

## PHYSICS

# Source of Rare Hydrogen Isotope Made at Princeton

## Entire Year's Work by Chemist Yields Ten Drops Of Fluid Rich in Tritium from 75 Tons of Water

**B**Y "boiling down" seventy-five tons of water over a period of a year, ten drops of the precious liquid, richer in the rare "hydrogen three" isotope than any ever made before, has at last been obtained by the chemistry department of Princeton University.

According to Prof. Hugh S. Taylor, chairman of the department, who described the work before the Electrochemical Society, one part in ten thousand of the half gram is fluid in which the hydrogen is of mass three instead of mass one as in ordinary water.

In the drinking variety of water the rare isotope of hydrogen is present to the extent of only one part in ten thousand million (10,000,000,000).

Such extremely minute concentrations are comparable with those encountered by Madame Marie Curie and her husband in their original experiments on the extraction of the element radium from its ores. Radium ore which will yield one-half gram of radium for five tons of ore is considered remarkably rich. Radium ores producing a half gram of radium for 100 tons of ore are worked commercially.

Explaining the work on tritium, Prof. Taylor said:

"In addition to the hydrogen isotope deuterium of mass 2 discovered by Prof. Harold C. Urey of Columbia University, for which he received the Nobel Prize in 1934, it is now known that a third hydrogen of mass 3 also exists. This still heavier atom of hydrogen has been produced artificially in Cambridge, England, and in Palmer Physical Laboratory of Princeton University by nuclear disintegration processes.

"About a year ago by the use of the mass spectrograph designed by Dr. Walker Bleakney, Princeton physicist, it was shown that the 'heavy water' (deuterium oxide) contained small amounts of the third isotope, tritium, but in a concentration estimated at one part in 200,000 of the 'heavy water' examined.

"During the year the same process of concentration by electrolysis has been continued by Dr. P. W. Selwood of

the Frick Laboratory. There now remains a residual ten drops (one-half cubic centimeter) from the electrolysis of 75 tons of ordinary water. The tritium concentration has steadily increased until it is now approximately one part of tritium for every 10,000 parts of deuterium water. The experiments show that in ordinary water this type of hydrogen is present to the extent of only one part in ten thousand million parts of water.

"Similar experiments to ascertain whether the electrolytic process concentrates the heavy oxygen of mass eighteen over that of normal oxygen of mass sixteen have shown that this method is much less efficient. A concentration of water by electrolysis from 120,000 volumes to one volume increased the heavy oxygen concentration merely from one part in 500 to one part in 450.

"While such changes in the ratio of the two species are sufficient for many scientific experiments, it will be necessary to utilize other methods of separation if it is desired to produce pure specimens of the two forms of oxygen similar to those already obtained with

deuterium, the heavy hydrogen of mass 2."

Commenting upon the effect the knowledge that hydrogen of mass 3 could be produced by the electrolytic process would have upon scientists, Prof. Taylor predicted that it would intensify the interest in this field which was initiated by the discovery of "heavy water."

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## ENGINEERING

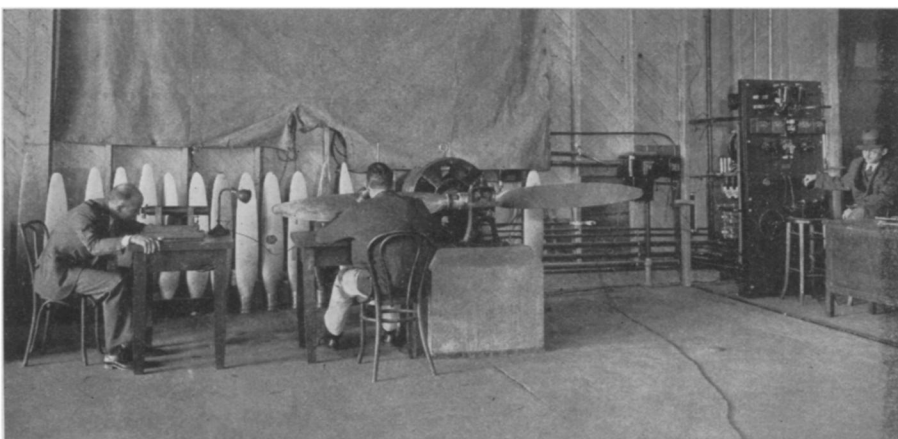
## Study Why Airplane Propellers Break in Air

**N**EW KNOWLEDGE of propeller vibration and the possible reasons why propellers break in midair is reported by Dr. Walter Ramberg, Paul S. Ballif and Mack J. West of the National Bureau of Standards. (*Journal of Research*, Feb.)

Such propeller failures, while rare compared with the number of propellers in service, usually have serious consequences. Often the flying broken parts rip through the wings of a plane, cause a wreck and sometimes loss of life.

Because it was almost hopeless to try to measure the size of propeller vibrations and the forces in blades while they were whirling rapidly, the government scientists produced a comparable effect by working backward.

