Servicing Radio Receivers

BEETHOVEN MODEL A3348

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THIS is a reasonably conventional type receiver designed round American octal type valves. It is for use on A.C. mains supplies only, and can cater for inputs of between 200 to 250 volts and 100 to 120 volts. A circuit giving normal coverage on long, medium and short waves is built around five valves, one being the H.T. rectifier. The valve line-up is 6K8G triode-hexode frequency changer; 6K7G intermediate frequency amplifier; 6Q7G double diode triode as A.F. amplifier, and signal and A.V.C. rectifier; 6V6G output pentode; 5Z4G H.F. rectifier.

The receiver has provisions for an extension loudspeaker of 2 to 5 ohms impedance, and a crystal or magnetic pick-up. Switching is not provided for the speaker or pick-up, but when the pick-up is employed it is desirable to remove the aerial and tune the set to a quiet part of the band; moreover, the pick-up should be disconnected when the set is used for radio reception.

The four control knobs situated from right to left, looking at the front of the cabinet, perform the functions of tuning, wavechange, volume/mains on-off and tone. Long, medium and short waves are selected by rotating the wavechange knob clockwise.

Circuit Description

The signals in the aerial coil L1 are inductively coupled to the short, medium and long wave aerial coils L2, K3 and L4 respectively, and the required aerial coil is selected by S1A section of the wavechange switch. Tuning is by C1 section of the two-gang tuning capacitor.

The oscillator coils are selected by S1B and S1C sections of the wavechange switch, and the selected oscillator coil is tuned by C2 section of the gang. Coils L5, L7 and L8 are for short, medium and long wave oscillator functions respectively; coil L6 is a feed-back winding for short-waves only.

An intermediate frequency of 465 kc/s is produced in the anode circuit of V1 and developed across the first I.F. transformer (I.F.T.1). From here it is conveyed to the signal grid of V2 for amplification. The amplified I.F. signal appears across the second I.F. transformer (I.F.T.2), and is fed to the signal diode in V3 for demodulation.

The A.F. content of the signal is developed across the 1 megohm volume control, after first being filtered by the associated 33 K. resistor and associated 150 pF capacitors. The A.F. signal is amplified by the triode section of V3, and is developed across the 200 K. resistor in the anode circuit; the 6.8 K. resistor and associated 4 μF electrolytic capacitor provide decoupling.

From the anode of V3 the signal is conveyed to the control grid of the output valve V4, via the 0.05 μF coupling capacitor C5 and the potential divider comprising resistors R1 and R2 in the grid circuit of V4.

Capacitor C6 gives a degree of fixed tone compensation, while a variable tone control arrangement is also provided by means of C7 and the 50 K. variable resistor.

A.V.C.

The I.F. signal appearing at the anode of V2 is passed through the 10 pF capacitor C8 to the A.V.C. diode in V3. This diode is loaded by means of the 1 megohm resistor R3, and across this appears a negative potential with respect to chassis of a magnitude depending on the amplitude of the I.F. signal. This negative potential is used as an A.V.C. bias to control valves V1 and V2.

It is fed to V2 through R4 (a filter resistor) and the secondary winding of I.F.T.1, and to V1 through R4 and R5; decoupling being given by the 0.1 μF

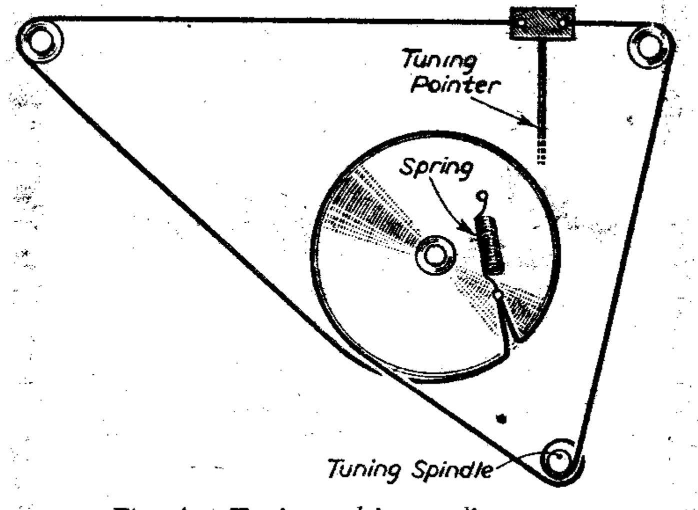

Fig. 4.—Tuning drive adjustment.

