SCIENCE NEWS

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PILOTLESS BALLOONS TO EXPLORE THE STRATOSPHERE

SMALL stratosphere balloons without pilots and using tiny radio transmitters to send back upper air information to earth-bound scientists will make possible a whole new program of cosmic ray studies, Dr. Arthur H. Compton, of the University of Chicago, reports to Science Service.

Preliminary announcement of the little 15-feet diameter balloons which send to earth information on air pressure, air temperature and the intensity of cosmic radiation at various altitudes was recently made. How all this information could be obtained from a single radio signal has never been disclosed. Now, Dr. Compton describes the operation of the device which may revolutionize stratosphere ballooning, especially its costs and hazards.

The small balloons—quite Lilliputian in size compared with the great 3,000,000 cubic feet bag of the recent National Geographic Society and U. S. Army Air Corps flight—weigh only 16 pounds when sent aloft by a bag whose largest extended diameter is but 15 feet.

The radio "voice" sending back the information to earth is a single tube oscillator transmitting a signal on 20 meters wave-length. A barometer, a thermometer and a cosmic ray meter affect the radio signal in such a way that accurate records of these conditions can be learned. A similar short-wave oscillator is kept in continuous operation.

The changing conditions in a special barometer vary the frequency (or what is the same thing, the wave-length) of the transmitted wave. Air pressure, and hence altitude, are thus determined by the "wobble" in the incoming radio signal.

The temperature is recorded by vibrations of a balance wheel somewhat like that of a watch, whose period, or time of oscillation, is affected by the temperature. This mechanical oscillator interrupts the carrier wave at each vibration. Thus the radio signal comes on and then goes off at intervals. The difference in length of the time intervals determines the temperature.

Cosmic ray intensities are determined by the current in the cosmic ray meter produced by ionization. The instrument is charged up to some value. As the cosmic rays make the surrounding air conducting, the electrical charge of the instrument leaks away. How rapidly the leakage occurs depends on how intense are the cosmic rays. Each complete discharge of the cosmic ray meter is noted by interruptions in the carrier radio wave.

All that is necessary in the ground laboratory, then, are instruments which make a record of the wave-length of the radio signal (this tells the air pressure and hence the elevation), and detect interruptions in the radio signal telling temperature and cosmic ray intensity.

Studies of the upper atmosphere, Dr. Compton indicates, have been made before by the system of sending up automatic recording instruments on two small balloons of different sizes. Together the twin bags carry the apparatus aloft until finally the smaller one bursts.

The remaining balloon is insufficient in size to keep up the ascent so that the apparatus descends to the ground in gentle fashion. Reward notices are attached to the whole unit payable on returning the apparatus. Good results have been obtained with this method by the German scientists Hess and Kolhorster and Professor R. A. Millikan in the United States.

While valuable, the method has one defect, however. It is adaptable only in regions of the world having a fairly dense population; where there is some assurance of finding the balloon and its instruments and having it returned. Europe, the United States and southern Canada comprise the regions of usefulness of the method.

Radio balloon apparatus, however, is sent up with little hope—and no need—of its recovery. The cost of $100 for each flight is only a few times that of an airplane flight and only a small fraction of the cost of a man-balloon ascension.

"We do not expect," concludes Dr. Compton, "that this radio transmission method of obtaining cosmic ray data from the stratosphere will replace measurements made in large balloons of the stratosphere type, because some kinds of measurements can only be made with equipment too heavy for small balloons to carry. Much information, however, can be obtained with these lighter balloons. This will supplement, in regions difficult of access, the more detailed information which the larger balloons give us in ordinary latitudes."

Near the North magnetic pole of the earth, in the wilds of northern Canada, is expected to be one place where small radio balloons will be especially useful.

The difficulties of transporting and launching a large manned balloon in the wilderness and the hazards which the balloonists would face on the landing exclude this method from any scientific program.

The chances of recovering instruments by rewards would also be small, so that the radio type balloon seems to be the one solution to the problem in wild regions. Yet stratosphere measurements at the North magnetic pole would be among the most interesting of all. Ground measurements have been made at this point, but upper information is needed to supplement them.

Professor J. M. Benade, of Forman Christian College at Lahore, India, developed the idea of using radio signals to transmit cosmic ray intensities.

SODIUM VAPOR LAMPS

THE new lamps filled with sodium vapor which are gradually coming into use for highway illumination have no special advantages or disadvantages for indoor clerical use. This is the report of Dr. James E. Ives, senior physicist of the U. S. Public Health Service, in announcing the result of a three months' test to learn whether the striking yellow-glow lamps held special merits for indoor work.

CWA clerical workers served as test subjects for the investigation held in New York City. By checks on speed and amount of work accomplished, and comparison tests of the eyesight of the subjects before and after undergoing the test, the following results are reported: 1. Sodium light has no permanent effect on the eyes which could be detected by clinical tests after the subjects had worked for 4 hours a day over a period of 12 weeks in the yellow light. 2. No significant difference in the amount of work performed by the groups of men working under sodium and tungsten lamps could be observed.

