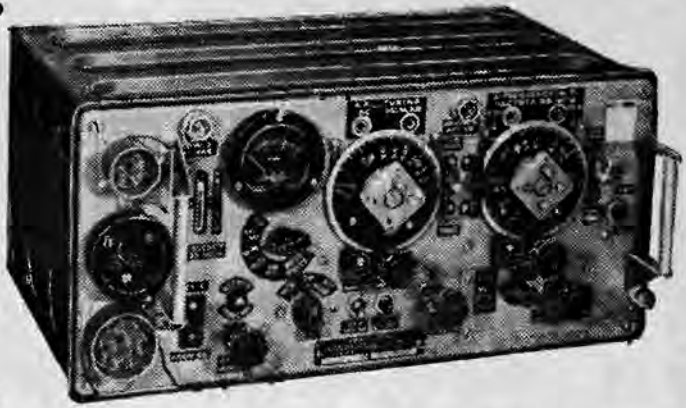
The "No. 19" Set



FURTHER IMPROVEMENTS

By D. W. Dillon

THE recent release of thousands of ex-army American-built W.S. No. 19 Mk.2's has resulted in almost every enthusiast's shack in the country containing one. While they are generally used in their original condition, several major defects soon become apparent. The first and most important of these is a great lack of selectivity—the subject of a recent PRACTICAL WIRELESS article. The second fault is that too much associated equipment is necessary for the operation of the set: power unit, accumulators, junction box, microphone, headphones and heavy connectors! The AVC action is too heavy and sluggish and the signal to noise ratio is very poor. It is very difficult to transmit good CW because of the lack of sidetone facilities. On telephony the output power is very low, the modulation invariably downward, and the speech quality poor. It is therefore fortunate that by the removal of the "B" set and "I.C." amplifier, much space is available for modifications. Although several amateurs have modified the "B" set for local two-metre use, in the majority of sets, this space simply goes to waste.

Modifications

The first part of this article should be of interest to all 19 set owners, and the carrying out of the simple modifications described results in transformation into a highly sensitive, selective and inexpensive mains-operated receiver. The second part of the article concerns the transmitter modifications and is of particular interest to licensed radio amateurs and those who hope to obtain a licence shortly. It should, however, be noted that, as with any radio transmitter, no matter how low the power, a Post Office licence is necessary before any attempt is made to transmit into an aerial.

The transmitter modifications will allow fully automatic sidetone monitoring on CW. The original circuit allowed only 12W input at about 30 per cent. efficiency on telephony, which does not usually result in flattering signal reports! This article will describe the addition of a 15W modulator stage requiring few extra components and which will allow 30W of good quality 100 per cent. modulated phone output to be run to the 807 P.A. Alternatively series-gate modulation is also described which gives carrier controlled output. The advantage of this method are the small space and few components required, but the disadvantages are lower efficiency and the necessity for 67½-90V negative bias on the modulator.

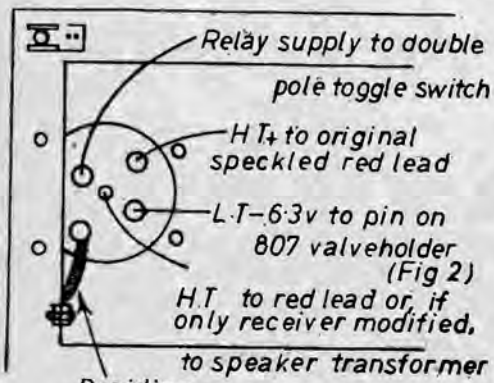


Fig. 1.—Wiring of the five-pin holder.

Testing

Having received the set, it is strongly recommended that it be tested in its original form, by obtaining the loan of the associated equipment. After it has been proved to be working satisfactorily, the B set and I.C. amplifier are stripped out. All the components to the left of the above-chassis screen (when looking at the front panel) should be removed, as should also those to the left of the below-chassis relays, with the exception of the key jack leads, the leads to pin 4 (green) on the 12-way plug and those to pins 4 (red) and 6 (speckled red) on the six-way plug. The B set gain control also remains. The six- and 12-way plugs are removed, the 12-way one being discarded and replaced by a British five-pin socket. The inside "plug" part of the five-way plug is discarded, the outside casing being once again bolted on to the panel, with a Mazda octal valveholder bolted behind the panel to receive the speaker and remote control plug. The braided earth lead is connected to tag 3 on the holder.

while the original red (H.T.) leads are re-routed under the chassis, being connected to the five-pin socket as shown in Fig. 1. A closed circuit jack is substituted for the "quench control" grommet.

