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CENTRIFUGE FOR TESTING MINES AND BRIDGES IN NEW COLUMBIA SCHOOL OF ENGINEERING RESEARCH

AT Columbia University's School of Engineering, celebrating its seventy-fifth anniversary, a centrifuge method of engineering testing will be demonstrated publicly for the first time on November 10.

Professor Philip B. Bucky, of the Columbia School of Mines, and his students have built an enormous centrifuge in which can be placed models of the underground workings of a mine or models of bridges built to scale using transparent bakelite plastic. These structures are whirled faster and faster in the centrifuge merry-go-round, and as they whirl the centrifugal force stresses them and thus tests them. A force of 2,000 times gravity is created.

In the case of the mine structure, the problem is to find just how far miners can go in cutting holes in the rock they are mining. Holes might cause the rock to smash to bits under the thousands of tons of other rock pushing down from above. The stress built up in the centrifuge substitutes for the real stress that might be encountered under actual working conditions. The miniature block of rock collapses when the speed is high enough, just as the real mine would under the force of gravity. Professor Bucky can thus tell the mining engineers in a real mine how far they dare have the miners go with safety.

Light is used to measure the stress in the whirling bridge models. Polarized light, light that vibrates in one direction only, from a powerful mercury arc lamp, is flashed on and off so rapidly in exact synchronism with the centrifuge that the transparent model bridge is seen as though it were standing still. Bands of light and dark move through the model and these photo-elastic fringes enable the Columbia engineers to calculate just how and where a real bridge of that same design will be stressed in actual service.—WATSON DAVIS.

FLICKERING SEARCHLIGHT BEAM FOR THE STUDY OF THE ATMOSPHERE

THE piercing, puzzling searchlight beam which mystified residents of northwest Washington last summer on moonless, dark and clear nights was explained on November 12 at the meeting of the Philosophical Society of Washington by Ellis A. Johnson, of the Carnegie Institution of Washington.

No ordinary searchlight beam was that seen by Washingtonians. Its brilliant beam flickered ten times a second and identified it, for scientific research, so that its scattering at heights of as much as 24.8 miles could be detected.

The experiments, Mr. Johnson reported, seek to probe the upper atmosphere for its secrets of temperature, density, presence of clouds and other important information at heights which are beyond the reach of stratosphere flights with balloons. Moreover, the new searchlight experiments tap that region of space lower than the radio reflecting layers in the ionosphere. The new technique thus investigates the "no man's land" of the atmosphere.

While the current experiments have been preliminary, seeking mostly to show the feasibility of the method, they indicate that studies can be carried out on the height of water vapor in the atmosphere, the amount of turbulence, the winds, dust, fluorescence and absorption of these upper altitudes up to nearly 20 miles. Actual measurements have been carried out at this height and it was found that the beam itself could be detected up to 40 kilometers, or about 24.8 miles.

In outline the searchlight experiment is simple. The beam of a great searchlight was directly upward and made to flicker (modulate) about ten times a second by an automatic Venetian blind type of shutter. Some three and a half miles away was placed a large mirror, containing at its focus a photoelectric cell. This mirror pivoted upward and caught light scattered from the beam in the sky. The photoelectric current generated by this scattered light was amplified in a special radio amplifier developed by Mr. Johnson, which is so sensitive that it can detect currents of only .000,000,000,000,032 amperes. From the geometry of the searchlight and the receiving mirror the altitudes at which the beam is studied can be calculated. The modulated, flickering nature of the light makes it possible to differentiate it from the general background light of the night sky. Even so, it was necessary to work only on clear nights without moonlight and at times when there was little haze at low altitudes. The experiments indicate that with a 60-inch searchlight and a 60-inch mirror as a receiver, the study of the upper atmosphere could be pushed to 90 kilometers, or nearly 56 miles.

THE TRANSMUTATION OF PLATINUM INTO GOLD

THE ancient alchemists used to talk of transmuting base metals into gold, but in results accomplished little. Investigators at Columbia University, as a demonstration stunt, achieved a transmutation of the elements which results in gold. The starting point was not base metals but precious platinum.

The occasion was the seventy-fifth anniversary of Columbia University School of Engineering, which was founded as the first School of Mines in the United States. The modern alchemists were Dean George B. Pegram, of the Columbia Graduate Faculties, and Professor John R. Dunning, of the department of physics.

The method was to place platinum for some hours near a long glass tube containing a small amount of radium which emitted atomic particles that, by bombardment, turned platinum of atomic weight 195.25 into gold of atomic weight 197.2. The radioactive gold in turn emitted particles which alone made possible the detection of the transmutation.

Other demonstrations included: The detection of radioactive sodium in the human body and its circulation by

the blood; the collapse of a model subterranean mine roof structure by whirling it in a centrifuge to simulate the force of gravity in a real mine; the crushing of an eight-foot brick masonry pier in the compression testing machine of the school of engineering; the demonstration of water seepage under power dams and through various types of soil structures; a demonstration of the manufacture of isotopes by Professor Harold C. Urey.

