# SCIENCE NEWS

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## THE CORONIUM

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ASTRONOMERS are excited by news from Sweden that one of their colleagues, Dr. Bengt Edlen, has found a satisfactory solution for the problem of "coronium"—which they once thought was an unknown element causing a strange green line in the spectrum of the sun's outer shell, its corona.

Dr. Edlen ascribes this and other mysterious lines to broken atoms, with many more electrons removed from their shells than had been supposed. His researches indicate that there is some yet unidentified but powerful excitation from the sun that breaks these atoms. They also indicate that the sun is sending to the earth very short ultra-violet rays, which possibly play a part in producing the ionized layers of our atmosphere and make long distance radio possible.

Dr. Polydore Swings, Belgian astronomer now on the staff of the Yerkes Observatory, in describing the research, states that it is "most certainly the most brilliant attack ever made upon the problem of the line spectrum of the solar corona." Dr. Swings was associated with Dr. Edlen in previous researches and spent some time discussing this with him in the summer of 1939.

The line spectrum of the corona has been observed for about seventy years at the times of total solar eclipses, and, in recent years, with an instrument called the coronagraph. This spectrum, produced by passing the coronal light through a prism, or reflecting it from a grating ruled with thousands of lines to the inch, shows more than twenty lines, some quite conspicuous. Most prominent is a green line. There are also two red ones, two in the infra-red and one in the ultra-violet. The last three are not visible, but can be photographed. Many previous suggestions have been made to explain them, but these have been unsuccessful.

Dr. Edlen proposes that they are so-called "forbidden" lines, that is, lines due to atomic changes which can not take place under ordinary circumstances. However, such changes do occur in the great gaseous nebulae in the sky. As a result of laboratory tests, he concludes that the atoms in the corona are much more highly ionized than has previously been considered. That is, more of the electrons which revolve around in them, like the planets in the solar system, have been removed. The green line, he suggests, is caused by iron atoms thirteen times ionized. By some as yet unexplained excitation, thirteen of the electrons are removed from the iron atom. The next three strongest lines, the two in the infra-red and the one in the ultra-violet, he ascribes to iron atoms from which twelve electrons have been removed. Weaker lines are caused by nine and ten times ionized iron, while eleven and twelve times ionized calcium and eleven, twelve, fourteen and fifteen times ionized nickel accounts for others.

"The general result," said Dr. Swings, "points to a maximum abundance for ions with ionization energy of about 400 volts and the source of such a tremendous excitation is very puzzling. Edlen concludes that 97 per cent. of the coronal line emission is now explained and that the coronal matter has a chemical composition similar to the average composition of the meteorites; this suggests a possible origin for the coronal matter."

## A NEW ELECTRICAL MUSICAL INSTRUMENT

USING vacuum tubes and electrical circuits like those of television transmitters, a newly patented musical device will play tones of any instrument desired. Invented by Ralph W. Bumstead, Westfield, N. J., the patent, 2,241,027, has been assigned to the Radio Corporation of America.

Even though two different instruments, a piano and violin, for example, may play the same note, they sound different because of the harmonics. From a tuning fork a pure A, for instance, may be obtained. But when this note comes from any of the instruments generally used, there is not only the fundamental A, consisting of vibrations at the rate of 440 per second. Mixed with it are vibrations of multiples of this figure, the harmonics. The first, 880 per second, is an octave higher than the fundamental, and so on.

One common type of electric organ uses a series of wheels, with scalloped edges, which rotate in a magnetic field, and set up fundamental tones. There is a wheel for each note. By combining them in different ways, the combination is produced, which has the effect of some other instrument. But this is limited, because, as Mr. Bumstead points out, the tones of an organ pipe or a single instrument may include as many as thirty harmonics, and cumbersome apparatus would be needed to provide each one of these.

In his invention, only one element is used, to give the fundamental, and this smooth wave has impressed upon it irregularities corresponding to the final result that it would have if all the harmonics had been added. This is done by means of an iconoscope tube, the "film" of the television camera, on which the picture is formed.

The scalloped wheel, or a tuning fork, makes the fundamental, and controls the beam of electrons which sweeps across the iconoscope's sensitive screen. On this is projected, from a miniature magic lantern, the silhouette of a mask cut to correspond with the desired sound wave. Since the response of the screen is different in the light and dark portions, the electrical current that comes out is amplified, and passes to the loud speaker where it is converted into sound, has the wave form of that from the instrument for which the mask was made. One form of the invention illustrated in the patent, shows a series of masks on a film, which may be rolled into place. Thus, by changing the mask, the pressure of the key may be made to give a note of organ, oboe, clarinet, violin, flute or perhaps some combination which might not correspond to any existing instrument, yet be of exquisite beauty.—JAMES STOKLEY.

