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THE CHICAGO MEETING

ALL patents and secret commercial processes must be foregone if the present industrial countries are to keep ahead of the Soviet Union in the race for the highest standard of living. This theory was advanced by Dr. A. P. M. Fleming, of the Metropolitan-Vickers Electrical Company of Manchester, England, at an engineering meeting of the American Association for the Advancement of Science. Since the social-economic problem of unemployment is world-wide except in the U. S. S. R., and the major portion of the blame can be laid to our modern scientific industrial system, Dr. Fleming believes that the solution lies in a removal of the barriers that impede the flow of all commercially useful information. The effects of applying science to industry and its bearing on unemployment are twofold. By improving the efficiency of industrial processes it reduces the necessity for manual labor, and conversely it creates new industries to reduce the number of unemployed. International pooling of scientific facilities are necessary to help to destroy this burden on all industrial centers. The U. S. S. R. contains within its boundaries most of the natural resources necessary for a very high standard of living. That country has organized its scientific activities under a central bureau, and expects science to play a leading rôle in its industrial and economic activities. "Whether the Soviet plans succeed or fail," Dr. Fleming said, "already enough has been accomplished to show the possibilities of this combined scientific effort. Even partial success may have far-reaching effects on the rest of the industrial world."

DEAN DEXTER S. KIMBALL, of the Cornell University College of Engineering, speaking before a joint meeting of several engineering and economic societies, pointed out that engineers of the future must also be students of economics if they expect to develop their fullest usefulness, and that if the engineer is to be an important figure in public affairs he must acquire a broader technique than that which he ordinarily possesses, and he must inform himself concerning a wide range of subjects of which ordinarily he knows little. Furthermore, he must acquire a wide knowledge of economic history and be able to trace the effect of economic changes over long periods of time. The broad economic problems that now trouble us are not isolated and circumscribed in character; most of them have long histories and many ramifications. It is true that some of the old economic theories developed in a handicraft age do not apply to our modern machine era, and the industrial engineers can do much to show their fallacious character. But on the whole the engineer who aspires to solve modern economic problems must expect to do an unusual amount of studying before he can replace these old theories with others that are suited to our day and methods.

PLANT cells resist the attack of fungi or other parasites by producing phenolic compounds, which are chemical relatives of carbolic acid. The invading threads of the parasite can break through these defenses of its victim, or "host," only if they do so before the surrounding cells have time to prepare their chemical warfare weapons. This secret of local immunity to parasitic attack in plants was explained by Dr. Jean Dufrénoy, of the Plant Pathology Station at Brive, France. Plants without resistance to parasite attack display two modes of behavior in their cells. Those of extremely susceptible plants apparently adopt a Pollyanna slogan of "business as usual," and do nothing about the invasion. The parasite simply makes itself at home, and spreads to other cells. Cells of plants still susceptible, but not on the extreme order, show a curious reversion to an infantile, or rather an embryonic, physiology. They cease to be able to form foods or to secrete other substances, and they convert into soluble form the food materials already present. This reversion to an embryonic condition is always signalled by the formation of many partitions of protoplasm, dividing the sap cavity or vacuole into many lobes or alcoves.

THE Wegener hypothesis, which holds that all the continents of the earth were once united in a single great land mass and subsequently drifted apart, received a hard blow at the hands of Professor Ludwig Diels, of the University of Berlin, who spoke before a meeting of the Botanical Society of America. Since Europe and North America are supposed by the theory to have lain edge to edge, back in the days of the dinosaurs, it would be reasonable to expect European and eastern American plants to be alike. But the only plants the two areas have in common are the ones that also grow all the way around the northern hemisphere. Distinctive things like magnolias and sorghum trees, that grow in the southeastern states, occur again not in Europe, but clear on the opposite side of the earth, in southeastern China. Other botanical reasons for doubting the Wegener hypothesis were also advanced by Professor Diels.

FROM the latest atom smashing comes proof that Einstein was right when, years before he introduced relativity, he formulated the law that mass and energy are interchangeable. Using the world's largest mass spectroscope, a kind of atom analyzer, Dr. K. T. Bainbridge, of the Bartol Research Foundation of the Franklin Institute, weighed with extreme accuracy the newly discovered heavy-weight hydrogen and the two varieties of lithium atoms. The atoms weigh only about one millionth of one millionth of one millionth of one millionth of an ounce and Dr. Bainbridge's mass-measuring spectroscope with its two-ton magnet weighs them to an accuracy of one part in ten to thirty thousand. He used these weights in computations based on atomic disintegration experiments made during the past year at the Cambridge Cavendish Laboratory, at the University of California and at Paris. Dr. J. D. Cockcroft, present at the meeting, was de-

lighted to learn that the atom rearranging he did with Dr. E. T. S. Walton in Cavendish Laboratory last year upholds the Einstein law. Hydrogen hearts of protons were hurled at atoms of lithium isotope seven, and two alpha particles, or helium nuclei, flew off. Dr. Bainbridge's figures show that the mass lost was transformed into energy as the Einstein law requires. Similarly, Dr. Bainbridge showed that the California experiments of Drs. G. N. Lewis, M. S. Livingston and E. O. Lawrence, in which lithium was bombarded with heavy hydrogen, and the Paris experiments of Dr. Irene Curie and Dr. G. Joliot, in which lithium was bombarded with helium, also satisfied the Einstein theoretical relation of mass and energy. Dr. Bainbridge concluded that the new weighing of the neutron shows that it is slightly lighter than the light hydrogen atom. Its weight is 1.0065 while hydrogen's weight is 1.0078.

