New Radio Device Helps Blind Landings

General Science

Following are reports of some of the more important papers presented before the autumn meeting of the National Academy of Sciences, at Schenectady, N. Y., November 19 to 21.

Airplanes may soon be able to land safely in a fog without the pilot seeing the landing field at all. This is one of the possibilities of a new radio altitude meter for airplanes developed by Dr. E. F. W. Alexanderson, of the General Electric Company, and described by him before the National Academy of Sciences.

The radio altitude gauge does the same thing for an airplane that the sonic depth finder does for a ship, he announced. With the aid of the latter, the captain can make a constant record of the depth of the water beneath him. He can not only avoid shallow water, but he can actually plot the contour of the ocean bottom and identify it with the contours given on his charts. It operates by sending a sound wave from an oscillator on the bottom of the ship. The wave travels to the bottom, is reflected upwards, and the difference between the time the sound is made and the time the echo returns permits an exact measurement of the depth.

Radio waves may be made to do the same thing for the airplane that the sound waves do for the ship, said Dr. Alexanderson, but since they travel at the speed of light and far faster than the sound waves through water, their use requires quite a different technique. The waves are sent out from a transmitter on the plane, part travel downwards to the ground. There they are reflected, and with the proper receiver they may be picked up again in the airplane. The time is too short to notice the difference, however, and an indirect method must be used.

The method consists in determining whether the returning wave is in step with the transmitted wave or not. If the height of the airplane is an exact number of wave-lengths above the ground, the two waves are in step. If the plane then goes higher or lower, or if the ground level itself becomes higher or lower, the two waves will be out of step. If the height above the ground changes more than a whole wave-length, the waves come into step again for a moment. If the airplane is equipped with apparatus for measuring the relation of the two waves, and the number of times they change, then the height of the plane above the ground can be measured.

In Dr. Alexanderson's device this is measured by the effect of the returning wave on the actual transmitter. This effect is to change the wave-length of the transmitted wave, and so it affects the strength of the returning wave. Thus by measuring this strength of the returning wave and the number of changes in step, the distance is determined.

Dr. Alexanderson also suggested a method of using two antennae with two oscillators of slightly different frequency. They could be arranged to give beats as the two sets of waves acted on each other, and could be arranged, for instance, to light a green lamp when the plane is 240 feet high and a red lamp at 80 feet.

"If these radio indications of height and position are combined with a mechanical landing device touching the ground at 10 to 15 feet," said Dr. Alexanderson, "it is conceivable, at least we are told so by our associates who are skilled aviators, that safe landings may be made in fog without any vision of the landing field."

Rays Trace Lamp Flicker

How a beam of cathode rays, tracing a luminous green line on a screen, can be used to study the flickering of electric lamps was described by Prof. Frederick Bedell, of Cornell University.

An electric incandescent lamp, lighted by alternating current, used in most cities, is constantly flickering. With 60-cycle current, commonly used, the lamp reaches its maximum candlepower a hundred and twenty times a second.

"The flicker is often of sufficient magnitude to be obvious to the casual observer," said Prof. Bedell. "A quick turn of the eye makes one conscious of it. Even when not obvious, the flicker is not infrequently a source of unconscious annoyance."

Previous methods of measuring this flicker have been indirect, and required many hours to determine the changes during a single alternation of the current. Now, with the use of the cathode ray oscilloscope, as the instrument is called, the light from the lamp being tested shines on a photoelectric cell. The cell gives a slight current, varying with the light. This is amplified, and it controls the path of the narrow pencil of cathode rays in the oscilloscope. As the rays strike a screen, it shines with a greenish light, and this light forms a curve that tells the exact variation of the brightness of the lamp. This curve can then either be traced or photographed.

Bombs of Gas Fall Into Sun

Bombs of gas, traveling at great speed, may fall into the sun, but not solid meteors. This was the surprising announcement made at the meeting of the Academy by Prof. Henry Norris Russell, astronomer of Princeton University.

