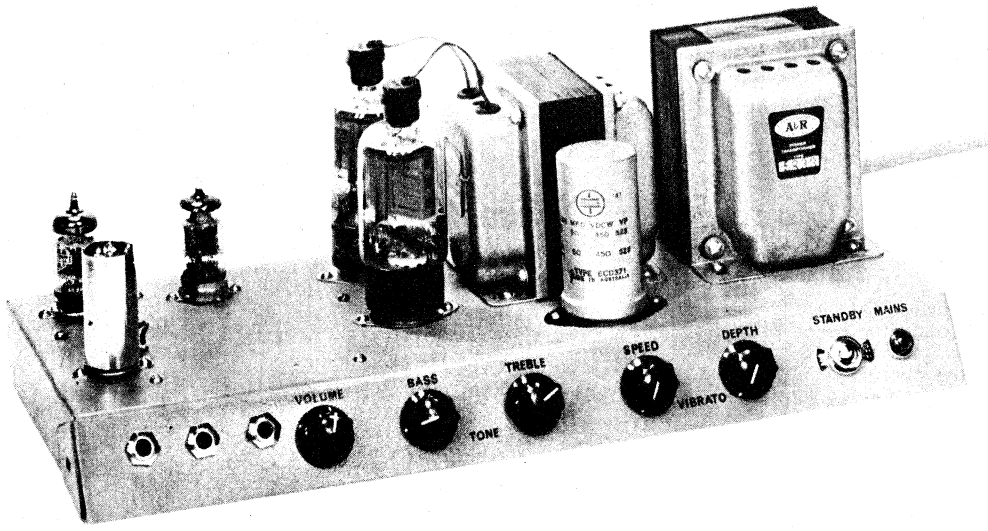


From the front and from underneath, the 60-watt amplifier looks little different from the 40-watt version featured last month. Note the more elaborate input system.

Guitar Amplifier — 60W Version

Following the presentation, last month, of a basic 40 watt guitar amplifier, we here give details of a more elaborate 60 watt version. Included in this latest design are specially "doctored" input facilities, having fixed amounts of bass and treble boost, and an optional "extra treble" circuit.

By Anthony Leo

In presenting the higher-powered version, we would stress that the rating is genuine: It will deliver to the loudspeaker system an actual output of 60 watts "undistorted." If operated under overload conditions for maximum sonic impact, as often happens with guitar amplifiers, it will deliver more power than this again.

The availability of audio power of this order automatically invokes the problem of providing loudspeakers to handle it. Obviously enough, it would be quite unrealistic to feed it into a system rated for, say, 20 watts and expect from it any kind of performance or durability. Any guitarist who aspires to use a 60-watt amplifier should be thinking in terms of multiple and/or very heavy duty loudspeakers, mounted in an adequate (and probably ponderous) enclosure. Particularly is this so for bass guitars or even ordinary guitars played so as to stress the lower register.

