engineering sciences

CONSTRUCTION

Detecting defects in wood

Knots, rot, cracks or pitch impair the strength of wood and lower its value as building lumber. In many cases, particularly with thick lumber, it is difficult to detect them visually.

The National Research Council of Canada has successfully used pulsed ultrasound to detect such defects under controlled laboratory conditions.

Samples of wood were placed on the foam-padded bottom of a tank of water. Ultrasound pulses of one million cycles per second were transmitted through the water into various parts of the wood sample. Echoes, which reflect from inside the wood where density and compressibility varied, were amplified and displayed on an oscilloscope. A different echo pattern was made by each type of defect.

COMMUNICATIONS

Microwaves for tunnel communications

Drive through any tunnel—the 8,000 foot long Lincoln Tunnel connecting New Jersey and New York City, for example—and your radio goes dead. While merely a nuisance to the average driver, it is a big problem for tunnel authorities and police who must maintain constant and clearly audible communications.

Bell Telephone Laboratories, in Murray Hill, N.J., has found that microwave frequencies might provide simple, clear communications that can be adapted for use in mobile vehicles in tunnels, subways, or any enclosed environment.

The microwaves would be transmitted by high frequency radio transmitters and then picked up by receivers in a moving vehicle. A complete mobile microwave system could fit into a unit the size of a lunchbox.

Microwaves are not absorbed appreciably by the tunnel walls; instead, the walls themselves act as excellent wave reflectors, guiding the waves by side-to-side reflections along the length of the tunnel. Only at the tunnel's open ends do radio signals drop off as the waves spread into space.

OCEANOGRAPHY

The anatomy of an ocean wave

Little is known about the process by which the form of an ocean wave changes as it moves shoreward, breaks and surges up the beach.

Scientists of the Commerce Department's Environmental Science Services Administration have conducted a study to determine the nature of waves and their effect on beaches and structures along the shore.

The study involved taking color movies of individual waves as they broke against the shore and then analyzing the film. A vertical lattice of pipes perpendicular to the shore near the pier provided a grid against which the waves could be measured. Waves were filmed by a fixed camera on a pier.

The study was conducted by the Land and Sea Interaction Laboratory (LASIL) at Norfolk, Va., one of the ESSA Research Laboratories. Results of the study will enable the development of mathematical equations for predicting how high various waves will rise on a sloping beach or seawall. The equations will aid engineers concerned with shore protection structures and will provide insight into the mechanisms by which sand is moved under different wave conditions.

COMPUTERS

Program simulates disease epidemic

Two scientists at the Connecticut Agricultural Experiment Station at New Haven, have devised a computer program that enables them to simulate disease epidemics. They use *Alternaria solani,* the cause of early blight of tomatoes, as their model microorganism.

Dr. James Horsfall and Dr. Paul Waggoner reported their results at the autumn meeting of the National Academy of Sciences at the California Institute of Technology.

The computer program integrates all of the variables in the life cycle of an *A. solani,* and all of the interactions of the weather, into one assessment of early-blight disease.

The computer is instructed to decide, from these thousands of bits of information, the fate of disease spores and the disease epidemic that originates from them. The program takes into account seven recognized stages in development of the disease. The microorganism matures quickly, and as many as 13 seven-day cycles, from spore to spore, may occur in a single growing season.

The computer reveals, as of the end of each day in the simulated tomato field, whether there are more lesions on the leaves than there were a day earlier. This tells the scientist whether the given set of circumstances produces an epidemic, and how severe it is.

LIGHT DETECTION

Improving the photomultiplier

A light detector, or photomultiplier, described as 10 times more efficient than those presently in use, has been developed by the industrial tube division of RCA in Lancaster, Pa.

When light strikes a photomultiplier, electrons are emitted by the first stage of the device. These strike the second stage, causing it to emit still more electrons, and so on through as many as 10 or 12 stages, essentially amplifying the strength of the light signal. Photomultipliers are thus useful in such applications as detecting faint stars, or other dim light signals.

The key to the improvement is the use of gallium phosphide as the electron emitting layer of the first stage. "For an applied field of 600 volts, for example," says Dr. Ralph E. Simon of the company's Conversion Devices Laboratory, "gallium phosphide will multiply one primary electron into an average of 30 secondary electrons. By contrast, the best conventional materials produce an average of only five. . . . Increasing the voltage will raise this ratio still further in the case of gallium phosphide. . . . Conventional materials, on the other hand, have intrinsic limits that are 10 times lower." Gains greater than 100 percent have been measured.