SCIENCE NEWS

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SHORT RADIO WAVES

VERY short radio waves, only a few feet in length, have traveled record distances in Harvard experiments and warm air currents riding above colder air masses are believed to be responsible.

Using a 1¼ meter wave-length, signals have been exchanged between a Cambridge experimental station and one at Mount Wachusett, Mass., a distance of 68 miles and probably a record for 1¼ meter transmission.

Another record, for 2½ meter transmission, is believed to have been established in the exchange of signals by the Blue Hill Observatory and a station on Mount Washington, N. H., a distance of one hundred and forty-two miles.

These unusually successful results are probably due to temperature inversions, according to Professor Charles F. Brooks, director of Blue Hill Meteorological Observatory at Harvard University, who has had a leading part in the ultra-high frequency radio research at the university.

Ordinarily, air temperature drops with increase in altitude, temperature inversion occurring when the regularity of this fall in temperature is interrupted. Inversions are common at night, when the lower air is chilled. They are also caused by a warm current of air flowing above cold air near the earth, or by an unusually cold current flowing close to the ground under warmer air at a moderate height.

There is a possibility of temperature inversion at four levels in the Kennelly-Heaviside region; at the base of the stratosphere; in the middle of the troposphere, and near the ground. Only the last two, however, seem to be of consequence in ultra-high-frequency radio transmission.

When a temperature inversion occurs, the radio waves which spread horizontally through the atmosphere are refracted in passing from cold or relatively dense air into a layer of warm or light air. This refraction is similar to, but very much less than, the refraction of a beam of light which passes from water into air.

Additional observations by G. W. Piccard, research associate at the Blue Hill Meteorological Observatory, on transmission and reception of five-meter wave signals, showed that there is a well-defined daily change in signal strength, with good reception during the night, best reception during morning and evening, and poorest reception near noon. His automatic records also indicate that there is probably a seasonal fluctuation, with best transmission during the summer.

The usual summertime inversion of temperature over the cold waters off the coast of Maine is believed to have been responsible for two exceptionally long distance transmissions of 5-meter signals last summer.

One was a signal sent from Blue Hill and picked up in a boat off Mount Desert Island, Me., more than 200 miles away. Later in the summer, five-meter signals from West Hartford, Conn., were received on Mount Cadillac, Mount Desert Island, Me., a distance of almost 300 miles.

CHEMICAL ELEMENTS

DISCOVERY of some twenty new varieties of the chemical elements, called isotopes, was announced to the Royal Society by Professor F. W. Aston, of the University of Cambridge and former Nobel Prize winner, as the result of several years of exacting spectrographic work on a dozen elemental substances.

The census of isotopes kept by Professor Aston shows that two hundred and forty-seven stable element varieties are now known from seventy-nine of the ninety-two elements.

Isotopes in chemistry correspond roughly to non-identical twins in animals, since they are the same stuff, but the atom of one isotope has a different mass or weight than another isotope of the same element.

The new isotopes are of the elements hafnium, thorium, rhodium, titanium, zirconium, calcium, gallium, silver, carbon, nickel, cadmium, iron and indium. They were discovered by mass spectrograph analyses made either by the anode ray or more usual discharge method. The mass spectrograph is an instrument that serves as an extremely sensitive balance for weighing the elements.

Important also was Professor Aston's announcement that he had discovered rays from hafnium, thorium and rhodium for the first time.

Because an average of three and a tenth isotopes for every chemical element has been discovered, this is taken to mean that there is a stable elementary atom for every whole number weight from one to two hundred and ten.

Professor Aston believes that not many more such isotopes are unlikely to be discovered, at least for many years, unless by quite new methods.

Professor Aston cited with approval the theory of Professor George Gamow, Soviet physicist now lecturing at George Washington University, Washington, D. C., that if more isotopes are discovered they will probably be radioactive, breaking down into other isotopes.

Not content with his pioneering explorations of atom varieties, Professor Aston said that he would modify his apparatus in the hope of obtaining still finer and more accurate measurements of atomic masses.

GLAND SURGERY AND HEART DISEASE

REMARKABLE success in the treatment of heart disease by removal of the normal thyroid gland was described at the University of Minnesota by Dr. Elliott Carr Cutler, surgeon-in-chief of Peter Bent Brigham Hospital, Boston, and professor of surgery at the Harvard Medical School.

Dr. Cutler discussed this radical and sensational form of surgery wherein a part of the body distant to the diseased part but having an effect upon it is attacked by the surgeon, as an example of the surgery of the future. He spoke of this change in the treatment of the body as

a unit as "A progression from anatomical to physiological surgery."

It is a step representing the greatly increased knowledge of the function of the body and offering the hope that surgery will become less and less a method by which parts of the body have to be removed in order to effect relief.

