SCIENCE NEWS

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THE SIMULTANEOUS CALCULATOR

A ONE-TON machine that in a single action can solve nine simultaneous equations with nine unknowns so complicated in form they might well require days of laborious computation by trained mathematicians has been developed at the Massachusetts Institute of Technology. Known as the simultaneous calculator, the machine is the product of three years' research by Dr. John B. Wilbur, of the department of civil engineering. Cooperating with him has been Dr. Vannevar Bush, vice-president and dean of engineering, who, under the program of the institute to eliminate delay and complications in engineering and research, has previously made important contributions to the mechanical solution of mathematical problems, including the differential analyzer.

The simultaneous linear algebraic equations solved by the new machine occur constantly over a wide range of engineering and scientific analyses. Thus although it was originally designed for the solution of problems in civil engineering, such as those involved in the construction of skyscrapers, it is expected to prove equally useful in such diverse fields as nuclear physics, geodetic surveying, genetics and psychology. The mathematician will be able to use it for the evaluation of determinants especially and in several other fields, since the machine under some circumstances can solve for even more than nine unknowns.

The machine weighs approximately 2,000 pounds and has more than 13,000 separate parts, including 600 feet of flexible steel tape and almost 1,000 ball-bearing pulleys. The outgrowth of an experimental model built by Dr. Wilbur two years ago, the new machine has undergone exhaustive tests and is now in active operation.

The simultaneous equations which constitute the basis of the machine's operation are mathematical expressions relating a number of unknown quantities in such a way that the value of each unknown may be determined by a simultaneous consideration of the relations involved as expressed by the equations. In the design of a suspension bridge, for example, the stresses on each part depend on the stresses on other parts. In addition, each of these stresses depends on the physical elastic properties of the parts themselves. Yet the value of the stresses can be calculated by solving a set of simultaneous equations which show the relations between these various stresses. In the usual analytical solution this process involves considerable laborious manipulation of the factors. With Dr. Wilbur's new machine, however, it is necessary only to set a series of tilting plates to account for the various coefficients and constants and a single movement of the mechanism performs in a few seconds computations that might take days by ordinary methods.

Construction was made possible by a fund established by Sir Douglas Alexander, of New York City.

THE SHORTEST CONTINUOUS RADIO WAVES

THE shortest continuous radio waves ever produced are being used in experiments at the University of Michigan. According to the report of Drs. C. E. Cleeton and N. H. Williams, of the department of physics, they are only 6.4 millimeters (about one quarter inch) in wavelength. So tiny is the tube used to generate the waves that it is assembled under a magnifying glass and its outside dimension is less than one quarter of an inch. Radio radiation generated by the equipment is being used for studies of the molecular structure of gases including water vapor. The minute rays have many of the properties of light and travel in straight lines when focussed by a concave mirror. Pieces of black paper, hard rubber and wood are transparent to the rays.

The possibility of using them for communication purposes is remote, since they are rapidly absorbed by the water vapor in the atmosphere. It is by a study of this absorption that new facts may be learned about the molecular makeup of water vapor. The 6.4-millimeters radio waves represent about the limit of radiation which can be produced from vacuum tube sources. To get shorter waves the dimensions of the radio tube must be decreased and this ultimately becomes a mechanical impossibility. For waves shorter than six millimeters it is necessary to use either the radiation from a quartz mercury arc lamp or spark sources in air. The wavelength region from one tenth millimeter to six millimeters waves is about the last untapped "no man's land" of infra-red research, for only a few isolated measurements have as yet been made in this region.

NEW APPARATUS FOR OBTAINING SAMPLES OF DEEP OCEAN BOTTOM

SAMPLES of ocean bottom gouged out of ten feet of solid mud or silt by a new type of apparatus have been undergoing analysis at the Carnegie Institution of Washington. They are expected to tell new stories of the geological and biological history of the depths, hitherto hidden because no previously existing form of apparatus could do more than scoop up a superficial handful of material from the ocean floor.

The device, called a core sampler, has been developed in the laboratories of the Carnegie Institution by Dr. Charles A. Piggot, of the Geophysical Laboratory. It consists of a short, thick-walled cylinder with a plunger that can be driven forward by a charge of cannon powder. Attached is a ten-foot tube of tempered steel, which is called the bit. When this sampler comes into contact with the bottom, the powder is exploded and the bit is driven into the ocean floor, gouging out a sample as a watermelon plugger takes a sample of the fruit into which it is plunged. The bit is lined with a thin brass tube, which is removable. The ocean bottom sample remains in this, to be corked up and filed away for study in the laboratories on shore. A new lining is shoved into the bit, the powder chamber in the gun reloaded, and the sampler is ready for use.

The first real deep-water samples were taken during the oceanographic season just closed, through the cooperation of one of the great commercial cable companies, which had to send out a powerful repair ship, the *Lord*

Kelvin, to mend a break in a trans-Atlantic cable. Because of the ample deep-water gear carried by this vessel, and its ability to "maintain station" at sea in any weather, and particularly because of the skill of its specially trained Nova Scotian crew, it was possible to obtain eleven samples of Atlantic Ocean bottom at depths ranging up to 2,640 fathoms, or three miles.