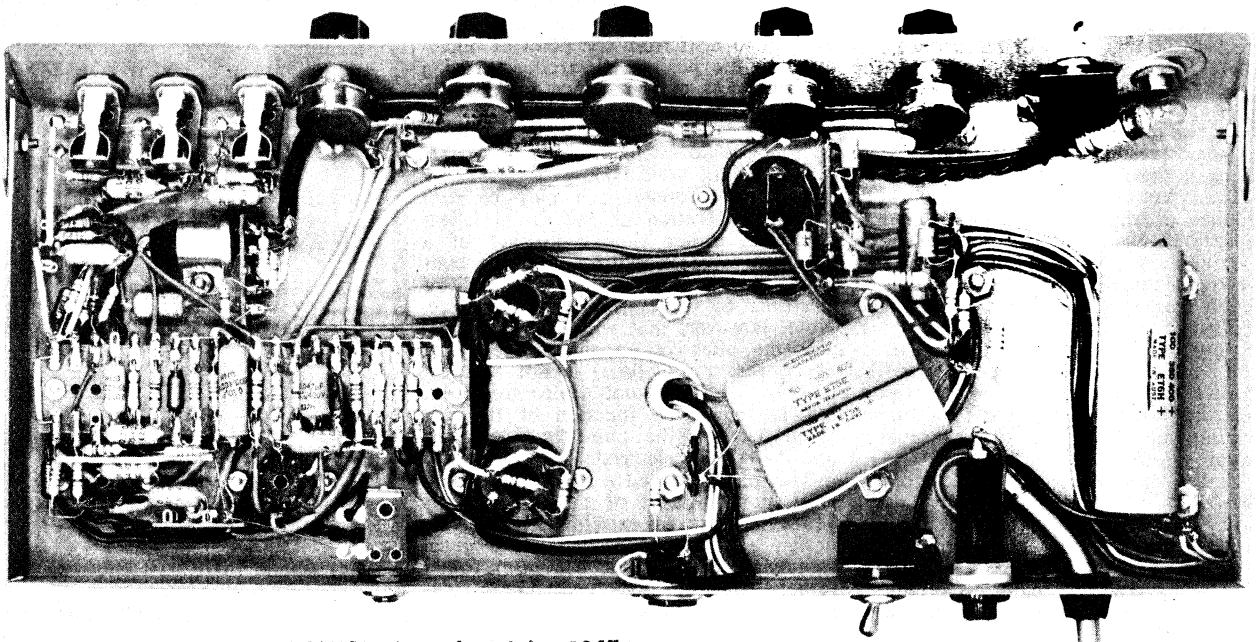
We may be able to say something about loudspeakers in a later issue but, for the time being, we can simply point up the need.

But why 60 watts — a figure well above that provided in the average electronic organ?

To some degree, there is a tendency amongst today's guitarists to regard high-powered amplifiers—and loudspeakers to match—as status symbols. What if they have to be transported in a large car and trundled in on castors? It's all part of the deal!

However, there is another side to it, in that guitar-group audiences aren't exactly noted for their silent attention, and the high power may well be necessary on occasions to ride over the competing ambient. But, whatever the motive, this 60-watt version should cope with just about any likely situation.

Over and above the provision of higher power output, on which we shall make further comment later in the



article, we have also provided a more elaborate input circuit, with three jacks individually compensated to favour lead, rhythm and bass guitars. The internal circuitry is such that there is a minimum of interaction between these input channels. If desired, two or even three guitars may be plugged in simultaneously and adjustment of the controls on one guitar will not significantly effect the balance from the others.

In making such provision, we are not seeking to contradict what is an accepted principle in guitar circles. Undoubtedly, the best presentation is obtained when the instruments operate through separate amplifiers and loudspeakers, each independently set up for optimum results. The total available power is greater and intermodulation is avoided, particularly in overstressed loudspeaker systems.

Provision of multiple, frequency-compensated inputs in our new amplifier serves a double purpose, however:

1. It makes it eminently suitable for any role, since selection of the proper input reinforces the action of the tone controls in the desired direction.

2. If the amplifier is to be used by more than one guitar, selection of the appropriate inputs provides an initial frequency differential, thereby simplifying the task of finding a suitable common setting for the major controls.

A rhythm guitar is usually played with the amplifier set for somewhere between "flat" and modest bass/treble boost, depending somewhat on the player, the instrument and the music. Accordingly, the input for rhythm accompaniment is "flat," the final balance being subject only to the amplifier tone controls and, of course, the tone controls on the guitar itself.

