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KING'S BUILDINGS,
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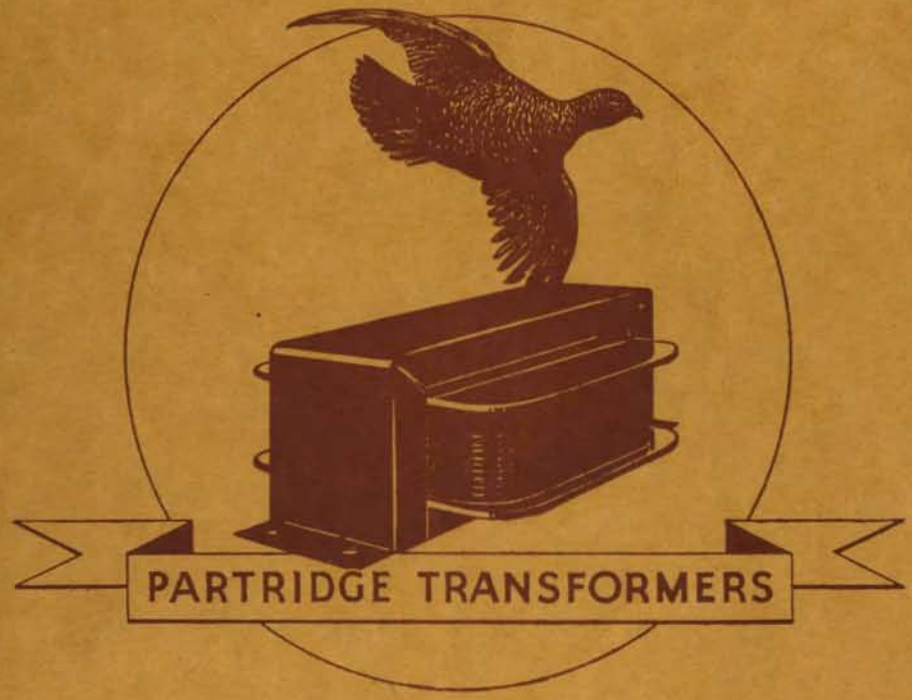
PARTRIDGE AMPLIFIER CIRCUITS

PRICE 2/-



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Because

(1) Every Partridge Amplifier Design has been built up from the users' point of view. These circuits do not boost a particular component, but aim to achieve technical excellence by the use of components carefully selected from the whole available range.

Because

(2) Every Partridge Amplifier Design can be relied upon to maintain a higher standard of reproduction than is obtained from commercially built amplifiers of similar type and cost. Good quality is the first essential for success in P.A., and therefore has received the first consideration.

Because

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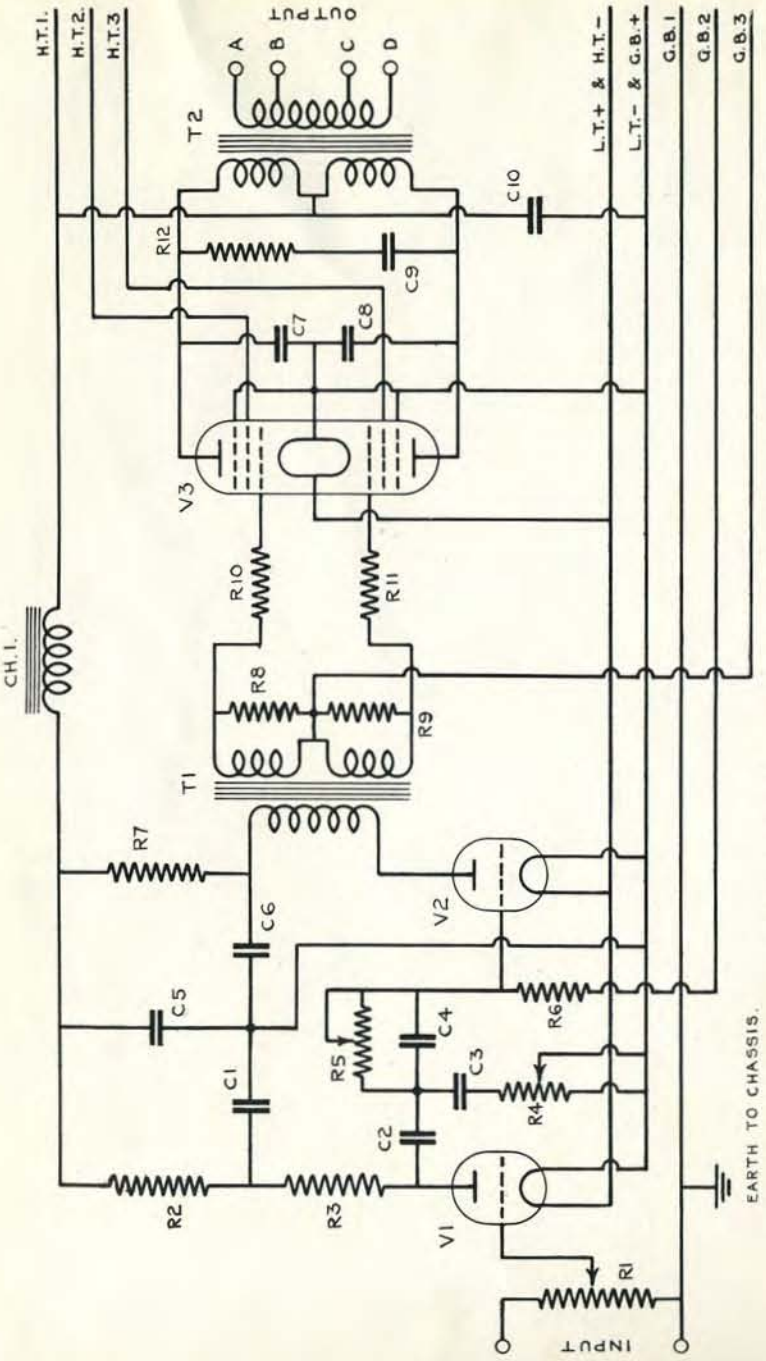
IMPORTANT NOTE

It must be understood that the information given herein is of a purely technical nature. No guarantee is given or implied that the circuits do not employ schemes which are the subject matter of patents or patent applications.



THE PARTRIDGE 2W BATTERY CIRCUIT

PARTRIDGE 2w.
BATTERY AMPLIFIER DESIGN

Specification:—2 watts audio output with approximately 0·05v. input. Bass and treble tone control. Entirely battery driven. Will operate direct from a sensitive carbon microphone.

Suggested Use:—For all purposes where mains are not available. Every care has been taken to produce the finest quality possible with a quiescent output stage, and, when used with an exponential horn speaker, the same volume of sound will be produced as is normally obtained from a 12w. mains amplifier working into a baffle mounted speaker.

Technical Notes:—Quiescent battery amplifiers are usually associated with low price and poor quality. For P.A. work, a few shillings on the cost is not so important as good quality. The Partridge 2w. Battery Amplifier is definitely more expensive to build than the average battery job but the results are so far ahead as to rival mains-driven equipment. The special features are:—(a) Liberal decoupling; (b) specially designed audio transformers with negligible magnetic leakage; (c) distortionless damping in grid and anode circuits of the QP240.

Constructional Notes:—Read the Partridge P.A. Manual and the notes on page 28 of this booklet before starting construction. The lay-out is not at all critical. T1 and T2 should be placed at right angles to each other and the grid and anode leads of the QP240 must be kept very short. R10, R11, C7 and C8 should all be connected close to the valve holder of the QP240.

Operational Notes:—The H.T. batteries specified give 180v. when connected in series. Only 150v. is needed at H.T.1, but as the battery voltage falls with use H.T.1 can be plugged into higher and higher tappings in order to

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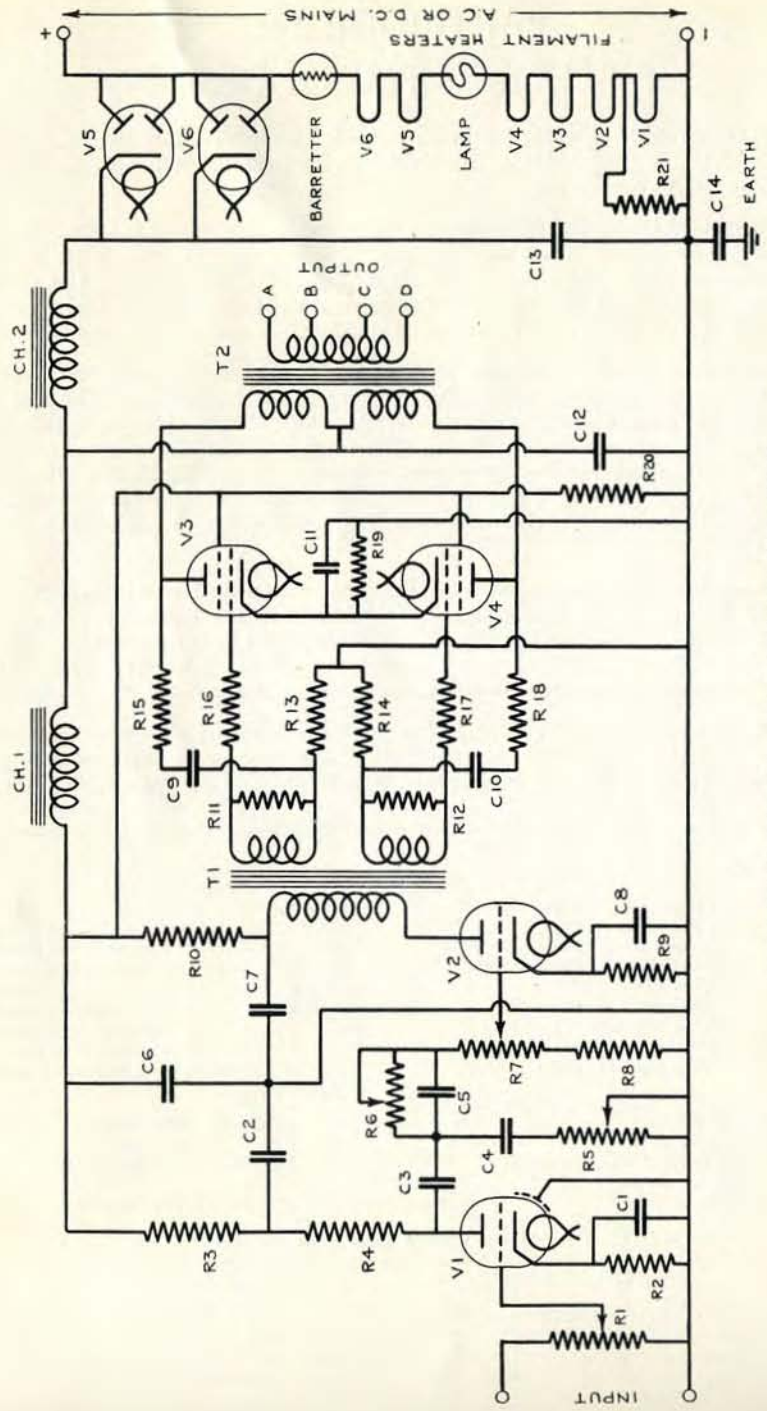
List of Parts:—

