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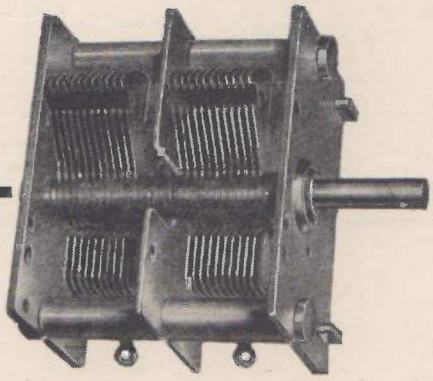

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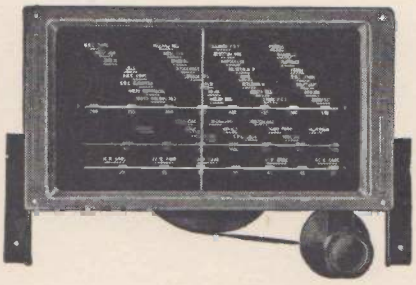

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Available as 1, 2 or 3 gang, 490 p.F. nominal capacity, matched and standardised to close limits. Supplied with trimmers if required.

Other capacities available—details on request.

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Low loss non-hygroscopic insulation.

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A precision slide rule drive. Complete with 3-band glass scale, 9in. $\times 4\frac{3}{4}$in. Printed—short, medium and long wave bands with station names.

Scale length 7in. The spin wheel drive gives easy control through a ratio of 24-1. Fitted with constant velocity coupling, eliminating strain on the Condenser, and providing mechanical and electrical isolation from vibration and noise.

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THE EMPEROR

A Radio-gram for the Home Constructor

Bernards (Publishers) Ltd.
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General Editor

WALTER J. MAY

★ ★ ★

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Preface

In response to repeated requests from many amateur constructors, Bernards (Publishers) Ltd. are pleased to present

"THE EMPEROR"

This radio-gramophone has been expressly designed for the home-constructor. It is presented in an essentially practical form, equally suitable for the novice and experienced amateur. Theoretical and practical wiring diagrams are included, together with point-to-point wiring tables, so that none may feel that the construction is beyond their capabilities.

By a combination of the finest radio products available to-day, together with a design of outstanding merit, "THE EMPEROR" represents the finest example of a radio-gram that has ever been offered to the practical home-constructor.

THE EMPEROR

INTRODUCTORY

The modern Radio-gram is a complex instrument, the design of which may not be lightly undertaken. It is of course simple to spend an enormous amount of money purchasing the latest so-and-so amplifier, a such-and-such record player, a speaker with a high sounding name and an even higher price. and to assemble the whole in a futuristic cabinet designed by an " expert." Such a combination is likely to prove disastrous financially, musically, and artistically.

The reason for all this is not difficult to see, a little thought will show that unless the various units and components which make up the complex instrument called a radio-gram, are skilfully blended by a competent designer, results cannot be other than disappointing.

The Emperor is the result of much careful thought and experiment. There is nothing haphazard or irrelevant in the design, each unit and component has been chosen because of its particular suitability for the work it has to perform. It is here that the designer of home constructed models has the advantage over the designer of commercial instruments. The latter is invariably tied to certain manufacturers or else must buy in the cheapest markets in order to compete with other companies. Home constructor designers can, however, discriminate and use only the best, though by no means necessarily the most expensive components. There are four main units to consider, the radio tuning unit, the amplifier, the record player and the loud-speaker. A fifth factor, and a very important one from the ladies point of view will come to mind—the cabinet. Opinions are widely diverse on what constitutes the best form of cabinet. A cabinet has been designed for this instrument, though of course, any well made cabinet of suitable proportions can be used.

RADIO TUNER

A conventional superheterodyne circuit forms the basis of the radio tuner. Three wave-bands are included, Short, Medium and Long. Inclusion of a short-wave band is useful, since so many interesting stations from all over the world, radiate on comparatively short-wave lengths. In this instance the short-wave band provided covers from 16 to 50 metres which is one of the most useful from an entertainment standpoint.

Wave-band coverage is effected by use of a coil pack, "Maxi-Q" CP 3/500 by Denco (Clacton) Ltd. This is a new design with a very fine performance, and is intended to work in conjunction with the J.B. tuning capacitor and dial specified. Tuning ranges provided by this unit are as follows:—

L.W.	800—2000	metres.
	375— 150	kc/s.
M.W.	200— 550	metres.
	1500— 545	kc/s.
S.W.	16— 50	metres.
	18.75— 6	Mc/s.

