SCIENCE NEWS

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THE LIGHTEST SOLID

THE lightest solid material ever made by man or found on earth has been produced at the Franklin Institute's Bartol Research Foundation laboratories at Swarthmore, Pa. It is a variety of lithium, lightest metal. It is lithium of atomic weight 6, the lightest of the two kinds or isotopes of this element. By comparison iron of atomic weight of over 55 is extremely heavy. This lightest solid is less than twice as heavy—atom for atom—as the gas helium used by the U. S. Government to inflate its airships.

The production of the world's lightest solid was achieved by Dr. L. H. Rumbaugh, who used electromagnetic means in the Swarthmore, Pa., laboratories. Dr. W. F. G. Swann, director of the laboratories, gave the first hint of the achievement in a lecture before the New York Electrical Society on January 5. Only the merest speck of material has yet been obtained, but as the result of four years of research there is hope of ultimately concentrating, in usable amounts, the rare isotopic varieties of the elements.

Heavy hydrogen, or deuterium, the heavyweight isotope of common hydrogen was the first of the chemical isotopes to be concentrated. For its identification and concentration Professor Harold C. Urey, of Columbia University, recently won the Nobel Prize in chemistry. The only other isotope ever concentrated in usable amounts is that of the gas neon, widely used in the red advertising signs, which was produced recently by Dr. Gustav Hertz in Germany. Concentration of solid isotopes is much more difficult than that of gaseous elements.

Dr. Rumbaugh's apparatus ionizes lithium so that the atoms have electrical charges upon them, and then shoots them into a magnetic field which acts as a sorter to spread different weight isotopes out onto a collecting strip. The magnetic field also acts as a lens to concentrate the ion beam into tiny deposits.

The "lightest" solid as a variety of lithium stands next to hydrogen and helium in the chemist's table of atomic weights. The relative weights of hydrogen, helium and lithium as determined by chemical tests are roughly as one is to four is to seven. Actually hydrogen's atomic weight is 1.0078 and the gas is composed of hydrogen of atomic weight 1, deuterium of mass two and a trace of hydrogen of mass three, all mixed in such proportions that the average atomic weight comes out to be 1.0078. Similarly lithium's real atomic weight is 6.940, composed of a mixture of lithium of mass six and lithium of mass seven, with the mass seven variety, of course, greatly predominating.

ELECTRON "MICROSCOPE" FOR THE STUDY OF THE ATOM

STILL another new tool by which science can study the atom and effect transmutation of the elements has been developed at the Ohio State University, according to an announcement from the department of physics and astronomy. This is the first successful production of strong narrow beams of negatively charged hydrogen atoms which can serve as "bullets" for use in atom bombardment research. It is the work of Dr. Willard H. Bennett and Paul Darby, of the physics department.

The hydrogen atom normally consists of one positively charged nucleus called the proton, and one negatively charged electron. It is now well known that these electrons can be knocked off and beams of protons or positively charged hydrogen atoms obtained. Positive ion beams of most elements have been familiar in laboratories for thirty years or more, but never before has any one been able to attach extra electrons to atoms and make them stick in sufficient quantity to obtain beams of negatively charged ions.

Production of the negative ions in quantity is described as having far-reaching effects in research with the new million volt tube at the Ohio State by which transmutation of the elements is effected. Since investigators previously have been unable to obtain negative beams of any element, the physical properties of such ions themselves hold great interest and will be a subject for further study. They are thought to play a decisive rôle in the production of striations in glow discharge, a familiar case of which is the discharge in a neon sign. Heavy hydrogen atoms, found in heavy water, probably behave in a similar fashion, and the properties of negative heavy hydrogen-ions can be studied just as easily.

An "electron microscope" played a prominent part in the discovery of these beams. This "microscope" is a vacuum tube whose parts focus the beams of charged particles on a screen, just as the lenses in an ordinary microscope focus the beams of light on a screen. It was so used that ions of all masses and charges could be focused on one screen and then separated by a transverse magnetic field.

SAFETY AND RAILROAD LOCOMOTIVES

THE thousands of passengers who speed each month between New York and Washington at 90 miles an hour behind great electric engines rightly take their safety for granted. But the story of how railroad engineers solved the safety problem and answered the question, "How fast can a locomotive travel in safety?" has been given exclusively to Science Service by the Pennsylvania Railroad.

High speed trains tearing over an experimental stretch of artificially roughened track; recording devices at each railroad tie measuring side thrust of the wheels, and automatic apparatus in the cabs of locomotives obtaining permanent records of the sway at the wheels, in the cab and at important bearings, are only part of the picture of behind-the-scenes tests to insure safety at high speeds.

When complete electrification of the more than 200 miles of mainline track between New York and Washington was decided upon, it was seen immediately that with

the almost unlimited electric power available, nearly any speed within reason—100, 120 or 150 miles an hour—could be used. But—how much of it could be used in safety as a regular running speed?