Instead of the propeller receiving its vibrations during actual flight the experimental test was performed with a



### LEARNING WHY PROPELLERS FAIL

Scientists of the National Bureau of Standards in Washington test airplane propellers to learn what causes the fairly rare, but usually fatal, propeller breaks in midair. Shown above is the testing room where with fixed blades scientists twist propeller shafts to produce vibrations like those experienced during actual flight. Points where greatest stresses were discovered proved to be the places where propellers broke when they were artificially fractured.

fixed propeller made to undergo the vibrations by having its propeller shaft twisted back and forth mechanically. Thus strains and stresses were experienced in the propeller blade similar to those encountered during normal operation. Most important, they could be measured.

It was found that the vibrations were those of resonance wherein tiny forces, timed at just the right period, built up and amplified one another until the total effect was enough to snap the blade.

It is such resonance vibrations which are feared when a column of troops is ordered to break step when marching across a bridge. If all the footbeats happened to be timed near the natural vibration period of the bridge, the lat-

ter might collapse from the built-up stresses created.

For the experimental propellers two vibration periods were found; one at the frequency of 35 times a second and the other 130 times a second. For the lower frequency of vibration it was found that the greatest stresses occurred at the middle of the propeller blade.

Stresses experienced were determined by measurements on a special strain gage invented by Dr. L. B. Tuckerman, also of the Bureau.

In the laboratory the scientists made eight propellers break artificially while vibrating with their fundamental frequency. All the blades broke at the middle where the stresses were within a few per cent. of the maximum measured.

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#### PHYSICS

## British Research Upsets Values for Atomic Weights

### New Atomic Weight for Hydrogen, if Verified, Will Make all Atomic Weight Tables Obsolete

**A** DRASTIC shakeup in science's conception of the weights of the atoms which make up everything in the universe appears imminent from a report to the Royal Society, London, by Prof. M. L. E. Oliphant and A. E. Kempton of Cavendish Laboratories, Cambridge University.

Lord Rutherford, commenting on the discoveries of his Cavendish colleagues, said that as a consequence of their new discoveries in transmutation experiments on the relationship between hydrogen and oxygen in ordinary water, science sees a way to get around what has been a serious conflict in reconciling disintegration experiments with the laws of the conservation of energy.

#### Due to Error

The worrisome trouble in the past, Lord Rutherford said, appears to have been that the widely recognized measurements on the ratio of the weights of oxygen and hydrogen in water erred by a factor of one part in four thousand.

Correcting Prof. F. W. Aston's measurements made on his original "atom scale," the mass spectrograph, by this factor, Prof. Oliphant finds a beautiful reconciliation for the energies of parti-

cles shot out in atom-smashing experiments with the theoretical loss of mass in the process.

The discrepancies in the past have raised the question whether more undiscovered fundamental particles exist. The new Cavendish experiments discount such questions.

The new atomic weight of hydrogen is now 1.0081 instead of 1.0078. If the new finding is substantiated independently, every atomic weight table in the science textbooks of the world will be obsolete, for the weights of the various atoms are all based on the weight of hydrogen. Any changes in the weight of the latter involve all the other 92 elements.

Determining atomic weights by measuring the distance they fly from smashed atoms is now a method more than ten times as accurate as the mass spectrograph, heretofore considered the most accurate of all atom scales, says the report.

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A Swedish anthropologist is studying Indian tribes in the comparatively little known lowlands of eastern Colombia, along tributaries of the Rio Guaviare.

#### PUBLIC HEALTH

## High Maternal Death Rate Not Explained by Reporting

**T**HE large number of deaths of American mothers in childbirth as compared with mothers in other countries cannot be explained away by laying the blame on methods of reporting, it appears from a study conducted by Dr. Elizabeth C. Tandy of the U. S. Children's Bureau.

"The official figure of the United States, which in the last few years has exceeded that of every country except Scotland, remains high no matter what method of assignment is used," Dr. Tandy states in her report.

Differences in methods of assigning causes of deaths are not enough to explain the high maternal mortality rate in the United States, as compared with foreign countries, Dr. Tandy found.

Even if the method of the country assigning the smallest proportion of deaths to the puerperal state were in use in the United States, the United States figure would still exceed that of all 16 countries included in the study, except Australia, Canada, Chile and Scotland.

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#### GEOPHYSICS

## People Inside the Earth Excited America in 1822

**P**EOPLE may be living inside the earth. The United States Government ought to send "in" an expedition to explore and find out.

This fantastic theory, which excited America over a century ago, is now arousing scientific attention, and amusement, again. In the rare collections of the Smithsonian Institution, research workers have found a broadside dated September 14, 1822, urging the public to believe in a hollow earth, the interior of which could be entered from North or South Polar regions. A yellowed, fragile pamphlet eloquently denouncing the theory has also come to light.

The broadside was written by the author of this hollow earth theory, Captain John Cleves Symmes, retired army officer, who bombarded the American public and institutions of learning with his geophysical ideas from 1818 to 1829. Groups of loyal Symmesites all over the country arose. Petitions urged Congress to send an expedition up to the vast hole at the North Pole to sail round the gentle curve and explore