Frequency changing is carried out by a single valve, type ECH 42.

This is a modern valve of advanced design. Top cap connections are avoided by its single-ended construction and its high conversion conductance is utilised to the best advantage by the carefully chosen circuit constants and efficient tuning coils.

A single stage of I.F. amplification is provided, utilising valve type EAF 42, which is an RF pentode with variable-mu characteristics, and a single diode unit.

An I.F. of 470 kc/s is employed as this is generally more satisfactory than the older 465 kc/s selection.

A.V.C. is provided in the normal way, by rectifying the amplified I.F. signal by means of a diode and feeding the resultant voltage back again to the ECH 42 and EAF 42.

The majority of receivers use a diode for detection and A.V.C. is obtained either from the detector diode or from an auxiliary diode contained within the same valve.

Diode detection is not used with this receiver and the form of detection used is not suitable for producing A.V.C., therefore it is necessary to obtain the control voltage from another source, in this case a diode unit contained within the I.F. valve.

There are two conventional methods by which A.V.C. may be applied, shunt feed and series feed. Both methods are shown in basic form in Fig.1. Series feed allows the A.V.C. voltage to be fed through the R.F. coil directly to the control grid of the stage or stages being controlled. This necessitates isolating the coil from direct connection with chassis or earth, and a blocking condenser is used for this purpose. For R.F. stages, the tuning range of the coil may be restricted a little on short-waves, unless the blocking condenser is of a high value and this is not always desirable. No such problem arises with I.F. stages and here the series feed is admirable.

With a shunt fed circuit the blocking condenser is in the grid circuit instead of the tuned circuit thus avoiding the series feed problem in R.F. stages. Feed is via a high resistance 0.5MΩ or thereabouts. Effectively this resistance is in shunt with the tuning coil, but its effect on an RF stage is negligible. It would have some effect at I.F. and for that reason a combination of series and shunt feed has been used for The Emperor.

Reference to the theoretical diagram of the receiver, Fig. 15 will make this clear. V.1 is shunt fed, C.1 is the blocking condenser and R.1 the feed resistor. A series feed is used for V.2, the control grid of the EAF 42 is fed through the secondary of I.F.T.1 from the A.V.C. line. Observe that

