

### Gain Adjustments

Having minimised residual hum, the split anode or grid loads (whichever are finally adopted) in V3 and V4 should be adjusted until the desired *normal* volume of output (not necessarily full power) is obtained from the chosen microphone connected at P1 and whilst speaking at the average intended distance and loudness, VR1 being at mid-track and all other controls at maximum.

Having completed this adjustment, VR1 should be turned down to zero, and all other controls to half-track. The desired radio receiver should then be adjusted to normal intensity on its internal speaker, and then switched over to SK2 of the amplifier, making adjustments to R11 if necessary, as already discussed. R9 should then be adjusted until the amplifier is on the verge of overloading, on both channels.

The radio receiver should then be disconnected from SK2 and the desired monaural pick-up

the producer and his helpers during dances and other functions.

### Choice of Components and Alternatives

Specified values of electrolytics should not be reduced, though slightly larger values, if able to be accommodated are permissible.

The main smoothing resistor, R51, may be replaced by a choke of about 10 to 20 henries inductance and about 30mA (not less) current rating. C28 and C29 must be high surge-rating electrolytic cans; whether two separate cans or a single double-value can is used is immaterial. The voltage rating must be 500V, for low leakage current at the operating voltage. All other electrolytics are small tubular items of lower voltage rating, as specified in the parts list.

The mains transformers h.t. windings must be 250-0-250V. Other voltages, lower or higher, are *not* permissible. The no-signal d.c. current drain from the rectifier cathode is 110mA and rises to

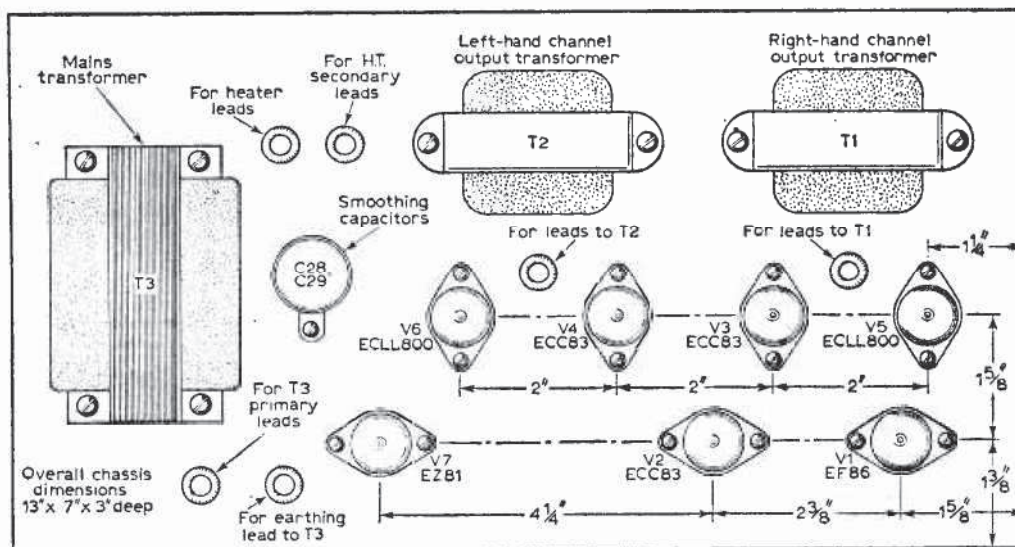


Fig. 3: Above-chassis layout and dimensions.

connected at SK3. If the makers specify a particular pick-up circuit, the additional resistors and capacitors must be included below the pick-up arm mount on the record player.

The four main amplifier controls should be advanced to maximum, and a medium intensity record played. R10 should be adjusted such that the amplifier definitely overloads, to allow a margin of safety for weaker recordings. The same procedure should then be repeated for the stereo input socket, SK4, adjusting the values of R24 and R25 (but always maintaining them equal).

It should be added here that, in general, the use of both monaural and stereo pick-ups, at SK3 and SK4, is not necessary, as all stereo record players will also play normal monaural records (but *not* vice versa: stereo records are immediately destroyed if played on a normal record player). However, the use of two turntables, only one of which need be stereophonic, gives greater scope for

150mA at full drive. The transformer and rectifier must thus be rated for 150mA.

Regarding output transformers, types standardised for a pair of 6V6 or EL84 valves in push-pull are usable, and should present no difficulty in obtaining. If winding these items oneself, according to general tables and experience, one should aim at an impedance of 11k $\Omega$  anode-to-anode, this being the optimum value, but by no means over critical.

An EZ81 rectifier, as specified, is essential. Type EZ80 is *not* suitable as a substitute, as it has insufficient maximum current rating.

### Tone Controls

In the following discussion, component numbers from the right hand channel will be referred to. Similar remarks apply to corresponding components in the left hand channel.

