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CONTENT OF HYDROGEN IN THE SUN

THE sun's content of hydrogen, its chief source of energy, is sufficient to last for 35,000,000,000 years at the present rate of production, according to a report made by Professor H. A. Bethe, of Cornell University, in the *Physical Review*.

Hydrogen is the only element consumed in any quantity in the chief atomic reaction that serves to light the sun and provide the source of its radiation. At present it makes up approximately 35 per cent. of the sun's weight.

A complicated atomic reaction among carbon, nitrogen and hydrogen, which ends in the production of carbon and helium, is the energy source. Though hydrogen is used up, helium is created and neither carbon nor nitrogen are consumed in any quantity. Energy is produced in the process. Only this reaction, outlined by Professor Bethe, produces an amount of energy that agrees with observations of the solar output. All other possible atomic reactions, he indicated, produce either far too little or far too much energy.

The energy-producing reaction takes place in four steps. First, carbon and hydrogen combine to produce an isotope of nitrogen with atomic weight 13. This is unstable and breaks down to form an isotope of carbon with the same atomic weight, 13, and the release of a positive charge of electricity.

The carbon 13 then combines with another hydrogen nucleus to form nitrogen. The nitrogen adds still a third hydrogen nucleus, producing an isotope of oxygen whose atomic weight is 15. But this is unstable and breaks down into nitrogen of atomic weight 15, releasing another charge of electricity. The nitrogen 15 adds a fourth hydrogen nucleus, breaking up into carbon and a helium nucleus.

THE PLANET VENUS

THE brilliant planet Venus owes its luminous splendor in the night sky to an atmosphere of tiny dust particles which scatter sunlight much more effectively than do the air molecules of the earth's atmosphere. This tentative conclusion was advanced at the New York meeting of the American Astronomical Society by Drs. E. C. Slipher and James B. Edson, of the Lowell Observatory.

Taking more than 500 pictures of Venus over a period of eight days late in November, when the planet was at its nearest approach to the sun, an entire ring of light extending around the planet when it was in its crescent phase like that of the moon at first or last quarter, have been photographed.

"Photometric measurements gave the ratio of brightness of the Venus twilight extensions to the brightness of our adjacent sky. Assuming the effective height of the Venus atmosphere as two miles, the brightness of the twilight extensions in the neighborhood of the theoretical cusps is between 35 to 40 times the brightness of our sky near the sun. Since the brightness of our sky in this region is probably about 4,000 lamberts, the brightness of the Venus atmosphere viewed tangentially appears to average more than 100,000 lamberts."

This extreme brightness appears to be due to fine dust particles scattered through the gaseous atmosphere of Venus. Observations through spectroscopes have never revealed the presence of water vapor in the atmosphere of the planet. Such water vapor particles would be the next most likely source of light scattering which could account for the amazing sky brilliance on the planet.

The actual surface of Venus, Drs. Slipher and Edson noted, is never seen because of the overlying dust-filled atmosphere with its light-scattering properties.

A SYNTHETIC SPEAKER

A SYNTHETIC speaker, whose voice never issued from a human throat, actually talked back recently at the bidding of an operator punching a keyboard in a unique demonstration in Philadelphia of electrical wizardry.

Its voice entirely the creation of electrical currents under the operator's control, "Pedro," as its Bell Telephone Laboratories inventors have dubbed it, thrust questions at its audience and parried their queries in turn in tones put together by a collection of vacuum tubes and the like.

The speaker was exhibited at the Franklin Institute on January 5 and for newspapermen earlier in the day, and the instrument is being made ready for lecturing at the New York and San Francisco fairs. One unit will be sent to each coast.

All its parts, with the exception of ten keys, the arm rest and foot pedal, according to H. W. Dudley, R. R. Riesz and S. S. A. Watkins, are in every-day telephone use.

The Voder, proper technical name of the machine, is in reality much like a radio receiving set in that it converts electrical currents into sound. But it differs in that the pattern of the electric wave is not controlled by other sounds, as in a radio transmitter, but by an operator punching the keyboard.

Its nickname, "Pedro," is a reference to Dom Pedro, emperor of Brazil in 1876. In that year Dom Pedro was shown one of the first telephones, on exhibition at the Centennial Exposition in Philadelphia. Asked to listen while some one spoke into a transmitter a few hundred feet away, he exclaimed, "My God! It talks!"

"Pedro" consists of the keyboard and current-producing units, which rest on a small table, and an amplifier to boost the tiny streams of electrons to currents powerful enough to excite a loudspeaker. The voice is actually slightly flat since, for the sake of clarity, unessential overtones are eliminated. The operators, selected from a corps of more than 300 telephone operators and given special training, are able to carry on ordinary conversation, but have not yet worked out sound combinations required for more complex words and ideas.

