SCIENCE NEWS

THE INTERIOR OF THE EARTH

Science Service

THE earth is built somewhat on the same principle as an old-fashioned metal-cored golf ball around which are wrapped several layers of lighter material ending in a thin surface crust. The metal core is pure iron or an alloy of that metal with nickel, according to a report to the Washington Academy of Sciences of Drs. E. D. Williamson and L. H. Adams, of the Carnegie Institution of Washington.

Discussing this report with a Science Service reporter, Dr. Adams said it was possible that the inmost core of the earth might be gold, or platinum, or other metals heavier than iron, but that it was practically certain that the center of the earth was an irregular sphere of iron about 4,200 miles in diameter. From the outer edge of this core, which is not sharply defined, to the surface is about 1,800 miles, and this distance is divided into three layers.

Next to the central iron core, Drs. Williamson and Adams relate, is a sort of mixed layer of iron and of rock, which extends with a gradually diminishing proportion of iron to within about 900 miles of the surface. Above this is a layer of rock, resembling that found at the surface but containing more magnesia and less silicates. Finally, there is the surface crust, about 35 miles thick, consisting essentially of the granitic rocks.

All this insight into the earth's anatomy is afforded through a study of the velocity of earthquake waves through the earth, mathematical considerations having to do with the mass of the earth as a whole, and a study of meteorites, whose average composition is believed to closely resemble that of the earth as a whole. For example, it is known that the density of the whole earth is about 5.52 times that of water, while the average density of the surface rocks is only 2.7. There must therefore be something heavier inside.

Pressure has something to do with that, as by squeezing the material of the rocks closer together it would make them denser, but the authors of the report state this would not be enough to cause such a great increase of density as is needed to explain the average density of the earth. The pressure at the center of the earth is calculated to be about 25,000 tons to the square inch.

A PORTABLE SEISMOMETER

Science Service

THE invention of a portable seismometer or earthquake measuring instrument, cheap, accurate and easily set up, was announced by Dr. Arthur L. Day, director of the Geophysical Laboratory of the Carnegie Institution of Washington, in a lecture before the institution on November 27. The new instrument will be used in a study to be made of earth movements in California. A specimen instrument exhibited at the lecture recorded the vibrations due to the movement of heavy trucks on the street outside.

The advance over the older type of seismometer made through the invention of this new type may be measured from the facts that the old type costs several thousand dollars, weighs tons and occupies a large amount of space, while the new instrument costs about $25 and may be quickly taken down and packed in an ordinary suitcase.

The principle of the new invention is the twisting effect of earth movements upon a piece of fine vertical wire to the middle of which is attached by one side a small weight. The ends of the wire are fastened to a framework which in turn rests upon a solid pier of masonry or other structure fastened securely to the earth's surface. Earthquakes move this framework while the attached weight remains still. This results in a twisting of the wire which is measured by the reflection of a beam of light from an attached mirror. A continuous record is possible by directing the beam of light upon a roll of photo-sensitive paper revolved by clockwork.

The apparatus itself seems extremely delicate to measure such a crude force as an earthquake. The wire is similar to the ordinary electric light wire filament and is about seven and a half inches long. The attached weight is a piece of copper about four fifths of an inch long and one tenth as thick, the mirror is about one sixth by one tenth of an inch.

Astonishing results have been obtained from the two of these little seismometers in use since last February in Pasadena, California. The Japanese earthquake was recorded in great detail from the beginning to the end. No little tremors in California go unrecorded. The device is sensitive to the passage of a street car at a distance of three quarters of a mile, while a railway train at a somewhat greater distance left a characteristic record.

Important practical applications are expected to follow the installation of numbers of these little instruments at different parts of California. It will easily be possible not only to record each quake, but to determine its direction and to track it to its lair. The machines may also be used for the recording of "artificial earthquakes" produced by the explosion in abandoned mines of left-over war explosives. Placed at varying and considerable distances from such explosions the record would be of great importance in determining little-known conditions in the deeper crust of the earth through which the waves would pass, conditions which might throw much light on the origin of quakes.

The instrument now in Pasadena accurately recorded a similar explosion 60 miles away last month when 115,000 pounds of blasting powder were set off at Palos Verdes.

Old fashioned seismometers or seismographs have been, because of their expense, rather a rarity in this country. With this new device it now becomes possible to set up a multitude of earthquake recording stations and to

broaden the knowledge of the earth's crust accordingly.

