## AMPLIFIER AM9/7

### General Description

The AM9/7 is a transistor microphone amplifier giving similar response-selection facilities to those of the AM1/4 (Section 1). These facilities are: lifting or depressing the frequency response at both high and low frequencies, and inserting a 'presence' bump at any one of three frequencies. The gain is switchable in 20 steps of 4 dB to a maximum of 50 dB at 1 kHz.

The AM9/7 is contained in a CH1/18C chassis for mounting in a PN3/23 panel. Index studs are fitted at positions 5 and 30. Input and output connections are made through soldering tags. The amplifier is designed for operation from a source impedance of 300 ohms, into a load which may be of any value not less than a few hundred ohms.

### Circuit Description (Fig. 9.3)

The input circuit of the AM9/7 consists of a balanced low-pass filter to cut out all frequencies above the audio range, followed by a transformer, the secondary of which is loaded with a gain-control potential divider.

The whole amplifier consists of three stages; first a pre-amplifier stage with three transistors TR1, TR2 and TR3, then an optional variable-response stage with the Darlington-pair transistors TR4 and TR5, and finally the output stage TR6 and TR7.

In the pre-amplifier stage the principal circuit feature is the gain control, labelled *Att. 1* in the diagram. This consists of a variable resistor ganged to a variable potential divider, but in such a way that they operate consecutively. To reduce the gain from maximum, the gain-control knob is turned anticlockwise; this increases the variable resistance in the emitter circuit of TR1 (across which feedback is developed via R10), and thus applies more feedback to TR1. When the variable resistance has been increased to maximum, and no more feedback can be applied, further rotation of the knob brings down the slider of the potential divider, thus reducing the voltage applied to the base of TR1. This method of gain control ensures that as much feedback as possible is always maintained from the emitter of TR3 to the input circuit of TR1. Transistors TR1 and TR2 are cascaded stages and TR3 is an emitter-follower feeding the next stage. Capacitor C23 shunts the feedback resistor R10 and causes the gain to be reduced above about 50 kHz to prevent instability.

Part of the output voltage from TR3 emitter is fed to one of the contacts of *Adj./Flat* switch SB; with this switch in the *Flat* position shown in the diagram, the voltage is applied to the output circuit consisting of transistors TR6 and TR7 in cascade.

With the circuit in the condition described, the amplifier has a flat response, but a variable response can be obtained if switch SB is moved to the *Adj.* position, so making contact at the bottom end of R23. This brings in the whole of the response-selection portion of the amplifier, the first part of which consists of a circuit of the Baxandall type, for manipulating the frequency response, in the feedback circuit of the Darlington-pair transistors TR4 and TR5. This is followed by a circuit which can give two amounts of broad 'presence' peak at any one of three different frequencies. This part of the amplifier is identical with the corresponding part of the AM1/4 amplifier, the operation of which is fully described in Section 1. Response curves for the treble and bass controls and for the presence control are also given in Section 1.

### Operating Conditions

The power supply is 24 volts, normally obtained from a PS2/9 Power Supplier. The total current should be 50 $\pm$4 mA. The following typical voltages, measured on the 25-volt range of a Model-8 Avometer from the positive side of the supply, are given to assist fault-finding:

| *Point of Measurement* | *Voltage* |
|---|---|
| TR1 emitter | −12·5 |
| TR3 emitter | −11·5 |
| TR5 emitter | − 4·3 |
| TR6 emitter | − 7·0 |
| TR7 emitter | −12·3 |
| TR2 collector | −11·5 |

On test, the amplifier should be operated between a source resistance of 300 ohms and a load resistance of 600 ohms, and the output level should be zero.