Previously, astronomers assumed that solid meteorites could fall into the sun. Prof. Russell pointed out that the great heat of the sun would change them completely to gas as soon as they approached, unless they are more than two or three feet in diameter. However, the mass of gas would itself continue towards the sun with the same speed as if the meteor were solid.

Dr. Harlow Shapley, of Harvard, has estimated that 1,000,000,000 meteors strike the earth daily, and the Dutch astronomer, J. C. Kapteyn, has computed the total quantity of matter in a given volume of the universe. This has allowed Prof. Russell to calculate that the average mass of a meteorite is about two milligrams, or about one fourteen-thousandth of an ounce, which would make them microscopic in size. He suggested that the meteors we observe from the earth may be members of the solar system, and that they might be larger, but he thinks that few of these would hit the sun.

Because this amount of meteoric matter is so small, not more than about 60 tons a second would fall into the sun, a very small amount, considering the sun's great size. On this account, he said, the gas generated by the meteors would not be enough to account for some of the strange dark bands observed in spectrum photographs of the stars, which are suns, like ours, but much farther away.

First Milk Insures Calves

The first milk a cow produces after giving birth to her calf carries sickness-insurance against the ills that calf-flesh is heir to, and if the bovine infant is not allowed to have this milk it is very likely to become an item in the (*Turn to next page*)

Meeting of National Academy of Sciences—*Continued*

infant mortality statistics of the farmyard. So Dr. Theobald Smith, famous American bacteriologist, declared.

Many young mammals are protected for a time against various diseases by antibodies passed over into their bodies before birth from the blood of the mother. But against other diseases they are not given this protection, and it is these that the first milk, called the colostrum, wards off. Young calves not allowed to have this colostrum showed a mortality of 75 per cent., in Dr. Smith's observations.

The blood serum of the cow is only partly protective. The main agent of disease during the first few days of a calf's life is the colon bacillus. A serum prepared by injecting cows with these bacilli protects all calves against the early diseases, when the serum is fed in place of the first milk. But in about one-third of the calves so protected during the first few days of their lives, certain diseases may appear during their second month. This indicates that the colostrum is able to protect calves from diseases other than those caused by the colon bacillus, to which the protective action of the serum is limited.

Time an Element in Sex Control

Daphnia is a most peculiar female. She lives in an Adamless eden, and produces offspring as she pleases, without having to worry about a mate. If things go to suit her, she brings forth only daughters, thus insuring continued feminine domination of a pleasant world. But if the little cosmos she lives in—a puddle of stagnant water — becomes too crowded, or if it gets cold, or if chemical poisons intrude, then she produces sons as well; and if conditions are especially bad her offspring are nothing but males. This feminist among the lower animals apparently thinks that a world gone wrong is plenty good enough for the he-ones.

These facts about *Daphnia,* an almost microscopic relative of lobsters and shrimps, were discussed by Dr. Arthur B. Banta of the department of genetics, Carnegie Institution of Washington.

Why the sex of offspring, which in most animals seems to be a matter of internal control exercised by specialized protoplasm particles known as chromosomes, should in *Daphnia* be subject to the vagaries of environmental change, was discussed at some length by Dr. Banta. He pointed out that to be effective, these outside changes had to take place four hours before the eggs are laid. This coincides with a critical period in the rearrangement of the chromosomes, and points to the possibility that the environment determines sex not directly but only by working on the chromosomes. Should this later be demonstrated a fact, *Daphnia's* peculiar behavior would fall in with that of other animals.

Concerning the possibility of sex control in the higher animals, including man, Dr. Banta did not offer much encouragement. "Obviously, if sex is to be controlled in higher animals the sex-chromosomes must be taken into account," he said. "If it were possible to control the type of sperm, whether a female-determining or a male-determining sperm, which fertilized an egg the sex of the resulting individual might thereby be controlled. Unless and until such control is accomplished, sex control in higher animals seems beyond the possibility of attainment."

