a short wave PRESELECTOR for the HF BANDS

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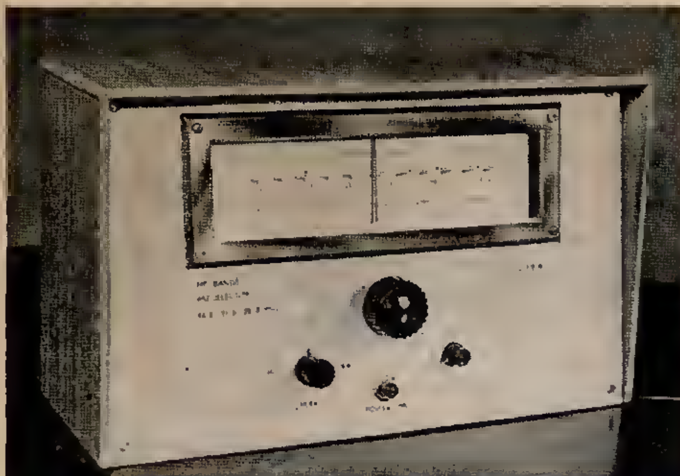
COVER SUBJECT



THE practical preselector design to be described is continuously tunable over the frequency range 14—30Mc/s tbereby embracing the tbree high frequency Amateur bands, viz., 10, 15 and 20 metres.

The prototype preselector is used primarily in c.w. connections; it is attractive physically and may be powered from the station receiver. Tuning is carried out via a slide-rule type drive with '10' and '20' occupying tbe scale ends. Ample space does exist for the inclusion of a small mains transformer plus rectifier circuit capable of supplying 200-250V d.c. at 20mA and 6·3V a.c. at 1A.

It is desirable to be able to mute the preselector when an associated transmitter is to be used nearby, and a self-shorting jack-socket is fitted via which a muting circuit may be introduced. The preselector may be muted very conveniently, either fully or partially, by arranging for a 50kΩ variable resistor to be automatically switched in and out of circuit by tbe transmitter 'Send/Receive' switcb. No provision is made for bypassing the unit—by means of a switch perhaps—since this is carried out manually.

Some communications-type receivers used at Amateur and SWL stations use valves that are considered to be 'noisy' by modern standards; by using a preselector between the aerial and the receiver a considerable improvement results particularly on the higher frequency bands. This is understandable since when a strong signal is fed to a 'noisy' receiver the a.v.c. system is loaded adequately and the valves are biased back heavily; the received signal then sounds clean and 'punchy'. It should be noted however that a preselector should not be considered as an alternative to a good aerial but merely an addition.

The complete circuit diagram is shown in Fig. 1 where V1 functions as a higb-gain r.f. amplifier with V2 operating as a conventional catbode-follower output stage. The station aerial is plugged in at socket Sk1, eitber direct or via the transmitter/receiver change-over switch or relay, and a *short* screened lead from socket Sk3 is connected to the receiver aerial socket. Band coverage is effected by means of VC1, the shaft of whicb is in connection with the panel-fitted drive and scale. Variable r.f. gain results from fitment of VR1. Amp-