The Voder, the first machine in the world to create speech, is the result of fundamental research in telephony carried on in the Bell Laboratories. Mr. Dudley in the

course of one of these researches developed a speech synthesizer which could be controlled electrically by a speech analyzer.

When the Bell System exhibits were projected for the expositions in New York and San Francisco, the synthesizer part of the apparatus seemed to offer possibilities for development into a novel display. Through its use, it was felt, the formation of speech sounds could be shown. Mr. Dudley and Mr. Riesz thereupon constructed a model which was put into form for exhibition by W. A. MacNair, also of the laboratories' staff. Mr. Watkins then undertook to work out its linguistic possibilities and a technique for its operation, as well as a course of training for the operators who would have to make the Voder speak its piece in public.

Twenty-three different sounds are available to the operator who, by pressing the keys, sends an electrical current of a particular pattern through the apparatus. This pattern corresponds very closely to the current pattern that would be created if analogous sounds were actually spoken into a transmitter.

The instrument's repertoire is not confined to the tone of the human voice at all. Bleating of sheep, lowing of cattle, grunting of pigs and even the rat-a-tat of the woodpecker can be produced with perfect realism.

PROPOSED INSTITUTE FOR RESEARCH ON NERVOUS AND MENTAL DISEASE

SURGEON-GENERAL PARRAN, U. S. Public Health Service, wants Congress to appropriate more money for the fight on syphilis and other venereal diseases. In his annual report he recommends an annual appropriation for this purpose of $25,000,000.

Establishment in the Federal Health Service of a neurological institute for laboratory and clinical investigations of mental and nervous diseases is also asked.

His third recommendation is for establishment of a special unit in the National Institute of Health for study of chemical remedies for diseases. Such studies, already made on a small scale, have resulted in development of new sulfanilamide compounds. The increasing usefulness of such remedies in treatment of a wide range of diseases indicates the need for further investigations along this line.

Surveying the work of the U. S. Public Health Service, including the National Institute of Health and the National Cancer Institute, Dr. Parran said:

"A greater advance has been made in public health in the United States during the past two years than ever before within a comparable period."

The health of the country was generally good during the period covered by the report, he found. The general death rate for the calendar year 1937 was 10.9 per 1,000 population as compared with 11.3 for the preceding year. For the first six months of 1938, at which point the report concludes, the death rate was still lower, 10.8 per 1,000 population. Deaths of mothers and infants also showed a decided decrease during this period.

In spite of this favorable health record, Dr. Parran says "it is a matter of grave concern" that about 40,000,000 people in the United States are unable to provide themselves with adequate medical care during serious illness and that in the country as a whole there is a deficiency of 360,000 hospital beds, including facilities for care of mental and tuberculous patients.

Dr. Parran's report shows that the Federal Health Service has carried on its health-protecting activities over a very wide range. Specific fights have been pushed on syphilis, cancer, infantile paralysis, Rocky Mountain spotted fever, typhus fever, Weil's disease, trichinosis, scarlet fever, leprosy, heart disease, mottled enamel of teeth and health hazards in pottery, granite, lead storage batteries, fur and manganese industries.

In addition to these specific disease fights, much assistance and technical supervision has been given to state and local health administrations for their improvement. Stimulated by federal grants-in-aid, the state and local appropriations for public health purposes have increased $8,000,000 annually.

THE HEALTH MENACE OF DUST

DUST as a menace to the health of American workers is by no means limited to silica dust and the disease, silicosis, it appears from the report of Daniel Harrington, chief of the health and safety branch of the U. S. Bureau of Mines. The dust problem is used largely as a racket, Mr. Harrington charged, when it should be an operating and engineering problem.

More than 1,000 lives have been saved every year in coal mines during the twenty-seven years that his bureau has been in existence, Mr. Harrington said. He estimated that about 50,000 non-fatal accidents have been prevented annually.

The health menace of dust includes not only silica dust but also bituminous or anthracite coal dust, or dust of iron ore, limestone, alumina or any other mine dust or all combinations of those dusts.

"The dust problem," Mr. Harrington stated, "at least in and around mines, both as regards health and safety in coal mining and as regards health in non-coal mines, is or should be almost entirely an engineering and operating problem. It now is used largely as a type of racket in which the victims of dust disease get little or no relief, financial or otherwise, yet the mine operators, chiefly through their own sins of omission, are harassed by lawsuits or foolish regulations. Moreover, well-meaning but poorly informed law-making bodies or investigation committees promulgate regulations or laws on dust disease, chiefly with reference to silicosis, an ailment all but impossible of anything like accurate diagnosis, when, as a matter of fact, no definite data are available as to numerous essential factors, among them the kind of dust that will give 'silicosis,' or the size of particle, or the number of particles, or the weight of the particles, or the percentage of silica in any dust to make it harmful, as well as numerous other data essential to a really correct determination of the definite cause of the injury to the health of the victim, even though the injury itself may be readily apparent."

