

United States District Court,
N.D. Illinois, Eastern Division.

UNDERSEA BREATHING SYSTEMS, INC., Plaintiff,
Counter-Defendant.

v.

NITROX TECHNOLOGIES, INC., Defendant,
Counter-Plaintiff.

Nov. 20, 1997.

Patentee brought infringement against competitor, alleging infringement of patent for oxygen enriched air generation system for filling scuba tanks, and competitor's filed counterclaim, alleging patent was invalid and seeking statutory penalty. The District Court, Morton Denlow, United States Magistrate Judge, held that: (1) patent was not infringed, either literally or under doctrine of equivalents; (2) patent was not invalid as anticipated; (3) patent was not invalid as obvious; but (4) \$500 penalty for deceiving public about whether patent had issued was warranted.

Judgment accordingly.

4,758,251, 4,860,803, 4,950,315, 5,053,058, 5,125,397, 5,306,331, 5,355,781, 5,611,845. Cited as prior art.

Sheldon Karon, Marianne C. Holzhall, Foley & Lardner, Chicago, IL, Robert J. Schneider, Chapman & Cutler, Chicago, IL, for Plaintiff.

Keith D. Parr, Charles R. Krikorian, Lord, Bissell & Brook, Chicago, IL, for Defendant.

MEMORANDUM OPINION AND ORDER

MORTON DENLOW, United States Magistrate Judge.

This patent case arises out of the issuance of a patent for an oxygen enriched air generation system designed principally for use by dive shops for filling scuba tanks. The Court conducted a bench trial from October 6-10, 1997, involving six in-court witnesses, two who testified by deposition, and numerous exhibits. The case involves two primary issues: 1) Was Plaintiff's patent infringed by Defendant? The answer is no. 2) Is Plaintiff's patent valid? The answer is yes. The following constitute the Court's findings of facts and conclusions of law pursuant to Rule 52(a) of the Federal Rules of Civil Procedure. To the extent certain findings may be deemed conclusions of law, they shall also be considered conclusions. Similarly, to the extent matters contained in the conclusions of law may be deemed findings of fact, they shall also be considered findings. *See Miller v. Fenton*, 474 U.S. 104, 113-14, 106 S.Ct. 445, 451-52, 88 L.Ed.2d 405 (1985).

FINDINGS OF FACT

I. THE PARTIES.

1. Plaintiff, Undersea Breathing Systems, Inc. ("Plaintiff") manufactures and markets oxygen-enriched air ("nitrox") generation systems for the production of divers' breathing gas. Its corporate officers are William H. Delp, II ("Delp"), Richard Rutkowski ("Rutkowski") and Dr. J. Morgan Wells ("Wells").
2. Defendant, Nitrox Technologies, Inc. ("Defendant" or "NTI") also manufactures and markets nitrox generation systems for producing divers' breathing gas. Its corporate officers are Cynthia Olson and Robert Olson ("Olson").

II. JURISDICTION AND VENUE.

3. This Court has jurisdiction over the parties and over the subject matter of this action pursuant to 28 U.S.C. s.s. 1331 and 1338(a).
4. Venue is proper in this district pursuant to 28 U.S.C. s.s. 1391(c) and 1400(b).

III. THE PATENT AT ISSUE.

5. United States Patent Number 5,611,845 ("the '845 patent") was issued on March 18, 1997, to Delp, as the inventor. (Px 1). Delp subsequently assigned the patent to Plaintiff. Delp filed the patent application for the system which led to the '845 patent on August 22, 1995. (Px 2).
6. The patent describes a particular type of nitrox generation system using a permeable membrane gas separation system for separating compressed air into a nitrogen gas component and a nitrox component. (Px 1).
7. The patent contains 33 claims. Claims 1 and 23 are independent claims with the remainder being dependent.
8. Plaintiff alleges that Defendant infringed independent claim 23 and dependent claims 24 and 29 of the '845 patent. Defendant denies the allegation and asserts that the '845 patent is invalid.

9. Claim 23 claims:

A system for generating [nitrox] comprising:

an air supply for supplying compressed air;

a permeable membrane gas separation system for separating a nitrogen gas component and [a nitrox] component from said compressed air;

means for detecting an oxygen concentration in said [nitrox] component;

means for selectively heating and cooling said compressed air as it passes between said air supply and said permeable membrane gas separation system; and (emphasis added)

means for selectively distributing said [nitrox] component for further use.

('845 patent, col. 9-10).

10. The principal issue with respect to Plaintiff's complaint for infringement is whether Defendant's system contains a means for selectively heating and cooling compressed air. The Court finds that Defendant's system does not contain a means for selectively heating and cooling the compressed air. In particular, the Court finds that Defendant's system lacks an equivalent structure for selectively cooling the compressed air. The Court's analysis of this issue is contained in the Conclusions of Law at Section VII.

11. Dependent claim 24 describes:

A system as defined in claim 23, and further comprising a compressed [nitrox] storage assembly,
a compressor,
a compressor feed line supplying said [nitrox] component to a compressor inlet and
an outlet line interconnecting a compressor outlet to said compressed [nitrox] storage assembly.

('845 patent, col. 10, lines 6-11).

12. Dependent claim 29 states:

A system as defined in claim 24, wherein said means for detecting the oxygen concentration is interconnected with an outlet of said permeable membrane gas separation system to permit monitoring of the oxygen concentration of said oxygen enriched air component passing through said outlet.

('845 patent, col. 10, lines 35-41).

IV. BACKGROUND FACTS.

A. The Parties' Involvement in Diving and Patent Development.

13. Delp attended college and took general engineering courses but did not receive a degree. He has had a continuing interest in diving since 1962, when he was certified as a diver. Delp has been involved in commercial diving and producing life support breathing gas mixtures for the diving industry since 1985. He is certified as a hyperbaric technician. Delp recognized that a system for generating nitrox using permeable membrane technology, which eliminates the need for a separate pure oxygen source, offered substantial advantages, such as increased safety and decreased cost and effort in producing nitrox.

14. Robert Olson has a bachelor's degree in oceanography. He has been a recreational diver since 1974. Olson has previously developed and patented systems using the nitrogen stream produced by permeable membranes for applications in the transportation industry, such as inerting containers used to ship grain and produce. (Dx 10 and 11). Olson assigned his patents to his then-employer, Prolong Systems, Inc., which produced and sold nitrogen generation systems for inerting purposes. In 1994, Olson began to work on a device to create nitrox for dive shops. He installed his first nitrox generating unit in July 1996. The NTI

system takes filtered, compressed air through a bundle of hollow fibers that separates the oxygen from the nitrogen using selective permeation. (Dx 25).

B. Diving.

15. When a diver's body is submerged under water, the liquid exerts pressure against the body in every direction. At sea level, the diver is subjected to normal atmospheric pressure, which can be quantified as 1 Atmosphere. The amount of pressure increases linearly as the diver submerges deeper below the water surface. For example, diving to a depth of 33 feet below sea level increases the pressure by 1 Atmosphere. Any diver, at any depth, must be in pressure balance with the forces at that depth. The body can only function normally when the pressure differences between the inside of the diver's body and forces acting outside is very small. (Px 29).

16. As pressure increases with depth, the diver's circulatory system is also compressed. If a diver surfaces too quickly, the rapid decompression can cause arterial gas embolisms, bubbles in the blood stream, to form. (Px 47, pp. 49-50, para. 9-14, U00437-38.) The bubbles of air in the blood vessels block some of the small terminal vessels, cutting off the blood supply to nerve endings. Known as decompression sickness or more popularly as the bends (and euphemistically by divers as "bubble trouble"), the consequent blockage throughout the circulatory system, can cause severe pain, temporary paralysis, permanent damage, or death.

C. Gases in Diving.

17. Divers' breathing gas is composed of eight gases, which are normally found in varying quantities in the atmosphere. These gases are oxygen, nitrogen, helium, hydrogen, neon, carbon dioxide, carbon monoxide and water vapor. Oxygen is the most important. Normal ambient air contains approximately 21 percent oxygen, 78 percent nitrogen, and 1 percent trace gases. It is the oxygen that is actually used by the body. The other 79 percent of air serves to dilute and carry the oxygen. Pure (i.e., 100 percent) oxygen is often used for breathing in hospitals and in aircraft. However, a diver who breathes pure oxygen under pressure may experience oxygen poisoning. (Px 29). Because it imposes a significant decompression obligation, ambient air is not the "ideal" breathing mixture for diving. Decompression obligation refers to the necessity when surfacing from a dive to stop periodically and allow the diver's body to adjust to the new pressure exerted on the body to avoid the bends. Decompression obligation is dependent on the quantity of nitrogen absorbed by the body during the course of a dive. Both the rate of nitrogen absorption and the total amount of nitrogen which can be taken in by the body are determined by the nitrogen partial pressure in the breathing gas. (Px 2, Tab 47, p. 21). Although nitrox is any combination of nitrogen-oxygen, nitrox mixtures with greater than 21 percent oxygen can offer significant advantages to many types of diving. (Px 2, Tab 47, p. 21). For the purposes of this opinion, any reference to nitrox will indicate a nitrogen-oxygen mixture which contains more than 21 percent oxygen.

18. If both the toxic and decompression obligation reducing properties of oxygen are considered, an "ideal" diving gas mixture for any depth / time combination can be produced. Such a mixture would offer the maximum decompression advantage without the risk of oxygen toxicity. The advantages of such a mixture as compared to air are that it will either increase the allowable time on a successive dive or reduce the surface interval, the time a diver must spend at surface level between dives, or both. (Dx 36, pp. 31-32.)

D. Pressure and Compression.

19. A gas mixture that is safe to breathe at the surface may not be acceptable at depths experienced by

divers. The breathing gas will not flow out of its storage tank unless it is at a higher pressure than its surroundings. Because pressure increases as the diver's depth increases, the breathing gas in the diver's tank must be stored at a pressure higher than the maximum that the diver will encounter. Other components of air, such as carbon dioxide or hydrocarbon contaminants, may be tolerable at ambient pressure but dangerous at the higher pressures encountered at depth.

20. Generating and compressing nitrox for diving implicates several problems. The enhanced oxygen content increases the risk of explosion or fire, necessitating the use of special cleaning and safety procedures. Moreover, because diving time, decompression time, and surface intervals vary with the gas composition of the breathing gas used, the oxygen and other gas components must be precisely controlled.

E. Prior Nitrox Generation Systems.

21. Prior to the '845 patent, nitrox was produced in one of three ways. The first, partial pressure blending, requires the mixture of compressed pure oxygen and compressed air or pure nitrogen. The second, the continuous blending method used by the National Oceanic and Atmospheric Administration ("NOAA"), involves the mixing of compressed pure oxygen with air at ambient pressure and the compression of the resulting nitrox for use in diving tanks. Both the partial pressure and NOAA continuous blending methods require a separate pure oxygen source and use of the precautions attendant to the use of pure oxygen. The third, the pressure swing adsorption ("PSA") method, uses a molecular sieve that selectively adsorbs nitrogen molecules during pressurization and depressurization with air. (Dx 30, p. 12). PSA technology requires cleaning and safety procedures identical to using pure oxygen. (Dx 30, p. 12).