Incidentally, it becomes possible to take a moving picture of an earthquake wave. In experiments made at Pasadena, motion picture film was used to record the movements of the earth. While it was used no real earthquake occurred, but had one done so it would have been possible to have run the film through a projector and to have shown the sinuous vibrations on the screen. But it would be rather expensive and impractical to use film and to wait for days perhaps for a quake whose photograph was worth taking.

RADIO WEATHER REPORTS

Science Service

ORDERS have been issued by the U. S. Shipping Board to the masters of the 402 Shipping Board vessels directing them to take two regular weather observations daily and to radio them at once to the U. S. Weather Bureau which will make use of them in forecast purposes. They will also be furnished to foreign weather services.

The order is effective December 1, but applies only to vessels within certain specified areas. These are the Atlantic and Pacific oceans north of 10 degrees North Latitude, including the whole of the Gulf of Mexico and the greater part of the Caribbean Sea.

The messages will be sent to the nearest U. S. Navy Radio station when the vessel is within range of one. Ships near the European coasts will send their messages to Paris, whence they will be relayed to the United States. They will be taken daily at 7 A. M. and 7 P. M. Eastern Standard Time, which is one hour earlier than the observations are taken at the 200 North American stations of the U. S. and Canadian weather services.

The data which will be observed and sent in the coded message will consist of the height of the barometer and any unusual rise or fall, the temperature, the state of the weather, direction and force of the wind, the latitude and longitude; and following these a brief note in plain language whenever unusual weather is met or hurricanes appear to be forming.

Weather Bureau officials say that these messages will be of great assistance in forecasting for the continental areas of the United States and for Europe. More than that, it will be possible to give accurate forecasts for at least the main steamer tracks in the Atlantic, and, according to excellent authority, such a program will probably be undertaken by the United States Weather Bureau soon after the beginning of the year. These forecasts will not merely extend to the Grand Banks as forecasts do now, but will cover the entire track across the ocean and also on the southern routes as far as Bermuda and the Tropics.

COMMERCIAL AIRPLANES

Science Service

THE future of airplane transportation as an economic possibility depends chiefly upon an increase in traffic, resulting in lowered operating costs, says an exhaustive report to the American Society of Mechanical Engineers by Archibald and D. R. Black, airplane engineers. At the present time, they state, the field of the airplane is the carrying of mail and small packages. Passenger transportation will not be profitable until there are enough planes in continuous operation to bring operating costs down.

This number is set at 50 planes each way a day between two points as far apart as New York and Chicago. All estimates are made for night flying because this is necessary to compete with railroad service. The type of plane assumed was the ordinary biplane or monoplane with a 600 h. p. engine, and capable of carrying a load of about one ton at a maximum speed of 125 to 135 miles an hour.

The figures presented show a rapid drop in operating costs as the number of planes in service is increased, since the initial capital expenditure is high, being estimated at $1,690 a mile for the operation of one plane each way a day five days a week.

Increasing this headway to 50 planes each way daily would make possible the inauguration of a package service between New York and Chicago at a rate only slightly above the present express rates. Night letters might be carried distances up to 1,200 miles and delivered quicker than by telegraph, this service being possible at the present time. In fact, it is asserted that a package rate between New York and Chicago of $1.50 a pound would be possible with only a slight development of the business.

Commercial passenger traffic will have to wait until operations may be carried on with short headway, the report continues, giving the figure of 8.23 cents for the cost per passenger mile of fully loaded planes operating at the rate of 50 a day between New York and Chicago. This, the authors state, would be within competing distance of the extra-fare limited trains and the prediction is made that within 20 years at the utmost it will pay the railroads to undertake this service themselves in order to avoid competition from the air. Regular package service between New York and Chicago is predicted within the next two to five years.

MIGRATION OF STARLINGS

Science Service

THE English starlings of the northern states, after more than 30 years of residence, have finally learned to migrate. Huge flocks of these birds went south this fall, and will return with the coming of spring, as they did last year. They may truly be said to have been naturalized. Until recently, through sheer ignorance, they have had to adapt themselves to a climate wholly unnatural in its severity, for at home in northern Europe the species migrates regularly to southern Europe, and even to northern Africa, it is said.

Many of them have managed ordinarily to survive even the rigors of the New England winter, but only because they possessed much resourcefulness in snatching a living under most adverse circumstances. Many of them are still ignorant of the milder climate southward, in a land where food is plenty, and persist in making

their night winter quarters in the belfries of the steeples of cities and towns or more rarely in a country barn.

