COSSOR TRANSISTOR PORTABLE Model 546

General Description: Portable two-waveband superheterodyne receiver using six transistors and germanium diode operating from dry batteries.

Power Supplies: Six 1·5-volt cells (Ever Ready LPU2 or equivalent), consumption 7·5 mA. under no-signal conditions rising to 54 mA. with 300 mW. sine-wave output.

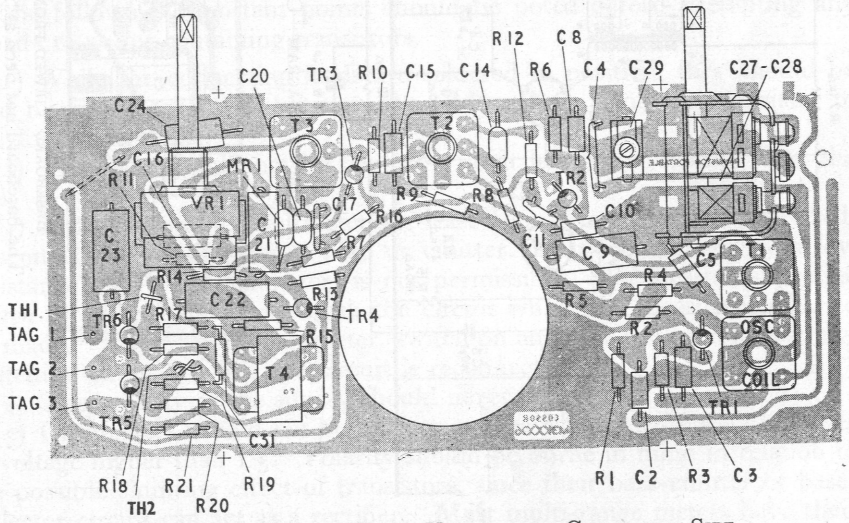
Wavebands: M.W. 185–550 m.; L.W. 1090–1910 m.

Transistor Analysis: The following measurements were made using a 20,000-ohms/volt testmeter, voltages being measured between transistor terminals and chassis (positive). Currents were measured in series with the transistor collector lead.