22. During the early 1990s, researchers Rutkowski, a hyperbaric medicine specialist, and Wells, director of the NOAA Experimental Diving Unit, began experimenting with the possibility of using permeable membrane technology as a commercially viable means of producing a safe nitrox breathing gas for divers. The advantage of this technology is the elimination of a pure oxygen source requirement. Rutkowski and Wells tested membrane packages manufactured by Permea and Medal to determine whether the nitrox permeate could be safely breathed at depth and whether contaminants and trace gases might be concentrated in the permeate; they experimented with flow rates to determine the optimum pressure for the feed air.

F. Permeable Gas Membranes.

23. The system claimed by the '845 patent discloses a gas separator in the form of a hollow-fiber permeable membrane in combination with additional elements to produce nitrox. *See e.g.*, United States Patent 4,230,463 for a multicomponent membrane for gas separations. (Dx 9).

24. Permeation results from the pressure differential across the fiber. (Dx 26, 03387.) Because a gas will always seek to reach an equilibrium pressure with its surroundings, the permeable hollow fiber membranes, filled with air at an elevated pressure, act like a "leaking" pipe. The gases that comprise air permeate, or "leak," through the fiber, as the air travels axially through the hollow fiber.

25. Each gas has a particular permeation rate; oxygen permeates faster than nitrogen. Thus, when a compressed air stream is fed to the inside of the hollow membrane fiber, the air separates into two streams: a permeate FN1 stream, at atmospheric pressure, which is oxygen enriched and a nonpermeate stream, near the original, elevated pressure, which is nitrogen enriched (actually oxygen depleted). (Dx 25, 03812-13).

FN1. "Permeate" refers to the gases, in this case primarily oxygen, which migrate out of the hollow fiber by

diffusing through the cylindrical wall.

26. Permeable membranes have been used for gas separation since the 1970s, and hollow-fiber permeable membranes have been used since the 1980s. Their predominant use, however, is the production of nitrogen. (See Px 24 describing AVIR Gas Separation Cartridge).

27. The use of nitrogen is sometimes referred to as "inerting," that is, displacing the oxygen in an environment with nitrogen. The three points of the "fire triangle"-fuel, heat and oxygen-must all be present for combustion to occur. When enough oxygen is displaced by nitrogen, combustion can no longer occur. Also with no oxygen in the atmosphere, most living things can not survive.

28. Nitrogen is used in the shipping and warehousing industries to prevent combustion, preserve freshness and increase shelf life of produce, or exterminate insects through oxygen deprivation. Other uses for nitrogen include: purging lines and vessels in industrial processes, producing pressurized gas for enhanced oil recovery, pressure testing pipe systems, preventing dust explosions in silos and bins, and supplying inert atmospheres for heat treating. (Dx 18, pp. 4-5, N00734-35).

29. In the overwhelming majority of membrane applications, the oxygen-rich permeate is considered a waste gas and discarded. In those few applications in which the permeate is used, such as the generation of nitrox for medical purposes, the permeate is used at ambient pressure. The potential use of permeable membranes to produce oxygenenriched breathing gas for divers was first being discussed in the 1990's by those engaged in the design and manufacture of equipment for the diving industry. In 1993, Wells and Linda Moroz wrote an article regarding the application of gas separation technology in the preparation of divers' breathing gases. (Dx 6).

G. The Invention Claimed by the '845 Patent.

30. The '845 patent claims and discloses a system which is capable of generating an oxygen-enriched, safe breathing gas for use by underwater divers. Nitrox may contain from 22 to 40 percent oxygen. Divers generally use a nitrox mixture containing 32 or 36 percent oxygen (known as Nitrox I and Nitrox II, respectively).

31. Nitrox has been used as a breathing gas by military, scientific and commercial divers for decades, and began to gain acceptance in recreational diving in the 1980s. Nitrox provides several advantages, such as reduced danger of decompression problems, increased bottom time, and decreased surface interval (the time that a diver must spend on the surface between dives).

32. In 1993 and 1994, Delp obtained permeable membranes from A/G Technology Corp. and Medal to evaluate the oxygen-rich permeate produced by separation and to determine whether the permeate would be safe and breathable for a diver at a depth where it would be supplied at elevated pressure. Delp focused on the concentrations of oxygen, nitrogen, argon, carbon monoxide, carbon dioxide, hydrocarbons and water vapors; these substances, while safe to breathe at the surface, can be toxic at elevated pressure.

33. Delp was aware that hollow-fiber permeable membranes are produced by fewer than a dozen manufacturers worldwide. These manufacturers were reluctant to have their membranes used in connection with a diving application because they considered it too dangerous and a serious liability risk. These

manufacturers include Permea, Inc.; A/G Technology Corporation; Generon Systems; Air Liquide America Corp. (or Medal); and Aquila Air. Delp also realized that the membranes produced by the various manufacturers differ with respect to their optimal feed air temperature and pressure ranges and their ability to withstand contaminants in the feed air. He therefore designed a system that could be adjusted for these differences and thus be used with any of the membranes. Delp ultimately selected a Permea membrane for use in the system that he would manufacture.

34. Delp testified that the invention claimed in the '845 patent was conceived and reduced to practice in early 1994 but offered no corroborating evidence.

35. Delp filed an application for a patent on his invention on August 22, 1995.

36. Plaintiff displayed its system at the Dive Equipment Marketing Association ("DEMA") trade shows in January 1996 and January 1997.

37. Delp was advised by the patent office in January 1997 that his claims had been allowed.

38. The '845 patent issued on March 18, 1997.

H. The NTI System.

39. Defendant manufactures a nitrox generation system which competes with the Plaintiff's system. (Px 6 and 7). The NTI system has been in existence since at least June of 1996. The NTI system takes filtered compressed air through hollow fiber membranes to produce a nitrox permeate stream. An oxygen analyzer confirms the percentage of oxygen in the stream as it is fed into the intake of a standard high pressure compressor. A flow control allows an operator to adjust the nitrox mixture up to 40 percent oxygen. (Px 6).

40. The NTI system is manufactured in the United States.

V. THE MARKET FOR THE NITROX GENERATION SYSTEMS.

41. The market for nitrox generation systems such as those sold by Plaintiff and Defendant consists primarily of dive shops located in the United States. Of these, only approximately 1,500 dive shops have the financial resources to purchase a system.

42. Plaintiff has the manufacturing and marketing capability to exploit the market.

43. The lifespan of an enriched air generation system is indefinite and depends on the life of the membrane. Therefore there is no replacement market for these systems.

44. The systems manufactured and sold by Plaintiff range in price from \$6,900 for the smallest unit to \$50,000 for the largest.

45. The systems manufactured and sold by Defendant range in price from \$9,000 for the smallest system to \$24,000 for the largest system.

46. Since the '845 patent issued, Defendant has sold at least three systems that were manufactured in the United States.

VI. THE DISPUTE.

47. Olson and Christian St. Claire, NTI's vice president of sales, displayed a bare membrane at St. Claire's booth at the DEMA show in January 1996 to ascertain whether there would be a market for a commercial product using membrane technology. Olson and St. Claire saw Plaintiff's system at that time. Delp advised Olson that he had applied for a patent on his system, and that he intended to enforce the patent upon its issuance. He threatened to sue Olson if Olson attempted to sell his device. For the remainder of the DEMA show, Olson and St. Claire displayed Plaintiff's logo and referred all inquiries regarding the membrane to the Plaintiff's booth.

48. In early September 1996, Delp learned of the installation of the NTI system at a dive shop and advised Olson that NTI's system would infringe the '845 patent when it issued.

49. In January 1997, Delp informed Olson and St. Claire that the claims of the '845 patent application had been allowed. Olson obtained a copy of the '845 patent on the day it issued and immediately faxed it to membrane manufacturers. Olson continued manufacturing and marketing the NTI system.

50. On March 24, 1997, Plaintiff filed suit against NTI alleging direct and contributory infringement of the '845 patent. NTI filed counterclaims for a declaratory judgment of non-infringement, a declaratory judgment of invalidity and unenforceability under 35 U.S.C. s.s. 102 and 103, and a declaratory judgment of patent misuse, as well as a counterclaim seeking a statutory penalty provided for by 35 U.S.C. s. 292.

51. After suit was filed, Defendant obtained a written opinion from counsel that its system did not infringe Plaintiff's patent. (Dx 47).

CONCLUSIONS OF LAW

VII. INFRINGEMENT.

[1] [2] 52. Plaintiff claims direct or, alternatively, contributory infringement. Persons who make, use or sell the patented invention are direct infringers. *Herbert F. Schwartz, Patent Law & Practice* (2nd ed.1996) (hereafter "Schwartz"), p. 77. Contributory infringers are persons who aid and abet direct infringers without themselves making, using, offering to sell, or selling the patented invention. *Id.* The patentee carries the burden of proving infringement by a preponderance of the evidence. *Rohm and Haas Co. v. Brotech Corp.*, 127 F.3d 1089, 1092 (Fed.Cir.1997).

53. A person infringes a patent when she "without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the patent...." 35 U.S.C. s. 271(a). A court's first step in an infringement analysis is to properly construe the claims. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed.Cir.1995), *aff'd*, 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). This is a question of law. *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, ---- - ----, 116 S.Ct. 1384, 1389-96, 134 L.Ed.2d 577 (1996). After the claims have been properly construed, they are then compared to the accused system. *Markman*, 52 F.3d at 976. This is a question of fact. *Kegel Co., Inc. v. AMF Bowling, Inc.*, 127 F.3d 1420, 1427 (Fed.Cir.1997).

54. Plaintiff alleges that Defendant's system infringes independent claim 23 and dependent claims 24 and 29 of the '845 patent. A dependent claim is infringed only if the independent claim on which it rests is

infringed. *Wolverine World Wide, Inc. v. Nike, Inc.*, 38 F.3d 1192, 1199 (Fed.Cir.1994).

A. Claim Construction.

55. In determining the proper construction of a claim, the court has numerous sources that it may properly utilize for guidance. These include both intrinsic evidence (*e.g.*, the patent claims, specification, and prosecution history) and extrinsic evidence (*e.g.*, expert testimony). *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed.Cir.1996). In most situations, an analysis of the intrinsic evidence alone will resolve any ambiguity in a disputed term. *Id.* at 1583. Unless the specification or the file history indicates that the inventor intended another meaning, a claim term will be accorded its "ordinary and accustomed meaning." *Wolverine World Wide, Inc.*, 38 F.3d at 1196. "Ultimately, the court must construe the claim language according to the standard of what those words would have meant to one skilled in the art as of the application date." *Wiener v. NEC Electronics, Inc.*, 102 F.3d 534, 539 (Fed.Cir.1996).

[3] 56. Under the doctrine of claim differentiation, claims should be presumed to cover different inventions; therefore, the court should avoid an interpretation of a claim that would make one claim read like another. *Laitram Corp. v. Rexnord, Inc.*, 939 F.2d 1533, 1538 (Fed.Cir.1991).

B. Construction of Means Plus Function Language.

57. Claim 23 contains means-plus-function language. If construed literally, a means plus function claim element would be construed to cover every conceivable structure that could perform the recited function. This broad construction of means plus function elements has been restricted by 35 U.S.C. s. 112, para. 6 which allows a patentee to claim an element of his invention in means-plus-function language but also "provide[s] a standard to make the broad claim language more definite." *Valmont Industries, Inc. v. Reinke Mfg. Co., Inc.*, 983 F.2d 1039, 1042 (Fed.Cir.1993). Section 112, para. 6 states:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

Paragraph six directs a court to construe means-plus-function language by turning to "the specification and interpret[ing] that language in light of the corresponding structure, materials, or acts described therein, and equivalents thereof, to the extent that the specification provides such disclosure." *In re Donaldson*, 16 F.3d 1189, 1193 (Fed.Cir.1994).

