

# engineering sciences

## LIGHT AMPLIFICATION

### Powerful laser developed

A gasdynamic laser theoretically able to produce thousands of kilowatts of infrared light has been developed by Avco Corp. First invented in 1965, this type of gasdynamic laser differs from an ordinary gas laser in that it burns fuel, such as carbon monoxide or cyanogen, to energize a carbon dioxide-nitrogen gas mixture. An ordinary laser gets its energy from electrical discharge.

The laser resembles a rocket motor, with an array of converging-diverging nozzles between the laser's end-mirrors. The purpose of the nozzles is to cool the gas to create a population inversion. This is a situation in which enough gas molecules are brought down to a lower energy level to prevent the loss of energy all at once. It is the cycle of higher and lower energy levels that insures continuous lasing.

The new laser, according to Dr. Edward T. Gerry, is more powerful than any existing continuous wave laser. The laboratory model has produced 60 kilowatts of light power.

## COAL GASIFICATION

### Method prevents caking

Up to now most coals could not be converted into natural gas because they cake.

A process developed by the U.S. Bureau of Mines prevents this with a pretreatment step: The coal surface is oxidized at 400 degrees C., and the finely ground coal is passed through a low velocity, hot-gas stream where it is converted to methane, hydrogen and carbon monoxide by the action of steam and oxygen.

Further treatment removes impurities such as tar, dust, sulfur and carbon dioxide. A catalytic reaction using nickel converts the hydrogen and carbon monoxide to more methane.

## SOLID WASTE

### Fly-ash glass for submersibles

Fly ash, one of the most burdensome of solid wastes, contains microscopic glass bubbles. Scientists are not sure where the glass comes from, but impurities are a prime suspect. The proportion of glass to ash is small but because there is so much ash around, the over-all total is large.

Dr. Alan A. Johnson of the Polytechnic Institute of Brooklyn has discovered a way to put these bubbles to work. Since they are almost identical to the commercial glass bubbles that, at \$10 a pound, now go into the rigid and bouyant composite material of deep-sea vehicles, he suggests them as a cheap substitute.

The small spheres are introduced into the resin materials because they can withstand pressures as high as 1,000 atmospheres, thus permitting the material to retain its buoyancy at great depths.

Dr. Johnson's experiments have shown that in a material composed of 50 percent glass spheres from fly ash, only a small proportion of the spheres will collapse at pressures twice those found in the deepest parts of

the ocean. Further experiments are planned increasing the fly-ash component to 70 percent.

## SEMICONDUCTORS

### Improved transistors

Dr. Takashi Tokuyama of Hitachi Ltd. in Tokyo has developed an improved method of silicon transistor manufacture. The new technique adds three steps to the conventional method. The protective silicon oxide layer is removed from the wafer surface, the surface is etched and a layer of alumina-phosphoric oxide glass sandwiched between two layers of silicon oxide is laid down in vapor form and condensed.

The added steps mean lower electrical noise, less chance of short circuiting in the transistor, greater current constancy and higher moisture resistance, the company claims.

## EXPLOSIONS

### Speculation about tankers

Shell Oil Co. still has no explanation for the explosions that ripped through three of its tankers on Dec. 12, 29 and 30. An investigation, which is still going on, has drawn hundreds of scientists and engineers at the Shell Research Center in Thornton, England, into the search for the cause. The investigation has so far all but ruled out impact as a cause, and it is considered possible but unlikely that all three might have separate causes.

There are striking similarities among all three explosions: They all occurred in the tropics, the tonnage of each ship exceeded 200,000 tons and, most important, all three had been cleaned with a new type of water-pressure gun. One possibility is static electricity from the cleaning jets. Before cleaning, the ship's tanks are ventilated by blowing fresh air through them to produce an oil-air mixture too dilute to explode. The theory is that the fresh air did not reach all the nooks and crannies, and stagnant explosive mixtures might have resulted.

## COMPUTERS

### New data processing method

The standard method of verifying computer data entered onto cards or tape is simply to have a second operator redo it. The idea is that it is unlikely that two operators would make the same error. The National Research Development Corp. of London has devised a system of computer data verification called SOVAL for single-operator validation. Elimination of the second operator makes for a speedier, more accurate, less costly operation.

As a keyboard operator enters each digit, it is also stored in electronic circuits. A standard fiber-optic viewing head, which he has been looking through, is replaced by a second one, in which jumbled fibers present the digits in a different sequence. The operator then keys in the new random sequence, which is electronically unscrambled. If the two entries correspond, the item is accepted and recorded for computer input.