Tonne.

A system was developed for guided missiles employing a television camera and radio link carried in the missile and reporting back to a television receiver in a parent aircraft. In the initial work, use was made of the German standard 441-line system with 50 frames inter-laced. The system was found to give about 200-line definition owing to the complication of interlacing under the working conditions of the project.

Tonne I therefore used a 220-line sequential scan with 50 frames per second, for simplification of the missile equipment and for economy of band-width.

For use in similar missiles a further system (Tonne II) was developed employing a diagonal scan of 400 lines and 10 frames per second, with further economy of size in the missile equipment. Neither of these systems was considered capable of giving results comparable with those of normal broadcast practice, but they were nevertheless adequate for their military purpose.

The method of synchronisation in Tonne I differs from that employed in broadcast practice by the omission of frame synchronisin pulses in the transmitted waveform - See Fig. 1. A block schematic diagram of this system is given in Fig. 2, showing the use of a locked-in sine-wave oscillator.

The advantage claimed for the use of this type of oscillator is greater stability under conditions of severe and rapid fading. Owing to the "fly-wheel" effect of such a system, it is less affected by interference and omission of groups of synchronising pulses. The system requires manual adjustment of the "lines" and "frames" at the receiving end.

Tonne II, employed two locked-in sinewave oscillators (frequencies 2000 and 2010) for synchronisation of the diagonal scanning. The block schematic diagram is given in Fig. 3.

Simplification of the missile equipment was effected by the omission of the dividing chain and large condensers rendered redundant by the absence of low-frequency scanning circuits. Manual picture adjustment is required as in the case of Tonne I. The system was never put into operational use.

Cameras for Tonne.

The camera tube which was developed for Tonne I was a miniaturised super-iconoscope. Fig. 4 - drawn from memory - shows details, and a report on this tube with drawings giving full constructional details and manufacturing process has been asked for.

During the final months of production 300 tubes per month were being manufactured by semi-skilled labour (women) with a yield of approximately 200 completely satisfactory tubes - i.e. tubes having good definition and contrast, no spots, and non-microphonic. In the initial manufacturing stages the "shrinkage" was 90 per cent.

Mosaics of both caesium on silver and caesium-antimony were used, the latter for bulk production.

Cathode-Ray Tubes for Tonne.

A cathode-ray tube, 16 cms. in diameter and 30 cms. overall length (approximately) was used for Tonne I having a normal sprayed white television screen, the powder being supplied by Auer. This tube operated at 6 K.V., the line-width (50 per cent. intensity curve) was 1/300th of the picture height. Later experimental tubes were operated at 12 K.V. The only special features were those required to reduce vibration effects. The tube had a neck of very small diameter (18 mm. external, 14 mm. internal), and the modulator was sealed in the glass of the neck. The tube was magnetically focussed and deflected, and the line-scan coils were interesting in that they were moulded in polystyrene.

E.H.T. for Receiver Unit (Tonne).

The 6000-volt supply for the cathode-ray tube is derived from the flyback voltage of the line-scanning circuit. Three additional windings on the line-scanning transformers are connected to three rectifiers (DH 6/5 - Fernseh), the outputs of which are connected in series. The 6 KV supply is stabilised. The heater power for these rectifiers (100 mW per rectifier) is also supplied from this transformer.

Transmitter and Receiver (Tonne I and II).

The focussing current for the cathode-ray tube in the receiver is stabilised by a series barretter. In the case of the inconoscope, where the requirement is more rigid, a gas discharge tube is employed. For simplification in the missile equipment, Fernseh were experimenting with electrostatic deflection for the iconoscope. A broken sample was inspected. The circuit and description of the diode modulator used for the transmitter are given in Fig. 5.

FIGURE 1.