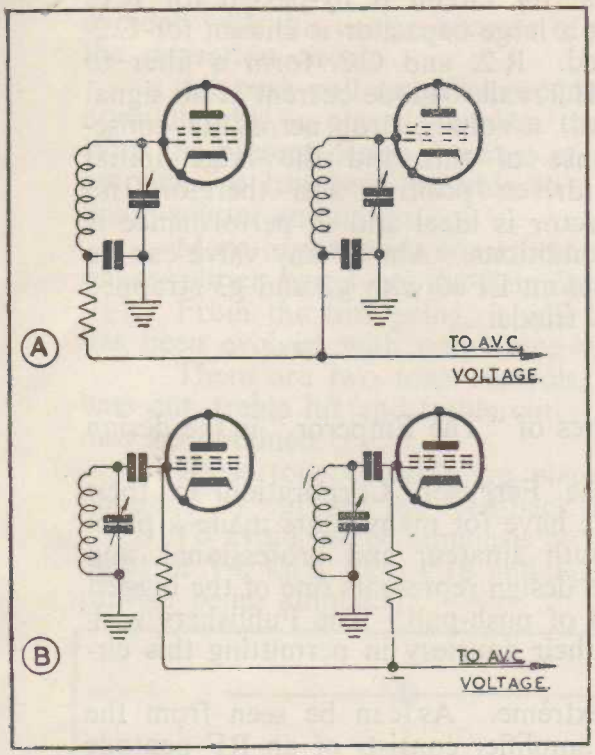


Fig. 1 (*A*) *A.V.C. Series feed,*
(*B*) *Shunt feed.*

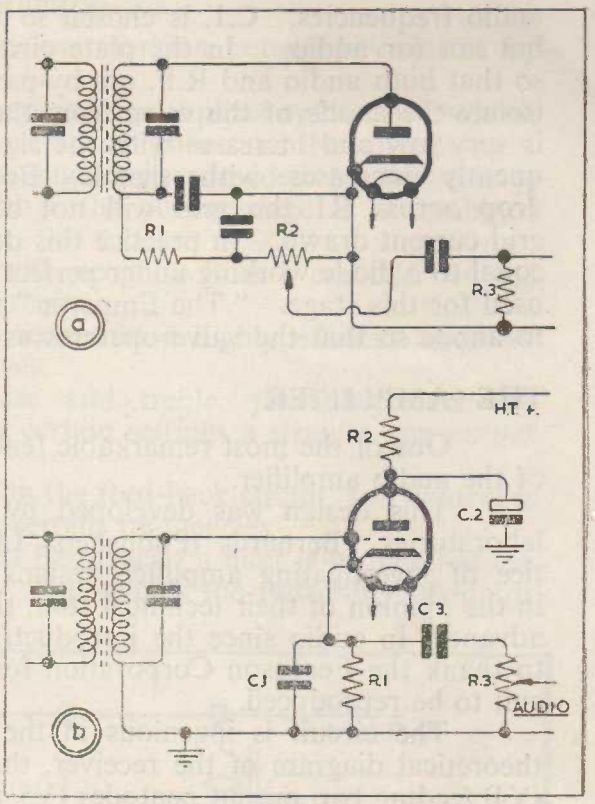


Fig. 2 (*A*) *Diode circuit,*
(*B*) *Infinite Impedance Detector.*

the A.V.C. diode is fed from 1.F.T.2 primary and that the values of C9 and R13 have been chosen to avoid undue damping which would ruin the IF selectivity. Feeding the diode from the primary also avoids any possibility of side-band screech because the signal is naturally less selective at this point than at the output of the secondary winding.

There are a number of methods which can be employed for the detection of radio signals. Perhaps the most usual form employed for modern superheterodyne receivers is the diode. The design of a satisfactory diode detector is based on the following requirements.

(1) That the input shall not be less than 10 volts peak.
(2) That no appreciable A.C. shunting should be present.

Requirement No. 1 is easily met for local stations but the second is not so easily met.

Fig. 2a shows a conventional diode detector circuit. It will be appreciated that the volume control/diode load (R.2.) well advanced it is shunted by the grid resistor R.3. With the majority of valves R.3. may not exceed 1 to 2 MΩ and the shunting can cause serious distortion. An infinite-impedance detector is used for "The Emperor." A basic circuit for this form of detection appears at Fig. 2b. This detector combines the high signal handling capabilities of the diode with low distortion, with the added advantage that it does not load the tuned circuit to which it is connected.

The load resistor (R.1.) is connected between cathode and earth so that it is common to both grid and anode circuits, giving negative feedback for the

audio frequencies. C.1. is chosen so that the circuit is by-passed for R.F. but not for audio. In the plate circuit a large capacitor is chosen for C.2. so that both audio and R.F. are by-passed. R.2. and C.2. form a filter to isolate the anode of the valve from the H.T. rail. Anode current at no signal is very low and increases with the signal. Voltage drop across R1 consequently increases with signal. Because of this and the large initial drop across R1 the grid will not be driven positive and therefore no grid current drawn. In practice this detector is ideal and in performance is equal to a diode working under perfect conditions. Almost any valve can be used for this stage. " The Emperor " uses an EF80 with g2 and g3 strapped to anode so that the valve operates as a triode.

THE AMPLIFIER

One of the most remarkable features of " The Emperor " is the design of the audio amplifier.

This design was developed by the Ferguson Corporation in their laboratories. Bernards (Publishers) Ltd., have for many years made a practice of investigating amplifier designs both amateur and professional, and in the opinion of their technical staff, this design represents one of the biggest advances in audio since the introduction of push-pull. The Publishers wish to thank the Ferguson Corporation for their courtesy in permitting this circuit to be reproduced.

The circuit is ingenious in the extreme. As can be seen from the theoretical diagram of the receiver, the amplifier consists of an RF pentode (V4) feeding two output pentodes (V5 and V6). Circuit constants for V4 are unusual, and it will be noticed that anode and screen voltages will be unusually low. One advantage of this mode of operation is that a much higher gain is available from the stage than would be the case if conventional circuit constants were used. It is in fact possible to operate an RF pentode with up to ten times its conventional value of anode load and in this condition a gain of 2500 is possible.

The basic form of this type of circuit is shown in Fig. 3. They are called " starvation " circuits because of the exceptionally low potentials involved. Briefly, coupling lead A carries the audio signal from the anode of V1 to the grid of V2, and B feeds the screen of V1 from a tap on the cathode resistor of V2.

This form of screen feed is called a " self-focusing " circuit and is an essential feature of this class of amplifier.

An interesting article on this class of amplifier appeared in ELECTRONICS, March 1951, and constructors who would like to know more about the subject should refer to this article.

