SCIENCE NEWS

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A LATENT IMAGE MECHANISM

A NON-LIVING "electrical eye" apparatus that has persistence of vision similar to that of the human eye was described by Dr. V. K. Zworykin, the RCA Victor Co. television inventor, at the meetings of the American Physical Society. It promises aid to astronomy, biology and other sciences as well as television.

It is an electrical latent image mechanism that stores electrically the information from an optical image projected on a mosaic of tiny cells that convert light into electricity. It can reproduce its electrically stored information when it is desired. Persistence of vision in human seeing is important in viewing movies, for instance. It results from the ability of the eye's retina to continue to register for a fraction of a second after light has ceased to fall upon it. Dr. Zworykin has made an apparatus that improves upon the eye in several respects.

The original Zworykin device was developed as a pickup camera for television. It is a part of the very promising television method that has encouraged scientists and engineers to believe that practical development of television may be "just around the corner" if people are willing to pay for it. The new form of electric eye is sensitive to ultra-violet rays and infra-red rays or heat that are invisible to the human eye. It can allow the amplification of light intensity of the image so as to increase its intensity many times. An electrical magnification of the scene being viewed is easily accomplished.

Dr. Zworykin explained that the broad idea behind his electrical latent image apparatus is not new, but that he has developed several different methods of applying the idea. A simple electrical experiment illustrates the principle behind the Zworykin apparatus. A condenser is connected in series with a photocell. The photocell is illuminated. The light on the photocell is converted into electricity which flows and charges the condenser. The condenser is made to discharge by flashing upon it a beam of electrons shot from a cathode tube.

The simplest form of the Zworykin latent image apparatus consists of a screen placed in a vacuum bulb. The screen is a thin sheet of mica coated on the back side with a continuous metal layer. On its front there is a mosaic of small isolated photo-sensitive globules, each a miniature mechanism for changing light into electricity.

Dr. Zworykin makes this mosaic very simply by evaporating a thin film of silver upon the mica, then breaking it into separate particles by heat and sensitizing the silver with the element caesium. The globules "soak up" the light converted into electricity when an image is projected by lenses upon the screen. Each photo-sensitive globule gets a positive electrical charge in proportion to the amount of light that falls upon it.

The screen is scanned regularly by the electron beam that releases these charges and this produces changes in the electrical capacity of the metal layer on the other side of the mica. By attaching an amplifying system to that metal layer, there can be drawn off from the system a fluctuating current that is an electrical representation of the light picture on the screen.

SOLAR RADIATION

ENERGY, on a scale so vast as to baffle all human imagination, poured into space by the sun, was one of the subjects discussed in the third Arthur Lecture, presented in Washington by Dr. Charles Greeley Abbot, secretary of the Smithsonian Institution.

Calculations on the known mass of the sun and its estimated mean temperature indicate that every year it radiates into space the heat equivalent of 400 billions of trillions of tons of anthracite coal. Of this prodigious amount the earth intercepts the equivalent of 200 trillions of tons. Compared merely with the small part of solar radiation intercepted by the earth, the total yearly consumption of coal for heat, light and power in the United States is trifling—only 500 million tons.

"This leads," continued Dr. Abbot, "to the inquiry why we depend on coal, oil and waterfalls for power, when the sun is furnishing to the earth so incomparably much more energy free, gratis, for nothing. There are two reasons. In the first place, clouds and night interrupt the continuity of the supply, and cut it off just at those times when we need power badly. Even during the day, the rays alter very much in their intensity because they shine through great thicknesses of the atmosphere in the early morning and the late afternoon. Night also varies greatly in length between summer and winter in temperate zones where the most power is used. Unfortunately, night is longest in winter when we need most power.

"Secondly, though sun rays cost nothing to produce, they cost much to capture. If their energy could be fully utilized it would require only about a square yard for one horepower. But the losses unavoidable in using sun rays for power will demand provision of at least four and probably ten square yards per horsepower. In fact no solar power plants thus far have reached such efficiency. To install apparatus over 10,000 square yards to obtain 1,000 horsepower, or over 10,000,000 square yards to match Niagara, may well give engineers pause."

Yet in spite of the difficulty of gathering up this scattered gold of sun-power, the task is not quite hopeless. Dr. Abbot described two experimental plants that have been built to operate on solar heat applied to boilers and made to run engines. Although their construction cost, per horse power, was several times that of a steam plant, yet in desert countries where fuel is scarce and sunlight plentiful they could offer a fair degree of competition to the more conventional power apparatus.

Dr. Abbot also described a sun-heat cooker which he himself built on Mount Wilson, California, which captures and concentrates heat enough to bake bread, preserve fruit, and do other kitchen jobs very successfully.

