16, 1958.

Licenses granted under Department of Agriculture patents—Continued

Patent No.	Title	Name and address of licensee	Date issued
2,876,558	Apparatus for Treating Particulate Material with Gaseous Media	Proctor & Schwartz, Inc., 7th St. and Tabor Rd., Philadelphia, Pa.	May 28, 1957.
		Process & Air Engineering (Corp) & Research	June 18, 1958.
		Nichols Engineering & Research Corp., 70 Pine St., New York, N.Y.	July 11, 1958.
		General Foods Corp., 250 North St., White Plains, N.Y.	Aug. 11, 1958.
		Diamond Manufacturing Co., San Leandro, Calif.	Aug. 22, 1958.
		Idaho Falls Sheet Metal Works, Idaho Falls, Idaho	June 18, 1959.
		Knipschild Dehydrater Co., St. Helena, Calif.	Jan. 6, 1960.
		E. H. Guthier Co., and James A. Nelson Co. (Partnership).	June 16, 1960.
		Clock Associates, Sherwood, Oreg.	Aug. 11, 1960.
		Chemet Engineers, Inc., Pasadena, Calif.	Oct. 12, 1960.
		Elliott Manufacturing Co., Inc., Fresno, Calif.	Oct. 26, 1960.
2,879,549	Carding Apparatus	Davidson-Kennedy Co., Atlanta, Ga.	Apr. 22, 1959.
		Dixie Textile Sheet Metal, Inc., Gastonia, N.C.	Do.
		Paramount Textile Machinery Co., Chicago, Ill.	Apr. 23, 1959.
		Carolina Machinery Co., Inc., Charlotte, N.C.	May 6, 1959.
		John D. Hollingsworth, doing business as John D. Hollingsworth on Wheels, Greenville, S.C.	Do.
		Piedmont Textile Machinery Co., Charlotte, N.C.	May 12, 1959.
		Benjamin Booth Co., Philadelphia, Pa.	May 14, 1959.
		Pneumafil Corp., Charlotte, N.C.	May 22, 1959.
		Saco-Lowell Shops, Inc., Biddeford, Maine.	June 12, 1959.
		Whitin Machine Works, Whitinsville, Mass.	July 1, 1959.
		Nemo Industries, Inc., 3081 Maple Dr. NE., Atlanta, Ga.	July 6, 1959.
		Davis & Furber Machine Co., North Andover, Mass.	Aug. 5, 1959.
		Paul Stewart Machine Co., Gastonia, N.C.	Sept. 28, 1959.
		B. S. Roy & Son Co., Worcester, Mass.	Sept. 29, 1959.
		Continental Gin Co., Birmingham, Ala.	Oct. 23, 1959.
		Ashworth Bros., Fall River, Mass.	Dec. 4, 1959.
		Sunray Co., Spartenburg, S.C.	Jan. 5, 1960.
		The Textile Shops, Inc., Spartenburg, S.C.	Do.
		James Hunter, Inc., Mauldin, S.C.	Jan. 22, 1960.
		W. S. Libbey Co., Lewiston, Maine.	Mar. 15, 1960.
		Proctor & Schwartz, Inc., Philadelphia, Pa.	Apr. 13, 1960.
		Holdsworth Manufacturing Co., Inc., Pawtucket, R.I.	Do.
2,848,754	Fiber Cleaner	Carolina Machinery Co., Inc., Charlotte, N.C.	May 6, 1959.
		Davidson-Kennedy Co., Atlanta, Ga.	May 14, 1959.
		Saco-Lowell Shops, Inc., Biddeford, Maine.	June 12, 1959.
		Cen-Tennial Cotton Gin Co., Columbus, Ga.	June 18, 1959.
		The Centrif-Air Machine Co., Inc., Atlanta, Ga.	July 21, 1959.
		Continental Gin Co., Birmingham, Ala.	Oct. 29, 1959.
		Sunray Co., Spartanburg, S.C.	Jan. 5, 1960.
		The Textile Shops, Inc., Spartanburg, S.C.	Do.
		James Hunter, Inc., Mauldin, S.C.	Jan. 22, 1960.

APPENDIX C

Foreign Research Projects

Foreign Agricultural Research Under Public Law 480 [1]

GRANTS EXECUTED

Fiscal year 1958

Section 104(a)

A10 Israel

UR–A1h–(30)–3 Fundamental studies of microbial flora within the tissues of fruits and vegetables and their effects on processing and preservation, as a basis for the development of products of superior quality.

Department of Food Technology, Agricultural Research Stations of the Ministry of Agriculture, Rehovot.

Grant FG–Is–100 executed June 22, 1958. Duration: 4 years.

Amount: 200,132 Israeli pounds ($111,184 equivalent).

UR–A10–(20)–4 A fundamental study of the oxidation of cotton by hypochlorite, hypobromite, and other oxidizing agents, to obtain data on the kinetics of the oxidation and the changes in physical and chemical properties, as a contribution to improved uses for cotton.

Institute for Fibres and Forest Products Research, Jerusalem.

Grant FG–Is–101 executed June 27, 1958. Duration: 5 years.

Amount: 236,325 Israeli pounds ($131,292 equivalent).

UR–A10–(10)–6 Fundamental studies on the mild oxidation of cereal grain starches by hypochlorite, hypobromite, hypochlorite-bromide mixtures, and other oxidizing agents for the determination of reaction mechanisms and the physical and chemical properties of the modified starches of importance to the production and use of this class of industrial starches.

Institute for Fibres and Forest Products Research, Jerusalem.

Grant FG–Is–102 executed June 22, 1958. Duration: 5 years.

Amount: 232,215 Israeli pounds ($129,008 equivalent.)

Fiscal year 1959

Section 104(a)

E8 Finland

UR–E8–(60)–4 Investigation of the influence of micro-organisms on flavor development and other chemical changes in dry sausage, to obtain information useful in producing sausage of improved quality and increased consumer acceptance.

Research Institute of Meat Technology, Biochemical and Bacteriological Laboratory, Hameenlinna.

Grant FG–Fi–101 executed May 5, 1959. Duration: 4 years.

Amount: 13,199,500 finnmarks ($41,377 equivalent).

UR–E8–(60)–5 Fundamental studies of the transmission of flavor constituents and other biologically active compounds from the feed of dairy cattle to milk, to obtain information useful in the development of means for minimizing such transport.

Biochemical Institute, Helsinki.

Grant FG–Fi–100 executed May 5, 1959. Duration: 5 years.

Amount: 80,741,500 finnmarks ($253,108 equivalent).

[1] Source: U.S. Department of Agriculture, Agricultural Research Service, Foreign Research and Technical Programs Division, Washington, D.C., Apr. 1, 1961.

E29 United Kingdom

UR–E29–(60)–2 A fundamental study of the mechanism of the deterioration of leather fibers by chemicals, sweat, and heat, to obtain information for use in the development of more stable tannages that will yield leathers of superior quality.
British Leather Manufacturers' Research Association, Surrey, England.
Grant FG–UK–106 executed July 8, 1958. Duration: 5 years.
Amount: 37,490 British pounds ($104,972 equivalent).

UR–E29–(20)–4 A fundamental investigation of the cause of warp breakage in the weaving of cotton yarns, as a basis for improving quality and reducing costs of production.
The Cotton, Silk and Man-Made Fibres Research Association, Shirley Institute, Didsbury, Manchester, England.
Grant FG–UK–102 executed July 8, 1958. Duration: 5 years.
Amount: 37,210 British pounds ($104,188 equivalent).

UR–E29–(20)–6 A fundamental study of the microbiological breakdown of natural cotton fiber, as a contribution to the better preservation of cotton products.
The Cotton, Silk and Man-Made Fibres Research Association, Shirley Institute, Didsbury, Manchester, England.
Grant FG–UK–107 executed July 8, 1958. Duration: 5 years.
Amount: 38,775 British pounds ($108,570 equivalent).

UR–E29–(20)–9 A fundamental study of the pyrolysis of cotton cellulose to provide information needed for improvement of flame-resistant treatments for cotton.
The Cotton, Silk and Man-Made Fibres Research Association, Shirley Institute, Didsbury, Manchester, England.
Grant FG–UK–108 executed May 1, 1959. Duration: 5 years.
Amount: 38,490 British pounds ($107,938 equivalent).

UR–E29–(20)–10 An investigation of the distribution of sulfur in wool: Identification and characterization of the sulfur-containing compounds present in the wool fiber, to provide fundamental information needed in improving the quality and broadening the uses of wool.
Wool Industries Research Association, Torridon, Headingley, Leeds.
Grant FG–UK–105 executed July 8, 1958. Duration: 4 years.
Amount: 22,200 British pounds ($62,160 equivalent).

UR–E29–(30)–17 Elucidation of the protective action of sulfur dioxide in controlling nonenzymic browning in dehydrated vegetables, as a basis for the development of processes yielding products of greater consumer acceptability.
Ministry of Agriculture, Fisheries and Food, Covent Garden Laboratory, London.
Grant FG–UK–104 executed July 8, 1958. Duration: 5 years.
Amount: 50,330 British pounds ($140,924 equivalent).

UR–E29–(60)–18 A basic investigation of the biochemical and physical changes occurring in meat fibers when they are dehydrated by the "accelerated freeze-drying" process, to determine conditions necessary for its commercial acceptance.
Ministry of Agriculture, Research Establishment and Experimental Factory, Aberdeen, Scotland.
Grant FG–UK–101 executed July 8, 1958. Duration: 5 years.
Amount: 45,555 British pounds ($127,554 equivalent).

UR–E29–(30)–19 Investigation of the antioxidant properties of some naturally occuring polyphenolic compounds and their derivatives, in order to develop new or improved stabilizers that will preserve the quality and increase the consumer acceptance of processed meat, dairy, and vegetable products.
Ministry of Agriculture, Fisheries and Food, Research Establishment and Experimental Factory, Aberdeen, Scotland.
Grant FG–UK–100 executed July 8, 1958. Duration: 5 years.
Amount: 44,205 British pounds ($123,774 equivalent).
Grant discontinued March 31, 1961.

UR–E29–(30)–20 Investigation of the chemical changes in carotenoid pigments during processing and storage of selected vegetables, and the effects of these changes on product stability and flavor.
Ministry of Agriculture, Fisheries and Food, Research Establishment and Experimental Factory, Aberdeen, Scotland.
Grant FG–UK–103 executed July 8, 1958. Duration: 5 years.
Amount: 50,705 British pounds ($141,974 equivalent).