6V Operation

The 12V line is earthed at the 807 valveholder (Fig. 2), and a lead taken from the other heater tag to the five-way socket. This allows 6V operation of the heater chain. The green lead (ex-pin 4 is attached to the headphone jack socket. The

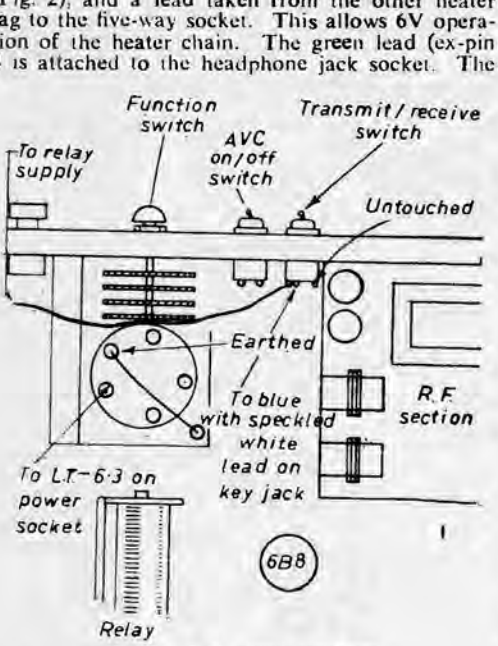


Fig. 2.—L.T. circuit rewiring.

leads to the single-pole toggle switch on the front panel are removed, as are also the left-hand section leads on the double-pole toggle switch.

The green and blue leads on the other section should not be disturbed. The large 0.1μF paper condenser fixed to the chassis beside the P.A. tuning condenser is replaced by a 750VW, 0.0005μF type. The 10Ω variable resistor (het tone) is removed and the leads insulated. In its place is mounted, a 10k wire-wound potentiometer. The resistor between the cathode (pin 8) of V1A (6K7) and earth is disconnected from the chassis tag, and joined to the potentiometer slider. The left-hand tag of the potentiometer is earthed. This is the new R.F. gain control. The single-pole toggle switch on the front panel is used as the AVC on/off switch, being connected between chassis and the AVC line (white) on the tagboard near the 6B8 valveholder.

The bracket which originally supported the B set tuning condenser is modified to support a miniature air-spaced 0.0005μF variable condenser. This bracket is replaced in its original position, together with the calibrated knob. A 1¼in. diameter 3in. coil former 3in. long is wound with 18 turns 22s.w.g. tinned-copper wire, evenly spaced over 2¼in., is mounted directly on the old E1148 valveholder. One end is joined to a soldering tag on the tuning condenser frame, and the other to the fixed vanes. The B set aerial socket is removed and replaced by a small ceramic feed-through insulation. This is joined to the fixed vanes. A four turn insulated link is fixed around the earthed end of the coil, and connected to a short piece of 80Ω coaxial cable, which passes directly under the condenser spindle and meter to the tank coil. The original screened box is replaced over the aerial tuning components.

Diode

A crystal diode is connected, with the black end to the fixed vanes and the red end to the small tagboard in the screened box. A wire is taken from this in the direction of the tank coil and marked for later described modifications. The lid of the box is fixed in position. The lead to the A set aerial socket is removed, together with the connection to C1A and the R.F. CL2B.

The tank coil L3A is removed, the connections being noted. The tapping point is ignored, and about three turns removed from the upper end. A four-turn insulated link is wound on the lower end and connected to the coaxial cable. The coil is replaced, the coaxial cable outer sheath being earthed to chassis at its base and all the original leads, with the exception of that to the tapped point, being reconnected to the coil. The set is now ready for testing.

