A Simple 3-Valver

By T. M. Bush

THIS unpretentious little receiver can be built very cheaply. Considering the extreme simplicity of the circuit, it has a very good performance and with careful manipulation of the controls, the single tuned circuit will enable all the more powerful transmissions to be received clear of interference.

Circuit

The EF91 is a high slope miniature valve which is available ex-equipment very cheaply indeed. Three of them are used in this receiver. The first is arranged as a pentode R.F. amplifier but it will be noticed from Fig. 1 that there is no tuned circuit associated with it. The high slope of the valve, however, goes a long way towards repairing this omission and quite a worthwhile gain is achieved. Because the EF91 does not have variable-mu characteristics it was necessary to achieve some method of gain control other than by variation of bias, and the problem was solved very satisfactorily and simply by feeding the signal from the aerial to the slider of a 1M potentiometer in the grid circuit.

The second valve, connected as a triode, is used as a conventional leaky grid detector, regeneration being applied through the variable capacitor VC1 to sharpen the tuning and increase the sensitivity. Because the R.F. stage isolates the aerial from the tuned circuit the tuning is not affected by aerial loading and if by chance, as will sometimes happen, too much reaction is applied, the resultant oscillations will not be radiated to the annoyance of the neighbours. Resistor R5 and capacitors C2 and C3 remove the R.F. component from the output and the audio signal is passed via the capacitor C4 to V3, the output valve. This is another EF91, again triode connected. The optimum load could not be discovered but this is not of much importance with the triode connection and an output transformer having a ratio of 50:1 was found very satisfactory for a 3Ω loudspeaker.

Power Supply

A miniature double-wound mains transformer of the instrument type, having an output of 20mA at 250V and 1A at 6·3V supplies the power in conjunction with a contact-cooled metal rectifier. Smoothing is provided by the resistor R8, and the associated electrolytic capacitors C5 and C6. A

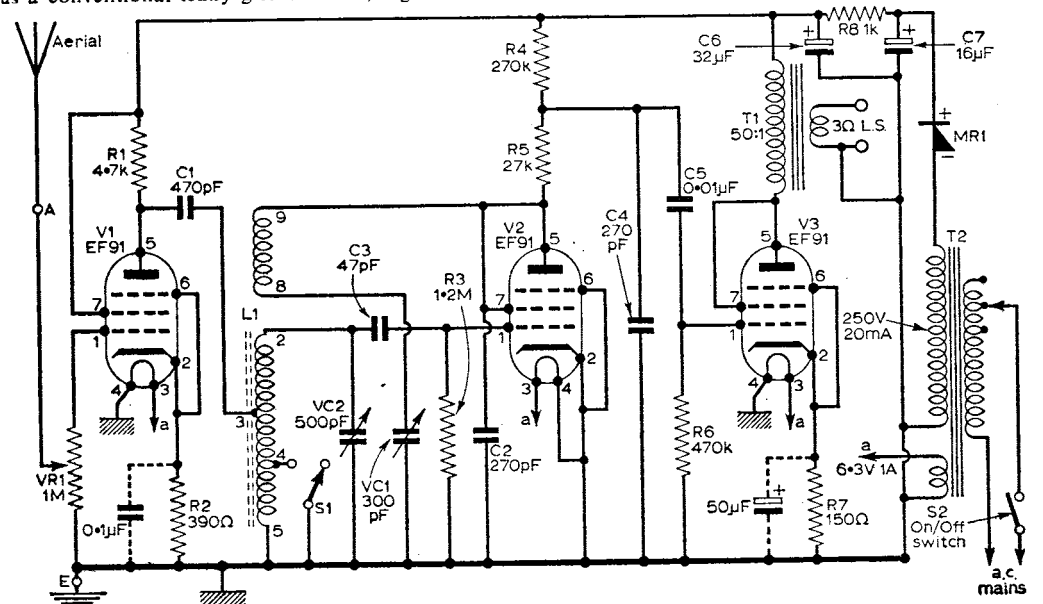


Fig. 1—The circuit.