Reporting observations made on sixty-four cases in which the thyroid was removed, Dr. Cutler reports that in spite of the almost hopeless condition of many of the cases either because of decompensation or angina pectoris, results were far more favorable than those following any other methods of therapy.

Total thyroidectomy for heart disease was proposed in 1932 and the first operation of this type was reported in 1933.

Both experimental studies and bedside clinical observations had shown a close relationship between the thyroid gland and the heart, and it is known that patients who suffer repeated attacks of over-secretion of this gland eventually show signs of heart failure.

Further observations showed that the speed of the blood flow roughly paralleled the basal metabolism in the body, rising when the basal metabolic rate was elevated and *vice versa*. Influence over the basal metabolic rate is only one function of the thyroid gland, but since it can be measured by a simple test, is commonly used as an indication of thyroid gland function.

Dr. Cutler reports that in patients with decompensated hearts the speed of blood flow is slow. This interrelationship suggested that when the circulatory rate in such patients could not be raised by rest, drugs or other means of medical therapy, the basal metabolic rate should be slowed by removing the thyroid gland.

In the sixty-four cases recounted, the only ones reported thus far, he found that thyroidectomy did drop the basal metabolic rate, which in turn demanded a slow rate of circulation. When this demand dropped to the point where it could be supplied by the crippled heart, equilibrium was established and compensation resulted.

ABSOLUTE ZERO

FROM the low temperature laboratory of Leyden University in The Netherlands a new low in cold temperature is reported. Professor W. J. De Haas and his colleagues have reached one five-thousandth of a degree above absolute zero in their experiments.

Absolute zero is 273.15 degrees below zero on the Centigrade scale, and 459.6 degrees below zero on the Fahrenheit classification.

A mercury thermometer would freeze fast in its glass stem and even the hydrogen in a gas thermometer would change to a mere drop of fluid. No thermometer in an ordinary sense can be used for so low a temperature.

Professor De Haas measures his temperatures with a magnetic thermometer. How it works is bound up with his method of attaining the low temperatures. The Leyden experiments are based on the fact that in chemical salts having random orientation of all their little internal unit magnets, there will be less energy in the sample if it is strongly magnetized in the field of a giant electromagnet.

Using special salts cooled first to the temperature of liquid helium at only 1.6 degrees above absolute zero, Professor De Haas lowered the energy of his samples by putting them in the field of 30,000 gauss. (Gauss is the unit of magnetism, just as volt is the unit of electrical potential.) The component of the earth's magnetic field which moves compasses, by comparison, is only three tenths of one gauss.

Then quickly the applied magnetic field on the sample was lowered from 30,000 gauss to but 25 gauss. The theoretical unit magnets of the sample, called magnetons, then went back to their normal random positions. They needed energy to swing themselves back. The sole place for obtaining this necessary energy was from the heat of the sample. Thus as the heat energy was used up, the sample became colder and colder.

Shortly, however, the sample began to warm up again to the temperature of the helium bath. Professor De Haas measured the rate of this warming up process by detecting the magnetization of the sample. He obtained a curve showing how magnetization varied with temperature.

The final step was to prolong the curve backward and in so doing he was able to deduct that the temperature of the lowest point was but one five-thousandth of a degree above the real "bottom" of all temperatures.

NUMBER OF PEOPLE OVER SIXTY-FIVE YEARS OF AGE

THE number of persons over sixty-five years of age that will be affected by the legislation for old-age pensions now before Congress is expected to increase greatly in the next few years, doubling in number in thirty-five years.

America is rapidly growing older. Thirty-five years ago, at the beginning of the century, about 4,000,000 people in the United States were sixty-five or older. Today 7,500,000 persons are in that age group. By 1970, the aged will be increased to more than 15,000,000. This outlook for a rapidly aging population is revealed in figures presented to President Roosevelt by the Committee on Economic Security.

Thus, the report indicates, the problem of old-age security is one not of immediate relief alone, but of provision for a growing need in the future.

Not only are the numbers of old people increasing, as one might expect in a growing population, but the proportion of old people is also becoming magnified. In 1900, America had just a fraction over four per cent. in the age group over sixty-five. By 1930, this proportion had increased to 5.4. But by 1970 the committee expects the percentage to have reached 10 per cent. Of every hundred men, women and children in the United States thirty-five years from now, ten will be sixty-five years old or older.

If you are now a young man of thirty, what are your prospects for the future? If you live for the next thirty-five years, you will then be one of the 15,000,000 people in the United States in the "old age" group. The

chances at present are about even that you will be dependent, either on relatives, friends or public charity.