Sodium vapor lamps have come into use recently because of the great saving in the amount of electric current necessary to produce the same intensity of light. It costs only about one fourth as much to operate sodium vapor lamps as it does for tungsten filament lamps.

Experimental highways have been set up at Schenectady, N. Y., in New York City and in New England which are illuminated with the new type lamps. It has been maintained that drivers on these roads find they can drive at night at high speeds without using headlights and yet see approaching cars distinctly.

Because the light from the lamps is brilliant yellow and almost completely of one single wave-length—the familiar D lines of the sodium spectrum—the visual acuity, or distinctness of the edges of objects, is better than under more normal radiation. It has been suggested that chromatic aberration should be absent for light of a single wave-length. Chromatic aberration means essentially that the various colors are not brought to the same focal point by the lens of the eye and a slight blur usually surrounds objects as a result. The effect is noticeable on very small objects and varies among different people.

While there is a definite gain in economy in using sodium vapor lamps, the single color of the light makes it impossible to perform any type of task dependent on color. Curious effects are obtained when color work is attempted under the yellow lights. On highways so illuminated, for example, green leaves all appear white, and a green field looks as if it were covered with snow.

THE SPEED OF RADIO WAVES

THE time required for short radio waves to travel between two distant points fluctuates constantly and rapidly by night to the extent of about ten per cent., whereas by day there is almost no fluctuation. This is the substance of a report made to the Paris Academy of Sciences by Dr. B. Decaux and Dr. J. B. Galle.

The method used was to send the note of an organ pipe from Paris to Algiers on a radio wave of 24.15 meters, and to return it from there to Paris on a wave-length of 24.65 meters. The note received in Paris was then combined with the direct note from the original organ pipe, reduced to the same intensity, in a cathode ray oscillograph.

In this instrument the outgoing note caused a beam of electrons to vibrate in a vertical direction, the incoming note caused it to vibrate in a horizontal direction. The results of the combined vibrations was to cause a little spot of light, produced by the electrons on a screen, to travel around in an oval or ellipse, called a Lissajou figure. Any variation in the time required for the radio signal to travel from Paris to Algiers and back was indicated at once by a change in the form of this figure. The ellipse became either flatter or rounder.

At night the figure continually changed its form so rapidly that the changes could not be followed. They showed that the time required for the signal to travel to Algiers and back varied by 1/1000 second, the whole time required for the journey being about 1/100 second. During the day the figure remained quite steady.

The same phenomena were observed with waves of 33 meters and even of 349 meters. With the long wave, however, which is within the broadcast range for the United States, the fluctuations were much less rapid.

Radio waves, when traveling long distances are reflected back and forth between the earth's surface and a reflecting layer high above the surface. Because of this zig-zag path, the time of travel between two distant points is greater than if the waves followed the earth's surface. The fluctuations in time shown by the experiments of Drs. Decaux and Galle indicate that the height of the reflecting layer is continually changing at night, but remains at a fairly constant level during the day.

THE TRANSPLANTATIONS OF SEX GLAND

SEX gland transplantations, one of the most-discussed of recent medical developments, had relatively little effect when tried on cattle in a series of experiments performed by Dr. Fred W. Miller, R. R. Graves and Dr. G. T. Creech, of the U. S. Department of Agriculture.

Their results are not in accord with the claims made for the famous Voronoff operation on livestock, which has been widely used as a means for rejuvenating aged but once valuable breeding animals, especially in France and the U. S. S. R.

Normal ovarian tissue was implanted in the bodies of several dairy cows which had various types of abnormalities in their reproductive organs, and also into two normally pregnant cows. In no case was there any apparent benefit to the sick cows, or harm to the pregnant animals.

Male sex gland tissue was also implanted in several bulls that had become old and useless for breeding purposes, as well as one young animal in a subnormal physical condition. After the operation, the old bulls were noticeably "pepped up" and aggressive, but their usefulness as breeding stock was not improved. There was some improvement in the condition of the young animal, but not enough to be biologically significant.

In the experiments, sex gland tissues from pigs were used on some of the animals, tissues from cattle on the others. Healing of the operational incisions was more rapid after the implantation of the pig tissue; otherwise no differences were noted.

The results of the experiments are described in detail in the current number of *The Journal of Agricultural Research*.

RECOGNITION OF WORDS BY DOGS

DOGS learn the meaning of certain words very well and are not fooled by similarly sounding words. Nor

are they fooled by certain other circumstances purposely introduced to confuse them. These facts were brought out by extensive experiments made by Dr. Emanuel Sarris at the Institute for Environmental Research, Hamburg.