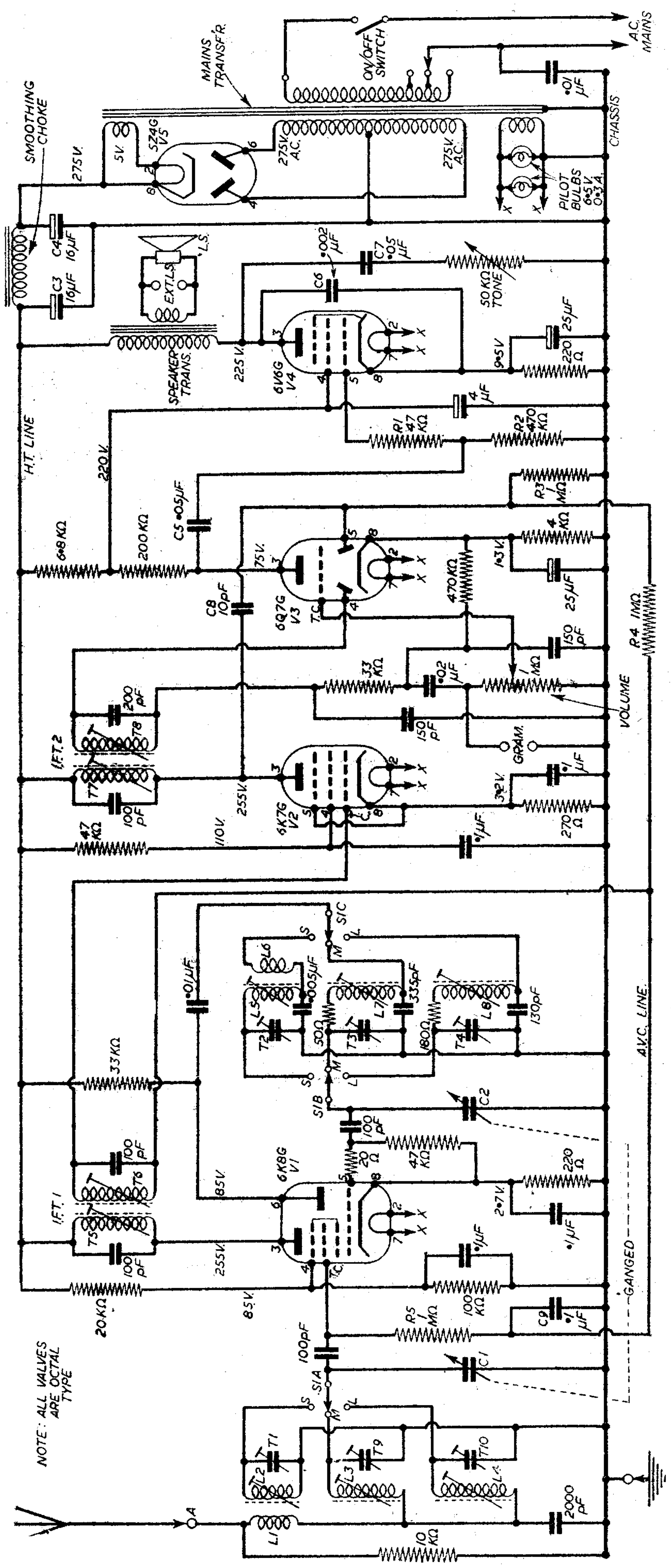

Fig. 1.—Circuit diagram of the Beethoven Model A3348.

capacitor C9. A degree of standing bias is also present on both of these valves as the result of the voltage drop across the associated cathode resistors.

Power Supply

H.T. power is supplied by the full-wave rectifier V5, energised from a 275-0-275 volt H.T. secondary winding on the mains transformer. H.T. smoothing is by the 16-16 μF electrolytic capacitor and the associated smoothing choke. A voltage of about 255 D.C. should be present on the main H.T. line, that is after the smoothing choke. The mains transformer also carries two L.T. windings, one for energising the rectifier heater, and the other for energising the heaters of the remaining valves and the two pilot bulbs.

