A 50-WATT CLASS AB_1 MODULATOR

Four type 1625 tubes were used in the output stage of the modulator shown in Figs. 9-20 and 9-22 for several good reasons. These tubes, 12-volt heater versions of the popular 807, are widely available on the surplus market at attractive prices. With the economical power supply shown here, four 1625s will deliver up to 50 watts of audio, sufficient to modulate a 100-watt transmitter. At higher plate voltages, four 1625s in Class AB_1 will furnish up to 140 watts (at 750 plate volts), sufficient to modulate a 280-watt transmitter.

Referring to the circuit diagram, the speech amplifier consists of a 6AV6 triode and the two triodes of a 6CG7. Transformer coupling between V_{1B} and the modulator tubes gives adequate signal for the 1625s at any rated plate voltage. A built-in bias supply, using a voltage-tripling circuit and selenium rectifiers CR_1, CR_2 and CR_3, furnishes operating bias that can be set to the proper value by R_2. During standby conditions, the modulator is turned off by opening the circuit at J_3 or by adding additional bias through J_4. Since connecting four tetrodes in push-pull parallel can often yield parasitic oscillations, resistors are connected in both control and screen grid circuits of the modulator tubes. With these resistors present, there should be no instabilities of any kind. The low- and high-frequency responses are restricted to good communications levels by proper proportioning of the coupling capacitors and the shunt capacitors. The 0.004-μf. capacitor across the secondary of T_2 will have a greater effect on restricting high-frequency response if a high-voltage low-current amplifier is being modulated than if a low-voltage high-current r.f. stage is used. The 0.004-μf. value was selected for use with a 400-volt 200-ma. amplifier.

Provision for connecting an external modulation monitor (see Chapter 10) is included, as well as a power outlet, J_5, for the monitor or other auxiliary equipment.

Construction

The modulator is built on a 17 × 10 × 3-inch steel chassis, although an aluminum chassis would

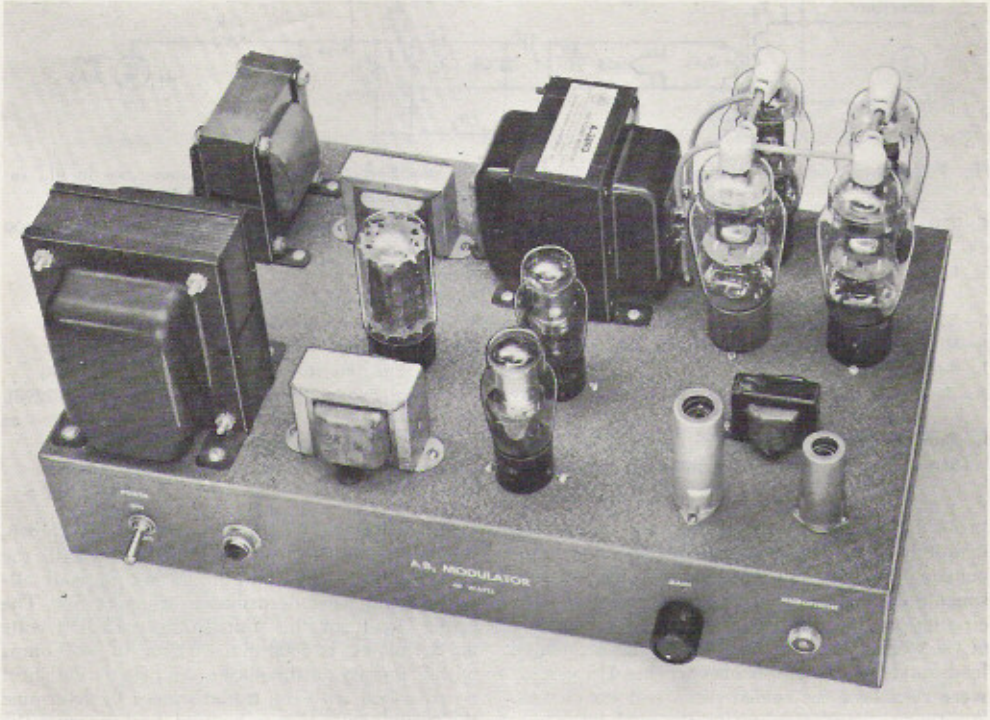

Fig. 9-20—A 50-watt modulator, using four 1625-type tubes in Class AB_1. With higher plate voltage and a larger modulation transformer, the tubes can deliver up to 140 watts of audio power.

Speech amplifier tubes and coupling transformer are at the right, in front of the four 1625s. The two voltage-regulator tubes in the center, in front of the modulation transformer, stabilize the screen voltage on the 1625s.

Power-supply filter choke is at the upper left-hand corner, and the small choke to the immediate right is connected in the screen circuit if a screen-grid r.f. amplifier is used. If desired, a cane-metal housing can be used over the modulator, but the use of high-voltage wire and insulated plate caps practically eliminates the danger of electrical shock when the unit is in its normal position.

