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ENGINEERING AND THE EVOLUTION OF SOCIETY

IN man himself, and in his behavior as a unit in the great superorganism into which society is developing, lies the chief obstacle to future social evolution. This was the keynote of an address given in New York on February 15 by General John J. Carty, vice-president of the American Telephone and Telegraph Company, in accepting the John Fritz Medal of the American Institute of Electrical Engineers. Only by adequate support of scientific research, he declared, can the human obstacle be surmounted.

"If seeking the truth and applying the truth to the affairs of men, is a spiritual thing, then the engineer must be absolved from the charge of materialism," said General Carty. "He is an advocate for truth. His works must be tried in the inexorable court of nature, where no errors are committed and no exceptions granted. The work of the engineer is dedicated to the use of mankind, and the pecuniary compensation which he himself obtains is slight compared with the great benefits received by society."

Future evolution of present-day man into a superman, even if it should occur, will be too slow to be of any immediate benefit. There is another kind of evolution that is preeminently under the control of the engineer. Quoting Professor E. G. Conklin, Princeton University biologist, General Carty pointed out that "the evolution of man, the individual, is no longer limited to his body or mind; but by adding to his own powers the forces of nature, man has entered upon a new path of progress. The differentiations of various members of a colony of ants or bees are limited to their bodies and are fixed and irreversible. But in human society, differentiations are no longer confined to the bodies of individuals. Although he is not as strong as the elephant, nor as deft as the spider, nor as swift as the antelope, nor as powerful in the water as the whale, nor in the air as the eagle, yet by his control of the forces of nature outside his body, man can excel all animals in strength and delicacy of movement, in speed and power, on land, in water and in air.

"The true object of engineering is not to create machines to which man would be bound by the chains of necessity, or mechanisms to which they would become slaves. The mission of the engineer is to obtain such a mastery in the application of the laws of nature that the forces of the universe will be employed in the service of man.

"The use of the spoken word to convey ideas distinguishes man from all other created things. It is the function of the engineer to provide for the extension of the spoken word by means of electrical systems of intercommunication which will serve to connect the nervous system of each unit of society with all the others, thus providing an indispensable element in the structure of that inconceivably great and powerful organism which I believe is to be the ultimate outcome of the marvelous evolution which society is to undergo.

"There is one element, and only one, which stands in the way of the realization of this inspiring vision. That is man himself, for he is the unit or cell out of which the new organism is to be evolved.

"Already, the applications of science to human affairs have far outrun the ability of man to use them wisely. The engineer has provided agencies of incalculable value in time of peace, but they are also endowed with prodigious powers of destruction which can be loosed in time of war. Unless we solve the problem encountered in man himself, the outlook is dark indeed, and it may even be questioned whether our civilization will endure. Human behavior presents the most formidable and the most important problem of all the ages. Its solution can be achieved only by concentrating upon it all of the knowledge and wisdom and resources at the disposal of man."

GEOPHYSICAL EXPLORATION FOR ORES

PROBING into the depths of the earth, inaccessible to the miner's eye or drill, the geologist is now determining the location of valuable oil and minerals through the use of instruments and methods that up to a few years ago were not known outside of scientific laboratories.

Engineers, gathered in New York City for the sessions of the American Institute of Mining and Metallurgical Engineers, discussed the application of these modern "divining rods" to the discovery of new mineral riches.

Gullible miners and landowners have been fooled and humbugged in past years by unscientific diviners who claimed to be able to locate hidden oil, coal and minerals by rods or devices that they held in their hands. Farmers have hired these rural mystics to determine where to dig wells. Such methods of prospecting have been discredited. Through the use of the principles of physics, however, the geophysicist has realized the wishful claims of the impostors and now by an array of complicated instruments can advise the mining engineer where to drill or dig in order to try for oil or metal.

Prospecting by geophysical methods is possible because the rocks and other deposits in the earth have different physical properties which can be detected by suitable apparatus at the surface, according to Dr. Hans Haalck, scientific expert for German and American exploration companies, speaking before the meeting. Geophysical prospecting is now possible practically by gravimetric, magnetic, seismic and electric methods.

Masses of light or heavy materials within the earth affect the gravitation of the earth nearby and can be detected with a pendulum, or gravity balance, like the Eotvos torsion balance. Such information about internal

structure aids the geologist to determine where to drill for oil, for instance. Various kinds of rocks have different degrees of magnetization and consequently vary the magnitude and direction of the earth's magnetic field. Refined forms of the compass and similar instruments allow the geologist to measure any magnetic irregularities and speculate upon the cause.