(To be continued)

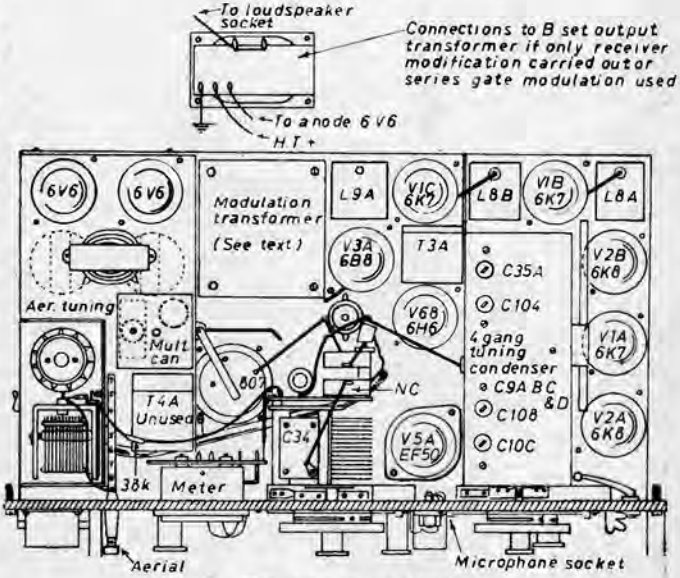


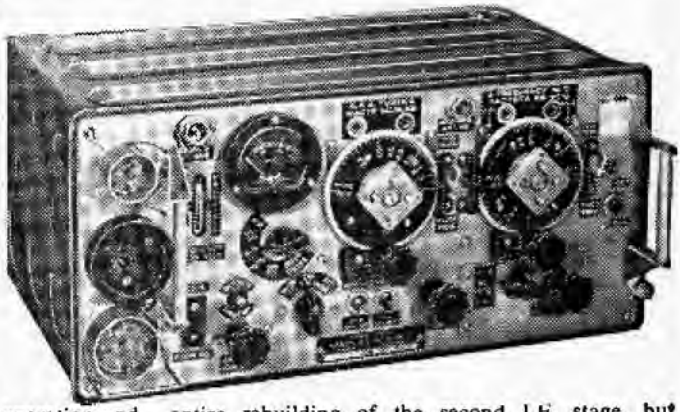
Fig. 3.—Top view of modified 19 set.

The "No. 19" Set

FURTHER IMPROVEMENTS

By D. W. Dillon

(Continued from page 962 of the March issue)



AFTER the modifications for 6V operation and to the tank coil, etc., have been carried out as described last month, the set is ready for trial.

Intermediate Testing

For testing, a suitable power unit supplying 250-300V and 6·3V is necessary. If only the receiver portion is required, a power unit similar to that shown in Fig. 4 should be constructed or purchased. If, however, the transmitter portion is also required, the circuit of Fig. 5, which includes a relay supply, should be constructed. The smaller power unit could also contain a small speaker, the connections to it being through the chassis and the unused 500V pin on the power socket. The circuit for an output stage will be given later.

The power unit is connected to the set, switched on, and a pair of low impedance headphones plugged into the new jack. The P.A. tuning should be set to approximately the same frequency as the main tuning. A long wire aerial is attached to the feed-through insulator. Rotation of the aerial tuning condenser should show a point where a great increase of signal level, or noise, results. The R.F. gain control is turned down, the AVC off, and the receiver tuned into a signal. No movement of the AVC meter should result. If all works correctly, the next stage of alteration may be commenced.

Selectivity

The most important part of the receiver modifications is the improvement of the selectivity. Although the replacement of the fixed condensers in the I.F.T. cans, removal of damping resistors, and complete realignment does help greatly, and has, in fact, been carried out on the author's set, the need was felt for even more selectivity. In the circuit to be described, this modification need not be carried out, although it is advisable to do so. Until a few years ago, the only solution to this problem would have been in the use of a crystal filter, involving the entire rebuilding of the second I.F. stage, but recently the idea of the Q-multiplier circuit has been imported from the U.S.A. A circuit suitable for use in the "19" set is shown in Fig. 6.