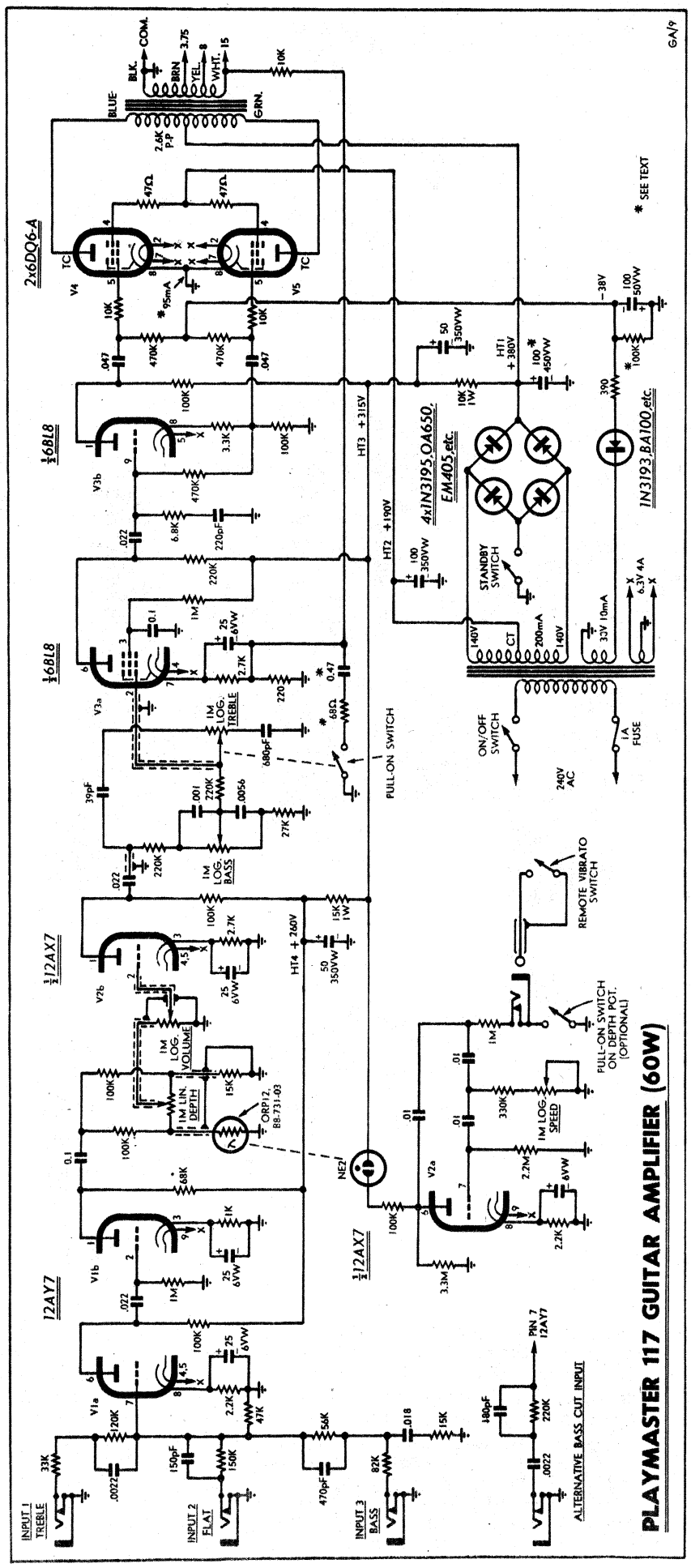
For lead guitar, more treble boost is normally desired and, accordingly, the input network for lead guitar provides an additional 6dB boost at 2KHz. With the treble control at maximum, something over 16dB of treble boost is available at 5KHz, which should meet all but extreme requirements.

For bass work, the bass input network provides an extra 8dB boost at 100HZ, making the total available bass boost about 25dB.

While we show one network of each type on the main circuit, individual constructors may elect to vary this to suit their own needs, putting in two "flat" inputs and two "treble boost" inputs and so on.

While on the subject of options, we show separately in the circuit another type of input network which provides a considerable degree of bass cut. This may be

Superficially, the circuit looks much the same as the 116 design featured last month. However, the revised operating conditions for the output stage, including the use of more expensive grain-orientated transformers, gives a 50pc increase in power output. Other provisions include a more elaborate input system, the use of a premium quality preamplifier valve and an "extra treble" facility operating on the main feedback loop; these latter features can be added, if desired, to the 116 circuit.



PARTS LIST

1 Chassis 16in x 7in x 1½in with outward sloping front panel.
1 Power transformer 240V to 280V at 200 mA with centre tap, 30V bias winding, and 6.3V at 4A with centre tap. A and R Transformer type PT5893, or similar.
1 Output transformer 2.6Kohms plate to plate with 3.75, 8 and 15 ohm secondary taps. A and R transformer type OT2842, or similar.
2 Octal valve sockets.
1 9-pin shielded valve socket.
2 9-pin valve sockets.
2 6DQ6A valves, 1 6BL8 valve, 1 12AX7 valve, 1 12AY7 valve.
4 Power diodes, types EM405, IN3195, OA650, or similar.
1 Bias supply diode, types, BA100, IN3193, or similar.
1LDR, type ORP12, B8-731-03, etc.
1 Neon lamp, type NE2.

