

## SCIENCE NEWS

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### FLOW OF ELECTRICAL CURRENTS IN THE ATMOSPHERE

By shooting radio waves up into the higher layers of the atmosphere, and measuring the brief period required for the echo to return, investigators at the Carnegie Institution of Washington are now able to determine the density of the broken atoms that cause these echoes.

There are three layers in the atmosphere, consisting of very rarefied gases which have been "ionized" by ultra-violet rays from the sun knocking outer electrons from the gaseous atoms. The lowest, the E layer, is responsible for most of the bending of radio waves around the earth's curve, which makes possible wireless transmission over long distances. This has a height of about 68 miles. Above are the F-one and F-two layers, with heights of 140 and 218 miles. At night these combine to form one F layer at about 155 miles.

"For the first time by this means," says the announcement, "it is possible to determine what happens to the upper atmosphere with the cyclic variation of spots on the face of the sun, due supposedly to titanic whirlwinds in the solar atmosphere. Between the minimum and the maximum number of sun-spots there is an increase of about 300 per cent. in the density of the electrified particles in the uppermost layer, while there is an increase of about 50 per cent. in the two lower layers.

"Among the problems which it is hoped to solve by the new technique," it is explained by Dr. L. V. Berkner, of the staff of the Carnegie Institution's Department of Terrestrial Magnetism, "is the level of flow of the great electric current-systems in the earth's outer atmosphere. Present indications are that the most suitable conditions for maximum current-flow exist at a level about 70 or 80 kilometers above the earth's surface. Experiments have been suggested but not yet made which should lead to quite precise estimates of electrical conductivity at the several heights."

### RADIO FREQUENCIES

SATURDAY, March 29, will be "moving day" for the country's radio broadcasters.

After 3:00 A.M., on that date, most of your favorite stations will come in at a different dial setting from the one they have had for many years.

If you have a set tuned by push-buttons, they will no longer work properly.

For the radio station engineers, it will mean a good deal of work, and a complete change of at least one small but important part.

The result of all this, however, will be greatly improved reception throughout the nation, especially in rural areas.

Through the Federal Communications Commission, the U. S. Government carefully polices the ether. From several monitoring stations in different parts of the nation, they watch all the broadcasters, to make sure that they stay in the band to which they are assigned.

On this account, the stations have taken careful pains

to stay where they should be. But beginning on the twenty-ninth, almost all will have to make a change. Only those with present frequencies below 740 kilocycles will be unaffected. In most instances, the shifts will be slight, generally a little higher. In a few, however, the jump will be half way around the dial. A station at 1090 kilocycles, as an example, will go to 1310. On the other hand, one at 760 changes only to 770.

A small crystal of quartz, about as big as a lump of sugar, provides the control of frequency at the transmitter. Such a crystal, carefully selected, precisely cut to size, can be made to vibrate so that it yields exact electrical vibrations of any desired frequency. Such a circuit is used to run some of the most accurate clocks.

But the frequency determines the dimensions of the crystal, and that means that each of the 700 stations which will change must get a new one. It might be imagined that some swaps could be effected. A station now on 1190 kilocycles, that has to move to 1210, might send its crystal to one at 1160, which is changing to 1190. This, unfortunately, is not practicable. The stations are in widely scattered parts of the country. On Friday evening, March 28, they will still be at the old position, with the old crystal still in use. But that evening, you may be sure, they will all have the new equipment ready to change over by the throw of a switch.

The reason for all this trouble is to improve reception, and as a gesture of good will to our southern neighbors, in Central and South America. Present broadcasting assignments were made in 1928. Then there were no big stations south of the border, so small ones in Latin America could operate freely on the same channels as U. S. stations. Now they have big ones. The most powerful station in the western hemisphere is in Mexico City. Its power is 350 kilowatts, seven times the 50 kilowatts maximum allowed in the United States by the F. C. C.

Some of these stations continued to operate on the same frequency as the U. S. stations, but their higher power interfered with them, except within fifty miles or less of the transmitter. Others tried to slide in between two American stations, but this was even worse. Already as close as practicable for them to be, with channel separations of 10 kilocycles, this meant that two U. S. broadcasters were affected.

To remedy this, an international conference was held in Havana in 1937 and new assignments were harmoniously worked out. Now Canada will have six exclusive channels, Mexico six, Cuba one, and the United States more than 40. In addition, certain channels are shared, where distances between stations are enough to prevent interference.

Changing push-button sets to operate on the new frequencies is not a difficult task. The directions that come with such sets tell in detail how to do it, and generally the only tool required is a screwdriver. Mostly, such changes will have to be made after the frequency shift takes place, otherwise you could not set the buttons ac-

curately. And while you are waiting to make the change, you can tune with the dial.—JAMES STOKLEY.