The 6K7 valveholder beside the aerial tuning unit (Fig. 3, February issue) is removed by filing the tops of the aluminium rivets, and a B9A valveholder mounted on small aluminium strips. Holes are drilled in the chassis to hold an I.F.T. can over the valve, with the valve in one corner of it. A coaxial lead is connected to pin 3 (anode) of the 6K8 frequency changer (V2A). The outer sheath is not connected at this end. Coil L1 is mounted at the bottom of the can in such a position that the core can be adjusted from the side of the set. The coil L2 is mounted directly above L1, and the coil-shaped trimmer at the top of the can. The condensers C3 and C4 should be high stability 2 per cent or 5 per cent types. The 5k wirewound potentiometer is used to vary the sensitivity, and can be substituted for the B set gain control; but if the transmitter modifications are to be carried out, it can be wired in temporarily

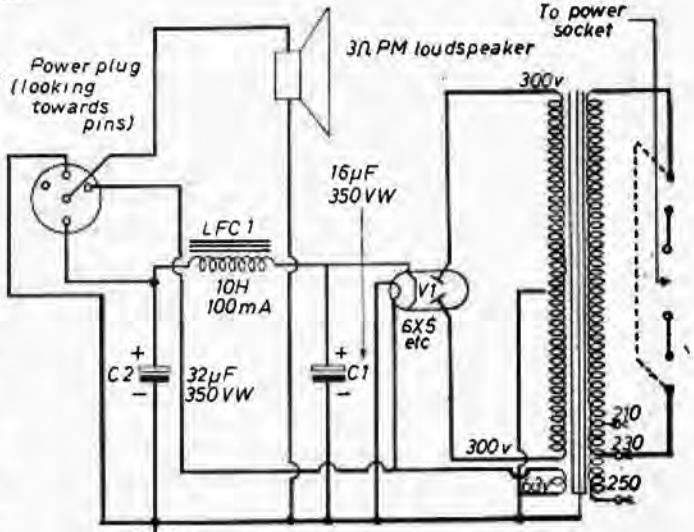


Fig. 4.—Circuit of a power unit.

and the best position on the track found, the resistance determined with an ohm-meter, and the nearest preferred valve resistor substituted for it. The H.T. + connection is joined to pin 6 on VIC (6K7). Pins 4 and 5 are earthed at the valveholder and pin 9 joined to the power socket 6V line.

Alignment

To align the unit, the set is switched on, allowed to warm up, the audio gain turned up half way, the AVC off, the netting control depressed, and a station tuned in normally to zero-beat. The core of L1 is adjusted for greatest signal strength. The 5k resistor is moved up about half way and the 100pF trimmer moved to half capacity. The core of L2 is then moved with a plastic screwdriver to peak the signal. At the peak, the high frequency audio sidebands should be greatly attenuated, giving a bassy output. The tuning will be extremely critical, and signals may not even be readable. The 5k resistor is varied to give best selectivity consistent with good readability. The cores can be sealed with a little hot wax. No adjustment of the original I.F.T.s is necessary, since L1 cancels out the reactive impedance and capacity of the coaxial cable.

Output Stage

The final receiver modification concerns the addition of an output stage. This is very simple, and uses the existing 6V6 and I.C. amplifier output transformer. The circuit will be given next month. The H.T.+ is obtained from the H.T.+ lead to the Q multiplier. The connections to the output transformer were given in Fig. 3, last month. The input signal for the amplifier is obtained from pin 3 (anode) of the 6B8. Insertion of the headphone jack turns off this stage. The speaker output

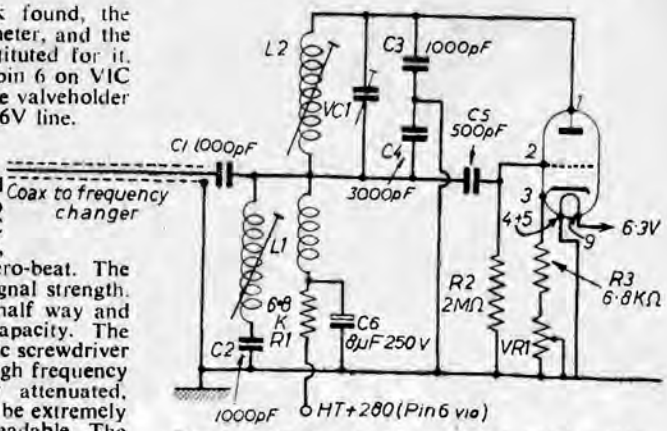


Fig. 6.—Circuit of a Q-multiplier (VR1 is 5k).

passes either through the centre pin of the 5-way socket on pin 6 of the control socket.

This will conclude the receiver modifications, and result in a small, highly sensitive, and selective receiver. If being used for CW reception, the set should be switched on to CW, tuned to zero-beat with a stable signal; and the core of L5AB moved until a beat note of about 1,000c/s is obtained. True single signal CW reception will then be possible. The AVC should be kept off, and the audio gain well up for best results.