UR–E29–(30)–27 A fundamental investigation of the influence of phytin on the texture of dry peas during maturation, as a contribution to expansion of

markets for vegetables through increased knowledge of the factors influencing quality.

Fruit and Vegetable Canning and Quick Freezing Research Association, Chipping Campden, Gloucester, England.

Grant FG–UK–113 executed June 19, 1959. Duration: 5 years.

Amount: 29,950 British pounds ($83,989 equivalent).

UR–E29–(60)–31 Application of paper chromatography and allied techniques to differentiation of the microorganisms important in dairy products, in order to obtain data useful in the scientific control of manufacturing procedures for producing dairy products of improved quality.

National Institute for Research in Dairying (University of Reading), Shinfield, Reading, England.

Grant FG–UK–109 executed May 7, 1959. Duration: 5 years.

Amount: 31,751 British pounds ($89,039 equivalent).

UR–E29–(50)–33 Fundamental studies on the reaction of sucrose with constituents of vegetable and animal fats and oils, to produce new and useful compounds having special hydrophilic and lipophilic characteristics.

Tropical Products Institute, London, England.

Grant FG–UK–110 executed May 1, 1959. Duration: 5 years.

Amount: 32,750 British pounds ($91,841 equivalent).

Fiscal year 1960

Section 104(a)

A10 Israel

UR–A10–(10)–1 A fundamental investigation of the synthesis and chemical and physical properties of multichain polymers and copolymers comprised of amino acids derivable from the cereal grain proteins, gliadin and zein, as a contribution to the increased utilization of cereal grains.

Weizmann Institute of Science, Rehovot, Israel.

Grant FG–Is–104 executed March 1, 1960. Duration: 4 years.

Amount: 202,100 Israeli pounds ($112,278 equivalent).

UR–A10–(20)–5 A fundamental investigation of crimp in cotton fibers and its relationship to other fiber properties, as well as its effect on processing performance and product quality.

Institute for Fibres and Forest Products Research, Ministry of Commerce and Industry of the State of Israel, Jerusalem.

Grant FG–Is–103 executed April 19, 1960. Duration: 5 years.

Amount: 415,200 Israeli pounds ($230,666 equivalent).

E8 Finland

E8–AMS–1(a) Studies on residues of insecticides and fungicides applied to different plant products after harvest, including methods of determining pesticide used; stability of the residues during marketing, storage, food preparation, and preservation; and the effects of the pesticides on the food quality.

College of Agriculture, University of Helsinki, Helsinki.

Grant FG–Fi–110 executed May 17, 1960. Duration: 4 years.

Amount: 18,050,200 finnmarks ($56,637 equivalent).

UR–E8–(60)–1 Investigations of lactic acid bacteria growth promoting factors to obtain basic information in their nature, structure, and physiological mechanism of action, as a basis for improvement of the manufacture of cheese and quality of the resulting product.

Institute of Biochemistry, University of Turku, Turku.

Grant FG–Fi–102 executed September 25, 1959. Duration: 5 years.

Amount: 18,163,000 finnmarks ($56,991 equivalent).

UR–E8–(40)–2 Investigation of continuous multistage countercurrent crystallization of linseed and soybean fatty acids as a practical method of producing pure unsaturated fatty acids, to provide a basis for new or improved uses of linseed and soybean oils.

University of Helsinki, Malmi (Helsinki).

Grant FG–Fi–106 executed February 24, 1960. Duration: 5 years.

Amount: 22,516,000 finnmarks ($70,640 equivalent).

UR–E8–(60)–3 Fractionation of gelatin and soluble collagen proteins by electro-osmotic and ion-exchange techniques, and characterization of the frac-

tions by chemical and physicochemical means, to provide fundamental information that may contribute to expanded utilization of hides and skins.

University of Turku, Department of Medical Chemistry, Faculty of Medicine, Turku.

Grant FG–Fi–105 executed Feburary 25, 1960. Duration: 5 years.

Amount: 20,278,000 finnmarks ($63,619 equivalent).

UR–E8–(10)–6 Isolation of organic phosphorus derivatives found in the yeast *Torulopsis utilis* and elucidation of their structures, to provide new basic information on the fermentation of cereal products to industrial materials by yeasts.

Biochemical Institute, Kalevankatu 56, Helsinki.

Grant FG–Fi–107 executed March 8, 1960. Duration: 5 years.

Amount: 26,166,000 finnmarks ($82,102 equivalent).

E9 France

UR–E9–(20)–1 Study of the sequence of amino acid building blocks in proteins of wools selectively degraded under controlled acid conditions, to provide new understanding of how chemical structure determines quality differences among wools.

University of Lille, Lille.

Grant FG–Fr–100 executed May 18, 1960. Duration: 4 years.

Amount: 117,176 New French francs ($23,902 equivalent).

UR–E9–(00)–29 Investigation of the preparation and properties of alkyl aryl ketones and their derivatives from vegetable oils and animal fats, to provide information of potential value in increasing utilization of these commodities in such industrial products as surface-active agents, lubricants, plasticizers, and fungicides.

Institut de Recherches pour les Huiles et Oleagineux, Paris.

Grant FG–Fr–102 executed June 1, 1960. Duration: 3 years.

Amount: 264,640 francs ($53,987 equivalent).

UR–E9–(10)–43 Quantitative estimation of certain phosphorus compounds in flours from selected types of wheat, and determination of the effect of phytates on the solubility of specified proteins important to the quality of flour on baked products.

Laboratoire de Biochimie et Physico-Chimie des Cereales, Paris.

Grant FG–Fr–101 executed June 28, 1960. Duration: 4 years.

Amount: 27,037,000 francs ($55,155 equivalent).

E15 Italy

UR–E15–(60)–5 Investigation of "red heat" and other defects caused by microbial action in hides exported from the United States, to obtain information useful in preventing these difficulties.

Stazione Sperimentale per l'Industria delle Pelli e delle Materia Concianti, Naples.

Grant FG–It–102 executed February 13, 1960. Duration: 4 years.

Amount: 33,150,000 lire ($53,040 equivalent).

UR–E15–(60)–7 Investigations of tanning methods for conversion of U.S. cattle hides into sole leather in Italian tanneries, to further the utilization of U.S. hides for leather making in Italy.

Stazione Sperimentale per l'Industria delle Pelli e delle Materia Concianti, Naples.

Grant FG–It–103 executed February 13, 1960. Duration: 4 years.

Amount: 39,925,000 lire ($63,880 equivalent).

UR–E15–(40)–8 An investigation of the minor constituents of linseed oil and their effect on the ability of linseed oil films to spread and adhere to surfaces, as a contribution to the expansion of markets for linseed oil.

Ministero dell' Industria e del Commercio, Experimental Station for Fats and Oils, Milan.

Grant FG–It–104 executed March 9, 1960. Duration: 5 years.

Amount: 51,142,311 lire ($81,828 equivalent).

UR–E15–(40)–9 Investigations of the controlled thermal polymerization of soybean and linseed oils, and of the separation and characterization of the reaction products, in order to obtain information useful in expanding and improving the industrial applicability of these oils.

Ministero dell' Industria e del Commercio, Experimental Station for Fats and Oils, Milan.

Grant FG–It–105 executed March 9, 1960. Duration: 4 years.

Amount: 32,322,042 lire ($51,715 equivalent).

UR–E15–(30)–11 A fundamental study of the effects of temperatures and temperature variations encountered in transportation and distribution on quality changes in canned concentrated peach and apricot purees, as a contribution to expansion of markets for canned fruits.

Experiment Station for Food-Preserving Industries, Parma.
Grant FG–It–101 executed August 6, 1959. Duration: 3 years.
Amount: 20,840,000 lire ($33,344 equivalent).

UR–E15–(60)–13 A fundamental investigation of the chemical and physical changes occurring in beef during the processing steps involved in canning, in order to obtain basic information that can be applied to improving the quality of canned beef.

Experiment Station for Food-Preserving Industries, Parma.
Grant FG–It–100 executed August 6, 1959. Duration: 4 years.
Amount: 38,210,000 lire ($61,136 equivalent).

E25 Spain

E25–AMS–1–(a) Basic studies on the constituents of rice that influence quality and development of objective methods for measuring market quality of raw and precooked rice.

Patronato "Juan de la Cierva" de Investigacion Tecnica, Valencia.
Grant FG–Sp–107 executed June 21, 1960. Duration: 4 years.
Amount: 1,163,380 pesetas ($19,390 equivalent).

UR–E25–(20)–1 Development of methods and equipment for determining the irregularity of transparency of the card web and for counting of neps, by means of electronic devices, as aids to improving product quality of cotton textile operations.

Patronato "Juan de la Cierva" de Investigacion Tecnica, Delegacion de Barcelona, Barcelona.
Grant FG–Sp–101 executed March 3, 1960. Duration: 3 years.
Amount: 1,710,000 pesetas ($27,448 equivalent).

UR–E25–(20)–2 Determination of the relationship between the cohesion of cotton fibers and other physical properties of fibers, rovings, and yarns, as a step in improving product quality and processing efficiency.

Patronato "Juan de la Cierva" de Investigacion Tecnica, Delegacion de Barcelona, Barcelona.
Grant FG–Sp–102 executed March 3, 1960. Duration: 3 years.
Amount: 1,525,000 pesetas ($24,478 equivalent).

UR–E25–(40)–4 Investigations of ion exchange procedures for removing pro-oxidant metals from soybean oil, in order to contribute to expanded utilization of soybean oil through improvement of its flavor and oxidative stability during transportation, storage, and use.

Instituto de la Grasa y sus Derivados, Seville.
Grant FG–Sp–103 executed March 1, 1960. Duration: 5 years.
Amount: 2,222,025 pesetas ($35,667 equivalent).

UR–E25–(10)–11 Isolation and characterization of yeasts for placement in the Culture Collection of the Agricultural Research Service, as potential agents for the conversion of farm-produced raw materials to products useful to industry and the consuming public.

Instituto Nacional de Investigaciones Agronomicas, Madrid.
Grant FG–Sp–104 executed February 25, 1960. Duration: 5 years.
Amount: 2,925,950 pesetas ($48,025 equivalent).

UR–E25–(20)–13 Determination of the effect of drafting forces in high-draft systems on the uniformity and strength of cotton yarns, as a step in improving product quality and processing efficiency.