Limiting the safe speed was the amount of side sway, or "swing," of the locomotive. But no one knew how much such sway might be or what effect different degrees of roughness in the track might have on the sway.

A special test section of track, 440 feet long, was built in the main line of the roailroad near Claymont, Delaware. The track was laid on steel ties with the rails resting on rollers on top of the ties. At each end of every other tie an ingenious pressure recording instrument was placed. These instruments were very simple. They consisted merely of a hardened steel ball held against a firmly supported steel plate. When a locomotive passed over the track, and there was a side thrust, the steel ball was forced into the softer plate, and by measuring the depth of the indentation, the thrust could be measured. The plate was moved slightly forward after every test. These tests gave very accurate results, but they did not tell which wheels of the locomotive gave the thrust.

While such tests were in progress, unknown to the passengers speeding over the experimental section, the engineers of the road asked themselves, "What wheels are extending the greatest side thrust and how is the thrust distributed among the wheels?"

To answer this question, inherent in any problem of choosing the best type of electric locomotive, other equipment was needed. Therefore a device was worked out to ascertain the changes in side pressure in the hubs of each of the driving wheels and in the truck wheels. This was a device that showed a change in electric current as the pressure in the hub changed. In the engine cab was a device that caused a beam of light from a mirror to swing back and forth as the pressure changed. This beam was directed upon a photographic film which, when developed, gave a record of the changes in pressure at each swing of the locomotive.

From the results of these tests it was decided to build electric locomotives with six drivers on each side. After making corrections in the design of locomotives as the result of these tests, it was found that the side pressure on the rails was no greater at a speed of 90 miles per hour than it formerly was at 70 miles per hour.

A locomotive has been developed therefore that can pull the heaviest passenger train over existing tracks at a speed of from 90 to 100 miles per hour at absolute safety and efficiency. In this way a great railroad fixed the maximum safe speed of its passenger trains, a result arrived at through scientific investigation and a perfect balance of the new and most powerful electric passenger locomotives. The result was the development of the GG–1 type engine, which costs $260,000 each, and develops 4,620 horsepower.

RAIN OF METEORS AS THE CAUSE OF THE CAROLINA BAYS

DR. GERALD R. MACCARTHY, associate professor of geology in the University of North Carolina, speaking before the New York City meeting of the Geological Society of America, stated that a great rain of meteors from the sky is still the only plausible explanation of the great oval shaped depression known as the Carolina bays which dot the coastal plain of the southeastern states.

The bays were much larger than the meteors which produced them, for they were accompanied by terrific air-blasts which increased the size of the hole they made in the ground. Moreover, the air-blasts did not exert their force in the same direction as the meteors and thus the elliptical depressions that make up the bays are not necessarily parallel to the direction in which the meteors were moving when they struck the earth. This variation of the bays' axes from a constant line has been one of the major criticisms of the hypothesis that the depressions were caused by meteoric visitors to the earth.

The meteors, said Dr. MacCarthy, were probably turned almost completely from solid iron to gases because of the great heat produced at their impact with the earth. The observed magnetic attraction of the bays can be attributed to the partial condensation in the holes of iron vapor produced when the meteors crashed.

The alternative suggestion for the formation of the Carolina bays was that they started as fresh water lakes occupying depressions on a beach, said Professor Douglas Johnson, geologist, of Columbia University. The general oval shape of the bays could have been caused by the action of wind blowing on the loose sand from the southeastern direction toward the northwest. It is from the southeast that the winds of maximum velocity are known to come.

SOIL EROSION SURVEY IN SOUTHEASTERN STATES

THE relation between soil erosion and the silting of six reservoirs will be studied in a new survey in the states of Virginia, North Carolina, South Carolina and Georgia, according to an announcement made by the Soil Conservation Service of the U. S. Department of Agriculture.

H. H. Bennett, chief of the service, stated that previous surveys have already determined on the silting of the six reservoirs in question and now new studies seek to determine just how serious the soil erosion problem really is in connection with silting.

"Completion of the surveys," according to Mr. Bennett, "will give to the service authoritative information of the direct relationship of soil erosion to costly reservoir silting. It may be possible to show how the soil washed from a farm several miles from a reservoir directly contributes to the expensive sedimentation of that reservoir. Millions of dollars in investment values are lost each year because of this reservoir silting and the surveys will show the value of soil conservation and erosion control in protecting these investments."

One survey will cover the watershed area lying above the High Rock, N. C., reservoir. This is an area of approximately 4,750 square miles, including all or parts of Surry, Wilkes, Rowan, Iredell, Davidson, Davie, Forsyth, Yadkin, Stokes, Randolph, Catawba, Caldwell, Alexander, Ashe, Alleghany, Watauga, Cabarrus and Guilford counties in North Carolina, and Carroll, Patrick and Grayson

counties in Virginia. Included in this area is a watershed of four square miles lying above Lake Concord, which will be surveyed with a view to correlating the extent of soil erosion with the extent and rate of sedimentation in the lake.

