CHEMISTRY

We Will Drink The Sea

Water-starved communities look to fresh water made from sea water for eventual relief. Interior Department is spending $10,000,000 on research. U.S. needs rising.

By WILLIAM GRIGG

➤ MAN HAS long been plagued by shortages of water, the simple compound more necessary for life than food. Without it, earth's fertile lands die, becoming worthless deserts.

Thus, from ancient times, men have had to dig wells, build reservoirs and catch rain on the roofs of their homes. Now, in the United States, these ancient methods are rapidly becoming inadequate. Water-starved communities look toward the glistening sea and wonder whether drinking the sea will become a practical reality.

Scientists believe it will. Congress has appropriated $10,000,000 to keep the U.S. Interior Department's research program on salt water going until 1963. Good progress has been made in the research, begun in 1952, but there is still a long way to go. It will be 10 to 15 years, at present rate of progress, before any sea-water to fresh-water process will be practical for widespread use.

For many years, scientists have been able to make drinking water from the sea, but they cannot yet do so cheaply. Distilled drinking water now being produced costs ten times as much as ordinary water supplies in most localities.

Even the most optimistic estimates of how much research can further reduce costs of present processes set the price at twice that of ordinary water.

Like Liquor Still

The still, using the same principle as in making whisky, is one of the methods of conversion. David S. Jenkins, the Interior's director of the saline water conversion program, estimates that one form of still, the Hickman, may make pure water at one-fourth the cost of any process now in use.

In all conversion stills, salt water is heated until it produces steam. The steam is salt free and can be condensed into pure water.

The conventional still creates steam under high pressure to force it into pipes that carry the steam to the condenser. The greater the pressure, the higher the temperature needed to turn water into steam.

To overcome this energy waste, Dr. Kenneth C. D. Hickman of Badger Manufacturing Company, Boston, Mass., lowers the pressure and uses fans to blow the steam into pipes. The fans compress the steam, which is piped through salt water, cooling the steam and, at the same time, efficiently heating the salt water to help make more steam.

Dr. Hickman believes he can produce a small distiller that could economically supply fresh water for an individual home beside the sea.

The high cost of fuel for a still makes it difficult to lower costs below a certain point. Atomic power may some day solve this problem.

Uses the Sun

Another answer to high fuel costs comes from Dr. Maria Telkes of New York University. Dr. Telkes is trying to devise practical means to use solar energy.

Solar distillation would not be possible, scientists believe, except in the southwestern United States, where sunshine conditions are most favorable. It is a much slower method than the Hickman still and requires expensive equipment.

All stills evaporate distilled water from salty water. The resulting water is free of all impurities, not just salt-free.

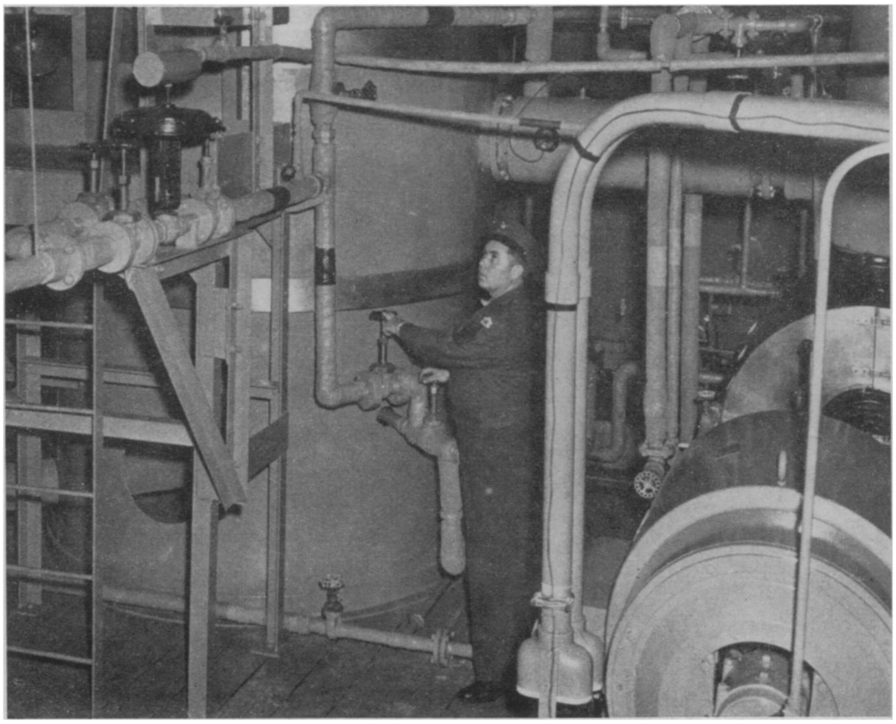
For the slightly brackish water abundant in many inland lakes and underground reserves in the U.S., some scientists believe that removing salt from the water will prove cheaper than evaporating the water. One salt-from-water process attracting a great deal of attention is the electric membrane process.