Patronato "Juan de la Cierva" de Investigacion Tecnica, Delegacion de Barcelona, Barcelona.
Grant FG–Sp–100 executed March 3, 1960. Duration: 3 years.
Amount: 1,715,000 pesetas ($27,528 equivalent).

E29 United Kingdom

UR–E29–(20)–11 A fundamental investigation of the chemical structure of wool-type proteins (keratins): A study of the penetration into keratins of charged molecules, to gain a knowledge of fiber structure that may lead to improved wool fibers of uniformly high quality.

Wool Industries Research Association, Torridon, England.
Grant FG–UK–117 executed September 19, 1959. Duration: 4 years.
Amount: 19,052 British pounds ($53,428 equivalent).

UR–E29–(10)–14 Studies of the effects upon baking quality of composition variations in wheat flour lipids, as influenced by variety and conditions of growth, as a contribution to the expansion of wheat flour utilization.

British Baking Industries Research, Herts, England.

Grant FG–UK–118 executed October 1, 1959. Duration: 5 years.

Amount: 29,400 British pounds ($82,446 equivalent).

UR–E29–(60)–15 A fundamental study of the isolation, purification, and characterization of specific enzymes which attack the components of animal connective tissue, to obtain information applicable to the control of freezer damage and improvement of the quality of meat.

Department of Scientific and Industrial Research, Cambridge, England.

Grant FG–UK–116 executed September 25, 1959. Duration: 5 years.

Amount: 36,300 British pounds ($101,796 equivalent).

UR–E29–(20)–22 A fundamental study of wool yarn lubrication in relation to knitting action and the appearance of knitted loops to provide a basis for development of more economical knitting operations and knit wool fabrics of improved quality, thus strengthening the competitive position of wool.

Hosiery and Allied Trades Research Association, Nottingham, England.

Grant FG–UK–112 executed July 1, 1959. Duration: 4 years.

Amount: 15,300 British pounds ($42,906 equivalent).

UR–E29–(60)–24 A fundamental investigation of the biochemical properties of pork muscle as they are related to pigment formation and color fixation during curing.

British Food Manufacturing Industries Research Association, Surrey, England.

Grant FG–UK–111 executed July 1, 1959. Duration: 4 years.

Amount: 20,360 British pounds ($57,096 equivalent).

UR–E29–(40)–29 Development of new uses for soybean and linseed oils through investigations of organometallic derivatives and complexes as components of protective coatings having improved properties.

Research Association of British Paint, Colour, and Varnish Manufacturers, Paint Research Station, Middlesex, England.

Grant FG–UK–121 executed May 5, 1960. Duration: 5 years.

Amount: 32,442 British pounds ($90,977 equivalent).

UR–E29–(20)–35 A fundamental investigation of the preparation and properties of esters, anhydrides, hydrazides, pseudohalides, fluorides, and related compounds of the phosphonitrilic chlorides for use in preparing new products to increase the utilization of cotton.

Department of Chemistry, Birkbeck College, University of London, London, England.

Grant FG–UK–115 executed August 4, 1959. Duration: 3 years.

Amount: 18,970 British pounds ($53,200 equivalent).

UR–E29–(10)–36 A fundamental study of chemical reactions for polymerizing glucose and glucose derivatives to form new high-molecular-weight compounds, as a basis for the development of new outlets for cereal grains and other starch-rich crops.

Arthur D. Little Research Institute, Inveresk, Scotland.

Grant FG–UK–114 executed July 15, 1959. Duration: 4 years.

Amount: 57,785 British pounds ($162,047 equivalent).

UR–E29–(10)–39 A study of the factors governing the onset of oxidative rancidity in oats, and oat products.

Research Association of British Flour-Millers, Cereals Research Station, Herts, England.

Grant FG–UK–120 executed February 5, 1960. Duration: 5 years.

Amount: 21,825 British pounds ($61,505 equivalent).

UR–E29–(10)–40 Investigations of the structure and properties of cereal starches—particularly corn and wheat starches—and their interaction with enzymes and other proteins, to obtain fundamental information concerning the structure and behavior of cereal starches, that would be useful in starch processing.

University of Birmingham, Birmingham, England.

Grant FG–UK–119 executed October 24, 1959. Duration: 5 years.

Amount: 34,867 British pounds ($98,259 equivalent).

Fiscal year 1960

Section 104(k)

A7 India

A7–FS–7 Survey for natural enemies of *Chermes* species of insects attacking silver fir and spruce trees in the Himalayas. (This is related to the balsam Dooly aphid control problem in U.S. forests.)
Commonwealth Institute of Biological Control, Bangalore.
Grant FG–In–100 executed May 2, 1960. Duration: 5 years.
Amount: 3.83.750 Indian rupees ($81,173 equivalent).

A17 Pakistan

A17–ENT Purchase of Baranov collectoin of Tachinid flies. (Includes about 5,000 identified specimens belonging to about 800 different species.)
Purchased June 17, 1960 from Dr. Nicolas Baranov, a private individual in Karachi.
Amount: 16,200 Pakistan rupees ($3,432 equivalent).

A17–FS–5 Investigations on the predators of *Adelges* (balsam wooly aphid) on fir trees in Pakistan, and their possible use in the U.S. for biological control of this insect.
Commonwealth Institute of Biological Control, Pakistan Station, Rawalpindi.
Grant FG–Pa–100 executed May 17, 1960. Duration: 5 years.
Amount: 238,800 Pakistan rupees ($50,460 equivalent).

A22 Turkey

A22–CR–1 New crops screening of native plants of Turkey of potential use in the agriculture of the United States.
Faculty of Agriculture, University of Ankara, Ankara.
Grant FG–Tu–100 executed March 4, 1960. Duration: 5 years.
Amount: 1,210,000 Turkish lire ($134,444 equivalent).

E8 Finland

E8–CR–5 Evaluation of genetic changes in seed of alsike, red and white clover varieties produced in the United States and Canada.
Department of Plant Husbandry, Agricultural Research Centre, Tikkurila.
Grant FG–Fi–109 executed June 15, 1960. Duration: 5 years.
Amount: 24,750,000 finnmarks ($77,659 equivalent).

E8–FS–31 The role of mycorrhizae in tree nutrition and growth, and the possible association of abnormal mycorrhizae with tree disease.
University of Helsinki, Helsinki.
Grant FG–Fi–103 executed October 23, 1959. Duration: 5 years.
Amount: 12,870,000 finnmarks ($40,383 equivalent).

E8–FS–39 The aerobic bacterial degradation of lignin.
College of Agriculture and Forestry, University of Helsinki, Helsinki.
Grant FG–Fi–108 executed February 27, 1960. Duration: 2 years.
Amount: 5,244,000 finnmarks ($16,454 equivalent).

E8–FS–40 Regional comparisons between the actual cuttings, cutting plans, growth, and forest resources. Theory, interpretation and analyses of selected countries.
University of Helsinki, Helsinki.
Grant FG–Fi–104 executed October 24, 1959. Duration: 3 years.
Amount: 4,930,000 finnmarks ($15,466).

E8–FS–43 Development of improved research methods for determining growth of forest trees and yield of forest stands.
Forest Research Institute of Finland, Helsinki.
Grant FG–Fi–112 executed June 17, 1960. Duration: 4 years.
Amount: 13,590,400 finnmarks ($42,643 equivalent).

E8–FS–44 A study of fertilization failure in controlled breeding of some species of forest trees.
Forest Research Institute of Finland, Helsinki.
Grant FG–Fi–113 executed June 17, 1960. Duration: 5 years.
Amount: 17,738,200 finnmarks ($55,657 equivalent).

E21 Poland

E21–ADP–1 Control of the liver fluke in domestic ruminants by chemotherapy and destruction of the snail intermediate hosts.
Department of Parisitology, Veterinary Institute, Pulawy.
Grant FG–Po–104 executed May 25, 1960. Duration: 4 years.
Amount: 2,128,400 zlotys.

E21–CR–8 Epidemiology and control of apple scab, a fungus disease of apples.
Research Institute of Pomology, Skierniewice.
Grant FG–Po–103 executed May 25, 1960. Duration: 5 years.
Amount: 545,500 zlotys.

E21–CR–9 The influence of environmental factors responsible for undesirable premature floral developement called "buttoning" in cauliflower, and effective ways of controlling the disorder.
Institute of Genetica, Polish Academy of Sciences, Skierniewice.
Grant FG–Po–107 executed May 25, 1960. Duration: 2 years.
Amount: 176,800 zlotys.

E21–SWC–3 Studies on the variability and genetics of Rhizobium.
University of Lublin, Lublin.
Grant FG–Po–105 executed May 25, 1960. Duration: 5 years.
Amount: 1,246,000 zlotys.

E21–FS–1 Influence of soil, moisture levels, and precipitation on growth and development of Scotch pine and spruce trees and stands of various ages.
Forest Research Institute, Warsaw.
Grant FG–Po–100 executed May 25, 1960. Duration: 5 years.
Amount: 1,775,175 zlotys.

E21–FS–2 Biological and chemical control of forest insects.
Forest Research Institute, Warsaw.
Grant FG–Po–101 executed May 25, 1960. Duration: 5 years.
Amount: 2,033,050 zlotys.

E21–FS–3 Growth, developemnt, and disease and insect susceptibility of North American forest tree species in Poland.
Forest Research Institute, Warsaw.
Grant FG–Po–102 executed May 25, 1960. Duration: 5 years.
Amount: 1,019,100 zlotys.

E25 Spain

E25–FS–5 Diseases of the native fir and pine trees and of the introduced pine *Pinus radiata* acclimatized in Spain.
Forest Research Institute, Madrid.
Grant FG–Sp–105 executed May 12, 1960. Duration: 4 years.
Amount: 2,456,000 pesetas ($40,933 equivalent).

E25–FS–10 Study of parasites, predators, and diseases of the gypsy moth in the forests of Spain, and their possible use in the United States for biological control of this moth.
Forest Research Institute, Madrid.
Grant FG–Sp–106 executed May 12, 1960. Duration: 5 years.
Amount: 3,544,000 pesetas ($59,067 equivalent).

Fiscal year 1961

Section 104(a)

A7 India

UR–A7–(60)–5 Studies on the isolation and use of milk coagulating enzymes of microbiological origin for cheese manufacture.
National Dairy Research Institute, Karnal, Punjab.
Grant FG–In–105 executed November 25, 1960. Duration: 5 years.
Amount: 242,230 rupees ($51,347 equivalent).

