engineering sciences

TESTING

On-site analysis of metal structures

On-the-spot analysis of strain and stress corrosion of ship's hulls, aircraft engines and other metallic structures, without preparing specialized samples of the material can be accomplished with a technique developed by Sanders Associates, Inc., Nashua, N.H.

The technique, called Remote, enables engineers to study the atomic makeup of metals by bouncing low energy gamma rays off of the material under study and electronically analyzing the rebounding rays. It can also detect latent rust spots before they are visible to the naked eye.

Says Dr. John Terrell of Sanders, "Remote is a simplified version of the Mossbauer Effect. Instead of penetrating a metal with gamma rays, we bounce rays off a material and analyze the backscatter. This technique requires very simple equipment such as a low energy gamma gun which is safe for humans; a detector, diagnostic electronics and a display or recording device." Conventional Mossbauer and X-ray type methods employ more instrumentation and usually require special preparation of the material being studied.

QUAKE RESULTS

Soil type controls building damage

Earthquake reports have generally shown that light wooden houses built on deep soil suffer the worst damage, while those on hard rocky ground fared best. Recent investigations indicate, however, that the reverse holds true for rigid brick and concrete structures.

Prof. C. Martin Duke of the University of California at Los Angeles made surveys directly after earthquakes in Mexico, Chile and Japan over a 15-year period. His investigations show that very rigid modern structures survive quakes best on soft soil, although flexible modern buildings still do better on firm soil. His explanation: the relationship between the earth vibrations set up during a quake, which differ according to the soil, and the natural vibrations of a building, which vary according to height and construction.

HOME HEATING

Rocks and sunlight heat and cool home

A home rockpile cooling and heating system is being tested at the Waite Agricultural Research Institute, Melbourne, Australia. Operating costs should be little more than that of a small electric fan.

Fifty tons of crushed rock in a unit 48 feet long by 6 feet high and 4 feet wide will provide hot air in winter and cool air in summer. The rockpile unit forms one wall of the building.

In summer, the cool night air is circulated through the warm rockpile to cool it down. In the morning, air from the cooled rockpile is circulated through the building. In winter, the sun's heat is trapped by a glass wall of the building. The sunlight heats the building and the hot air in the building is circulated through the rockpile during the day to warm it up. Then at night, warm air from the rockpile is drawn into the building.

ELECTRONICS

Magnetic beacon for avalanche rescue

The survival limit for skiers buried under an avalanche is about an hour. A new magnetic beacon makes it possible to locate them rapidly with limited manpower.

The avalanche rescue beacon, developed at Cornell Aeronautical Laboratory, Buffalo, N.Y., utilizes a 2,250 Hz (cycles per second) alternating induction field. An induction loop is sewn into the back of the skier's parka. A connecting cord leads to the transceiver in an inside parka pocket. The alternating magnetic field which the skier's equipment generates surrounds him in all directions. Signals are detected with very high reliability at 100 feet, and have been picked up at 400.

STEELMAKING

Process eliminates ingots

A 900-pound refractory pouring tube is helping eliminate the traditional ingot from American steelmaking. The tube, 10 feet long by 10 inches in diameter, is part of a rig that casts molten steel directly into slabs, eliminating ingot casting and slabbing mills.

A ladle of molten steel is sealed in a chamber set in the plant's floor. A graphite mold moves over the pouring chamber. Air pressure forces the steel up from the sealed pit, through the refractory tube, and into the mold. The molten steel solidifies into a finished slab, ready for further processing. The tube was developed by Synrox Corp. of Crystal Lake, Ill., using calcined alumina supplied by Reynolds Metals Co.

FUSION

Device generates and confines plasma

A device to generate and confine plasma by using lasers and superconductive magnets has been built by the Central Laboratory of the Mitsubishi Electric Co., Ltd. It will be used by Tokyo and Nagoya Universities for research on the means of harnessing nuclear fusion.

The experimental Japanese device uses a laser to heat the gas and two superconductive magnets, producing a field of 40 kilogauss, to confine it.

A cryogenic unit above the magnets produces an icicle of solid hydrogen. This icicle is cut by a ray from one laser unit, and the cut piece falls and turns into a plasma as it is irradiated by a ray from a second laser unit whose output is several hundred megawatts.

The plasma temperature thus generated exceeds 10 million degrees C. It is confined in the magnetic trap of the two superconductive magnets which are cooled to minus 269 degrees C.

The strength of the second laser will be increased to several thousand megawatts in the future. Even with that increased power, however, the temperature achieved will probably be below the 70 million degrees C. needed to fuse deuterium and tritium atoms, the isotopes of hydrogen which appear to be the most practical fuels. Laser energy has been suggested before as a fusion device (SN: 5/4, p. 420), but the problem continues to be confining the plasma.