(To be continued)

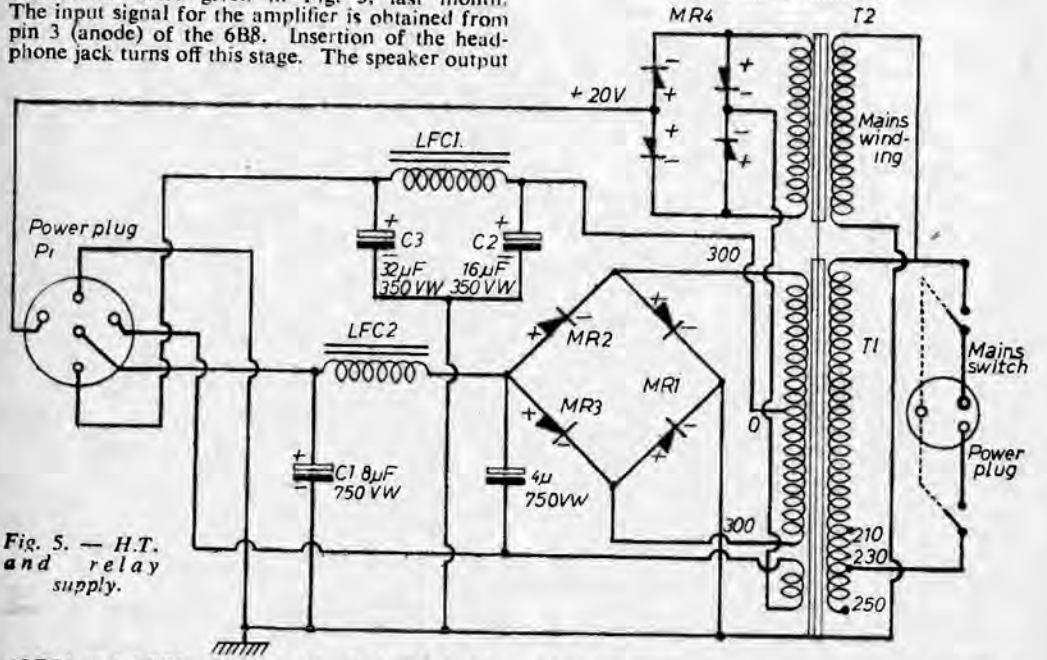


Fig. 5. — H.T. and relay supply.

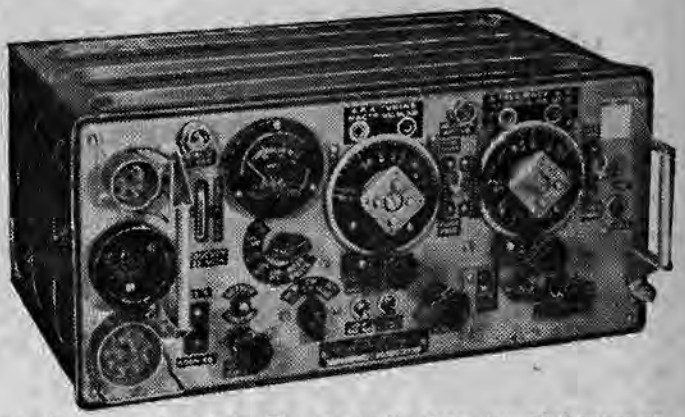
(LFC1 and LFC2 are 10H 100mA; MR1, MR2 and MR3 is a bridge rectifier giving about 400V at 100mA; MR4 is a bridge rectifier giving about 20V at 1A.).

The "No. 19" Set

FURTHER IMPROVEMENTS

By D. W. Dillon

(Continued from page 1028 of the April issue.)



IN the two previous articles, information has been given on modifications to the receiver section of the No. 19 Set and the intermediate testing was discussed. A circuit for a Q-multiplier to improve selectivity was also given. The valve used in this circuit was half of a 12AX7 double triode and in the circuit diagram (Fig. 6, page 1028 of the April issue) the unmarked coil is a high inductance R.F. choke. The remaining two coils are QA5/6·300 types, L1 being 7·5 to 3mH and L2 120-150μH.

