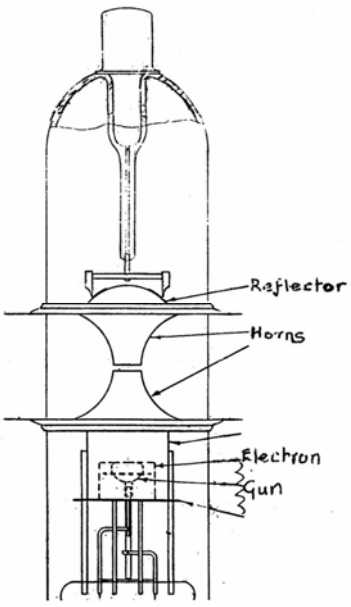
NR89 10E/501 - Very Early British Klystron = CV11

- The above sample is the only known original 'Sutton tube' reflex klystron still surviving. It can be easily identified for its cup-shaped top reflector. Click to enlarge.

NR89 was the first reflex klystron. It was designed by Robert Sutton of the Signal School group at Bristol in 1940, soon after the decision of developing a 10 cm radar. The design moved from the documentation of early prototypes recently developed by Varian brothers at Stanford. For the best stability, Sutton decided to use an external high-Q cavity instead of deformable diaphragms. To connect the internal edges to the external cavity he took advantage of the glass-to-metal seal processes recently developed at GEC. He used a CRT gun to generate the electron beam and cup-shaped reflector to keep the beam focused in its way back to the resonator. The deep-drawn horns terminated in a quite large iris. An un-based bulb is in the collection.



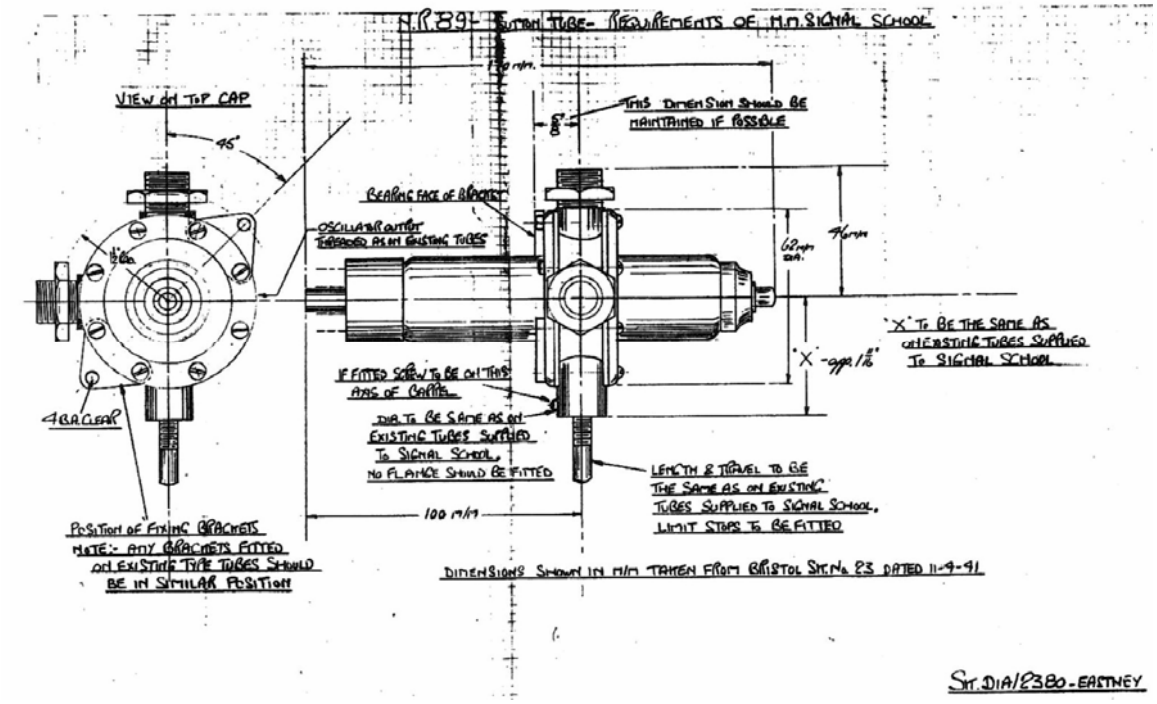
- Click to enlarge

The first oscillator, complete with its external cavity, operated in September 1940. It gave 10 mW in output and could be tuned over a 3% range. In December 1940 the development was complete with tuning range increased to 8%. The klystron, also known as ‘Sutton tube’, was standardized as NR89, AM store code 10E/501, and later as CV11. It was used in all the early 10 cm radar sets built through 1941, including the early Type 271 Naval radar. Early in 1941 improved variants of NR89, known as Type 8, were built for Canadian REL by Rogers as Type 8A to 8D.

The internal irides were terminated in large holes, to keep very low the coupling with the electron beam and hence the noise. The tube oscillated in very high mode due to the long drift space, increased by the cup shaped reflector. Its tuning was critical and required frequent adjustments of the focusing potentiometer. NR89 required to operate about 1700 V, well stabilized. Due to the quite high resonator voltage, its use was very difficult in airborne application. Nevertheless it was the only reflex klystron suitable as local oscillator in 10-cm radar receivers through the early steps of the microwave sets and until the late 1941, when the new improved EMI types, as the CV35 and the CV67, were first released.

4 V at 1.45 A heater. -275 V reflector.

Pinout: 1 focus grid, 2 and 7 heater, 8 cathode. Reflector to top cap.



- Draft of the NR89. Click to enlarge

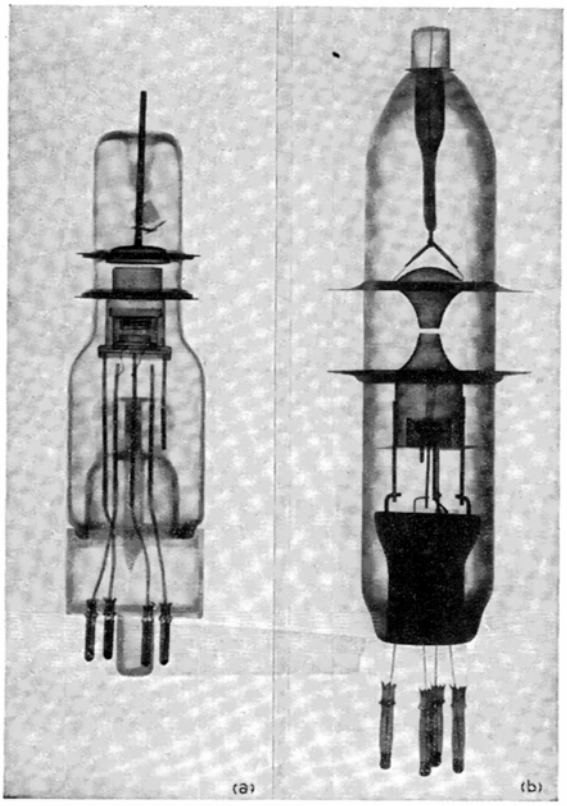


FIG. 11.3–14. X-ray views of early models of reflex oscillator tubes for use with external cavities.

The NR89 'Sutton tube' was the only reflex klystron suitable for use as local oscillator in 10 cm radar receivers from mid 1940 to the late 1941. Here an X-ray image (b) taken at Bell Labs. near to the first Western Electric similar device, the 707A (a), introduced only at the end of 1941.