Modifications to the CR100

by W. STUDLEY

Some simple modifications which can be carried out on the CR100 and similar receivers

MANY AMATEUR AND SHORT WAVE LISTENING stations are equipped with Marconi CR100/B28 receivers. These receivers offer good value for money and can do an excellent job even in these so called "modern days" of high QRM and QRN levels! One criticism fairly aimed at the CR100, however, is that it tends to drift, since no stabilised h.t. supply for either the b.f.o. or local oscillator is fitted. The problem of local oscillator drift does not normally cause much inconvenience in practice and is simply overcome if the receiver is switched on for some time prior to operation. It is with the b.f.o. that the drift problem is most serious, because this is normally only switched in for c.w. or for s.s.b. reception and no preliminary running period can take place. Drift in the b.f.o. is particularly aggravating when attempts are made to resolve s.s.b. as constant resetting of the b.f.o. control is needed. Due to this factor it is not unusual for most of an "over" to be missed completely, and such a state of affairs is intolerable.

Stabilising the h.t. supply to the b.f.o. is, therefore, essential. Fortunately, this can be done fairly easily without any serious alterations to the receiver.

Stabilising the BFO Supply

Normally, h.t. is applied to the b.f.o. valve when the operational switch is set to either "CW—AVC" or "CW—MAN". Referring to Fig. 1(*a*), resistor R_{54} (100kΩ) is the b.f.o. valve anode load resistor and R_{46} (22kΩ) the decoupling resistor. A voltage slightly in excess of 220 should appear at the junction of these two resistors, and series connected voltage stabilisers may be connected to this point as is indicated by the heavy lines. It should be noted that if the d.c. potential at point "A" in the diagram is reduced overmuch, inadequate b.f.o. injection might result. Whilst this may not

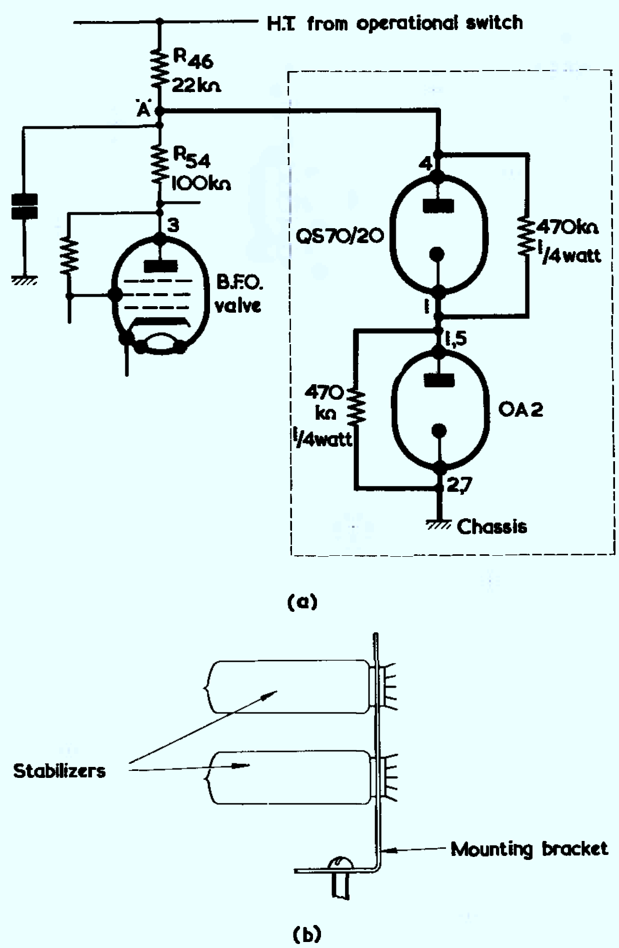

Fig. 1(a). Adding an h.t. stabilising circuit to the b.f.o. The additional circuit is shown in heavy line (b). Mounting the stabiliser valves be serious with c.w. reception, when s.s.b. signal are sought, difficulty will be experienced in reading them unless the r.f. gain is retarded excessively. The b.f.o. output needs to be as large as is conveniently possible and the use of a single stabiliser tube is thus ruled out. A single OA2 for example, would only permit a potential of some 150 volts to appear at point "A", and this may be considered inadequate as has been found by experiment. By using the two tubes specified, however, little difficulty will be experienced.*

Mechanical Details

If the CR100 is turned upside-down and its base plate removed it will be found possible to mount a small sub-chassis at the rear of the b.f.o. screening can. The B7G valveholders for the stabilisers are fitted to a small L-shaped piece of aluminium as indicated in Fig.1(*b*). This sub-chassis is wired beforehand and fitted with a flying lead for connection to point "A", the connection to chassis being made automatically when the assembly is bolted in position. The underside of the assembly—the pins of the tubes—should face the panel. Looking at the receiver chassis from the front, a strip carrying seven vertically mounted resistors and a capacitor will be seen along the left-hand side. The flying lead from the added sub-chassis should be connected to R_{46} the second resistor from the front panel (22kΩ), on the side more difficult to get at; i.e., the end of the resistor nearer the receiver chassis underside surface.