FLYING IN THE FOG

HOPES that flying in foggy weather could be made safer by the use of infra-red radiation were blasted by scientists and engineers gathered in Washington at the request of the Bureau of Aeronautics of the U. S. Department of Commerce for a conference on the problem of overcoming the hazard of fog.

There is no known source for obtaining infra-red radiation of the wave-lengths necessary for penetrating fog in energies of more than a few millionths of a millionth of a volt, it was pointed out by Dr. Irving Langmuir, of the General Electric Research Laboratory, and others in the discussion. No one knows how to produce this type of radiation in useful amounts. The discovery of a way to produce such radiation would be a stroke of genius and is not likely to occur in the course of routine experimentation.

The scientists also discouraged governmental experimentation with proposed schemes for dissipation of fog by use of the Tesla coil and other means. Such plans have been tested for many years, but Dr. W. J. Humphreys stated that it is well known to physicists that it is theoretically impossible for them to work well enough to be of practical use. Those that are based on sound scientific principles are too expensive to be considered for use in aviation.

Two possible solutions to the problem of fog landings were, however, given sanction by the meeting, and intensive research along these lines was urged. The first aid to the fog-bound fliers will be the radio. It is known positively that radio will penetrate fog. And radio signals can indicate to the flier, by the use of instruments, his location with reference to the flying field. It is true that they do not give distances shorter than the length of the radio wave-length used, but it is now possible to use wave-lengths as short as 10 meters (10.9 yards) for this purpose. These are very good; it is not necessary to wait until one centimeter or ten centimeter wave-lengths are available.

Another aid which further research may adapt for the use of the flier is the device used by vessels to determine the depth of the water beneath the hull by measuring the time required for a sound to return as an echo. A similar device has already been tried on airplanes, but at present it is necessary for the flier to judge from the loudness of the sound how far he is above the earth. It would be quite possible to have an instrument pick up the echo and show on a dial the height of the plane in feet above the landing field.

HEAT DESTRUCTION OF LAYERS OF THE CORTEX

A NEW tool for physiologists and brain surgeons, the precision of which will surpass the keenest of scalpels and steadiest of hands, was described by Dr. J. G. Dusser de Barenne, Sterling Professor of Physiology at the Yale School of Medicine. Speaking before the Association of Yale Alumni in Medicine, Dr. Dusser de Barenne explained the technique, devised by him, whereby any number of the consecutive layers of nerve cells in the cerebral cortex, the thin outer coat of gray matter of the brain, may be destroyed at will.

This method solves one of the difficulties long encountered in studies to determine the functions of the different areas of the cortex controlling bodily activities. Hitherto investigators have not been able to distinguish between the functions of the different layers because there has been no way of eliminating one or more layers selectively. The cerebral cortex consists of only six layers of nerve cells, except in the motor area where there are five.

"Laminar thermocoagulation of the cortex," brought about by the local application of moderate heat for a short period of time to the exposed surface of the brain, is the new technique announced by Dr. Dusser de Barenne. The depth to which the tissue is killed depends upon the temperature and the length of time heat is applied.

It was found that heating to between 90 and 100 degrees Centigrade for five seconds results in death of all the nerve cells in the heated area throughout the whole thickness of the cortex. By heating to about 70 degrees Centigrade from one to two seconds, it is possible to kill the nerve cells of only two superficial layers.

As an example of results which can be obtained by the new method in determining the functions of the different layers of the cortex, Dr. Dusser de Barenne said that he had found that the movements obtainable on electrical stimulation of the motor cortex are due to direct stimulation of the two inner layers and in all probability to the direct stimulation of the large nerve cells of the fourth layer.

Microscopic studies reveal that this method of destroying a predetermined number of layers of nerve cells over a large or small area does not damage the immediately adjoining cortex, and that the dead tissue is resorbed within a few months without leaving any scar or distortion. This new method of nerve cell destruction is expected to prove useful in human brain surgery in special cases, such as cortical focal epilepsy, in which a sharply localized extirpation of part of the cortex is necessary.

THE MENTAL AND PHYSICAL GROWTH OF CHILDREN

DR. T. WINGATE TODD, Western Reserve University, speaking before a Conference on Child Development, Care and Training, in Washington, stated that the child's record of achievement should be distinguished from his progress in maturity or growth. The former does not always keep pace with the latter.

"Physical growth of the body covers some twenty years in human life, but physical growth of the brain is practically completed in six years, and in the better-nurtured children in four." The speed with which the child's achievements follow after his development makes them possible, depends upon his opportunities for education. "Capacity for walking is attained at twelve months or soon afterward, but capacity for riding a tricycle is not attained until about three years. The achievement of these accomplishments is, however, not necessarily completed at these ages.