Dwarfs from Pieces of Eggs

It takes a whole egg to produce a chick or a duckling, but farther down the scale of life are animal eggs that can be broken up into pieces and each of the pieces will still be able to hatch, although the larvae developing from them will be dwarfs. So Prof. E. B. Wilson of Columbia University said. The animals on which most of the experiments have been performed are a kind of sea worm. The eggs are broken up by being whirled rapidly in a centrifuge, and the fragments then fertilized in the normal way. This capacity of pieces of eggs to develop as though they were whole ones, Prof. Wilson said, is evidence against the notion that eggs are permanently organized in advance of fertilization or the beginning of development.

Back in Cambrian geological time, so long ago that geologists refuse to estimate its age even in millions of years, the sea stood where the Penobscot River now finds its way across the rocks of Maine. The invasions of this ancient Cambrian sea are known from other parts of this continent, but the evidence for the ancient "wetness" of the oldest of dry states was presented for the first time by Prof. Edward S. C. Smith of Union College. Prof. Smith has discovered abundant fossils of an organism known as *Oldhamia occidens,* which seems to have been a kind of seaweed, in a thick series of folded slates and sandstones along the banks of the east branch of the Penobscot River.

Dam Upsets Salmon Travel

Capturing an entire salmon run and lifting the fish bodily over a dam which now obstructs their route toward the ancestral spawning grounds was the radical step advocated by Prof. Henry B. Ward of the University of Illinois.

Prof. Ward has for several years been making a study of the effects of a power dam across the Baker River, Oregon, on the annual run of the salmon. He found that the migrating fish tend to seek the coldest water, and since at this dam the coldest water issues from the powerhouse tailrace, the salmon exhaust themselves in useless attempts to swim up this torrent.

The construction of the dam has created a deep, cold lake which has captured some of the young salmon migrating downstream towards the ocean, and thus has produced a race that is physiologically landlocked. This race, however, is small and of no commercial value.

Plenty of milk, served early, is the secret of an apparently unlimited growth rate for a young animal. The falling-off in rate of growth that comes after a rapid initial spurt is due not to any internal factor or force, but simply to a limited food supply, Dr. F. Carleton MacDowell of the department of genetics, Carnegie Institution of Washington, told the Academy. Experimenting with young mice, he found that during the suckling stage the usual retardation in growth rate after the first week could be done away with by seeing that they got all the mouse milk they could drink, instead of the comparatively limited supply afforded by their mother.

Spiders Ride Hurricanes

The spiders of some of the islands of the West Indies have been long-distance aviators for many ages, according to Prof. Alexander Petrunkevitch of Yale University. And hurricanes have helped their flights instead of hindering them.

Prof. Petrunkevitch has been making a study of the distribution of spider species in the tropical American islands, and finds that in the western group, or Greater Antilles, they were (*Turn to page* 325)

National Academy—*Cont'd*

apparently pedestrians, crossing from the South American mainland over a land connection long since sunk into the sea. Along the Greater Antilles to the east, however, they give evidence of having traveled by air, the lines of distribution lying approximately in the direction of the most frequent hurricanes.

Racial Mental Differences

"We are driven to the conclusion that there is a constitutional, hereditary, genetical basis for the differences between the two races in mental tests."

This was the conclusion resulting from a series of mental tests of whites, Negroes and mixed bloods in Jamaica, conducted by Dr. C. B. Davenport of the department of genetics, Carnegie Institution of Washington.

Groups of individuals of the two races and their crosses, all of approximately the same social and educational levels, were given mental tests for aptitudes in a number of different fields. In some, the whites showed very definite superiority. These included tests intended to bring out capacity to size up a situation, use common sense on it, reason it out.

But the results were by no means one-sided. The Negroes beat the whites in certain memory tests. In musical aptitudes there was more or less of a stand-off: the score of the white race was higher where a sense of harmony was being tested, but in the more elementary matters of pitch and rhythm the Negroes were more acute.

