

## The Simplest Modulator

### Plugs Into Key Jack—No Plate Supply Needed

BY IRA F. GARDNER,\* W6LNN

**I**T is possible that many c.w. operators have been looking for an easy way to modulate their rigs, especially now that the 40-meter band has been opened up for 'phone. This little modulator may be the answer.

The interesting point about it is that it can be plugged into the cathode circuit of any final amplifier and you are on 'phone. No separate plate supply or matching output transformer is needed. The plate voltage for the unit is derived from the final plate supply.

As shown in Fig. 1, the audio output voltage is impressed between the r.f. amplifier cathode and ground, giving principally grid-bias modulation of the amplifier although there is a small amount of accompanying plate and screen modulation. You can modulate triodes, tetrodes or pentodes, single-ended or push-pull. The efficiency is comparable with that of other grid- or screen-modulation systems and so, of course, cannot equal plate modulation, but good quality reports will be obtained. One feature of the system is that, with most finals at least, proper operating conditions for good modulation are attained practically automatically.

The speech amplifier uses a double-triode 6SL7GT with resistance coupling, and gives adequate gain for a crystal microphone. Plate voltage comes from the amplifier cathode, with  $C_1$ ,  $C_3$ ,  $C_6$ ,  $R_3$ ,  $R_7$ , and  $R_{10}$  providing additional filtering as well as decoupling. The voltage will vary with the power of the transmitter, but in any event the measured voltages at the 6SL7 plates are quite low.  $R_{11}$  should not be needed if the modulated amplifier is operating at such low power that the voltage at the screen of the 6Y6G does not exceed the maximum rating of 135 volts.

\* 2613 No. 17th St., No. Sacramento 15, Calif.

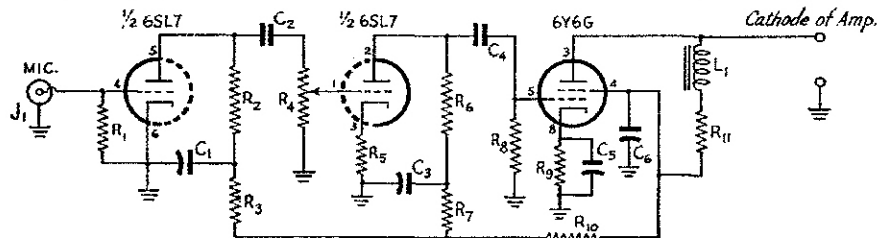
• This is about as easy a way to get on 'phone as any we've seen. The same modulator unit will serve for any transmitter power (c.w. input) up to a kilowatt, simply by using two or more tubes in parallel for the heavier plate currents. The only power supply required is a means for lighting the tube heaters.

To use the modulator, first tune up the transmitter for c.w. operation and load it to normal input. Then connect the modulator into the amplifier cathode circuit — it can be plugged in in place of the key if there is a key jack in the cathode — and the plate current should drop to about half its c.w. value. Then talk — that's all there is to it! The r.f. amplifier plate current should remain steady except possibly for a slight flicker on voice peaks. In the event that the plate current with the modulator plugged in is considerably above half the c.w. value, it can be brought into the right region by increasing the value of resistor  $R_9$ .

One word of caution, especially when using powers over 200 watts or thereabouts: Be sure the modulator filaments are ON before applying plate voltage. This will insure the proper path of the final cathode current and prevent possible burn-out of the small audio filter choke in parallel with the 6Y6G circuit. This applies particularly to separate control of filament voltages.

The author's unit is built into a  $6\frac{1}{4} \times 3\frac{1}{2} \times 2$ -inch "channel-lock" box. This size accommodates all the parts except the small audio choke.

In estimating the number of tubes required to modulate a given transmitter, allow one 6Y6G for each 200 ma. of c.w. plate current or 100 ma.



