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.

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