R1	250,000 ohm potentiometer	C1	2 m.f.	(250v.)
R2 & 3	50,000 ohms (1W)	C2	0·1 m.f.	(250v.)
R4	50,000 ohm potentiometer	C3	0·02 m.f.	(250v.)
R5	1 megohm potentiometer	C4	0·0005 m.f.	(250v.)
R6	250,000 ohms (1W)	C5 & 6	2 m.f.	(250v.)
R7	10,000 ohms (1W)	C7 & 8	0·001 m.f.	(250v.)
R8 & 9	75,000 ohms (1W)	C9	0·01 m.f.	(250v.)
R10 & 11	25,000 ohms (1W)	C10	4 m.f.	(250v.)
R12	15,000 ohms (2W)	All the above should be paper condensers.		

1	120v. H.T. Battery	V1	PM2DX (Mullard)
1	60v. H.T. Battery	V2	LP2 (Osram)
Both Ever Ready "Power" Series		V3	QP240 (Mazda)
1	16v. G.B. Battery		
1	2v. Accumulator		

T1	Partridge Transformer	Type 2W/IV
T2	Partridge Transformer	Type 2W/O
Ch1	Partridge Choke	Type C75/25

The 2W/I.V. and 2W/O have been specially developed for this circuit and consequently are the most important components. The small Q.P.P. or Class B transformers so popular a few years ago are not suitable. The output transformer can be wound with any ratio to order. If no figure is specified the Partridge Series Type (see Manual, page 29) for 15 ohm speakers will be supplied.



THE PARTRIDGE 6W A.C.-D.C. CIRCUIT

keep it at a true 150v. . . . naturally H.T.2 and 3 will require similar adjustments. The method of correctly adjusting H.T.2 and 3 is fully explained in the printed instructions supplied with the QP240.

The L.T. should be obtained from a 2v. accumulator capable of delivering 0·7A. continuously.

The grid bias voltages are G.B.1, 1·5v.; G.B.2, 3v.; G.B.3, 11·5v. These are correct only if H.T.1 is kept at 150v. If this voltage is allowed to fall marked distortion will result.

PARTRIDGE 6w. A.C.-D.C. AMPLIFIER DESIGN

Specification:—6 watts audio output with an input of approximately 0·05v. Can be fully loaded from a sensitive carbon microphone. Separate bass and treble tone controls. Will operate from either A.C. or D.C. mains.

General:—This circuit has been designed to produce the best possible quality by means of A.C.-D.C. valves. The A.C.-D.C. system has not been used to reduce the cost, but to meet the demand for a really good amplifier for P.A. work for use in D.C. districts.

Technical Notes:—The particularly good quality produced by this circuit is due to four things:—(1) Liberal decoupling; (2) negative feed-back in the output stage; (3) the special audio transformers that maintain their correct phase relationship up to an extremely high frequency, and (4) the close H.T.

List of Parts:—

R1	250,000 ohm	potentiometer
R2	2,000 ohms	(1W)
R3	25,000 ohms	(1W)
R4	50,000 ohms	(1W)
R5	50,000 ohm	potentiometer
R6	1 meg ohm	potentiometer
R7	250,000 ohm	potentiometer
R8	30,000 ohms	(1W)
R9	500 ohms	(1W)
R10	5,000 ohms	(2W)
R11 & 12	75,000 ohms	(1W)
R13 & 14	10,000 ohms	(1W)
R15 & 18	90,000 ohms	(1W)
R16 & 17	50,000 ohms	(1W)
R19	100 ohms	(1W)
R20	10,000 ohms	(10W)
R21	130 ohms	(2W)

C1	50 m.f.	(12v. Elec.)
C2, 6 & 7	8,8 & 8 m.f.	(500v.)
	Dubilier Elec. Block Type 312	
C3	0·1 m.f.	(450v.)
C4	0·02 m.f.	(450v.)
C5	0·0005 m.f.	(450v.)
C8	50 m.f.	(12v. Elec.)
C9 & 10	0·25 m.f.	(450v.)
C11	50 m.f.	(25v. Elec.)
C12 & 13	16 & 16 m.f.	(500v.)
	Dubilier Elec. Block Type 314	
C14	0·01 m.f.	(450v.)

All condensers not marked Electrolytic (Elec.) must be paper.

V1	HL1320	Mazda (Metallized),	1 m.a. H.T.
V2	L30	Osram (Plain),	12 m.a. H.T.
V3 & 4	KT31	Osram (Plain),	45 m.a. H.T. (anodes)
			11 m.a. H.T. (screens)
V5 & 6	U30	Osram (Plain),	125 m.a. H.T. (total) plus current
Barretter	303	Osram	drawn by bleeder resistance R20.
Lamp	6.5, 0.3a.	Osram	

T1	Partridge Transformer	Type 1V240
T2	Partridge Transformer	Type 6W/O
Ch1	Partridge Choke	Type C25/60
Ch2	Partridge Choke	Type 6W/SC

The iron cored components are very critical, and none but the specified ones should be used. The 6W/O can be wound for any output impedance, but if no figure is specified the Partridge Series Type (see Manual, page 29) for 15 ohm speakers will be supplied.

Fig. 1. The Partridge 12w. P.A. Amplifier as built by Messrs. H. J. Leak & Co. The mains transformer is at the back of the chassis and the intervalve transformer as far from it as possible at the front of the chassis, the cores of these components being at right angles. The chassis is of steel, but stout aluminium is equally effective and reduces the risk of unwanted magnetic coupling.

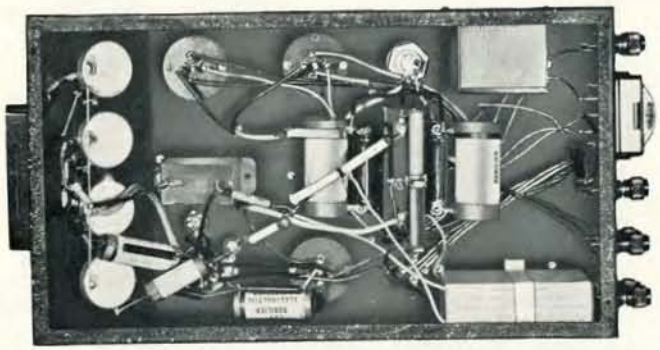


Fig. 2. Under-chassis view of the amplifier shown in Fig. 1. To ensure stability all leads have been kept as short as possible and well spaced. Note the screened grid lead running from the input circuit to V1.

regulation obtained by using two rectifiers, large reservoir condenser, low resistance chokes and a bleeder resistance (R19).

Constructional Notes:—Read the Partridge P.A. Manual and the notes on page 28 of this booklet before starting construction. Since the earth line of the circuit must be connected directly to one side of the mains (as with all A.C.-D.C. circuits) it is not advisable to use a metal chassis. The sides of the chassis can be made from plywood and the top, upon which the components are mounted, of Paxolin. An earth should be connected to the circuit through the small condenser C14, as shown in the diagram.

Operational Notes:—The input leads to the amplifier must be screened, and the screens connected to the H.T. negative which is the effective earth from the point of view of hum potential. It follows that the screen may be at a high potential (full mains voltage) with respect to true earth and therefore insulated screen must be used. Suitable lead, having a central conductor surrounded by a screen which in turn is covered with insulating material, can be obtained from J. Dyson & Co. (Works), Ltd., 2, Coleman Street, London, E.C.2. Similarly, the pick-up case, microphone stand, etc., cannot be connected to earth if hum is to be avoided, but must be connected to the negative H.T. line through a 0·001 m.f. condenser. This condenser is quite effective in removing hum and at the same time prevents the parts in question being alive.

It will be noted that two volume controls are provided (R1 and R7). R7 should always be turned as low as the occasion will permit so that R1 is normally set near its maximum. By keeping R7 turned as low as possible all noises (hum, microphony, etc.) arising in V1 are maintained at a minimum.