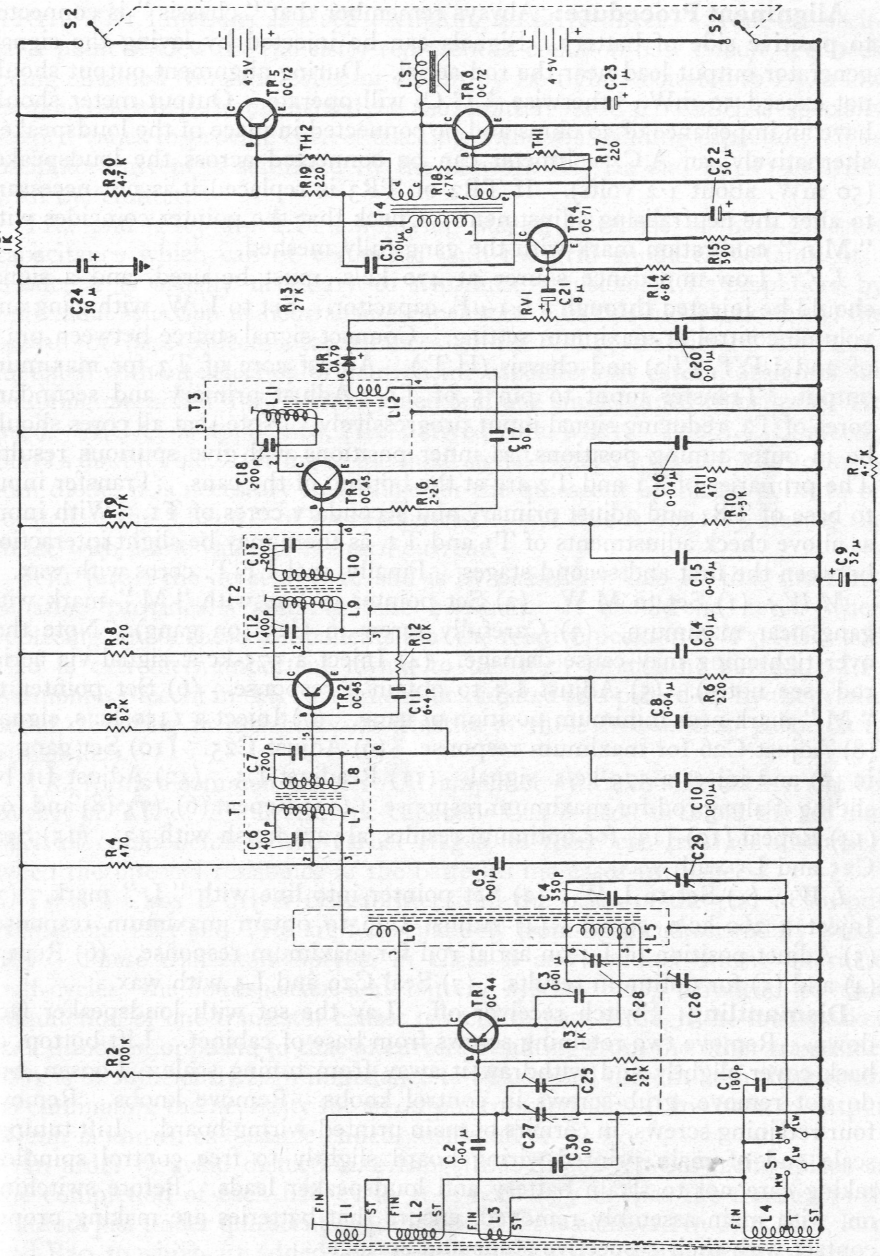
Transistor	*Function*	*Collector, volts*	*Collector, mA.*	*Emitter, volts*
TR1 OC44 . .	Self-oscillating mixer	5·4–5·5 †	0·77–0·82 *	0·7–0·92 *
TR2 OC45 . .	I.F. amplifier	5·65	0·78 *	0·17
TR3 OC45 . .	I.F. amplifier	5·65	0·9	0·42
TR4 OC71 . .	Audio driver	8·8	2·4	1·0
TR5, TR6 } OC72 . .	Push–pull output	—	2·0 ‡	—

* Depends upon setting of tuning gang and wave-change switch.
† No input signal.
‡ Quiescent condition, 20° C., individual readings should not differ by more than 0·1 mA.

Servicing Precautions: The chassis and scale plate are both part of the printed circuit, and should be treated with care. Precautions which should be taken when testing transistors are discussed under Model 544.



MAIN PRINTED WIRING BOARD VIEWED FROM COMPONENT SIDE



CIRCUIT DIAGRAM—COSSOR MODEL 546

Note: In later models C20 is 0·04 μF. and C23 is 4 μF.

Alignment Procedure: Always remember that " chassis " is connected to positive side of battery. Signals can be injected by laying the signal-generator output lead near the rod aerial. During alignment output should not exceed 50 mW., otherwise A.G.C. will operate. Output meter should have an impedance of 30 ohms and be connected in place of the loudspeaker, alternatively, an A.C. voltmeter can be connected across the loudspeaker (50 mW. about 1·2 volts). If TR2 or TR3 is replaced it is not necessary to alter the neutralising adjustment. Check that the pointer coincides with " Min " calibration mark with the gang fully meshed.

I.F.: Low-impedance source at 470 kc/s. must be used, and a signal should be injected through a 0·1-μF. capacitor. Set to L.W. with gang and volume control at maximum setting. Connect signal source between pin 5 of 2nd I.F.T. (T2) and chassis (H.T.). Adjust core of T3 for maximum output. Transfer input to pin 5 of T1. Adjust primary and secondary cores of T2, reducing signal input progressively. Note that all cores should be in outer tuning positions, as inner positions will give spurious results. The primaries of T1 and T2 are at the bottom of the cans. Transfer input to base of TR1 and adjust primary and secondary cores of T1. With input as above check adjustments of T1 and T2, as there may be slight interaction between the first and second stages. Finally, seal I.F.T. cores with wax.