Artificial earthquakes can be caused by small explosions and recorded on seismographs in order to determine the difference in elasticity of the underlying rocks. This information gives clues to mineral deposits and formations in some instances. Electric currents passed through the earth sometimes give valuable information since different kinds of rocks have different conductivities. Other methods not yet in wide practical application include: Radioactivity measurements, transmission of radio waves, temperature records, measurement of natural earth currents, etc.

President Max Mason, of the University of Chicago, was among those who spoke on geophysical exploration for ores, and other reports revealed that the new methods are being used for oil prospecting in the mid-continent fields, in the lead and zinc district of Missouri, Arkansas and Oklahoma, in England, in the Lake Superior copper country and elsewhere.

SCIENTIFIC METHODS IN THE STEEL INDUSTRY

THE city of Youngstown, Ohio, to-day lies in the midst of one of the greatest industrial battles in years—the battle iron and steel manufacturers are waging to retain a reasonable margin of profit. In this struggle, scientists are bringing forth many new ideas as weapons against loss. Some of their ideas, if successfully applied, may revolutionize the whole industry. Others seek to cut off a cent from the cost here and another cent there and little by little to keep the production cost down.

Much money is spent by the industry for improvement. Unfortunately, in some instances cost of production is advanced so rapidly by adverse economic conditions that the profit gained through improvements can hardly keep abreast.

It was said that one of the most substantial improvements made recently lies in the use of electricity as a source of motive power. The Youngstown Sheet and Tube Company is installing high pressure boilers to run electric generators at a plant in Ohio. The boilers will be fired by the waste gas from coke ovens. Electric motors used for driving rolling mills, conveyors and other machinery are more economical because they permit the operation of one unit at a time. They increase the flexibility of the mill operation and thereby save time and labor, it is said.

Plants located near sources of water-power are calling upon it to furnish electricity for more economical operation.

In the struggle against advancing costs, iron and steel manufacturers are adopting a more diversified output. They are taking advantage of the fact that if the market for rods and strips slumps they can keep their mills going by turning out tinplate.

Chemists and metallurgists are eyeing the blast furnace critically. "This business of shipping iron ore down here from way out in Minnesota seems to be a waste of money," say some, "Why can't we ship iron down here instead of ore with all its impurities?"

With the use of the blast furnace, iron and steel plants must have a means of manufacturing coke. This entails the operation of a gas plant in most cases. The University of Minnesota has been experimenting with the combination of gas plant and blast furnace. They mix the ore with coal and put the mixture into a coke oven similar to those used in the manufacture of coal gas. They heat the mixture. The iron comes out in a crumbly form and is pressed into cylindrical blocks for shipment to steel plants. It is declared that iron produced in this manner near where it is mined costs a few cents less after shipment to Pittsburgh than iron manufactured in blast furnaces at Pittsburgh.

A process similar to this for the elimination of the blast furnace is being tried by the United States Steel Corporation in its plant at Lorain, Ohio. Metallurgists are reluctant to predict how successful this experiment will be.

More economical methods in the use of fuel are being sought. It has been found that the admonition "cleanliness is next to godliness" holds true in the manufacture of iron and steel as well as in human life. More care is being taken with the cleaning of coke before it goes into the blast furnace. Cleaning of coke eliminates ash. As little as one per cent. of ash taken from the coke takes twenty cents off the cost of production of pig iron.

Attention is being given to purifying the gas from the blast furnace of all particles of dust. Some plants have installed electric precipitators across the path of the gas. The dust particles become charged electrically and can no longer be carried along by it.

Manufacturers are seeking greater fuel economy in the open-hearth furnace where the greatest steel tonnage is manufactured. Before gas and air in this furnace reach the charge that is to be melted down, they pass through heated chambers stacked with fire-brick. These chambers comprise the regenerator. In an effort to make the operation of the regenerators more efficient, the bricks are being stacked in new arrangements to get as much heating surface as possible in a small space. Bricks made of carborundum, which will withstand a higher temperature, also are being tried.

Engineers who have many problems to solve in the rolling mill have not been idle. The United Engineering and Foundry Company, at Pittsburgh, has perfected mills for the continuous rolling of sheet metal. Heretofore, rolling has been a comparatively slow process. The metal has had to be sent through the mill to be rolled for one thickness, backed up and rolled again if a greater degree of thinness is desired. One of the new continuous rolling mills will take a 63,000-pound ingot 8¾ inches thick and roll it down to a sheet of No. 20 gauge metal 41 inches wide at the rate of a ton a minute.

MULTIPLE WALLS FOR THE ABSORPTION OF SOUND

MULTIPLE-LAYERED walls are the most efficient absorbers for deep musical sounds, Dr. E. C. Wente and E. H. Bedell have discovered as a result of experiments at the Bell Telephone Laboratories.