SOLAR RADIATION

TRAPPING the heat of the sun as it falls on the roof of a house and storing it in the basement for future use is to be attempted at the Massachusetts Institute of Technology soon, as part of a long-range program on the possibilities of using solar radiation as a direct source of energy.

An experimental house, which it is planned to heat during the winter, air condition during the summer and possibly even supply with power, all with the energy of sunlight, has already been constructed and the research is expected to begin at once.

One of the major features of the house is a large, well-insulated water storage tank which is to be used in ironing out the fluctuations in heat which are inevitable with a source as variable as the sun. The heating system is based on a method of forcing air either over the hot surface of the tank or through the coils of a refrigeration system which is also to be run on energy stolen from the sun.

Professor Hoyt C. Hottel, who is in charge of the program, plans to try several types of "heat traps," or energy collectors, during the research. First attention will be devoted to a shallow, box-like device which will be placed in a recess in the building's roof. For a bottom this box has a thin sheet of metal, painted black to absorb as much of the sun's heat as possible. Firmly fixed to this bottom is a series of small, thin-walled metal tubes which are to be heated by contact with the sheet and which will then pass this heat on to water circulating through them. This box has a series of glass covers, separated by dead air, through which nearly all the sunlight can pass but through which little heat can escape back to the outside. The sunlight, as it strikes the metal sheet, is converted into heat and the whole arrangement has a layer of mineral wool beneath it to prevent heat escape in that direction. The warm water in the coils is then piped, through carefully insulated tubes, to the well-insulated storage tank where the engineers expect to keep it hot anywhere from a few weeks to six months, depending on the size of the tank.

The best size for these units, the most heat-absorbent paint, the most effective number of glass plates and the best angle at which to slope the roof are among the problems to be investigated. Professor Hottel emphasized that he and his colleagues are well aware that the amount of solar heat in New England would make domestic heating by solar radiation uneconomical in comparison with other heat sources, but there is sufficient sunshine in this region to test the efficiency of heating systems for those localities where the climate is less rigorous.

The research is one of several projects planned at the Massachusetts Institute under the terms of a gift of nearly $650,000 from Dr. Godfrey L. Cabot, of Boston, "for research on the utilization of solar radiation for the tasks of man."

INSULATION AND HEAT LOSS

ADEQUATE insulation of a house against heat loss can cut the fuel bill nearly in half, E. S. Draper, director of the department of regional planning studies of the Tennessee Valley Authority, reported at the meeting in New York on November 6 of the Committee on Hygiene of Housing of the American Public Health Association.

Mr. Draper announced at the same time that a simple heater practical for central heating of small houses, improved after tests in a TVA house at the Gilbertsville Dam construction community, is now in production for the open market.

The insulation studies were carried out in two identical four-room houses in the Hiwassee Dam construction community. Installation of electrical heaters made it possible to record with great accuracy the heat loss in the two houses. One of them was insulated throughout by wool bats in the walls and over the ceiling and an insulation board under the floor joists. Both houses had both doors weatherstripped. Both families were held to the same schedule of window-opening in bedrooms at night, windows closed by day, and the heaters were turned on and off at the same time. The reduction in total heat loss in the insulated house was 44.75 per cent. Cost of insulation, including labor and materials, was about $200.

The simple heater described by Mr. Draper was designed to effect a reduction in the capital cost of central warm air heating over that of installing the warm air furnaces then available on the market. The object was to have a primary heat source (without provision for air filtering or humidification) placed in an exceptionally small first floor heating chamber centrally located so that it might service all rooms of a small house without the usual extensive system and basement.

COMETS

THE discovery of a new and unexpected twelfth magnitude comet on November 1 by Clarence L. Friend, of Escondido, Calif., brings to twelve the number of comets which so far have been sighted by astronomers during 1939. Seven of these comets have been of the periodic type which return to the region of the sun and earth at regular intervals which astronomers can calculate accurately. As might be expected, professional astronomers working in large observatories rediscovered all these returning comets.

Of the five new and unexpected comets found so far this year, two have been found by amateur astronomers, two jointly by an amateur and a professional and one by a professional astronomer alone.

The significant mark of the new Friend comet is its rapid motion. From its originally discovered position in the "keystone" of Hercules near right ascension 16 hours, 52.9 minutes and declination plus 34 degrees, three minutes, it is moving rapidly east and south.

The first comet of 1939 was the unexpected one found

independently on January 19 by Kosik, professional observer at Tashkent Observatory, U.S.S.R., and Leslie C. Peltier, Delphos, Ohio, an amateur who has discovered seven comets.

The second comet of the year was the return of the Pons-Winnecke comet found on March 17 by Dr. H. M. Jeffers, of Lick Observatory. This is comet 1939 c.

On March 17, too, Dr. Y. Vaisala, director of the observatory at the University of Turku, Finland, reported the discovery on asteroid photographic plates of a new comet. The Vaisala comet was granted designation 1939 b.

