SCIENCE NEWS

Science Service, Washington, D. C.

AN ULTRA-FAST OSCILLOGRAPH

A BEAM of electrons sweeping back and forth across a photographic film at speeds up to 18,000 miles per second, a tenth that of light, times a lightning flash to a few billionths of a second, measures the current and voltages, and draws a picture of the oscillations. This is the ultra-fast oscillograph described by E. J. Wade, T. J. Carpenter and D. D. MacCarthy, all of the General Electric Company, Pittsfield, Mass., in a paper presented at the Chicago meeting of the American Institute of Electrical Engineers.

The instrument was developed for research on lightning arresters to determine the duration, intensity and character of the electric surges that occur when the arrester is struck by lightning. Artificial lightning was used. One film showed a flash which died away in about a ten-millionth of a second. During that time, however, 11.3 oscillations occurred. Thus the electron beam swept back and forth this number of times across the film or at the rate of 113 million times a second, and attained a maximum "writing speed" of 18,000 miles a second.

The instrument, a veritable time-microscope, can of course be used in any other cases where "transients" or electrical actions of exceedingly short duration are involved. The ordinary oscillograph is used in television, in determining the wave forms of alternating currents and in many electronic devices. It has even been used in geophysical prospecting for oil.

THE ELECTRIC INDUCTION MOTOR AT WRIGHT FIELD

A 40,000-horsepower electric induction motor drives air through the great wind tunnel at Wright Field. It is part of a large group of powerful machines required for the proper operation of the tunnel. Among these are a 38,000-horsepower motor-generator set, another of around 8,000 horsepower, a 400-horsepower exciter set, 6,900-volt and 460-volt switch gear, great cooling fans, oil circulation pumps, electronic control apparatus and other instruments.

The fine speed regulation of the great motor, the harmonious coordination and control of all the rest of the machinery and safety of operation were discussed by Robert R. Longwell and M. E. Reagan, of the Westinghouse Electric and Manufacturing Company of East Pittsburgh, Pa., at the Chicago meeting of the American Institute of Electrical Engineers. The operation and control are as far as possible automatic. A few manual operations are required to start the auxiliary machinery. When this is smoothly running, the operator merely sets a pointer on a dial to the desired speed. Automatically the oil pumps are started, switches are thrown, control apparatus brought into play, and the great motor is brought gradually and smoothly up to the desired speed and then held there by electronic control. To change the speed, the operator simply moves the pointer up or down. To stop the motor, he moves the pointer back to zero. During an airplane test, the speed is maintained constant to within 0.3 per cent. to 0.5 per cent.

One reason for describing this installation was that the same principles can be applied wherever large powers must be very accurately controlled, or many machines must be coordinated to do their proper tasks at the proper times.

1,000,000-VOLT X-RAY UNITS

THAT more than 40 of the compact 1,000,000-volt x-ray units recently developed are now in operation in industrial plants, or soon will be, as against only one a year ago, was reported to the Atlantic City meeting of the American Society for Testing Materials by Dr. Ernest E. Charlton, head of the x-ray division of the General Electric Research Laboratory. His associate, W. F. Westendorp, collaborated in the preparation of the paper.

These units, each a complete outfit including the transformer and completely shielded, are three feet in diameter, four feet high and weigh 1,500 pounds. They are portable in the sense that they can be lifted about by a crane and transported to any part of a plant where their services are needed. Previous 1,000,000-volt units were big as a house and necessarily fixed in position. In a hospital this was no insurmountable obstacle. The patients could easily be brought to the machine. But in an industrial plant, where the "patients" are masses of steel weighing many tons, this is impossible. The machine must be brought to the patient.

Two things were principally responsible for making the light-weight unit possible. First, the resonance transformer developed by Mr. Westendorp, which dispensed with the heavy iron core usually employed. Second, the substitution of 40 pounds of Freon gas for 5 tons of oil as insulating material. But a portable outfit for industrial use would still have been impossible without the device of putting the transformer inside the unit, thus avoiding any external high tension wires. This is the resonance transformer which jacks the voltage up to a million and immediately lets it down through the tube—which is in the center of the coil where the iron core would ordinarily be—in 12 easy stages of about 85,000 volts each.

Million-volt x-rays can penetrate 8 inches of steel and in a few minutes make a picture which otherwise would require hours or even be impossible. These new portable and safe units will not only speed up war production, but will make the material turned out safe for use of our armed forces. Some of them have been in use for nearly a year and have shown no sign of deterioration.

EXTENSION OF THE SPECTRUM

A NEW "window" in the atmosphere has been discovered by Dr. Arthur Adel, of Lowell Observatory, at Flagstaff, Ariz. To the American Astronomical Society, he has reported the extension of the observable spectrum in the infrared region from wave-lengths 14 $m\mu$ (one mμ is a millimicron or a millionth of a millimeter) to 24 mμ, or nearly a whole octave.