Beyond C7 the feed to V3 is split into a bass branch (via R30) and into a treble branch (via R28). The treble branch is variable, giving maximum (level) treble response with VR2 slider at the top; movement of the slider towards C9 reduces treble response. The action can be made more powerful, if desired, by increasing the value of C9, and vice versa. If rising treble response is desired, a capacitor of between 100pF and 250pF should be inserted between the top end of VR2 and R28.

The bass branch gives about 10dB fixed boost. This can be reduced by increasing the value of R34. Increase of bass boost is achieved in the negative feedback circuit if required (see below).

If a variable bass control is to be added, this

should be in the form of a 500kΩ linear potentiometer whose track is connected across C11, R34 then goes to its slider.

A further (approximately) 5dB of bass boost are obtained by means of R70 and C30, which reduce negative feedback over the main amplifier loop at low frequencies and thus increase gain. The amount of bass boost contributed here can be increased by increasing the value of R70, and vice versa. The turnover frequency for the bass boost can be raised by decreasing the value of C30, and vice versa.

Whatever alterations are made to one channel during all these adjustments *must* be made to the

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### COMPONENTS LIST

#### Resistors:

R1 10kΩ 1W	R39 2.2kΩ
R2 27kΩ 1W	R40 2.7kΩ
R3 47kΩ 1W	R41 2.7kΩ
R4 100kΩ 1W	R42 180kΩ
R5 220kΩ	R43 180kΩ
R6 1MΩ	R44 47kΩ
R7 820Ω	R45 47kΩ
R8 220kΩ	R46 220kΩ
R9 470kΩ	R47 220kΩ
R10 100kΩ	R48 27kΩ
R11 47Ω 1W	R49 27kΩ
R12 1MΩ	R50 47kΩ 1W
R13 1MΩ	R51 1kΩ 2W
R14 2.7kΩ	R52 2.7kΩ
R15 2.7kΩ	R53 2.7kΩ
R16 47kΩ	R54 100Ω
R17 47kΩ	R55 100Ω
R18 180kΩ	R56 680kΩ
R19 180kΩ	R57 680kΩ
R20 2.7kΩ	R58 1MΩ
R21 2.7kΩ	R59 1MΩ
R22 1MΩ	R60 1kΩ
R23 1MΩ	R61 1kΩ
R24 220kΩ	R62 180Ω 2W
R25 220kΩ	R63 180Ω 2W
R26 680kΩ	R64 150kΩ
R27 680kΩ	R65 150kΩ
R28 180kΩ	R66 1kΩ
R29 180kΩ	R67 1kΩ
R30 180kΩ	R68 1MΩ
R31 180kΩ	R69 1MΩ
R32 180kΩ	R70 2.2kΩ
R33 180kΩ	R71 2.2kΩ
R34 180kΩ	R72 1kΩ
R35 180kΩ	R73 1kΩ
R36 15kΩ	R74 100Ω 2W
R37 15kΩ	R75 100Ω 2W
R38 2.2kΩ	R76 10kΩ 1W

All Carbon,  $\frac{1}{2}$ W,  $\pm 10\%$ , unless otherwise stated.

#### Capacitors:

C1 16μF electrolytic 350V
C2 16μF electrolytic 350V
C3 16μF electrolytic 350V
C4 8μF electrolytic 350V
C5 0.02μF paper 500V
C6 50μF electrolytic 12V
C7 0.05μF paper 500V
C8 0.05μF paper 500V
C9 500pF ceramic 500V
C10 500pF ceramic 500V

C11 0.02μF paper 500V
C12 0.02μF paper 500V
C13 16μF electrolytic 350V
C14 16μF electrolytic 350V
C15 0.05μF paper 500V
C16 0.1μF paper 500V
C17 0.1μF paper 500V
C18 0.02μF paper 500V
C19 0.02μF paper 500V
C20 100μF electrolytic 12V
C21 100μF electrolytic 12V
C22 8μF electrolytic 350V
D23 8μF electrolytic 350V
C24 0.02μF paper 500V
C25 0.02μF paper 500V
C26 250μF electrolytic 25V
C27 250μF electrolytic 25V
C28 100μF } double can electrolytic 500V
C29 50μF }
C30 0.25μF paper 500V
C31 0.25μF paper 500V

#### Potentiometers:

VR1 250kΩ log	VR4 500kΩ log
VR2 500kΩ lin	VR5 500kΩ log
VR3 500kΩ lin	

#### Valves:

V1 EF86	V5 ECLL800
V2 ECC83	V6 ECLL800
V3 ECC83	V7 EZ81
V4 ECC83	

#### Sockets:

SK1 Coaxial panel type
SK2 Coaxial panel type
SK3 Coaxial panel type
SK4 Stereo pick-up
SK5 Stereo speaker
SK6 Stereo speaker
SK7 Mains connector, 3 pole

#### Transformers:

T1, T2 Push-pull output transformer. Primary 11kΩ, secondary to suit speaker. (Allen OPI348). Any conventional transformer for 6V6 or EL84 valves is suitable.
T3 Mains transformer. Secondaries: 250-0-250V 150mA; 6.3V 4A.