Two other surveys will be started in North Carolina. One, in the watershed area lying above Lake Michie, will cover approximately 170 square miles in parts of Person, Orange and Durham counties. The other, in the watershed area lying above University Lake, will cover approximately 27 square miles in portions of Orange and Chatham counties. In South Carolina, the survey will cover approximately 89 square miles in Greenville and Spartanburg counties, in the watershed area lying above the Spartanburg Municipal Reservoir.

All or parts of 13 counties will be covered by the survey in Georgia. Approximately 1,850 square miles in the watershed area lying about the Lloyd Shoals Reservoir, including all or parts of Gwinnett, Barrow, Fulton, De Kalb, Clayton, Fayette, Henry, Spalding, Butts, Jasper, Newton, Rockdale and Walton counties will be surveyed.

Temporarily, G. A. Crabb, of the Soil Conservation Service, will be in immediate charge of the erosion surveys in the four southeastern states. Headquarters for the work in Virginia and North Carolina has been established at Winston-Salem, N. C. Headquarters for the work in South Carolina and Georgia have been established at Atlanta, Ga.

ITEMS

A CHECK in the thirty-year decrease in the birthrate of the United States and continued good health conditions in general throughout the country were reported to the Congress by Dr. Hugh S. Cumming, surgeon-general of the U. S. Public Health Service. About 94,000 more babies were born in the United States in the calendar year 1934 than in 1933. Later figures are not yet available. The report covers activities of the U. S. Public Health Service only for the past fiscal year, ending June 30, 1935. More babies were born, but there was also a slight increase in deaths of infants under one year of age per 1,000 births. The infant mortality rate for 1934 was slightly higher than for 1933, but lower than for any year earlier than 1932. The deathrate for the general population was also slightly higher in 1934 than 1933, but again was lower than any recorded rate earlier than 1932. For 1934 the deathrate was 10.9 per 1,000 population.

THE rate of flow of a glacier depends in part on the weather, according to a report of the Harvard-Dartmouth Crillon Expedition, which last summer made hourly observations on the great Crillon Glacier in Alaska, day and night for a whole week. It was found that the ice flowed nearly twice as fast in clear, warm weather as on dark, cloudy days. Sometimes the ice came almost to a full stop, while at other times it flowed at a rate of more than two feet a day. The expedition was under the leadership of Bradford Washburn.

TOMBSTONES in the yard of Ivan the Terrible's bodyguards have been unearthed during construction of the subway at Moscow. Soviet archeologists have gathered so much material and historic data from the subway activities that two volumes are announced to appear shortly, describing their finds. Moscow is noted for its fantastic dungeons, secret passages and other subterranean surprises. More archeological discoveries were made in a single year of subway digging than during a hundred years previous. So closely have archeologists worked with engineers that the Academy of History of Material Culture—in charge of the work—stationed its representatives among workers of each shaft of the underground railway.

AMERICAN barbed-wire manufacturers are said to be refusing orders from the belligerent powers in Africa. But something similar from America is at the front. Cactus is figuring in news pictures from the Ethiopian war zone. Machine-gun nests are shown flanked or half-camouflaged by huge plants of flat-jointed prickly pear bristling with spines. All true species of cactus are of American origin. The prickly plants were unknown in the Old World before the voyages of Columbus. But once cacti were introduced from Mexico and South America they became established all around the Mediterranean shores in amazingly quick time, and from there they spread throughout the dry lowlands of northeast Africa and southern Asia, until now they seem normal, native parts of the landscape.

BLAME for lack of knowledge of the extent of tropical diseases in the United States was placed squarely on the practising physicians by Colonel Chas. F. Craig, director of the department of tropical medicine of Tulane University School of Medicine, in his presidential address at the meeting, in St. Louis, of the American Academy of Tropical Medicine. Physicians not only fail to report tropical disease cases and deaths, they do not even diagnose them correctly, Colonel Craig charged. In the case of malaria, for example, many physicians still make their diagnosis from the patient's symptoms instead of examining his blood to determine the presence of the organism that causes malaria. There is no excuse for this because even if the physician is unable to make the blood examination himself, the various State Boards of Health will do it for him if he sends in a sample of the patient's blood.

SOVIET designers are strenuously working to make parachutes handier, safer and easier for transportation. An improved type of parachutes for glider pilots has been made which meets the limited space in the glider, where the bulky standard parachute can not be used. Of great interest also is a new controllable parachute. The diameter of the aperture in the center of the parachute dome has been increased to thirteen feet, and can be closed at the wish of the parachutist with special valves. When the aperture is opened, the parachutist falls at a regular speed of 25 to 30 meters a second. By partly closing the aperture with the valves, he can change the speed of his fall at his will, and by closing all valves he reduces the speed to normal, enabling him to land safely. Lighter and less strong fabric may be used in the manufacture of the new parachute, which will reduce its weight.