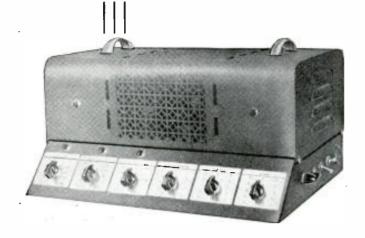
## Powerful PA Amplifier Uses an 815



Transmitting tube puts out a 54-watt a.f. signal

By GERALD A. CHASE

HE little 815 seems finally to be coming into its own. Many amateurs now are using it as a final amplifier in their low-powered transmitters and as a push-pull driver or multiplier in their higher-powered rigs. As yet, however, it does not seem to be much used for audio work. Where space is at a premium, the 815 is an ideal tube. Measuring slightly less than 4 inches high and 2 inches in diameter, it contains a pair of husky tetrodes. Used in push-pull, with 500 volts on the plates and a bias of -15 volts, it kicks out a healthy 54 watts.

A PE-103-A dynamotor is used with the amplifier described here for mobile work. With an output of 160 ma at 500 volts it is ideal for an 815 as long as the rest of the amplifier draws very little current. Even if the current exceeds the 160-ma rating enough to drop the voltage to 400, output is still better than 40 watts.

One of the main considerations in

planning the amplifier was to keep plate and filament currents as low as possible to minimize battery drain when working mobile.

The minimum requirements for input were two microphones and one phonograph, with noninteracting controls to mix all three. As can be seen from the schematic, a single 6SC7 was used for the two microphone preamplifiers. Mixing is done between the 6SC7 and the following 6SK7.

In the following stage a 6SK7 is used in conjunction with a 6C5 and a 6H6 in a volume-expander-compressor circuit which is fairly standard. This circuit was included primarily for recording. However, it has also been found very desirable for PA work. Some speakers have a tendency to wander away from the microphone. Compressor action works as an automatic gain control to boost the volume when the speaker is at a distance and to cut it as he speaks directly into the mike. Care

must be exercised in setting the control for it is possible to cause distortion with over-compression.

As shown in the schematic, the control is a special center-tapped 1-megohm potentiometer (IRC VC-539X). When the arm is at center position, the grid return from the 6SK7 is directly grounded and its operation is normal. When moved toward the plate end of the control, compression takes place; and when moved toward the cathode end, expansion results.

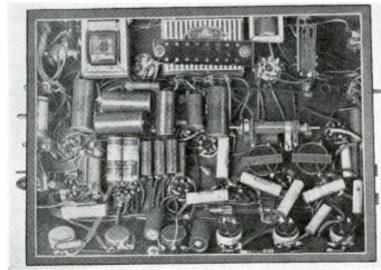
When playing music, a greater dynamic range can be achieved by using the expander. Again, care should be taken, for distortion will also result from overexpansion.

## The tone control

The next stage is the tone-control circuit using a 6C5 as a "normal-tone" amplifier with a 6SL7 in parallel as a treble and bass amplifier. The signal for the grid of the 6C5 is taken from between a 47,000-ohm resistor and a 100,000-ohm resistor. This drops the signal to two-thirds of its original value. If the grid were connected directly to the 0.1- $\mu$ f coupling capacitor, the "normal-tone" volume would be great enough to blanket the action of the treble and bass controls.

The 100,000-ohm resistor between the 6SK7 plate and the grid of the bass section of the 6SL7 isolates the .01- $\mu$ f bypass across the bass control from the rest of the circuit. The 500,000-ohm potentiometer controls the amplitude of the low-frequency sounds. Be careful to filter and shield the previous stages, for, with the bass control at maximum, there is a tendency to amplify hum.

The signal is fed to the treble section of the 6SL7 through a 250- $\mu\mu$ f capacitor, which filters out the bass. Large amounts of treble boost can be obtained with the control. It is usually impossible to operate it at more than two-



This under-chassis view shows how the bias battery should be mounted in place.

thirds of maximum because it brings out excessive hiss, needle scratch, and other high-frequency noise. Also, unless the microphones are placed with great care, there is feedback at high settings of the control. A compromise can be found between bass and treble to satisfy the requirements of almost any installation. With both controls at zero the tone is normal.

A 27,000-ohm resistor between each of the tone-control-tube plates and the 0.1-µf coupling capacitor acts as a safety measure to prevent interaction between circuits.

