SCIENCE NEWS

Science Service, Washington, D. C.

TEMPERATURE OF THE INTERIOR OF THE EARTH

THE interior of the earth has cooled very little in the two billion years or so of the planet's existence. This was brought out in a lecture by Dr. L. H. Adams, of the Carnegie Institution of Washington, on October 27.

Yet in spite of its terrifically high temperature (well over 5,000 degrees Fahrenheit) the middle of the earth is not molten, as men once thought it was. It is prevented from melting because of the tremendous pressure, which at the center mounts to the unimaginable figure of 47,000,000 pounds per square inch.

The earth is made up of three concentric parts, like a baseball. At the center, corresponding to the rubber core of the baseball, is a core having the density of iron, and probably actually composed of iron or iron-nickel. This enormous mass of metal is plastic rather than rigid, and it is non-magnetic, so that it has no influence on terrestrial magnetic fields.

Next, in position comparable to the baseball's string winding, is an intermediate layer composed mainly of magnesium and silica in a chemical combination known to petrologists as olivine rock. Although this rock makes up the bulk of the planet's substance, very little of it is found at the surface.

Finally, there is a relatively thin outer layer or crust, corresponding to the horsehide cover on the ball. This crust is itself double, consisting mainly of granite on the outside, underlain with basalt.

Many methods are used by geophysicists and geologists in getting at the secrets of the earth's interior. Mountain ranges and deep canyons yield direct observational data on the outermost few thousand feet. Eruptive material from volcanoes gives samples from a little deeper down. Inferences can be drawn from the analysis of iron and stone meteorites, which are sometimes thought of as the shattered fragments of an older planetary system, and which in any case probably fairly represent the stuff the solar system in general is made of.

Of especial value are the records of earthquake waves as recorded on distant seismographs. The rate at which they come through the earth, and the apparent paths they take, permit legitimate inferences regarding the kinds of material they traverse and the physical states in which these materials exist.

FATIGUE IN METALS

How science is studying the x-ray "fingerprints" of metals in the hope of being able to forecast the failure of airplane propellers and other metal structures was described at the meeting on October 21 of the American Society of Metals at Cleveland, by Dr. Charles S. Barrett, of the department of metallury of the Carnegie Institute of Technology at Pittsburgh. Dr. Barrett explained that within limits, it is now possible to examine by x-rays a piece of metal suspected of fatigue and possible impending failure, and obtain some idea of the internal damage which has already occurred in it. A specimen piece of metal from an airplane propeller (for example) is placed in front of an x-ray tube and the piercing x-radiation passed through it. The little metal crystals bend the x-rays into a design named the Laue pattern after their famous European discoverer. The pattern, characteristic for each metal, looks like rings of tiny spots arranged in circles with somewhat the appearance of three rings.

Fresh new metal, which has never been stressed in actual use, shows one kind of Laue x-ray pattern and a similar piece of the metal, except that it has been in use, will show a slightly different pattern. This change in the x-ray "fingerprints" of metals with age is quite different from what happened to human fingerprints. From infancy to old age the pattern of fingerprints remains unchanged, and this is the basis of their use in identification and police work.

Where it is possible to have test samples of metal in the laboratory and have on record an x-ray pattern for varying lengths of metal life and fatigue, the state of another piece of metal can be compared roughly. In theory at least, if a piece of metal broke after 2,000,000 flexings with a load of 29,000 pounds to the square inch, and showed a characteristic pattern, it would be possible to tell roughly how near another piece of similar metal—used in an airplane propeller—might be to fracture and failure. Dr. Barrett pointed out that it is necessary to have some idea of the past history of the metal under examination.

RECENT ADVANCES IN PHYSICAL SCIENCE

AT the meeting of the physicists in New York City on October 29 and 30, which celebrates the fifth anniversary of the founding of the American Institute of Physics, atoms and atomic nuclei have a major share of attention on the complicated technical program. But the ways in which the apparently abstract science of physics touches the layman through its applications is receiving special emphasis.

Here are some of the things which physics has done in the five years since the Institute of Physics was created by the founding societies—the American Physical Society, the Acoustical Society of America, the Optical Society of America, the Society of Rheology and the American Association of Physics Teachers:

(1) The ancient alchemist's dream of converting one element into another by transmutation has been abundantly realized.

(2) Artificial radioactive materials have been made available which rival and even excel costly radium in the radiation which they produce. Machines which make this possible have directly brought about a drastic cut in the once-exorbitant price of natural radium.

(3) Studies in aerodynamics and the nature of light alloys have improved both speed and safety of air transport. Radio advances have brought the radio beam navigation to aviation.

(4) Studies in streamlining and the use of light metals have revived the railroads and brought the high-speed, light-weight trains.

(5) In water transport the use of infra-red beams enables navigators, for the first time, to penetrate the baffling problem of fog.