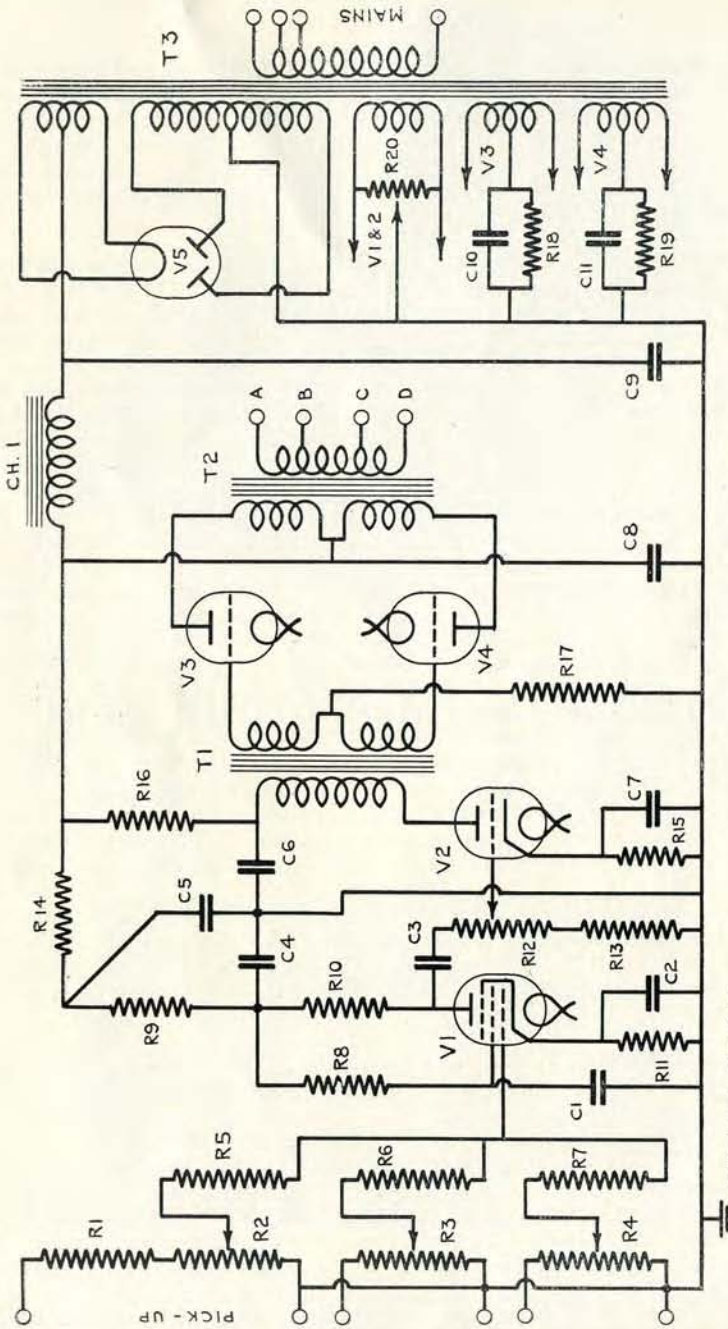
PARTRIDGE 12w. P.A. AMPLIFIER DESIGN

The object of this design is to provide a high quality portable amplifier with negligible background noise, making it suitable for high quality work in small rooms as well as for the usual small hall and outdoor work. The special points of interest are:—(1) 12 watts undistorted output. (2) Independent control and mixing for two microphones and a pick-up. (3) Sufficient amplification to give a good range with carbon microphones and close range with moving coil microphones without the need for a pre-amplifier. (4) High quality push-pull (Class A) output giving a level response from 30 to 15,000 cycles. (5) Small size (16 in. × 9 in. × 9 in. high) and weight (27 lbs.). (6) Special output transformer enables exact matching of any number of similar speakers from one to ten (see Partridge P.A. Manual).

Technical Notes:—The mixing circuit is arranged so that the sensitivity is much greater from the microphone inputs than from the pick-up input, the latter being suitable for a crystal pick-up. If greater sensitivity is required, it can be obtained by reducing R5 to 250,000 ohms and omitting R1.

Two means of volume control are available . . . the three input potentiometers and the master control R12. It is very important that R12 be turned as low as possible so that R2, 3 and 4 are normally working at about their maximum setting. By keeping R12 always as low as circumstances permit, the noise (hum, microphony, etc.) arising in V1 will be kept at an absolute minimum.

A hum-dinger (R20) is provided so that the electrical centre of the filament of V1 can be earthed. While adjusting R20 to the position of minimum hum the potentiometer R12 must be turned fully up to its maximum position.



THE PARTRIDGE 12W P.A. CIRCUIT

The values of the components associated with V1 must not be varied, as they have been carefully designed to produce negligible harmonic distortion under all operating conditions. No other valve than that specified should be used for V1. The reader should refer to the Partridge P.A. Manual for a description of the special intervalve and output transformers.

The American Type 83v. rectifier (5v. filament) is used because it is definitely better for the present purpose than any British valve available at the time of writing.

Constructional Notes:—The lay-out is not very critical providing the points mentioned on page 28 are observed. Photos of this amplifier as manufactured by Messrs. H. J. Leak & Co., are given on page 6 together with a brief description of the lay-out adopted.

List of Parts:—

R1	250,000 ohms (1W)	C1	2 m.f. (450v.)
R2, 3 & 4	250,000 ohm potentiometer	C2	50 m.f. (12v. Elec.)
R5	2 megohms (1W)	C3	0·1 m.f. (450v.)
R6, 7 & 8	250,000 ohms (1W)	C4, 5 & 6	8, 8 & 8 m.f. (500v.)
R9 & 14	40,000 ohms (1W)		Dubilier Elec. Block Type 312
R10	70,000 ohms (1W)	C7	50 m.f. (12v. Elec.)
R11	500 ohms (1W)	C8	8 m.f. (500v. Wet Elec.)
R12	250,000 ohm potentiometer	C9	4 m.f. (650v.)
R13	50,000 ohms (1W)		Dubilier Type L.E.G.
R15	600 ohms (1W)	C10 & 11	50 m.f. (50v. Elec.)
R16	35,000 ohms (3W)		
R17	30,000 ohms (1W)	All condensers not marked Electrolytic (Elec.) must be paper.	
R18 & 19	500 ohms (3W)		
R20	30 ohm hum-dinger		

V1	AC/S2 Pen. Mazda (Metallized),	2 m.a. H.T. (anode) 0·7 m.a. H.T. (screen)
V2	AC/HL Mazda (Plain),	6 m.a. H.T.
V3 & 4	PP5/400 Mazda (Plain),	126 m.a. H.T.
V5	83V American	134 m.a. H.T. (total)

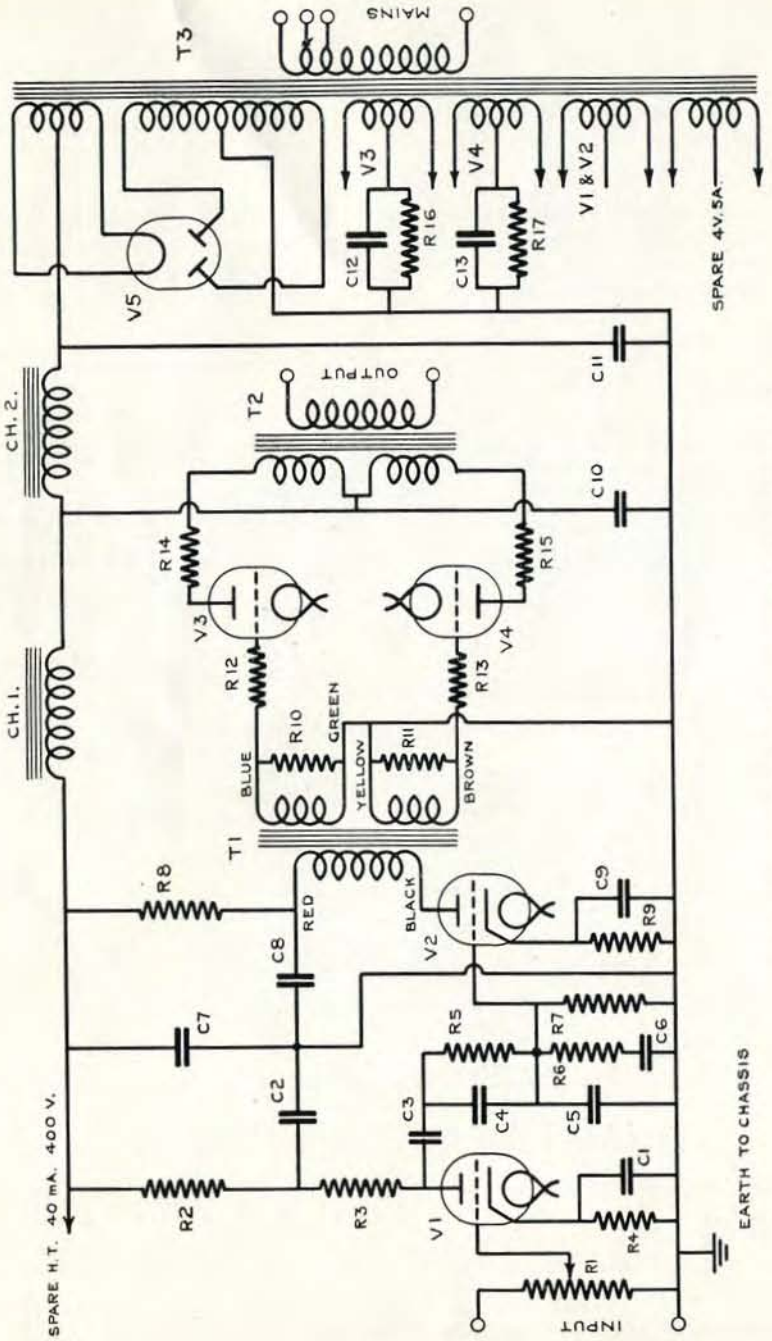
T1	Partridge Transformer	Type 1V60
T2	Partridge Transformer	Type 12W/O
T3	Partridge Transformer	Type 12W/M
Ch1	Partridge Choke	Type 12W/SC

The importance of using the exact components specified cannot be over-emphasized. The reason for this is fully explained in the Partridge P.A. Manual. The 12W/O can be supplied with any ratio to order, but if no instructions are given the Partridge Series Type for 15 ohm speakers will be supplied (see Manual, page 29).

PARTRIDGE 12w.
QUALITY AMPLIFIER DESIGN

Specification:—12w. audio output with an input of approximately 0·3v. High fidelity push-pull output. Pre-set tone correction circuit to compensate for listening conditions. Spare 40 m.a. at 400v. H.T. and 4v. 5a. L.T. for radio unit or pre-amplifier.

Suggested Use:—This amplifier is intended for very high quality work in the home, music room or small hall. Equipment with a straight line response is often disappointing when installed owing to the effect of the acoustics of the



THE PARTRIDGE 12W QUALITY CIRCUIT

room and other more obscure reasons. Provision has therefore been made for adjusting the treble and/or bass response. This is not the usual type of adjustable control, but is intended to be set permanently when the equipment is installed. A full description of the procedure is given on page 12.

Technical Notes:—Apart from the tone correction scheme which is described elsewhere, the circuit is quite straightforward. Decoupling is very thorough and so is the damping of the grid and anode circuits of the output stage. The chief reason for the exceptional quality of reproduction is to be found in the choice of intervalve and output transformers. The special features of these components are fully set out in the Partridge P.A. Manual.