58. A claim using means-plus-function language must still " 'particularly point out and distinctly claim' the invention." *In re Donaldson*, 16 F.3d at 1195 (quoting 35 U.S.C. s. 112, para. 2). Although the patentee need not recite "structure, material, or acts" in a claim's means-plus-function element, to satisfy the enablement requirement, "the patent specification must describe some structure which performs the specified function." *Valmont Industries, Inc.*, 983 F.2d at 1042. However, "there is and can be no requirement that applicants describe or predict every possible means of accomplishing that function." *In re Hayes Microcomputer Products, Inc. Patent Litigation*, 982 F.2d 1527, 1535 (Fed.Cir.1992) (internal quotations omitted).

[4] 59. A limitation containing means-plus-function language is "not rendered open-ended by the presence of another claim specifically claiming the disclosed structure underlying the means-plus-function clause or an equivalent of that structure." *Laitram Corp.*, 939 F.2d at 1538. The statute expressly provides that the

patentee is entitled to a claim covering equivalents as well as the disclosed structure. *D.M.I., Inc. v. Deere & Co.*, 755 F.2d 1570, 1574 (Fed.Cir.1985).

C. Prosecution History of the '845 Patent.

60. Delp's original patent application contained 24 proposed claims, three independent claims and 21 claims all dependent on what was to become independent claim 1 of the patent. (Px 2A, U00134). In a PTO Examiner's Action on May 28, 1996, the examiner allowed independent claim 1 and rejected for obviousness the two other independent claims, claims 23 and 24 of the original application. (Px 2A, U00196-97).

61. The original, proposed independent claim 23 attempted to claim:

A process for generating breathable [nitrox] comprising the steps of:

supplying compressed air;

separating a nitrogen gas component and [a nitrox] component from said compressed air through the use of a permeable membrane gas separation system;

detecting an oxygen concentration in said [nitrox] component; and

selectively distributing said [nitrox] component for breathing.

(Px 2A, U00158-59).

62. Similarly, proposed independent claim 24 attempted to claim the analog system to proposed process claim 23 as follows:

A system for generating *breathable* [nitrox] comprising:

an air supply for supplying compressed air;

a permeable membrane gas separation system for separating a nitrogen gas component and [a nitrox] component from said compressed air;

means for detecting an oxygen concentration in said [nitrox] component; and

means for selectively distributing said [nitrox] component for breathing. (emphasis added).

(Px 2A, U00159).

63. The examiner found that both the proposed process and system claims were unpatentable because of obviousness over U.S. Patent Number 4,950,315 ("Gollan patent") in light of U.S. Patent Number 5,053,058 ("Mitariten patent"). (Px 2A, U00197). The proposed claims were different from Gollan because Gollan did not disclose the use of a concentration detector on the permeate outlet line of the permeable gas membrane separator system. However, the examiner noted that Mitariten teaches such use of the concentration detector

and, therefore, concluded that the combined teachings of the prior art references rendered the proposed claims obvious. (Px 2A, U00197).

64. In response to the examiner's action, Delp filed on August 22, 1996, an amendment to his application which canceled the two proposed independent claims rejected by the examiner and which added claims 25 through 35. (Px 2A, U00100). In a Notice of Allowability on October 25, 1996, the examiner allowed these added claims, which became claims 23 through 33 in the patent. (Px 2A, U00185).

65. Only two differences are evident between proposed independent claim 24 and what eventually became independent claim 23 in the patent. Claim 23 omits the word *breathable* from the preamble of the claim, and claim 23 adds the following limitation: "*means for selectively heating and cooling said compressed air as it passes between said air supply and said permeable membrane gas separation system.*" (Px 1, U00171). The Court finds that the additional limitation distinguishes Delp's invention from the prior art presented to the examiner.

D. Other Claims in the '845 Patent.

66. Independent claim 1 of the '845 patent contains four limitations that are identical to those found in independent claim 23. Claim 1 contains two other limitations not found in claim 23: (1) a "*means for dividing the nitrogen gas component into a cold gas stream and a hot gas stream;*" and (2) a "*flow-modifying means for directing the compressed feed air through the two gas streams to selectively heat and cool the feed air.*" ('845 patent, col. 8, lines 1-6.) The structures recited in the specification which accomplish these functions are the vortex tube and the two solenoid valves. ('845 patent, col. 4, lines 20-23 and col. 3, lines 54-56, respectively).

67. Claim 23 includes, besides the four identical limitations, one other limitation: a "*means for selectively heating and cooling said compressed air as it passes between said air supply and said permeable gas separation system.*" ('845 patent, col. 10, lines 1-3). Thus, the doctrine of claim differentiation directs that the selective heating and cooling means claimed in independent claim 23 not be construed to carry the same functional meaning as the two different limitations in claim 1.

68. The limitation in claim 23 recites a function (to selectively heat and cool the compressed feed air) which is more broad than the combined functions in claim 1: (1) to divide the nitrogen gas into two components; and (2) to direct the compressed feed air through the two components to selectively heat and cool the compressed feed air.

69. Dependent claim 27 is a system as defined in dependent claim 26 FN2 but contains a further limitation on the means for selectively distributing the nitrox for further use: "*wherein said means for selectively distributing said [nitrox] component for further use comprises [a nitrox] supply line and at least one valve provided in said [nitrox] supply line to regulate flow of said mixture into the means for storing said mixture.*" ('845 patent, col. 10, lines 25-30.)

FN2. Dependent claim 26 is a system as defined in claim 25 but contains a further limitation on the means for detecting an oxygen concentration: "*wherein said means for detecting an oxygen concentration is interconnected with said outlet line [of the compressor] to permit monitoring of the oxygen concentration of a mixture of ambient air and the [nitrox] component in said outlet line.*" ('845 patent, col. 10, lines 19-23.)

Dependent claim 25 is a system as defined in claim 24 that further comprises an ambient air feed line placed before the compressor inlet recited in claim 24 to allow the mixing of the nitrox permeate and ambient air and a regulating means to regulate the amount of ambient air mixing with the nitrox permeate to permit further adjustment of the oxygen concentration in the mixture. ('845 patent, col. 10, lines 12-18.)

70. Rather than adding an additional limitation, dependent claim 27 narrows a limitation by providing a location within the system for certain elements of its structure. In so doing, claim 27 indicates the types of structure that are included within this limitation, that is, supply lines and valves. Therefore, similar structures should also be contained within the "means for selectively distributing the nitrox permeate" limitation found in claim 23.

E. Construction of the Disputed Claims in the '845 Patent.

71. The parties vigorously dispute the meaning of the limitations containing means-plus-function elements in claim 23. In particular, the parties dispute the meaning of the word "selectively" in the third limitation of claim 23. The Court will construe in turn the three claims at issue.

F. Independent Claim 23.

72. Claim 23 is an independent claim that defines a system for generating oxygen enriched air which contains five limitations, three of which contain means-plus-function elements: (1) an air supply to supply compressed air; (2) a permeable membrane gas separation system to separate air into nitrox and nitrogen; (3) means for detecting an oxygen concentration in the nitrox permeate; (4) means for selectively heating and cooling compressed air before it enters the permeable membrane; and (5) means for selectively distributing the nitrox permeate. ('845 patent, col. 9-10).

73. The court construes the first limitation of claim 23, "*an air supply for supplying compressed air,*" as follows: The air supply is either one or more storage vessels of compressed air or an oil-free air compressor. ('845 patent, col. 2, lines 40-48.) The limitation is further narrowed by specifying a function for the element, namely to supply compressed air.

74. The court construes the second limitation of claim 23, "*a permeable membrane gas separation system for separating a nitrogen gas component and [a nitrox] component from said compressed air,*" as follows: The structure for the separation system is a standard, commercially available, permeable membrane, nitrox and nitrogen gas separation system. ('845 patent, col. 3, lines 60-66.) The limitation is further narrowed by specifying a function for the element, namely to separate the compressed air into nitrogen and nitrox components.

75. The third limitation of claim 23 claims a "*means for detecting an oxygen concentration in said [nitrox] component.*" The Court construes the third limitation to correspond to the following structures and functions: the structure recited in the specification for the means for detecting an oxygen concentration includes a junction; a sampling line; and a conventional oxygen analyzer. (*See* '845 patent, col. 5, lines 12-15.) The concentration detector detects and provides a reading (typically, anywhere from 0% to 50%) of the nitrox permeate's oxygen concentration as it passes through a flow control valve and into a compressor feed line leading to an oil-lubricated, high pressure compressor. (*See* '845 patent, col. 5, lines 16-21.)

[5] 76. The fourth limitation of claim 23 claims a "*means for selectively heating and cooling said compressed air as it passes between said air supply and said permeable membrane gas separation system.*" The Court construes the fourth limitation to correspond to the following structures and functions: the

structure recited in the specification for the means for selectively heating and cooling the compressed air includes: (1) a heating and cooling heat exchanger which includes a commercially available spin vortex tube, FN3 which has a cold nitrogen gas exhaust directed towards the first coil and a hot nitrogen gas exhaust directed towards the second coil, and two heat exchanger lines, with the corresponding first coil along one line and second coil along another line; (2) two solenoid valves; (3) a solenoid control unit; and (4) a temperature sensor. (See '845 patent, col. 4, lines 9-36.) The Court concludes that the function found in this limitation includes both the ability to heat *and* to cool.

FN3. A spin vortex tube uses compressed gas as a power source, has no moving parts, and generates hot gas from one end and cold gas from the other. A valve built into the hot gas exhaust adjusts the volume and temperature of the hot and cold streams. The spin vortex tube can create temperatures as low as -40 (deg.)F and as high as +200 (deg.) F. (Dx 33, p. 8). One widely accepted theory regarding how a vortex tube works explains the dynamics of the phenomena as follows:

Compressed air is supplied to the vortex tube and passes through the nozzles that are tangent to an internal counterbore. These nozzles set the air in a vortex motion. This spinning stream of air turns 90 (deg.) > and passes down the hot tube in the form of a spinning shell, similar to a tornado. A valve at one end of the tube allows some of the warmed air to escape. What does not escape heads back down the tube as a second vortex inside the low-pressure area of the larger vortex. This inner vortex loses heat and exhausts thru [sic] the other end as cold air. (Dx 33, pp. 8-9.)

77. The interpretation of the term "selectively" is critical to the construction of this limitation and to whether Defendant's system infringes the '845 patent. The means for *selectively* heating and cooling the compressed air requires the "appropriate operation of the solenoid valves by the control unit permits selective heating and cooling, *i.e.*, 'temperature conditioning' of the compressed low pressure feed air passing through the heat exchanger and the supply line so that the temperature is appropriate for, and meets the specifications of, the particular separation system selected." ('845 patent, col. 4, lines 34-37.) Cycling the solenoid valves can be used to selectively heat and cool the feed air in the supply line and, therefore, adjust the oxygen concentration in the nitrox permeate because the concentration is dependent, *inter alia*, on input temperature. ('845 patent, col. 5, lines 24-27).