A10 Israel

A10–AMS–7(a) Development of a rapid, simple test for protein nutritive value of cereal grains and feeds.
Israel Institute of Technology, Haifa.
Grant FG–Is–110 executed January 24, 1961. Duration: 4 years.
Amount: 186,815 Israeli pounds ($103,785 equivalent).

UR–A10–(10)–9 Studies of the preparation of new cereal starch derivatives by the introduction of fluorine into starch and products derived therefrom, to provide a basis for increased industrial utilization of wheat, corn, and sorghum.
The Hebrew University, Jerusalem.
Grant FG–Is–113 executed February 17, 1961. Duration: 3 years.
Amount: 109,565 Israeli pounds ($60,869 equivalent).

UR–A10–(40)–18 Investigations of soybean saponins as related to the processing of petroleum ether-extracted meal for feed and to the preparation of soy-

foods, to provide information basic to improving the nutritional value of soybean protein products.

The Hebrew University, Faculty of Agriculture, Rehovot.

Grant FG–Is–112 executed February 20, 1961. Duration: 5 years.

Amount: 204,430 Israeli pounds ($113,571 equivalent).

E8 Finland

E8–AMS–2(a) Studies on the contamination and deterioration of market milk by nonpathogeni bacteria.

Department of Microbiology, College of Agriculture, University of Helsinki, Helsinki.

Grant FG–Fi–120 executed October 13, 1960. Duration: 2 years.

Amount: 7,466,000 Finnmarks ($23,426 equivalent).

E9 France

UR–E9–(60)–47 Investigation of the proteolytic activity of crystalline rennin on the individual components of casein, to obtain information on the coagulation of milk which can be applied to improving cheese manufacturing processes and the quality of cheese.

Institut National de la Recherche Agronomique, Paris.

Grant FG–Fr–103 executed December 13, 1960. Duration: 4 years.

Amount: 291,735 New French francs ($59,498 equivalent).

E15 Italy

UR–E15–(40)–10 Investigations of the effect of metallic catalysts and physical conditions on oxidative cleavage products produced in the autoxidation of polunsaturated fatty acids, to provide basic information for applied research on the production of new industrial chemicals from soybeans and linseed oil.

Experiment Station on Fats and Oils Industry, Milan.

Grant FG–It–106 executed November 27, 1960. Duration: 4 years.

Amount: 42,259,992 lire ($68,052 equivalent).

UR–E15–(40)–14 Studies of the admixture of soybean protein products with wheat flour in the manufacture of pasta (spaghetti, macaroni, etc.) to contribute to increased utilization of soybeans.

National Institute of Nutrition, Rome.

Grant FG–It–108 executed July 26, 1960. Duration: 4 years.

Amount: 45,721,120 lire ($73,625 equivalent).

UR–E15–(60)–16 Development of new food products from concentrated milk and fruit juices, to aid in the expansion of outlets for nonfat dry milk and other dairy products, and fruit products.

Stazione Sperimentale del Freddo, Milan.

Grant FG–It–112 executed February 3, 1961. Duration: 3 years.

Amount: 32,891,137 lire ($52,965 equivalent).

UR–E15–(10)–21 Investigations of the growth factor (known as Vitamin B_{13}) of distillers' dried solubles through studies of methods of isolation and purification, mode of formation, and conditions of optimum production by yeast fermentation of cereal grains, to provide basic information for utilizing grains to produce this vitamin.

Instituto Scientifico di Chimica e Biochimica "Giuliana Ronzoni," Milan.

Grant FG–It–107 executed August 25, 1960. Duration: 5 years.

Amount: 53,600,400 lire ($86,313 equivalent).

UR–E15–(10)–25 Investigations of the reaction of cereal starch dextrins with fatty acid chlorides and fatty amines, and evaluation of the products, to provide information important to increasing the utilization of wheat, corn, and sorghum.

Instituto di Chimica Industriale della Universita degli Studi, Bologna.

Grant FG–It–110 executed December 19, 1960. Duration: 5 years.

Amount: 35,270,000 lire ($56,795 equivalent).

UR–E15–(10)–26 Investigation of the fermentative conversion of glucose to 5-ketogluconic acid through studies of the metabolic pathway in organisms of the *Acetobacter* genus, to obtain fundamental information for the utilization of grain products in the fermentative production of chemical intermediates.

University of Milan, Milan.

Grant FG–It–111 executed December 19, 1960. Duration: 4 years.

Amount: 35, 836, 604 lire ($57,708 equivalent).

E21 Poland

E21–AMS–1(a) Studies on the nutritional requirements of selected species of mites of importance to stored products (grain, cheese, cured meats, dried fruit, spices, etc.).

Central College of Agriculture, Warsaw.

Grant FG–Po–119 executed February 2, 1961. Duration: 5 years.

Amount: 402,905 zlotys.

UR–E21–(10)–1 Determination of the relationships between sulfhydryl groups and amylolytic and proteolytic enzymes in wheat, wheat flour, and malted wheat, to obtain fundamental information on the role of these reactants in the utilization of wheat for bread-making and other purposes.

University of Poznan, Poznan.

Grant FG–Po–109 executed July 23, 1960. Duration: 4 years.

Amount: 617,600 zlotys.

UR–E21–(60)–7 Investigations on the development of mutant strains of molds with increased ability to synthesize vitamin B, for use in improving the quality of mold-ripened cheese.

Institute of Dairy Industry, Warsaw.

Grant FG–Po–116 executed February 1, 1961. Duration: 4 years.

Amount: 547,800 zlotys.

E25 Spain

E25–AMS–5(a) Study of changes in the specific antibacterial activity of eggs during cold treatment and storage, and the role played by different adjuvant procedures.

Centro Experimental del Frio, Madrid.

Grant FG–Sp–109 executed January 20, 1961. Duration: 3 years.

Amount: 1,025,670 pesetas ($17,095 equivalent).

UR–E25–(60)–18 Investigation of factors responsible for protein destabilization during storage of frozen concentrated milk, to obtain information for use in devising improved means of preventing or minimizing protein coagulation resulting from frozen storage.

Centro Experimental del Frio, Madrid.

Grant FG–Sp–108 executed January 20, 1961. Duration: 4 years.

Amount: 2,005,400 pesetas ($33,424 equivalent).

E29 United Kingdom

E29–AMS–1(a) Effect of temperature, concentration of carbon dioxide, and the concentration of oxygen on the respiratory gaseous exchange of apples, under constant conditions and also as related to rate of change of environment.

Ditton Laboratory, Larkfield, Maidstone, Kent, England.

Grant FG–UK–123 executed September 13, 1960. Duration: 5 years.

Amount: 23,865 British pounds ($66,822 equivalent).

UR–E29–(30)–16 Determining the causes and control of discoloration in processed potato products through investigation of enzymes and substrates involved in darkening during the porcessing steps that precede blanching.

Low Temperature Research Station, Cambridge, England.

Grant FG–UK–122 executed July 25, 1960. Duration: 5 years.

Amount: 35,900 pounds sterling ($101,170 equivalent).

UR–E29–(40)–26 Studies on the fatty acid and glyceride composition of cottonseed oil and crystallizing behaviour of some of the major components, to obtain fundamental information that will contribute to the development of improved edible products and hence to expanded utilization of cottonseed oil.

British Food Manufacturing Industries Research Association, Leatherhead, Surrey, England.

Grant FG–UK–126 executed October 17, 1960. Duration: 4 years.

Amount: 17,968 British pounds ($50,310 equivalent).

UR–E29–(10)–37 Studies on the quantitative measurement of properties of wheat kernels that vary significantly during conditioning, as a basis for improved conditioning of wheat for milling by new and improved methods and increased industrial utilization of flour and milled wheat products.

Research Association of British Flour-Millers, Herts, England.

Grant FG–UK–130 executed February 28, 1961. Duration: 4 years.

Amount: 20,353 British pounds ($56,988 equivalent).

UR–E29–(60)–41 Isolation and characterization of selected enzymes of milk, to obtain fundamental information that will aid in improving the quality of dairy products.

National Institute for Research in Dairying, Shinfield, Reading, England.
Grant FG–UK–124 executed November 28, 1960. Duration: 5 years.
Amount: 23,545 pounds sterling ($66,161 equivalent).

UR–E29–(10)–47 Development of rapid chemical methods for assay of changes in the biological value of proteins during processing of wheat food products, as a contribution to the expansion of markets for wheat.

University of Cambridge, School of Agriculture, Cambridge, England.
Grant FG–UK–127 executed Febuary 1, 1961. Duration: 5 years.
Amount: 22,477 pounds sterling ($62,977 equivalent).

UR–E29–(40)–49 Investigation of the reactions of unsaturated fatty acids and their derivatives in molten alkali, to discover new chemical intermediates important to the increased utilization of soybean and linseed oils.

Queen Mary College, University of London, London, England.
Grant FG–UK–125 executed October 12, 1960. Duration: 5 years.
Amount: 11,970 British pounds ($33,516 equivalent).

UR–E29–(40)–50 Quantitative study of the polysaccharides in fat-free soybean meal to provide information needed to improve the processing of meal for foods and feeds thereby contributing to its expanded utilization.

University of Edinburgh, Edinburgh, Scotland.
Grant FG–UK–128 executed December 27, 1960. Duration: 4 years
Amount: 18,240 pounds sterling ($51,072 equivalent).

Fiscal year 1961

Section 104(k)

A7 India

A7–ENT–10 Acarine disease problem of honey bees.

Government Agricultural College and Research Institute, Ludhiana, Punjab.
Grant FG–In–103 executed November 25, 1960. Duration: 5 years.
Amount: 1,63,332 rupees ($34,623 equivalent).

A7–FS–3 Working qualities of Indian timbers.

Forest Research Institute, Dehra Dnn.
Grant FG–In–107 executed November 25, 1960. Duration: 5 years
Amount: 3,38,210 rupees ($71,693 equivalent).

A7–FS–5 Accelerated laboratory investigations on durability of wood.

Forest Research Institute, Dehra Dun.
Grant FG–In–106 executed November 25, 1960. Duration: 5 years.
Amount: 2,01,610 rupees ($42,737 equivalent).

A7–FS–6 Accelerated laboratory investigations on termite resistance of woods.

Forest Research Institute, Dehra Dun.
Grant FG–In–101 executed November 25, 1960. Duration: 5 years.
Amount: 1,62,770 rupees ($34,503 equivalent).