In Fig. 4 on page 1027 of the previous issue, a draughtsman's error occurred and a revised diagram is given in Fig. 7 below. The bridge rectifier MR2/MR3/MR4 may consist of 4 half-wave types or a combination of half-wave and full-wave types provided they are of suitable rating.

Transmitter Modifications

The first necessity is to remove the original grid modulation components, and to short circuit the resistor, limiting the output power on 'phone. The 100k resistor between the grid pin of the 807 (R7G) and C22B is removed (care should be taken to select the correct resistor, since the grid leak R7D is also 100k). The brown lead going to the nearest section of the rear gang of the function switch is cut off and earthed. Full power will now be run on 'phone. It is recommended that the correct circuit diagram of the set be obtained for the remainder of the conversion, and some previous constructional experience is advantageous.

For the remainder of the conversion, as may be seen from Figs. 8 and 9, a number of sections of phone/CW switching, and transmit/receive switching are required. All the transmit/receive switching required can be carried out by the B set relay, which is connected in parallel with the other one. One end of the field coil is earthed to chassis, the other end being connected to the same tag as the blue-speckled white lead on the key jack. The connection from one of the tags on this jack to chassis is broken, being connected to the 24V+line on the power socket. Insertion of the key jack will not put the set on "transmit" as before. This should be tested to make sure that both relays function simultaneously. Transmit/receive switching is also carried out by the double-pole switch on the front panel.

To obtain phone/CW switching, some of the redundant sections of S7A are used. The one from which the brown lead has been removed may be used as it stands, the slider being already earthed to chassis by the yellow lead. Another section on the rear gang shunts the meter when switched to

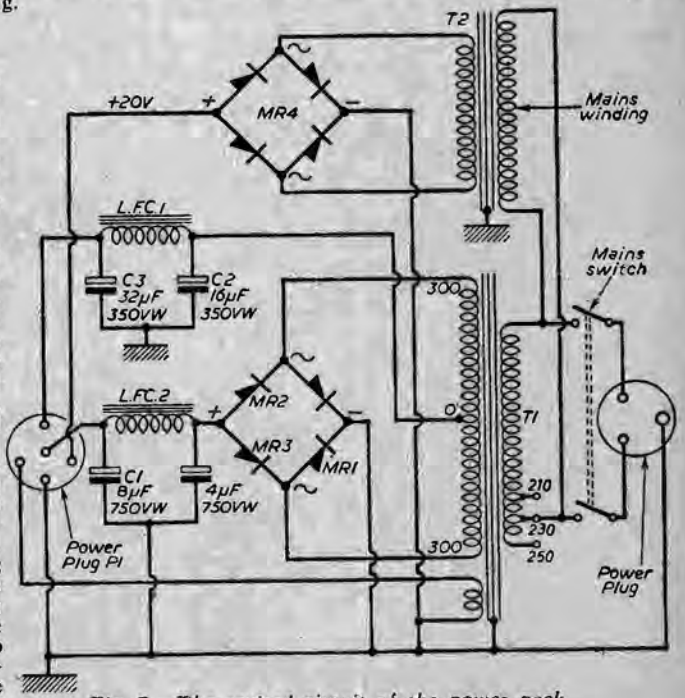


Fig. 7.—The revised circuit of the power pack.

