ENGINEERING

Magnetron Tube

Mass production of the heart of radar assisted greatly in making sufficient modern radar to play its important role in war.

➤ THE STORY of how mass production of magnetron tubes, the heart of modern radar, was developed was told by officials of the Raytheon Manufacturing Company, said to be the largest maker of these tubes in the world. The mass production gave a sufficient supply of this essential part to permit the construction of enough radar equipment to meet the war needs both of America and England. Raytheon turned out, it is claimed, over half of all the magnetrons produced in the world.

The early magnetron was a British invention and was brought to this country to the government's Radiation Laboratory on the campus of the Massachusetts Institute of Technology in the summer of 1940. It was capable of generating microwaves of a power theretofore unknown. This English tube was very much improved by scientists at the l boratory, and various improved types, manufactured in America, became standard in all Allied radar equipment.

The magnetron is an oscillator, but magnetron oscillators differ from ordinary radio-frequency oscillators. It uses a magnetic field in conjunction with an electrostatic field to guide the electrons. Also the efficiency of the magnetron oscillator is very high at frequencies where the usual types of radio frequency oscillators refuse even to operate. For this reason magnetron tubes are not only the key to radar, but also to all ultra-high frequency radio designs.

Basically, the cavity magnetron, the type most commonly used, is made up of a heavy cylinder of copper around whose inner diameter a series of identical key holes have been cut with the narrow slot opening into the center hole. Each of the key holes represents a transmitter circuit. In the center of the body is placed an emitting cylinder, usually a nickel sleeve coated with an active material which upon heating produces a copious flow of electrons.

The electrical operation of the cavity magnetron can be best understood by remembering that the oscillators are placed cylindrically around the axis of the cathode, and a means of exciting these cavities must be provided. A magnetic field is applied axially to this diode, which causes the electrons emitted from the cathode to perform circular paths about the cathode. The electric motion can be thought of as an air stream passing a slot, which, when it acquires the correct velocity, causes the cavity to resonate.

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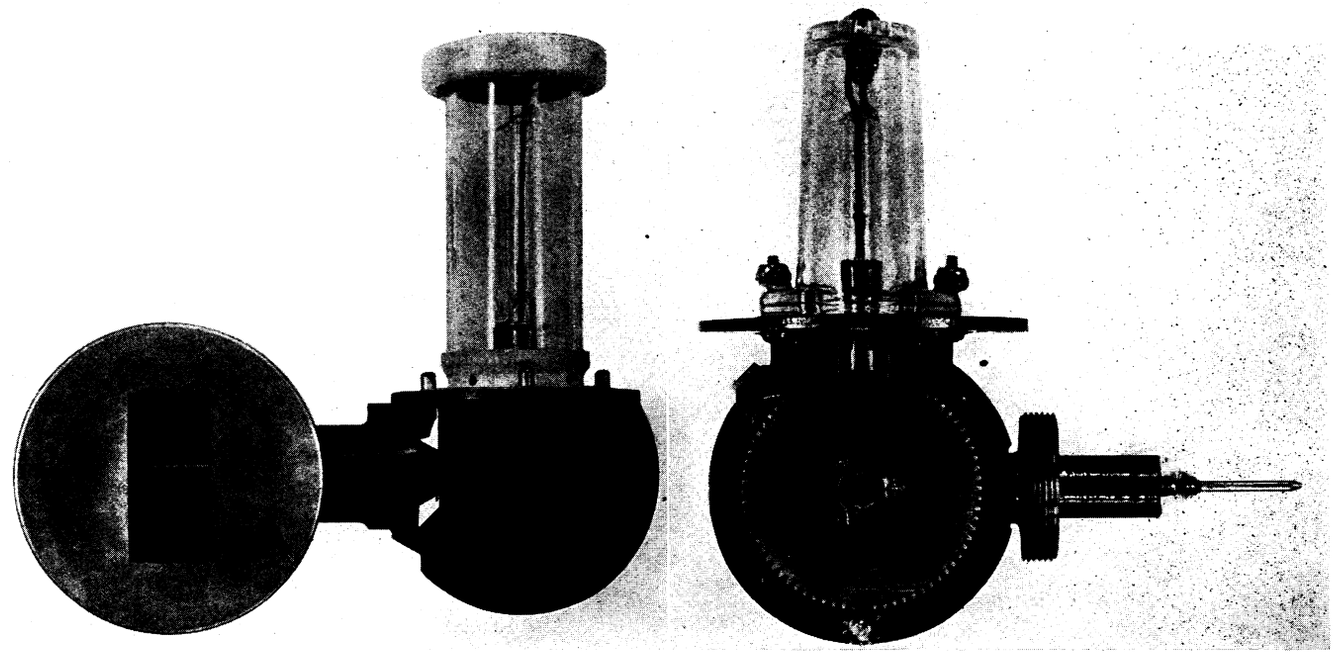
AERONAUTICS-ORDNANCE

Radar-Guided Bat Bombs Blasted Jap Shipping

See Front Cover

➤ LAUNCHED by Navy Privateer patrol bombers outside the range of enemy anti-aircraft fire, and guided to distant targets by radar, Navy "Bat" bombs destroyed many tons of Jap shipping in the last year of the war. Operating on somewhat the same principle as live bats, which emit a short



HEART OF RADAR—The tube at the left is used primarily for high powered search and is a fixed frequency 12 cavity magnetron oscillator capable of delivering 1 megawatt peak power at 3500 megacycles. At the right, is type 2J54B tunable magnetron oscillator. This tube delivers 50 kilowatts peak power under pulsed conditions over a frequency range of 3120 to 3260 megacycles.