NATURAL RESOURCES

Sea Water To Fresh Water

Ocean brine, with salts removed, may be used to meet domestic demands. Compression distillation, chemical methods and refrigeration are possible ways.

➤ SCIENTISTS are looking toward the ocean to get additional fresh water to meet increasing demands made by homes, industry and agriculture. Congress is now considering an appropriation to investigate possible commercial methods of getting drinkable water from the ocean brine.

The supply of fresh water from the usual sources is not inexhaustible, as many suppose. The underground water level is getting lower and lower in many parts of the United States. A crisis is foreseeable. The increasing population and the tremendous amount of water now used in industrial operations and irrigation are responsible for the impending shortage. There is plenty of water in the oceans. The problem is to freshen it, and to do so at reasonable cost.

Ordinary distillation is the long-used process, and many vessels at sea operate shipboard stills to get their fresh water from the ocean. The process, however, is too costly to use for getting a city domestic supply. A more economical method is essential. The proposed investigation would concern itself with all possible methods, both chemical and physical.

One possible method, known as the vapor compression distillation process, has been developed by Arthur D. Little, Inc., Cambridge, Mass. It was tested on a large scale by the armed forces during the war. Over 1,000,000 men were supplied with fresh water from sea water on islands in the Pacific and on the mainland beachheads. Overall cost of this method is about one dollar for 1,000 gallons. Further refinements of the method may make the cost lower.

In compression distillation, a little preliminary heat is used to get a small amount of steam. This steam is mechanically compressed. The process raises its temperature as steam, and also raises the temperature at which it condenses to water. The temperature raise means that heat is given off. This heat is used to evaporate more of the water in the still. As long as the pressure is kept up, the process is continuous. Fuel is used to provide the mechanical pressure, but not to heat the water as in ordinary distillation.

Chemical means of getting drinkable water from the ocean were successfully used during the war in lifeboats and liferafts. One kit used contained silver alumino silicate in a treatment bag. When ocean water was added two insoluble compounds were formed. These were strained out by a cotton filter in the reaction bag.

The so-called ion-exchange process, used for many years in softening water in homes, is regarded as a possible method of freshening sea water. An ion is an atom with an electric charge upon it. In the ion-exchange process, harmless portions of an added substance are swapped for the unwanted impurities in the water. The process has other applications in addition to the purification of water.

Synthetic resins are sometimes used as ion-exchange materials. In the process the sodium ions of the salt of sea water are replaced by hydrogen ions. In another bed of ion-exchange material, the chloride ions of the salt are replaced by hydroxyl ions from the water. The result is that the salt in water is replaced by pure water, giving as a final result a demineralized water.

A mixture of synthetic resins, a recent discovery, permits both exchanges to take place at the same time without interference with each other. After use, the resins can be separated, regenerated, and then remixed for repeated use.

Refrigeration of sea water is another process seriously proposed. It has been a laboratory technique for some time. Nature also practices this scheme on a large scale. Ice floes in polar regions are pure water, it is claimed. A practical method for commercial use of freezing the salt out of sea water, however, has not yet been developed.