## RADIO WAVES

PROFESSOR BOBERT C. COLWELL, H. Atwood, Jr., J. E. Bailey and C. O. Marsh, of West Virginia University, have found that radio waves have "practically the velocity of light," in experiments which were reported to the recent meeting in Washington of the American Physical Society. The speed of light is about 186,000 miles per second.

They set up a transmitter on the campus at Morgantown, which broadcast ten pulses a second, each lasting for a hundred thousandth of a second. This was received by a portable unit which automatically sent a return pulse, in its turn received at the first transmitter. There, both the original and the return signal were shown by a luminous line on a tube like that used in television receivers. This indicated the total time taken for the round trip. Part of it was due to actual transmission between the stations, the rest was the delay in operation of the parts of the radio equipment.

First, readings were taken with the portable station near the fixed one. Then it was moved farther away and more measurements made. Since the instrumental delay was the same in both sets, the difference between the measurements "is the time taken for the radio pulse to travel twice the distance between the two positions of the portable station."

The measured velocity in the line of sight, they stated, came out practically the same as that of light.

## MACHINE PARTS MADE FROM POWDERED METAL MASSES UNDER PRESSURE

ALTHOUGH science has not yet found out exactly what happens in the process, the making of metal parts for machinery used in defense and other industries from powdered metal under heat and pressure promises a new industrial revolution. The Axis powers have already made wide use of these methods to speed their production, but they are now coming into extensive use in this country, according to Dr. Harvey N. Davis, President of Stevens Institute of Technology, which is inaugurating a special laboratory for powder metallurgy.

As an example, Dr. Davis cited the oil pump gear of a 1940 automobile. "Previous to the production of this gear from powders it was customary to produce it from a cast iron gear blank by generating the teeth in a highly specialized gear shaper. It was startling to find that a gear possessing comparable physical properties could be accurately produced in large quantities by simply filling a mold with an iron or mild steel powder which would pass through a one hundred mesh screen, subjecting the powder to a moderately high pressure of approximately 15 tons per square inch and applying a consolidating and welding heat treatment to the pressed powder compacts. The molded gear proved in service to be lighter, more nearly noiseless, and in every way more satisfactory than the machined cast iron product, and it was produced at a fraction of the cost of its predecessor. Many other articles have been similarly produced from ferrous and non-ferrous powders and it is becoming generally accepted that in a great many applications, the molding of metal powders will eventually replace other production methods."

Development of these methods may lead to amazing results, according to Dr. Davis, who continued: "Imagine, for example, an exhaust valve for an airplane engine, fashioned and completely finished to exact size in one operation, the rim of which is composed of a special alloy peculiarly well fitted to hold an accurate seating surface, while the cap merges over into another alloy specially fitted to resist high temperatures, and the stem is made of still a third alloy specially fitted to withstand wear as it moves back and forth through its guides. Of course, many new problems, such as differential thermal expansion, to say nothing of the as yet unsolved problems of the diffusion alloying of the steels themselves, would have to be worked out, before such a valve could be made. But here, as everywhere in the field of powder metallurgy, the slogan of its devotees is never 'impossible' but always merely 'not yet.'"

Cutting tools used in lathes, millers and similar machines used for making other machines, are made in this way, for instance, the cemented carbides "which have proved to hold such an important position in our present defense program as superlatively high-speed cutting and metal working materials." The Axis powers, he said, are believed to have gained much of their large-scale production by the use of similar cemented carbide cutting tools applied to ordnance and munitions.

No one yet knows exactly how minute particles of metal are made to adhere so tightly on one another at temperatures far below their melting points. Another mystery is why some mixtures shrink considerably, while others, almost the same, shrink hardly at all. To understand more fully the finer points of these phenomena and to apply them intelligently in industry, it was decided to establish the powder metallurgy laboratory at Stevens Institute. Here technical personnel will be trained, researches will be made with the cooperation of several large manufacturing corporations which have established fellowships, and the unknown fundamentals will be investigated.

## EARWORMS AND SWEET CORN

IF you want to keep earworms out of the patch of sweet-corn that you have just now hopefully planted, carry on chemical warfare against them with mineral oil, is advice given by the U. S. Department of Agriculture. The time for attack is when the ears are shaping up and the silk, having performed its function in pollination, is beginning to wilt.

Plain mineral oil squirted into the silk at the ear-tip will get rid of earworms if they are still very small. If they have had time to get their growth started, the oil should be fortified with dichloroethyl ether, a chemical readily obtainable on the open market. A quarter of a teaspoonful to an ear is sufficient. It can be applied with an ordinary oilcan, for small gardens; force appliers with larger reservoirs are available for commercial growers. Since earworms travel quite readily every ear in the planting should be protected. This can be done easily in

some of the newer hybrid varieties which mature their silks all at the same time; older sweetcorn varieties may require several trips through the patch to insure complete protection.

The oil-dichloroethyl-ether mixture, at a preferred strength of two per cent., works best in warm weather, when the temperature is above 60 degrees Fahrenheit. In cooler weather, a two tenths per cent. mixture of pyrethrin in oil is recommended.