But doubtless these birds or their descendants will hear of the fairer land, and after a time the starling will be much less common in winter in the north. As it is, the winter population in the northern states is growing smaller and that of the middle Atlantic and southern states larger. The result should be a great increase in the starling population of America as a whole, for northern winters like that of last year kill off countless thousands of the birds.

The species may become the pest of which Europeans complain. Flocks grow to incredibly great size, even to hundreds of thousands, and when such a flock descends on orchard, vineyard or field, nothing remains for the owner. But on the other hand, there are records of insect blights, such as a plague of grasshoppers, being removed almost in a day by the coming of the starling hosts.

The starling has been a resident of the United States since about 1890, when half a hundred of them were released in Central Park, New York. They multiplied rapidly, and drifted into the surrounding country, and, as years passed, spread farther and farther in the country, until now they are common all through the east and the central states. Their first knowledge of migration, ornithologists believe, probably came from their contact with the flocks of blackbirds and bronze and purple grackles, with which latter species they are confused by many people, though they are easily distinguished by their yellow bills. They mingled with flocks of these and other species, and doubtless began to drift southward with them in the fall and back again in the spring.

THE EUROPEAN CORN BORER

Science Service

THE European corn borer, an undesirable immigrant which has already caused serious damage in a few widely separated parts of the east, has invaded New York City. This typical farm pest has apparently felt the lure of the bright lights and has established himself in that city, along the waterfront sections of Brooklyn.

Fearing that he may naturally feel like returning to the farm in the springtime and that he might invade some of the rich truck farming section of the Long Island suburbs, the U. S. Department of Agriculture is on his trail, and the second battle of Long Island in which a foreign invader is the enemy is about to begin. He will literally be fought with fire.

This latest invasion is believed to have been due to broom-corn. Last year the crop was short and much was imported from Europe where the corn borer is a serious pest. The imported corn was sterilized by steam, and no borers are believed to have got in through regular channels; but some bundles were broken in transit and were thrown overboard in the harbor, unsterilized. These are believed to have drifted ashore and started the infection.

The borer first arrived in this country a decade ago and has spread chiefly around Boston, in the upper Hudson valley, and along the shores of Lake Erie. In badly affected fields it may cause a loss of 15 per cent. of the crop. Other crops besides corn are affected.

While making his home in New York, the borer is dwelling in hollow-stemmed weeds which are quite favored by him. In these he passes the dormant larval stage during the winter, and upon this habit the warfare against him depends. The Department of Agriculture men will first mow and then burn all the weeds in the infected area, which is largely vacant lots.

The importance of the fight may be recognized even by those who think a farm pest in a great city nothing to worry about, when it is known that a few miles eastward out on Long Island one million bushels of sweet corn are raised every year.

ITEMS

Science Service

NAVIGATION lights on airplanes as well as beacon and boundary lights at landing fields were recommended by Lieutenants H. R. Harris and D. L. Brunner, of the U. S. Air Service, in a recent address before the American Society of Mechanical Engineers. In addition to these, parachute flares and hand flashlights or similar devices for signaling purposes were advised. The beacons at terminal landing fields should have a candlepower of at least 250,000, they stated, and illuminated wind cones should be provided at every landing field. With these aids, night flying could be carried on with safety and reliability.

INTEREST in projected super-power development in the northeastern states, with high tension electric transmission lines running from immense power plants at the coal mines to the great industrial centers, has overshadowed the real progress toward super-power development which has been made in other parts of the country. There are now only four gaps with a total extent of twenty-five miles in a continuous electric power system along the Pacific Coast from British Columbia to Mexico, a distance of 1,400 miles. Five of the southeastern states are included in another super-power development which furnishes hundreds of thousands of horsepower, and extensions are projected into neighboring states.

INSUFFICIENT sleep causes impairment of memory, according to recent researches on the subject of sleep by Professors Engelen, Frerichs and Weygandt. The memory becomes unreliable even if the shortage of sleep has occurred for only a short time. Eight hours is the average needed for sleep, but brain workers sometimes require more. A reduced period of slumber may be partly made up for by increased intensity, a short period of deep, undisturbed sleep having the same effect as a longer and lighter one. The investigators also conclude that brain workers need a month of rest every year and that even longer vacations do not cause a lessening of acquired abilities but rather an intensification of them.

THE finding of potash deposits in Czechoslovakia, which are estimated to contain at least 70 million tons, has been reported to *Industrial and Engineering Chemistry*, the publication of the American Chemical Society.