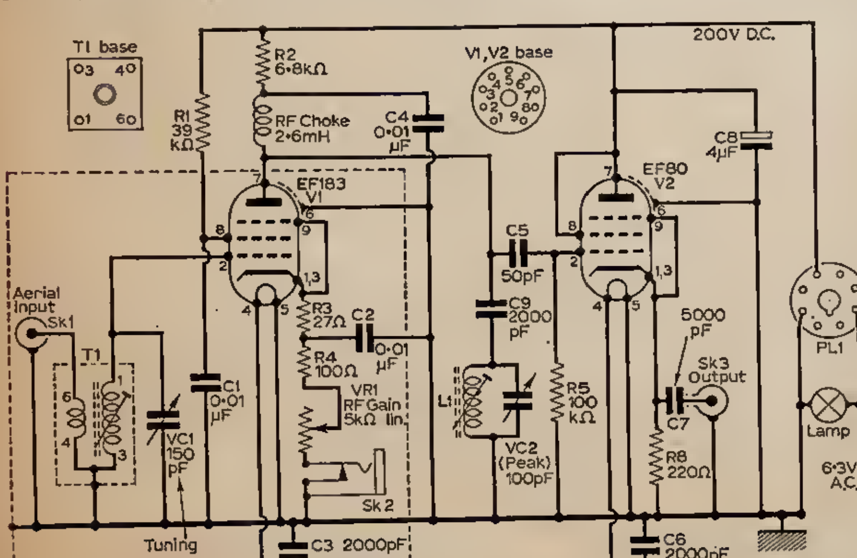


Fig. 1: The theoretical circuit diagram.

lified r.f. appearing at pin 7, V1 'sees' considerable opposition from the r.f. choke whereupon it passes more readily to the cathode-follower output stage via capacitor C5 to re-appear at socket Sk3.

Normally the anode circuit of V1 is operated in a non-resonant state, grid circuit tuning being adopted. Extra gain may be obtained however by resonating the anode circuit close to the operating frequency and to this end coil L1 and panel-fitted VC2 are provided. Although, in theory, maximum gain occurs when both grid and anode circuits are

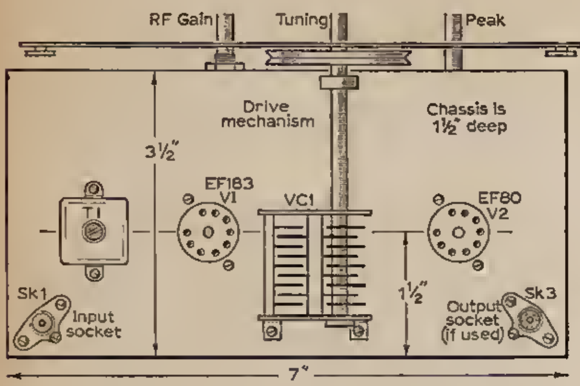


Fig. 2: Above-chassis layout and dimensions.

tuned to tbe same frequency such exact tuning is rarely practical since oscillation takes over. Under certain conditions—maladjustment of VC2 for example—oscillation can be instigated; it becomes very important therefore to include adequate screening. In the prototype the grid and anode circuits of V1 are well screened from each other; a 'can' is fitted to T1 and the chassis box is also made use of. Screening is indicated by the broken lines in Fig. 1.

Normally VC2 is set to minium capacitance and is used only under difficult copying conditions. The circuit is useful c.w.-wise for as VC2 is manipulated tuning tends to sharpen due to positive feedback. The benefits are somewhat less apparent on 'fone' for the extra gain secured is at the cost of an increased noise level. In this part of the circuit it should be noted that capacitor C9 is a d.c. 'blocker' and it must on no account be omitted!

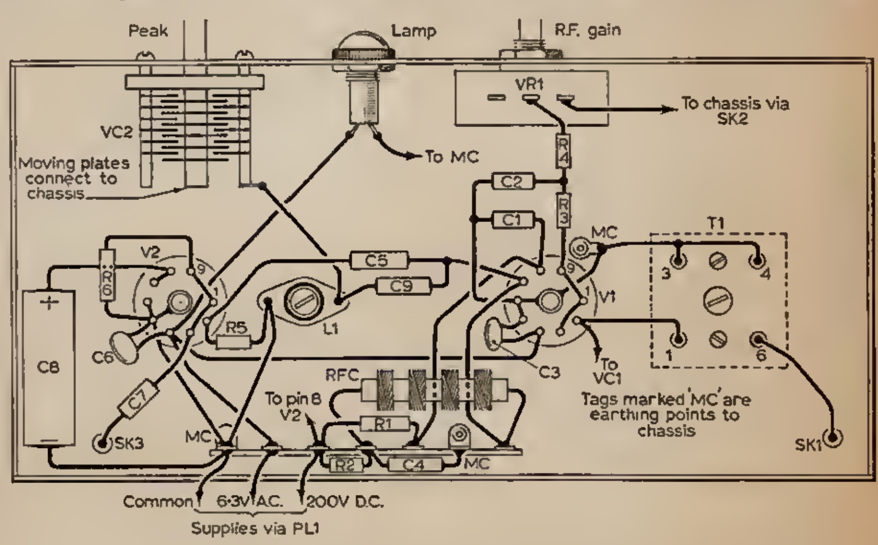


Fig. 3: Wiring and layout below chassis.

