GEOPHYSICS

Reliable Radio Signals

Long-distance radio communication difficulties can be overcome with new system more than 99% reliable under some conditions. Scattered radio waves are used.

➤ A NEW method for sending long-distance radio signals, more than 90% reliable, is being used between northern Maine and Thule in northern Greenland, Science Service learned. Under some conditions, propagation is over 99% reliable.

It gives interference-free reception between points 600 to 1,200 miles apart. The system is free from ordinary atmospheric disturbances that plague shortwave users during long-distance transmissions.

Some technical details are under security wraps, but the method has been successful in over a year's use.

The new kind of radio propagation at very high frequencies over long distances has important military applications, particularly in the Arctic and Antarctic where communications are very often disturbed by auroras and magnetic storms.

Early warning radar lines such as DEW, for distant early warning, across the Arctic wastelands of northern Canada and Alaska, could use the system to signal back to the United States approach of enemy bombers over the polar regions several hours before they reached target cities.

Shortwave radio is not reliable for such purposes. Scientists rate regular shortwave channels, sending at three to 30 megacycles, as only 70% to 80% efficient because of atmospheric disturbances. Sometimes transmissions are blacked out for hours or days.

Radio signals of the new system actually come through more clearly at times when reception of shortwave becomes thus disturbed. High power, about 30 kilowatts, is required to send the signals.

Other nations, such as Norway and France, are known to be experimenting with the system. It is presumed that Russia, also, is learning to use this new type of radio transmission.

Radio waves of 30 to 40 megacycles are used, higher than those of the standard broadcast band, 550 to 1,500 kilocycles, but lower than those of commercial television, which start at 58 megacycles.

The 30 to 40 megacycle band is now used for low-power short-range transmissions, such as for Army field telephones, police broadcasts and communications by industrial companies.

Eventual redistribution of this part of the radio spectrum to cover long-range high-power use under the new system is foreseen by radio experts. Transition will be gradual, they believe.

Although the high power transmitters and receivers needed are expensive to build, the method is cheap when its reliability is considered.

The system's operation can be likened to "seeing," from hundreds of miles away, a powerful searchlight beamed into the air behind a mountain. The light beam actually goes off into space, but impurities—dust, pollen, etc.—in the air catch a very tiny portion of the rays. This light could be seen with a telescope by someone hundreds of miles away, if the exact spot to look is known.

Similarly, most of the radio frequency power in the new method is lost, but some is scattered by the lower part of the E region, a layer in the earth's atmosphere 45 to 55 miles above the surface. This portion is received hundreds of miles away by high-gain antennas aimed at the exact spot.

The system is called either forward scatter, or FPIS, for forward propagation by ionospheric scatter. The method was just tested between Cedar Rapids, Iowa, and Sterling, W. Va.

U. S. armed forces have had four communication channels in operation since January, 1954, transmitting from Goose Bay, Labrador, to Sondrestrom, just south of the center of Greenland, and from there to the far northern base of Thule.

Human error and equipment difficulties have prevented measuring reliability to an exact decimal above 99%.

The scientists who first reported experimental discovery of the new type of radio propagation were D. K. Bailey, R. Bateman and G. F. Montgomery of the National Bureau of Standards, Washington, Dr. L. V. Berkner of Associated Universities, Upton, N. Y., Dr. H. G. Booker of Cornell University, Ithaca, N. Y., Nobel Prize winner Dr. E. M. Purcell of Harvard University, W. W. Salisbury of Collins Radio Company, Cedar Rapids, Iowa, and Dr. J. B. Wiesner of Massachusetts Institute of Technology.

Success of the system was first revealed at the Institute of Radio Engineers recent convention in New York.

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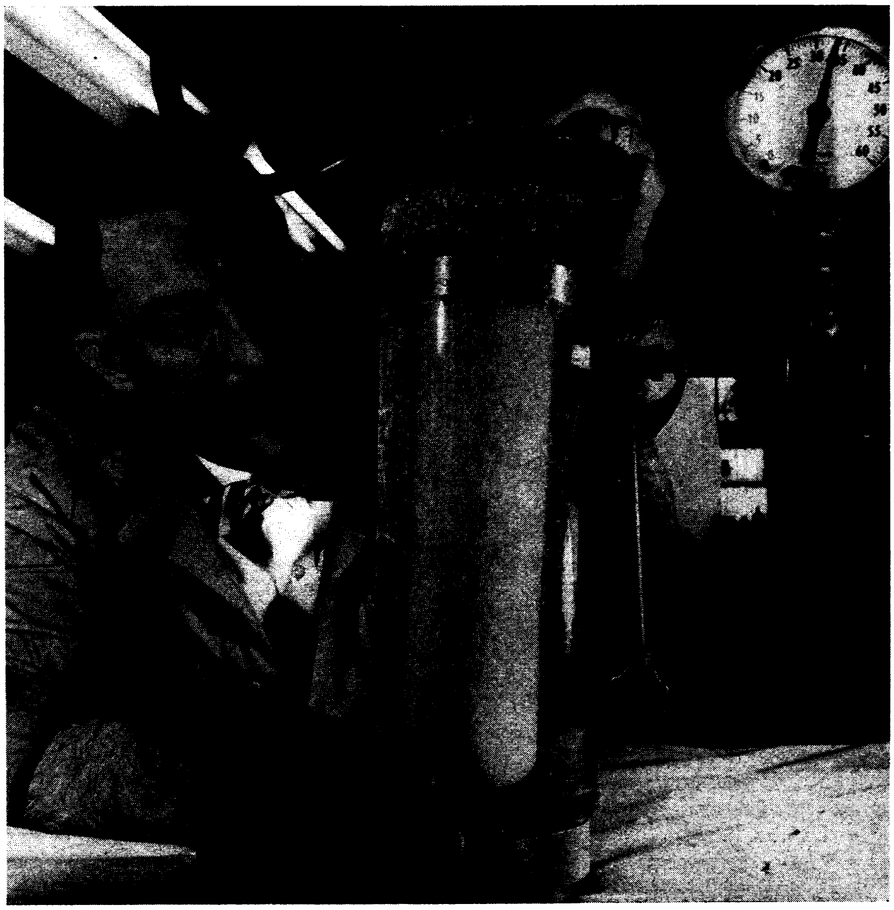

CERAMIC FILTER—With its 800,000,000 holes per square inch, this long white filter can strain Salk vaccine for bacteriological purity. Jack Kerns, engineer for Selas Corporation of America, which developed the filter, tests the device. Number of holes per filter is measured precisely by checking the air pressure needed to create bubbling in water.