A10 Israel

A10–ADP–2 Studies on the prevention and control of chronic respiratory disease in chickens, and the chemistry of its causative agent.

The Hebrew University, Rehovot.
Grant FG–Is–107 executed December 22, 1960. Duration: 3 years.
Amount: 52,540 Israeli pounds ($29,189 equivalent).

A10–CR–1 The screening of collections of cultivated barleys and related species for resistance to barley disease pathogens and the utilization of sources of resistance as genetical material for breeding for resistance.

The Hebrew University and Agricultural Research Station, Rehovot.
Grant FG–Is–109 executed January 20, 1961. Duration: 5 years.
Amount: 174,275 Israeli pounds ($96,819 equivalent).

A10–CR–2 The quantitative inheritance of characters influencing lint yield and quality in cotton, studied by means of diallel crosses between varieties of *Gossypium hirsutum* and *Gossypium barbadense*.

The Hebrew University, Rehovot.
Grant FG–Is–114 executed February 18, 1961. Duration: 5 years.
Amount: 46,700 Israeli pounds ($25,944 equivalent).

A10–CR–3 The root system of spring wheat with reference to its influence on lodging resistance.
The Hebrew University, Rehovot.
Grant FG–Is–108 executed January 20, 1961. Duration: 4 years.
Amount: 36,760 Israeli pounds ($20,422 equivalent).

A10–CR–7 The physiological basis of the tolerance of evergreen fruit trees to lime and saline soil and water conditions, with special reference to the selection of rootstocks of avocado and citrus by physiological tests.
Agricultural Research Station, Rehovot.
Grant FG–Is–111 executed February 8, 1961. Duration: 5 years.
Amount: 184,700 Israeli pounds ($102,610 equivalent).

A10–CR–8 The physiology of rest (dormancy—temporary suspension of visible growth, especially that of buds and seeds) and its application to fruit growing.
Agricultural Research Station, Beit-Dagan.
Grant FG–Is–105 executed August 28, 1960. Duration: 5 years.
Amount: 132,600 Israeli pounds ($73,667 equivalent).

A10–CR–10 New crops screening of native plants of Israel of potential use in the agriculture of the United States.
The Agricultural Research Station, Beit-Dagan.
Grant FG–Is–106 executed November 10, 1960. Duration: 5 years.
Amount: 208,000 Israeli pounds ($115,555 equivalent).

A10–FS–6 The germination of seeds of desert plants (especially plants with potential use for forage or watershed cover).
The Hebrew University, Jerusalem.
Grant FG–Is–115 executed February 17, 1961. Duration: 5 years.
Amount: 144,290 Israeli pounds ($80,160 equivalent).

A17 Pakistan

A17–ENT–9 Studies on insect enemies of noxious weeds in Pakistan.
Commonwealth Institute of Biological Control, Rawalpindi.
Grant FG–Pa–101 executed July 22, 1960. Duration: 5 years.
Amount: 184,100 rupees ($39,004 equivalent).

A22 Turkey

A22–ADP–1 The transmission, distribution, and bioeconomics of the giant liver fluke disease of domestic ruminants in Turkey.
Ankara University, Veterinary Faculty, Ankara.
Grant FG–Tu–101 executed January 5, 1961. Duration: 2 years.
Amount: 104,150 lire ($11,572 equivalent).

A22–ADP–2 Etiologic investigation of bovine urinary bladder tumors due to enzootic bovine hematuria in Turkey and its relation to bovine papilloma agent.
Ankara University, Veterinary Faculty, Ankara.
Grant FG–Tu–102 executed January 5, 1961. Duration: 5 years.
Amount: 462,447 lire ($51,383 equivalent).

A22–ADP–3 Foot and mouth disease in Turkey, its virus types, its virus production in tissue cultures and comparative studies with cattle, sheep, goat and guinea pig kidney cultures, vaccine production with these viruses and experimental application for the control of this disease.
Ankara University, Veterinary Faculty, Ankara.
Grant FG–Tu–103 executed January 5, 1961. Duration: 5 years.
Amount: 233,580 lire ($25,953 equivalent).

E8 Finland

E8–AE–1 Tractive, stability, and safety characteristics of wheel-type farm tractors on steep slopes (such as cleared forest areas). Ancillary, laboratory investigations of starting, fuel, oil, material, and wearing tests at low temperatures.
State Research Institute of Agricultural Engineering, Helsinki.
Grant FG–Fi–125 executed February 17, 1961. Duration: 2 years.
Amount: 6,603,000 finnmarks ($20,667 equivalent).

E8–AH–1 Breed differences regarding the antigenic properties of cattle blood, their inheritance and relation to economic characteristics and evolutionary origin of breeds.
Agricultural Research Centre, Tikkurila.
Grant FG–Fi–122 executed April 1, 1961. Duration: 4 years.
Amount: 19,697,200 finnmarks ($61,804 equivalent).

E8–CR–4 Intensifying of polyploidy breeding in clover species.
Department of Plant Breeding, Agricultural Research Centre, Jokioinen.
Grant FG–Fi–123 executed January 10, 1961. Duration: 4 years.
Amount: 6,201,200 finnmarks ($19,457 equivalent).

E8–ENT–1 Population dynamic studies on *Calligypona pellucida* (F.) and the nature of injuries caused by this species on cereals, especially on oats and spring wheat.
Agricultural Research Centre, Tikkurila.
Grant FG–Fi–126 executed January 26, 1961. Duration: 4 years.
Amount: 13,676,000 finnmarks ($42,911 equivalent).

E8–FE–1 The relation of management and planning to success in farming.
Department of Agricultural Economics, University of Helsinki, Helsinki.
Grant FG–Fi–114 executed July 19, 1960. Duration: 5 years.
Amount: 13,920,000 finnmarks ($43,677 equivalent).

E8–FS–1 Studies of the most important factors controlling the quantity and quality of natural seed crops of forest trees.
Forest Research Institute, Helsinki.
Grant FG–Fi–117 executed September 10, 1960. Duration: 4 years.
Amount: 13,344,800 finnmarks ($41,742 equivalent).

E8–FS–9 Factors affecting the impregnability of wood.
State Institute for Technical Research, Helsinki.
Grant FG–Fi–118 executed September 10, 1960. Duration: 3 years.
Amount: 8,921,976 finnmarks ($27,995 equivalent).

E8–FS–10 Moisture-temperature-time-strength relations for *Pinus sylvestris*, *Picea excelsa*, and *Betula verrucosa* (Scots pine, Norway spruce, and European birch).
State Institute for Technical Research, Helsinki.
Grant FG–Fi–121 executed October 8, 1960. Duration: 5 years.
Amount: 11,640,000 finnmarks ($36,523 equivalent).

E8–FS–18 Accessibility studies of cellulose fiber (wood).
State Institute for Technical Research, Helsinki.
Grant FG–Fi–119 executed October 5, 1960. Duration: 4½ years.
Amount: 20,046,000 finnmarks ($62,899 equivalent).

E8–FS–30 Developing increment methods of forecasting growth and inventory of large forest stands.
Institute for Forest Mensuration and Management, University of Helsinki, Helsinki.
Grant FG–Fi–115 executed December 3, 1960. Duration: 3 years.
Amount: 4,500,000 finnmarks ($14,120 equivalent).

E8–FS–32 Improved forest survey methods.
Institute of Forest Mensuration and Management, University of Helsinki, Helsinki.
Grant FG–Fi–124 executed January 2, 1961. Duration: 4 years.
Amount: 13,638,800 finnmarks ($42,975 equivalent).

E8–FS–36 The importance of soil temperature, height of water table, and microclimate as growth factors of pine, spruce, and birch trees.
Forest Research Institute, Helsinki.
Grant FG–Fi–116 executed September 10, 1960. Duration: 4 years.
Amount: 12,727,760 finnmarks ($39,936 equivalent).

E8–FS–38 Investigation of the orientating stimuli guiding insect pests of forests to suitable host trees, by determining the attractiveness to the insects of various extracts from bark, foliage, and wood of trees.
University of Helsinki, Institute for Agricultural and Forest Zoology, Helsinki.
Grant FG–Fi–111 executed July 7, 1960. Duration: 4½ years.
Amount: 15,765,000 finnmarks ($49,466 equivalent).

E21 Poland

E21–AMS–6(k) Studies of flaxseed storage and chemical changes during storage.
College of Agriculture, Olsztyn.
Grant FG–Po–121 executed February 22, 1961. Duration: 4 years.
Amount: 996,968 zlotys.

E21–ADP–2 The changeability of biological properties of viruses.
Laboratory on General Virology, Institute of Veterinary Research, Pulawy.
Grant FG–Po–113 executed December 13, 1960. Duration: 4 years.
Amount: 861,164 zlotys.

E21–AH–1 Secretion of anterior pituitary hormones and ovulation in small ruminants.
Institute of Animal Physiology, Polish Academy of Science, Warsaw.
Grant FG–Po–110 executed September 12, 1960. Duration: 3 years.
Amount: 632,250 zlotys.

E20–AH–2 Basic studies on the color of pork meat and on the color in pork as influenced by heredity, sex, age, feeding and management of animals.
Institute of Animal Physiology and Nutrition, Warsaw.
Grant FG–Po–117 executed January 9, 1961. Duration: 5 years.
Amount: 2,353,100 zlotys.

E21–CR–5 Studies on the nature of plant resistance to soil nematodes.
Institute of Plant Protection, Helminthological Laboratory, Poznan.
Grant FG–Po–108 executed August 1, 1960. Duration: 5 years.
Amount: 454,000 zlotys.

E21–CR–7 Studies on growth promoting substances and inhibitors in apple trees during different stages of tree development.
Research Institute of Pomology, Skierniewice.
Grant FG–Po–111 executed December 5, 1960. Duration: 5 years.
Amount: 731,200 zlotys.

E21–CR–10 Nitrogen forms in different species and varieties of leguminous plants and their inheritance.
Institute of Plant Breeding, Polish Academy of Sciences, Poznan.
Grant FG–Po–122 executed March 1, 1961. Duration: 5 years.
Amount: 952,500 zlotys.

E21–ENT–2 Studies on the possibility of biological control of aphids and scale insects and the effects of pesticides on the natural enemies of these fruit tree pests.
Research Institute of Pomology, Skierniewice.
Grant FG–Po–114 executed December 5, 1960. Duration: 5 years.
Amount: 594,000 zlotys.