THE RESOURCES OF CHINA

WHAT will happen next, now that China's Wild West is being tamed under the stress of the Sino-Japanese war?

Geographers are curiously watching the speed with which China's western and southwestern provinces, comprising one of the main areas still under the Chinese Government, are being invaded by schools, industries and millions of pioneers. The southwestern tableland of China, close to the Tibetan frontier, has been particularly isolated. About half of the eleven million people of this rugged tableland in Yunnan and Kweichow provinces are Chinese; the rest are people of about 200 different tribes so primitive and independent that the Chinese often refer to them as barbarians.

Even if great waves of immigrants should move back eastward when war emergencies are over, China's West and Southwest will never be the same, is the view of J. E. Spencer, set forth in the *Geographical Review*, of the American Geographical Society. Roads will remain, and some of the new industries and progressive developments are bound to last.

Whether industries developed as wartime projects will be profitable under peacetime conditions, Mr. Spencer can not foresee. But it will have been proved, he declares, that native iron from Szechwan province can be made into fine steel products, that airplanes can be manufactured in Yunnan's capital city Kunming, and that industrial chemicals can be produced in the West.

"As almost none of the Southwest's resources have been mortgaged or otherwise divided by concession among foreign interests," he points out, "they will constitute a valuable basis for native industrial growth."

Yunnan, the far southwest corner of China, he considers fated to be most affected by the swift changes, now that its remoteness and non-Chinese population are no longer barriers to the exploitation of its resources. In event of a prolonged war, it is foreseen that the seat of government may be moved to this extreme inland corner of China, to the capital of Yunnan.

ITEMS

ALL provisions of the national health program, presented at a conference called by the President last July and expected to become the basis of legislation at the present session of Congress, should be administered through the state health departments. This is the opinion of the American Public Health Association, as presented in a recommendation to the Technical Committee on Medical Care in Washington. Expansion of public health and maternal and child health services, of hospital, clinic and other institutional facilities, and provision of medical care for the medically needy, should have priority in initiation over other features of the national health program, the association recommends. Complete integration of all the Federal Government health services under one cabinet officer, preferably a Secretary of Health, is also recommended.

OFFICIALS of the U. S. Public Health Service are watching nation-wide health reports closely for signs of a coming influenza epidemic. So far, however, they see no sign of any and no cause for alarm. The total number of cases reported for the week ending December 24, the latest for which figures are available, was 1,634, excluding Pennsylvania, which has not yet reported for that week. An increase in this disease is expected at this time, it is pointed out. While in some regions of the country the number of cases has increased considerably over the 5-year average, it is not especially large in any region. Stay in bed and keep warm, if you have influenza, and call your family doctor, is the advice given by the Federal Health Service.

THE tug-of-war between order and disorder in nature is strongly exhibited by solutions, Dr. John G. Kirkwood, of Cornell University, told the symposium on intermolecular action of the American Chemical Society meeting in Providence, R. I. The forces between the molecules in a solution, he said, represent the forces of law and order which try to bring regularity out of random chaos. The forces of disorder, producing this chaos of randomness, are the helter-skelter wanderings of molecules due to heat. Two kinds of orderliness can exist in a solution containing two kinds of molecules. If the attractive forces between unlike molecules is greater than the attraction between like molecules, then each molecule builds up around itself a localized grouping of the opposite kind. Where attractive forces between like molecules are larger than between unlike molecules there is the opposite kind of grouping. Like molecules tend to group together and in extreme cases the solution will actually separate into two phases.

BEFORE children "break out" with measles, they may be given injections of convalescent measles serum that will spare them a severe attack and perhaps avoid a fatal or a prolonged illness. The use of convalescent serum in the treatment of measles after the appearance of the eruption has not proved successful in most cases, as stated by Drs. Jerome L. Kohn, Irving F. Klein and Herman Schwarz, of New York City, in the *Journal* of the American Medical Association. They report success in modifying the course of measles in 19 out of 24 children so treated at the Willard Parker Hospital for Contagoius Diseases, New York. A doctor can diagnose a case of measles before the eruption appears by the presence of Koplik's spots. These are small bluish-white spots surrounded by a reddish areola which appear on the mucous membranes of the cheeks and lips during the early stage of measles.

THE U. S. Weather Bureau has re-christened the radiometeorograph, that featherweight little robot weather reporter that rides small balloons up into the stratosphere and wirelesses back the news about how cold it is, how damp it is, etc. The new name is "radiosonde," a word of French origin that has already been officially adopted in Germany. Objection to the name, meteorograph, was mainly to the "graph" part, which implies that the instrument makes a written record, which it does not do. "Sonde" is French for depth (or height) soundings: the rubber bubbles on which the radiosondes ride aloft are known technically as sounding balloons.