In practice, the higher the value of the anode load, the greater the gain. Unfortunately, as the gain is increased by this means, severe frequency limitation takes place which renders the amplifier useless for domestic radio purposes. However, by careful design and the use of modern valves it is possible to obtain exceptional gain with full frequency range and at a very low noise level. This, of course, has been done with the present design. Direct coupling between stages is always an advantage, phase shift is reduced so that heavy negative feed-back can be used without risk of instability.

Usually direct coupling involves high HT voltages, but this has been

avoided with this design because of the low working potentials required by the starvation circuit.

All push-pull amplifiers require some form of phase-splitter or invertor, normally this is placed between the voltage amplifier and the output stages. With the present design, because of the high gain provided by the voltage amplifier, it has been possible to arrange the output stage as a combined phase-splitter and output.

More experienced constructors will recognise it as a cathode coupled phase-splitter based on the Schmitt circuit.

From the fore-going, it will be seen that a highly efficient amplifier has been evolved with only three valves.

There are two tone controls, bass and treble, providing bass lift, bass cut, treble lift and treble cut. At certain settings a straight line output may be obtained.

These tone controls are placed in the feed-back circuit, and control is obtained by varying the feed-back at certain frequencies.

To avoid undue emphasis at bass frequencies a filter is included at the input of V4, C19, R24, C18 and R25. This avoids the possibility of motor rumble being amplified.

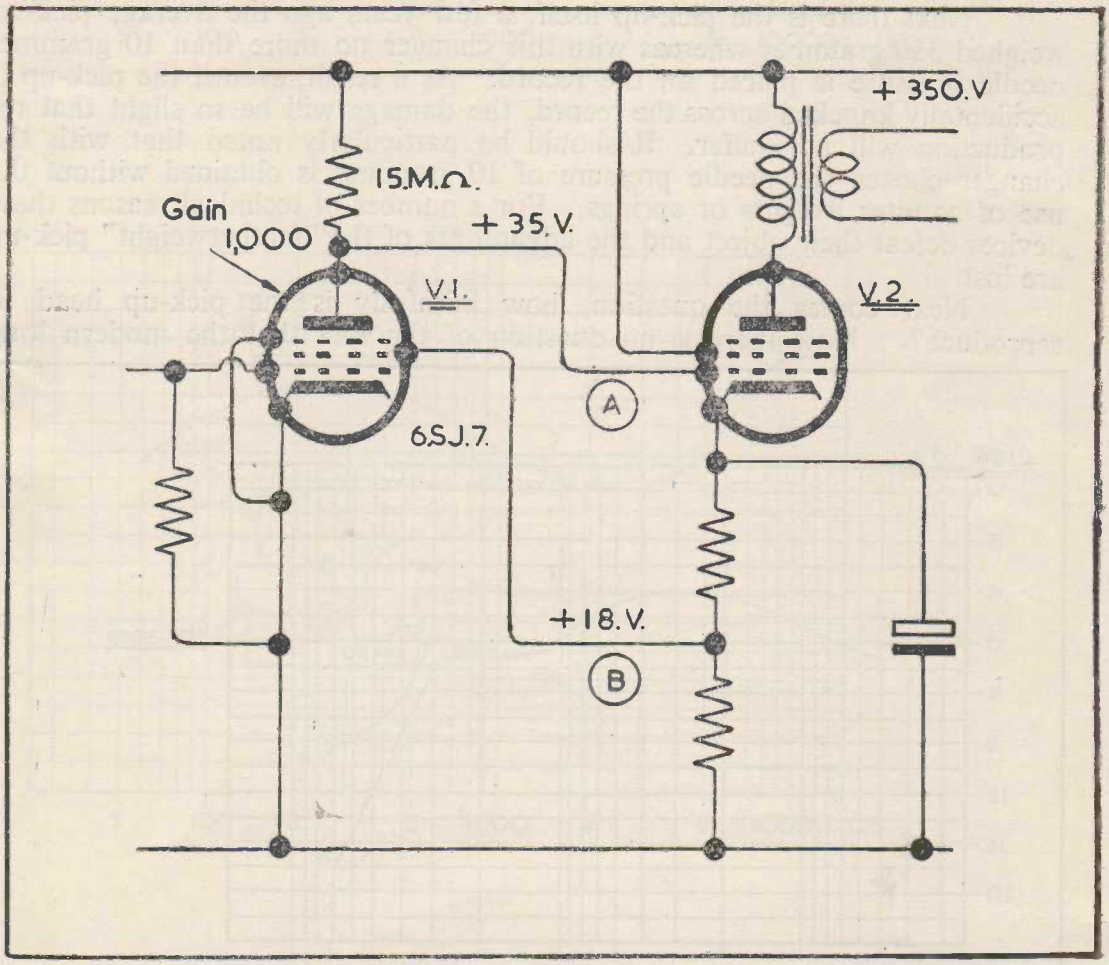


Fig. 3 Basic Starvation Circuit

THE RECORD CHANGER

Choice of a suitable record player is not an easy job. Amateurs may well feel at a loss when confronted with the large number of different models and designs available. With the inception of the long playing record drastic changes have taken place with pick-up heads and the mechanism driving the records, with the result that there are countless designs of all shapes, sizes and operating principles available.