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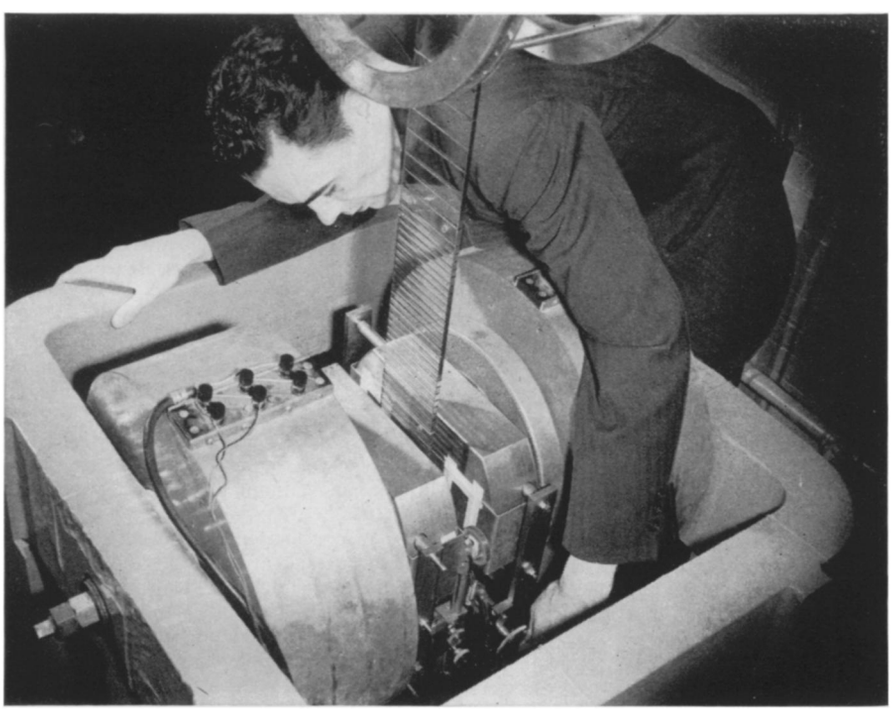
NUCLEAR PHYSICS

Basic Computations Made More Accurately

➤ TWO mathematical computations which are of basic importance in the whole field of atomic and nuclear physics have been recalculated with "unprecedented accuracy" by scientists at the National Bureau of Standards

The computations are: the absolute value of the magnetic moment of the proton; and the value of the basic constant e/m—electric charge to mass ratio of the electron. These provide needed fundamental knowledge about the atom for researchers working on the practical applications of atomic energy.

The computations give a standard for measuring magnetic fields, the possibility of a redetermination of all other physical



MAGNET ASSEMBLY—Dr. A. H. Thomas of the National Bureau of Standards is shown adjusting the position of a nuclear resonance detector to plot the strength of a magnetic field at various points. This is part of the apparatus used to recalculate two basic mathematical computations in the field of atomic physics.

constants dependent on the measurement of magnetic fields and a method for the stabilization of magnetic fields at an accurately known value.

Protons, or positively charged particles, and neutrons, or uncharged particles, make up the nuclei of atoms. Each proton which carries an electric charge equal and opposite to that of an electron, and 1840 times as heavy, spins on its own axis. When a proton is placed in a magnetic field, the positively charged particle will line up with its axis parallel to the magnetic lines of force. The magnetic moment of the proton is a measure of this interaction with magnetic fields.

Ordinary water was selected as a convenient proton sample because each hydrogen atom has a single proton as its nucleus while all other kinds of chemical atoms have nuclei made up of both protons and neutrons. This calculation of the magnetic moment will be especially helpful in the operation of giant electromagnets which are used as atom "smashers".

The basic constant which was recalculated gives physicists a more precise mathematical base on which to erect the staggering computations of electronics research.

This experimental work was performed by Dr. H. A. Thomas, R. L. Driscoll and J. A. Hipple. Dr. Edward U. Condon, director of the Bureau, termed this work "of the utmost significance in nuclear and atomic physics at a time when much research required this knowledge."

Science News Letter, April 9, 1949

PHYSICS-CHEMISTRY

Thermal Analysis Used To Study Materials

➤ A LABORATORY method known as differential thermal analysis has been valuable in studying the composition of materials containing clay minerals, carbonates, hydrates, sulfides, zeolites, chlorites, and some silicates, scientists were told at the New York Academy of Sciences meeting by Dr. Ralph E. Grim, State Geological Survey, Urbana, Ill.

The method of differential thermal analysis determines, by suitable apparatus, the temperature at which thermal reactions take place in a material when it is heated continuously to an elevated temperature, and the intensity of such reactions. Because of dehydration, oxidation reactions, destruction of lattice structure and changes in crystalline phase, many substances undergo thermal reactions, and the temperature of the thermal reactions, their intensity, and general character are characteristics of the particular material.