To test the modification set the Operational switch to "MOD—AVC". With the receiver switched on both stabiliser tubes should remain dead, but they should glow when the Operational switch is adjusted to "CW—AVC" or "CW—MAN".

Adding Side-tone/Muting Facilities

The CR100 and other receivers not equipped with side-tone and muting facilities can easily be adapted, although the modification is only normally required when a transmitter is to be used close by. The "front end" of a receiver not suitably operated can be heavily overloaded if left running whilst a transmitter tuned to the same frequency is radiating nearby (as occurs at amateur stations) and damage can result. For this reason it is advisable either to mute the receiver completely, perhaps by switching it off manually on "Transmit" (and the CR100 does have a "Stand-by" position accommodated on the Operational switch) or to silence it via a relay operated automatically by the transmitter. Partial and automatic muting is even better, for the operator may then monitor his own signals via the receiver when phones are in use. One practical system which can be adopted is illustrated in Fig. 2, where the existing r.f. gain control is shown connected to chassis at point "X", as in (*a*). By lifting the earthy end of the r.f. gain control from chassis and fitting a closed-circuit jack socket and a 25kΩ preset potentiometer, as in (*b*), it is clear that nothing is changed functionally until a jack plug is inserted, whereupon extra resistance due to VR_1 is introduced. If the leads to the jack plug are connected to a relay energised and operated by the transmitter, VR_1 can be switched in and out of circuit automatically via the "Transmit/Receive" switch. The relay contacts should be open during "Transmit". The effectiveness of VR_1 is determined by its precise resistance setting, and it should be adjusted so that when the associated transmitter is operating, the receiver passes sufficient signal for monitoring purposes. It should be added that a circuit of this type is already fitted to the CR100/2 which does not, in consequence, require altering.

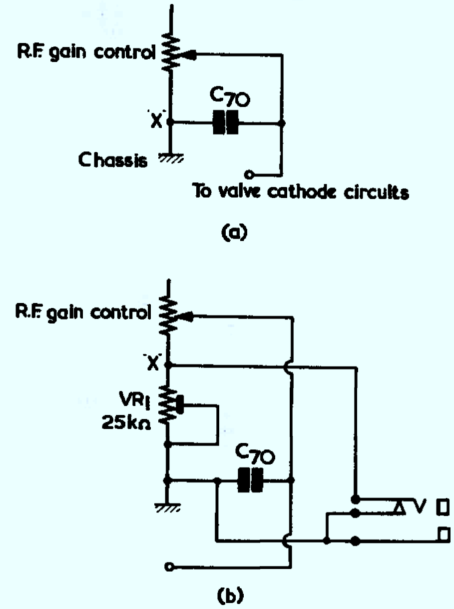

Fig. 2(a). The existing r.f. gain control circuit (b). Adding a preset gain control (VR_1) to give side-tone and muting facilities. The additional control is only brought into circuit when a plug is inserted in the jack

Practical Modification

Fitting the additional items to a CR100 is simple. First remove all knobs and the front panel. Locate the earthy end of the r.f. gain control and disconnect the lead to this tag. Potentiometer VR_1 may then be mounted on the tuning capacitor frame, or nearby, by means of a small L-shaped bracket in such a position that its control shaft points upwards towards the lid of the receiver for subsequent adjustment

* The OA2 has a burning voltage of 150 and the QS70/20 a burning voltage of 70, and it might be considered that these would not strike reliably when the voltage at point "A" is of the order of 220 volts only. However, the author confirms that the stabilisers work excellently and never fail to strike in the CR100 modified by himself. Should difficulty be experienced in this respect, R_{46} could be reduced in value by connecting another 22kΩ resistor across it. The position of R_{46} in the chassis is discussed later in the text.—Editor.