#### Miscellaneous:

FS1 Panel fuse
LPI Panel pilot lamp 6.3V
S1 D.P.S.T./Q.M.B. on/off toggle switch
Chassis 7in. x 13in. x 3in. approx. Perforated cover. Wire, sleeving, tagstrips, bolts, grommets.
Control knobs. Seven noval (B9A) valve holders.



shadow. Once balanced the control should be left in gang (apart from a periodic check) and any further balance compensation for particular commercial recordings carried out by decreasing volume to the appropriate speaker on the "monitor" control.

It was found initially that a "whistle" was recorded and this was traced to a beat note between the two erase oscillators. To cure this, switch to record on both channels and adjust the tuning slug on either one of the erase oscillator coils until the whistle disappears. The oscillators are remarkably stable as I have only had to carry out this operation once and no reappearance of "beat" has manifested in 18 months.

#### Mono Operation

For mono operation one amplifier at a time can be used—the other amplifiers being muted by the appropriate "monitor" control (or separate mains switches can be inserted). Ample volume is available for ordinary domestic purposes with only one channel used. Full track mono use is available by this method and "head" switching is avoided.

On home recordings it was found that a disappointing amount of bass was evident. Compensation is made in the circuit to level out the characteristic of the amplifier in the record position; this was altered by removing C16 (in the Martin circuit) from the record/play switch and placing a short across this connection: C16 was

then placed in series with the sliding contact of this switch and the cathode of V2A (thus reducing bass feedback). An immediate improvement was evident and I reported this to Martins assuring them I was not a "boom" addict: they replied that technically I had "messed" up the response and they could not explain the apparent improvement. Constructors may like to try this modification if they are similarly disappointed.

#### Stereo Operation

The subject of stereo recording is an enormous one and outside the scope of a constructional article. For some really demonstrative instruction I would recommend the purchase of a four-track stereo tape called "Stereo Confidential" issued by Music on Tape and available in either a  $3\frac{1}{4}$  or  $7\frac{1}{2}$  in./sec. version.

To feed an external stereo amplifier the outputs from the pre-amplifier in the tape recorder can be taken from the "radio" sockets. Stereo discs can be directly recorded by providing two jack plugs from a stereo pickup (red to Channel A) using the Radio sockets (remember, however, the re-recording of commercial discs is prohibited by the usual copyright regulations).

Quality is extremely good and adjudged superior to quite expensive console stereograms. With the internal output stages it would not be good enough for the hi-fi purist but this recorder is, by comparison, portable and very much cheaper. Cost of the deck and units was about £36 but "careful" buying could possibly reduce this price. ■

## The "7-20" Stereo Amplifier

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other one too, in exactly the same position and to the same extent. It is of paramount importance to maintain absolute symmetry between the two channels.

Adjustments of frequency response in the main amplifier should be carried out such that subjectively correct reproduction, with ample bass and treble, results from stereo records over SK4, with VR2 and VR3 set at mid-track. If this does not lead to sufficient speech clarity from a microphone over SK1 (too much bass), reduce the value of C5 until satisfactory performance is obtained. Much will depend upon the type of microphone used. A certain amount of treble boost in the microphone preamplifier, V1, alone is also obtainable by replacing C6 with a paper capacitor of about 0.1  $\mu$ F capacity.

Wherever grid stoppers are specified (resistors directly in series with control grid connections) these must be wired hard up against the respective valveholder pins.

#### Loudspeakers

As already mentioned, speakers, or speaker groups, of adequate power rating are essential. The circuit as shown in Fig. 1 is for 4 to 6  $\Omega$  speakers or groups.

If 15  $\Omega$  units are to be used, the output transformers must be obtained with the appropriate

secondaries and the components in the main amplifier negative feedback loops must be changed. The correct values for R70, R71 are then 3.9 k $\Omega$ , for R72, R73 1.8 k $\Omega$  and for C30, C31 0.15  $\mu$ F. If original values were altered during frequency response adjustments, the above values for 15  $\Omega$  speakers require alteration in the same proportion.

There is no objection to the use of series-parallel combinations of smaller speakers at different locations, provided that the total power rating remains adequate and the normal rules of matching are observed. Furthermore, with such multiple speaker positions, care should be exercised that stereophonic reproduction (if used) is not thereby confused.

#### Final Checks

Upon completion of the amplifier, even if it appears to be working satisfactorily, voltages at all points shown on Fig. 1 should be compared with the prototype figures entered in Fig. 1. A meter of at least 20 k $\Omega$  per volt sensitivity must be used, or a valve voltmeter.

If a meter of lower sensitivity is used, readings may in some cases be falsified (indicate low). Slight departures from prototype figures are possible, and may be ignored. But large differences—especially if different for corresponding points of the two channels, indicate faulty components or wiring errors, and should be traced and removed. It is advisable to check all wiring very carefully before first switching the completed amplifier on. ■