78. The Court concludes that in this limitation "selectively" indicates an ability to choose a specific point along a continuous range of possible temperatures and to control the temperature of the compressed air by directing it along the "hot route" to heat it and / or along the "cold route" to cool it until it reaches the optimum operating temperature. The ability to control the temperature during operation is central to the concept of "selectively heating and cooling."

79. The fifth limitation of claim 23 claims a "*means for selectively distributing said [nitrox] component for further use.*" The Court construes the fifth limitation to correspond to the following structures and functions: the structure recited in the specification for the means for selectively distributing the nitrox permeate includes: a low-pressure nitrox permeate feed line and a conventional flow control valve disposed in the feed line; and optionally a branch line and a conventional flow control valve disposed in the optional branch line. The Court finds that the means for selectively distributing the nitrox permeate allow the flow of nitrox through the feed line to be "permitted, shut off and regulated." (See '845 patent, col. 5, lines 9-11.) The Court finds that the word "selectively" is used consistently in the fourth and fifth limitations to denote the situation where the means can control the function in a continuous manner.

G. Dependent Claim 24.

80. Claim 24 is a dependent claim that defines a system as defined in claim 23 and contains four additional limitations: (1) a compressed nitrox storage assembly; (2) a compressor; (3) a compressor feed line to supply the nitrox permeate to the compressor inlet; and (4) a compressor outlet line to connect the compressor outlet to the compressed nitrox storage assembly. The court construes claim 24 to include every limitation found in independent claim 23 as construed earlier in this opinion.

81. The court construes the first additional limitation of claim 24, "*a compressed [nitrox] storage assembly*," as follows: the assembly contains as many conventional storage vessels (such as a nitrox storage cylinder or a scuba tank) as the operator of the system desires, and it contains an identical number of branch lines, one branch line for each storage vessel. (See '845 patent, col. 6, lines 20-28.)

82. The second additional limitation of claim 24 describes "*a compressor*." Although the specification, indicates that "a standard, oil-lubricated, high pressure compressor" could be used in the invention, ('845 patent, col. 4, lines 52-53), the use of such a compressor is predicated on using the nitrogen gas component to inert the crankcase of the compressor. ('845 patent, col. 4, lines 42-52.) However, claim 24 contains no limitation requiring the use of the nitrogen gas component in such a manner. Accordingly, the court construes "*a compressor*" in this limitation as follows: a compressor, either oil-free or oil-lubricated, capable of compressing and delivering air at least at 3000 p.s.i.g.

83. The court construes the third additional limitation of claim 24, "*a compressor feed line supplying said [nitrox] component to a compressor inlet*," as follows: a line which connects the permeate outlet of the permeable membrane gas separator to the inlet of the immediately above-described compressor.

84. The court construes the fourth additional limitation in claim 24, "*an outlet line interconnecting a compressor outlet to said compressed [nitrox] storage assembly*," as follows: a line which connects the outlet end of the compressor to the nitrox storage assembly.

H. Dependent Claim 29.

85. The Court construes claim 29, which is dependent on dependent claim 24, to include every limitation found in dependent claim 24 as construed earlier in this opinion with the exception that the third limitation, "*means for detecting an oxygen concentration in said [nitrox] component*," which is further narrowed by the following:

said means for detecting the oxygen concentration is interconnected with an outlet of said permeable membrane gas separation system to permit monitoring of the oxygen concentration of said [nitrox] component passing through said outlet.

('845 patent, col. 10, lines 34-39.)

86. The Court finds that the structure recited in the specification for the "*means for detecting the oxygen concentration*" is the same as for claims 23 and 24.

87. The Court finds the third limitation is narrowed: (1) by adding a further description of the location in the system of the means-for-detecting-an-oxygen-concentration element: it is connected to the permeate outlet

of the permeable membrane gas separation system; and (2) by further specifying the element's function: it monitors the oxygen concentration of the nitrox permeate as it passes through the permeate outlet of the gas separation system.

I. Direct Infringement.

[6] 88. Direct infringement is found where each and every limitation of an asserted claim is found in the accused device either literally or under the doctrine of equivalents. *Intellicall, Inc. v. Phonometrics, Inc.*, 952 F.2d 1384, 1389 (Fed.Cir.1992). The absence of a single limitation is enough to negate infringement of the claim. *Laitram Corp.*, 939 F.2d at 1535.

J. Literal Infringement.

89. An accused system literally infringes a claimed invention when "every limitation recited in the claim is found in the accused device, *i.e.*, when the properly construed claim reads on the accused device exactly." *Cole v. Kimberly-Clark Corp.*, 102 F.3d 524, 532 (Fed.Cir.1996).

[7] [8] 90. To determine whether the claim's limitation with means-plus-function language literally reads on the accused device, the Court must "compare the accused structure with the disclosed structure, and must find equivalent structure as well as identity of claimed function for that structure." *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 934 (Fed.Cir.1987). Means-plus-function language does not extend the scope of the element to cover equivalent functions. *Johnston v. IVAC Corp.*, 885 F.2d 1574, 1580 (Fed.Cir.1989). 35 U.S.C. s. 112, para. 6 does not allow finding that a limitation containing a means-plus-function element is met literally "where the function part of the element is not literally met in an accused device." *Id.*, 885 F.2d at 1580 (Fed.Cir.1989).

K. The Accused Device.

91. The Court finds that Defendant offered to sell a system which included *inter alia*: (1) a cabinet-style enclosure that holds a permeable membrane gas separation system for separating compressed air from a compressed air supply into a nitrogen gas component and a nitrox component, a conventional oxygen analyzer as an identical means for detecting and measuring oxygen concentration which is connected to the permeate outlet of the membrane to detect the oxygen concentration in the nitrox component, a heater, and a digital temperature controller to regulate the heater; (2) an external high pressure-reducing regulator. located on the input side of the cabinet, to reduce the pressure in the compressed air fed to the membrane housed inside the cabinet, and (3) a flexible air line. located on the output side of the cabinet which is connected at one end to the nitrox permeate outlet of the membrane and which could be connected at the other to a compressor. (See Dx 12, N00143).

92. The Court finds that Defendant's system does *not* include: (1) an air supply for supplying compressed air, (2) a nitrox storage assembly, (3) a compressor; (4) a line which connects the compressor output to the nitrox assembly; or (5) a flow control valve disposed on the nitrox permeate, outlet end of the permeable membrane.

L. Comparison of the Accused Device to the Claims.

1. Claim 23 Is Not Literally Infringed.

[9] 93. The Court concludes that Defendant's system does not literally infringe claim 23 because it does not include: (1) an air supply to supply compressed air; (2) an identical or equivalent structure which selectively heats and cools compressed air before it enters the permeable membrane; or (3) an identical or equivalent structure which selectively distributes the nitrox permeate.

94. First, the Court finds that the limitation "an air supply to supply compressed air" is not found in Defendant's system. Defendant's sales brochure depicts an air supply, either as a compressor or compressed air storage cylinders, in use with the cabinet system; however, Defendant does not offer to sell the air supply. Although Defendant's flow schematic reveals that an air supply is necessary, (Dx 13, N00191), it does not list an air supply in the bill of materials.

95. Second, the Court concludes that Defendant's system does not contain an identical or equivalent structure which selectively heats and cools compressed air before it enters the permeable membrane. The Court finds that Defendant's electric, resistive heater that can be set to heat the compressed air to a particular temperature with the digital temperature controller is structurally equivalent to the heating aspect of the heat exchanger in Plaintiff's system. Both operate by indirectly heating the compressed air, and both can be operated at a continuous range of temperature settings. The heater in Defendant's system performs the identical function as the "hot" side of Plaintiff's claimed heat exchanger.

96. However, the Court finds that Defendant's pressure regulator, regulating the pressure of the compressed air entering the membrane, is not structurally identical or equivalent to the "cool" side of Plaintiff's heat exchanger. An attendant physical phenomena of reducing a gas' pressure is reducing its temperature. Although a pressure regulator will cool the air passing through it as it reduces the air's pressure, the cooling is a function of the type of regulator selected and the amount of pressure drop. Defendant's pressure regulator cannot cool the compressed air passing through it in the same "selective" manner that Plaintiff's heat exchanger can. The two devices perform their functions in such a drastically different manner that no equivalence of structure and no identity of function can be found.

97. Third, the Court finds that no structure in Defendant's device performs a function identical to the fifth limitation, a "*means for selectively distributing the nitrox component.*" Defendant's sales brochure makes no mention of any structure which acts as a means for selectively distributing the nitrox permeate. Defendant's flow schematic reveals a flow control valve disposed at the nitrogen outlet end of the permeable membrane, (Dx 13, N00191, item 10), but no corresponding flow control valve appears on the nitrox permeate outlet end. Rather, a vacuum relief valve and a pressure relief valve are disposed at the end the nitrox end. (Dx 13, N00191, items 17 and 18.) Neither of these relief valves can perform a function identical to that described in Defendant's limitation, namely to *selectively distribute the nitrox permeate*. The relief valves can act to limit a characteristic but cannot act to stop or vary the flow.

2. Claim 24 Is Not Literally Infringed.

98. Because the Court finds that independent claim 23 is not infringed, dependent claim 24 is not infringed. *See Wolverine World Wide*, 38 F.3d at 1199. However, assuming *arguendo* that every limitation in claim 23 read on Defendant's system, the Court holds that Defendant's system does not literally infringe claim 24 because it does not include a nitrox storage assembly; a compressor; or a line which connects the compressor output to the nitrox assembly. The Court makes this and other alternative findings for the sake of providing a full and complete record in the event of an appeal. In this way the Court and the parties may avoid the possible expense and delay of a retrial to resolve these issues.

99. The Court does find, however, that Defendant's system includes a flexible air line which acts as a compressor feed line to supply the nitrox permeate to a compressor inlet.

3. Claim 29 Is Not Literally Infringed.

100. The Court concludes that Defendant's system does not literally infringe claim 29 because it fails to infringe independent claim 23 and dependent claim 24, upon both of which claim 29 depends. *See Wolverine World Wide*, 38 F.3d at 1199.

101. However, assuming *arguendo* that the Court had found that claims 23 and 24 were infringed, then the Court would have found claim 29 infringed because the conventional oxygen analyzer connected to the permeate outlet of the membrane in Defendant's device does satisfy the narrowed limitation found in dependent claim 29 for the means for detecting and measuring oxygen concentration in the permeate nitrox.

M. Doctrine of Equivalents.

102. Having found no literal infringement, the Court now considers whether infringement exists under the doctrine of equivalents. The accused device may infringe the patented invention under the doctrine of equivalents "if it performs substantially the same function in substantially the same way to obtain substantially the same result." *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 608, 70 S.Ct. 854, 856, 94 L.Ed. 1097 (1950).