### MOLECULES MEASURE TINY SURFACES

If you wanted to measure the surface area of a floor and you lacked both tape and yardstick, you could still do the job if you had a large enough bag of marbles. And if the surface happened to be uneven and full of waves as in the case of, say, a mud hut, you could probably to a better job with the marbles than with the yardstick.

By simply pouring your marbles out until they covered the whole floor in a layer one marble thick, and then counting the marbles in the layer, you could calculate from their number and from their known diameter the extent of the space they covered.

This is the way Dr. Thomas W. DeWitt, assistant professor of chemistry at Virginia Polytechnic Institute, explains a method known as low-temperature adsorption which he and Dr. P. H. Emmett, head of the department of chemical engineering at the Johns Hopkins University, applied successfully in measuring the surface areas of numerous very finely divided or porous materials used in industry. The "marbles" he uses are molecules of gas.

Some of their results are reported in the Analytical Edition of *Industrial and Engineering Chemistry*. The method was developed by Dr. Emmett and Dr. Stephen Brunauer, but its application to these industrial materials is new, and many an industry processing such materials may derive practical benefit from it.

Commercial clays, pigments and carbon blacks are a few of the substances for which a knowledge of surface areas of the particles is important. There are other ways to measure them, but none provides so direct and simple an approach to the problem as that employed by the authors of the present article in their work at the Johns Hopkins.

### THE PHYSICAL FITNESS OF CHILDREN

THE physical fitness of boys and girls between two and twenty years of age can now be reliably and quickly appraised by a new method using height and weight figures. The method, which fills a need felt for over a century by physicians, school and child health authorities and military authorities, was developed by Dr. Norman C. Wetzel, of the School of Medicine of Western Reserve University. Details are presented to physicians in the *Journal* of the American Medical Association.

Efforts to improve the health of American youth, quickened by the spur of national defense preparations, can go forward with increased speed by the use of this method. With more than 40,000,000 boys and girls under twenty years of age in this country, health improvement programs are delayed at the very start by the vast number of examinations that must be made to find all the boys and girls needing better diet or medical care. Dr. Wetzel's grid method for using height and weight measurements alone enables the medical examiner to tell at a glance, the editor of the journal points out, whether a child "is safely situated in a channel where its nutrition

can not be seriously questioned or whether it belongs to the abnormal groups."

Tests on several thousand Cleveland school children show the method to be 94 per cent. reliable in picking out the children whom experienced examiners call "poorly nourished" or "borderline."

The method shows any tendencies toward abnormal growth or development at an early stage, when the abnormalities can be most readily corrected. It has the advantage, also, of giving information in an objective way, making it most suitable for large surveys of the physical status of millions of children. Such surveys have heretofore been unsatisfactory because medical examiners have used different indices of physical fitness and there has been no agreement on which was most reliable.

### SULFADIAZINE

HOPE that sulfadiazine, one of the newest of the sulfa drugs, may prove the means of preventing as well as curing meningitis appears in a war-censor-delayed report made public in Boston on March 22.

Significant advances toward the control of diphtheria and scarlet fever, as well as meningitis, were made in Halifax, N. S., this winter during epidemics which threatened to slow the steady flow of supplies to Great Britain. The investigation was made by eleven American men and women comprising the Harvard Medical School expedition. Under the leadership of Dr. J. Howard Mueller, this expedition spent four weeks in the disease-ridden city studying these infections and helping local authorities to bring them under control.

The story of the expedition can be told now because the menacing epidemics have been checked; because measures have been taken which make their recurrence unlikely, and because the advances made will be used to strengthen America's defense against disease.

Meningitis was never as rampant in Halifax as was diphtheria, but it was a constant smouldering threat. The new sulfa drug was used by Dr. John H. Dingle, of the Harvard expedition, to control the situation. It appeared "to have certain advantages" over other sulfa drugs used against meningitis and was felt to be especially valuable in solving the important problem of carriers of the disease.

This is because sulfadiazine not only helps the patient to get well but apparently swiftly banishes the meningitis germs from his nose and throat, where they may lurk long after he is well, constituting a hazard to other persons. "The suggestion is obvious," Dr. Mueller reported, "that healthy carriers may be similarly cleared up."

This theory could not be verified experimentally in Halifax, but it has since been confirmed by an Ottawa physician who studied troops in that area. It is an entirely new idea and one completely contrary to the experience of the last war. It is believed that it may be the beginning of the end of the carrier problem in meningitis.

A new and better technic for diagnosing meningitis which has certain advantages making it "particularly suitable for military use under field conditions" was developed through a new culture medium for growing meningitis germs prepared by Dr. Mueller.

A better method for dealing with the problem of protecting adults against diphtheria and more knowledge about scarlet fever, including the discovery of a new strain of scarlet fever germs, are other advances made by the expedition.