Not so many people over sixty-five are finding employment as they did in the past. If you have been a long time with one firm, a survey has revealed, you are less likely to be dismissed than a younger worker. If you have drifted about a good bit from job to job, you will not have that advantage. In case you do lose your job, you are far less apt to secure new employment than younger workers are.

The committee estimates that although 31.6 per cent. of the men over sixty-five were unemployed in 1900, that high figure has increased to 41.7 per cent. in 1930. And the tendency is still upward.

Will you have saved enough to take care of yourself during your old age? That depends upon your present income. Five and three quarter million families in the United States had in 1929 an income of $1,000 or less. They were not able to put aside anything for approaching rainy days. Ten and a half million families, the most representative American group, made between $1,000 and $2,000. These families saved a total of $750,000,000. A calculation will show that this seemingly large sum, when divided by ten and a half million, gives a sum for each family of but $71.

The man who lives to be sixty-five years old may reasonably expect to live 11 or 12 years longer. Women, at the same age, may expect to live 15 years. If you should be among the 15,000,000 who are sixty-five in 1970, and you wish to have an income of $25 a month for the rest of your life, you should have saved, the committee estimates, about $3,300 or $3,600, not $71.

Only families having incomes larger than $10,000 a year save as much as this amount on the average.

If only this amount of income is allowed to all the people of sixty-five years and over, the cost of support of the aged would represent a claim upon current national production of $2,000,000,000 per year, the committee reports. Regardless of what may be done to improve their condition this cost of supporting the aged will continue to increase. In another generation it will be at least double the present total.

DISEASE AND THE INTESTINAL TRACT

THE upper intestinal tract has a natural disinfecting power that, when we are in normal health, kills off most of the germs that come into the stomach by way of the mouth, Dr. Lloyd Arnold, of the University of Illinois, reported to a recent meeting of the Chicago Medical Society. This is the reason why we do not have more diseases of the intestinal tract.

He and his associates have been working for twelve years on determining the bacterial flora of the digestive tract. The lower intestine is very densely populated with bacteria, while the upper intestine and the stomach have normally very little bacterial life. The secretions of the stomach and upper intestine are acid in their reaction, while in the lower intestine the reaction is alkaline. There is, however, no division between the upper and lower intestines; it is the line of acidity that determines the height that the bacterial flora will ascend. Consequently, if, for any reason, the acidity of the upper digestive tract is lessened, the bacterial flora of the lower intestine may ascend even as far as the stomach, and the disinfecting power of the mucous lining of the intestine is not able to function properly.

Killing doses of cholera germs were fed to rabbits whose stomach contents were known to be acid. None of these rabbits showed any effect of the germs. The disinfecting power of the upper intestine was able to do its work. The same dose of cholera germs was given to two groups of rabbits whose stomach and upper intestinal contents had been made artificially alkaline. All the rabbits in these two groups contracted cholera and the majority died of the disease. Then a less-than-lethal dose of cholera bacilli was injected intravenously in two sets of rabbits, one with normal intestinal reaction, the other artificially alkalized. The second series became very sick, and most of them died. The other set remained healthy.

Dr. Arnold states that studies they had made showed that in very hot weather the contents of the human stomach were always less acid than in cooler weather. The prevalence of dysentery and typhoid during the hot months is attributed to this cause, and if the diet is such that the acidity of the stomach and upper intestine is maintained at all times, few intestinal diseases can develop. The natural disinfecting power of the upper intestine will be able to prevent them.

ITEMS

DESPITE cold waves, the United States was 90 per cent. "hot" during January. Weather records covering the whole country for the month have been studied by statisticians of the U. S. Weather Bureau, and the results of their figure-digestion have been announced. Nine tenths of the total area reported average temperatures for the month above normal for January. The Rocky Mountain region was relatively warmest, with temperatures in many places ranging from six to twelve degrees above normal. The South also showed mean temperatures above normal, though the paradox of extensive crop injuries from cold resulted from brief but sharp invasions of cold. During one of these cold waves a tenth of an inch of snow fell in New Orleans.

THE air normally has more than enough oxygen to supply the needs of the human body, even under conditions of strenuous physical exertion. The amount of oxygen a man consumes in a minute is the same, whether he breathes ordinary outdoor air or air containing 40, 60 or 90 per cent. of oxygen. These are among the conclusions of a study conducted by Dr. Francis G. Benedict at the Nutrition Laboratory of the Carnegie Institution of Washington. In the experiments which Dr. Benedict reported the amount of oxygen consumed was measured first while the subjects were at rest, then while they expended measured amounts of energy on a bicycle, and finally while they were recovering following the strenuous exertion. A helmet placed over the subject's head enabled the investigators to measure the amount of oxygen consumed, whether the subject was breathing air or air enriched with varying amounts of oxygen.