TECHNOLOGY

Membrane Filters Air

Using a new synthetic silicone membrane, submarine crews may soon be supplied with air from the waters surrounding them, and patients may have a cheap oxygen supply.

See Front Cover

➤ A WISP of synthetic membrane, only a thousandth of an inch thick, may hold the answer to a simple system for supplying submarines with air drawn from the water around them, the purification of air in space capsules or moon stations, and a means of providing cheap, reliable oxygen supplies for patients in hospitals or at home.

The secret lies in a silicone film that is thinner, and therefore more permeable, than any silicone membrane ever before reported. Even though this membrane is completely free of holes, it permits the passage of liquids or gases.

Since different gases pass through the membrane at different rates, it is called "selective." The ability of the membrane to "select" those gases which will pass through most easily could be applied in a space capsule.

An opening covered with such a membrane would allow unwanted water vapor and carbon dioxide to escape easily into the vacuum of space, while vital oxygen was held in, because the first two gases pass through much more quickly than oxygen.

Oxygen, on the other hand, passes through such a membrane over twice as fast as nitrogen, which makes up 80% of the air we breathe. As a result, if ordinary air is brought into contact with one side of a membrane while the other side of the membrane is maintained at a lower pressure, the gas passing through the membrane will be rich in oxygen.

A man consumes about three quarters of a cubic foot of oxygen per hour. To meet his requirements solely by means of a selective membrane system could require as little as two and one-half square yards of membrane, plus a compressor or pump to remove the enriched air from the low pressure side of the membrane. The membrane is more than 100 times as permeable as the membrane material of which the lungs are composed.

For patients needing oxygen-rich air in hospitals or at home, a small air-enriching device with a compressor to provide a difference in pressure and a membrane to separate the gases could replace pure oxygen bought by the tank, cutting costs sharply.

Underwater applications would depend upon the fact that seawater is essentially saturated with air to a depth of many hundreds of feet.

The "aqua-hamster" penned in a submerged plastic tank, shown on this week's cover, is kept alive by an artificial "gill," a piece of the synthetic membrane stretched across the top, bottom, and two sides of its underwater home.

The "gill" extracts air from the surrounding water, while resisting the passage of the liquid. Carbon dioxide exhaled by the hamster passes out through the membrane, dissolves in the water and is carried away.

Since a small quantity of water with the salt removed would pass through the membrane, the hamster, the crew of a submarine, or the inhabitants of an underwater experimental station would be supplied not only with air but also with fresh water for drinking.

The method of producing the membrane was discovered by Dr. Walter L. Robb of the General Electric Research Laboratory, Schenectady, N.Y., who is shown in the picture standing behind the fish tank. Possible applications are being studied at General Electric's Advanced Technology Laboratories and elsewhere.

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PHYSICS

Superconducting Magnet Aids Nuclear Studies

➤ A NEW SUPERCONDUCTING magnet —a magnet made of materials that lose all electrical resistance when cooled to near absolute zero—has been developed.

Believed by researchers to be the biggest of its kind, the new magnet has an outside diameter of 24 inches and a bore or inside diameter of 10 inches. Present plans are to use it in conjunction with a particle accelerator to study subnuclear reactions. The superconducting magnet was built by Avco-Everett Research Laboratory, Everett, Mass.

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Avco-Everett Research Laboratory

SUPERCONDUCTING MAGNET —The ten-inch diameter superconducting magnet is lifted from its container of liquid helium after a test run.

PHYSIOLOGY

High Pressure Oxygen May Cause Malformation

➤ WARNINGS of possible human malformations if pregnant women are treated with high-pressure oxygen have been sounded as a result of experiments with golden hamsters.

With increasing use of hyperbaric oxygen treatment in medical practice, Dr. Vergil H. Ferm of the Dartmouth Medical School, Hanover, N.H., said other species should be studied to determine the effect on embryonic development.

Open spines, protruding brains, umbilical hernia, harelip and peculiar limb defects were found in a small but significant number of hamster fetuses after such treatment, he said.

Fifty-three pregnant hamsters in the early stages of pregnancy were placed in a 22-foot hyperbaric chamber, which was then flushed with 100% oxygen for three minutes.

They were then exposed to hyperbaric oxygen at 3.0, 3.6 and 4.0 atmospheres for periods of three and two hours.

Forty-one animals survived the treatment without apparent ill effects, but the fetuses showed gross malformations.

The U. S. Public Health Service supported the study, which was reported in the Proceedings of the Society for Experimental Biology and Medicine, 116:975, 1964.

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PUBLIC HEALTH

Membrane Helps Purify Contaminated Water

➤ FRESH DRINKING WATER can be obtained by forcing contaminated water through a membrane and filtering out the impurities.

This new, economical method, called the reverse osmosis process, uses a semipermeable membrane of cellulose acetate which filters out most minerals and organic materials.

Detergent impurities also are removed, leaving fresh non-sudsy water. The membrane may even filter out radioactive contamination.

While fresh water and contaminated water are separated in this new process, under normal conditions fresh water would naturally flow by osmosis through the membrane into the waste water.

However, by applying a force greater than the normal osmotic pressure to the contaminated water, fresh water is produced as the membrane filters out the impurities.

Designed and tested at the Aerojet-General Corporation in Azusa, Calif., the process can convert 96% of waste water into freshwater with a purity exceeding potability standards set by the Public Health Service.

The process is easier and cheaper to run than other purification methods of distillation and freezing that require large amounts of power to change water into vapor or ice to remove impurities.

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