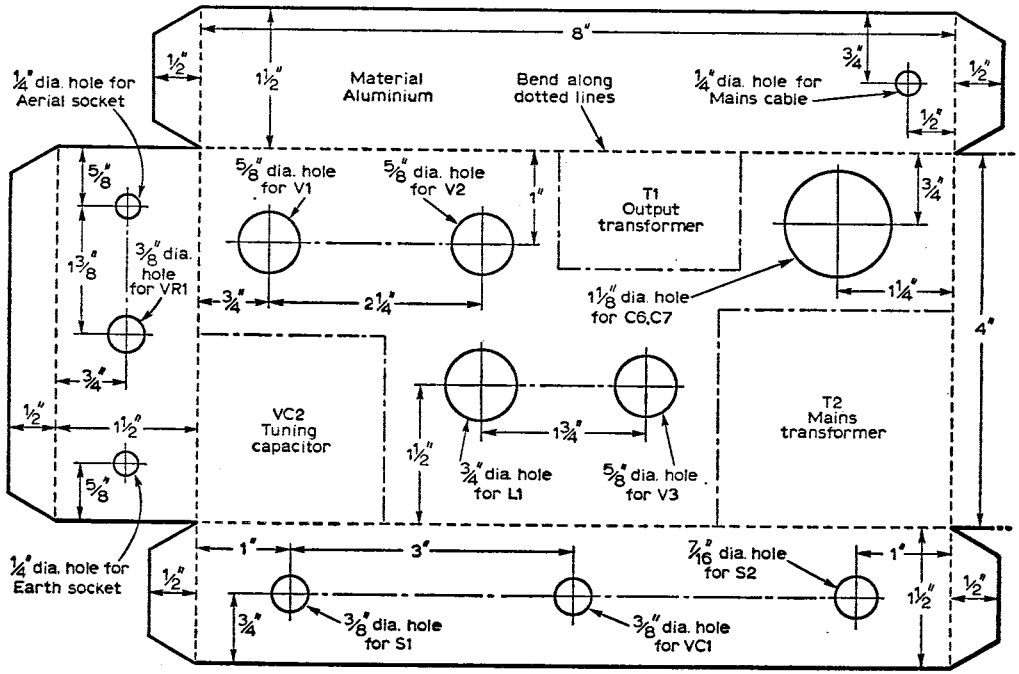
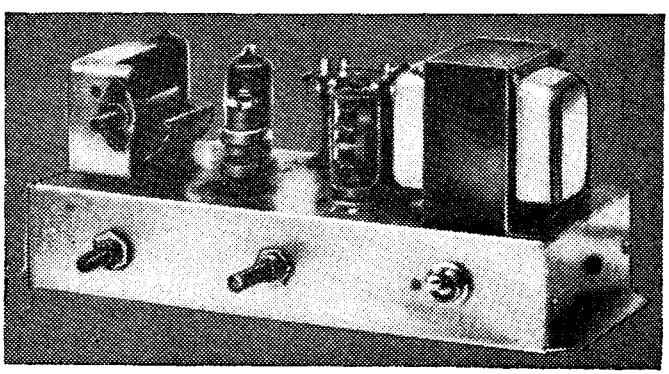


Fig. 2—The drilling dimensions of the chassis.

pilot or dial light, if fitted, should be 6·3V 0·04A, so as not to exceed the rating of the transformer winding. A separate on/off switch was fitted in the prototype but there is no reason why mains switching should not be incorporated with VR1. The power consumption from 240V A.C. mains is less than 20W.

Modifications

It will be noticed that the bias resistors of V1 and V3 are not by-passed. Consequently, if greater gain is required, capacitors may be fitted across them as shown in dotted outline in Fig. 1. A further increase in gain can be obtained by reducing the value of R2 to 150Ω but this will increase the current through the value and is permissible only if the mains transformer can accept the extra load. The total H.T. current in the prototype was exactly 20mA.



The receiver nearing completion.

Construction

The prototype was constructed on a chassis of 18s.w.g. aluminium sheet measuring 8in. x 4in. x 1½in., details of which are given in Fig. 2. This gives plenty of room for standard size components with the exception of the reaction capacitor, VC1, where a miniature must be used in order that it may be accommodated within the depth of 1½in.; alternatively, the chassis could be made deeper. Construction may proceed in any convenient order. The layout and the arrangement of the wiring and components is not at all critical so long as the connections around V2 and the coil are kept to a reasonable length. Tinned copper wire of 22s.w.g. covered with sleeving is recommended for all the wiring, details of which are given in Fig. 3. The loudspeaker is connected direct to the secondary terminals of the output transformer on top of the chassis. It is good practice to connect one of these terminals to chassis and a solder tag should be fitted for the purpose on one of the transformer holding-down bolts.