Constructional Notes:—This amplifier is particularly simple to construct and is not at all critical regarding the lay-out. The only vital points to watch are:—(1) Keep the mains equipment well away from the first stage and from the intervalve transformer, and (2) keep the grid and anode leads of the output valves very short. R12, 13, 14 and 15 should be connected close against the valve holder of V3 and 4. A metal chassis can be constructed from sheet aluminium and strengthened if necessary by plywood supports. The H.T. negative must be connected to the chassis, which should be earthed.

Spare H.T. and L.T.:—Very good regulation has been obtained in both the H.T. and L.T. supplies. For this reason spare H.T. current from 0 up to 40 m.a. can be drawn from the point shown without upsetting the main voltage. It is not necessary or desirable to employ a bleeder circuit if no spare H.T. is being used. The same applies to the spare 4v. 5a. L.T. winding, which can be used to supply any current from 0 to 5 amps.

List of Parts:—

R1	250,000 ohm potentiometer	C1	50 m.f. (12v. Elec.)
R2	25,000 ohms (1W)	C2	2 m.f. (450v.)
R3	50,000 ohms (1W)	C3, 4, 5 & 6—see page 12	
R4	1,000 ohms (1W)	C7	4 m.f. (450v.)
R5	200,000 ohms (1W)	C8	2 m.f. (450v.)
R6	50,000 ohms (1W)	C9	25 m.f. (25v. Elec.)
R7	1,000,000 ohms (1W)	C10	4 m.f. (450v.)
R8	10,000 ohms (10W)	C11	4 m.f. (650v.)
R9	400 ohms (1W)	C12 & 13	25 m.f. (50v. Elec.)
R10	16,000 ohms (1W)		
R11	25,000 ohms (1W)	All condensers not marked Electrolytic (Elec.) must be paper.	
R12 & 13	5,000 ohms (1W)		
R14 & 15	100 ohms (1W)		
R16 & 17	540 ohms (3W)		

V1	354	Mullard,	3 m.a. H.T.
V2	ML4	Osram,	22 m.a. H.T.
V3 & 4	DO24	Mullard,	126 m.a. H.T.
V5	83V	American,	151 m.a. H.T.

T1	Partridge Transformer	Type 1V120
T2	Partridge Transformer	Type 12WQ/O
T3	Partridge Transformer	Type 12WQ/M
Ch1	Partridge Choke	Type C22/120
Ch2	Partridge Choke	Type C13/200

The output transformer for the above amplifier can be supplied wound for any output impedance . . . these are not held in stock but specially wound for every order. Tappings on the secondary winding are not recommended (see Partridge P.A. Manual).

TONE CORRECTION

When high quality equipment is installed one might expect to obtain faithful reproduction providing the entire apparatus has a level response from input to output. Unfortunately things do not work out that way. The acoustics of the room or hall and the effect of the non-linear response of the human ear combine to upset the tone balance. The network consisting of C3, 4, 5, 6, R5 and 6 in the Partridge 12w. Quality Circuit makes it possible to compensate partially for this defect.

Level Response:—When C3 is made 0·1 m.f. and C4, 5 and 6 are omitted altogether (R6 being connected directly to the H.T. negative), the response of the amplifier is substantially level.

Bass Cut:—This is controlled by C3. Start by using 0·01 m.f. and note the effect. Reduce the value to give a greater loss of bass if desired.

Bass Boost:—Here C6 is the centre of interest. Start by making this condenser 0·05 m.f. and reduce the value to give a greater bass boost if necessary. Naturally, C3 must be left at 0·1 m.f. when attempting bass boost . . . one cannot cut and boost at the same time.

Treble Cut:—This is brought about by adjusting C5. A value of 0·001 m.f. is suitable for a first experiment. Increasing this condenser will increase the top loss.

Treble Boost:—A condenser (C4) across R5 will have the desired effect. Try 0·0002 m.f. in the first place and increase or reduce if more or less top is needed.

Method of Procedure:—Set the circuit to give a level response as stated above and listen to the result. This listening should spread over several days and should cover all types of music and speech. A critical ear will probably notice an excess or deficiency in either treble or bass. The next step is to make the appropriate correction as outlined above, and to listen again. The ear quickly tires and it is useless to try to judge the effect of a number of changes at one sitting . . . this experimental adjustment must be spread over several days.

General Hints:—If equipment is to be used for reproducing orchestral music, a slight boost in both treble and bass is often helpful, particularly if the volume of the reproduced music is well below that of the original orchestra. In the case of speech the reverse applies and a slight cut in both treble and, more especially, the bass usually makes for clear diction.

Be careful not to overdo these corrections. A large bass boost produces a satisfying sensation at first but quickly becomes tiring, and in any case the effect is vulgar from the artistic viewpoint.

PARTRIDGE ECONOMY 28

The Partridge Economy 28 incorporates the most recent developments in amplifier technique. That this circuit is destined to become one of the most popular for P.A. work can be judged from the fact that 28 watts undistorted output is obtained at the same cost, size and weight as the usual 12w. amplifier. This extraordinary result is achieved by using the Partridge Control Circuit (patent applied for and owned by the Mullard Radio Valve Co., Ltd.), which is fully described in the Partridge P.A. Manual.

Fig. 3. The Partridge Economy 28, as built experimentally for the author by Messrs. H. J. Leak & Co. This was the first amplifier to employ the Partridge Control Circuit (invented by N. Partridge, B.Sc., A.M.I.E.E., patent rights purchased and controlled by The Mullard Radio Valve Co., Ltd.). An undistorted output of 28 watts is obtained although the cost, size and weight are no more than those of the usual 12 watt chassis.

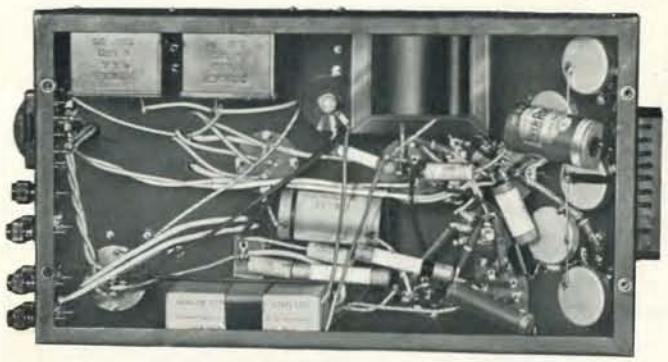
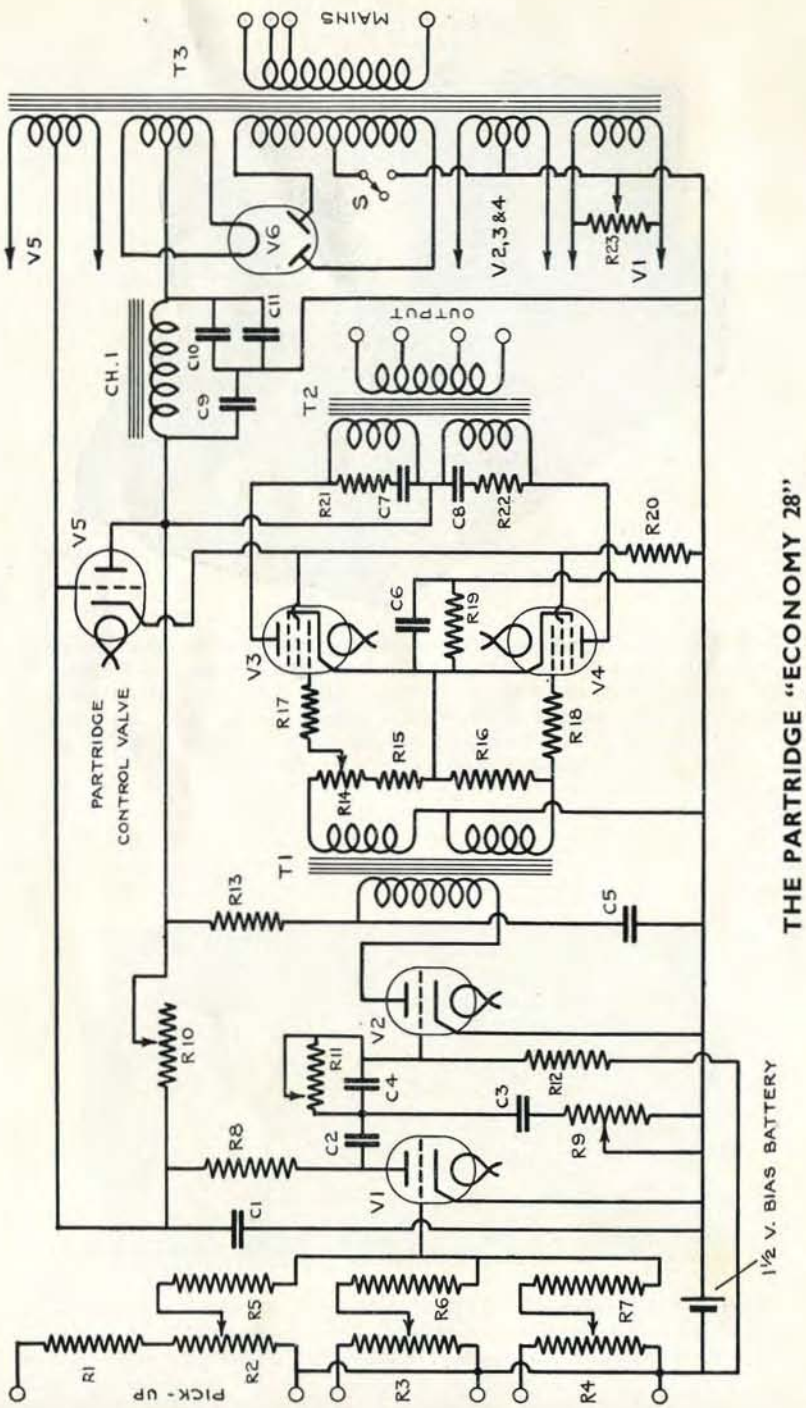


Fig. 4. Under-chassis view of the Partridge Economy 28. The intervalve transformer has been mounted under the chassis—this is not essential, and a lay-out similar to that of the 12w. P.A. amplifier can be adopted if desired.



THE PARTRIDGE "ECONOMY 28"

Specification:—28w. output. Independent control (including mixing) for two microphone input channels and one pick-up. Separate bass and treble tone controls. Adjustment for balancing the output valves. Pentode screens regulated by means of the new Partridge Control Circuit. Output transformer designed to match any number of speakers (see Partridge P.A. Manual). Size, cost and weight the same as those of the usual 12w. amplifier.