Before a record changer was chosen for the "Emperor," a number of current models were tried out. The Philips changer seems to combine all the individual advantages of others without the disadvantages and in addition has a number of highly desirable features entirely of its own.

One of the biggest problems when reproducing long playing records is the elimination of motor rumble. Philips have overcome this problem by a skilfully designed motor employing many more pole-pieces than is usually contemplated together with precision bearings for the mechanism. The result is rumble free reproduction and really silent running. It is a pleasure to observe the careful manner in which the pick-up is placed on the records and taken off, after experiencing certain other types of changer in action.

Next there is the pick-up itself, a few years ago the average pick-up weighed 350 grammes whereas with this changer no more than 10 grammes needle pressure is placed on the record. As a result, even if the pick-up is accidentally knocked across the record, the damage will be so slight that reproduction will not suffer. It should be particularly noted that with the changer chosen the needle pressure of 10 grammes is obtained without the use of counter weights or springs. For a number of technical reasons these devices defeat their object and the advantages of the "featherweight" pick-up are lost.

Next comes the question, how faithfully is the pick-up head to reproduce? Now there is no question of the fact that the modern long

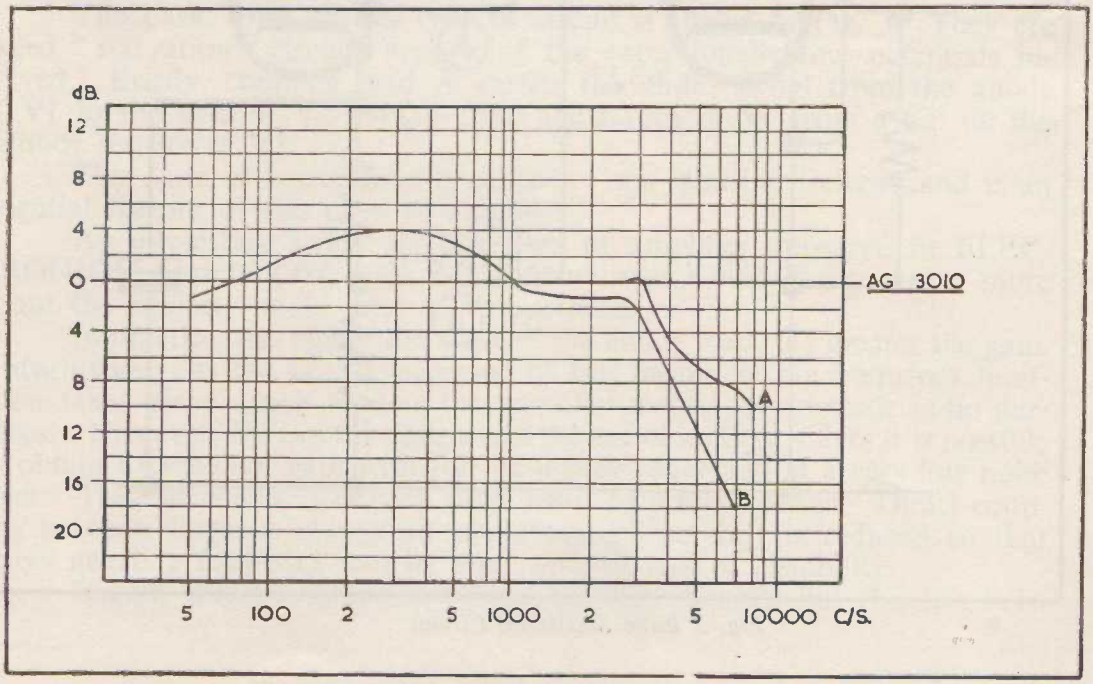


Fig. 4 The AG3010 head Characteristic

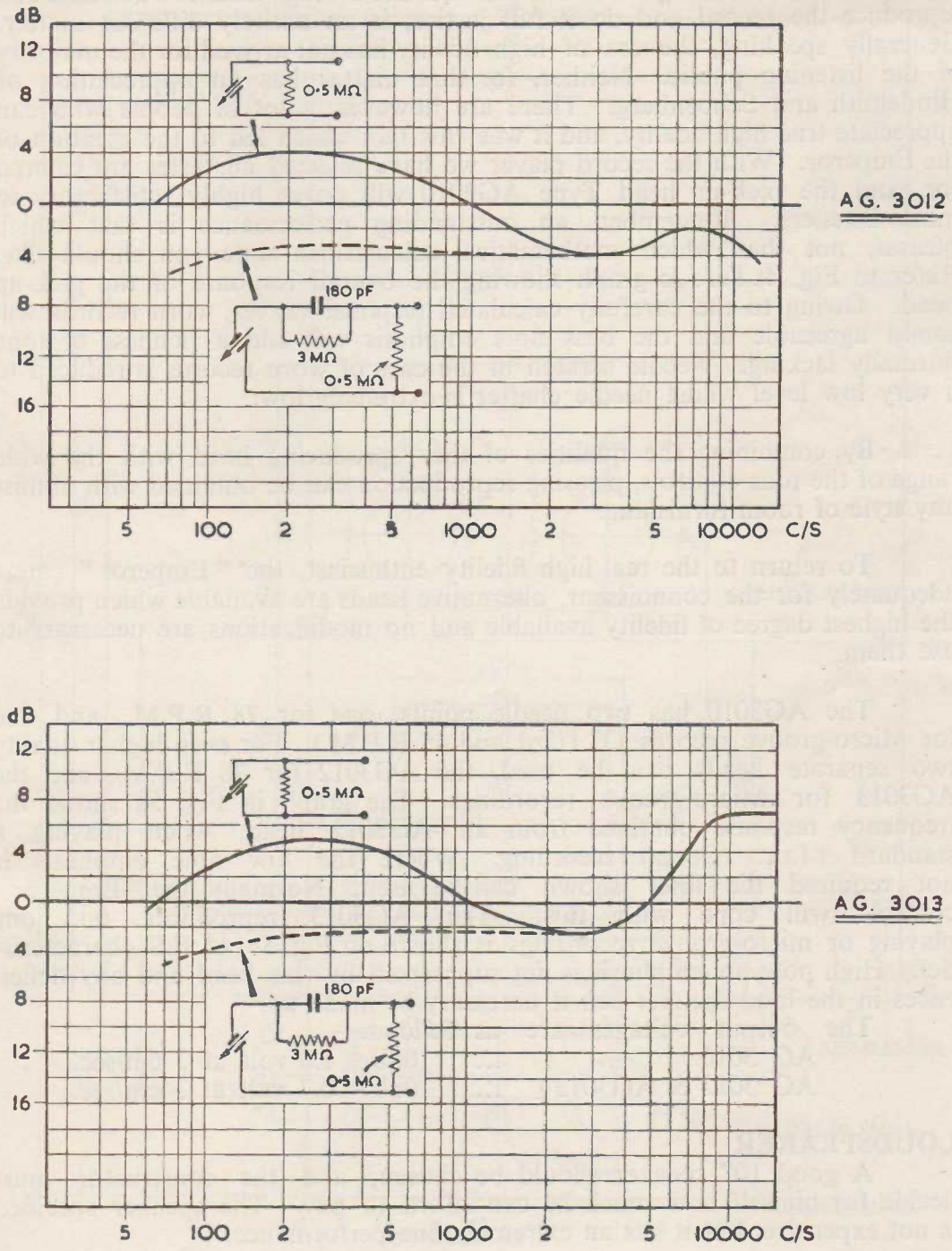


Fig. 5 AG3012 and AG3013 head Characteristics

playing record has imprinted on it, all that is necessary for quality of the highest fidelity to be reproduced. Whether the average listener's machine can reproduce the record and do it full justice, is an entirely different matter. Generally speaking, the era of high fidelity has not arrived for the majority of the listening public. Neither, for that matter has an appreciation of Hindemith and Schoenberg. There are however, a lot of people who can appreciate true high fidelity, and it was this fact which led to the creation of the Emperor. With the record player we have selected all tastes are catered for, and the pick-up head Type AG3010 will prove highly satisfactory to most listeners. Remember, an outstanding performance is that which pleases, not that which mathematical calculations state you should like. Refer to Fig. 4; here is graph showing the overall response of the pick-up head. Owing to the carefully calculated response curves, worn records will sound agreeable and the bass note emphasis will add a richness of tone normally lacking. Needle scratch in the case of worn records is reduced to a very low level whilst needle chatter is extremely low.