"By comparison with anthropoid growth, a child's

life has four significant subdivisions, namely: infancy (birth to two years), the preschool period (two to six years), the grade school period (six to twelve years) and adolescence (twelve to eighteen years). In human life, infancy and the grade school period are greatly prolonged for in the anthropoid these occupy about one year and two years, respectively.

"Until the school plateau in physical maturity is reached, the better nurtured children are physically the larger and mentally the more advanced. After the attainment of six years bodily growth continues but the so-called mental growth is really a mental expansion depending upon the integration of experience in a brain which already has the functional capacity of adult structure." The problems of adolescence are a result of the rapid spurt of maturity at that time. "The attainment of adolescence is a feature of maturity progress rather than a stage in physical growth. It is expressed in certain physical features which are intimately related to the mental outlook but social perspective and emotional balance depend upon the educational processes of experience. This is the clue to the differentiating personality. In a a phase of rapid progress in maturity, such as occurs towards the second birthday or at puberty, change in outlook outruns the accumulation of experience and temporary disharmonies result in problems of social perspective and emotional balance. It is, therefore, during these periods when adjustment taxes the child's developing personality that understanding, patience and skill on the part of the guardians are of greatest significance in the developing citizenship-value of the child."

ITEMS

THE recording cosmic-ray meter taken to an altitude of 61,243 feet on the Settle-Fordney stratosphere flight brought back a message that Professor A. H. Compton and Dr. R. J. Stephenson, of the University of Chicago, interpret as meaning that cosmic rays are charged particles, not radiation like super gamma rays or x-rays. To the American Physical Society, meeting on February 24, Dr. Compton announced this interpretation. The relationship between the ionization shown by the meter and the altitude is such that Professor Compton does not believe that it can be explained by radiations of the gamma ray type, but it does fit in with the effects produced by alpha rays or ionizing particles with a definite range.

REPORTS from Italy that automobiles have been operated on a gas fuel made in transit from charcoal and steam recall experiments along the same line that were made several years ago in France and other European countries. The principle is that involved in the manufacture of some kinds of gas used in cities and in operating stationary internal combustion engines. Some carbon-containing material, usually coal, is heated and then water in the form of steam is run over it. Carbon monoxide and hydrogen are formed. Both are gases that will burn with high heat output. Mixtures of this sort are called "water gas" or "producer gas." Such gas can be used as fuel in internal combustion engines in vaporized gasoline. Usually these gas engines are not used on trucks or autos because of the difficulty of carrying around the fuel supply. They are effectively used for power generation in permanent locations. Trucks that run on wood, charcoal, manufacturing their own gaseous fuel as they go along, are used commercially in France to a limited extent.

DR. R. W. SKINNER, assistant chief of chemical and technological research, recently reported to congressmen comprising the subcommittee of the House committee on appropriations for the Department of Agriculture, that alcohol blended with gasoline is not completely satisfactory when used as a motor fuel. There are both technical difficulties and operating difficulties. The mileage obtained from a gallon of such fuel is less than that obtained from straight gas. Depending upon the proportion of alcohol used, there may or may not be a decrease in power. There are technical difficulties in the way of preparing alcohol from corn which can be used in such a mixture.

YELLOWSTONE NATIONAL PARK has a new pool, situated in Midway Geyser Basin. Ranger Frank Child passed through the region late in January, and saw nothing unusual. But when he returned during the following week, the pool was there, about forty feet in diameter. In being born it caused the dislocation of several tons of rock. Some of the dislodged rocks, now thirty feet distant from the pool, are estimated to weigh more than 600 pounds. The new pool is very hot and very muddy. Violent boiling occasionally takes place on the north side. When this occurs a slight shock can be felt several feet from the edge.

LEE STRONG, chief of the Bureau of Entomology, has warned members of the House subcommittee on appropriations for the Department of Agriculture, that grasshopper trouble can be expected in six Northwestern states this year. Surveys of eggs in the soil have shown federal workers what to expect in Montana, Nebraska, Wyoming and the Dakotas, and possibly to a lesser extent in Minnesota, where the state has carried on for two years an effective control program. Grasshopper damage in Montana in 1933 is estimated at almost $3,000,000 and in North Dakota at $10,250,000 in wheat, oats, barley, corn and flax. South Dakota estimates its damage at $3,600,000 and Wyoming at $250,000.

A NEW way of tracing the origin and early activities of Polynesian peoples is to be tried by Yale scientists. The new attack on the problem will be an investigation of over 2,500 wood specimens from remote islands of the South Seas. By studying these samples of wood, and comparing them with old wooden implements used by Polynesians, the Yale School of Forestry hopes to learn more about where the islanders came from, and with what regions they had contact. The collection of South Sea woods has been given to the School of Forestry by the Bernice P. Bishop Museum of Honolulu, and is intended for use in the systematic study of woods of the entire world now being sponsored by Yale in cooperation with the International Association of Wood Anatomists.