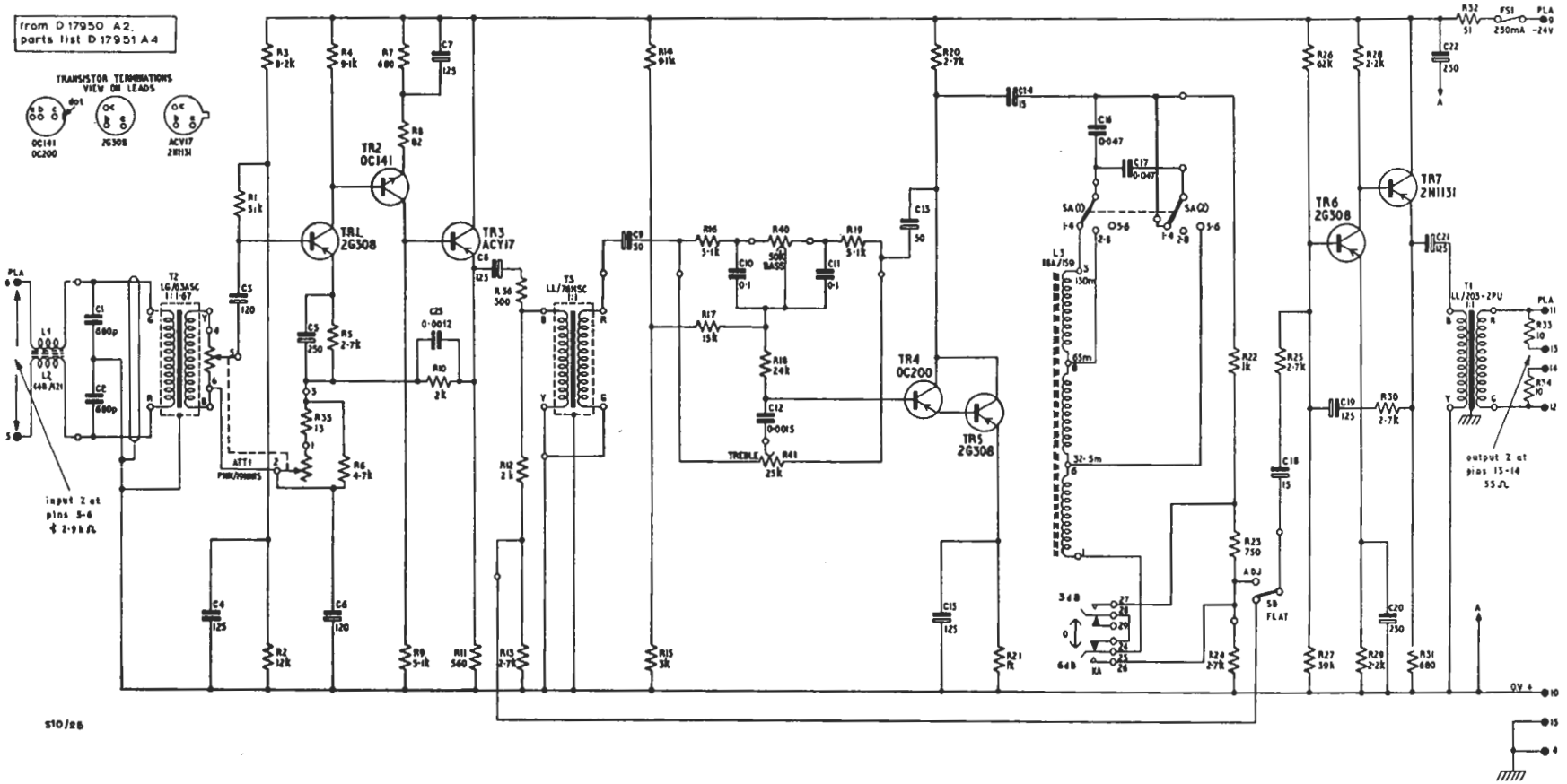


*Fig. 9.3. Amplifier AM9/7: Circuit*

**Performance**

Variable response circuit cut out.

*Gain*

The maximum voltage gain at 1 kHz should be 50 ±1 dB. When the gain is reduced step by step, there should be 20 steps of 4 ±0·5 dB and the minimum voltage gain should be −30 ±3 dB.

*Frequency Response*

The frequency response limits with respect to 1 kHz and with constant sending e.m.f. should be:

from 60 Hz to 20 kHz, ±0·5 dB,
at 40 Hz, +0 −1 dB.

*Nonlinearity*

At an output of +8 dB the total harmonic content should not exceed:

0·4 per cent at 1 kHz,
0·6 per cent at 60 Hz.

Serious distortion at 1 kHz judged from inspection of waveform on an oscilloscope should not occur at an output level of +12 dB or less.

*Noise*

The total unweighted noise output at maximum gain when the input is terminated with 300 ohms should not be greater than −77 dB, measured on a T.P.M. peaking to 6.

**Variable Response Circuits**

*Treble and Bass Controls*

With the *Presence* control at *0*, the response at the extreme settings of the treble and bass controls should conform to the curves in Fig. 1.1 of Section 1, within ±1·5 dB.

*Presence Control*

With the treble and bass controls set for flat response, the *Presence* control settings should provide responses conforming to the curves in Fig. 1.2 of Section 1, within ±1 dB.

J.H.H. 8/67