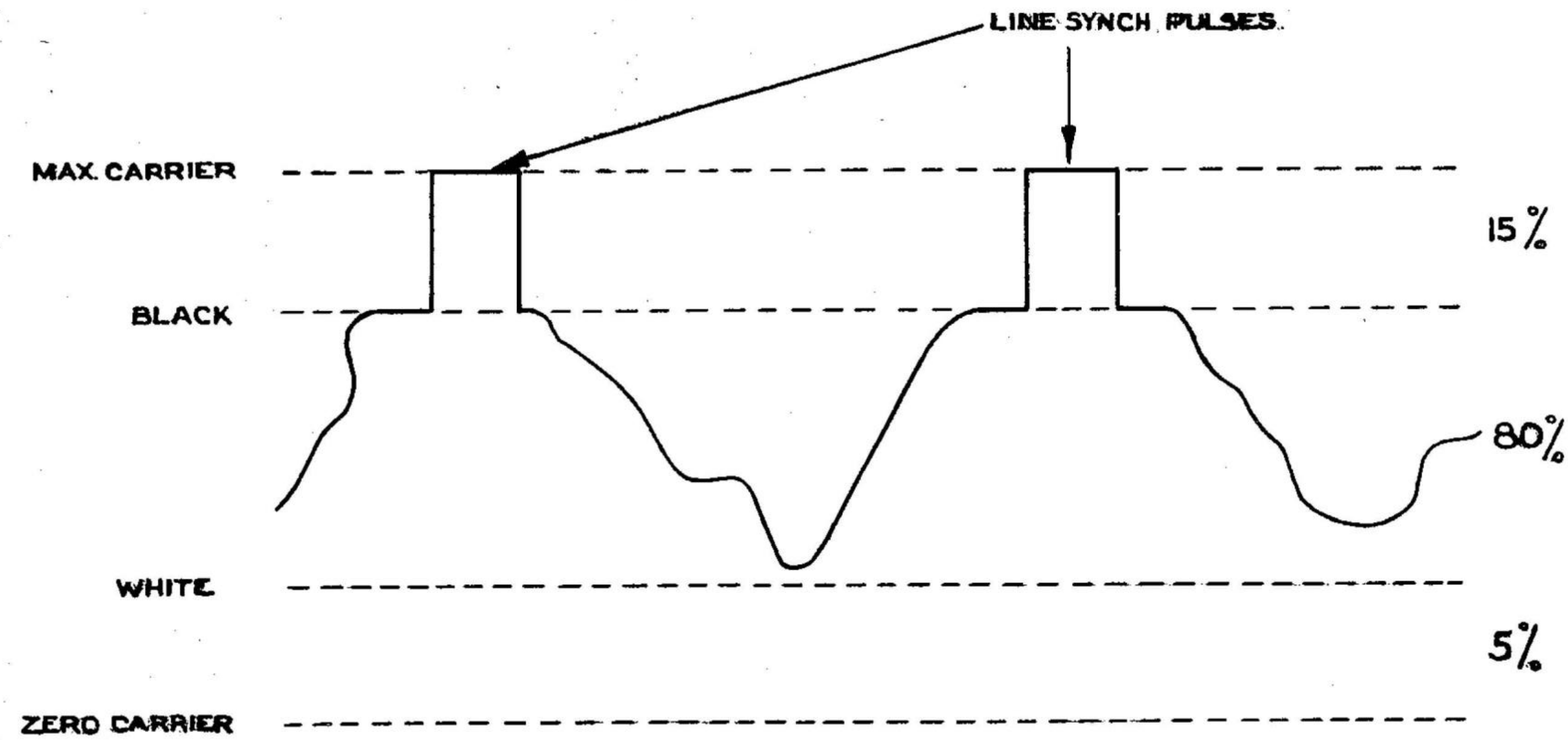
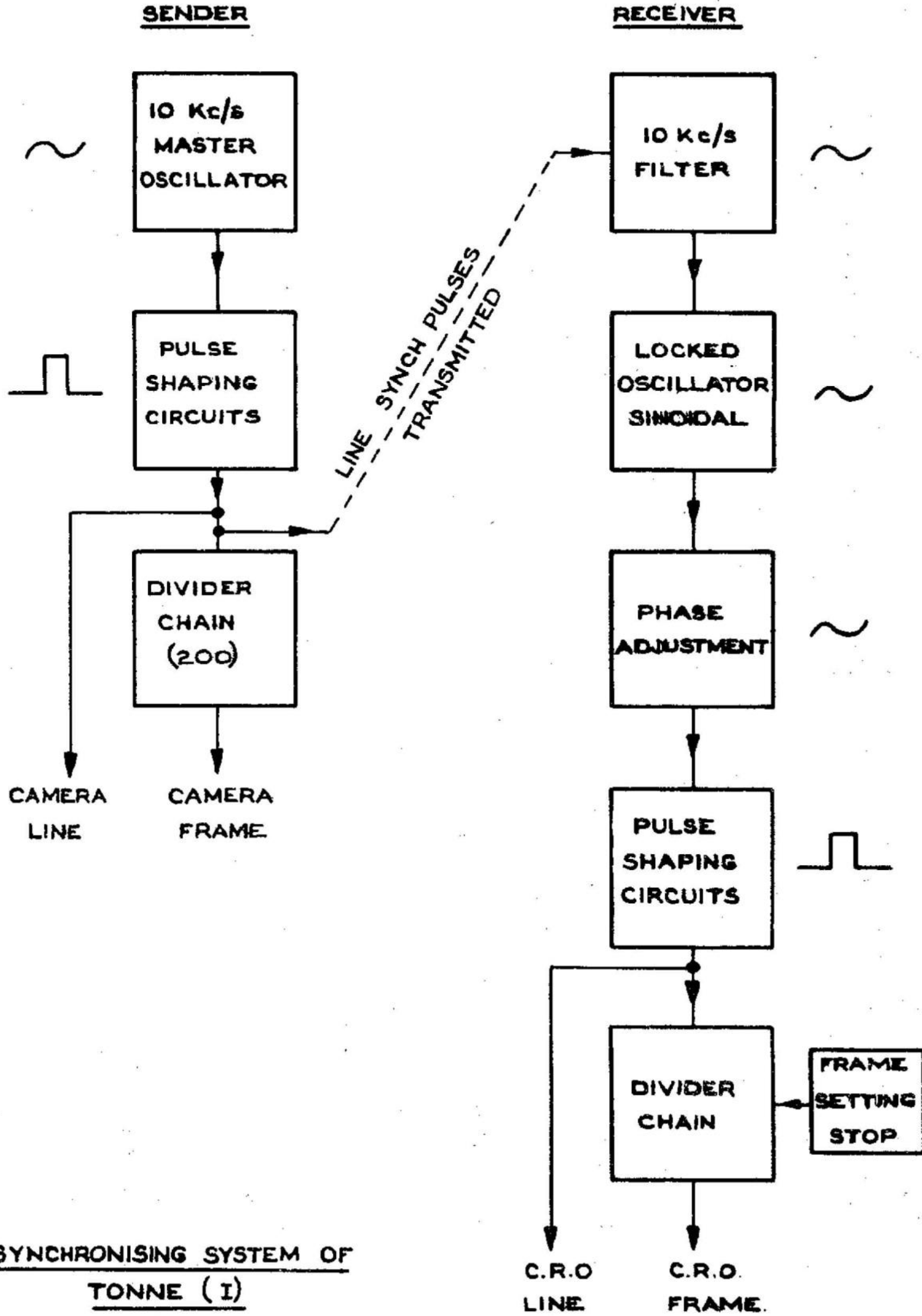