By combining the qualities of the reproducing head with the wide range of the tone controls, pleasing reproduction can be obtained with almost any style of room furnishing.

To return to the real high fidelity enthusiast, the " Emperor " caters adequately for the connoisseur, alternative heads are available which provide the highest degree of fidelity available and no modifications are necessary to use them.

The AG3010 has two needle points, one for 78 R.P.M., and one for Micro-groove records (33 1/3rd and 45 R.P.M.). For even higher quality two separate heads can be used, the AG3012 for 78 R.P.M., and the AG3013 for Micro-groove recordings. The graph in Fig. 5a shows the frequency response obtained from an AG3012 head, when playing a standard f.f.r.r. (Decca) recording. Where the low note emphasis is not required the filter shown can be used. Normally the " Emperor ' controls will cope with this. The AG3013 reproducer on long playing or micro-groove recordings is shown on Fig. 5b. (A.E.S. characteristic). High note pre-emphasis is not suppressed by this head and any deficiences in the loud speaker can if necessary be made up.

The output voltages are as follows:—

AG 3010	...	...	0db = 1.0 volt at 3 cm/sec.
AG 3012 & AG3013		...	0db = 0.7 volt at 3 cm/sec.

LOUDSPEAKER

A good 10″ speaker should be chosen, and the constructor must decide for himself how much he can afford to pay. The speaker specified is not expensive, but it has an extremely fine performance.

POWER UNIT

A separate power supply is housed in the lower part of the cabinet. It is a conventional full-wave circuit using resistance smoothing, which avoids the cost of a large choke.