Technical Notes:—The most interesting point is the operation of V5. A full report of this will be found in the Partridge P.A. Manual under the "Partridge Control Circuit," to which reference should be made. Other important things to note are that a total capacity of 8 m.f. is used across the rectifier (C10 and 11), and that a separate L.T. winding with a hum-dinger across it is provided for the first valve (V1). Both these matters are discussed at length in the Manual.

The switch "S" has been included to avoid unnecessary strain on the condensers during the time the valves are heating. Always see that this switch is turned off before connecting the mains and do not close the switch "S" until after an interval of about one minute. Switch "S" off immediately after the mains are switched off.

Lay-Out:—The arrangement of the components is no more critical than that of the average high gain, high power amplifier, and either the scheme employed in the case of the Partridge 12w. P.A. Amplifier or that adopted by

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List of Parts:—

R1	250,000 ohms (1W)	C1, 5 & 9	8,8 & 8 m.f. (500v.) Dubilier Elec. Block Type 312
R2, 3 & 4	250,000 ohm potentiometer	C2	0·1 m.f. (450v.)
R5, 6 & 7	250,000 ohms (1W)	C3	0·02 m.f. (450v.)
R8	100,000 ohms (1W)	C4	0·0005 m.f. (450v.)
R9	50,000 ohm potentiometer	C6	50 m.f. (50v. Elec.)
R10	100,000 ohm potentiometer wire wound 5 m.a.	C7 & 8	0·015 m.f. (450v.)
R11	1 megohm potentiometer	C10 & 11	4 m.f. (650v.) Dubilier Type L.E.G.
R12	250,000 ohms (1W)		
R13	30,000 ohms (2W)		
R14	10,000 ohm potentiometer wire wound		All condensers not marked Electrolytic (Elec.) must be paper.
R15	40,000 ohms (1W)		
R16	50,000 ohms (1W)		
R17 & 18	5,000 ohms (1W)		
R19	165 ohms (5W)		
R20	250,000 ohms (1W)		
R21 & 22	4,000 ohms (3W)		
R23	30 ohm hum-dinger		

S Single pole On-Off Switch for H.T.

V1	904V	Mullard (Metallized)	1·5 m.a. H.T.
V2	MH4I	Osram (Metallized)	5 m.a. H.T.
V3 & 4	Pen.428	Mullard (Plain)	96 m.a. H.T.
V5	T.T.4	Mullard (Plain)	10 m.a. H.T.
V6	83V	American	112·5 m.a. H.T.

T1	Partridge Transformer	Type IV60
T2	Partridge Transformer	Type 28W/O
T3	Partridge Transformer	Type 28W/M
Ch1	Partridge Choke	Type 28W/SC

The Partridge Economy 28 is one of the most efficient circuits available for P.A. work. It is easy to build and absolutely stable but no modification should be attempted in the choice of components . . . this applies particularly to the transformers.

The output transformer (Type 28W/O) can be supplied with any ratio to order. If no instructions are given the Partridge Series Type for 15 ohm speakers will be supplied (see the Partridge P.A. Manual).

Messrs. H. J. Leak & Co., as illustrated on page 13, can be used. Before starting construction read the notes on page 28 of this booklet.

The adjustable potentiometers R10 and R14 should be mounted under the chassis so that they cannot be touched after being properly set. Only good quality, wire-wound components should be used because failure may cause serious damage to the output valves.

Adjustment:—Set the slider of R10 so that all the resistance is in circuit, i.e., so that the current passes through the entire winding of R10 before reaching R8. Set R14 so that the slider connects directly to the secondary of the intervalve transformer, i.e., to the end of R14 remote from R15. See that the switch "S" is turned off. Switch on the amplifier, and after an interval of about one minute switch on the H.T. by means of the switch "S." Connect a voltmeter across R20 and slowly adjust R10 until the meter reads 295. (screen voltage plus G.B.). Next measure the anode currents taken by V3 and V4. To do this a meter adapter must be used or else jacks can be permanently wired as in the case of the 45w. amplifier. Switch off the amplifier and place the valve taking the least current in the position V3, i.e., in the valve holder associated with the bias adjustment R14. Now adjust R14 until the two output valves draw equal anode currents. After adjusting V3 check the current of V4 and readjust if necessary. The amplifier is now ready for service.

General Remarks:—This amplifier has been designed for outdoor work and large indoor jobs where several speakers are employed. It should not be used in a small room with a single speaker, the Partridge 12-watt Design caters for this class of work.

PARTRIDGE 30w. AMPLIFIER DESIGN

The Partridge 30w. Amplifier was designed to meet the following requirements:—(a) Ample output power without distortion; (b) Ability to maintain pure reproduction at all volume levels, i.e., when supplying one speaker in a small room or when feeding a number of speakers in a large hall; (c) Complete freedom from "hum" and other background noise; (d) Low initial cost and low maintenance costs together with absolute reliability; (e) Simplicity in design, making it particularly suitable for those with no previous experience of high power amplifiers; (f) Provision for supplying L.T. and H.T. for a pre-amplifier or radio.

Specification:—30w. audio output with approximately 5 per cent. harmonic distortion. Level response from 30 to 15,000 cycles. Separate bass and treble tone controls. Spare 40 m.a., 400v., H.T., and 5v., 2a., L.T., for pre-amplifier or radio.

The input required fully to load the output stage is less than 0·1v. The amplifier can be fully loaded from a pick-up or sensitive carbon microphone, but for long range work a pre-amplifier is recommended.

Technical Notes:—The output stage is run in Class A—B (low-loading), and this makes battery or fixed bias essential. Under no circumstances should automatic bias be attempted. The reason for this is fully explained in the Partridge P.A. Manual.

It will be noted that the ML4 valve in the penultimate stage passes 25 m.a. (approx.), whereas the makers' specified current for normal operation is only 16 m.a. No fear that the valve is being overrun need be entertained. The makers' figure for the allowable dissipation is 5w., and 25 m.a. at 200v. does

Fig. 5. The Partridge 45w. Amplifier Design, as interpreted by Messrs. H. J. Leak & Co. The equipment is easily transportable and is also suitable for large permanent installations or radio relay work. The large output of 45 watts is obtained without the use of an excessively high H.T. voltage.

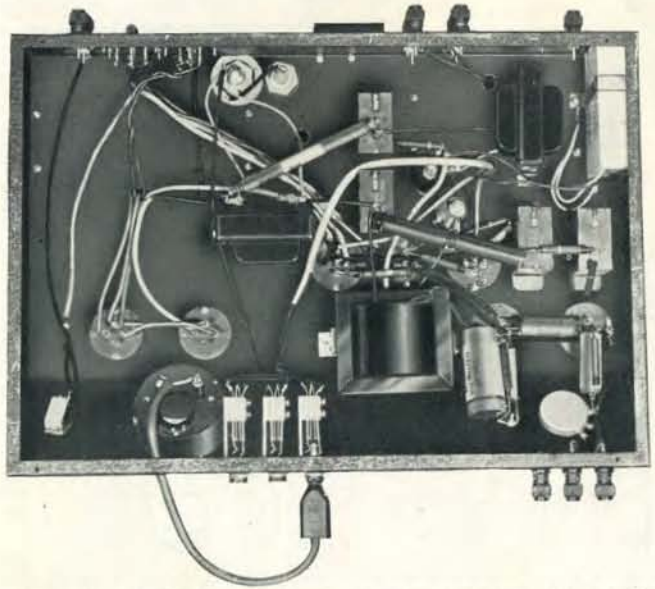
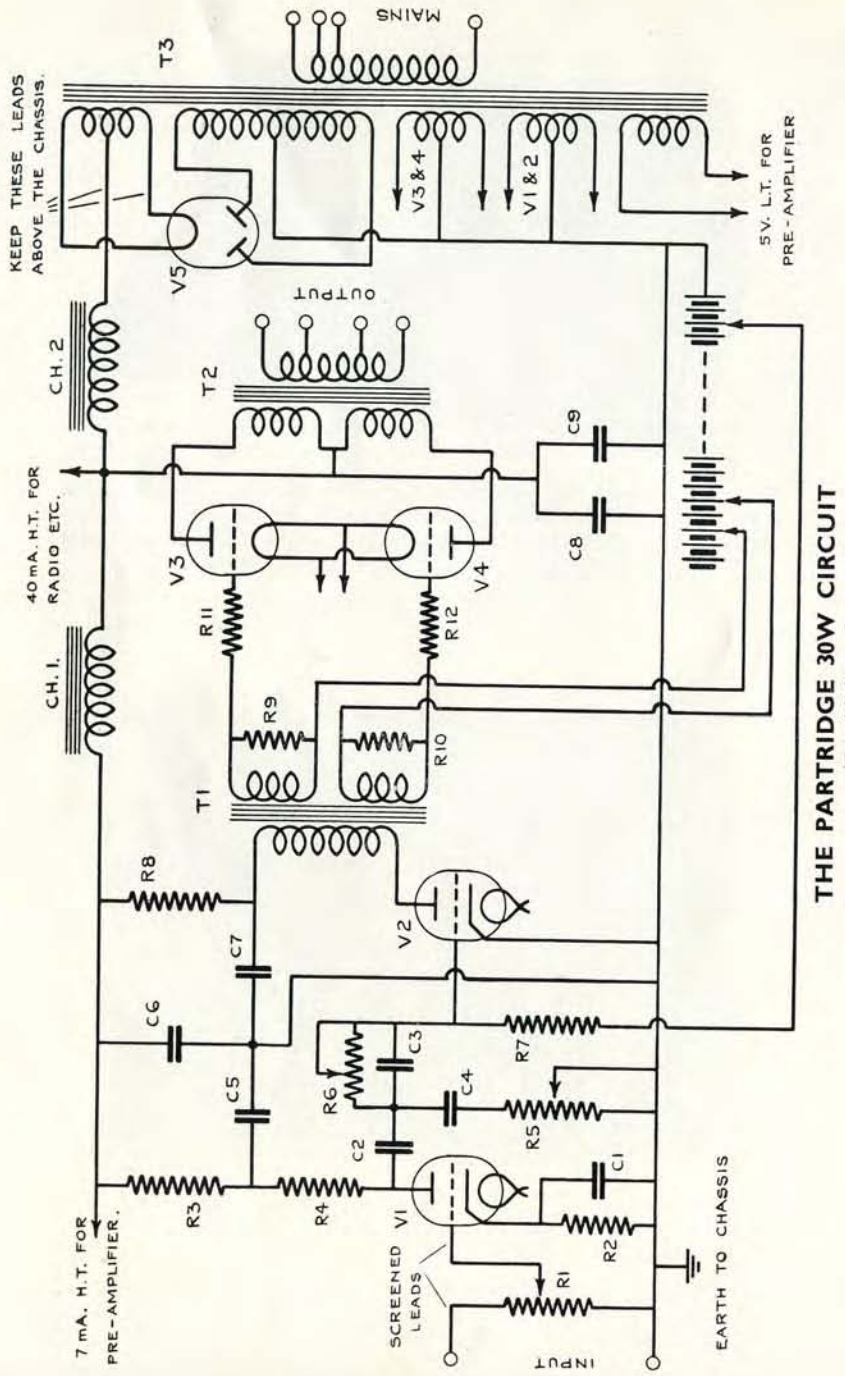


Fig. 6. The intervalve transformer can be seen on its side next to the meter jacks. This lay-out is satisfactory, but an arrangement similar to that suggested for the 30w. amplifier is probably easier for the inexperienced constructor.