103. Infringement analysis under the doctrine of equivalents is not the same as an analysis of literal infringement under 35 U.S.C. s. 112, para. 6, equivalents. *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931 (Fed.Cir.1987). The doctrine of equivalents expands the protection of a patent claim to "[prevent] a copyist from evading patent claims with insubstantial changes." *Valmont Industries, Inc.*, 983 F.2d at 1043. Under para. 6, "an equivalent results from an insubstantial change which adds nothing of significance to the structure, material, or acts disclosed in the patent specification. A determination of s. 112, para. 6 equivalence does not involve the equitable tripartite test of the doctrine of equivalents." *Id.*

104. On the one hand, s. 112, para. 6 narrows the potentially broad implications of claim limitation with a means-plus-function element by finding literal infringement only where the accused device possesses an identical or equivalent structure, material, or act recited in the patent specification and where it performs an identical function. *Id.* at 1043-44. On the other hand, the doctrine of equivalents equitably expands claims by finding infringement where an accused device possesses only insubstantial differences from the invention. *Id.* To avoid conflicting with "the definitional and public-notice functions of the statutory claiming requirement," the Supreme Court held that "each element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole. It is important to ensure that the application of the doctrine, even as to an individual element, is not allowed such broad play as to effectively eliminate that element in its entirety." *Warner-Jenkinson Co., Inc. v. Hilton Davis Chemical Co.*, --- U.S. ---, ---, 117 S.Ct. 1040, 1049, 137 L.Ed.2d 146 (1997). Moreover, the range of equivalents under the doctrine of equivalents cannot "ensnare the prior art." *We Care, Inc. v. Ultra-Mark Int'l Corp.*, 930 F.2d 1567, 1570 (Fed.Cir.1991). By viewing the role of each limitation against the backdrop of the entire claim, the Court is able to decide "whether a substitute element matches the function, way, and result, of the claimed element, or whether the substitute element plays a role substantially different from the claimed element." *Warner-Jenkinson*, ---U.S. at ---, 117 S.Ct. at 1054.

[10] 105. The doctrine of prosecution history, or file wrapper, estoppel "bars the patentee from recapturing subject matter that was surrendered by the patentee during prosecution in order to promote allowance of the claims." *Regents of the Univ. of California v. Eli Lilly and Co.*, 119 F.3d 1559, 1573-74 (Fed.Cir.1997) (internal quotations omitted). If a claim has been narrowed by an amendment to avoid a prior art rejection, the patentee may not argue that the surrendered subject matter is within the range of equivalents. *Warner-Jenkinson*, --- U.S. at ---- - ----, 117 S.Ct. at 1049-51.

106. Because determining whether the accused device infringes the claimed invention under the doctrine of equivalents involves deciding whether a claimed element is equivalent to an element in the accused device, "the proper time for evaluating equivalency-and thus knowledge of interchangeability between elements-is at the time of infringement, not at the time the patent issued." *Warner-Jenkinson*, --- U.S. at ----, 117 S.Ct. at 1053. Also, a skilled practitioner's knowledge of the interchangeability between the claimed and accused elements is relevant to the extent that it "provides content to, and limits on, the concept of 'equivalence.'" *Id.* at ----, 117 S.Ct. at 1049.

N. Claim 23 Does Not Infringe Under the Doctrine of Equivalents.

[11] 107. The Court finds that Defendant's system does not directly infringe claim 23 under the doctrine of equivalents because it does not include an equivalent for each element of the claimed invention. The Court finds that Defendant's system includes elements equivalent to the claimed permeable membrane gas separation system and the claimed means for detecting an oxygen concentration. However, Defendant's system does not include an air supply to supply compressed air; an equivalent means to selectively distribute the nitrox permeate; or an equivalent means to selectively heat and cool the compressed air before it enters the permeable membrane.

108. The Court finds that Defendant's system does not include *any* element which could be equivalent to an air supply.

109. The Court finds that Defendant's system does not include elements equivalent to a means for selectively distributing the nitrox permeate. The relief valves located on the nitrox permeate outlet end of Defendant's system do not perform substantially the same function as a control valve. In other words, the relief valves cannot allow the flow of nitrox permeate to be "permitted, shut off and regulated." (See '845 patent, col. 5, line 11).

110. The Court finds that Defendant's system does not include elements equivalent to a means for selectively heating and cooling the compressed air before it enters the permeable membrane.

111. Plaintiff's patent specification teaches that a conventional pressure regulator "is used to reduce the pressure of the compressed air passing into a low pressure feed air line so that it is lower than approximately 600 p.s.i.g., and, typically, in the range of 50-250 p.s.i.g." ('845 patent, col. 2, line 66-col. 3, line 2). The compressed, low-pressure air passes into the heat exchanger where it is selectively heated and cooled by the cycling of the solenoid valves as directed by the control unit. ('845 patent, col. 3, lines 2-23). In Defendant's system compressed air passes through a pressure regulator to reduce the pressure. (Dx 13, N00192). The compressed, low-pressure air is subsequently heated by a heater, which is regulated by a temperature controller. (Dx 13, N00192).

112. The two systems do not perform substantially the same function, "temperature conditioning," with substantially the same result. Plaintiff's system selectively heats and cools. Defendant's system only selectively heats. The Court notes that other prior art references contain the functional combination of a pressure regulator and a heater in the same configuration as found in Defendant's system. (Dx 3; Dx 18; Px 2A, U00248). The Court, in equitably extending the scope of Plaintiff's claimed invention, is precluded from "ensnar[ing] the prior art." *We Care*, 930 F.2d at 1570. Therefore, whatever structure may be said to be equivalent to means for selectively heating and cooling under the doctrine of equivalents, it is clear that the combination of a pressure regulator and a heater or heat exchanger would not qualify.

113. The Court finds that persons of ordinary skill in the art would not recognize the combination of a pressure regulator and a heating element as interchangeable, and thereby equivalent, with the structure disclosed in the '845 patent specification as a means of selectively heating and cooling the feed air. The Court finds the testimony of Defendant's expert, Professor Benny D. Freeman as credible on this point and rejects Plaintiff's expert's testimony.

O. Claim 24 Does Not Infringe Under the Doctrine of Equivalents.

114. The Court concludes that Defendant's system does not directly infringe claim 24 under the doctrine of equivalents because the Court finds that independent claim 23 is not infringed and that Defendant's system does not include *any* element which could be equivalent to a nitrox storage assembly; a compressor; or a line which connects the compressor output to the nitrox assembly.

P. Claim 29 Does Not Infringe Under the Doctrine of Equivalents.

115. The Court concludes that Defendant's system does not directly infringe claim 29 under the doctrine of equivalents because independent claim 23 and dependent claim 24, on which claim 29 depends, are not infringed.

116. Assuming arguendo that claims 23 and 24 are infringed, then claim 29 would be infringed because Defendant's system includes an equivalent means for detecting oxygen which is located at the nitrox permeate outlet of the permeable membrane.

Q. Contributory Infringement.

1. Principles.

[12] 117. Contributory infringement exists when anyone sells or offers to sell:

"a component of a patented machine, manufacture, combination, or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use."

35 U.S.C. s. 271(c).

118. The contributory infringement doctrine "exists to protect patent rights from subversion by those who, without directly infringing the patent themselves, engage in acts designed to facilitate infringement by others." *Dawson Chemical Co. v. Rohm & Haas Co.*, 448 U.S. 176, 188, 100 S.Ct. 2601, 2609, 65 L.Ed.2d

696 (1980). Contributory infringement protects a patentee "where enforcement against direct infringers would be difficult, and where the technicalities of patent law make it relatively easy to profit from another's invention without risking a charge of direct infringement." *Id.*

119. However, contributory infringement exists only when "the fact or intention of a direct infringement" is established. *Deepsouth Packing Co. v. Laitram Corp.*, 406 U.S. 518, 526, 92 S.Ct. 1700, 1706, 32 L.Ed.2d 273 (1972). If no one *directly* infringes the patent, there can be no *contributory* infringer. *Aro Mfg. Co. v. Convertible Top Replacement*, 365 U.S. 336, 341, 81 S.Ct. 599, 602, 5 L.Ed.2d 592 (1961). Further, in an effort to balance the competing doctrines of contributory infringement and patent misuse, section 271(c) "adopts a restrictive definition of contributory infringement that distinguishes between staple and nonstaple articles of commerce. It also defines the class of nonstaple items narrowly." *Dawson Chemical*, 448 U.S. at 200, 100 S.Ct. at 2615.

2. Application.

120. The Court notes that even if a customer attached the missing elements which correspond to the unsatisfied claim limitations, the customer would not directly infringe the patented invention because Defendant's system does not literally or equivalently read on the means for selectively heating and cooling the compressed air limitation. Unless a customer changed the internal components found inside the Defendant's cabinet enclosure (a situation beyond Defendant's control or contemplation), this limitation would not be satisfied and thus the customer would not directly infringe the patented invention.

121. Therefore, in conducting the contributory infringement analysis, the Court will assume *arguendo* that the means for selectively heating and cooling; the means for detecting an oxygen concentration, and the permeable membrane gas separation system limitations have been satisfied and will limit its consideration to those elements from the claim limitations which are not found in Defendant's system.

122. Plaintiff did not prove that any of Defendant's customers had ever purchased a system and subsequently used it in a way that would infringe Plaintiff's patented invention. Defendant's sales contracts show that Defendant sold his system; they do not indicate how a customer used Defendant's system. Therefore, the Court will only conclude Defendant contributorily infringed the patented invention if it can find Defendant intended a customer to use its system in an infringing manner.

123. Defendant's sales brochure depicts three installation options. (Dx 12, N00145). The options depict different flow charts for the operation of Defendant's system. The Court finds that these flow charts are persuasive in demonstrating how Defendant's intended customers to use their cabinet system.

124. Option 1 depicts a straight-line process where the system includes, on the input side of Defendant's cabinet system, a high-pressure compressor which fills a bank of compressed air cylinders. This tandem is an air supply. The air from the storage cylinders can then flow through a high-pressure regulator (external to Defendant's cabinet system), and subsequently the compressed, low-pressure air enters Defendant's cabinet. On the output side of the cabinet, a second high-pressure compressor can be connected to a fitting located on the cabinet, (see Dx 13, N00191, item 12), which connects the compressor inlet to the nitrox permeate outlet of the permeable membrane (located inside the cabinet). The second compressor's outlet, which pumps compressed nitrox, is connected to either a bank of nitrox storage cylinders or nitrox scuba tanks. The bank of nitrox cylinders is a nitrox storage assembly.

125. Option 2 also depicts a straight-line process but changes the elements on the input side of Defendant's cabinet. In option 2, a low-pressure compressor acts directly as the air supply and pumps compressed, low-pressure air into an external pressure-reducing regulator (*not* a *high-pressure* regulator). All the elements on the output side of the cabinet are the same as in option 1.

126. Option 3 shows a circular process which more closely reads on the patented invention as it is described in the specification. On the input side of the cabinet is a bank of air storage cylinders as the air supply which sends high-pressure, compressed air through a high-pressure regulator and then into the cabinet. On the output side of the cabinet, the flow chart shows an ability to mix the output nitrox with ambient air and to direct the consequent mixture to the inlet of a high-pressure compressor. The outlet of the compressor is connected to a nitrox storage assembly and to the air supply located on the input side of the cabinet, thus completing the circle. This flow chart suggests that in this configuration Defendant's cabinet system can be used to create compressed nitrox (which may be mixed with ambient air) and that the external compressor can be used to fill the air supply to supply compressed air.

a. Claim 23.

127. The Court concludes that Defendant does not contributorily infringe claim 23 because Plaintiff did not meet its burden in showing by a preponderance of the evidence that Defendant intended its customer to use its cabinet system with a means for selectively distributing the nitrox.