Until recently, the long wave-length limit for which we could observe the spectrum of the sun was 14 mμ. In July, 1941, Dr. Adel discovered a new spectral region of atmospheric transparency which allowed the obtaining of the sun's spectrum down to 24 mμ. This discovery concluded a search he had begun in 1935.

Because of its high density, the atmosphere effectively absorbs great quantities of the light and energy we receive from the sun and the stars. In some cases it does this selectively, that is, for just certain wave-lengths of the incoming light. The absorption is accomplished by nitrogen, oxygen, water vapor and carbon dioxide. The bands of water vapor and carbon dioxide are particularly strong in the infrared region of the spectrum; however, Dr. Adel has pierced this "fog" in at least this one region.

In addition to revealing hitherto unknown portions of the solar and terrestrial spectra, the discovery is important in connection with the problem of the radiation of the earth into space and the reception of long-wave radiation from the cooler planets, Jupiter, Saturn, Uranus and Neptune.

The potassium bromide prism used by Dr. Adel in his investigation was furnished by Dr. C. G. Abbot, secretary of the Smithsonian Institution, of Washington, D. C.

THE ELECTRON MICROSCOPE USED AS A DIFFRACTION CAMERA

J. HILLIER, R. F. Baker and Dr. V. K. Zworykin, of the Research Laboratories of the RCA Manufacturing Company, Camden, N. J., reported to the American Physical Society meeting at Pennsylvania State College that the electron microscope can now not only make an enormously magnified picture of a minute object, but also determine its molecular structure. You can not see the atoms but you can find out where they are. This of course could be done before by means of another instrument, the diffraction camera, using either x-rays or electrons. But now an "adapter," applied to the standard commercial electron microscope, quickly converts it to a diffraction camera, thus dispensing with the second instrument and with a second source of radiation.

Within a few minutes of each other a picture and a diffraction pattern of the same specimen can be made without remounting it, without removing it from the vacuum, and without tampering with it in any other way. In many fields of investigation this is a great advantage.

To pass from microscope to diffraction camera, it is only necessary to shift the position of the specimen in the tube, which is done by gadgets on the outside, and to change the lens. The latter is easy. An electron lens is merely a coil of wire in which an electric current is flowing. When the current stops, it ceases to be a lens. Hence, to switch from the projection lens which makes the picture to the lens which produces the diffraction pattern, it is only necessary to switch the current from one to the other.

The instrument is so arranged that diffraction patterns can be made either by transmitted light or (for opaque objects) by reflected light. For the latter the specimen is turned so that the electrons are reflected at a grazing angle. Provision is also made for rotating the specimen in its own plane, which is useful in making diffraction patterns. The diffraction pattern produced in this way is a set of concentric circles, some sharp, some diffuse. From dimensions and intensities, the arrangement of the atoms in the material can be determined.

ALEUTIAN WEATHER

ALEUTIAN ISLAND weather is fully as bad as Navy men say it is, examination of published records of the U. S. Weather Bureau shows. It's the kind of thing we hear about Iceland—plus.

It must be one of the drizzliest places on earth. The observatory on Attu, one of the islands reported seized by Japan, shows a mean annual rainfall of about 71 inches, which is not at all terrific so far as total precipitation goes. Annual rainfall along the Atlantic coast near Washington runs about 50 inches. But the total number of days on which measurable rainfall occurred was 200 out of the 365. That means an endless procession of little rains. And it doesn't count heavily cloudy days on which no rain occurred; neither does it count fogs that put no water in the rain gauge.

It never gets very cold in the Aleutians—and it never gets warm. Zero Fahrenheit has never been reported; the thermometer in winter hovers constantly near freezing point, but seldom dips below it. Summer temperatures average a trifle under 60 degrees, and rise to near 70 so seldom that such days don't figure in tabulation of averages.

While frosts have been recorded during every month except July, they are uncommon in summer. The frost-free season extends from late May until early October. According to the Weather Bureau, it gives a growing season actually longer than that of some of the northern states. "However, owing to the large amount of cloudiness and the comparatively low summer temperatures, vegetation, except native grasses, makes slow growth, and gardens are not much of a success." Orchards and forests would be even less of a success, apparently; the natural vegetation of the islands includes no tree species whatever.

The climate of the islands, however dull, is not without its exciting spells of weather. Cold water of the Bering Sea on one side, warm water brought up from subtropical Pacific areas by the Japan current on the other, set up contrasts that breed all manner of storms. Many of the cyclonic disturbances that sweep down across North America originate here, or take on their characteristics after emerging as "young" storms from Siberia across the way. There are also the notorious local "williwaws," violent windstorms in which the air currents seem to blow "every-which-way."—FRANK THONE.

ITEMS

LITHIUM, third lightest element, has been identified in at least 19 stars by Drs. A. McKellar and W. H. Stillwell, astronomers at the Dominion Astrophysical Observatory, Victoria, B. C. Their results were reported to the members of the American Astronomical Society meeting at New Haven. Hitherto, lithium had been found defi-