engineering sciences

MATERIALS

Composite welding technique

The engineering material of the age is the composite, a high-performance material made of different substances. A problem with metal composites, however, is welding. They do not lend themselves to conventional fusion welding techniques, which either hardens them excessively or cracks them.

The Boeing Co. in Seattle has come up with an answer by adapting diffusion welding, a process for bonding two difficult metals together. Relatively low heat, high pressure and time are combined to fuse composite sheets together.

Boeing tried out the method on an aluminum-boron composite. Sheets of the material were subjected to pressures of 5 tons per square inch at 950 degrees F. for 10 to 15 minutes. A strip of welded composite sheet, thin as a knife blade, was produced.

MEDICAL ENGINEERING

Transfusion regulator

In giving blood transfusions to infants, the blood flow rate must be strictly maintained. Too fast, and the vascular system becomes overloaded, resulting in heart failure. Too slow, and it can aggravate shock.

A chemical engineer, Prof. Ronald G. Barile of Purdue University, has solved the problem with a simple mechanical device. The trouble was that the effect of gravity on the suspended blood reservoir increased as it filled and decreased as it drained. Dr. Barile's solution was to design a spring with the proper tension so that it would raise the reservoir as it drained to keep the flow uniform.

The last step was to preset the blood flow rate. This was accomplished with a plastic plate with a hole in it. Orifices of different sizes could produce the desired flow rate, or one orifice would do if the height of the reservoir were preset.

HIGHWAY SAFETY

The color of ice

On wintry nights, accidents often occur because a driver comes upon a patch of ice or slippery snow. To forewarn a driver, the Battelle Institute in Frankfurt, West Germany, has developed a device that tells him the temperature of the road surface ahead, thus alerting him to the possibility of ice or snow.

The device is a light reflector that changes its color according to the temperature nearby. It is mounted on a lamppost and the color is picked out by the car's headlights. Green indicates temperatures above 45 degrees F. and yellow, temperatures around 37 degrees F. Orange and red represent lower temperatures.

AVIATION

Safer fuel system

When a plane crashes, if the impact does not harm the occupants, the resulting fire often does. To eliminate this hazard, the U.S. Army Aviation Materiel Laboratories, Fort Eustis, Va., have developed a fuel system designed not to break open in a crash.

This system was achieved by a combination of high-impact resistant materials, self-sealing fuel tanks and breakaway fuel lines. The high-impact materials are laminated composites of nylon plus natural and synthetic rubbers. A special compound of natural gum rubber containing plasticizers swells upon contact with hydrocarbon fuels to seal off punctures. When the breakaway lines separate, valves close to prevent fuel from escaping.

The new system is expected to go into operation this spring in Army helicopters, with nearly all Army aircraft converted to it by 1975.

POLYMERS

Plastics under the road

Plastics are finding increased use in strengthening construction materials (SN: 11/15, p. 449), and Louisiana State University is studying them as roadbed strengtheners.

Beneath the hard surface of a highway is a layer of soil and cement. It is to this layer that Prof. Ara Arman and Dr. Clayton D. Callihan want to add one-half to one percent plastics developed at LSU. The plastics, invented after five years of work, are made of cotton residue, a cellulosic waste. Because they are water repellent, they prevent moisture from getting into the roadbed, thus waterproofing and stabilizing it.

BOILERS

A better fuel oil burner

The British Admiralty Marine Engineering Establishment has worked out a way to get better combustion from its fuel oil burners. Called the double vortex combustion cell, the system works by having the fuel injected from individual atomizer heads so that the fuel spray, mixed with swirling air, converges rather than diverges as with conventional heads.

The result of this air-fuel flow pattern is that two combustion cells are produced, a primary and a secondary, where combustion is completed. A well-defined boundary, like that seen in the flame of a Bunsen burner, divides the two combustion cells.

FUEL CELLS

Sugar power for pacemakers

Researchers at Emory University in Atlanta have developed a fuel cell capable of generating electricity from the chemical energy in sugar, specifically glucose. The objective is a glucose-powered fuel cell for cardiac pacemakers, says Harold Warner, chief of the Yerkes Electrobiophysics Laboratory.

The fuel cell works by the oxidation of glucose. A plastic membrane is sandwiched between two platinum electrodes. One electrode is in contact with a liquid glucose solution and the other with oxygen obtained from body tissue and fluids. A galvanic cell is thus set up, with electrons flowing from the hydrogen of the glucose to the oxygen.