THE PARTRIDGE 30W CIRCUIT

not exceed this figure. The reason for employing low bias and high anode current is to avoid distortion at low frequencies due to the inductive anode load (T.1), and resultant elliptical load line.

Another important point is that no reservoir condenser is connected across the rect fier and that Ch.2 is not an ordinary smoothing choke but a specially designed component. A full explanation of this will be found in the Partridge P.A. Manual.

Constructional Hints:—The lay-out illustrated on page 20 has proved very satisfactory. The chassis is made of $\frac{1}{2}$-in. plywood, 18 in. by 14 in., supported along the sides and back (not front) by 4 in. by $\frac{3}{4}$-in. strip. An aluminium sheet 18 in. by 18 in., bent 4 in. from one edge covers the top of the chassis, and the bent portion forms the front panel. An additional aluminium screen 10 in. by 5 in. high is placed between the rectifier and the remaining valves, as shown on the lay-out diagram.

The only components above the chassis are the valves T1, T2, T3 and Ch.2. All other components are mounted below the chassis, keeping all connecting leads as short as possible. The G.B. batteries are most conveniently fixed by brackets under the chassis, as shown on diagram.

Screened leads should be used on the input to V1, as shown in the circuit diagram, and all wiring should be under the chassis except the lead connecting Ch.2 to the mains transformer (see circuit diagram). This lead must be kept very short and must be above the chassis or hum will result.

High voltages are on many of the connecting leads and it is therefore essential that good quality sleeving be employed over the connecting wires.

The exact positions of the components not marked on the lay-out diagram are not critical. They should be arranged so as to keep all connecting wires as short as possible.

List of Parts:—

R1	250,000 ohm potentiometer	C1	50 m.f.	(12v. Elec.)
R2	750 ohms (1W)	C2	0·05 m.f.	(450v.)
R3	75,000 ohms (1W)	C3	0·0005 m.f.	(450v.)
R4	50,000 ohms (1W)	C4	0·02 m.f.	(450v.)
R5	50,000 ohm potentiometer	C5 & 7	2 m.f.	(450v.)
R6	1 megohm potentiometer	C6, 8 & 9	4 m.f.	(450v.)
R7	250,000 ohms (1W)			
R8	8,000 ohms (10W)			
R9 & 10	75,000 ohms (1W)			
R11 & 12	1,000 ohms (1W)			

All condensers not marked Electrolytic (Elec.) must be paper.

1 108v. H.T. battery with 9v. tappings.
1 16½v. G.B. battery with 1½v. tappings.

V1	MH41	Osram (Metallized)	2 m.a. H.T.
V2	ML4	Osram (Plain)	25 m.a. H.T.
V3 & 4	PX25A	Osram (Plain)	114 m.a. H.T.
V5	5Z3	American	141 m.a. H.T. (total)

T1	Partridge Transformer	Type 1V240
T2	Partridge Transformer	Type 30W/O
T3	Partridge Transformer	Type 30W/M
Ch1	Partridge Choke	Type 30W/SC
Ch2	Partridge Choke	Type 30W/FC

Although the circuit diagram appears very simple, it must be remembered that the output stage operates in Class A—B, and for this reason the iron cored components are of a very special design, and only those specified should be used. The reason for this is fully explained in the Partridge P.A. Manual, which should be carefully studied before building this amplifier.

The output transformer (30W/O) can be supplied with any ratio to order, but if no instructions are given the Partridge Series Type for 15 ohm speakers will be supplied (see Manual, page 29).

Adjustments and Operation:—The G.B. adjustment is extremely important. The 108v. battery has its positive end connected to the earth line and the grid lead from V2 must be connected to the 99v. tap, thus giving the ML4 9v. grid bias. The negative end of the 108v. battery should be connected to the positive end of the 16½v. battery to form one battery of 124½v. If a meter is not available the two PX25A output valves should be biased to 118½v.; this will be obtained by connecting to the 10½v. tapping on the 16½v. battery. If a meter is available the bias on the output valves should be adjusted so that each valve passes 57 m.a. with no load on the amplifier. When the amplifier is delivering 30w. output the anode current of the output valves will increase to 100 m.a. each.

It is of vital importance that the G.B. should not be adjusted while the amplifier is switched on. It must be switched off each time the G.B. is altered or the output valves will be ruined. It is recommended that the leads be soldered to the battery when the correct tappings have been found.

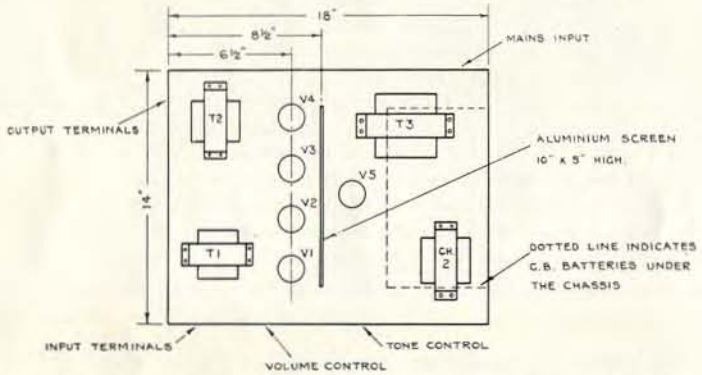


Fig. 7. Lay-out diagram for the Partridge 30w. Amplifier. The view shown is the plan looking down on top of the chassis.

PARTRIDGE 45w. AMPLIFIER DESIGN

The Partridge 45w. Circuit has been produced as a result of the many requests from customers who were delighted with the performance of the Partridge 30w. Design, but wanted an amplifier with greater output, mains bias, meters and other refinements that are desirable in equipment of this calibre.

Specification:—45w. audio output with an input of approximately 0·1v. Mains bias from separate rectifier circuits. Special adjustment for bias voltage and for balancing the output pair to compensate for irregularities in the manufacture of the valves. Diode damping of the output grids to prevent excessive positive drive and to protect the power stage from surges.

The treble and bass tone controls described in the 30w. Amplifier Design can be included if desired.

Spare H.T. and L.T. is provided to feed the Partridge Two-Stage Pre-Amplifier, which is particularly suitable for use in conjunction with this amplifier.

Fig. 8. The Partridge Two-Stage Pre-Amplifier. This is the ideal control unit for use in conjunction with the Partridge 30w. or 45w. amplifiers. Two microphones and two pick-ups together with separate bass and treble tone controls can all be operated from the sloping panel.

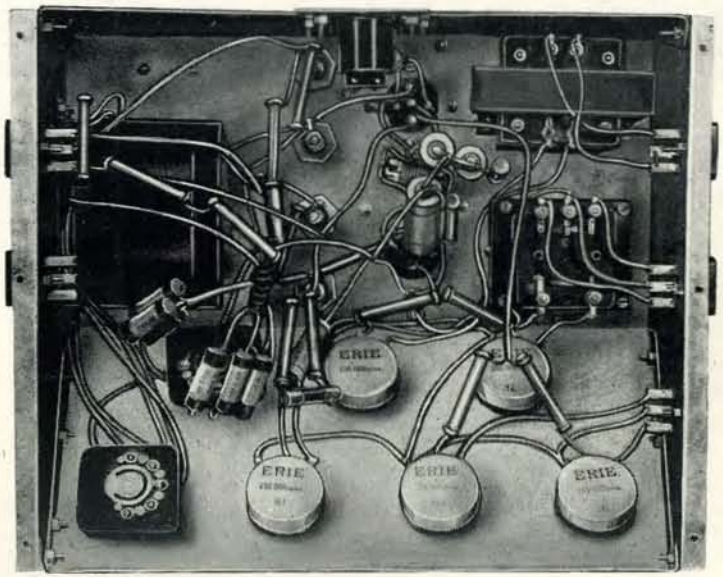
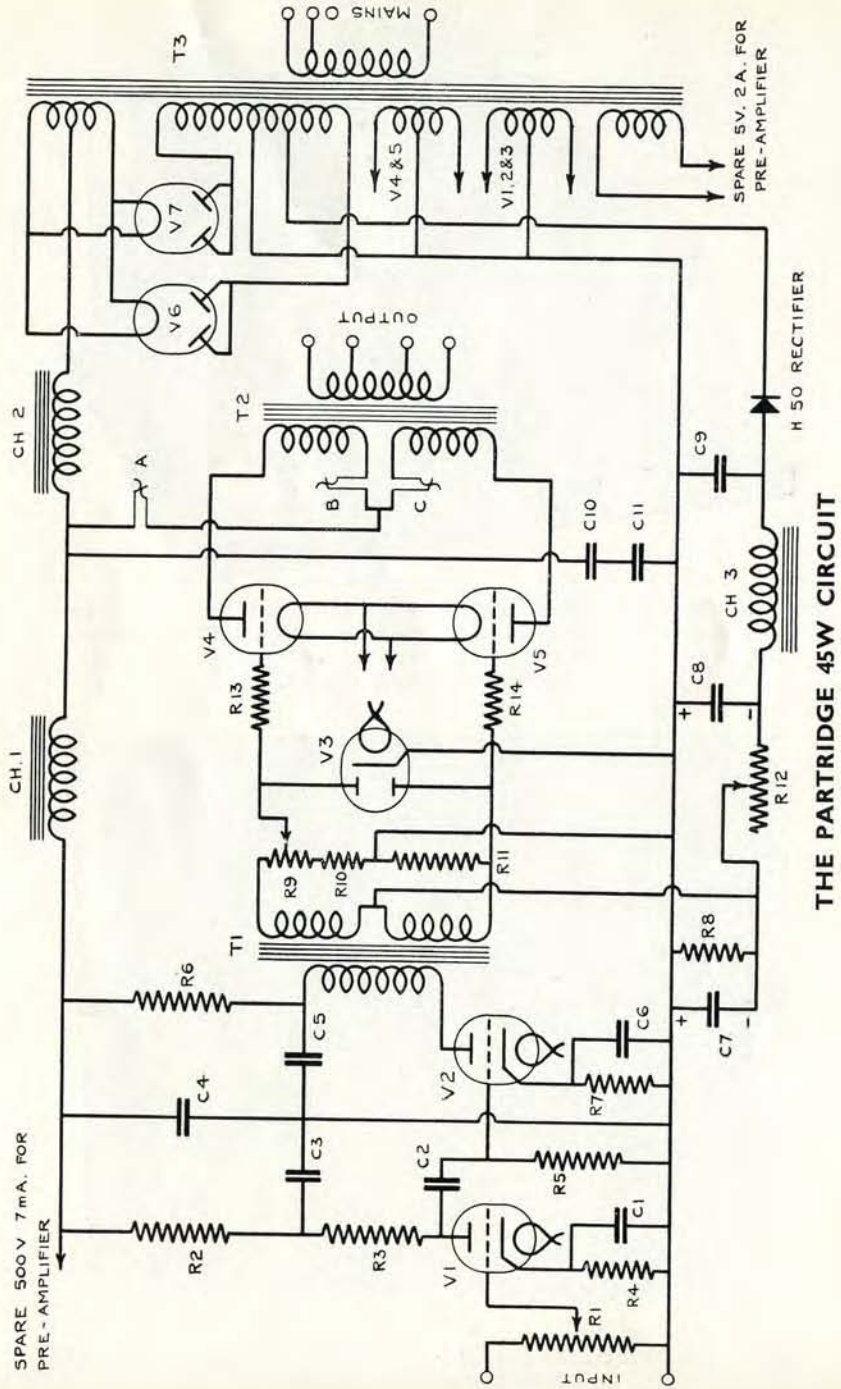