M.W.: (1) Set to M.W. (2) Set pointer in line with " M " mark with gang near maximum. (3) Carefully screw in C25 (on gang). Note that over-tightening may cause damage. (4) Inject a 575-kc/s. signal via aerial rod (see notes). (5) Adjust L5 to obtain a response. (6) Set pointer to " M " mark near minimum position of gang. (7) Inject a 1450-kc/s. signal. (8) Adjust C26 for maximum response. (9) Adjust C25. (10) Set gang as in (2) and inject a 575-kc/s. signal. (11) Readjust L5. (12) Adjust L1 by sliding it along rod for maximum response. (13) Repeat (6), (7), (8) and (9). (14) Repeat (10)–(13) for optimum results, always finish with 13. (15) Seal C25 and L5 with wax.

L.W.: (1) Set to L.W. (2) Set pointer into line with " L " mark. (3) Inject a 260-kc/s. signal. (4) Adjust C29 to obtain maximum response. (5) Adjust position of L4 on aerial rod for maximum response. (6) Repeat (4) and (5) for optimum results. (7) Seal C29 and L4 with wax.

Dismantling: Switch receiver off. Lay the set with loudspeaker face down. Remove two retaining screws from base of cabinet. Lift bottom of back cover slightly and withdraw it away from tuning scale. Loosen, but do not remove, grub-screws in control knobs. Remove knobs. Remove four retaining screws, in corners of main printed-wiring board. Lift tuning-scale end of main printed-wiring board slightly to free control spindles, taking care not to strain battery and loudspeaker leads. Before switching on, with main assembly removed, ensure that batteries are making proper contact with their respective studs and springs.

Circuit Description: M.W. and L.W. aerial coils (L1, L2, L4) are wound on a ferrite rod and are tuned by C27. L3 forms a low-impedance coupling coil by means of which the incoming signals are fed to the base of

TR1. TR1 functions as a self-oscillating additive mixer. From the oscillator point of view the transistor represents a common-base circuit, feedback being obtained from the collector circuit by L6 tightly coupled to L5, a low tapping of which is connected to the emitter via C3. C28 has specially shaped vanes to provide correct tracking without a padding capacitor. The oscillator current is stabilised by the network R1, R2 and by R3 in series with the emitter.

TR2 and TR3 are I.F. amplifying stages. Because of base-collector capacitance which can be compared with the grid–anode capacitance of a triode, it is usually necessary to neutralise transistor I.F. amplifiers by individual selection of neutralising capacitors. In this model, however, the spread of base-collector capacitances of the OC45 transistors is accommodated without selection of neutralising capacitors by careful design of the coupling circuits. Two double-tuned and one single-tuned transformer are used. A.G.C. is applied to TR2, derived from MR1. The A.G.C. system plays a double role. Owing to the small signal voltage applied to the germanium diode, it is necessary to arrange for the quiescent operating point to be located at the " bend " of its characteristic, and this is done by biasing the diode with a low value of forward current.

RV1 forms the detector load and is by-passed by C20 so that the combination provides a suitable time constant. It should be noted when replacing any of these components that the relative position of T3, MR1 and C20 is extremely important owing to the high circulating current. I.F. harmonics present in this current can be radiated and picked up by the ferrite aerial, resulting in instability or whistles at these frequencies, particularly at 940 kc/s.

TR4 forms a common-emitter A.F. amplifier with bias stabilisation similar to that on TR3. An electrolytic capacitor C24 is used to avoid the feeding back of components in the earlier stages, as these can produce distortion when the internal resistance of the batteries increases with age.

T4 is a Class B driver transformer, and the bases of the pair of output transistors TR5 and TR6 are fed separately from balanced secondary windings. These transistors operate in Class B and conduct during alternate half-cycles, the loudspeaker and battery system being arranged so that conduction of one transistor causes current to pass through the loudspeaker in a direction opposite to that of current resulting from the other transistor. LS1 is of sufficiently high impedance to be coupled directly into the circuit, so eliminating the necessity for an output transformer. This form of output circuit is known as " single-ended push–pull ".

In order to avoid distortion, arising from discontinuities taking place at the completion of each half-cycle, it is necessary to bias the transistors to conduct just under quiescent conditions. This is achieved by R17, R18, R19 and R20, to which are added two thermistors to reduce considerably the temperature sensitivity of the system and thus avoid distortion, which may result from incorrect bias current, and minimize the risk of " thermal runaway ".