Locates Nucleus of Universe

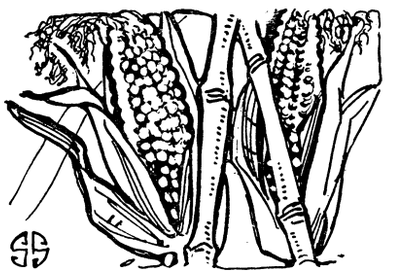
The nucleus of our "universe"—the galaxy of stars of which the sun, the Milky Way and all the other stars that we can see are part, has now been located. This discovery has been made by Dr. Harlow Shapley, director of the Harvard College Observatory.

This nucleus is in the same direction as the constellations of Sobieski's Shield, Ophiuchus, Sagittarius, Scorpion, the Southern Crown, the Altar, the Rule, and the Centaur. The latter four are all groups that can only be seen from the southern hemisphere of the earth. As we see it, the nucleus extends for about fifty degrees along the Milky Way, in these constellations. Its distance from us is about 47,000 light years. A single light year, which is the distance that a (*Turn to next page*)

NATURE RAMBLINGS

By Frank Thone

Natural History



Corn

The Thanksgiving Day table offers up a great variety of things native to America: the turkey and its accompanying cranberry sauce; white potatoes, sweet potatoes, tomatoes, squash, pumpkin and a postprandium of pecans, peanuts, Brazil nuts, black walnuts, chocolates and tobacco.

But of all the gifts which the primitive Indian agriculturists presented the European settlers—or which aforesaid settlers took from them without thanks—the greatest has been corn. Corn probably originated in the South American highlands but by the time the white men came its cultivation had spread as far north on this continent as the climate would permit, so that from Columbus onward every European comer met it. Chance caches left by the Pequots and not too conscientiously acquired by the Pilgrims saved Plymouth Colony more than once during the terrible first winter of 1621.

So completely did this new grain come to dominate the agriculture of the new settlements that it appropriated a name from the English language, just as the speakers thereof had appropriated it and the land whereon they raised it from the original owners. In seventeenth-century English, "corn" was a collective name for all kinds of grain—wheat, barley, rye, and all the rest—and that is what a Britisher still means when he says "corn." When he talks about our corn he calls it maize. The first settlers began by distinguishing the aboriginal grain as "Indian corn," but presently, with typical New England thrift of words, they simply called it corn. Another mark of dominance of maize in American agriculture is our new name, "small grains," for what our British cousins call "corn."

Radio to Moon?

Physics

Radio communication with the moon is not impossible after all. At least, it would be possible if there were people there to receive the messages. Radio waves can actually leave the earth, for at least a million miles. They are not completely stopped by the Kennelly-Heaviside layer, which has been supposed to act as an opaque screen to the waves.

This announcement is made by Dr. Carl Stormer, famous Norwegian physicist, in a communication to *Nature,* the English science journal. He has found that radio waves of about 31 meters length may give echoes that return as long as 15 seconds after transmission. Radio engineers have frequently observed an echo after about a seventh of a second, due to the waves traveling around the earth. They have also detected the return wave, reflected from the Kennelly-Heaviside layer. The newly observed echo, however, takes so much longer that it can not be due to either of these causes.

The long echo was first noticed by an Oslo radio engineer, Jorgen Hals. He communicated (*Turn to next page*)

Fight "Monkey Law"

Evolution

Arkansas courts must decide whether Arkansas schoolrooms shall continue to have dictionaries and encyclopedias in them, is the opinion of J. P. Womack, State Superintendent of Public Instruction. He holds that if the law should be interpreted as meaning that a reference book is a textbook, then even dictionaries must go. But a court decision will be necessary to decide the point, and in the meantime the reference books stay.

This raises a dilemma for the Arkansas schools. Offending textbooks may be removed promptly, and the lips of teachers sealed on penalty of loss of their jobs and a stiff fine, but in the meantime, easily accessible to every curious youngster, there remain the encyclopedias, all of which contain articles on evolution.