CANCER GROWTH CHEMISTRY

CANCER tissue, contrary to generally held opinion, requires the same sort of protein nourishment for its growth as normal tissue does. Experiments showing this are reported by Drs. Carl Voegtlin, J. M. Johnson and J. W. Thompson, of the U. S. Public Health Service's National Institute of Health, in the current issue of *Public Health Reports.* The results of the studies, in which the growth of cancers in mice were checked by certain types of diet, can not be applied in the treatment of cancer in man. New fundamental knowledge of the chemistry of cancer growth, however, has been gained. The growth of breast cancer in mice can be checked by feeding the animals a diet deficient, though not entirely lacking, in cystine. This chemical is an amino acid, one of the essential building stones of all tissue proteins. Cystine is also part of another chemical, glutathione, which is widely distributed in body tissue and which apparently stimulates the multiplication of normal body cells. After the cancer growth in the mice had been checked for about a month by the diet deficient in cystine, repeated injection of glutathione caused a marked stimulation of the cancer growth. This shows that glutathione is necessary for the rapid growth of cancer tissue just as it is apparently necessary for growth of normal tissue. Previous studies by Dr. Voegtlin and associates showed that deficiency of another of the body's protein building stones, lysine, also checked the growth of cancer in mice.

STERILIZATION OPERATIONS PERFORMED IN THE UNITED STATES

TWENTY-EIGHT states have laws providing for the compulsory or voluntary sterilization of mentally deficient persons, and under these laws at least 23,118 operations have been performed, William J. McWilliams, Counsel for the National Committee on Maternal Health, reported at the Symposium on Sterilization held by the New York Academy of Medicine. He warned his audience, however, that before performing a sterilization operation they should remember Judge Cardozo's statement, applying to all surgery, that "a surgeon who performs an operation without his patient's consent commits an assault for which he is liable in damages—except in cases of emergency where the patient was unconscious." The consent to the sterilization may be given by the patient, or by the patient together with his parents or guardian, or it may be imposed by state officials, Mr. McWilliams said. When a sterilization operation is performed as an incident to curing a disease, this is lawful, if the patient has consented.

X-rays or radium are the best methods for sterilization of women. Sterilization by irradiation presents few difficulties and there is little likelihood of any adverse reactions following treatment. A further advantage lies in the fact that the patient need not enter a hospital to be treated. In order to obtain effective results irradiation sterilization must be carried out only by those properly prepared by training and experience in the employment of x-ray and radium treatment. Otherwise harm might result from overdosage.

Dr. Eliot Bishop, discussing surgical methods in use for sterilization of women, said that he had had good results at the Brooklyn Hospital and the Methodist Hospital by using the procedure devised by Pomeroy. According to this method, a loop of the fallopian tube—through which the ovum descends from the ovary—is caught up and ligated with an absorbable suture. The loop is then cut off. According to Dr. Bishop this operation has the merit of being simple and entirely safe.

FORMATION OF SEEDLESS FRUITS IN UNPOLLINATED FLOWERS

SEEDLESS tomatoes and peppers have been induced to form in unpollinated flowers by treating the fruit-producing parts, or ovaries, with any one of four different organic acids, Dr. Felix G. Gustafson, of the University of Michigan has reported to the National Academy of Sciences through that body's official proceedings. Similar results were also obtained with the fruits and seed-pods of a number of other vegetables and garden flowers. While no immediate commercial application is contemplated, it is interesting to note that in the tomatoes at least the seedless specimens had very small seed-spaces—indeed in some of the smaller ones the flesh was completely solid. Immediate commercial exploitation is regarded as impracticable at present because each flower requires individual operation by a skilled botanist. The real significance of the experiments is the proof that fruit production without pollination is possible through the use of growth-promoting substances.

The chemicals used by Dr. Gustafson were indole-propionic acid, indole-butyric acid, indole-acetic acid and phenylacetic acid. All of these have been used by a number of botanical researchers to promote the growth of stems and leaves on dormant plants and parts of plants. One, indole-acetic acid, has been found in extracts of plants and has been called heteroauxin because it acts in promoting growth like auxin, the natural growth-promoting substance. The four acids were mixed into a kind of salve with hydrous lanolin for application to the places where growth promotion was desired. In this, Dr. Gustafson followed the technique developed at the Boyce Thompson Institute for Plant Research at Yonkers, N. Y., by Drs. P. W. Zimmerman and A. E. Hitchcock, which won for its originators the $1,000 annual prize of the American Association for the Advancement of Science a year ago.