CAPACITORS

1 100uF 450VW electrolytic.
1 100uF 350VW electrolytic.
2 50uF 350VW electrolytic.
1 100uF 50VW electrolytic.
5 25uF 6VW electrolytic.
1 0.47uF L.V. ceramic.
2 0.1uF 400V plastic.
2 .047uF 400V plastic.
3 .022uF 400V plastic.
3 .01uF 400V plastic.
1 .018 L.V. plastic.
1 .0056uF L.V. plastic.
1 .0022 L.V. plastic.
1 .001uF L.V. plastic.
1 680pF L.V. plastic.
1 470pF L.V. plastic.
1 220pF L.V. ceramic.
1 150pF L.V. plastic.
1 39pF L.V. ceramic.

RESISTORS

½-watt, 10 per cent, unless specified.
1x3.3M, 1x2.2M, 3x470K, 1x330K, 3x220K, 1x150K, 1x120K, 8x100K, 1x82K, 1x56K, 1x47K, 1x33K, 1x27K, 1x18K, 2x15K, 1x15K, 1 watt, 3x10K, 1x10K, 1 watt, 1x6.8K, 1x3.3K, 2x2.7K, 2x2.2K, 1x1K, 1x470 ohms, 1x220 ohms, 1x68 ohms, 2x47 ohms.

POTENTIOMETERS

4 1M log. (C-taper).
1 1M linear (A-taper).

MISCELLANEOUS

1x8-way tag strip, 2x6-way tag strips, 1x5-way tag strip, 1x4-way tag strip, 1x3-way tag strip, 3x2-way tag strips, 21 lug length of miniature resistor panel.
2 single pole toggle switches.
1 pilot lamp assembly.
1 fuse holder.
4 "shorting" type jack sockets and plugs.
1 4-pin speaker socket and plug.
Power flex and plug, clamp and rubber grommet, knobs, shielded cable, hookup wire, nuts, bolts, washers, solder, etc. Remote foot switch and mounting, if desired.

useful in situations where one guitarist wants consistently to use more bass boost in the amplifier than a second guitarist finds acceptable.

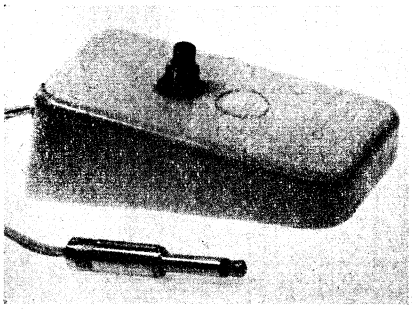
A further option is a modification to the main negative feedback loop which will provide the amplifier with an additional 6dB of treble boost at 3KHz. We devised the modification after observing that a particular group, who checked the amplifier for us, seemed to regard "normal" treble as something above what actual measurement showed to be level. The modification can be wired in permanently or brought into circuit by means of a "pull-on" switch attached to the rear of the treble tone control. In this way, operation of the switch will add 6dB of treble boost to whatever the control would otherwise determine.

Obviously enough, any treble boost so obtained from the feedback network must be at the expense of the total effective feedback. In other words, if we have 16dB of negative feedback and we wish to provide 6dB boost, the feedback will of necessity be reduced by about 6dB at the boosted frequencies. Fortunately, 10dB of negative feedback is adequate for an amplifier of this type. The network consisting of a 680 ohm resistor in series with a 0.47uF capacitor is shown dotted on the circuit diagram.

The modified input networks introduce an inevitable loss of gain which could render the amplifier not quite sensitive enough for low output guitars. Replacement of the 12AU7 in the first stage with a 12AX7 would more than offset this but could mean that the input circuits might overload too readily with higher than average signal voltages. Accordingly, we have specified a 12AY7, a less well known premium-quality valve, with a gain midway between the other two. It has the additional advantage of low-noise low-microphony construction and is therefore a good choice for situations where high energy from bass loudspeakers could vibrate the amplifier chassis.