The layout and most of the wiring is shown in Figs. 2 and 3. No chassis drilling diagram is given since constructors may vary things to suit items to hand. The type of capacitor used for VC1 for example is not over-critical and any small single-gang item of about 150pF maximum capacitance is suitable. Note in Fig. 2 that the lugs of the can associated with T1 are bent outward (not inward) to permit the can to be removed without disturbing the coil itself.

Coil Details

Both T1 and L1 are home-brew dust-cored items. Considering T1, and assuming approximately 30pF for circuit 'strays', a tuned circuit inductance of some 0·9μH used in conjunction with a 150pF variable capacitor will enable the desired band coverage to be obtained. T1 consists of 10 turns 28 s.w.g. enamelled copper wire close wound on a 0·3in. former, and 6 turns of 36 s.w.g. d.s.c. copper wire close wound, for the aerial winding. The two windings are separated from each other by 0·05in. L1 is 12 turns of 28 s.w.g. enamelled copper wire, turns close. Later, a turn per coil may need to be removed to ensure correct band coverage, coils being tested either by using a g.d.o. when they are *in situ*, or via received signals. When finding the frequency range afforded by the T1/VC1 combination with a g.d.o. it will normally be necessary to remove the screening can although it should be remembered that re-fitment of this will cause the circuit to resonate at a slightly different frequency to that measured. Fortunately the dust cores permit considerable inductance variation.

The size of the chassis used is also shown in Fig. 2 but when self-powering items are to be used this should be made 2in. longer.

Details regarding the front panel are given in Fig. 4, matters being so arranged that when the completed assembly is placed on the table the front panel slopes backwards slightly to assist operation of tbe controls; the appearance also benefits.

Casing details are given in Fig. 5 to agree with the prototype which is fashioned from faced hardboard and held together witb pins and impact adhesive.

When the preselector is not self-powered a suitable power pick-up socket should be fitted to the main receiver. An international-octal (I.O.) valve holder is ideal for the purpose rigidly situated so

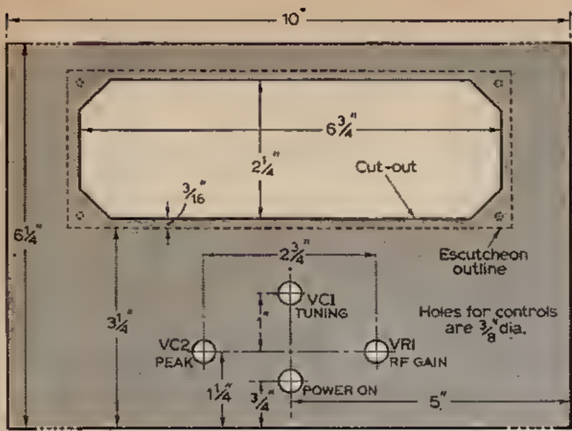
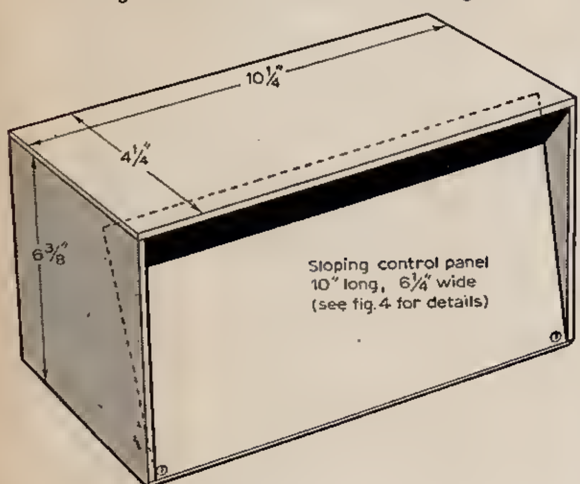


Fig. 4: Panel details.