E21–ENT–3 The influence of some vitamins and fats on the physiology of the Colorado potato beetle (*Leptinotarsa decemlineata* Say).
Institute of Plant Protection, Poznan.
Grant FG–Po–123 executed March 3, 1961. Duration: 5 years.
Amount: 413,500 zlotys.

E21–ENT–5 Studies on the different susceptibility of red spiders (which affect fruit orchards) to acaricides and on cholinesterases in red spiders as influenced by acaricides.
Institute of Pomology, Skierniewice.
Grant FG–Po–115 executed December 5, 1960. Duration: 5 years.
Amount: 636,000 zlotys.

E21–ENT–6 The nature of infectious processes caused by protozoa in insects.
Institute of Plant Protection, Poznan.
Grant FG–Po–112 executed September 26, 1960. Duration: 5 years.
Amount: 339,700 zlotys.

E21–ENT–7 The development, maturation, and production of drones and natural mating of virgin and drone honey bees.
Department of Pomology of the Central Agricultural College, Warsaw.
Grant FG–Po–124 executed January 23, 1961. Duration: 5 years.
Amount: 662,000 zlotys.

E21–SWC–7 Distribution of micronutrient elements among soil minerals.
The Institute of Soil Science and Plant Cultivation, Pulawy.
Grant FG–Po–118 executed January 17, 1961. Duration: 4 years.
Amount: 626,300 zlotys.

E21–FS–7 Studies in the development of improved strains of parasites of forest insects.
Chair of Forest Protection, College of Agriculture, Poznan.
Grant FG–Po–120 executed March 3, 1961. Duration: 4 years.
Amount: 251,500 zlotys.

E21–FS–16 Saprophytic soil fungi as a factor determining the development of phytopathogenic fungi living in forest soils.
Institute of Plant Protection, Poznan.
Grant FG–Po–126 executed March 3, 1961. Duration: 4 years.
Amount: 376,200 zlotys.

E25 Spain

E25–AH–4 Contribution to the study of the metabolism of zinc in living organism by means of zinc 65.
University of Madrid, Madrid.
Grant FG–Sp–113 executed March 16, 1961. Duration: 4 years.
Amount: 2,116,620 pesetas ($35,277 equivalent).

E25–CR–1 Factors affecting the frequency of monoploid seedlings in maize and their subsequent diploidization.
Instituto Nacional de Investigaciones Agronomicas, Madrid.
Grant FG–Sp–110 executed January 17, 1961. Duration: 5 years.
Amount: 1,310,000 pesetas ($21,833 equivalent).

E25–CR–3 Cereal rusts in Spain.
Instituto "A. J. Cavanilles", Madrid.
Grant FG–Sp–112 executed February 15, 1961. Duration: 5 years.
Amount: 4,078,040 pesetas ($67,967 equivalent).

E25–CR–11 New crops screening of native plants of Spain, of potential use in the agriculture of the United States.
Instituto Nacional de Investigaciones Agronomicas, Madrid.
Grant FG–Sp–111 executed February 10, 1961. Duration: 5 years.
Amount: 9,371,560 pesetas ($156,192 equivalent).

E29 United Kingdom

E29–ADP–2 Investigation of scrapie disease in sheep and goats (transmissibility, immunology, control, etc.).
Agricultural Research Council, Field Station, Compton, England.
Grant FG–UK–129 executed to begin March 1, 1961. Duration: 5 years.
Amount: 53,240 British pounds ($149,072 equivalent).

E29–ADP–3 Scrapie disease of sheep (emphasizes genetic or contact methods of transmission).
Animal Disease Research Association, Moredun Research Institute, Edinburgh, Scotland.
Grant FG–UK–131 executed February 27, 1961. Duration: 5 years.
Amount: 53,700 British pounds ($150,360 equivalent).

F4 Egypt

F4–CR–1 Identification of physiologic races in wheat rusts, and studying genetics of rust and smut resistance in wheat and net blotch resistance in barley using local and imported resistant stocks.
Ministry of Agriculture, Orman, Giza.
Grant FG–Eg–100 executed February 11, 1961. Duration: 5 years.
Amount: 27,956 Egyptian pounds ($62,842 equivalent).

F4–ENT–3 Induced sterility of males of the Mediterranean fruitfly, *Ceratitis capitata*, as a means of controlling and possibly eradicating that pest.
Plant Protection Department, Dokki.
Grant F–EG–101 executed February 11, 1961. Duration: 5 years.
Amount: 37,720 Egyptian pounds ($84,790 equivalent).

APPENDIX D

Patents acquired through contract research since 1954

Inventor	Patent No.	Date	Contract No.	Contractor
Bixler, M. E.	2,923,956	Feb. 9, 1960	A-1s-33846	The Hoover Co., North Canton, Ohio.
Bogdan, J. F., et al.	2,698,538	Jan. 4, 1955	A-1s-33438	School of Textile, North Carolina State College, Raleigh, N.C.
Brownell, L. E., et al.	2,807,560	Sept. 24, 1957	A-1s-33464	University of Michigan.
Do.	2,818,358	Dec. 31, 1957	A-1s-33464	Do.
Do.	2,873,220	Feb. 10, 1959	A-1s-33464	Do.
Do.	2,858,079	Oct. 28, 1958	A-1s-33464	Do.
Carlsen, E. W., et al.	2,896,384	July 28, 1959	A-1s-33711	Fruit Industries Research Foundation; Washington State Apple Advertising Commission.
Carlsen, E. W.	2,668,648	Feb. 9, 1954	A-1s-30945	Do.
Glabe, E. F.	2,816,035	Dec. 10, 1957	A-1s-33031	Food Technology, Inc., Chicago, Ill.
Do.	2,803,547	Aug. 20, 1957	A-1s-33806	Do.
Hertel, K. L.	2,706,403	Apr. 19, 1955	A-1s-30927	Fiber Research Laboratory, University of Tennessee.
Isaacs, G. W.	2,794,269	June 4, 1957	A-1s-33696	Michigan State College.
Marvel, C. S., et al.	2,929,806	Mar. 22, 1960	12-14-100-492(71)	University of Illinois.
Rose, A., et al.	2,784,150	Mar. 5, 1957	A-1s-33025	Walker Laboratory Pennsylvania State College, State College, Pa.
Veneklasen, P. S., et al.	2,922,303	Jan. 26, 1960	12-14-100-511(74)	Western Electro-Accoustic Laboratory, Los Angeles, Calif.
Stokes et al.	2,989,405	June 20, 1961	12-14-100-500(74)	Midwest Research Institute, Kansas City, Mo.
Smith, A. K., et al.	2,967,108	Jan. 3, 1961		Cooperative contract research understanding.
Nury, F. S., et al.	2,967,614	Jan. 10, 1961		Do.
Do.	2,966,988	Jan. 3, 1961		Do.
White, H. D., et al.	2,801,126	July 30, 1957		Do.

Seven patent applications on inventions, derived from contractor research were abandoned in the period 1955–61; five or more patent applications on inventions derived from contractor research are pending presently before the Patent Office including one or more applications derived from research conducted under Public Law 480. Several of these patented inventions have had extensive exploitation such as the automatic box filler, bag filler, and the dump basket. The writeups of these inventions may be found on pages 112, 113, and 115.

APPENDIX E

The Executive Order Supplementing the Townsend-Purnell Plant Patent Act

November 24, 1930

Memorandum No. 606

FACILITATING THE CONSIDERATION OF APPLICATIONS FOR PLANT PATENTS

The Executive order of October 17, 1930, is as follows:

"I, Herbert Hoover, President of the United States of America, under the authority conferred upon me by Act of May 23, 1930 (Public No. 245), entitled 'An Act to provide for plant patents,' and by virtue of all other powers vested in me relating thereto, do hereby direct the Secretary of Agriculture: (1) to furnish the Commissioner of Patents such available information of the Department of Agriculture, or (2) to conduct through the appropriate bureau or division of the Department such research upon special problems, or (3) to detail to the Commissioner of Patents such officers and employees of the Department, as the Commissioner may request for the purposes of carrying said Act into effect."

In pursuance with the intent of this Executive order, Dr. W. A. Taylor, Chief of the Bureau of Plant Industry, is hereby designated and authorized to represent the Department in all dealings with the Commissioner of Patents related to the Executive order, in furnishing the Commissioner such pertinent information as is available to the Department, or in arranging for special researches to provide the information desired but not otherwise available.

Questions arising regarding the detail of officers or employees to the Commissioner of Patents should be referred to the Director of Personnel and Business Administration.

(Signed) Arthur M. Hyde, *Secretary.*

APPENDIX F

DEPARTMENT OF AGRICULTURE EMPLOYEE EMPLOYMENT REGULATIONS

CHAPTER 15—PATENTS ON INVENTIONS OF THE DEPARTMENT

SECTION 1—GENERAL

878. PURPOSE. The purpose of these regulations, which are a condition of employment of all employees of the Department, is, in general, to provide a patent policy relative to inventions of employees and to prescribe the procedural rules for implementing and effectuating such policy, and for the administration of inventions subject to Department control.

879. DEFINITIONS. As used in this chapter, "Invention" includes any art, machine, manufacture, design, or composition of matter, or any new and useful improvement thereof, or any variety of plant [qualified as indicated in 1 AR 900] which is or may be patentable under the patent laws of the United States. "Employee" includes all full-time employees of the Department. Part-time employees and part-time consultants are included insofar as inventions made during periods of official duty are concerned, except when special circumstances require an exemption, each such exemption to be subject to the approval of the Chairman of the Government Patents Board. The terms "part-time consultant" and "part-time employee" mean any person the terms of whose appointment or employment contemplate that he shall work less than (1) the minimum number of hours per day or (2) the minimum number of days per week, or (3) the minimum number of weeks per year, regularly required of full-time employees of his class. "Administrator" refers to the Administrator of the Agricultural Research Service, "Chairman" refers to the Chairman of the Government Patents Board. "No-fee act" refers to 35 U.S.C. 266. "Executive Order 10096" refers to the Executive Order of this number dated Jan. 23, 1950 (15 F.R. 389). "Administrative Order No. 5" refers to an order entitled "Rules and Regulations for the Administration of a Uniform Patent Policy with Respect to the Domestic Rights in Inventions made by Government Employees," dated April 26, 1951 (16 F.R. 3927). "Patent rights" include the right to cause an application for patent to be filed and to own any such application and any patents which may issue on the invention concerned, and the right to place the invention in the public domain as by dedication, publication without patenting, or otherwise. "Commercial rights" include the patent rights subject to the license rights of the Government arising pursuant to these regulations or subject to law.