CHEMISTRY'S 93 elements are still but ninety-three in number, but many of them have developed what a biologist would call subspecies or varieties as a result of recent research. That is, a given element that used to have only one atomic weight assigned to it now proves to be a mixture of atoms of several different atomic weights, usually fairly close together. Such elemental varieties the chemist calls isotopes. Professor Fred Allison, of the Alabama Polytechnic Institute, spoke of his use of a method of his own invention, the magneto-optic method, for detecting isotopes when they are present in exceedingly minute proportions. The magneto-optic method consists essentially in shooting a ray of light through a solution of the material to be tested, and then suddenly slamming on a powerful magnetic field. The light, which is in the state known as polarized, is rotated more or less, according to the composition of the solution under examination. Using this method, Professor Allison has discovered that the light metal beryllium, which may some day become as familiar as common aluminum, is made up of two isotopes. Mercury is shown to have twelve isotopes, three of them hitherto undetected by previously used chemical methods. And there are no less than fourteen isotopes of zinc.

EARTH-MATERIALS under extremely high pressures, such as they have to endure at considerable depths in the earth's interior, act structurally much as they would if subjected to high temperatures. This is one of the results of x-ray investigations of matter at high pressures reported by Dr. Willi M. Cohn, of Berkeley, California, before the meeting of the American Physical Society. In a special apparatus, it has been made possible to attain pressures as high as 3,000 atmospheres, or 45,000 pounds per square inch. Of course, to obtain such pressure it is necessary to make the metal walls of the cylinder thick and exceedingly strong. This would of necessity interpose a very difficult barrier to the passage of x-rays by means of which the materials under pressure are to be studied. This difficulty is avoided by setting a window of beryllium, a very light but very strong metal, on the side where the rays are admitted. Opposite this window, on the "exit" side, is a second window of glass or bakelite. Behind this the photographic plate is placed. Photographs of the minute structure of the materials under study, made with x-rays both before and after the pressure is applied, give patterns from which it is possible to deduce the physical changes taking place.

VARIABLE stars, which shine brightly for a given period and then become dimmer for a time, have a second and invisible variability, at least in certain types of such stars, according to Dr. Edison Pettit and Dr. Seth B. Nicholson, of the Mount Wilson Observatory of the Carnegie Institution of Washington. They have trained exceedingly sensitive instruments, attached to telescopes, on a number of variable stars of one special type. Although such stars get hotter as they grow brighter, and cooler as they grow dimmer, nevertheless when the total amount of radiation, visible and invisible, is measured, the time of maximum radiation is found to lag appreciably behind the time of maximum brightness.

How the old trick of bending a wire or a piece of tin back and forth until it finally breaks is used scientifically to test the strength of steel and other metals was described before the meeting of the American Society for Testing Materials. Professor H. F. Moore and H. B. Wishart, of the University of Illinois, told of a new method for determining the endurance limit of samples of rail steel and similar metals. Short strips of the metal are placed in a machine that will bend them back and forth 1,500 times a minute. The machine is left running all night, so that by morning the samples have been put through 1,400,000 cycles of bending. In the morning the samples are taken out and put in other machines that pull them until they break, at the same time measuring the tension necessary to pull them in two. Really good metals often have their tensile strength actually increased by the long siege of bending back and forth. But hidden flaws or faults in the metal will start cracks, and the sample will either be found broken at the end of its back-and-forth bending ordeal, or will pull in two relatively easily in the tension machine.

AT the same meeting, R. L. Templin, research engineer of New Kensington, Pennsylvania, told of similar testing machines that have been devised for studying "fatigue" in aluminum and light-metal alloys. These require a great deal more of the back-and-forth bending than do steel samples: 500,000,000 cycles of it are necessary for most of the light alloys. Another endurance test described by Mr. Templin is performed on light-metal wires and cables such as are used in aircraft construction. Long samples of these are placed under known tension and "wobbled" up and down by electrically driven machinery until they break. An automatic registering device counts the number of vibrations, and stops when the specimen at last gives way.

CADMIUM, a metal now well known only to chemists and metallurgists, may join chromium, tungsten and aluminum in the procession of metals that have marched out of the scientific laboratory into the rank-and-file familiarity of daily common use. C. E. Swartz and A. J. Phillips, of the American Smelting and Refining Company, Maurer, New Jersey, told of their researches on

babbit metals for engine and other machine bearings that must work at high temperatures. They found that by substituting cadmium for tin as a base in such metals they could build bearings that will operate satisfactorily at temperatures up to 570 degrees Fahrenheit. These bearings were not brittle, and they were soft enough so that they would not scratch the mildest of steel shafts.