## EARLY MAN IN AMERICA

ROUGH stone knives and other tools used in the beach life of early Canadians, apparently more than 10,000 years old, have come to light near Lake Huron in the region of Manitoulin Island, Ontario.

Excavation of a workshop where ancient people turned out quartzite knives as big as daggers, some of them ten inches long, and rough cleavers up to seven inches long, was reported by Dr. Emerson F. Greenman, of the University of Michigan, to the Society for American Archeology, which met in Minneapolis in conjunction with the central states branch of the American Anthropological Association.

Dr. Greenman reported that the beach is estimated to be 10,000 to 15,000 years old. The site is now four miles from the shore and 297 feet above the present level of Lake Huron.

Some of the knives and a graving tool used by the ancient Canadians are similar to the equipment used by the famous Folsom Men of ancient America, whose big-game hunting life some 10,000 to 20,000 years ago is becoming known through discoveries in various parts of the United States. Similar knives, described as semi-lunar in shape, large and coarsely flaked in technique, have been found in at least three other places in Canada —in northern Labrador, in Quebec province and Alberta. All these sites were near the water, and all, according to Dr. Greenman, were found "under conditions suggesting a high antiquity."

Discovery of mastodon bones in the kitchen refuse pits of a large prehistoric house near the Mississippi River south of St. Louis was reported by Robert McCormick Adams, of the Academy of Science of St. Louis.

It is not clear from the discovery, Mr. Adams pointed out, whether man and mastodon were contemporaries in the St. Louis region, and whether man hunted and possibly cooked and ate mastodon meat there, or whether American natives who lived long after ancient elephants vanished from America found mastodon bones as curios.

Excavations for an office building in Boston in 1939 brought to light remains of a fishweir, which has since attracted fourteen investigators to the scene to study Boston's prehistoric fishing conditions. Reporting that the weir is probably 5,000 years old, and upsets scientific views on antiquity of prehistoric man in the area, Frederick Johnson, of Phillips Academy, Andover, said that the weir was used over a long period of time and repaired frequently. A joint volume will be issued on what has been learned from this buried scene about the oyster bed, the molluscs, the barnacles, pollen that shows what the plant life was like, the geologic conditions, and the description of the weir which called for driving 65,000 stakes and forcing layers of brush between them to form a barricade.

## ITEMS

FIGURES compiled by the National Wildlife Federation indicate that forest fires during the month of April swept over more than 1,300,000 acres of timber land, principally in the South and East. Translated into terms of lumber, the destruction comes close to 300 million board feet, or enough to build barracks for nearly 200,000 soldiers.

THE weather map of the United States is turned topsy-turvy, as spring advances with drought in the East and too much rain where black storms once roared out of the Dust Bowl in the Southwest. Recent showers have not materially relieved the situation in the East, although winter wheat and other crops already growing are not yet in danger. Farmers in the upper Ohio Valley have hesitated to plant corn in the dust, while in the Southwest they could not plant it in the mud. Corn and cotton already germinated in Texas, the U. S. Weather Bureau reports, are pindling and anemic-looking because of too much cloudy, wet, cool weather.

TWO elements made by the cyclotron to give off rays like radium have for the first time been obtained in pure form, according to J. D. Kurbatov, M. L. Pool and H. W. Law, of the Ohio State University, who made a report to the American Physical Society. These are radioactive strontium and barium. While the former was secured by bombarding strontium oxide with deuterons, or nuclei of heavy hydrogen atoms, obtained from the cyclotron, the barium was made by transmutation from another element, lanthanum.

THE mineral molybdenite, made of molybdenum and sulfur, is a good lubricant, M. E. Bell and J. H. Findlay, of the Westinghouse Electric and Manufacturing Company, reported to the American Physical Society. They used it in x-ray tubes in which the anode is spun in order to expose different areas to the exciting rays and so avoid overheating. Oils and greases could not be employed because they evaporate and ruin the vacuum. However, the crystal structure of molybdenite was found to be suitable. It consists of laminations of sulfur atoms and molybdenum atoms, which slide over each other. Its use, they declared, "is not necessarily limited to a vacuum."

WITH a "test-tube" sixty feet high, atoms of oxygen gas of different weights have been sorted out, was reported by Dr. S. B. Welles, of Yale University, to the American Physical Society at its meeting on May 1. Ordinary oxygen in the air is made up to the extent of 99.76 per cent. of atoms of weight 16, 0.2 per cent. of weight 18 and 0.04 per cent. of weight 17. As enriched in the sixty-foot tube by Dr. Welles, the proportions of the two rare forms were increased to 14 per cent. for oxygen 18, and nearly 1 per cent. for the 17 variety. The method used was that of thermal diffusion. Down the center of the tube is a hot wire, and when oxygen is admitted, the heavier atoms go to the bottom and the lighter ones to the top.