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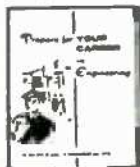
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MS-123

Radio Sextant Tracks Moon

New precision instrument aboard Navy experimental navigation ship has ten times the accuracy of present marine compasses.



Control console aboard navigation ship.

FOR the first time in history, the moon has been tracked continuously by radio through the use of a new precision radio sextant designed and constructed by Collins Radio Company. The new radio sextant has been delivered and installed aboard the Navy's experimental navigation ship, the USS "Compass Island," where it is used in navigation research. The unit is also used to track the sun and such tracking is possible even under foul weather conditions. In addition, the sextant functions as a precise compass, furnishing the direction of north with more than ten times the accuracy of present marine compasses.

The instrument utilizes a 5-foot parabolic antenna connected to an extremely sensitive radio receiver that measures the thermal radiation in the short microwave region. Operation is at a wavelength of 1.8 centimeters (about 16,500 mc.). A new tracking system involving advanced servo techniques is used. A special remote angle read-out system, which can punch its data directly on cards with great precision, is part of the installation. It is also possible to control and check all phases of operation from a remote-control console. From a mechanical standpoint, machining processes with tolerances as small as 25 millionths of an inch were required, and new procedures for optical alignment were worked out. In order to provide the necessary mechanical precision, an air-

conditioning and heating system is used to maintain the equipment at a constant temperature at all times.

Aboard the USS "Compass Island," radio sextant observational data is coupled with the vessel's precision time standard and presented directly to a navigational computer. This then combines celestial and inertial data to determine the ship's location and true north.

The sextant operates by picking up radiation from the moon or sun. Such radiation fluctuates in the same fashion as the Johnson noise from a resistor, making detection of the weak signal difficult. In this instrument, the antenna scans a circle around the sun or moon's rim. If the antenna is pointed directly at the sun or moon, the received signal will show no modulation at the scanning frequency, but if the antenna is displaced slightly, the moon or sun signal will be modulated. Phase-sensitive detectors derive error voltages which are used to make the radio sextant's antenna track the sun or moon.

The use of other heavenly bodies, such as radio stars, is presently very difficult with practical size receiving equipment. These stars produce extremely weak radiation in a much longer wavelength portion of the microwave region so that high resolving power is difficult to achieve with reasonably compact equipment of the type described above.

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Antenna system of the AN/SRN-4 radio sextant installed on the USS "Compass Island."