128. The Court finds that Defendant's sales brochure demonstrates Defendant intended a customer to use Defendant's cabinet system with a compressed air supply. However, the Court found nothing offered into evidence which indicated that Defendant intended a customer to use, or that a customer actually used, a means for selectively distributing the nitrox.

b. Claim 24.

129. The Court concludes that Defendant does not contributorily infringe claim 24 because independent claim 23, upon which claim 24 depends, is not infringed.

130. Assuming *arguendo* that independent claim 23 is infringed, the Court would conclude that Defendant contributorily infringes claim 24. The Court finds that Defendant's sales brochure demonstrates Defendant intended a customer to use Defendant's cabinet system with a compressed air supply, a nitrox storage assembly and a compressor with lines connecting it between the nitrox permeate outlet line of Defendant's cabinet and the nitrox storage assembly.

c. Claim 29.

131. The Court concludes that Defendant does not contributorily infringe claim 29 because independent claim 23 and dependent claim 24, upon which claim 29 depends, are not infringed.

132. Assuming *arguendo* that independent claim 23 and 24 are infringed, the Court would conclude Defendant *directly* and *contributorily* infringes claim 29.

R. Willful Infringement.

[13] 133. When a potential infringer has notice of another's patent rights, he has an affirmative duty to

exercise due care to determine whether he is infringing that patent. *Underwater Devices, Inc. v. Morrison-Knudsen Co., Inc.*, 717 F.2d 1380, 1389-90 (Fed.Cir.1983).

[14] 134. The Court holds that Defendant acted properly in contacting counsel to obtain legal advice and at all times exercised due care to avoid infringing the '845 patent. Even if the Court had found that Defendant's system was infringing, the Court finds that Defendant's conduct does not constitute willful infringement.

VIII. PATENT VALIDITY.

135. A patent is presumed valid, and each claim, whether independent or dependent, shall be presumed valid without regard to the validity of other claims. 35 U.S.C. s. 282. The party attacking validity bears the burden of proving invalidity by clear and convincing evidence. *Magnivision, Inc. v. Bonneau Co.*, 115 F.3d 956, 958 (Fed.Cir.1997). The Court finds that Defendant has failed to meet its burden of proving the '845 patent or its claims invalid.

A. Anticipation under 35 U.S.C. s. 102.

136. Infringement and anticipation are interrelated, or mirror images, in the sense that "[t]hat which infringes, if later, would anticipate, if earlier." *Knapp v. Morss*, 150 U.S. 221, 228, 14 S.Ct. 81, 84, 37 L.Ed. 1059 (1893). Anticipation is a question of fact. *Electro Medical Systems, S.A. v. Cooper Life Sciences, Inc.*, 34 F.3d 1048, 1052 (Fed.Cir.1994). To establish anticipation under section 102, Defendant must prove by clear and convincing evidence that a single prior art discloses each and every element of the claimed invention.FN4 *Kegel Co.*, 127 F.3d at 1429. The absence of even a single claim element from a prior art reference precludes anticipation by that reference. *Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1572 (Fed.Cir.1992).

FN4. To serve as an anticipation when the reference is silent about a particular characteristic found in the accused patent's claim limitation, "such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.... Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268-69 (Fed.Cir.1991)(internal quotations omitted).

[15] [16] 137. Whether deciding infringement or patent validity, a court must give the same interpretation and the same meaning to the patent claims. *Kegel Co.*, 127 F.3d at 1429. When an invention is claimed in means-plus-function language, the prior art reference does not anticipate the claimed invention if it does not disclose a structure which is capable of performing the functional limitation claimed in the "means" element. *RCA Corp. v. Applied Digital Data Systems*, 730 F.2d 1440, 1444 (Fed.Cir.1984).

1. s. 102(a) and (b).

138. Title 35 U.S.C. s. 102(a) states:

A person shall be entitled to a patent unless-

(a) the invention was known or used by others in this country, or patented or described in a printed

publication in this or a foreign country, before the invention thereof by the applicant for patent.

139. Section 102(b) defines a different statutory bar:

"A person shall be entitled to a patent unless-

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States."

140. The section 102(a) inquiry asks three basic questions:

(1) whether the date of the reference precedes invention;

(2) whether the reference is accessible to the public; and

(3) whether the contents of the reference put the invention into the hands of the public.

141. "The general purpose behind section 102(b) bars is to require inventors to assert with due diligence their right to a patent through the prompt filing of a patent application." *LaBounty Mfg., Inc. v. United States Int'l Trade Comm'n*, 958 F.2d 1066, 1071 (Fed.Cir.1992). Courts have articulated several factors which weigh against the inventor and in favor of the statutory bar's enforcement including the policies of "1) protecting the public in its use of the invention where such use began prior to the filing of the application, 2) encouraging prompt disclosure of new and useful information, 3) discouraging attempts to extend the length of the period of protection by not allowing the inventor to reap the benefits for more than one year prior to the filing of the application." *TP Laboratories, Inc. v. Professional Positioners, Inc.*, 724 F.2d 965, 968 (Fed.Cir.1984).

[17] [18] 142. Priority of invention "goes to the first party to reduce an invention to practice" unless another can show that it first conceived the invention and exercised reasonable diligence in later reducing the invention to practice. *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1577 (Fed.Cir.1996)(internal quotations omitted). To prove actual reduction an inventor must show that the invention actually works. *Estee Lauder, Inc. v. L'Oreal, S.A.*, 129 F.3d 588, 592-93 (Fed.Cir.1997). Constructive reduction to practice occurs when a patent application for the claimed invention is filed. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed.Cir.1986) (citations omitted).

[19] 143. For a prior art reference to be a "printed publication" under 35 U.S.C. s.s. 102(a) or (b), it must have been "sufficiently accessible to those skilled in the art; dissemination and public accessibility are the keys to a legal determination whether a prior art reference was 'published'." *In re Cronyn*, 890 F.2d 1158, 1160 (Fed.Cir.1989). If the reference is not sufficiently accessible to those skilled in the art, it is not prior art within the purview of section 102.

[20] 144. Prior art embodied in a printed publication must be enabling, "thus placing the allegedly disclosed matter in the possession of the public." *In re Epstein*, 32 F.3d 1559, 1568 (Fed.Cir.1994). To be enabling a prior art reference "must provide a description sufficient to teach a person of ordinary skill in the art how to make and use the apparatus or process." *Beckman Instruments, Inc. v. LKB Produkter AB*, 892 F.2d 1547, 1550 (Fed.Cir.1989). However, to satisfy the enablement requirement, the invention disclosed in a

publication need not have been actually made. In re Donohue, 766 F.2d 531, 533 (Fed.Cir.1985).

2. Reduction to Practice of Plaintiffs Invention.

145. Delp filed the patent application for the system which led to the '845 patent on August 22, 1995. He did not furnish any satisfactory evidence of an earlier invention date. The Court finds that Delp's invention was constructively reduced to practice on the date of his patent application. Therefore, only prior art existing before August 22, 1995, can be considered. The critical date for statutory bar considerations is August 22, 1994. Any publication, use or sale of the claimed invention before that date bars the patentee's right to a patent monopoly.

3. Prior Art.

[21] 146. Defendant alleges that the following prior art references anticipated the invention claimed in the '845 patent. These references will be considered in light of every subsection under section 102.

a. The '781 Patent.

147. United States Patent Number 5,355,781 ("the '781 patent"), issued October 18, 1994, to Liston et al., entitled "Controlled Atmosphere Storage System," was not disclosed by Delp or his patent prosecution counsel to the PTO during the prosecution of the application that eventually issued as the '845 patent. (Dx 3).

148. The '781 patent discloses the combination of a compressor to provide a compressed air supply; a finned tubing heat exchanger to cool the compressed air after it leaves the compressor; a high pressure relief valve to prevent the cooled, compressed air from exceeding 125 p.s.i.g.; an electric heater to heat the compressed air; a gas separation means, comprising a hollow fiber permeable membrane, to separate air into a nitrox permeate stream and a nitrogen product stream; an exit port to deliver the nitrogen stream into a storage container; and an oxygen sensor to detect the oxygen concentration in the storage container.

149. The '781 patent teaches the use of a permeable gas membrane as a nitrogen generation device for maintaining a controlled oxygen atmosphere of five percent oxygen or less within a transport container vessel.

150. The Court finds that the '781 patent does not include: (1) a means for detecting an oxygen concentration in the nitrox permeate because the oxygen concentration is detected in the storage container and is located on the nitrogen product stream; (2) a means for *selectively* heating and cooling the compressed air before it enters the permeable membrane because the combination of the finned tubing heat exchanger to cool and the electric heater to heat the compressed air does not allow for any selection in the presence or absence of the two functions, *i.e.*, one cannot select only heating or only cooling; (3) a means for selectively distributing the nitrox permeate because no structure exists to perform that function (Figure 3 of the '781 patent refers to the nitrox permeate as "[oxygen] discharge"); (4) a compressed nitrox storage assembly; (5) a compressor feed line to supply the nitrox permeate to a compressor inlet; or (6) a compressor outlet line to connect the compressor outlet to the compressed nitrox storage assembly. Therefore, the Court finds that the '781 patent does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

b. '7 Patent.

151. United States Patent Number 5,125,937 ("the '7 patent"), issued June 30, 1992, to Sadowski et al., entitled "Reversible Membrane Plant," was not disclosed by Delp, or his patent prosecution counsel to the PTO during the prosecution of the '845 patent. (Dx 4). The Court notes that the same primary examiner, Robert Spitzer, reviewed both the '7 and the '845 patents.

152. The '7 patent discloses the combination of a compressor to provide compressed air; an air chiller to cool the compressed air; a pressure regulator, placed at the end of a compressed air conduit, to control the pressure of the cooled, compressed air; a permeable membrane gas separation system to separate the regulated, cooled, compressed air into a nitrogen product and a nitrox permeate; a valve means operable either to locate port 1 or 2 of the membrane as the input port, and the other as the output port of the membrane; an electrical heating device to heat one end of the membrane; and a product gas conduit to collect the nitrogen product or to supply the nitrogen to an apparatus in which it is used.

153. The '7 patent teaches that the permeable membranes's life can be extended by using a four-port, two-way valve which allows the user to periodically alternate the input and output ends. A disproportionate amount of contaminants are located at the input end and tend to negatively affect the membrane's performance. The ability to reverse the input end avoids this situation.

154. The Court finds that the '7 patent does not include: (1) a means for detecting an oxygen concentration in the nitrox permeate; (2) a means for selectively heating and cooling the compressed air *before* it enters the permeable membrane; (3) a means for selectively distributing the nitrox permeate because no structure exists to perform that function; (4) a compressed nitrox storage assembly; (5) a compressor feed line to supply the nitrox permeate to a compressor inlet; or (6) a compressor outlet line to connect the compressor outlet to the compressed nitrox storage assembly. Therefore, the Court finds that the '7 patent does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

c. '331 Patent.

155. United States Patent Number 5,306,331 ("the '331 patent"), issued April 26, 1994, to Auvil et al., entitled "Process for Cooling the Feed Gas to Gas Separation Systems," was not disclosed by Delp or his patent prosecution counsel to the PTO during the prosecution of the '845 patent. (Dx 5). The Court notes that the same primary examiner, Robert Spitzer, reviewed both the '331 and the '845 patents.