The equipment used in the process consists of a furnace with controls to provide a relatively uniform rate of temperature increase. Then there are specimen holders, thermocouples and other electrical instruments to measure and record the electromotive forces set up.

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CHEMISTRY-ENTOMOLOGY

Pyrethrum Synthesized

➤ SYNTHETIC pyrethrum for insect-killing sprays, prepared by two U. S. Department of Agriculture scientists, Dr. F. B. LaForge and M. S. Schechter, is chemically identical with the natural pyrethrum from flower-heads, except that the arrangement of atoms in the molecule has been shifted a little. This slight difference seems to be an advantage, for the synthetic product has a higher killing rate than the natural.

Several variants of the new synthetic have been prepared, and one of them has six or seven times more killing power than the natural pyrethrum. In quick knock-down effect the synthetics are at least as good as the old natural standby.

The higher fly- and mosquito-killing power of the new compounds will make it possible to prepare sprays and aerosols for space-spraying purposes without the addition of DDT. This is especially desirable where spraying has to be carried on under conditions that might result in food contamination. An aerosol spray without DDT would also have the advantage of not causing irritation to the nose and throat membranes of persons constantly exposed to it.

Synthetic pyrethrum preparations, Department entomologists emphasize, will be used primarily in sprays and aerosols where immediate results are desired. They have no residual effect; walls and other surfaces coated with them will not kill insects for months afterwards, as DDT-coated surfaces will. For residual effects, DDT will still be necessary.

Starting materials for the synthesis are pyruvic aldehyde and aceto-acetic ester. Basis of the first of these is propylene glycol, and the second is made from ordinary alcohol and acetic acid. All three of these raw materials are common industrial chemicals, obtainable in tank-car lots.

Pyrethrum synthesis frees this country from dependence on foreign sources of the natural poison. Before the war, most of the pyrethrum used in the United States came from Japan. When this source was cut off, we obtained a partial supply from plantations in Africa. The Japanese growers have not re-developed their old business, and the present price of natural pyrethrum is about six times as high as the pre-war figure.

Patents will be issued on the new synthesizing process, with rights assigned to the Department of Agriculture. Licenses to produce will be granted, royalty-free, to reputable private firms desiring to manufacture the new product. Several manufacturing chemical companies have already expressed interest.

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RADIO

Enlarge Television Field

➤ TELEVISION receivers located between transmitting stations of the same network operating on the same channel will be subject to little if any interference of one station with the other when frequency difference is eliminated by a new method known as television carrier synchronization.

The method was developed at the laboratories of the Radio Corporation of America, Princeton, N. J., in the television section under the direction of Ray D. Kell. Permanent synchronization equipment has been installed in Wilmington, Del., to reduce interference between WNBT, New York, and WNBW,Washington. It has also been installed, he said, at Sandusky, Ohio, to cut down co-channel interference between WNBK, Cleveland, and WWJ-TV, Detroit.

Use of synchronization permits a closer spacing of television stations on the same channel than is possible without this method of reducing interference between stations, he explained. It also enlarges the service area of television stations, thus enabling television to reach out to many more people. This is of particular importance to rural sections, making possible service that otherwise could not be obtained.

The equipment now in use between New York and Washington stations of National Broadcasting Company consists of two units, one at Wilmington and the other in New York. When the system is in operation, signals from New York and Washington stations are compared electronically at the output of two receivers at Wilmington.

Information regarding frequency differences of the two distant transmitters is carried as frequency modulation of a 1,000-cycle tone by telephone line to New York. The frequency shift of this tone is utilized to change the frequency of the New York transmitter. This automatic system keeps the New York transmitter on exactly the same frequency as the Washington station.

The use of synchronization will be extended when equipment is available to other areas which are troubled with the problem of interference where two or more stations are on the same channel. At present in the United States, there are 12 channels assigned to television with a total of 55 television stations using them. Construction permits have been granted for 67 additional stations, and over 300 applications for permits are in the hands of the Federal Communications Commission.

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