

technology notes

GEOENGINEERING

Research on Large Tunnel Forces

Using data from underground excavations such as the Air Force's Air Defense Command Center in Granite Peak, Colo., and the Navajo Water Tunnel in Utah and New Mexico, Purdue University engineers are building a theory of how rock and earth distributes itself about an opening.

"Large tunnels and other excavations have been built employing empirical cut-and-try methods," says Prof. W. R. Judd of Purdue's School of Civil Engineering. "This is an extremely expensive way to keep the roof from falling in." The work is being done for the Army Corps of Engineers.

CRYOGENICS

Formula for Cooling Time

Supercold liquefied gases are being used more and more, and the problem of transferring them from one container to another is becoming important. Uncooled pipelines in large systems may take hours to reach a point where the liquid won't boil off.

In designing of cryogenic installations, the cool-down time is thus an important factor. Engineers at the National Bureau of Standards Cryogenics Laboratory in Boulder, Colo., have constructed a formula which will compute the time required, given only the heat content of the pipe and the fluid, and the density and velocity of sound in the warm gas. The model works only for simple systems in which the pipe is much longer than its diameter, and has a constant flow. A more complicated model taking in large pipes with constrictions and other flow variations is being developed. The simple model was found to match well experimental results at the Boulder station.

ELECTRICAL ENGINEERING

Aluminum Replaces Copper in Transformers

Major electrical manufacturers in Japan have recently succeeded in producing pole type transformers using aluminum instead of the conventional copper. Research and development of the new transformers was prompted by unstable and marked fluctuations in the world price of copper.

The transformers use aluminum foil instead of copper wire, and an aluminum body shell instead of iron or steel. Copper is used generally because of its high conductivity.

Aluminum transformers have a higher resistance to mechanical burning in case of short circuits, as well as superior heat resisting properties because of the larger surface area. The problem of connecting leads to the aluminum foil was solved by using either cold pressure or ultrasonic wave welding.

CIVIL ENGINEERING

Frost Damage Predicted

A new test for predicting future frost damage in the rock aggregate used in concrete highways and bridges has been developed by engineers at Pennsylvania State University.

The laboratory test, called the slow-cooling method, duplicates the conditions of freezing and thawing that lead to serious deterioration of many concrete structures. Dr. Thomas D. Larson and Philip D. Cady of the civil engineering department reported details of the new test to the National Cooperative Highway Research Board.

Most concrete aggregates are susceptible to frost damage to some extent. However, some are more likely to deteriorate than others. Previously available laboratory tests have not been flexible enough to predict realistically how a given sample of rock aggregate will perform under field conditions.

Many aggregates that failed to pass previous test methods may well be found suitable for certain uses with the new techniques, the engineers believe.

SOLID STATE

SST Is New Semiconductor

A significant advance in the capabilities of semiconducting devices has been made with the development in Japan of an oscillator that can generate submillimeter waves having frequencies of hundred of thousands of megacycles.

The oscillator is called "suppressor space-charge triode," or SST. It is expected to have many applications including milliwave telecommunications and computers. The SST can function over a very wide range, peaking so far at 380 billion megacycles, a level hitherto attainable only in large, expensive electron tubes.

The SST consists of an inverted U-shaped piece of gallium arsenide, with an electric power input electrode at each end of the U. Control electrodes, insulated with barium titanate oxide, are attached to each of the oscillator's two sides.

The oscillator was developed by Dr. Shoei Kataoka of the Ministry of International Trade and Industry's Electro-technical Laboratory in collaboration with Hiroshi Taten. Commercial production at relatively low cost is believed possible.

INDUSTRIAL CHEMISTRY

Quick Checks for Bacterial Contamination

Fast checks for bacterial contamination of water, milk, food and clinical specimens are now possible using a luminescence photometer developed by the DuPont Company's instrument products division. Thousands of laboratories count bacteria in the time-consuming method used since Pasteur's day; the new photometer cuts the time from hours or days down to minutes.

The reaction between adenosine triphosphate, or ATP, and luciferin and luciferase, resulting in a flash of light, permits measurement of a variety of chemical and biological luminescence reactions, such as the concentration of some enzymes, energy metabolism and the viability of stored blood.

Key to the instrument's success is the fact that the level of ATP in bacterial cells is sufficiently constant across all phases of microbial growth in various species to allow a direct correlation between recovered ATP and the number of bacterial cells originally present in the sample.

The portable, table-top instrument is expected to be available commercially by mid-1968.

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