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.

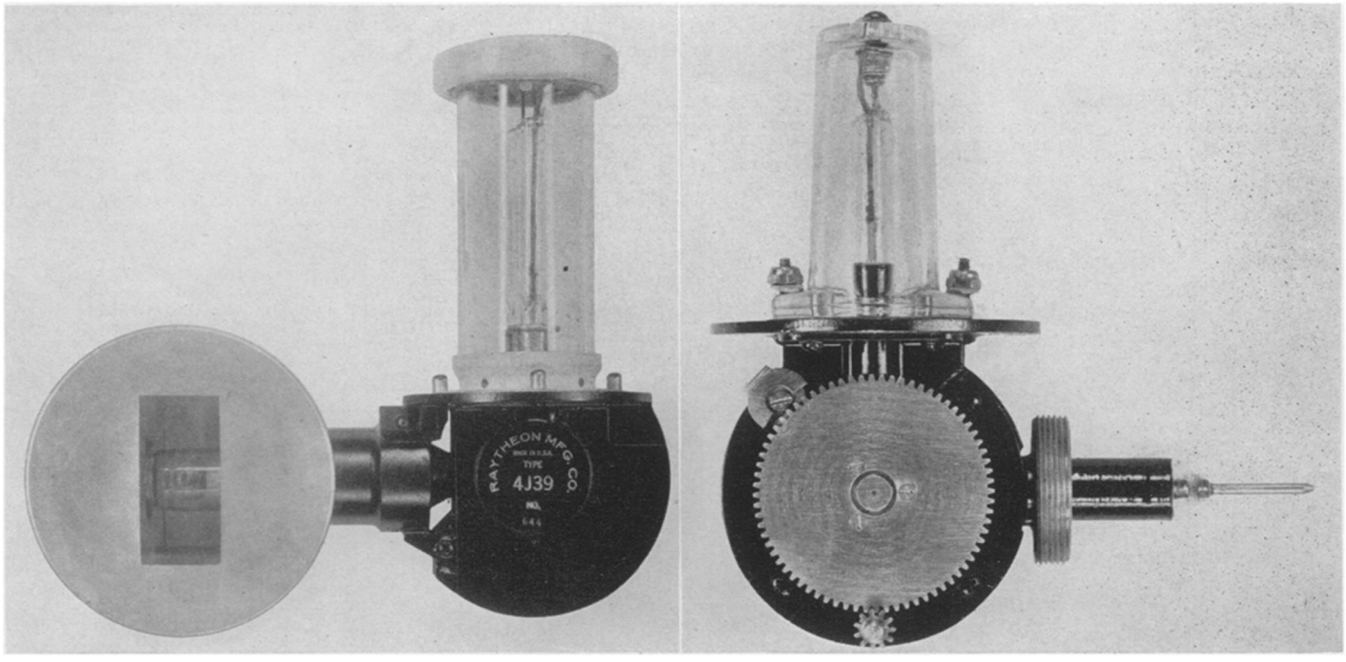
Science News Letter, December 29, 1945

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.

pulse of sound and direct themselves by echoes, robot "Bats" are guided by radar echoes. In the official U. S. Navy photograph on the front cover of this SCIENCE NEWS LETTER, a pulley device lifts the robot "Bat" to its launching position under the wing of the plane.

"Bats" were "briefed" on the target selected by the mother plane before being released. After their release, they were piloted by their own radar installation alone to hit the target—following the object despite the most extensive maneuvers.

Science News Letter, December 29, 1945

GEOLOGY

Productive Oil Field

Oklahoma pool is most important discovered since Pearl Harbor. By September of this year, it had produced nearly 25,000,000 barrels.

➤ DEFINITE faith on the part of the owner that there was oil in the area in spite of the lack of geological or geophysical evidence is responsible for the recent discovery of the West Edmond, Oklahoma, oil field, probably the most important oil pool found in the United States since Pearl Harbor. By September, 1945, the field had produced nearly 25,000,000 barrels.

The story of the opening of this field, Oklahoma's largest single oil field, is told in *Mining and Metallurgy*, (Dec.) journal of the American Institute of Mining and Metallurgical Engineers. It is told by E. G. Dahlgren of the Interstate Oil Compact Commission and Dan O. Howard, petroleum geologist of the Oklahoma Corporation Commission.

The area of the field is 26,800 acres, or over 41 square miles, and it is now equipped with 670 producing wells. One company estimates that there are some 600,000,000 barrels of oil in the ground, about one-third of which can be recovered by primary methods, leaving 400,000,000 barrels to be recovered by the various secondary methods of pressure maintenance, water-flooding, and re-pressuring.

The first well was started on Jan. 2, 1943, and on April 28 that year was flowing 522 barrels of light oil in 24 hours. Now, according to the report, the average initial production of the wells in the area is 1,200 barrels a day, with individual wells ranging in initial production from a minimum of 25 barrels to a maximum of 4,800 barrels each 24 hours.

When drilling of the first well was begun, it was planned to drill down to the Wilcox sand, estimated at about 7,350 feet but found at 7,670 feet. No oil was found in the Wilcox sand, however, but there had been a slight indication of oil when the well passed through the Hunton lime formation at a depth of 6,866 feet. It is in the Hunton lime that the oil exists.

"Seven-inch outside diameter casing was set at 7,301 feet through the Hunton lime," the authors state. "A cable-tool unit was moved on the location on March 31, 1943; the well bailed dry and perforated on April 5, 1943. Eleven holes were shot in the casing at from 6,951 to 6,856 feet, and the well started to head through the open casing. On April 28, after additional perforating, and after 2½-inch tubing had been run, the well flowed 522 barrels of oil in 24 hours."

Science News Letter, December 29, 1945

MEDICINE

Spotted Fever Remedy May Exist in B Vitamin

➤ A CHEMICAL remedy for dangerous, sometimes fatal Rocky Mountain spotted fever may exist in one of the B vitamins, para-aminobenzoic acid, it appears from a case reported by Drs. Harry M. Rose, Richard B. Duane and Edward E. Fischel of Columbia University College of Physicians and Surgeons and Presbyterian Hospital, New York (*Journal, American Medical Association,* Dec. 22).

Although a serum for treating the disease was developed a few years ago, no specific chemical remedy has heretofore been found. Results in one case do not prove that this B vitamin chemical is a remedy for the disease, the New York doctors point out, but they are suggestive.

A "precipitous" drop in the patient's temperature occurred when she was given this chemical, and her condition improved after the first 24 hours of treatment. She was entirely free of symptoms within 10 days.

Para-aminobenzoic acid had previously been found very effective in treating Rocky Mountain spotted fever in guinea pigs and it has been used with good results in typhus fever, which is also caused by germs of the rickettsia class.

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Rain water that falls in districts near the sea coasts usually contains appreciable quantities of chlorides.

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