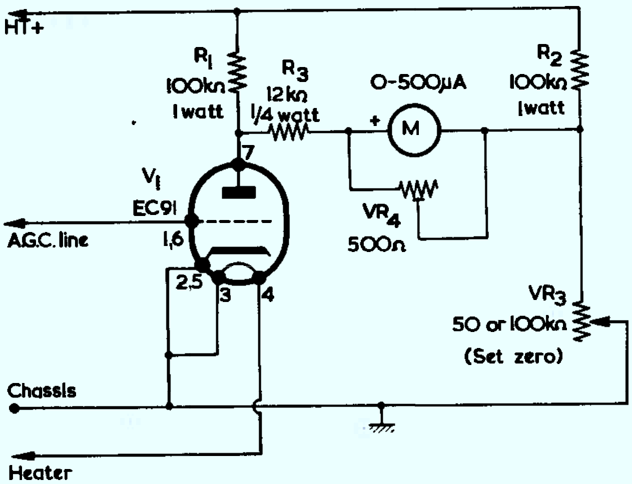

Fig. 3. An add-on circuit which enables a forward-reading S-meter to be incorporated

purposes. At the rear of the chassis a suitable point for locating the closed-circuit jack socket exists alongside the aerial connector. A single lead is then run from the jack to point "X" of Fig. 2(*b*) and VR_1 and the r.f. gain control wired appropriately. The receiver will now function as if unmodified in this respect, until switching due to an external transmitter-controlled relay is introduced via the jack.

Adding a Signal Strength ("S") Meter

Although S-meters are normally calibrated rather arbitrarily, they tend to give only approximate indications of received signal strength. They are, however, very useful aids when tuning or netting. Some operators rely on their S-meters more than others but it is thought that a great many of the "S" reports heard over the air have been aurally rather than visually assessed. Even so, an S-meter is of definite value, provided the limitations of the device are appreciated, at both amateur and s.w.l. stations.

There are various ways of adding an S-meter to a receiver, the usual plan being to sample the a.g.c. line voltage and use it to deflect the pointer of a meter. To avoid interfering with receiver constants excessively a small "add-on" type of meter actuating circuit is suggested, and a suitable bridge-type, forward-reading circuit is shown in Fig. 3. Here, under no signal conditions, V_1 passes a current through R_1, and the potential appearing at the anode of the valve is balanced out by the adjustable potentiometer circuit given by R_2 and VR_3. Provided VR_3 is correctly adjusted, the result is that the meter pointer remains at zero. If, now, the potential at the valve grid goes negative due to reception of a signal, the current passed by the valve falls and the potential at its anode goes positive, resulting in a deflection of the meter pointer. The amount of deflection depends on the negative potential applied to the valve grid and it follows that, by connecting this directly to the receiver a.g.c. line, changes in signal strength may be indicated by the meter. The fact that no grid resistor is shown in Fig. 3 is of no consequence, for the a.g.c. diode load resistor provides the necessary return circuit to chassis.

Preset resistor VR_4 is a meter sensitivity control, and enables full-scale deflection to correspond to the strongest signal it is anticipated will be received.

Modification Details

The EC91 valve is on the B7G base and it is an easy matter to build the oddment of added circuitry shown in Fig. 3 on a small L-shaped sub-chassis equipped with three colour-coded flying leads, the fourth (chassis) lead connection being automatically made when the assembly is mounted.

In the CR100 a small assembly can, with care, be contained under the chassis in the i.f. stages compartment that runs along the right-hand under-side, looking from the front. The heater fly-lead can be soldered to pin 2 of V_5 and the h.t. fly-lead to the receiver h.t. positive lead where it connects to R_{21}, the screen-grid feed resistor for V_5.

With the receiver switched off, locate R_4 (47kΩ), which is the second resistor from the front on the right hand side of the chassis (chassis upside-down and knobs to the front). R_4 is the a.g.c. feed resistor for V_5 and it connects, via the second i.f. transformer, to the top cap of V_5. Confirm this point with an ohmmeter. The end of R_4 remote from the i.f. transformer (which will, of course, measure 47kΩ to the top cap of V5) connects to the main a.g.c. line and should show a resistance of approximately 1MΩ to chassis when the Operational switch is in one of the two "AVC" positions, and zero resistance to chassis when the switch is in either "MAN" position. Having confirmed these points, connect the flying lead from pins 1 and 6 of the EC91 to the end of R_4 remote from the i.f. transformer (as just determined).

The meter movement itself may be mounted to the left of the main tuning dial and VR_3 may be located on the panel between the r.f. gain control and the tuning knob. If maximum S-meter indications are required it is beneficial to reduce the a.g.c. delay voltage, and this can be done by short-circuiting the 10kΩ resistor connected between the earthy end of the volume control and the chassis.

Testing the S-meter

With the receiver switched on and the Operational switch set to "MOD—AVC", VR_3 should be adjusted to give a zero meter reading when no aerial is connected. Immediately the aerial is connected and the r.f. gain advanced any signal tuned in should cause the S-meter pointer to move in the full-scale direction. If a commercial transmission is sought somewhere near the 40-metre band, where signal strengths tend to vary rather widely, the effectiveness of the S-meter may be assessed. The effect of the receiver aerial trimmer, the r.f. gain control and any externally used tuning unit will also be observable and it will soon be appreciated how useful the added S-meter can be.