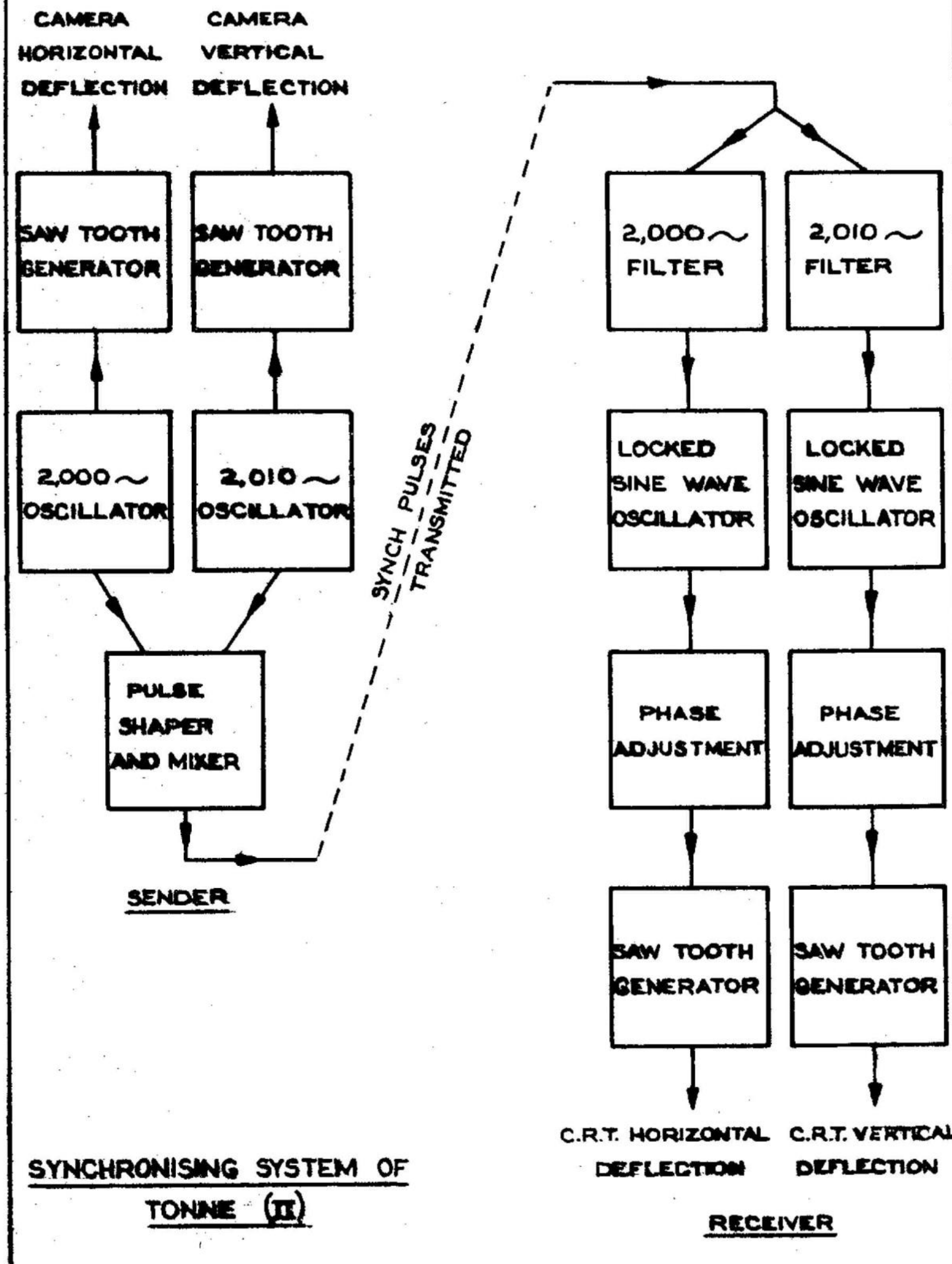