Radio studios, auditoriums and other places, where echoes are troublesome and must be carefully controlled, can be made to have better acoustic properties through the use of a thin, perforated partition, set a short distance out from the main wall.

Formerly such sound studies had to be made in a large room, with good-sized pieces of the material to be tested. Dr. Wente and his associate have invented a way of testing in a small tube, and they claim that it gives results as satisfactory as with the older method. At one end is a telephone receiver to furnish the sound of any desired pitch. Sliding in the other end is a piston, with which the material undergoing test is covered. The echoes formed are studied with a still smaller tube that goes into the main tube at the end near the telephone receiver. On the outside, at the end of this small tube, is a telephone transmitter with which the sounds can be picked up and analyzed.

Sounds of high pitch are largely absorbed by layers of felt, porous "acoustic tile" or wood fiber mixed with felt. Deep or low frequency sounds pass through rather easily. But if the wall is covered with felt, and then, an inch away, a piece of perforated building board is placed, the low frequency sounds are much more completely absorbed. Still better is the effect of two layers of building board, with two air spaces.

Somewhat similar to this is the method recently adopted by engineers of the National Broadcasting Company in designing the new studios of station WRC in Washington. In order to make a sound-proof window between the studio and the control room, three layers of glass of different thicknesses are used. Each piece has its natural frequency, and sounds of a similar pitch would be transmitted. But sounds that get through the first layer are stopped by the second, while any that might still leak through are stopped by the third.

THE TRANSPLANTATION OF SMELT

THE transplanting of fresh-water smelt from eastern Maine to the waters of Idaho is planned in an experiment now being tried out by the United States Bureau of Fisheries, the Forest Service and the Idaho State Game Commission.

Smelt is the natural food of the land-locked salmon, and the object of introducing the Maine smelt in Idaho is to produce an abundant and suitable forage fish to serve as food for salmon and trout. The smelt live principally on minute forms of life which ordinarily occur in abundance in deep-water lakes and turn this into a readily available trout food. Salmon has been introduced in the Redfish Lake section of Idaho, and it is believed that the planting of the smelt will make favorable results much more certain.

The smelt, ordinarily growing to about six inches in length, is remarkably prolific and runs in large schools in the deep waters of the lake. In the early spring these little fish ascend inlets to spawn, the spawn being very minute and adhering to rocks and sticks. The eggs develop readily and hatch in from two weeks to a month, the tiny young migrating immediately to deep water.

The main difficulty encountered in transplanting this fish from the East to the Far West is due to the rapid development of the eggs. The eggs to be shipped to Idaho will be surrounded by a layer of ice and packed in an insulated box, for sending by express. If this method of transportation is not successful, it is planned to attempt a small shipment by air mail.

ITEMS

A NEW type of loud-speaker, that can give out sounds 300 times as loud as any of the older types, has been invented by engineers at the Bell Laboratories. However, there is no danger that this will form a new source of annoyance to apartment-house dwellers, for the horn is so large that it is not adapted for use with ordinary radio sets. It is intended particularly for out of door public address systems, and for talking motion pictures in large theaters. The new device is the invention of Dr. E. C. Wente and A. L. Thuras. It employs a moving coil, in which the entire electromagnet that all such sound reproducers contain, moves back and forth according to the current flowing through it. In small speakers, the magnet is fixed, and moves a small armature attached to the vibrating diaphragm from which the sound waves start. This is not new, but Dr. Wente and his associate have worked out improvements in the design, and in the way the diaphragm is connected to the horn. As a result, 30 watts of electrical power can be used in the horn, instead of about 5 watts, the previous maximum. Its efficiency, in converting this electrical power to sound, is about 50 times greater than older speakers, so that good reproduction can be obtained about 300 times as loud as formerly.

THE only case of rickets that experts from the U. S. Children's Bureau found in a recent survey of 600 Porto Rico babies was in an infant that had spent five of its six months in a cellar lighted only by electricity. The survey was undertaken under the direction of Miss Grace Abbott, chief of the bureau, to determine the effect of the tropical sun on rickets, the disorder of the mineral chemistry in the bodies of young children that is prevented by the action of ultra-violet rays. It is especially desirable, Miss Abbot pointed out, to have a series of X-ray pictures of the bones of babies who live in the tropics, because they normally spend most of their waking hours with their little bodies completely exposed to the beneficial action of the sun. The photographs will be used to compare with those of children in temperate climates so that some sort of a standard can be obtained of what the healthy bones of a growing child should look like.