SECTION 2—DOMESTIC PATENT RIGHTS

880. DETERMINATION OF DOMESTIC PATENT RIGHTS. The domestic * * * patent rights in inventions made by employees of the Department will be determined in accordance with Executive Order 10096 implemented by Administrative Order No. 5 * * * Pertinent portions of that Administrative Order are quoted below:

"(1) The Government shall obtain the entire domestic right, title and interest in and to all inventions made by any Government employee (i) during working hours, or (ii) with a contribution by the Government of facilities, equipment, materials, funds, or information, or of time or services of other Government employees on official duty, or (iii) which bear a direct relation to or are made in consequence of the official duties of the inventor.

"(2) In any case where the contribution of the Government, as measured by any one or more of the criteria set forth in subparagraph (1) last above, to the invention is insufficient equitably to justify a requirement of assignment to the Government of the entire domestic right, title and interest in and to such invention, or in any case where the Government has insufficient interest in an invention to obtain the entire domestic right, title, and interest therein (although the Government could obtain same under subparagraph (1) above), the Government agency concerned, subject to the approval of the Chairman, shall leave title to such invention in the employee, subject, however, to the reservation to the Government of a nonexclusive, irrevocable, royalty-free license in the invention with power to grant licenses for all governmental purposes, such reservation, in the terms thereof, to appear, where practicable, in any patent, domestic or foreign, which may issue on such invention.

"(3) In applying the provisions of subparagraphs (1) and (2) above to the facts and circumstances relating to the making of any particular invention, it shall be presumed that an invention made by an employee who is employed or assigned (i) to invent or improve or perfect any art, machine, manufacture, or composition of matter, (ii) to conduct or perform research, development work, or both, (iii) to supervise, direct, coordinate, or review Government financed or conducted research, development work, or both, or (iv) to act in a liaison capacity among governmental or nongovernmental agencies or individuals engaged in such work, falls within the provisions of subparagraph (1) above, and it shall be presumed that any invention made by any other employee falls within the provisions of subparagraph (2) above. Either presumption may be rebutted by the facts or circumstances attendant upon the conditions under which any particular invention is made and, notwithstanding the foregoing, shall not preclude a determination that the invention falls within the provisions of subparagraph (4) next below.

"(4) In any case wherein the Government neither (i) obtains the entire domestic right, title and interest in and to an invention pursuant to the provisions of subparagraph (1) above nor (ii) reserves a nonexclusive, irrevocable, royalty-free license in the invention, with power to grant licenses for all governmental purposes, pursuant to the provisions of subparagraph (2) above, the Government shall leave the

entire right, title and interest in and to the invention in the Government employee, subject to law."

* * * * * * *

881. DISPOSITION OF PATENT RIGHTS IN GOVERNMENT-OWNED DOMESTIC APPLICATIONS. If a U.S. patent application is filed on an invention made by an employee of this Depatrment and which is subject to ownership by the Government, either the domestic patent rights shall be dedicated to the public or, in the event that it is desirable to retain control of the invention in the Department, the application shall be assigned to the Government as represented by the Department. The dedicating clause may be included in the application over the inventor's signature.

882. PROCEDURE IN CASE THE INVENTOR DOES NOT CLAIM COMMERCIAL RIGHTS. If a U.S. patent application is to be filed and the domestic patent rights in the invention are to be dedicated or the application assigned as indicated in 1 AR 881, without contest, information concerning the invention shall be submitted to the General Counsel in accordance with the following procedure.

a. *Information to be Submitted by Inventor.*

(1) A disclosure of the invention sufficient to enable the Office of the General Counsel to prepare a patent application, the inventor's full name, residence, and post office address; whether he is a full-time or part-time employee, part-time consultant, or any other type of employee; if not presently employed by the Government, whether he was so employed at the time he made the invention, and whether it was understood between him and the Government that the invention could be manufactured and used by or for the Government for governmental purposes without the payment of royalty, thus to bring the case under the requirements of 38 Ops. Atty. Gen. 402; and the citation if the invention has been disclosed in a printed publication.

(2) A brief statement of the most pertinent prior art known to the inventor and the manner in which his invention is distinguished thereover.

(3) An abstract of the invention.

b. *Submission by Inventor's Superior.* The inventor's superior shall promptly submit the information through Department agency channels to the General Counsel along with recommendations and reasons therefor as to why patent protection should be obtained, whether the domestic patent rights should be dedicated or the application assigned, whether the invention is used or likely to be used in the public interest, and such additional information as the Office of the General Counsel may require.

* * * * * * *

c. *Office of the General Counsel to Handle Patent Application.* The Office of the General Counsel will prepare the patent application and prosecute it before the Patent Office. If the invention is disclosed in a printed publication after the inventor submits the information to his superior and before the application has been filed in the Patent Office, the Department agency should advise the General Counsel of the citation.

883. PROCEDURE IN CASE THE INVENTOR CLAIMS COMMERCIAL RIGHTS. Information concerning any invention of an employee made to any extent under any of the conditions (i), (ii), and (iii) set forth in

1 AR 880(1), on which the inventor seeks patent protection with commercial rights therein, shall be submitted through the inventor's immediate superior and Department agency channels to the General Counsel.

a. *Information to be Submitted by Inventor.*

(1), (2) and (3) The same information is included under these items as under 1 AR 882a.

(4) A detailed statement of the circumstances under which the invention was made (conceived, constructed or carried out, and tested) including information as to the extent it was made during working hours and the extent use was made of Government facilities, equipment, materials, funds, or information, or time or services of other Government employees on official duty, and such information as to his own contribution relative to these items as may be pertinent.

(5) A statement of his duties and their relation to the invention, including information sufficient to determine whether his duties place him under any of the categories (i) to (iv) of 1 AR 880(3).

(6) A statement explaining why he believes he is entitled to commercial rights in the invention, and whether his rights should be determined pursuant to 1 AR 880(2) or to 1 AR 880(4).

(7) A statement as to whether or not he desires to obtain a patent under the provisions of the No-Fee Act. If so, why he believes the invention is used or likely to be used in the public interest.

(8) Any other information that the Office of the General Counsel may require.

b. *Submission by Department Agency.* The Department agency promptly submit a report to the General Counsel including the information given by the inventor, together with a statement as to the accuracy of the facts given under 1 AR 883a (1), (4) and (5), and any additional information regarding the circumstances under which the invention was made that will be helpful in determining whether the inventor is entitled to retain commercial rights in the invention. The agency may also submit a statement of views as to the patent rights and whether the patent rights should be determined pursuant to 1 AR 880 (1), (2) or (4) and the agency shall give recommendations and reasons as to why patent protection should or should not be obtained, whether the domestic patent rights should be dedicated or the application assigned, and whether the invention is used or likely to be used in the public interest, in the event the Government is entitled to the domestic patent rights.

* * * * * * *

c. *Determination by Office of the General Counsel.* The Office of the General Counsel shall impartially determine in accordance with these regulations, whether or not the inventor is intitled to retain commercial rights. A determination what the inventor is entitled to commercial rights is subject to approval of the Chairman of the Government Patents Board as provided in Administrative Order No. 5. A determination that the inventor is not entitled to commercial rights pursuant to 1 AR 880(4), is subject to an appeal to the Chairman, as provided in Administrative Order No. 5. Nothing in this regulation shall be taken to render the finding of the Office of the General Counsel conclusive in any proceeding in the courts to determine the respective rights of the Government and the inventor. In

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the event the inventor is entitled to retain commercial rights and an application is to be filed under the No-Fee Act, the General Counsel may prepare the application and prosecute it before the Patent Office. If the invention is disclosed in a printed publication after the inventor submits the information through his superior and before the application is filed in the Patent Office, the inventor or the Department agency should advise the General Counsel of the citation.

d. *Procedure When Employee is Entitled to Retain Commercial Rights.* If the inventor is entitled to retain commercial rights he may file an application for a patent directly in the Patent Office in the same manner as any private person, or he may request that the patent be obtained under the No-Fee Act following the procedure outlined above. In the event the inventor files an application directly in the Patent Office on an invention in which he retains title pursuant to 1 AR 880(2), he shall keep the Department informed regarding the application and shall include the license specified in 1 AR 880(2). However, as to any invention on which an application is filed under the No-Fee Act, the Government has a license throughout the world corresponding to that specified in 1 AR 880(2).

884. PROCEDURE IN CASE THE DOMESTIC PATENT RIGHTS ARE SUBJECT TO ASSIGNMENT TO THE GOVERNMENT AND THE DEPARTMENT AGENCY DETERMINES NOT TO FILE A U.S. PATENT APPLICATION. If the domestic patent rights in an invention, except a plant, are assignable to the Government, and the Department agency has determined that a patent application should not be filed, information concerning the invention should be submitted through the agency channels to the General Counsel. The submission should include that information required under 1 AR 882a(1), (2) and (3), and a statement of the agency determination including information as to the manner in which it is intended the invention will be placed in the public domain, or as to any other disposition to be made of it, and the basis on which the determination has been made. The above information shall be submitted to the Chairman for review in accordance with Administrative Order No. 5.

885. PROMPTNESS OF HANDLING. Agency transmissions to the General Counsel and other transmissions involving inventions that may be patented should be made promptly. The purpose of this requirement is to avoid delay that might jeopardize the inventor's or the Government's patent rights. In order to obtain the advantages of an early filing date, the application may be filed in the Patent Office prior to making the determination whether the inventor is entitled to retain commercial rights.

SECTION 3—FOREIGN PATENT RIGHTS

892. The foreign patent rights of employees are determinable in accordance with Executive Order 9865 (12 F.R. 3907) and Administrative Order No. 6(19 F.R. 3937). No employee of the Department shall file or cause to be filed an application for patent in any foreign jurisdiction (except on behalf of and at the direction of the Government) on any invention in which the Government has acquired the patent rights, or holds an unexpired option to acquire the patent rights, in that jurisdiction, or take any steps to preclude the filing of an application on behalf of the Government.

SECTION 4—PLANT PATENTS

900. POLICY. Plants developed by employees of the Department under circumstances which render the patent rights therein assignable to the Government shall not be patented in this country.

901. EMPLOYEES NOT TO ASSIST IN PREPARATION OR PROSECUTION OF APPLICATIONS. No employee of the Department shall assist any person in preparing or prosecuting an application for a plant patent. The Department cannot advise members of the public as to the novelty of an alleged invention. Inquiries with respect to plant patents are to be referred to the Commissioner of Patents.