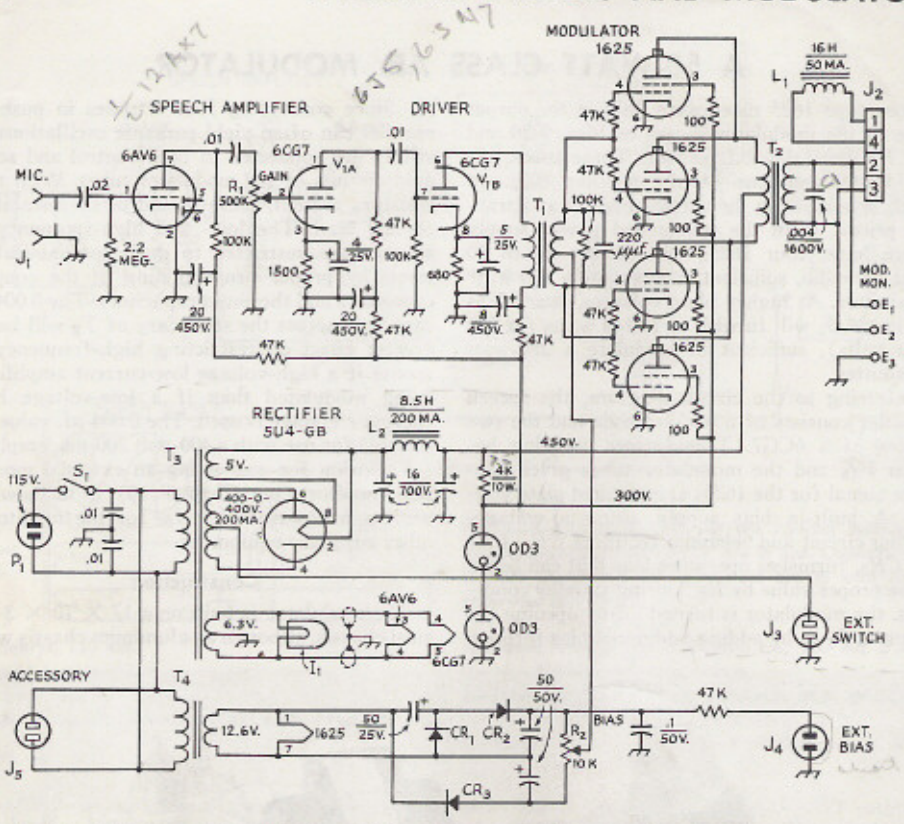

Fig. 9-21—Circuit diagram of the 50-watt modulator. Unless specified otherwise, capacitances are in μf., resistances are in ohms, resistors are ½ watt.

C_1—0.004 μf., but subject to modification. See text.
CR_1, CR_2, CR_3—20-ma. 130-v. selenium rectifier.
E_1, E_2, E_3—Nylon tip jacks (Johnson 105-601, 105-602 105-603).
I_1—6.3-volt pilot lamp.
J_1—Microphone connector (Amphenol 75-PC1M).
J_2—4-prong tube socket.
J_3, J_4—2-pin chassis-mounting a.c. receptacle (Amphenol 61-F1).
J_5—Phono jack.
L_1—Screen choke, used when modulating tetrode amplifier.
L_2—8.5-henry 200-ma. filter choke (Knight 61 G 409 or equiv.).
P_1—A.c. line plug.
R_1—Volume control, audio taper.
R_2—2-watt wire-wound control, linear taper.
S_1—S.p.s.t. toggle switch.
T_1—1:3 ratio interstage transformer (Triad A-31X).
T_2—60-watt modulation transformer (Stancor A-3893).
T_3—400-0-400 v, at 200 ma., 5 v. at 3 a., 6.3 v. at 5 a. (Knight 61 G 414 or equiv.).
T_4—12.6 v. at 2 a. (Knight 61 G 420 or equiv.).

probably be almost as strong and would be definitely easier to drill and punch. The components were arranged to keep a.c. leads a reasonable distance away from the speech-amplifier circuits, and the heater leads to the 6AV6 and 6CG7 were run in shielded wire. These shielded leads, and the shielded leads carrying 115 v. a. c., were run along the folded corners of the chassis. Another precaution in wiring the modulator is to keep the leads to and from T_2 away from the speech-amplifier portion of the modulator, to reduce the chances for feedback and consequent audio oscillation. The leads to and from T_2 should be made with well-insulated wire, and wherever they pass through the chassis rubber grommets should be used.

The connections to T_2 will depend upon the voltage-to-current ratio of the d.c. input to the modulated stage. With the power supply shown, the modulator is well suited to work with the 75-watt 6DQ5 transmitter and the 90-watt all-purpose amplifier described in Chapter Six. The proper load for the four 1625s, with 450 volts on the plates, is 3800 ohms, rising to 6000 ohms with 750 volts on the plates. An instruction sheet is furnished with the transformer; to determine the transformer taps to be used, first measure the plate voltage and current of the modulated stage. Divide the voltage by the current in amperes, to determine the secondary load, and from the instruction sheet select the connections that come closest to matching the secondary load to 3800 ohms. Although it is not likely that an exact match will be possible, it is of little or no consequence. The *ratio* of the impedance is the important consideration.