The 6F6 is triode-connected as a driver for the 815 final. With a bias of -20 volts and a plate-supply voltage of 250, the 6F6 normally delivers approximately 0.8 watt. Actually it is slightly less in this case because of the voltage drop across the 2,500-ohm decoupling resistor. It is still sufficient, however, to supply the 0.35-watt driving power to the 815 grids and make up for the power loss in the driver transformer.

The 815 takes a bias of -15 volts. A C-battery is used; it is as economical as a separate bias supply. Cathode bias would have meant considerably more distortion due to the wide variation in plate current when operating class AB2.

The secondary of the output transformer is tapped to provide impedances of 4, 8, 15, 250, and 500 ohms. One end is grounded, and the other leads are run to an impedance-selector switch. Thus, any speaker or combination of speakers can be matched accurately to the output.

## Separate monitor channel

The amplifier in use before this one was built had no facilities for monitoring; in some locations monitoring would have been a decided asset. In one in-

that was being said and this made it hard to ride the gain effectively. On top of that, comments from the audience in the control room were not very flattering.

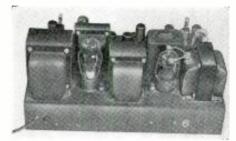
So we decided to include some means for monitoring in our new amplifier. A 6K6-GT is used, with its grid in parallel with that of the 6F6 driver. A small output transformer couples the 6K6-GT to a circuit-closing jack at the back of the chassis. When the speaker is plugged in, it is connected to the voice-coil winding and at the same time the heater of the 6K6-GT is grounded. In half a minute the tube is up to operating temperature. When the plug is withdrawn, the filament circuit is broken and the tube ceases to draw current.

## The power supply

It might have been better practice to build a separate low-voltage power supply for the voltage-amplifier tubes and the 815 screens but it would have complicated matters when operating from the dynamotor. A common supply was decided upon, and an attempt at good voltage regulation was made.

We felt that choke-input filtering was an absolute must for class AB2. There is very little filtering action at this point of the circuit, but choke input does tend to keep the voltage constant over wide variations of current. The 815 plate voltage is taken off immediately after the input choke. It was unnecessary to filter it further, and this connection lessened the current through the succeeding choke. A d.p.d.t. switch is used to change from a.c. to d.c. operation by switching the filament and high-voltage supplies.

A d.p.s.t. switch is used between the center tap of the plate transformer and chassis as a stand-by switch. When the amplifier is "off the air" but must be



A rear view of the amplifier reveals the 815.

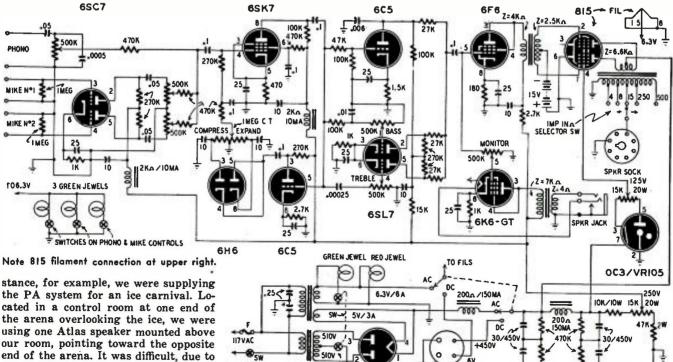
ready to operate at a moment's notice, this switch effects a saving in plate current during the stand-by period. The other half of the switch operates a green panel lamp to indicate when the high voltage is on.

Two bleeder circuits are used to obtain lower voltages for the amplifier stages and the 815 screens. A 15,000-ohm, 20-watt adjustable resistor in series with an OC3/VR105 voltage regulator supplies the correct screen voltage. The 815 screens are connected to the adjustable arm, which is varied to give 125 volts. The voltage across the VR-105 is just under 100.

The second bleeder circuit gives 250 volts for the plates of the voltage amplifiers.

There are five pilot lights in the amplifier: A red jewel indicates when line voltage is applied, a green jewel when the high voltage is switched on, and a green jewel over each microphone and phono control when each circuit is in used. A s.p.s.t. switch is mounted on each control to turn on the pilot lights when the control is turned up.

In wiring these switches, run the hot filament wire to the pilot lights and place the switches in the grounded side. Unless this is done, hum may be picked up in the control.



5**Z**3

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TO PE-103-A DYNAMOTOR