**Fig. 1** — Circuit diagram of the speech amplifier and modulator.

- C<sub>1</sub>, C<sub>2</sub>—0.1- $\mu$ fd. paper, 400 volts.  
C<sub>3</sub>—0.005- $\mu$ fd. paper, 400 volts.  
C<sub>4</sub>—0.01- $\mu$ fd. paper, 400 volts.  
C<sub>5</sub>—50- $\mu$ fd. electrolytic, 50 volts.  
C<sub>6</sub>—8- $\mu$ fd. electrolytic, 450 volts.  
R<sub>1</sub>—2.2 megohms,  $\frac{1}{2}$  watt.  
R<sub>2</sub>—0.22 megohm,  $\frac{1}{2}$  watt.

- R<sub>3</sub>, R<sub>7</sub>, R<sub>10</sub> — 22,000 ohms, ½ watt.  
 R<sub>4</sub> — 0.5-megohm volume control.  
 R<sub>5</sub> — 2200 ohms, ½ watt.  
 R<sub>6</sub>, R<sub>8</sub> — 0.1 megohm, ½ watt.  
 R<sub>9</sub> — 50 ohms, 2 watts (see text).  
 R<sub>11</sub> — 2000 ohms, 2 watts (see text).  
 L<sub>1</sub> — Small filter choke, "a.c.-d.c." type satisfactory.



Practically any layout you want can be used for the modulator. The unit at W6LNN uses the circuit of Fig. 1 and has ample gain for a crystal microphone. A carbon microphone could be coupled to the modulator grid through the usual transformer, without speech amplification.

when the modulator is plugged in. One tube will modulate up to 200 ma. c.w. current, two tubes up to 400 ma., and so on, it being understood that these values should drop to one-half when the modulator is in circuit. Type 6L6 tubes can be substituted for the 6Y6G but are not as desirable because higher plate and screen voltage are required for the same cathode current. Since the voltage drop across the modulator tube or tubes subtracts from the voltage actually applied between plate and cathode of the modulated amplifier, a larger tube drop means a reduction in

power input to the final amplifier stage.

In typical cases, 'scope patterns have shown that with tone input very good waveform is obtained up to about 80 per cent modulation. The positive peaks are somewhat clipped with heavier modulation, but the distortion is not particularly noticeable even at 90 per cent modulation.

The simplicity of the unit makes it readily adaptable to portable rigs. It would also be useful as a spare modulator when the regular high-powered speech system needs attention.

## OUR COVER

Here's the antenna system responsible for that husky 20-meter signal from W2SAI, Riverton, New Jersey. The self-supporting seamless-tubing mast rises 100 feet above ground, tapering from ten inches in diameter at the base to two inches at the top. The whole affair is made rotatable by setting the mast ten feet in the ground in an oil-filled sleeve which, in turn, is imbedded in a 4 x 4 x 10-foot concrete block. A prop-pitch motor with chain drive serves as rotator.

If you will observe the photo background closely, you will notice that the three stacked 20-meter dipoles (at the 40-, 70- and 100-foot levels) are backed up by a "bedspring"-type plane reflector. The reflector, made of No. 18 copperweld wires spaced two feet apart, measures 42 feet by 60 feet overall.

The feed system consists of paralleled RG-8/U coax cables (totaling 104 ohms impedance) feeding into twin paralleled quarter-wave matching lines inserted in the center dipole. From here, 1:1 open-wire phasing transformers are used.

A 33-foot vertical for 7 Mc. is mounted atop the mast.

## Strays

W2HH, 88 years young, filed in June for another in his long series of license renewals.

### HEADQUARTERS STAFF OPENING

The ARRL Communications Department invites applications for present and prospective staff posts. A present vacancy involves contest checking and analysis work. Applications should indicate any ARRL field organization posts held, amateur operating background, any contest work, possible interest or availability for WIAW operation, etc. Preference will be given to a single man in the 20-to-30 age bracket and to field organization appointees. Experience, personality, skill, accuracy on records and ability to formulate QST reports, all count. Salary depends on job and experience. If interested and available, send a card or message for personnel form. All applications will be considered confidential.