Fig. 5: Dimensions of the main casing.



that plug P11 carrying the 3-core supply cable from the preselector can be engaged.

Tests sbould tben be carried out, using an ohmmeter, to ensure that no h.t.-chassis sbort circuit exists after wbicb a sbort screened lead from socket Sk3 may be connected to the receiver aerial socket. The receiver may have separate aerial/eartb sockets in which case the braid of the screened cable sbould be connected to tbe eartb socket and tbe lead associated with capacitor C7 connected to the aerial socket. The receiver is then switched on and this will bring the preselector warning lens to life.

Alignment

A weak signal is now sought around 14Mc/s and the preselector pointer moved fully right to completely enmesb the vanes of VC1. The vanes of VC2 should be fully disengaged and the dust core of L1 removed. The core of T1 should next be carefully adjusted to increase the strength of the signal tuned using the receiver 'S' meter as a visual guide.

The receiver is now tuned to the 15-metre band and a weak signal sought, after whicb tbe scale pointer of the preselector is moved toward mid-scale—or to where the signal sounds strongest. The same procedure is adopted on the 10-metre band when the preselector pointer should be almost fully to the left of the scale for maximum received signal strength.

Should it seem however that the preselector cannot be tuned down far enough to peak the signal tben too much inductance is in circuit and the core of T1—or the number of turns—requires adjustment. Without the aid of frequency measuring gear some experimenting is inevitable but the aim should be to get '10' and '20' peakable at the opposite ends of the preselector scale. VC1 plays a major part in the band coverage and an electrically over-large item is undesirable. Where a good quality variable capacitor is to hand but which possesses excess capacitance, a fixed-value item may be wired in series with it. For example a 250pF variable may be suitably 'reduced' by including a 470pF capacitor in series witb it—or, alternatively, vanes may be removed.

Wben the T1/VC1 combination has been dealt with attention may be given to the 'Peaking' circuit, L1/VC2. The core should be lightly inserted in the coil and first tests made on '20' as before. The normally weak signal, already being amplified by the preselector should be further peakable as VC2 is carefully rotated when L1 is of the correct inductance value.

Although signals are likely to be heard at almost any time of day or night on '20' none may materialise on '10', or even '15' for lengtby periods solely due to unfavourable propagation conditions. ■

★ components list

Resistors:
R1 39kΩ
R2 6·8kΩ
R3 27Ω
R4 100Ω
R5 100kΩ
R6 220Ω
VR1 5kΩ pot. (Lin.)

Capacitors:
C1 10,000pF ceramic
C2 10,000pF ceramic
C3 2000pF ceramic
C4 10,000pF ceramic
C5 50pF silver mica
C6 2000pF ceramic
C7 5000pF ceramic
C8 4μF electrolytic, 350V
C9 2000pF ceramic
VC1 150pF variable (see text)
VC2 100pF variable Jackson 'Air tune'

Valves:
V1 EF183
V2 EF80

Sockets:
Sk1, Sk3—Coaxial type, surface mounting
Sk2—Miniature closed-circuit jack type

Dial and Drive:
Jackson type SL16 5191 complete

Miscellaneous:
R.F. choke, 2·6mH (Denco type RFC5), 0·3 in. Bakelite coil former with dust iron core and screening can (Denco Ref. 5000A/4PL), Coil former with dust iron core (Denco—Ref. 351/8BA), Miniature panel lamp (Eagle PL), Octal plug, Knobs (3), Valveholders 89A (2), Chassis 7 x 3½ x 1½in. etc. and casing materials.