This is how it works:

In water, salt breaks up into positively charged sodium ions and negatively charged chloride ions. If a positively charged electric pole is placed in one end of a pool of salt water, and a negatively charged pole is placed in the other end of the pool, the poles will attract the chloride and sodium ions, respectively.

Membrane Trap

If the pool is divided into three parts by membranes enclosing the electric poles, the membranes prevent chemical changes near the poles from affecting the water in the central part. At the same time, the membranes permit sodium and chloride ions in the pool's center part to enter the two end areas where they become trapped. The central area thus becomes salt-free.



FRESH WATER FROM SALT—Ocean water is changed to fresh water in this huge distillation plant, developed and tested by the Corps of Engineers at Boston Army Base and now operated at Kindley (U.S.) Air Force Base in Bermuda. Drinking water produced by this plant costs ten times what U.S. communities pay for natural fresh water, but in Bermuda, no water is available from rivers or wells. Natives must catch rain water in containers on the roof-tops of their homes.

The process has been tested in Arizona, where plugging and sliming proved to be problems. The water used was from a slightly brackish inland supply. Although the conversion cost has not been officially announced, it is probably more than $20 per acre-foot. An acre-foot is 325,851 gallons.

Using the electric membrane process for ocean water would probably cost $500 per acre-foot. Under an Interior Department contract, Ionics Incorporated of Cambridge, Mass., conducted the Arizona tests. The company produces a line of brackish water demineralization equipment for commercial use.

Economic Forces

In its research program, the Interior Department is acting on the theory that economic forces, as well as scientific research, will make conversion practical. If underground water supplies continue to drop and U. S. population and industry continue to rise, the demand for water may eventually make even the most expensive conversion method "practical."

The Interior Department's goal is not to develop conversion methods that could compete on a cost basis with natural water supplies. For municipal and industrial water, the goal is $100 to $125 maximum cost per acre-foot.

A few industrial plants in the United States pay almost $100 per acre-foot for fresh water. Most communities pay between $1.50 and $50 an acre-foot.

If put into operation now, large conversion plants using known techniques probably could produce an acre-foot of water from the ocean for between $150 and $1,200.

The Pacific Gas and Electric Company's plant on Morro Bay in southern California uses water distilled from the ocean. Although it costs $500 per acre-foot, this water was cheaper than the company's alternatives of drilling for water or building a dam.

Expensive, But Practical

Conversion is "practical" on ships of the U. S. Navy even though the cost is $1,500 an acre-foot. Solar distillation kits are standard equipment on Army and Navy life rafts.

Besides investigating the three processes discussed above, the Interior Department plans research on freezing, solvent, membrane-hydraulic, and high pressure-high temperature processes for freeing water of its salt.

The freezing process is based on the fact that salt water loses its salt when frozen. Since it takes seven times as much energy to evaporate water as to freeze it, this process might lower fuel costs considerably.

Solvents have been developed to extract fresh water from brine, but further research is necessary to determine if this could be done economically. Research on a desalting process using membranes and hydraulic pressure is "encouraging," Interior officials reported.

The Swedish inventor Baltzar von Platen suggested the high pressure-high temperature process. A critical pressure device using pressures up to 5,000 pounds and temperatures up to 800 degrees Fahrenheit is being investigated by Nuclear Development Associates, White Plains, N. Y.

Science News Letter, August 6, 1955

PHYSICS

New Instrument Used To Study Small Viruses

➤ AN INSTRUMENT for studying small viruses and protein molecules has been developed. A gas-filled X-ray tube and a total reflection camera are combined to probe the sizes and shapes of such materials, important in medical and biological fields.

Small viruses and protein molecules are much too small to be seen with a light microscope, and are altered by viewing under the electron microscope.

Dr. Jesse W. M. DuMond of California Institute of Technology, Pasadena, and Burton L. Henke, now at Pomona College, Claremont, Calif., reported advantages of the new instrument in the *Journal of Applied Physics* (July).

X-rays of wavelength 8 to 25 Angstroms are used in the instrument. One Angstrom is four-billionths of an inch. One of its important advantages, they point out, is that specimens do not have to be viewed under high vacuum, as required in the electron microscope.

Science News Letter, August 6, 1955