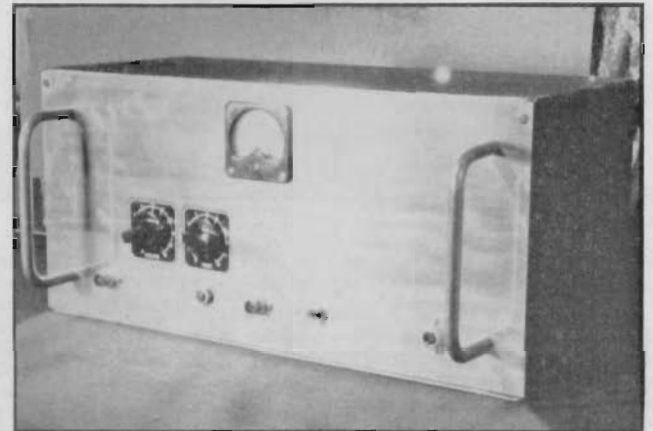


HIGH QUALITY MODULATOR FOR THE AMATEUR TRANSMITTER

by David Noble, G3MAW and David M. Pratt, G3KEP

A Conventional Design for Inputs up to 50 watts



GENERALLY SPEAKING, telephony is more popular than c.w. among British radio amateurs. This being so, with the new licences now being issued the number of telephony stations on the amateur bands increases rapidly.

It is important, therefore, that every amateur operator takes all possible precautions to ensure that his transmitter is operating correctly, is not overmodulating, and that speech quality is pleasant to the listener. If due attention is not paid to modulation it may mean that valuable space on the amateur bands is unnecessarily wasted, and that other stations may lose contacts. It would be of some advantage if *all* radio amateurs aimed at getting their modulation and speech quality just a little better than that of the nearest local call sign.

The modulator to be described was originally designed to anode and screen-grid modulate a power amplifier running up to 50 watts input. It is, however, mainly used for a 160 metre 10 watt transmitter,¹ and as only 5 watts of audio power are required to modulate a 10 watt p.a. input power, and the modulator has a maximum output of 25 watts, the gain control is turned well down.

Circuit

In the first two stages EF50 (VR91) valves are used as voltage amplifiers, the second being strapped as a triode. The reason for the choice of this type of valve was that it has its own screening can, and that it is cheap. The gain control is a simple potentiometer

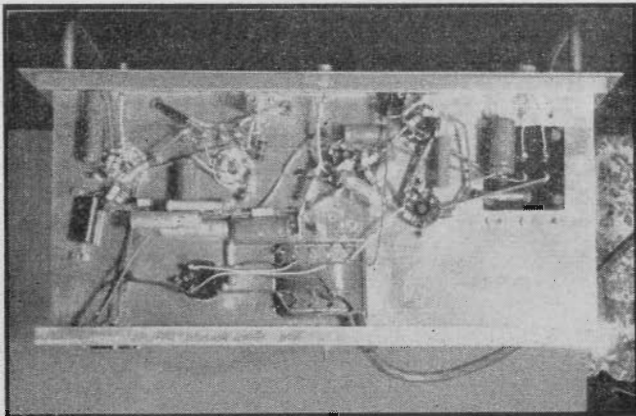
between the first two stages, and the tone control is a simple top-cut circuit between V_2 and the phase-splitter, V_3 . The phase-splitter is a 6SL7 in a conventional paraphase circuit which feeds the push-pull output stage. A coaxial socket is connected to the grid of the 6SL7, and high level inputs may be fed to this socket. This facility was originally intended for a 1,000 c/s phase-shift oscillator used for m.c.w. during slow morse transmissions, and it proved to be an invaluable refinement as it did not necessitate changing over the microphone and oscillator plugs before and after verbal announcements.

It is important that several of the components in the phase-splitter and output section be accurately matched. These are the two anode load resistors R_{11} , R_{12} ; the two blocking condensers C_{11} , C_{12} ; the grid resistors R_{15} , R_{16} ; and the grid stoppers R_{17} , R_{18} . Although the actual values themselves are not very critical, the pairs of components, except for R_{17} and R_{18} , should be matched to within 2%. R_{17} and R_{18} are matched to within 5%. Of the matched pair R_{15} and R_{16} , R_{15} should, preferably, have the higher value.

Output Stage

The output stage employs two 6L6's operated in class AB1. A common screen-grid resistor is used, and is calculated for the screen current at zero signal level. The

¹"A Transmitter Circuit for 160 Metres", David Noble, G3MAW, and David M. Pratt, G3KEP, *The Radio Constructor*, August, 1959.



Underside view of G3KEP's and G3MAW's modulator

condenser C_{13} ensures that the screen voltage remains constant when the current increases as the signal voltage is applied.

It will be seen from the photographs and from the circuit diagram that a meter is included in the anode circuit of the output stage. This has been included in order that a check can be made on the modulator supply current.