156. The '331 patent discloses that conventional membrane separation of air into its components involves (1) compressing air, (2) passing the compressed air through an after-cooler which uses water or air, and (3) preheating the compressed air using external sources such as electrical heaters to minimize moisture condensation prior to (4) directing the compressed air to a permeable membrane gas separation system. The claimed process operates by: separating air into nitrox and nitrogen streams using this permeable membrane gas separation system; cooling water by evaporation with either stream; cooling the compressed air being fed into the permeable membrane by direct contact (such as with a cooling tower) or indirect contact (such as with a heat exchanger) with the cooled water; heating, electrically, the cooled, compressed air; and recovering the other stream of gas that was not used in cooling the water.

157. The '331 patent teaches that one stream from a permeable membrane gas separation unit can be used in an evaporation cooler to provide cool water which can cool, by direct or indirect contact, the compressed air supply before it enters the membrane.

158. The Court finds that the '7 patent does not include: (1) a means for detecting an oxygen concentration in the nitrox permeate because no structure is recited which could detect oxygen; (2) a means for selectively distributing the nitrox permeate because no structure exists to perform that function; (3) a compressed nitrox storage assembly; (4) a compressor feed line to supply the nitrox permeate to a compressor inlet; or (5) a compressor outlet line to connect the compressor outlet to the compressed nitrox storage assembly. Therefore, the Court finds that the '7 patent does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

d. Wells' 1991 System.

159. In 1991, Wells was employed the NOAA where he developed a system for generating nitrox. The Wells system essentially consisted of the NOAA continuous blending system (as described in his patent, U.S. Patent No. 4,860,803), where the permeate stream from a permeable membrane was substituted for the separate pure oxygen source. This experimental unit was not publicly shown, but was described in a September 1993 NOAA publication titled, "Applications of Gas Separation Technology in the Preparation of Diver's Breathing Gases and Hyperbaric Atmospheres." (Dx 6). The publication does not depict any system which incorporates a permeable membrane but indicates that a generic NOAA Continuous Nitrox Mixer can use a membrane "as a replacement for the oxygen source." (Dx 6, U01291). The publication does not disclose how the membrane can act as the replacement for the pure oxygen source. Also, although the publication indicates that a working model of the continuous mixer with the permeable membrane option exists, no specific details were available regarding what it entailed.

160. Accordingly, although it is unable to determine what exactly makes up the Wells system, the Court finds that the Wells system disclosed in the September 1993 publication does not include a means for selectively heating and cooling the compressed air before it enters the permeable membrane. Also, the Court finds that the publication depicting Wells' system is not enabling because it does not "provide a description sufficient to teach a person of ordinary skill in the art how to make and use the [system]." *See Beckman Instruments, Inc.*, 892 F.2d at 1550. Therefore, the Court finds that the Wells system does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

e. Rutkowski's 1994 System.

161. In January 1994, Richard Rutkowski developed a system for generating nitrox as a diver's breathing gas. This system comprised a combination of a compressed air supply; a pressure regulator to regulate the pressure of the compressed air; a heater to regulate the temperature of the compressed air; a permeable membrane gas separation module to separate the compressed air into a nitrox component and a nitrogen gas component; an oxygen analyzer to detect the oxygen content of the nitrox component; and means to selectively distribute the nitrox stream to a storage tank. Rutkowski displayed his system in January 1994 at the DEMA show, a diving industry trade show open to the public to determine potential sales and public demand for such a product in the United States.

162. During the time he experimented with permeable membranes, Rutkowski produced nitrox for diving applications by using established systems that required a separate oxygen source: the NOAA continuous blending method and the partial pressure method. His experiments with permeable membranes were conducted at one atmosphere, *i.e.*, ambient pressure.

163. The Court finds the Rutkowski system does not include: (1) a means for selectively heating and cooling the compressed air before it enters the permeable membrane because there is no structure that cools the

compressed air before it enters the permeable membrane; (2) a compressed nitrox storage assembly; (3) a compressor; (4) a compressor feed line to supply the nitrox permeate to a compressor inlet; or (5) a compressor outlet line to connect the compressor outlet to the compressed nitrox storage assembly. Therefore, the Court finds that the Rutkowski system does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

f. Permea's 1986 Commercially-Marketed System.

164. In 1986, Permea developed and commercially sold an air separation system comprising in combination a compressed air supply; a pressure regulator to regulate the pressure of the compressed air; a heater to regulate the temperature of the compressed air; a permeable membrane gas separation module to separate the compressed air into a nitrox component and a nitrogen component; an oxygen analyzer to detect the oxygen content of the nitrogen gas component or the nitrox component; and delivery valves to deliver the nitrogen stream to a nitrogen storage tank. (Dx 18).

165. The Court finds the Permea system does not include: (1) a means for selectively heating and cooling the compressed air before it enters the permeable membrane because no structure is recited which could selectively cool the compressed air before it enters the permeable membrane; (2) a means for selectively distributing the nitrox permeate; (3) a compressed nitrox storage assembly; (4) a compressor; (5) a compressor feed line to supply the nitrox permeate to a compressor inlet; or (6) a compressor outlet to connect the compressor outlet to the compressed nitrox storage assembly. Therefore, the Court finds that the Permea system does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

g. The Garms British Patent Office Application.

166. On August 4, 1993, Michael Garms filed an application with the British Patent Office disclosing a nitrox generation system for supplying nitrox breathing gas comprising a combination of a compressing means to compress atmospheric air to provide a compressed air supply; a thermostatically controlled heating device to regulate the temperature of the feed air; a permeable membrane gas separation system to separate the compressed air into a nitrox component and a nitrogen gas component; an after-cooler coil to cool the nitrox permeate component; and a supply conduit to deliver the nitrox to a nasal canula. (Dx 7).

167. Even if this patent application was sufficiently accessible to those skilled in the art, the Garms patent application does not recite any structure which can detect an oxygen concentration in the nitrox permeate. Also the Garms patent application does not recite any structure which could selectively cool the compressed air *before* it enters the permeable membrane. The after-cooler coil cools the nitrox permeate, not the compressed air.

168. The Court finds that the Garms patent application does not include: (1) a means for detecting an oxygen concentration in the nitrox permeate *before* it enters the permeable membrane; (2) or a means for selectively heating and cooling the compressed air *before it* enters the permeable membrane; (3) a compressed nitrox storage assembly; (4) a compressor feed line to supply the nitrox permeate to a compressor inlet; or (5) a compressor outlet line to connect the compressor outlet to the compressed nitrox storage assembly. Therefore, the Court finds that the Garms patent application does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

h. The '251 Patent.

169. United States Patent Number 4,758,251 ("the '251 patent"), issued July 19, 1988, to Swedo et al., entitled "Separation of Gases Through Gas Enrichment Membrane Composites," was not disclosed by Delp or his patent prosecution counsel to the PTO during the prosecution of the application for the '845 patent. (Dx 8). The Court notes that the same primary examiner, Robert Spitzer, reviewed both the '251 and the '845 patents.

170. The '251 patent discloses that a gas can be separated into its component parts by passing a feed stream of the gas across the surface of a permeable membrane. The '251 patent discloses specific uses for nitrox, such as breathing systems for submarines and other underwater stations, improved heart-lung machines, other lung assist devices, and to provide oxygen enrichment for life support systems in an aircraft.

171. The Court finds that the '251 patent describes a permeable membrane gas separation system. The Court finds that to the extent that the '251 patent discloses any particular application of the permeable membrane, any such disclosure is not enabling. Therefore, the Court finds that the '251 patent application does not anticipate the invention described in claim 23, 24 or 29 of the '845 patent.

172. Thus, the Court concludes that none of the prior art relied upon by Defendant establishes that the invention claimed by the 845 patent was invented by another because no prior art reference contains every element of the '845 patent.

B. Obviousness under 35 U.S.C. s. 103.

173. Obviousness is governed by Section 103 which states:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

35 U.S.C. s. 103(a).

174. Obviousness must be proven by clear and convincing evidence. *Para-Ordnance Mfg., Inc. v. SGS Importers Int'l, Inc.*, 73 F.3d 1085, 1087 (Fed.Cir.1995). Obviousness is a question of law that turns on a number of factual inquiries. *Graham v. John Deere Co.*, 383 U.S. 1, 17, 86 S.Ct. 684, 694, 15 L.Ed.2d 545 (1966). The factual backdrop for determining obviousness includes determining: "the scope and content of the prior art, the differences between the prior art and the claims at issue, and the level of skill in the relevant art." *Id.* Secondary considerations further clarify the circumstances at the time of the invention and include whether the claimed invention: has enjoyed commercial success, has satisfied a long-felt but unsolved need, has succeeded where others have failed, or has been copied.

175. Obviousness is decided by determining what the prior art references would have meant to a person of ordinary skill in the field of the claimed invention. *In re Gorman*, 933 F.2d 982, 986 (Fed.Cir.1991). Reconstruction performed today, through the benefit of hindsight's enhanced clarity, may make a solution to a problem easy or "obvious." After all, answering a question is easy if the answer is known in advance. Therefore, the "invention must be viewed not after the blueprint has been drawn by the inventor, but as it would have been perceived in the state of the art that existed at the time the invention was made." *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed.Cir.1996).

[22] [23] 176. It is not enough that the party challenging validity show that the individual elements of the claimed invention appear in various prior art references; instead, the challenger must establish some teaching, suggestion or incentive in the prior art that those elements should be combined. Gorman, 933 F.2d at 986. Whether a suggestion in the prior art need be explicit or only fairly inferred depends on the totality of circumstances viewed in light of the prior art and its relationship with the claimed invention. *Id.*

1. Scope and Content of the Prior Art.

[24] 177. The scope of the prior art includes references "reasonably pertinent to the particular problem with which the inventor was involved." In re GPAC Inc., 57 F.3d 1573, 1577 (Fed.Cir.1995)(internal quotations omitted). In considering what is pertinent, a court can consider whether the prior art reference is in an art where one skilled in the art of the invention would search for a solution to the problem that the invention solves. *Id.* at 1578. The hypothetical person of ordinary skill in the field of invention is presumed to have knowledge of prior art in the same or analogous fields. Gorman, 933 F.2d at 986.

178. The Court finds that the relevant art is the design and manufacture of equipment employed in diving and related activities, such as equipment for the production of breathing gases and divers' life support systems. In determining whether the '845 patent is invalid because the prior art renders it obvious, the Court will consider prior art cited by Delp to the examiner during the patent prosecution and prior art referenced by Defendant in this action.

2. Differences between the Prior Art and the Claims at Issue.

[25] 179. Although *Graham* directs that differences between the prior art and the claims at issue should be considered, the issue in deciding obviousness is not "whether the differences themselves would have been obvious" but "whether the claimed invention as a whole would have been obvious." Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1537 (Fed.Cir.1983).

180. The Court refers to the discussion of anticipation, *supra*, and incorporates here those findings which indicate the differences between the prior art and the invention as described in claims 23, 24, and 29.