902. REVIEW OF APPLICATIONS FOR PLANT PATENTS. The Agricultural Research Service is authorized to review applications for plant patents referred to it by the Commissioner of Patents and to furnish the Commissioner such pertinent information as is available in the Department.

SECTION 5—REQUESTS TO PATENT OFFICE TO ADVANCE THE EXAMINATION OF PATENT APPLICATIONS

907. Rule 102 of the Rules of Practice in the U.S. Patent Office provides for advancing the examination of (making special) applications for patents that are of peculiar importance to the public service, upon the request of Department heads. Department agencies receiving requests from persons outside the Department that the Commissioner of Patents be asked to advance the examination of applications for patents pending before him shall, before taking any further action in the matter, call upon the person making the request for a copy of the application concerned, together with the serial number and filing date thereof. Upon receipt of this information the agency interested shall determine whether the invention, if patented, will be of peculiar importance to the Department * * * and whether the immediate consideration of the application and issuance of the patent will be of advantage to the Department in the prosecution of its work. Employees who handle or obtain any such information shall not reveal it prior to issuance of the patent, without consent of the person making the request, except as required for the purpose of this section. If such request is thought to be justified, appropriate recommendations and reasons therefor will be submitted to the Administrator for making the request to the Commissioner of Patents.

SECTION 6—INFORMATION CONCERNING INVENTIONS AND PATENT APPLICATIONS TO BE REVEALED ONLY FOR OFFICIAL PURPOSES

912. Employee-inventors, and employees who handle or obtain information concerning inventions of the employee-inventors, or concerning any other invention in which the Department may have an interest, on which an application for patent has not been filed, or concerning the status of any such filed application or the subject matter thereof, shall not reveal such information prior to issuance of the patent, except for official purposes.

SECTION 7—ASSIGNMENT OF ADMINISTRATIVE FUNCTIONS

918. All administrative functions on behalf of the Secretary relating to the acquisition and administration of patents are assigned to the Agricultural Research Service. (See 9 AR 200i.) Such functions include, for example; making certifications to the Commissioner of Patents for filing patent applications under the No-Fee Act; requesting the Commissioner of Patents to make applications special; signing an abandonment or consent to abandonment of an application filed under the No-Fee Act or of an application assigned to the Government or dedicated to the public and administered by the Department; signing of, or of a consent to an abandonment of contest, a concession of priority, or a disclaimer, to terminate an interference; and issuing licenses under patents, or patent applications, administered by the Department.

APPENDIX G

PROCEDURE FOR FOREIGN PATENT APPLICATIONS COVERING INVENTIONS BY DEPARTMENT OF AGRICULTURE EMPLOYEES. GENERAL DEPARTMENTAL CIRCULAR NO. 4, AUGUST 12, 1943

U.S. DEPARTMENT OF AGRICULTURE,
Washington, D.C., August 12, 1943.

GENERAL DEPARTMENTAL CIRCULAR NO. 4

Procedure to be followed in the presentation, consideration, and handling of foreign patent applications covering inventions made by employees of the U.S. Department of Agriculture

In order to protect the interests of the Government in its inventions made by employees of this Department, every invention made by such an employee in anywise pertaining to the work of the Department upon which a foreign application is to be filed must be submitted in accordance with regulation 1561 of the regulations of the Department, and such foreign application shall not be filed without the approval of the Secretary or the War Food Administrator, as the case may be. If the invention, by virtue of the circumstances under which it was made, is the property of the United States, such approval shall require the foreign application to contain the stipulation that the invention may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon, in order that such stipulation may, in effect, appear upon the face of any patent which may issue on the application. However, if the United States is entitled to a shop right interest only in the invention as a result of the circumstances under which it was made, the matter will be considered to determine whether the activities of the Government are such that the shop right extends to the particular foreign country involved so as to require a similar stipulation in such foreign application.

Where the invention has been previously submitted under regulation 1561 for the purpose of filing a domestic application for patent, resubmission will not be required, but a request for approval to file the foreign application must be made. If such previous submission contained a request that the invention either be assigned to the United States of America or be dedicated to the public, it will be presumed that the invention is the property of the United States by virtue of the circumstances under which it was made, unless the applicant indicates otherwise and presents evidence in support of his position. However, where an invention has been previously submitted under regulation 1561, as a result of which there has been a final adjudication of title as between the inventor and the Government, in accordance with the procedure outlined in Secretary's Memorandum No. 731,

dated August 25, 1937, the question of title to the invention shall not again be raised in requesting approval to file a foreign application.

It is imperative that applicants, in filing foreign applications for patent covering inventions made in the United States or in otherwise exporting information concerning such inventions, observe and follow carefully the laws which may be in effect at the time. Attention is particularly called to the act of August 21, 1941 (55 Stat. 657), Public Law 239, 77th Congress, which provides, among other things, including penalties for its violation, that no person shall file or cause or authorize to be filed in any foreign country an application for patent or for the registration of a utility model, industrial design, or model, in respect of any invention made in the United States, except when authorized by the Commissioner of Patents. The term "application" covers not only applications, but also modifications, amendments, supplements, or continuances.

This is supplemental to Secretary's Memorandum No. 731, dated August 25, 1937.

PAUL H. APPLEBY,
Acting Secretary.
WILLIAM B. BRADLEY,
Acting War Food Administrator.

APPENDIX H

Standard Patent Clause Used in Most Cooperative Agreements

Any invention resulting from this cooperative work and made jointly by an employee or employees of the U.S. Department of Agriculture and the cooperator or an employee or employees of the cooperator shall be fully disclosed, either by publication or by patenting in the United States, and any such patent shall either be dedicated to the free use of the people in the territory of the United States or be assigned to the United States of America, in the discretion of said Department, and the said Department shall have an option to acquire the foreign patent rights in the invention for any particular foreign country, said option to expire in the event that the Government fails to cause an application to be filed in any such country on behalf of the Government or determines not to seek a patent in such country within 6 months after the filing of an application for a U.S. patent on the invention. Any invention made independently by an employee or employees of the U.S. Department of Agriculture or by the cooperator or an employee or employees of the cooperator shall be disposed of in accordance with the policy of the United States Department of Agriculture, or the cooperator, respectively.

APPENDIX I

Research Contract Provisions Requiring Reports, Access, and Publication of Research Results

1. Records and Reports.—In addition to any records and reports specifically mentioned above, the contractor shall maintain such records as may be required and shall furnish such reports with respect to the status and progress of the project as the contracting officer or his designated representative shall require.

2. Access to Facilities, Records, and Accounts.—Accredited representatives of the Department shall have access at any reasonable time to the plant, laboratories, offices, or other facilities utilized in connection with the project, for purposes of inspection and observation of the status and progress of the project, and all data, information, records, reports, and accounts of the contractor relating to the project shall be made available to such representatives of the Department, and all such data, information, records, reports, and accounts shall be maintained available for inspection a minimum of 2 years beyond the termination date of this contract. Officers and employees of the contractor, or other personnel, assigned to or engaged in the conduct of the project, shall be available for consultation with such representatives at any reasonable time.

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10. Patent Provisions and Publication of Results.—

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(b) *Nonpatentable Results.*—Results of research or investigations and information concerning the project, which the contracting officer determines will not form the basis of a patent application, shall be made known to the public in such a manner as the parties hereto may agree. In case of failure to agree, results may be made known to the public by either party after due notice and submission of the proposed manuscript to the other with such credit or recognition as may be mutually agreed upon, provided that full responsibility is assumed by such party for any statements on which there is a difference of opinion, and provided further that no copyright shall subsist in any such publication. (In the case of publication by the contractor, ------ reprints shall be supplied to the Department.)

APPENDIX J

Rural Electrification Administration

The Rural Electrification Administration is an agency of the Department of Agriculture. Its major function is to make loans for financing electric and telephone systems in rural areas, and to assure repayment of these loans. Congress annually determines the amount REA may lend in each program.

The REA itself does not own or operate rural electric or telephone facilities. REA has the responsibility to assure itself that physical properties financed with REA funds are designed adequately and include no elements that would jeopardize the efficient performance of the system. Therefore, the Electric Engineering and Telephone Engineering Division of the REA determines the specifications, drawings, materials, and equipment that will be acceptable for REA financing. These activities brought about the recognition that tests and research and development work concerned with many phases of telephone plants were necessary for the optimum achievement of the objectives of the rural telephone loan program. Some of the reasons given to the subcommittee were—

1. Existing industry system designs, equipment, and material were developed primarily for urban telephone systems and studies indicated that they were not entirely satisfactory for area coverage of rural telephone service of reasonable quality and at costs which would make loans feasible.

2. Standardization in the telephone industry, outside of the Bell System, was negligible. REA needed to initiate and stimulate a great deal of standardization to effectively reduce costs of providing rural telephone service and this requires a great deal of testing of equipment and materials to determine basic data and requirements on which to base standards.

3. Approximately 90 percent of the telephone plants in terms of investment were owned and operated by affiliated Bell System Co. These companies purchased nearly all of their equipment from the Western Electric Co., also a Bell System affiliate. This left only 10 percent (approximately) of the possible telephone market for the independent manufacturers which limited the amount any one independent manufacturer would invest in research and development work. To stimulate this activity, funds were needed to defray a part or all of the research and development cost. In the electric loan program, the relatively small amount of testing and development work required was usually undertaken by the manufacturer at his own expense with the objective of increased sales.

Under Public Law 600, approved act of August 2, 1946 (50 U.S.C. 55a) and section 11 of the Rural Electrification Administration Act, the 1952 appropriation bill included authority for REA to use administrative funds to finance a research and development program on a contract basis.

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3. Approximately 80 percent of the telephone plants in terms of investment were owned and operated by affiliated Bell System companies. These companies purchased nearly all of their equipment from the Western Electric Co., also a Bell System affiliate. This left only 20 percent (approximately) of the possible telephone market for the independent manufacturers which limited the amount any one independent manufacturer would invest in research and development work. To stimulate this activity, funds were needed to defray a part or all of the research and development cost. In the electric loan program, the relatively small amount of testing and development work required was usually undertaken by the manufacturer at his own expense with the incentive of increased sales.

Under Public Law 699, approved act of August 2, 1946 (60 U.S.C. 950) and section 11 of the Rural Electrification Administration Act, the 1962 appropriation bill included authority for REA to use administrative funds to finance a research and development program on a contract basis.