Components

Resistors may be ½W or ¼W, except R8 which should be 1W. The capacitors have to withstand

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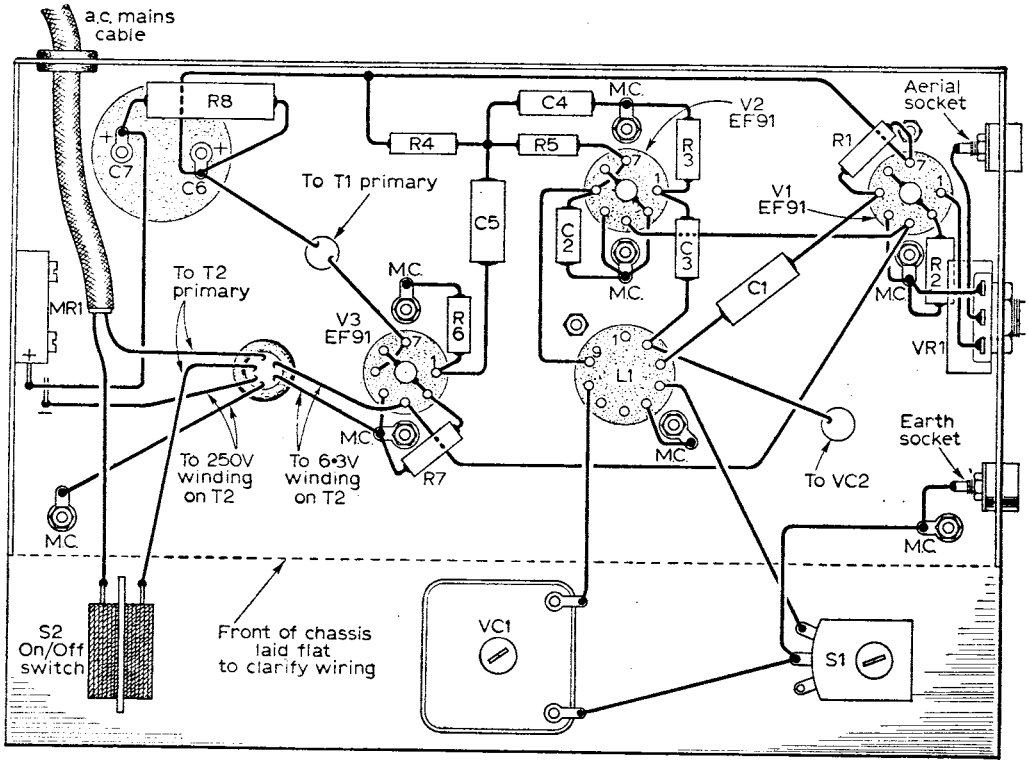

Fig. 3—The complete wiring diagram.

COMPONENTS LIST

Resistors (all ½W, carbon unless otherwise stated):

R1	*4·7k*	*R5*	*27k*
R2	*390Ω*	*R6*	*0·47M*
R3	*1·2M*	*R7*	*150Ω*
R4	*270k*	*R8*	*1k 1W*

VR1 1M carbon potentiometer

Valves:

V1, V2, V3 } EF91, B7G base

Coil:

Iron dust core, dual range, medium and long wave bands, with reaction winding. (Repanco)

Capacitors:

C1 470pF ceramic or mica
C2 270pF ceramic or mica
C3 47pF ceramic or mica
C4 270pF ceramic or mica
C5 0·01μF paper 350V
C6 32μF electrolytic, 350V
C7 16μF electrolytic, 350V
VC1 300pF solid dielectric variable
VC2 500pF air dielectric variable

Transformers:

T1 Output—about 50 : 1
T2 Mains—Tapped primary. Secondaries: H.T.: 250V 20mA half wave. L.T. 6·3V 1A

Rectifier:

Contact-cooled 250V 20mA

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the full H.T. voltage from the rectifier when first switching on and must therefore be 350V working. Any kind of tuning capacitor, air-spaced or otherwise can be used for VC2 or one-half of a two-gang component can be used as in the prototype. The coil L1, may be any iron-dust-cored dual wave type with a reaction winding but it is convenient if it is designed to plug into a B9A or B7G valve base. For tuning, a 3in. diameter engraved knob is fitted direct to the tuning capacitor but there is no reason why a slow motion drive should not be fitted if desired.

Testing and Operation

When the wiring has been completed, a test should be made with a meter between C6 and chassis to see that there are no short-circuits in the H.T. wiring. If all is well, power can be applied and transmissions should then be received. Two or three feet of wire as a throw-out aerial will usually be enough, though in poor reception conditions, some more efficient arrangement may be necessary. An earth is not essential, but will reduce mains-borne interference.

It will probably be found that with VR1 at maximum, some programmes will be receivable at adequate volume with VC1 set at minimum, but will suffer from interference from adjacent stations. In this case, the procedure is to reduce the volume by means of VR1 and bring it back to the desired level by the application of reaction, at the same time adjusting VC2 for the best results. ■