Alignment Procedure

The I.F. stages should first be adjusted as follows: Connect a properly-loaded output meter across the secondary of the speaker transformer—the loudspeaker can remain in circuit. Mute the local oscillator by shorting C2 section of the tuning gang. Connect the live lead of an accurately calibrated service oscillator or signal generator direct to the signal grid of V1; set the generator to 465 kc/s, switch on the internal modulation, and adjust T8, T7, T6 and T5 (Fig. 3), in that order, for maximum indication on the output meter.

Remove the short from across C2, connect the signal generator, through a dummy aerial, between the aerial and earth sockets. Tune the receiver and signal generator to 150 kc/s (L.W.) and adjust the core of the L.W. oscillator coil L8 and the core of the L.W. aerial coil L4 for maximum output.

Tune the receiver and generator to 300 kc/s (L.W.), and adjust the L.W. oscillator trimmer T4 (Fig. 2) and the L.W. aerial trimmer T10 (Fig. 2) for maximum output. Repeat at 150 kc/s and again at 300 kc/s until optimum tracking is secured.

Tune the receiver and generator to 600 kc/s M.W. and adjust the core of the medium-wave oscillator coil L7 and the core of the M.W. aerial coil L3 (Fig. 2) for maximum output. Retune the 1,400 kc/s M.W., and adjust the M.W. oscillator T3 and the M.W. aerial trimmer T9 (Fig. 2) for maximum output. Repeat at both frequencies for optimum tracking.

Tune the receiver and generator to 6 Mc/s S.W., and adjust the core in the S.W. oscillator coil L5 and the core in the S.W. aerial core L2 (Fig. 2) for maximum output. Retune to 19 Mc/s and adjust the S.W. oscillator trimmer and the S.W. aerial trimmer T1 (Fig. 2) for maximum output. Repeat adjustments at both frequencies until no further improvement can be obtained.

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During the whole of the alignment process it is essential to maintain the lowest input signal from the oscillator or generator, consistent with readable deflection on the output meter. Too great an input will bring the A.V.C. system into operation and consequently give rise to misleading output meter indications.

Servicing Notes

The top and underside views of the chassis, showing coil and trimmer positions, are illustrated in Figs. 2 and 3. Fig. 4 shows the mode of tuning pointer and drive cord function. Nylon drive cord is best suited, and when replacement is necessary care should be taken to ensure that the traverse of the pointer corresponds to the relative positions of the tuning gang. This point should also be borne in mind before alignment of the oscillator and R.F. circuits is attempted.

If the receiver is totally dead with not a trace of hum from the loudspeaker, it should be established that H.T. voltage is present at pin 8 of the H.T. rectifier valve V5. If it is not, the rectifier itself is generally to blame; although heater failure is nearly always responsible, the emission sometimes fails while the heater continues glowing, and at first glance the valve may be considered to be up to standard.

If H.T. is present at the cathode of V5, a meter should be used to follow it along through the smoothing choke and on to the H.T. line. If it is present on the H.T. line, the voltages relating to V4 should be checked. Probably the 'speaker transformer primary will be found to be open-circuited.

If a slight hum is heard from the loudspeaker, but stations cannot be tuned in, it is often a good idea to touch the top-cap of the 6Q7G with the volume-control at maximum. This will result in a loud mains hum if stages V3, V4 and V5 are working. This proves, therefore, that the trouble lies somewhere in stages V1, V2.

Usually, in this case, valve substitution reveals the trouble, but if it does not, then the local oscillator should come under suspicion. The grid and anode oscillator coupling capacitors should be suspected, and the 33 K oscillator anode feed resistor should be checked for continuity.

Excessive distortion, generally accompanied by V4 overheating, nearly always means that C5 is leaky—a good quality capacitor should be used here for replacement. Distortion is also caused by V3's anode load resistor (200 K) becoming high in value; such a fault, however, does not result in V4 over-heating, though it is generally accompanied by low-volume. Distortion should also lead one to suspect the resistor and capacitor combination in the cathode circuit of V4. A leak in the capacitor would kill the bias for this valve, while the stage would be subjected to negative feed-back if it becomes open-circuit.

General fall-off in sensitivity on all wavebands is sometimes caused by alteration in value or deterioration in goodness of one or more of the fixed tuning capacitors across the windings of the I.F. transformers. Such a fault shows up by "flat" tuning of the associated core during the I.F. alignment process. If one of the capacitors has drifted quite a bit in value it will probably be found impossible to peak the associated core at the intermediate frequency.