LINE SYNCH PULSES.
MAX. CARRIER
BLACK
WHITE
ZERO CARRIER
15%
80%
5%

FIGURE 2



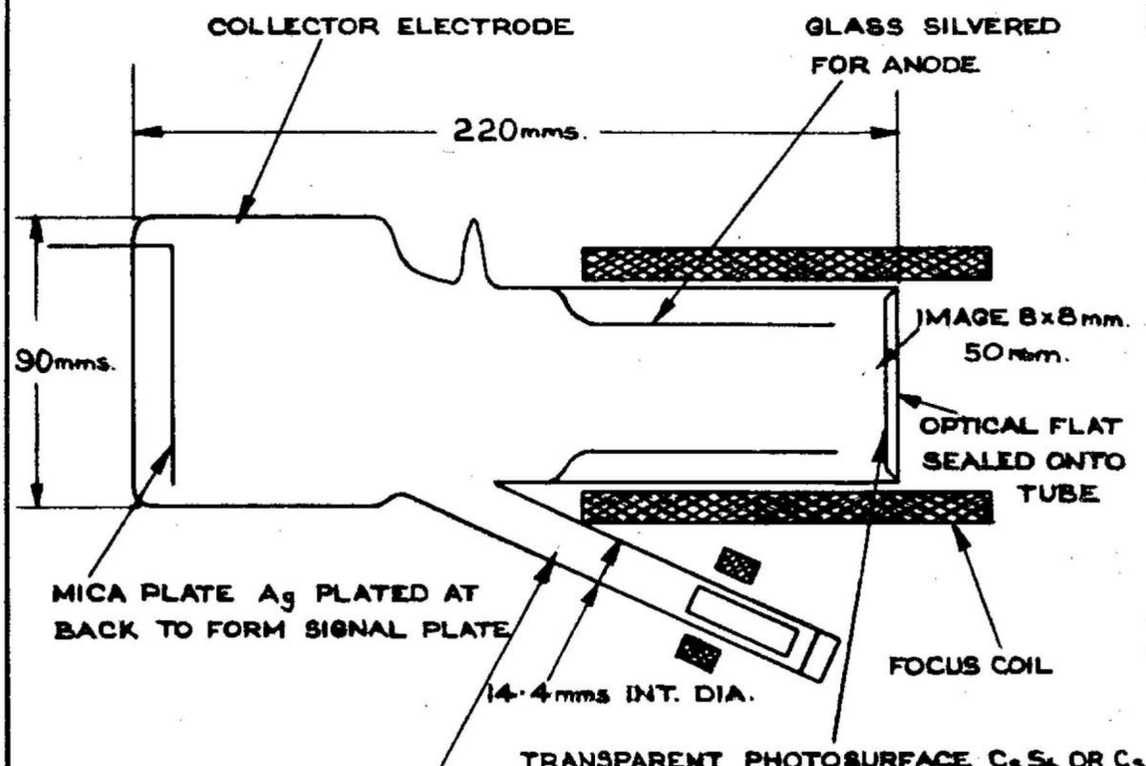
SYNCHRONISING SYSTEM OF TONNE (I)