(6) Public health has been improved by studies of air contamination with city dusts.

(7) Refrigeration and heat insulation have aided health in quick freezing of foods and methods of vaccuum packing.

(8) Television has been brought to the threshold of accomplishment; economic problems are now more troublesome in this field than are the experimental difficulties.

WASTE PRODUCTS FROM PAPER MILLS AS FERTILIZER

LARGE-SCALE agricultural uses may be found for one of the most abundant and troublesome of industrial waste products, sulphite liquor from paper mills, as the result of investigations conducted in the U. S. Department of Agriculture by Dr. M. Phillips, M. J. Goss, B. E. Brown and F. R. Reid.

They found that by adding ammonia to either the sulphite liquor itself or to the dried residue left by its evaporation, and heating for several hours at the relatively high temperature of 220 degrees Centigrade, a nitrogen-containing product was formed that had fairly good properties as a fertilizer and soil conditioner. The ammoniated sulphate waste, however, does not produce as marked growth stimulation on test plants as did other crude fertilizers, such as cottonseed meal and dried blood. Sulphite liquor is the result of chemical treatment of wood, to dissolve out lignin, which is undesirable in paper-making, and leave the pure cellulose. The lignin, plus a number of other compounds which also come out in the liquor, constitutes about 50 per cent. of the total bulk of the wood. Yet the sulphite liquor containing it has continued to be a waste product, polluting the streams into which it is emptied.

Lignin is now considered to be one of the chief constituents of humus, the stuff that makes rich soils black, and renders them physically well suited for the growing of plants. Previous attempts to use sulphite liquor as a means for introducing lignin into soils needing humus have failed, principally because the raw liquor is poisonous to plants. But after ammoniation by the new process, it was found to be non-poisonous, and of at least moderate value as a fertilizer.

THE ISOLATION OF THE VITAMIN D

MARKED progress toward the isolation of natural vitamin D, an accomplishment that would be of incalculable value toward a better understanding of body processes, was reported to the meeting of the American Dietetic Association, at Boston, by Professor John W. M. Bunker, of the Massachusetts Institute of Technology. The work was done with the aid of short-wave radio.

This vitamin, best known for its ability to prevent and cure rickets, has been recognized for fifteen years but it has not been possible to obtain it in a state which is beyond all doubt free of contaminating and associated substances.

Working with Dr. Nicholas A. Miles, also of the institute, Dr. Bunker has been able to purify and concentrate a fish oil with the exceptionally high potency of ten million units per gram. Ordinary cod-liver oil, the most familiar source of the vitamin, has only two hundred and fifty units per gram, while even the best known commercial grades have only eight hundred and fifty units per gram.

Reporting attempts at the synthetic production of an antirachitic substance, Dr. Bunker stated that he and his associates have prepared a potent vitamin of this type by radio, as it were, utilizing the electromagnetic force of a short-wave radio to activate irradiated ergosterol, a less concentrated form of the vitamin.

From experiments with this and other derivatives, Dr. Bunker has concluded that there may be a multiplicity of antirachitic substances, each different from the other. These would include, he said, the natural vitamin D of fish liver oil; substances of the irradiated ergosterol type; irradiated cholesterol, another derivative, and a fatty acid fraction of milk.

There are still other rickets-preventing factors in the diet, Dr. Bunker said. The relation of phosphorous to calcium, for instance, is important, and so is casein. This is the principal protein in milk. Casein protects against rickets when it is the only protein in a diet which by all classical criteria should result in rickets. This holds good even when the imbalance between calcium and phosphorous is as great as eight to one and despite the use of the most rigorous purified casein obtainable.

PATENTS OF PLANTS

DESPITE the fact that over 200 plant patents have been granted by the U. S. Patent Office since such patents on flowers, fruits and vegetables became legal in 1930, the field of patented plants is virtually untouched.

Material prepared in connection with the coming Centennial Celebration of the American Patent System on November 23, shows this fact as a logical conclusion.

Here are some of the future possibilities of the effect of plant patents on everyday life: (1) Forest trees as an annual crop, like oats and potatoes. (2) Oranges and bananas grown outdoors in Maine. (3) Apples and peaches six inches in diameter. Such apparent fantasies appear remote at the present time, but much less so than the idea of the radio or airplane seemed to the old patent examiners in 1836, when the present patent system was just beginning.

Queen Elizabeth, it is disclosed, granted what were virtually the first plant patents—except in name—in the famous monopolies given to favored individuals for exclusive rights to flax, hemp, currants and medicinal and dye plants.

In the early American colonies monopolies of any form were extremely unpopular. Most of all, dislike was centered on any plant which was considered the gift of nature

for all to use as they liked. No one, at that time, foresaw possible research and invention aimed primarily at bringing new and different plant forms, intentionally and for profit.