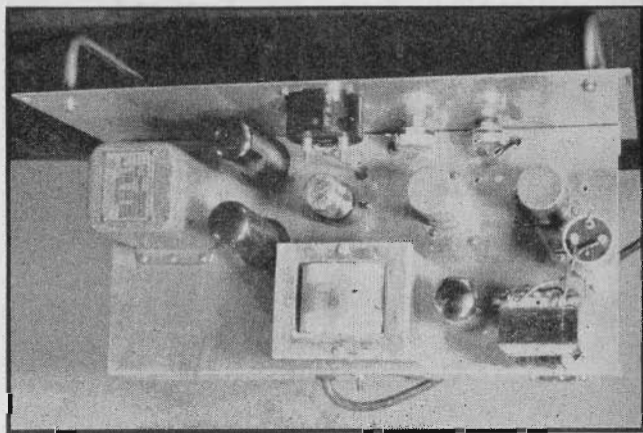
The output valves used in this circuit have an anode to anode load impedance of 9,000 ohms. This is the same load as that required by the transmitter¹. (The p.a. conditions being 300 volts at 33mA giving an input power of 10 watts and a load impedance of 9,000 ohms.) As the impedance of the modulator is equal, in this case, to that of the transmitter power amplifier, a modulation transformer with a turns ratio of 1 to 1 is employed. In the prototype a Collins modulation transformer was used. This has

the correct ratio and is available quite cheaply on the surplus market. Multi-ratio types such as the Woden UM1, etc., may, however, also be used.

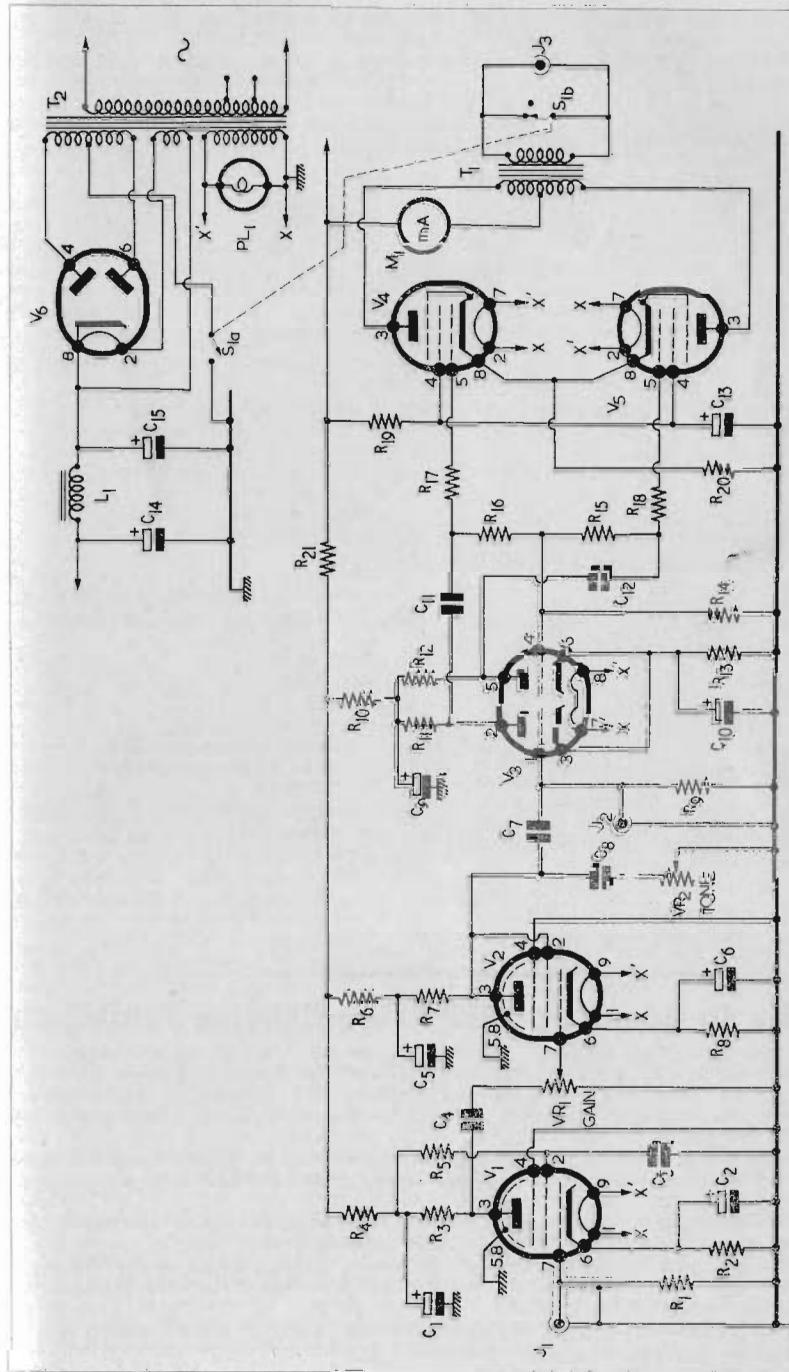
The output of the modulation transformer is fed to an insulated Belling-Lee coaxial socket; this component was substituted for the original jack socket which was found to arc on modulation peaks. One other feature which is not normally found in designs of this nature is the switch $S_{1(a)}$ and (b). This is a toggle switch of the single-pole changeover variety. It is wired in such a manner that, when the h.t. supply to the modulator is switched off, the secondary of the modulation transformer is shorted. This enables c.w. to be used without removing the modulator connection from the transmitter.