Operation

When the modulator is completed, connect a key or other external switch temporarily at J_3, and short-circuit J_4. Plug P_1 into an a.c. outlet, plug in the 5U4-GB and the 0D3s, and turn on S_1. The filament of the 5U4-GB should glow. Close the key or switch at J_3; the 0D3s should light. Open the external switch and plug in the speech amplifier tubes. After allowing time for the 6AV6 and 6CG7 to warm up, as indicated by the heater glow, turn on the external switch and turn off S_1. Allow a half minute for the filter capacitors to be discharged by the speech amplifier tubes, and then check with a voltmeter that no charge is left in the filter. Open the external switch, plug in the 1625s, and close S_1. After the heaters warm up, set the arm of R_2 to give a voltage of -32 between arm and chassis. Connect the transmitter or a dummy load to the modulator output (never operate the modulator without a load; the modulation transformer insulation may break down). Set the volume control at minimum (arm of R_1 at chassis end) and close J_3. With a microphone connected at J_1, speaking into the mike and slowly opening R_1 should deliver audio output from the modulator.

To obtain more power from the four 1625s, it is necessary to use a higher-powered modulation transformer at T_2 and to raise the plate voltage and grid bias. At 750 volts on the plates, the bias should be -35 volts.

The modulator should be turned on and off with the transmitter, so that a load is always furnished for the transformer. The modulator can be placed on standby by opening the circuit at J_3, or by adding additional negative voltage at J_4, depending upon the basic station control circuitry.

If a number of 1625s are available, it is desirable to select four that have substantially the same plate current (28 ma.) for the -32 volts bias. The plate currents of the individual tubes can be measured between insulating plate cap and the tube plate cap, connecting the + terminal of the milliammeter to the transformer lead. Turn off the equipment between measurements to avoid the possibility of a dangerous electrical shock.

As with any modulator using an output transformer, the secondary winding should be short-circuited (or the modulator disconnected) when the r.f. amplifier is used for c.w. or as a linear amplifier.

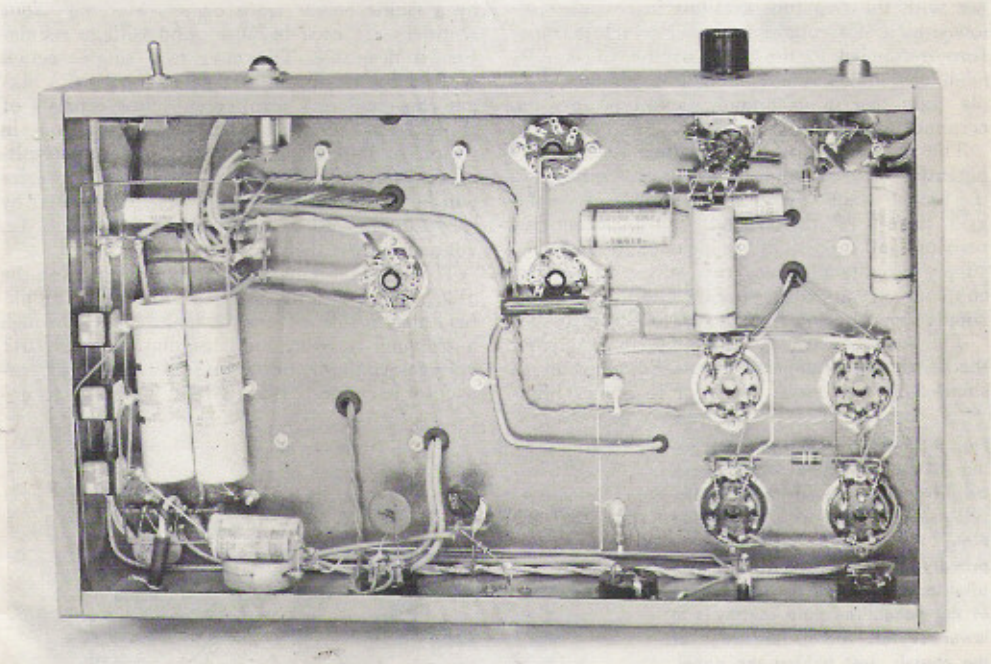

Fig. 9-22—Under the chassis of the 50-watt modulator. Three selenium rectifiers in the bias supply are mounted on the left-hand wall of the chassis. Associated components are grouped around the speech-amplifier sockets (upper right).

Components mounted on the rear apron of the chassis, from left to right, are bias potentiometer, audio power socket J_2, external bias connection J_4, external switch connection J_3, modulation monitor terminals E_1, E_2 and E_3, and the accessory socket J_5.

Shielded wire is used on 60-cycle a.c. leads in the power transformer primaries and secondaries to reduce the possibility of hum pick-up in the speech amplifier section.