Incidentally, all these modifications—the frequency compensated inputs, the 12AY7 valve and the treble boost in the feedback network—are immediately applicable to the 40-watt amplifier described last month.

A suitable tagstrip will need to be installed adjacent to the input jacks to carry the three networks. We used an 8-lug tagstrip, wired as indicated in the accompanying diagram and mounted by the screw which earlier had held the modulator component tagstrip. The lat-



The vibrato off-on foot switch is the same as specified for our original Playmaster 102 and 103 guitar amplifiers. It can be used as well as or instead of a switch on the rear of the "Depth" control potentiometer.

ter has been relocated further back, both to avoid crowding and to keep later wiring away from the input components.

Having looked at the modified input arrangements, we can describe the modifications to the output and power supply stages, necessary for the amplifier to deliver the additional 20 watts.

As we mentioned last month, the power output stage employs two 6DQ6A power valves operating push-pull in class AB1, with fixed grid bias. In the 40-watt unit, the total cathode current for the two valves was 100mA

POWER: 60 watts RMS output.
DISTORTION: Total harmonic distortion at 60 watts output is 2 per cent, and 1 per cent at 55 watts output.
INPUT SENSITIVITY: 20mV for 60 watts output at 500Hz.
LOAD IMPEDANCE: 3.75, 8 or 15 ohms.

(quiescent), a figure determined mainly by the amount of negative grid-bias applied.

To obtain the additional power output, it is necessary to modify the operating conditions of the output valves, involving a slight increase in plate voltage, a slight increase in grid signal swing and a reduction in the plate-to-plate load impedance from 3300 ohms to 2600 ohms.

The increase in supply voltage must be countered by a reduction of 5 milliamps in standing current, if the plate dissipation of the output valves is to be kept inside the limit figure of 18 watts apiece.

Reduction of the quiescent current naturally involves a modification to the bias supply, the required bias now being about —38 volts. The bias voltage should be adjusted, by varying the 100K shunt, to give a total cathode current of 95mA.

Other than the bias supply, the power supply components, with the exception of the power transformer itself, are the same as those for the lower power version.

Although the quiescent current has been reduced, the current drawn at the peaks of the signal excursion will be considerably greater than it was for the 40 watt version, substantially increasing the average current drawn under dynamic conditions. This, together with the increased HT voltage, means that the power supply is called upon to deliver substantially more power.

The new power transformer has a secondary voltage rating of 280V overall with a nominal current capacity of 200mA.

Although both transformers must handle considerably more power in this amplifier, they are physically no larger than those for the 40-watt version. This is made possible by the use of grain-orientated laminations in the transformer cores.

When the silicon steel for transformer laminations is rolled, an alignment of the crystaline structure occurs, forming a grain in the direction of the rolling. It is found that the steel presents less reluctance to the magnetising force, along its grain, than it does across the grain structure; reluctance is the magnetic analogue of electrical resistance. By stamping-out laminations with the grain orientated in the direction of the longest magnetic path, a transformer can be produced which has lower magnetic resistance and so higher flux density in its core.