Fig. 9. Under-chassis view of the Pre-Amplifier. The lay-out is not critical. The tone control choke can be seen to the left and the two microphone transformers to the right of the photograph.



THE PARTRIDGE 45W CIRCUIT

Technical Notes:—The general arrangement of the circuit follows the original 30w. design very closely. The higher H.T. voltage and greater current have necessitated the use of two rectifiers. These should be connected as shown so that the two anodes of each rectifier are strapped together.

The smoothing condenser immediately following Ch.2 is made up of two wet electrolytics in series (C10 and 11). The case of C10 will not be at earth potential, and an insulating washer must be inserted between the condenser and chassis. These washers are obtainable from the manufacturers. Wet electrolytic condensers when run in series automatically adjust the voltage dropped across each and it is not necessary or desirable to employ bleeder resistances for this purpose.

The AC/P in the penultimate stage passes 23 m.a. The usual current for this valve is only 17 m.a., but no damage will be done by passing the higher current, since the anode dissipation is still well within the makers' specified limit.

The bias circuit and its adjustment must be very carefully studied for a wrong setting or connection may ruin the output valves. The rectifier circuit for the bias supply is quite normal, but it should be remembered that the bias voltage must be negative relative to the chassis and amplifier earth line. For this reason C7 and 8 (block condensers) must have a common positive which is connected to earth. Before putting the output valves into their sockets,

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List of Parts:—

R1	250,000 ohm potentiometer	C1	50 m.f. (12v. Elec.)
R2	100,000 ohms (1W)	C2	0·1 m.f. (450v.)
R3	50,000 ohms (1W)	C3 & 5	2 m.f. (450v.)
R4	750 ohms (1W)	C4	2 m.f. (650v.)
R5	250,000 ohms (1W)	C6	50 m.f. (50v. Elec.)
R6	10,000 ohms (10W)	C7 & 8	8 & 8 m.f. (500v.)
R7	550 ohms (1W)		Dubilier Elec. Block Type 0288
R8	50,000 ohms (1W)		with common positive.
R9	10,000 ohm potentiometer	C9	2 m.f. (450v.)
	(wire wound, 10 m.a.)	C10 & 11	32 m.f. (320v.)
R10	60,000 ohms (1W)		Wet Elec. (T.C.C.)
R11	70,000 ohms (1W)		
R12	10,000 ohm potentiometer		
	(wire wound, 10 m.a.)		
R13 & 14	1,000 ohms (1W)		

A, B & C. Sockets for meter jack. These must be designed so that the meter connects before the H.T. supply is broken.

H.50 Westinghouse metal rectifier Type H.50.

Meter (not shown in diagram) 0—250 m.a. moving coil.

V1	MH4I	Osram (Metallized)	2·5 m.a. H.T.
V2	AC/P	Mazda (Plain)	23 m.a. H.T.
V3	D4I	Osram (Plain)	
V4 & 5	DA30	Osram (Plain)	100 m.a. H.T.
V6 & 7	5Z3	American	125·5 m.a. H.T.

T1	Partridge Transformer	Type 1V240
T2	Partridge Transformer	Type 45W/O
T3	Partridge Transformer	Type 45W/M
Ch1	Partridge Choke	Type 45W/SC
Ch2	Partridge Choke	Type 45W/FC
Ch3	Partridge Choke	Type 45W/BC

High power, high efficiency amplifiers such as the Partridge 45w. Design are easy to operate and thoroughly stable only providing the correct iron cored equipment is employed. Under no circumstances attempt to use any transformers or chokes except those specified above.

The output transformer (45W/O) can be supplied with any ratio to order. If no instructions are given the Partridge Series Type for 15 ohm speakers will be supplied (see Partridge P.A. Manual).

check the polarity of the bias supply. If the metal rectifier (H50) is connected the wrong way round a positive voltage will be developed and this will cause the output valves to be destroyed.

The method of adjustment is as follows:—Set R9 so that the slider connects directly to the secondary of the transformer T1, i.e., to the end of R9 remote from R10; also set R12 so that the slider connects directly to the choke Ch.3, i.e., so that R12 is virtually out of circuit. See that the volume control R1 is turned right down to zero. Plug the milliammeter into the socket "A," and switch on the mains. After the rectifiers have had time to heat up, carefully and slowly adjust R12 until the total anode current reaches about 80 m.a. Next plug the meter into sockets "B" and "C," and note the two individual anode currents. If they differ slightly, switch off the amplifier and put the valve with the lower anode current in the position V4, i.e., in the valve holder which is associated with the bias adjusting potentiometer R9. Switch on again and leave the amplifier running for a full five minutes to allow the valves, resistances, etc., to become heated to working temperature. Now plug the meter into the socket "C" and adjust R12 until V5 is passing 50 m.a. Next plug into socket "B" and adjust R9 very slowly and very carefully indeed, until V4 is passing 50 m.a. Re-check the current passed by V5. The output stage is now properly adjusted and is balanced so that the two valves each contribute their proper share to the total output power. The meter should be left plugged into the socket "A" when the amplifier is in use.

Lay-Out:—This can follow the lines suggested for the 30w. design, the G.B. unit taking the place of the bias battery. Alternatively the scheme adopted by Messrs. H. J. Leak & Co. is satisfactory. This is clearly shown in the photographs on page 17.

The bias adjusting potentiometers R9 and R12 must be mounted under the chassis so that there is no possibility of their being touched after having been properly adjusted. These potentiometers must be good class, wire wound components; should one develop an open circuit the bias to the output valves may fail with disastrous results.

PARTRIDGE
TWO-STAGE PRE-AMPLIFIER DESIGN

Introduction:—This is the ideal control unit for general P.A. work. Two microphones and two pick-ups can be independently operated and mixed at will, while both treble and bass response can be varied to suit any conditions. Background noise has been reduced to an absolute minimum and the unit is entirely mains fed.

The voltage amplification from the microphone input to the line is approximately 15, and from the pick-up input to the line about 1½. Any number of amplifiers can be fed in parallel from one pre-amplifier.

This unit has been specially designed for use with the Partridge 30w. and 45w. Amplifiers, but it is suitable for use with any amplifier requiring not more than 0·5v. fully to load the output stage.

Constructional Hints:—A very convenient shape for the chassis is shown in the photograph on page 21. The exact dimensions are not important, but should be large enough to accommodate the microphone transformers, and may even be extended to take the batteries if desired. It is essential that the bottom should be screened so that the chassis forms a closed box (see single stage pre-amplifier described in the Partridge P.A. Manual).

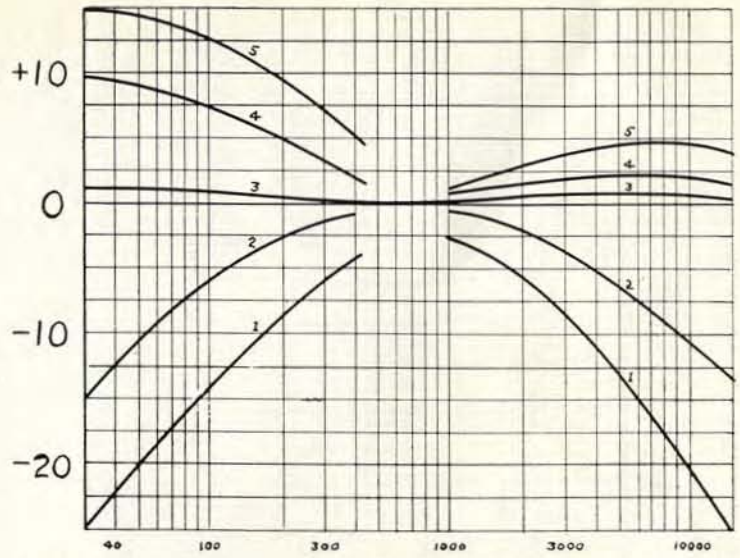


Fig. 10. The frequency response curves of the Partridge Two-Stage Pre-Amplifier. The figures against the treble response curves refer to the setting of S1, while those against the bass curves refer to S2.