Microphone

Almost any type of crystal microphone may be used with the modulator, and good



Top view of the modulator described in the text



ME26

Fig. 1. Circuit diagram of the 25 watt modulator transformer described by G3KEP and G3MAW. The switch S_1 is shown in the "off" position with the secondary of the modulation transformer shorted so that c.w. may be used without disconnecting the modulator

results have been obtained from a variety of different types ranging from "surplus" deaf-aid inserts to the more expensive commercial units.

Construction

The modulator and its power supply were built on to a chassis $7\frac{1}{2} \times 15\frac{1}{2} \times 2$ in. This conveniently fitted into a TU-unit outer case with a suitable front panel. The external appearance of the modulator was designed to match the transmitter with which it is used.¹ The power supply was mounted along the rear of the chassis, the mains transformer being well away from the modulation transformer and the first stage. The modulation

transformer itself is mounted towards the front of the chassis; with the first three valves mounted in line from left to right and the output valves equally spaced on either side. (See photograph of top view.) The modulation transformer is mounted in line with the first valves.

Results

No difficulties were encountered when getting the modulator working. If constructors who decide to make this equipment take the usual precautions with regard to grid wiring, etc., they will find that this general purpose modulator will give extremely satisfactory results

Components List

Resistors ($\frac{1}{2}$ watt unless otherwise stated)

R ₁	5.6M Ω
R ₂	1.5k Ω
R ₃	390k Ω
R ₄	82k Ω
R ₅	820k Ω
R ₆	68k Ω
R ₇	220k Ω
R ₈	2.2k Ω
R ₉	680k Ω
R ₁₀	10k Ω
R ₁₁	220k Ω } Matched $\pm 2\%$
R ₁₂	220k Ω }
R ₁₃	1.5k Ω
R ₁₄	220k Ω
R ₁₅	220k Ω } Matched $\pm 2\%$
R ₁₆	220k Ω }
R ₁₇	10k Ω } Matched $\pm 5\%$
R ₁₈	10k Ω }
R ₁₉	18k Ω , 1 watt
R ₂₀	250 Ω , 6 watts
R ₂₁	33k Ω , 2 watts

Condensers

C ₁ , C ₅ , C ₉	8 μ F, 350V wkg. electrolytic
C ₂ , C ₆ , C ₁₀	50 μ F, 25V wkg. electrolytic

C ₃	0.1 μ F, 400V wkg. paper
C ₄ , C ₇	0.001 μ F, 400V wkg. paper
C ₈	0.01 μ F, 400V wkg. paper
C ₁₁ , C ₁₂	0.05 μ F, 400V wkg. paper, matched $\pm 2\%$
C ₁₃	8 μ F, 500V wkg. electrolytic
C ₁₄ , C ₁₅	50 μ F, 500V wkg. electrolytic

Miscellaneous

VR ₁	500k Ω potentiometer, log track
VR ₂	250k Ω potentiometer, lin. track
V ₁ , V ₂	EF50 (VR91)
V ₃	6SL7-GT
V ₄ , V ₅	6L6
V ₆	GZ34
M ₁	0-100mA meter
PL ₁	6.5 volt, 0.3 amp pilot lamp
J ₁ , J ₂	Belling-Lee coaxial socket, type L604/S
J ₃	Belling-Lee insulated coaxial socket, type L. 603.
T ₁	Modulation transformer—see text
T ₂	Mains transformer 350-0-350V, 200mA, 6.3V, 2A and 6.3V, 4A
L ₁	10 henry, 200mA choke
S ₁	Toggle switch—changeover

Brian Rix to Open the 1960 Radio Hobbies Exhibition

Brian Rix, stage, screen and c.v. laughter-maker and now B.B.C. impresario, will appear in an unfamiliar role when he opens the Radio Hobbies Exhibition in London on 23rd November, 1960.

Mr. Rix has a special interest in this show for amateur radio and television enthusiasts, as it is the annual rendezvous for members of the Radio Society of Great Britain and for all amateur radio enthusiasts.

Known on the Short waves by the call sign G2DQU, Mr. Rix obtained his amateur radio licence in 1938 and was soon conversing with fellow radio enthusiasts in all countries throughout the world.

In speech and morse code they discussed technical and personal topics in the friendly way for which the international amateur radio fraternity is well known.

Although he is known to millions through the record-breaking farces at the Whitehall Theatre and on television, he also has this more individual means of communications at his command and is a member of the R.S.G.B.

The show will be held at the Royal Horticultural Society's Old Hall, Westminster. It will display all types of receiving and transmitting radio and television equipment, together with test gear, components and accessories.