3. Level of Ordinary Skill in the Pertinent Art.

181. The obviousness of the invention must be evaluated through the eyes of one of ordinary skill in the art, rather than the inventor, who may have been of exceptional skill. Motorola, Inc. v. Interdigital Technology Corp., 121 F.3d 1461, 1472 (Fed.Cir.1997). Accordingly, the inventor's educational level does not conclusively establish the level of ordinary skill in the art of the invention but rather is one factor to consider along with, *inter alia*, "the type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and the educational level of active workers in the field." In re GPAC Inc., 57 F.3d at 1579.

182. The Court finds that the level of one of ordinary skill in the art is that of a person having practical experience with basic mechanical engineering, permeable membrane gas separation systems, and diving equipment and apparatus to support diving operations.

4. Secondary Considerations.

183. When deciding obviousness, the trial court should always consider any "secondary consideration" evidence presented and give it the appropriate weight, not just when the existing prior art makes resolution of the issue uncertain. *Stratoflex*, 713 F.2d at 1538-39. The secondary considerations provide evidence of "how the patented device is viewed by the interested public: not the inventor, but persons concerned with the product in the objective arena of the marketplace." *Arkie Lures, Inc. v. Gene Larew Tackle, Inc.*, 119 F.3d 953, 957 (Fed.Cir.1997). However, to receive substantial weight, secondary-consideration evidence must demonstrate a nexus between the merits of the claimed invention and the evidence offered. *Stratoflex*, 713 F.2d at 1539.

184. Before the '845 patent, no other nitrox generation system could achieve the same combination of economic efficiency and safety. The dive shops that comprise the market for Plaintiff's system are reluctant to produce nitrox using the partial pressure, continuous blending or pressure swing adsorption methods because of the safety and maintenance considerations attendant to the use of pure oxygen and the expense associated with the use of a molecular sieve. Also, although Wells and Rutkowski may have attempted to forecast or conceptualize how a nitrox generation system using a permeable membrane gas separation module might operate, they were unable to do so. Where others had failed, only Delp was able to reduce the concept to practice.

185. Plaintiff's nitrox generation system has been a commercial success. Since the system's introduction to the market, Plaintiff has sold more than 100 systems in the United States and overseas. However, the nexus between the commercial success of the commercial embodiment and the merits of the invention is not satisfactorily established because often the commercial embodiment of the invention replaces the heat exchanger with an in-line heater to heat the compressed air as it passes between the compressed air supply and the permeable membrane gas separation system. Consequently, the probative value of Plaintiff's market success is reduced.

5. Teaching Away.

186. In *Arkie Lures*, the defendant invented a fishing lure made from salt-impregnated plastisol. 119 F.3d at 954. Because of the lure's salty taste, a fish kept it in its mouth longer than other lures, increasing the fisherman's chances of landing the fish. *Id.* The prior art disclosed the use of salty bait, plastisol lures, and organic fish attractants in plastisol lures to catch fish. *Id.* at 956. However, before the invention, skilled workers in the relevant art strongly doubted that salt would be a feasible additive to plastisol because it would roughen the surface texture of the lure, reduce the tensile strength of the plastic, and possibly be unsafe to manufacture since mixing a salt with a plastic can cause violent explosions. *Id.* at 955. In reversing the district court's judgment of invalidity based on obviousness, the Federal Circuit noted that the issue was not whether salt could be used as an additive but rather whether the invention was obvious in light of the "relevant knowledge at the time of [the defendant's] activities, including concern for the quality of the product, the warnings, and the perceived manufacturing difficulties, all manifested in the widespread skepticism that [the defendant] encountered among those of skill in the field." *Id.* at 958.

187. When Delp was in the preliminary stages of his invention, he visited Permea, a permeable membrane manufacturer. Rather than encourage him to explore alternative applications for its product, the Permea representative expressed to Delp a great deal of concern regarding the compression of the nitrox permeate and did not recommend Delp's trying his experiments with Permea's product. The same was true for other membrane manufacturers contacted by Delp. The volatility of the predominantly oxygen-concentrated nitrox dissuaded many from exploring alternative applications even when the nitrox was not to be compressed. In

fact, in most applications using a permeable membrane, the nitrox permeate is considered a waste product.

188. Each of the elements of the invention claimed in the '845 patent appear in the prior art. Nowhere in the prior art, however, is there any art which combines these elements to produce a system for generating safe nitrox to be compressed for use as a diver's breathing gas. None of the references relating to the use of permeable membranes for the production of nitrox for breathing at ambient pressures suggest that it be compressed for use as a diver's breathing gas; on the contrary, membrane manufacturers and users consciously avoided such a use. Therefore, the Court concludes that Defendant has failed to meet its burden of proving that the '845 patent is invalid on the basis of obviousness.

C. Enablement.

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Enablement, the inventor's quid pro quo for the limited monopoly granted by the patent, is intended to place the subject matter of the claims in the public sphere and should be gauged by the knowledge of one of ordinary skill in the art. *Glaxo, Inc. v. Novopharm, Ltd.*, 52 F.3d 1043, 1050 (Fed.Cir.1995). To satisfy the enablement requirement, a patent must "contain a description that enables one skilled in the art to make and use the claimed invention." *Atlas Powder Co. v. E.I. du Pont De Nemours*, 750 F.2d 1569, 1576 (Fed.Cir.1984). A patent may be enabling even though experimentation is necessary to make or use the invention as long as the experimentation is not "unduly extensive." *Id.*

190. The Court finds that the '845 patent enables one skilled in the art to make and use the claimed invention without unduly extensive experimentation. Substantially all of the witnesses agreed that the '845 patent provided sufficient information to one skilled in the art to make and use the claimed invention.

IX. PATENT MISUSE.

[27] [28] [29] 191. Defendant, the party asserting patent misuse, has the burden of proof. *Novo Industri A/S v. Travenol Labs., Inc.*, 677 F.2d 1202, 1210 (7th Cir.1982). To prevail on its claim seeking a declaratory judgment that the '845 patent is unenforceable for patent misuse, Defendant must establish that Plaintiff has "impermissibly broadened the 'physical or temporal scope' of the patent grant with anticompetitive effect." *National Presto Industries, Inc. v. Black & Decker (U.S.) Inc.*, 760 F.Supp. 699, 702 (N.D.Ill.1991) (quoting *Windsurfing Int'l, Inc. v. AMF Inc.*, 782 F.2d 995 (Fed.Cir.1986)). Generally, claims of patent misuse are measured by conventional antitrust principles, and are confined to a few specific anti-competitive practices, such as tying arrangements coupled with market power, covenants not to deal and mandatory package licensing. *Id.*

192. 35 U.S.C. s. 271(d) states:

No patent owner otherwise entitled to relief for infringement or contributory infringement of a patent shall be denied relief or deemed guilty of patent misuse or illegal extension of the patent right by reason of his having done one or more of the following:

(1) derived revenue from acts which if performed by another without his consent would constitute contributory infringement of the patent;

(2) licensed or authorized another to perform acts which if performed without his consent would constitute contributory infringement of the patent;

(3) sought to enforce his patent rights against infringement or contributory infringement.

193. Congress enacted 35 U.S.C. s. 271 to codify certain aspects of the judicially-developed doctrine of patent misuse. *Dawson Chemical Co. v. Rohm & Haas Co.*, 448 U.S. 176, 179, 100 S.Ct. 2601, 2605, 65 L.Ed.2d 696 (1980). Section 271(d) "specifies conduct of the patentee that is *not* to be deemed misuse." *Id.* at 181, 100 S.Ct. at 2605.

[30] 194. The Court finds that Plaintiff has not engaged in patent misuse. Although Plaintiff brought this action almost as soon as the patent issued, the patentee can seek to enforce his patent rights, or his limited monopoly granted by the patent, against infringement or contributory infringement. No other anti-competitive practice has been proven by Defendant. Therefore, the '845 patent is not rendered unenforceable under the doctrine of patent misuse.

X. INEQUITABLE CONDUCT.

[31] 195. To demonstrate that a patent was obtained through inequitable conduct requires clear and convincing evidence that a material fact was intentionally misrepresented or withheld from the PTO. *Hupp v. Siroflex of America, Inc.*, 122 F.3d 1456, 1465 (Fed.Cir.1997). A fact is material if it satisfies the objective or subjective "but for" test; the "but it may have been" test; or " '37 C.F.R. s. 1.56(a), *i.e.*, whether there is a substantial likelihood that a reasonable examiner would have considered the omitted or false information important in deciding whether to allow the application to issue as a patent.' " *Atlas Powder*, 750 F.2d at 1578. "On sale" information, like prior knowledge or use, is particularly material because the PTO has no way of knowing of the existence of any such prior art. *Paragon Podiatry Laboratory Inc. v. KLM Laboratories, Inc.*, 984 F.2d 1182, 1193 (Fed.Cir.1993).

[32] 196. Evidence that prior art was not disclosed to the PTO which demonstrates only "negligence, oversight, or an erroneous judgment made in good faith" is not sufficient to render the patent unenforceable. *Orthopedic Equipment*, 707 F.2d at 1383. However, where the materiality of the non-disclosed prior art is high, the lower the level of intent needed to be proven. *Under Sea Industries, Inc. v. Dacor Corp.*, 833 F.2d 1551, 1559 (Fed.Cir.1987).

[33] 197. The Court has carefully reviewed and considered all of the material which Defendant claims Plaintiff intentionally withheld from the primary examiner during the patent production. Even if the prior art references cited by Defendant are material, the Court finds that in the context of the disclosures Plaintiff did make to the primary examiner, Defendant has failed to meet its burden of proving by clear and convincing evidence that Plaintiff *intentionally* withheld material information from the PTO.

XI. DEFENDANT'S COUNTER-CLAIM FOR STATUTORY PENALTY.

[34] 198. 35 U.S.C. s. 292 imposes a civil penalty upon any person who improperly uses the word "patent" or a similar phrase implying patent protection where none exists:

Whoever marks upon, or affixes to, or uses in advertising in connection with any unpatented article, the word "patent" or any word or number importing that the same is patented, for the purposes of deceiving the public ... shall be fined not more than \$500 for every such offense.

199. Defendants point to two occasions where Delp prematurely indicated that his invention was patented: in a brochure advertising his device in which Delp refers to the device as patented before the patent issued and in a flyer released to the public for an open house held on August 26 and 27, 1995, just a few days after the patent application was filed.

200. In the former instance, Delp asserts that the printer made a mistake and that once he became aware of the error he corrected it. The brochure was not introduced into evidence. The Court finds that the first incident was an inadvertent error.

201. In the latter incident, the invitation to the open house indicates that Plaintiff "developed and patented" the nitrox system. (Dx 41.) Coming right on the heels of the patent application, the Open House was an opportunity to publicly display the invention and is an advertisement for Plaintiff's system. "Patented" may be a loose way of describing the act of applying for a patent, but in the context of the flyer it unmistakably deceives the public.

202. The Court finds that the Open house invitation violates 35 U.S.C. s. 292 because its use of the word "patented" deceives and leads the public to conclude that the system had already been patented. Accordingly, the Court fines Plaintiff \$500.

XII. CONCLUSION.

The Court holds that the product made, manufactured and sold by Defendant does not infringe any of the claims of the '845 patent. The Court holds that Defendant has failed to prove that the '845 patent is invalid. The Court holds that Defendant has failed to prove that the '845 patent is unenforceable under the doctrines of patent misuse and inequitable conduct. The Court holds that Plaintiff violated 35 U.S.C. s. 292 and will be assessed the statutory penalty of \$500.

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