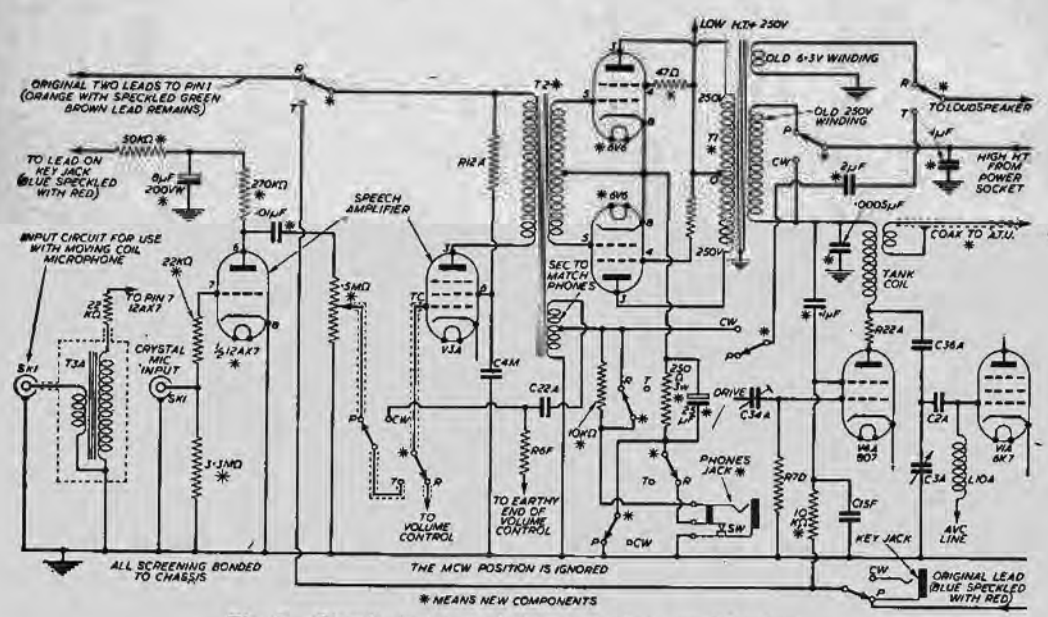


Fig. 8.—Circuit diagram of the transmitter modifications.

Ae on CW. This can also be used, the resistor being removed. All cut leads should, of course, be insulated. Another switching section is made available by the removal of the "Het Tone" leads. These are of thick, yellow insulated, tinned copper braiding.

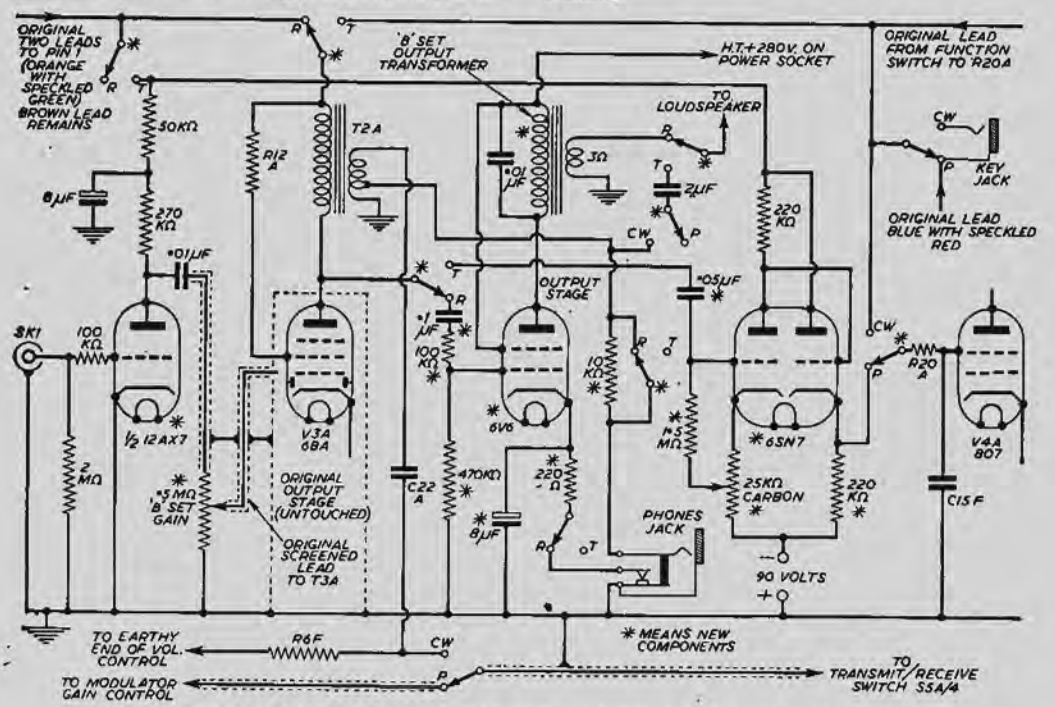


Fig 9.—Modifications to allow series-gate modulation and keying side-tone.