To avoid leaky walls, use absorbent, "soaky" brick and make the mortar joints thin. These recommendations were made by Professor W. C. Voss, of the Massachusetts Institute of Technology. The brick should be able to absorb from 5 to 10 per cent. of its weight in water in two days; and most of this absorption should take place in the first ten minutes of soaking. The bricks' ability to "drink water" insures good bonding with the mortar, making the wall into practically one solid piece. There should be some lime in the mortar to insure this action, Professor Voss recommended. Brick structures are commonly thought of as being stiff and unyielding, and likely to crack suddenly under heavy loads. Yet brick masonry beams built and tested under the supervision of Professor M. O. Whitney, of the University of Wisconsin, showed astonishing degrees of flexibility. The bricks are laid in a mortar containing a high proportion of Portland cement, on various types of steel framework, which served as reinforcement after the masonry beams had solidified.

YELLOWSTONE PARK hot springs deposit travertine, a limestone-like substance, containing minute quantities of radium. The amount in a given deposit varies according to its age. Professor Herman Schlundt, of the University of Missouri, told of studies that have enabled him to estimate the ages of some of the hot springs formations at Mammoth Hot Springs, the park headquarters. Minerva Terrace, Hymen Terrace and Pulpit Terrace, now active, are very young—not much over one hundred years. Liberty Cap, the cone of an extinct hot spring, is about 2,500 years old. Hotel Terrace, a long-extinct hot springs area, is estimated to be about 3,200 years of age. Behind all the present and recent hot springs formations rises Terrace Mountain, which has ancient extinct hot springs at its top; these springs are estimated to be more than 14,000 years old.

WITH a thermometer in the depths of a Wisconsin copper mine as their "calendar of prehistory," two geologists have estimated that the last ice age withdrew from northern Wisconsin twenty to thirty thousand years ago. The scientists, Drs. W. O. Hotchkiss, president of Michigan College of Mining and Technology, and L. R. Ingersoll, of the University of Wisconsin, told how they obtained their data and made calculations. The new figure is much less than the estimated period since the Niagara Falls region was free of a continental glacier. It is greater than the seven or eight thousand years European geologists have determined from studies of layers of sediment as the time since the retreat of the last ice sheet from parts of Norway and Sweden. But it does agree roughly, as geological time is approximated, with the dates set for the retreat of the last great ice shelf from Europe and North America. The temperature measurements, which were made at levels 500 feet apart to a depth of one mile, also indicate that the melting of the ice "was followed, perhaps after several thousand years, by a period distinctly warmer than the present, which was succeeded in turn by one slightly cooler and lasting until rather recent times." Only the average temperature of the ground varied in this manner, it was pointed out, while the average air temperature could have been different. The calculations depend on the assumption, which geologists consider reasonable, that the last ice sheet covered the site of the measurements for about 50,000 years. In this time it would have cooled the ground to the same temperature throughout the mile depth in which measurements were taken.

PLANTS could use more of the light the sun sheds on them if they had more carbon dioxide to work on. They are in the position of factories with plenty of power available but not enough of raw material. Mr. Hoover and his colleagues in Washington have been shining light of various colors and known levels of energy on wheat plants, giving them various concentrations of carbon dioxide in the air supply, and measuring the rates at which they use it up. They found that wheat plants use red and yellow light with about equal efficiency, violet light with much less—only about thirty per cent. of the red. They found also that plants would use as much carbon dioxide as they could get, making it over into food and plant tissues. At the same session, Professor Ernest Shaw Reynolds, of the Missouri Botanic Garden, St. Louis, told of the effects of radiation on growth. Plants are not "just plants," he warned, and the results you get from a given experiment on a wheat plant can not necessarily be assumed to be true for a bean. Nor can it be assumed that because a plant responds in a certain way to light or other stimuli while it is young, it will respond in the same way when it is older.

ELECTRICAL instruments so delicate that they will register a millionth of a volt are being used to explore microscopic areas of the brain, according to Professor C. Judson Herrick, of the University of Chicago. Information thus obtained is expected to revolutionize our whole knowledge of the way the human mechanism works. Professor Herrick ventured the prediction that "the electro-biological era now beginning will yield as revolutionary changes in our conceptions of the physiology of the nervous system as the invention of the microscope inaugurated in anatomy." There are from ten to fourteen billion nerve cells in the cerebral cortex—the part of the brain with which we think—and they are arranged in definite patterns. It is the little electric currents that flow from cell to cell and from group to group that the new electrical methods are measuring. This new knowledge of inter-cell telegraphy in the brain promises to yield positive results in understanding differences in behavior between man and his evolutionary cousins, the higher apes, and among the human races themselves, that the older methods, which depended on the study of the grosser features of the brain, could only block out roughly.