In the experiments, the stigma or natural pollen-receiving surface was cut off and the growth-promoting acid preparation smeared on the cut surface. From there it diffused into the unpollinated ovary and caused the development of all parts except the fertile seeds themselves. In some of the species used, seeds did develop, but when

they were cut open they were found to be hollow, without the tiny embryo plant necessary for germination. In other cases, as in the seedless tomatoes, the fruits grew and ripened normally and did not contain even hollow seeds. In still other cases, there was relatively little fruit development.

In all the experiments, parallel controls were carried through. This was done in two ways: by pollinating companion flowers to the ones under treatment, and by keeping others both untreated and unpollinated. The pollinated flowers developed fruits or pods with seeds, as was expected, while the unpollinated ones simply died and dropped off.

Dr. Gustafson sums up the results of his numerous experiments in two sentences: "The significance of these experiments seems to be that definite substances, which are not specific, cause the ovary of a flower to develop into the fruit. These substances seem to be closely related to the auxins."

RADIO THERAPY

DOCTORS whose business is saving lives may be unwittingly endangering other lives through the use of therapeutic equipment that interferes with radio communication. Radio messages between ships and shore, aircraft and ground and directional signals upon which human lives depend can be seriously interfered with by "sky waves" of considerable intensity set up by the short wave diathermy and artificial fever devices now employed by many physicians. Dr. H. B. Williams, of New York City, warns physicians of the nation through the *Journal* of the American Medical Association that they must take prompt steps to abate this nuisance. Otherwise, he states, that relief through legislation will be sought, with a possibility of undesirable restrictions being placed on the use of therapeutic machines. The council on physical therapy of the American Medical Association is expected shortly to alter its requirements for acceptance of electrical equipment such as is known to have caused interference. Manufacturers will be asked to submit evidence that the construction and installation specifications are such as to prevent interference. Even when not a menace, the physician's and surgeon's diathermy machine may be a nuisance, causing static in every radio receiving set that derives power from the same line, Dr. Williams points out. The chief instance of radio interference from this cause came last winter when important activities of the Naval Research Laboratory at Washington, D. C., were subjected to interference so serious as to stop the work completely. After great trouble and expense, the disturbance was eventually traced to a diathermy unit located in a hospital at Cambridge, Mass.

ITEMS

So acute is Germany's need for grease and fats that large scale recovery of drain-pipe greases is to be undertaken, according to reports received at the Bureau of Foreign and Domestic Commerce, in Washington, from the American Consulate at Frankfort-on-Main. It is estimated that from 25,000 to 30,000 tons could be obtained annually from this source. Salvaging drain-pipe fats and grease is another side to the general problem of obtaining more fats for the German nationalism program which led, recently, to the plea by the Commissar for Food Control that Germans eat less fat in the future.

THE threat of death is now lifted from the heads of royalty and commoners alike who suffer the dangerous, hereditary disease of hemophilia. These men and boys (the disease is transmitted by women but afflicts only males) need no longer lead a timid, hot-house existence for fear a scratch or slight exertion will bring on fatal bleeding. The remedy, which could have saved the lives of kings and princes of the past, has been discovered by Drs. W. A. Timperley, A. E. Naish and G. A. Clark, of the University of Sheffield. Egg white thoroughly mixed with potassium bromide and kept in an incubator at body temperature for several days yields a substance which makes blood clot quickly and firmly, they report to *The Lancet*. Failure of the blood to clot at the normal rate of speed is the dangerous characteristic of hemophilia. The new remedy can not be called a cure but the report shows it to be a promising treatment.

RISING over 30,000 feet higher into the air than the regular weather observing airplane, a robot weather balloon has ascended high above the earth in the first nighttime radio meteorograph balloon ascension in this country. This pioneering flight was conducted at five A. M. (November 30) immediately following the regular weather flight by airplane. Dr. Charles F. Brooks, director of the Blue Hill Observatory of Harvard University, found the minimum temperature of 77 degrees below zero Fahrenheit when the balloon reached a peak altitude of 50,000 feet, one hour and 12 minutes after its release from the earth. While the radio speaking weather balloon shot up through the lower part of the atmosphere it showed the same form of temperature curve as that brought back by the weather observing airplane. There was a 13-degree fall to 3,500 feet, then a sharp 2-degree rise, followed by 23-degree fall to 17,000 feet. The instrument was designed by Dr. K. O. Lange and A. E. Bent, research associates at Harvard, and built by R. D. Feiber. Dr. Lange and Mr. Feiber released the three balloons and instrument, and C. B. Pear, Jr., received the radio signals, which were recorded by two chronographs designed for the purpose. The results, including a humidity record, will be reported to the International Commission for the Investigation of the Free Atmosphere, which designated November as a month for special effort.

THE first airplane to complete a trans-continental flight across America—it took 84 days—has now been placed beside Colonel Lindbergh's *Spirit of St. Louis*. The plane suffered fifteen crackups *en route* in 1911 and arrived in California with only its original rudder and two wing struts. A freight train followed along with spare parts. Galbraith Perry Rodgers, who flew it, spent a month in a Pasadena hospital. The present flying time for the same trip is now nine hours and twenty-six minutes.