Excessive whistling superimposed on the local medium-wave stations is sometimes caused by pick-up in the I.F. channel of a spurious signal which beats with the carrier of the transmission to which the receiver is tuned. This can be cleared by returning the I.F.s to 470 kc/s, and then realigning the oscillator and R.F. stages.

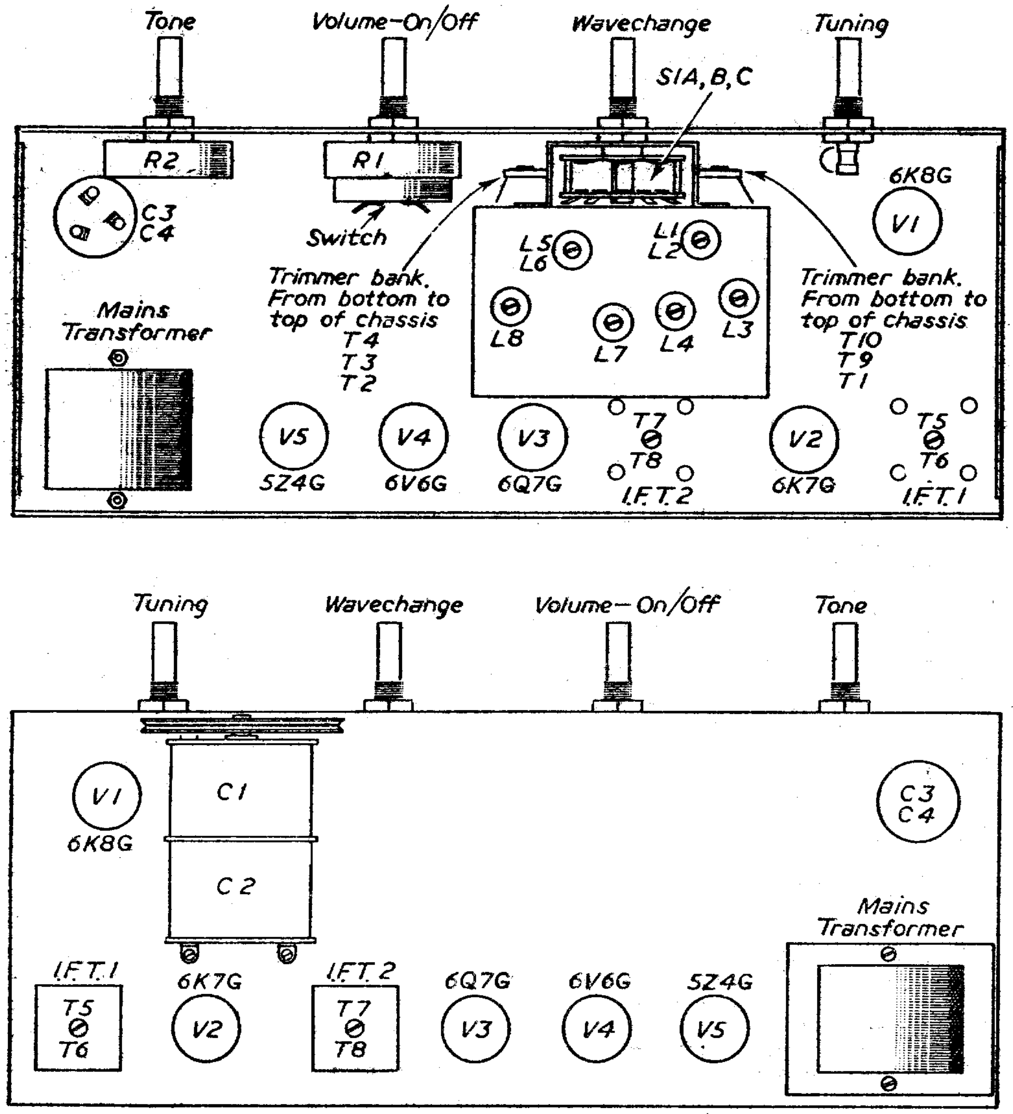

Fig. 2 (Top) and Fig. 3 (Bottom).—Underneath and top views of chassis.