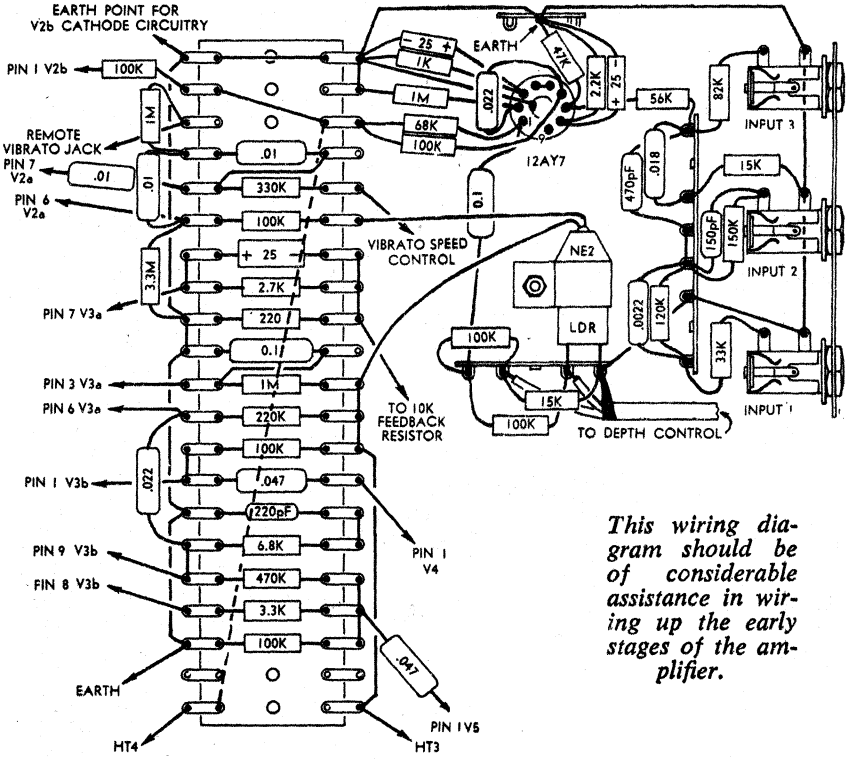
By selecting high quality material, taking advantage of grain orientation and using thinner than usual laminations to reduce eddy current loss, it is possible to produce transformers which will handle considerably more power than regular transformers of the same physical size.

Not surprisingly, there is a price to be paid for this and the higher rated power transformer, together with the new output transformer, will cost several dollars more than those for the 40-watt version. (The transformers used in our new amplifier were A & R types, PT5893 and OT 2842, but equivalent units will probably be made available by other manufacturers.)

Apart from the new transformers and the modified input circuitry, the layout of the basic amplifier has not been changed.

Again we are using the previously described vibrato system, wherein "modulation" of the guitar signal is effected by means of a light dependant resistor in a balanced resistance network. Guitarists who tested the amplifier voted it as about the best vibrato they had ever used, the amplifier showing no tendency to "pump" the loudspeaker cones. The vibrato may be switched by either a switch on the depth control, as indicated in the circuit, or activated by a remote foot switch.

The remote vibrato on/off switch, as pictured, consists of a robust "button" switch, mounted in a small plastic box which has been suitably tapered to a wedge shape, so as to facilitate foot operation. The actual switch may be either of two types, a push-on and push-off type or a push on type with a self returning spring action. Either way, the assembly must be of such construction



This wiring diagram should be of considerable assistance in wiring up the early stages of the amplifier.

as to stand plenty of knocking about. The foot switch is connected to the amplifier by a length of small diameter figure-8 twin flex with a standard telephone jack.

Our switch container was made from a small plastic box manufactured by Watkin Wynne Pty. Ltd. and measuring 4¾ x 2-5/8 x 1-5/8in. The rear edges were tapered to obtain the wedge shape and two holes drilled, one toward the "high" end and on top to mount the "button" switch and the other in the high end itself, through which the cord passes. In addition to a grommet being placed in the latter hole, some means of securing the cord should be provided, to prevent mechanical strain being placed on the soldered switch connections.

Should a more robust foot switch be required, an auto headlamp dip switch could be mounted in a metal box; the metal box could be folded from heavy gauge sheet aluminium. An alternative arrangement might be a wedge shaped wooden block which has been suitably hollowed out so as to accomodate the switch.

A switch which appeared to be rugged enough to withstand severe punishment is made by Alpha Engineering Co. Pty. Ltd. of Sydney, and marketed under the trade name of "Alpha."

Construction of the amplifier is virtually identical to the Playmaster 116, with the exception of the additional tag strip at the input which we mentioned previously.

Again we would sound a word of warning regarding the feedback connection, which should be made after the output and driving stage is functioning normally. If the amplifier remains stable after the feedback connection is made and there is a drop in the level of any test signal from the amplifier, the feedback is negative and all is well. If the gain increases, however, and/or the amplifier howls, it is a sure sign that the feedback is positive.

Since it is logical, and an unwritten law, to leave the common end of the secondary earthed and not to cross over the flying leads to the output valves, the simplest modification is to swap over the "drive" leads from the component board to the grids of the two output valves. ■