On April 18 was found comet 1939 d, a new comet and one of the "most discovered" of all the year. First reported by a professional observer, Hassel, at Oslo, Norway, it was later found that two Russian amateurs, Jurlof and Achmarof, had discovered it just ahead of him. A triple name, the Jurlof-Achmarof-Hassel comet, was thus assigned. Many observers all over the world reported independent discoveries of this comet for some days following.

The reappearance of the Kopff periodic comet (1939 e) was announced by Professor G. Van Biesbroeck, of Yerkes Observatory of the University of Chicago, on April 22.

The periodic Schwassmann-Wachmann comet (1939 f) was found anew by the professional observer Jackson, at Johannesburg, S. A., on June 12.

Periodic comet Brooks II (1939 g) was found by Dr. H. M. Jeffers, at Lick, shortly afterward.

On July 28 the new comet 1939 h was discovered by the French amateur astronomer Roger Rigollet, a variable star observer.

On July 31 came the one comet discovery of the year which has not yet been confirmed. This was the announcement of a seventh magnitude comet by the professional observer Kaminsky at Tashkent Observatory, U.S.S.R. While reported seen from Italy, also, the comet could not be located by astronomers elsewhere, and it has not yet been given a number designation.

Periodic comet Tuttle reappeared on August 14 when Dr. H. M. Jeffers, of Lick Observatory, found it on a photograph taken with the 36-inch Crossley reflector. It has received designation 1939 i.

September was without comet discoveries, but on October 14 Professor G. Van Biesbroeck, of Yerkes Observatory, announced the reappearance of the Giacobini-Zinner comet. This is comet 1939 j.

On the same astronomical announcement card listing the new Friend comet is the reported rediscovery of the Faye periodic comet by Dr. H. M. Jeffers, of Lick Observatory, on November 3.—ROBERT D. POTTER.

ITEMS

COMPLETELY successful operation of the experimental apparatus was obtained by the substratosphere expedition of the University of Chicago on October 23, according to Professor Arthur H. Compton, of the university. Rising to 29,000 feet, while scientists breathed oxygen, the airplane bore aloft a Wilson cloud chamber apparatus to make visible the tracks of the cosmic ray particles. Dr. Compton said that "Preliminary findings show the presence of cosmic ray tracks for every expansion of the cloud chamber at altitudes of over 20,000 feet as compared with the rate occurrence of the tracks at sea level." The major effort of the expedition was to find and study "slow" mesotron particles, the heavyweight charged particles, some 160 times as massive as ordinary electrons. The rate of mesotron production near 30,000 feet was very greatly increased. Professor Compton directed the flight by radio from the ground. In the plane, running the apparatus, were his assistants, Drs. Gerhardt Herzog and Winston Bostwick.

WARM-BLOODED animals can be sent into hibernation artificially by injecting insulin, or a combination of insulin and magnesium chloride, into their veins, according to Dr. Paavo Suomalainen, of the Helsinki Biochemical Institute. Working with European hedgehogs, Dr. Suomalainen found that the injections caused a drop in blood sugar content to less than half normal, and produced the cold-blooded state characteristic of warm-blooded animals in hibernation. The animals remained asleep as long as he kept them in a refrigerator, at temperatures around freezing point. When he removed them to a warm room, at a temperature of from 70 to 75 degrees Fahrenheit, they awoke and returned to the normal warm-blooded state.

BACTERIA have been shown to be able to change the eye color in Drosophila, or fruit flies, in experiments reported by Dr. Edward L. Tatum, of Stanford University, who has been working on a project financed by the Rockefeller Foundation. Such changes have hitherto been considered to be a monopoly of genes, or hereditary units within the cells of the insects themselves. The change, from white to brown color in the eyes, is brought about by a hormone produced by the bacteria, working in conjunction with tryptophane, an amino acid which is part of the flies' diet. The bacteria-produced hormone seems to be identical with a hormone produced by the flies, under certain conditions. Dr. Tatum made his discovery when the tryptophane used in feeding his fruit flies became contaminated with a still unnamed species of bacterium.

PARA rubber trees are being tried out in three nurseries at different altitudes in the Ethiopian highlands, in the hope of eventually making Italy independent of foreign sources of rubber. The plantings at the lowest altitude, at Gambela (2,000 feet above sea-level), have been most successful; the seedlings have reached a height of about two feet in the first year after sowing.

DINOSAURS may have died out because the world got too hot for them, not because it became too cold as commonly conjectured. This reversal of the usually accepted theory of dinosaurian extinction is suggested by Dr. Raymond B. Cowles of the University of California at Los Angeles. Dr. Cowles bases his theory on the known facts about present-day reptiles, distant cousins of the dead giants of the Mesozoic. Reptiles become sluggish when chilled, but when over-heated they die outright, even the lizards that are supposed to be happiest on a hot rock, he says. Any temperature above 98.6 degrees Fahrenheit is bad for them.