The chassis should be connected to the earth line of the circuit at one point only, somewhere near V1. The filaments of the two valves must be symmetrically wired as shown at "a" in Fig. 11. If the connections are crossed, as shown at "b," the hum-dinger will not be fully effective. The filament leads should be twisted together and kept well away from the grid circuits of the valves.

The valve screens shown in the photograph are not essential if metallized valves are used. Microphonic feed back will be reduced by tying cotton wool tightly round the valves, particularly V1.

Operational Notes:—The method of using the screened flex and connecting the H.T. and L.T. lines is fully explained in the notes on the single stage pre-amplifier described in the Partridge P.A. Manual. In this case either of the

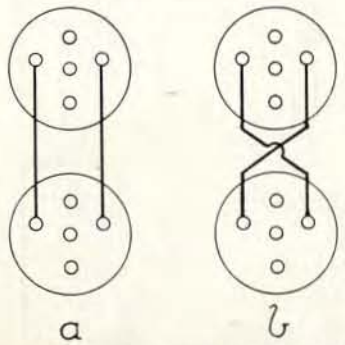
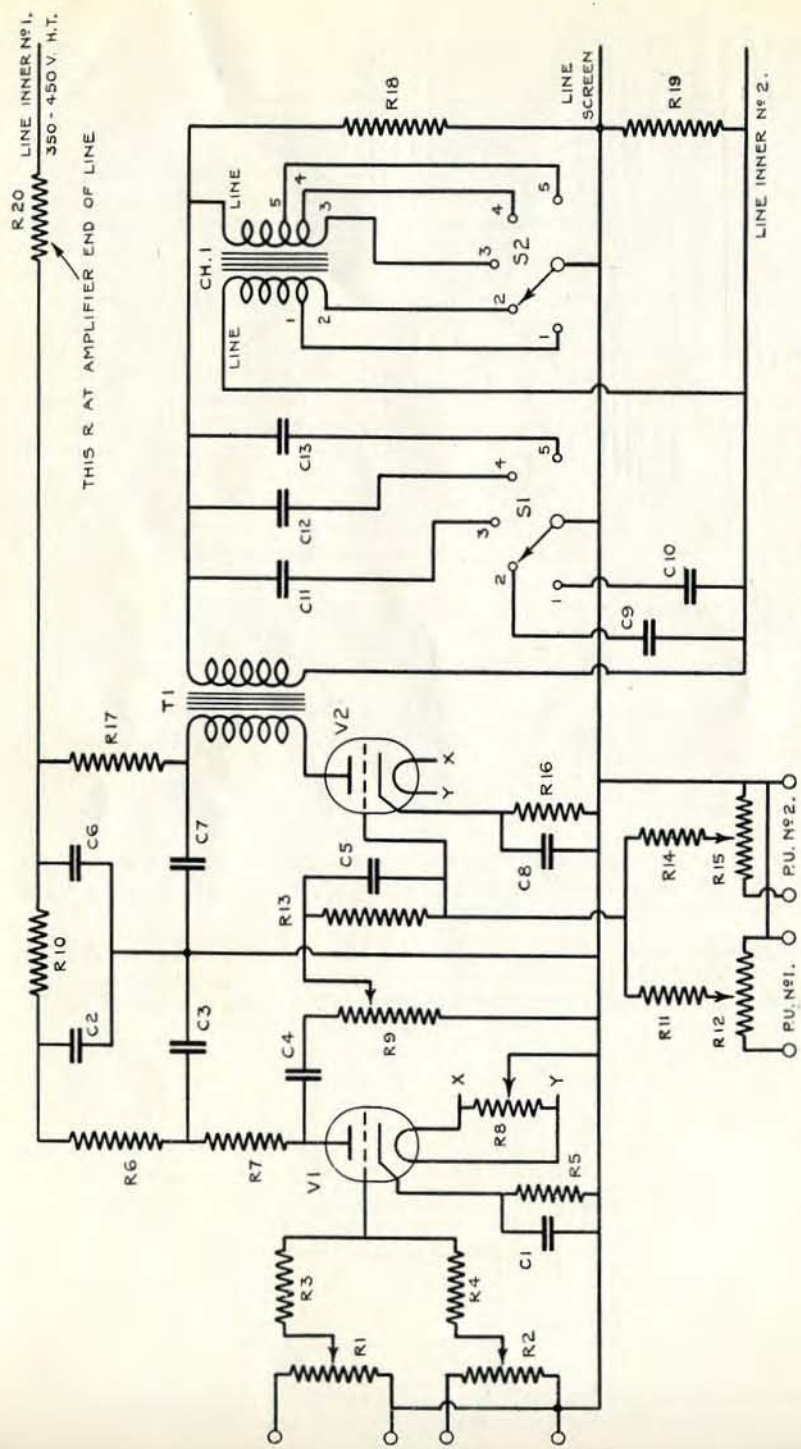


Fig. 11. Filament connections: (a) is the correct method, (b) may result in hum, owing to the hum-dinger not affecting the two valves similarly.



THE PARTRIDGE TWO-STAGE PRE-AMPLIFIER CIRCUIT

three lengths of flex given in the list of parts will drop one volt when passing 2 amps., hence it is essential to have a 5v. A.C. supply at the main amplifier. A filament transformer must not be mounted on the pre-amplifier chassis.

The use of the bass control is obvious, but studs 3, 4 and 5 on the treble control need a little explanation. Treble boost is not necessary or even desirable, so these positions are used to correct for attenuation caused by the capacity of the screened flex line. The single stage pre-amplifier using type L4/1 transformer does not need any correction owing to the low line impedance: In the present case the tone control circuits make it desirable to use a slightly higher line impedance (5,000 ohms), and therefore a small correction becomes necessary. The response curves given on page 25 were taken with 15 yards of screened line; when the length is increased to 30 yards all the curves drop approximately 2 db. at 10,000 cycles, so that stud 4 gives a level response; similarly with 50 yards of line the curves drop a further 3 db., and stud 5 becomes the setting for a level response. The total variation is so small (only 5 db.) that an intermediate line length will cause no aural deviation from the level.

R9 controls the gain of the first stage and this should always be kept as low as possible. The two input volume controls should be turned well up and the volume adjusted by reducing R9. By this method valve hiss arising in V1 will always be kept at a minimum.

Modifications:—It is strongly urged that no changes be made in this circuit. Relatively small changes in the values of condensers or resistances can have a serious effect upon the frequency response.

Accumulators may be used for the 4v., 2a. L.T. supply. This will in fact remove the slight trace of hum that can be heard in the background when the amplification is set to a maximum.

List of Parts:—

R1, 2, 9, 12 & 15 250,000 ohm potentiometer		C1	50 m.f. (12v. Elec.)
R3, 4, 11, 13 & 14 250,000 ohms (1W)	...	C 2, 3, 6 & 7	8 m.f. (450v.)
R5	2,000 ohms (1W)	C4	0·1 m.f. (450v.)
R6, 7, 10 & 18	50,000 ohms (1W)	C5	0·0001 m.f. (250v.)
R8	30 ohm hum-dinger	C8	100 m.f. (12v. Elec.)
R16	300 ohms (1W)	C9	0·002 (250v.)
R17	20,000 ohms (1W)	C10	0·02 m.f. (250v.)
R19	5,000 ohms (1W)	C11	0·0015 m.f. (250v.)
R20	15,000 ohms (1W)	C12	0·002 m.f. (250v.)
		C13	0·0027 m.f. (250v.)

S1 & S2 — 5 way single pole switches (Bulgin, etc.). These switches should open circuit between studs and not short circuit adjacent studs.

V1 MH4 Osram (Metallized)
V2 MH41 Osram (Metallized)

50 yards (or less) screened flex type 21 obtainable from C. F. Ward, 45, Farringdon Street, London, E.C.4.

Either 10 yards 23/0076 standard 3 amp. flex.
or 20 yards 40/0076 standard 5 amp. flex.
or 50 yards 110/0076 standard 15 amp. flex.

T1 Partridge Transformer Type L2/1
Ch1 Partridge Choke Type T.C.1

NOTES
ON AMPLIFIER CONSTRUCTION

Preliminary Considerations:—Before taking any step whatever in the direction of building an amplifier, read the Partridge P.A. Manual very carefully from cover to cover. A few hours' serious study will place the reader in a better position to choose a circuit suited to his needs and will considerably lessen the risk of trouble and disappointment when the amplifier is put on test.

Circuit Designs:—Modern amplifiers are extremely efficient, give very good quality and are thoroughly stable. The choice of components, however, is definitely critical, and one ill-chosen modification may easily upset the operation of any of the amplifiers described herein.

Lay-Out:—(a) Avoidance of Instability. The lay-out should be progressive, starting with the input circuits followed by the first stage, second stage, etc., and ending with the mains equipment. The "earthy" side of the audio input should be connected to the chassis, which in turn should have a true earth connected to it. Output leads must be kept well away from the audio input circuits and the intervalve and output transformers should have their cores at right angles.

(b) Avoidance of Hum. See that the intervalve transformer has its core at right angles to that of the mains transformer and keep the two components as widely separated as possible. When mounting transformers and chokes, place a stout piece of card or felt beneath each to prevent vibration against the chassis.

Wiring:—Always wire neatly and keep the connections as short as possible. Do not use the chassis as a common earth return except in the case of electrolytic smoothing condensers. All the audio circuits should have proper wired earth connections and every care must be taken to avoid dry joints if the connections are soldered. Wires associated with the input circuits and first stage should be run close to the chassis and not allowed to float in mid-air. Leads to the grids of the output valves and those from the anodes to the output transformer must be kept very short.

A mains transformer rated at 500—0—500v. has 1,000v. A.C. across the outers. Hence the three wires from the H.T. winding must each be run in systoflex. If they are not systoflexed or if all bunched together in one piece of systoflex, breakdown will certainly result. Filament leads should be twisted together similar to lighting flex.

Testing:—Check all connections carefully and see that the valves are in their correct positions before switching on the mains. Never make adjustments or remove a valve while the mains are on . . . such procedure may damage the amplifier.