Several dogs were used and given such names as Paris, Haris, Aris, Argos, Niki, etc., some of which have very similar sounds, others very different. The dogs learned to respond to their respective names perfectly. They were then taught a few simple words and phrases of importance in the dog world, such as meat, stick, basket, on the chair, under the table, etc. Once having learned these words and phrases, they recognized them under a variety of confusing circumstances by their sound alone, independent of tone of voice or emphasis, and without the help of signs or gestures. They recognized them when mixed with other words, when the speaker and object were out of sight, and whether the voice was male or female.

Thus the dogs being in one room and the experimenter in another, such commands as the following were given: "Come Paris (or Haris, or Aris, etc.), to the meat"; "Come to the meat Paris"; "Paris come to the meat." In each case the appropriate dog did the appropriate thing. Variety of phraseology and similarity of sounds did not confuse them.

Aris was sung to in Greek. In the midst of the poem, one of the words he knows was inserted, but it was sung in the same tone and rhythm as the rest of the poem. Aris recognized it at once and acted accordingly. Later he learned the Greek word for it.

Aris was taken into a room in the institute where he had never been before. "On the chair," commanded his master, without moving a muscle. Aris ran all around the room searching and stopped finally at a chair turned over on its side, looking at it dubiously for a few seconds. Then he jumped on top of it. In a similar way on different occasions he accepted a stool up-side-down, a stool on top of another, a stool under the table, a bench, a settee, three chairs in a row and a chair wrapped up in gray paper.

When commanded, "Under the table," Aris crawled under the typewriter desk, although he had never seen such an object before.

The experiments showed that dogs recognize words by their sound alone, and can pick them out from a confusion of other sounds. They can also pick out from a confused and unfamiliar environment objects corresponding in function to familiar objects.

ITEMS

THERE is no super-heavy element called bohemium. Announcement made last month, when the supposedly new substance was first reported by Dr. O. Koblic, was premature, he now reports to *Nature*. The tiny speck of yellow powder obtained from pitchblende, a common source of radioactive material like radium, was not a new element. It was simply the metal tungsten, declares Dr. Koblic, like that found in the small wires inside electric lights. But the tungsten was in a form not easily identified. For the month that Dr. Koblic's element bohemium was thought to exist, science had to puzzle over two elements both having atomic number 93. As such they were both heavier than any elements recognized in chemical tables which end with uranium, element 92. The second element 93 was that of Dr. Enrico Fermi, Italian physicist from Rome. Now the Italian variety of element 93 stands alone. It is radioactive and disintegrates like radium. But substantiation of Dr. Fermi's work is still unreported by other scientists.

PROFESSOR JELLINEK, French scientist, placed a raw egg between two condenser plates connected to a short wave radio transmitter. The power applied was 1,000 watts, the wave-length 3 meters. After five minutes' exposure the yolk of the egg was found to be cooked hard and solid, but the white was scarcely affected, being only of the consistency of a jelly. Yet the temperature of the yolk at the end of the cooking was only 140 degrees Fahrenheit, while that of the white was 176. This experiment was part of a research on the effect of short radio waves on different organic tissues, which Professor Jellinek recently reported to the Paris Academy of Sciences.

SPECIAL radio receivers at filling stations and other points along motor routes to supply autoists with weather information is suggested by the Bureau of Air Commerce. Every hour 68 airways broadcast stations in the United States send out the latest weather news for the benefit of fliers. This information, often valuable for motorists, could be made available by the installation of 200 to 400 kilocycle receivers at places motorists frequent on a cross-country trip. The plan, it is believed, would be particularly valuable in rugged and mountainous regions where a fog may mean delay, a heavy rain a road washout and snow an impassable section of road.

IT is reported that many fires have been traced to small birds who pick up lighted cigarette butts from the street and, leaving a trail of smoke like a tracer bullet, carry them off to their nests in the eaves of old buildings or warehouses. A report to the Railway Fire Protection Association states that an abandoned theater in Rockwood, Tennessee, was destroyed by a fire originating at a point where sparrows made their nests. As the narrative goes, citizens sitting in the cool of the evening before the town hotel had seen sparrows pick up discarded cigarettes and fly off with them still burning. Fire-chief Johnson, of Knoxville, reported that a locomotive engineer had seen a sparrow pick up a lighted cigarette and fly away with it, leaving a thin wraith of smoke behind him, to the eaves of a near-by dwelling. Several days later when the engineer stopped the train at that town he was surprised to see that the house had been destroyed by fire. Extremely small charges of static electricity have been found also to be one cause of the great toll of fires which cost industry so much each year, both in life and property. During the past six years 147 fires have been attributed to this form of electricity. The friction of an endless belt running over pulleys has been observed to generate a spark of two volts potential. In an atmosphere containing a certain amount of inflammable gases this would be sufficient to cause an explosion resulting in a very serious fire.