A legal test of the new statute may be initiated in the near future. A committee of leading citizens of Arkansas who oppose the law are now in correspondence with the University of Arkansas chapter of the American Association of University Professors, and their decision as to appropriate action is expected daily.

The passage of the Arkansas anti-evolution law (*Turn to next page*)

Radio to Moon—*Cont'd*

his results to Dr. Stormer, who then arranged for special signals from the large radio station of the Philips lamp works at Eindhoven, Holland. Dr. Stormer himself heard echoes from these at intervals of from 3 to 15 seconds after transmission. His observations were verified by Dr. van der Pol at Eindhoven.

The speed of radio waves is well known; it is the same as that of light, 186,000 miles a second. In 15 seconds, therefore, the radio waves have traveled at least a million miles away and back. This is about four times the distance to the moon.

Dr. Stormer thinks that the echoes are caused by a layer of electrons which come from outside the earth, particularly from the sun. The magnetic field of the earth deviates them, so that they form a vast hood around the earth, but reaching the earth near both magnetic poles. Within it there are no electrons. The radio waves travel out to this hood, far beyond the moon, and then are reflected back, he thinks. Whether or not some may even penetrate the electron layer, and actually travel to the other planets cannot now be determined.

Science News-Letter, November 24, 1928

"Monkey Law"—*Cont'd*

will be the signal for a stiff fight by the American Association of University Professors for the right of their colleagues to teach science according to the laws of nature rather than according to the dictates of the anti-scientific forces of Southern rural districts. This was indicated by Prof. A. O. Lovejoy of the Johns Hopkins University, prominent in the councils of the Association.

"We did not take part in the pre-election fight over this law," said Prof. Lovejoy, "because we knew that the people in Arkansas would be sensitive and resentful about outside interference. But now that it is on the books it can be attacked—and we think successfully—on constitutional grounds. The American Association of University Professors will probably take action at an early date."

Science News-Letter, November 24, 1928

Tokyo has set aside parts of 200 streets for children to play in after school hours.

A method of putting out fires by freezing the flames with solid carbon dioxide at 100 degrees below zero has recently been devised.

National Academy—*Cont'd*

beam of light will traverse in a year, measures about 6,000,000,000,000

Next to the galaxy itself, or the other galaxies which we see as spiral nebulae, it is the hugest thing ever measured by man. It extends for about 29,000 light years in the direction in which we look at it, and is about 16,000 light years thick. The center is in the constellation of Sagittarius, the archer, a group that is now low in the western sky just after sunset. Some years ago Dr. Shapley found that this region was the center of a supersystem of the globular clusters of stars that appear in various parts of the sky.

"Apparently," said Dr. Shapley, "our entire Galaxy rotates about this nucleus."

The method by which he found the nucleus and measured its distance was with the use of the changes in light in many variable stars. These particular stars, known as Cepheid variables, change their light in a peculiar way, from which the astronomer can calculate their distance. Another type of variable star, known as the long period variables, was also employed.

In proving the existence of this nucleus, Dr. Shapley has furnished a new proof of the similarity of the Galaxy, or "universe" of stars in which we live, to the spiral nebulae. Thousands of these are known, and were shown several years ago, by Dr. Edwin P. Hubble, of the Mt. Wilson Observatory, to be stellar systems beyond the limits of our own. As a nucleus is a characteristic feature of these nebulae, and as they apparently rotate around them, it now appears more certain than ever that we actually live in a spiral nebula.

Are new mountains beginning to grow along the Atlantic seaboard of America?

At least slight indications that such may be the case were called to the attention of the Academy by M. R. Campbell of the U. S. Geological Survey. Mr. Campbell has made a study of geologically recent gravel deposits on the old river terraces on the Potomac, Susquehanna and Schuylkill rivers, and has found them bent upwards at three different places. The arching is not great, but it is sufficient to indicate upfoldings in the deeper layers of the earth, taking place long after the mountain-building movements that gave rise to the Appalachian system.

Science News-Letter, November 24, 1928