Thus agitation for plant patents continued from 1868 until 1930 before it was finally enacted into law. Here are a few of the patented fruits, flowers and vegetables which you can buy to-day: Apple, apricot, avocado, blackberry, carnation, cherry, chrysanthemum, dahlia, gardenia, gladiolus, grass for gulf greens, grape, grapefruit, peach, pecan, plum, rose, strawberry and waterlily.

ITEMS

THE earthquake that shook Venice, Italy, on Sunday, October 18, did not register its occurrence on distant seismographs. The sensitive instruments in the United States, Canada and the Pacific area that usually pick up a really severe disturbance anywhere, no matter how distant, showed no trace of it. However, Venice could be really severely damaged by even a minor local earthquake, for the city is a veritable "set-up" for seismic trouble. It stands on a group of low, sandy islands off the coast, and this kind of shifting ground is exactly where an earthquake can play the most mischief. The constant additions to the sand and silt load on the sea bottom, brought down by the Po and the lesser rivers of the Venetian plain, are in themselves contributors to eventual earthquake disturbances. By lightening the load on the land, and increasing it on the sea bottom, they set up strains that in the end find their relief through earthquakes.

PACIFIC COAST winter weather during the coming season is expected by Dr. George F. McEwen, physical oceanographer of the Scripps Institution, to be slightly warmer than average, and from normally to slightly more than normally rainy. For a number of years, Dr. McEwen has been making forecasts for the winter season, based on offshore ocean temperatures and other factors. He has been successful in a high percentage of his forecasts.

AN apparatus making use of an "electric eye" to grade milk according to color was exhibited by Dr. John W. Bartlett, professor of dairy husbandry at Rutgers University, at the meeting of the International Association of Milk Dealers at Atlantic City. The apparatus is expected to help dairymen in their efforts to obtain, by suitable breeding, milk of the popular golden yellow color.

THE remarkable blueness of Crater Lake, in Oregon, is not due to anything dissolved in the water. On the contrary, the water of this lake is unusually pure and free from suspended solid particles, and the lake is unusually deep. The explanation lies in a multiple scattering of the light that falls on it, according to Dr. Edison Pettit, of the Mount Wilson Observatory, who made a study of the lake for the Carnegie Institution of Washington. In the process, the red and other colored rays are largely filtered out, and the blue-violet part of the spectrum comes to dominate.

THE birth rate in the United States continues downward, according to the latest figures analyzed by statisticians of the Metropolitan Life Insurance Company. The 1935 birth rate of 16.8 births per thousand population almost reached the all time low of 16.6 recorded in 1933. The slight rise in 1934 encourage the hope that the long downward trend and the threat of an ultimate declining population might be averted. The latest figures show that the 1934 rise was only a temporary deviation from the general downward trend of the birth rate. Each of 33 states and the District of Columbia, representing over half the country's population, showed a falling birth rate. Nine states which showed increases in 1935 were: Illinois, Michigan, Wisconsin, Arizona, Colorado, Montana, California, Florida and Mississippi. These states make up 21 per cent. of the population of the country. Canada is birth rate is declining even more markedly but this nation can better afford the decline as she has a somewhat higher birth rate than the United States. The Canadian birth rate for 1935 was 20.2 per thousand.

A NEW aid for architectural decoration in the form of a treated marble which reveals its sub-surface beauties and texture is on display in New York City. The product is claimed to be the first and only marble whose color and luminous qualities are the result of scientific selection and processing of the natural stone. It was developed by the Mellon Institute of Industrial Research, Pittsburgh, Pa., for the Vermont Marble Company. The problem set the research workers was to make a study of the calcite crystals, of which marble is composed, with a view to determining the particular type of crystal structure best adapted for transmitting light. This accomplished, the next step was to develop a method for processing the specially selected marble so as to obtain the most artistically satisfying effects of light and color. Six color styles are available: brilliant gold with brown markings, a rich deep red, clouds of soft green on a cream background, alternate bands and bars of green and cream, "sunset shades" crossed by bands of green, and the "light and dark wavy effects in striking contrast with crystal-clear areas of quartz."

A LIGHT-WEIGHT portable device that rings a warning bell or sounds a horn when deadly carbon monoxide gas gets too plentiful in an airplane cabin or cockpit has been perfected by S. H. J. Womack and J. B. Peterson, of the National Bureau of Standards. Recent tests show that very small amounts of the gas, contained in the exhaust of airplane and other engines, may be dangerous, particularly in high-altitude flying. Only five parts in 100,000 of air are permissible at an altitude of 15,000 feet. Earlier carbon monoxide indicators used commercially and by the U. S. Navy were modified and re-designed. The heart of the instrument is a cell containing a granular mixture of manganese dioxide and copper oxide, which changes the carbon monoxide into carbon dioxide with generation of heat. Accurate measurement of heat rise indicates the amount of the gas present. The National Advisory Committee for Aeronautics has made public the results of this research.