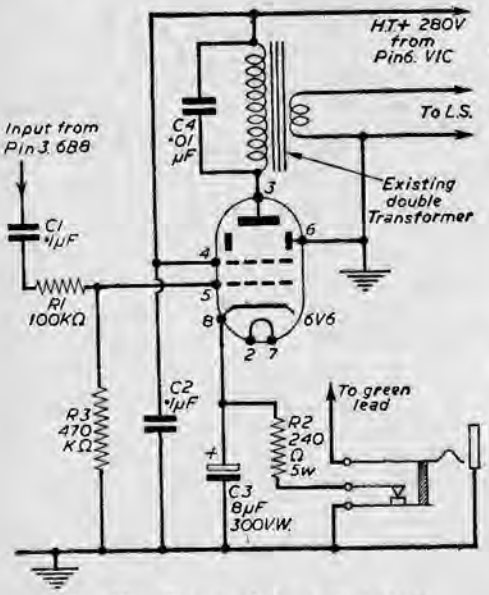


Fig. 10.—Circuit of the output stage.

Construction of Modulator

Two alternative methods are here available; either to use series-gate modulation with simple construction, lack of iron-cored components, and comparatively low efficiency, or to use anode and screen modulation which is slightly more difficult to construct and necessitates rewinding a transformer, but has high efficiency and slightly better output quality.

No attempt will be made to give a wiring diagram or description of the construction of the series-gate modulator. The layout is by no means critical, and all connections are given in the circuit diagram. The speech amplifier is the remaining half of the Q-multiplier 12AX7. A small 90V H.T. battery is mounted beside the 6V6 output stage, and provides modulator bias. Since current is only being drawn from this when the set is on transmit on phone, its life will be very long. The 25k carbon potentiometer is mounted in one of the original chassis feed-through holes. It is adjusted so that one-fifth to one-third of the peak carrier output is being indicated with no modulation input. When this modulation system is in use, the 6V6 output stage, as shown in Figs. 9 and 10, is required for speaker operation. In order to obtain a qualitative reading of the R.F. voltage on the aerial, a resistor (38k used in prototype) is connected from the tagboard in the A.T.U. to the tag. on the board mounted on C3A. which originally supported L2B (see Fig. 3 March issue).

The only portions of the anode and screen modulator (Fig. 8) worthy of mention are the modulation transformer T1 and the driver transformer T2. T1 is an old upright mounting 250-0-250V 60mA and 6·3V mains input transformer, connected according to Fig. 8. The 6·3V winding is used for the speaker output.

This must be one of the very few amateur band receivers which includes a 14W output stage! T2 is slightly more complicated. A small driver transformer of ratio 1:3+3 was obtained surplus, and had an extra (probably negative feedback) winding. This was removed, and the secondary winding from T2A wound in its place, care being taken to see that the winding direction is the same as that on T2A, or sidetone feedback will not be obtained on CW.

If moving coil microphone input is required, T3A is connected to the pre-amplifier; as shown in Fig. 8. Although this circuit diagram looks fairly complicated, many of the components are in place already and are only shown for clarity.

Final Testing

The best aerial for use with the set is a half wave type. This is about 134ft on 80m and 67ft on 40m. The set should be switched to CW transmit, and the P.A., and aerial tuning condenser alternately rotated to give the highest possible meter reading in the Ae position. All this time a medium frequency audio oscillation is heard in the loudspeaker when the key is depressed. It should be noted that the oscillation is not modulating the output; which is pure CW. The set should then be switched to phone; if series gate modulation is used, the power is lowered to about one-fifth by the carrier control. A suitable microphone is then plugged into the original A set aerial socket, and the modulation gain control increased until, on speaking, the carrier output increases. If series-gate modulation is used, the output should increase to the original CW valve, but if anode and screen modulation is used, the static carrier on phone and CW should be identical. Only a slight upward kick with modulation should be tolerated to prevent overmodulation.

A MAINS SHORT WAVE TWO

(Continued from page 29)

When using 'phones, these should be isolated from the H.T. circuit. This can be done by wiring a 0.1µF 500VW condenser from that side of the speaker transformer primary which is taken to the valve anode, and using this for one 'phone lead, taking the other to chassis and earth. The speaker itself may be disconnected.

Using the receiver

The 100k potentiometer should be rotated only sufficiently to bring the detector to the point of oscillation, as shown by maximum sensitivity. Turning it too far will cause oscillation, and a drop in volume. This control is therefore operated in conjunction with the tuning control, in the normal way for reaction circuits.

The aerial condenser C1 is not shown in Fig. 3, and will not be needed with short aerials. For long aerials, or to reduce aerial damping, it is added in series with the aerial lead, at the receiver. It can be a fixed condenser, or a 50pF pre-set component.