FIGURE 3



SYNCHRONISING SYSTEM OF TONNIE (II)

FIGURE 4



CAMERA TUBE

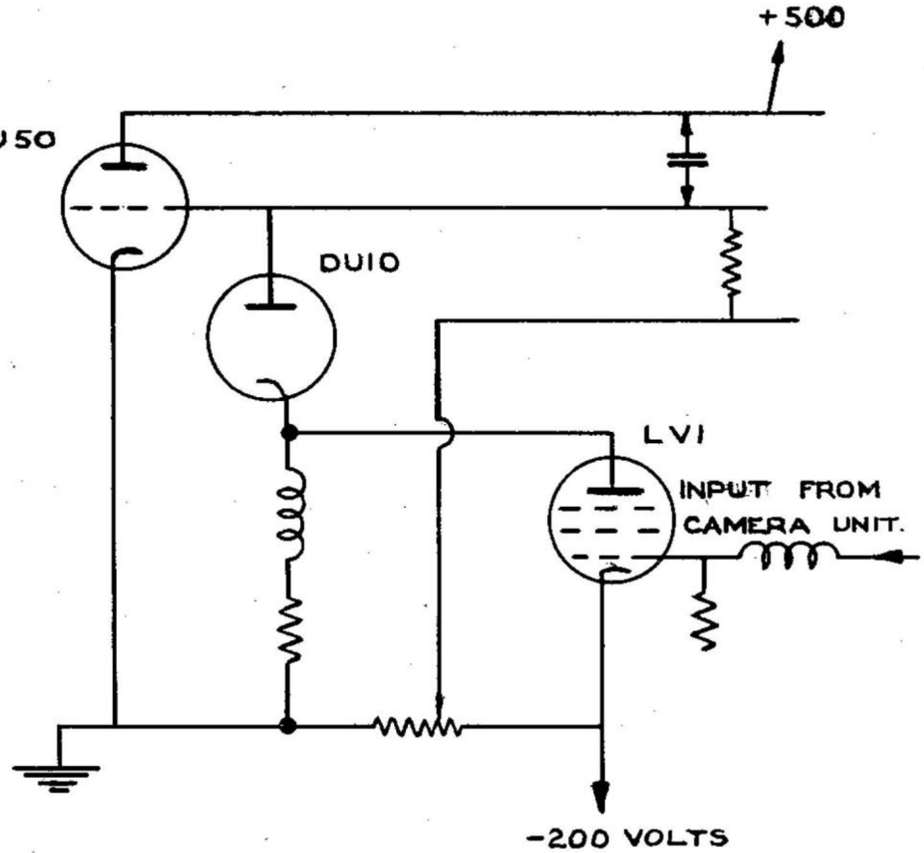
(FOR A GOOD PICTURE i.e. ADEQUATE CONTRAST & DEFINITION FOR TONNE I SUPER ICONOSCOPE. F 3·5 LENS. 2000 LUX.)

MADE OF SODA GLASS. (GLASS WORK TIME 50 MINS)

REPORT ON THE ABOVE LF 71 WITH ADDITIONAL DRAWINGS REQUESTED.

* BERICHT UBER DIE BILD AUFNAHMERÖHRE

FIGURE 5



A SPECIAL DIODE DEVELOPED BY FEINSCH (DU10) OF LOW CAPACITANCE (1 μμF) WAS CONNECTED CLOSE TO THE GRID OF THE 70 CM. OSCILLATOR TU50 AND FED ON THE CATHODE FROM THE FINAL MODULATOR TUBE (LV1 TELEFUNKEN). IN THE CONDITION OF MAX: CARRIER THE DIODE IS NON CONDUCTING; WHEN THE DIODE CATHODE POTENTIAL FALLS, MODULATION IS EFFECTED INITIALLY BY DAMPING OF THE LECHER LINE CIRCUIT, AND FURTHER, BY SHIFTING THE WORKING POINT OF THE TU50. DC RESTORATION IS NOT NECESSARY DUE TO DUAL-CONNECTION FROM THE TU50 GRID TO LV1 ANODE.

DIODE MODULATOR TONNE I & II

From B.I.O.S. Final Report, Television Development and Application in Germany