The official report is being forwarded to the Surgeon-General of the U. S. Public Health Service so that this nation may profit from the Halifax experience.

### SOYBEANS

SOYBEANS, the newest major addition to American farm crops, have been enlisted for the war on weeds by Professor A. L. Bakke, of Iowa State College. The enemy under attack is the European bindweed, alias Creeping Jenny, one of the worst pests with which Midwestern and Western farmers have to contend. It is a species of wild morning-glory that forms dense tangles on the ground and strangles almost any crop that the farmer tries to grow. Bindweed in the field constitutes valid reason for refusal of a loan in many communities.

The first step in Professor Bakke's method of attack is ordinary fall plowing. Then, in early spring, the soil is worked with a duckfoot cultivator, and in June comes a second plowing, burying the bindweed shoots under six or eight inches of soil. After this, the field is leveled off and the soybeans drilled in, thick and solid. Before the buried bindweed shoots can work their way to the surface the beans are up and growing, and they keep the lead all season, never letting the sun get down to the struggling weeds.

Bindweed roots tremendously deep—sometimes 15 or 20 feet into the soil, with great reserve stocks of food in thick tubers. So the treatment has to be kept up until the weed's reserves are all gone—usually a matter of five years. However, the soybeans pay their own way and something over, so that the farmer does not lose money while he is conducting the operations.

An entirely different line of attack on bindweed and other field pests is being conducted, thus far only on an experimental basis, by E. M. Dieffenback, agricultural engineer at the Utah State Agricultural College at Logan. Mr. Dieffenback is trying to develop a means for electrocuting bindweed in the field by discharging electricity into the plant's long rootstocks.

In experiments to date, all rootstocks that took as much as ten milliamperes, at from 150 to 700 volts, were killed. If the method can be put on a practical, large-scale basis, it will probably open a great market for low-priced electric current in areas now being opened up to rural electrification.

One Kansas inventor has recently obtained a patent on a special farm implement designed for fighting bindweed. It is built very much like an ordinary hayrake, but instead of teeth it has several horizontal blades, set at angles to the line of movement, and so arranged as to slice through the ground a little below the surface. While this implement will doubtless give a clean shave to a field heavily bearded with bindweed vines, it will not exterminate them, for their rootstocks go too deep for such superficial treatment. Still, it clears the surface, and

should permit quick-growing crops, like soybeans, to get a good start.—FRANK THONE.

### ITEMS

CONTINUOUS records of weather run back for a hundred years at only a few stations in the United States, but a study made by the U. S. Weather Bureau of four such records from widely separated stations (Minneapolis-St. Paul, St. Louis, Boston and Washington) indicates quite strongly that since 1830 there has been a tendency for the climate to warm up. During the first third of the century of 1840 to 1939 temperatures at all four stations were prevailingly low. During the second third they showed frequent alternations between below and above normal, and in the past two decades there has been persistent abnormal warmth.

HYBRID corn is now being planted on approximately 25 million acres in the 12 Corn Belt states, according to Dr. R. W. Jugenheimer, of the U. S. Department of Agriculture. This is more than half the corn acreage in those states. In Iowa, where hybrid corn got its first start through the scientific experiments and promotion efforts of Henry Wallace while he was still editor of *Wallace's Farmer*, some 7½ million acres, constituting 88 per cent. of the state's corn acreage, was planted to hybrid corn in 1940.

GLYCERINE, a chemical important in wartime for the manufacture of explosives, and highly useful in peace as well, can be made from readily available raw materials, such as petroleum refinery gases, by a new process invented by Dr. Richard S. Shutt, of the Battelle Memorial Institute at Columbus. Previously, the 150,000,000 pounds of glycerine which America uses annually for making plastics and other products has come from purified vegetable and animal fats. Using a rare chemical compound as a catalyst to speed the reaction without itself being changed, the Shutt process is said to have many advantages. It produces no undesirable by-products, and high temperature chlorination, common to other methods, is eliminated.

SERIOUS complications and illness may follow operations if talcum powder from the surgeon's gloves gets into the surgical wound. A warning of this danger is given by Dr. Edward J. McCormick and Dr. Thomas L. Ramsey, of Toledo, Ohio, in a report in the forthcoming issue of the *Journal of the American Medical Association*. They report two cases of postoperative complications in which second operations were required, one of them resulting in the loss of the child-bearing organs in a 21-year-old woman. In both cases crystals of magnesium silicate, or talc, were found in the inflamed tissues removed at the second operations. It is probable, the Toledo surgeons believe, that many other cases of postoperative complications caused by talcum or by lycopodium powder have gone undiagnosed in the past. Careful washing of the gloved hands of the surgeon and his assistants, to remove the powder used on the gloves, and care to keep the air of the operating room free of the powder are urged to prevent such complications.