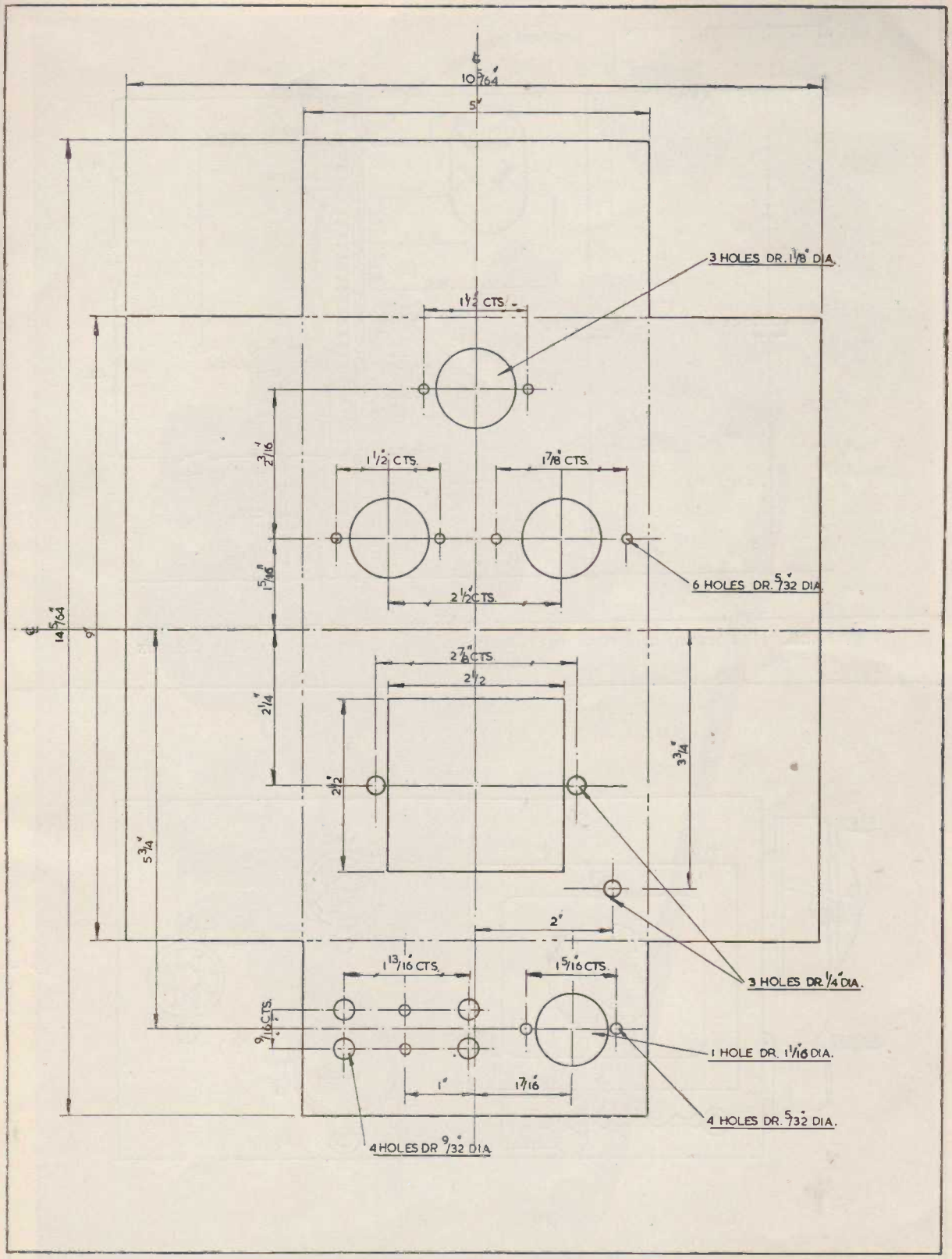


Fig. 6 Chassis dimensions for the Power Unit

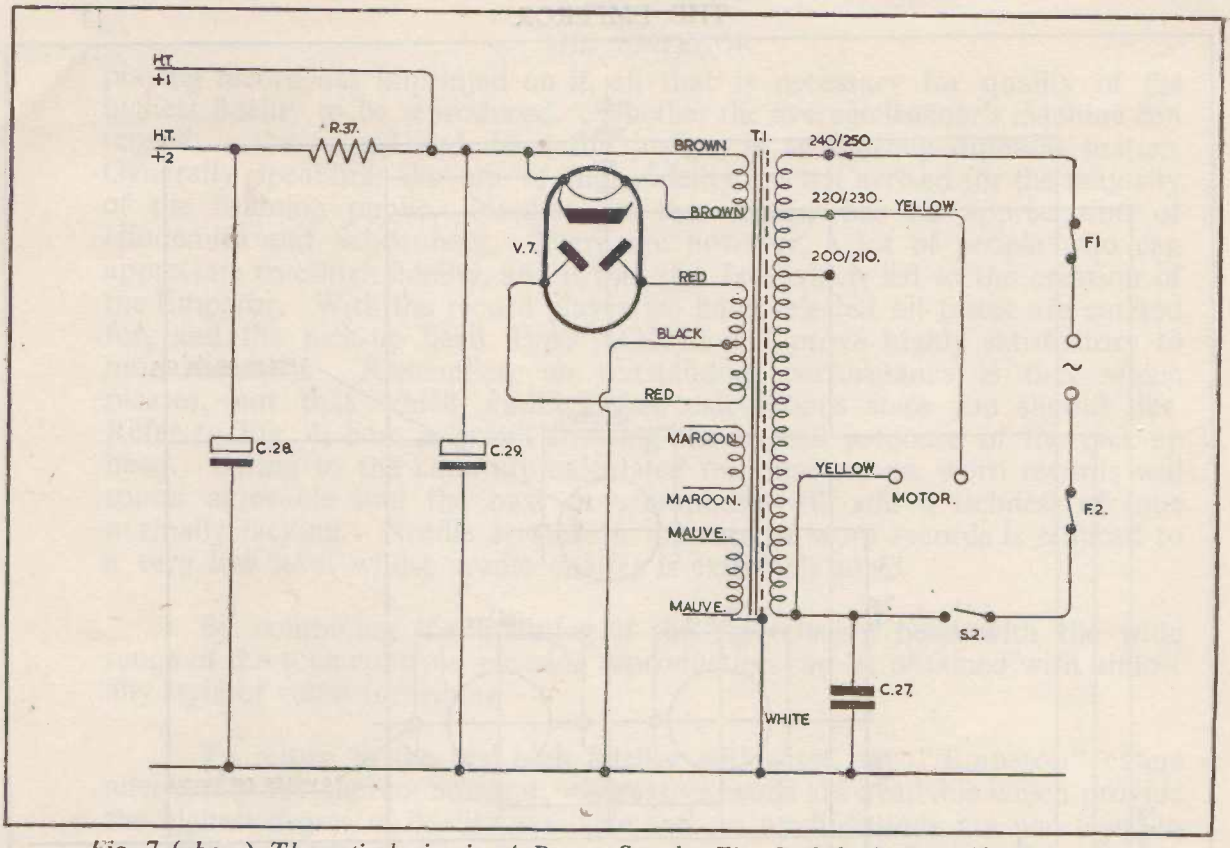
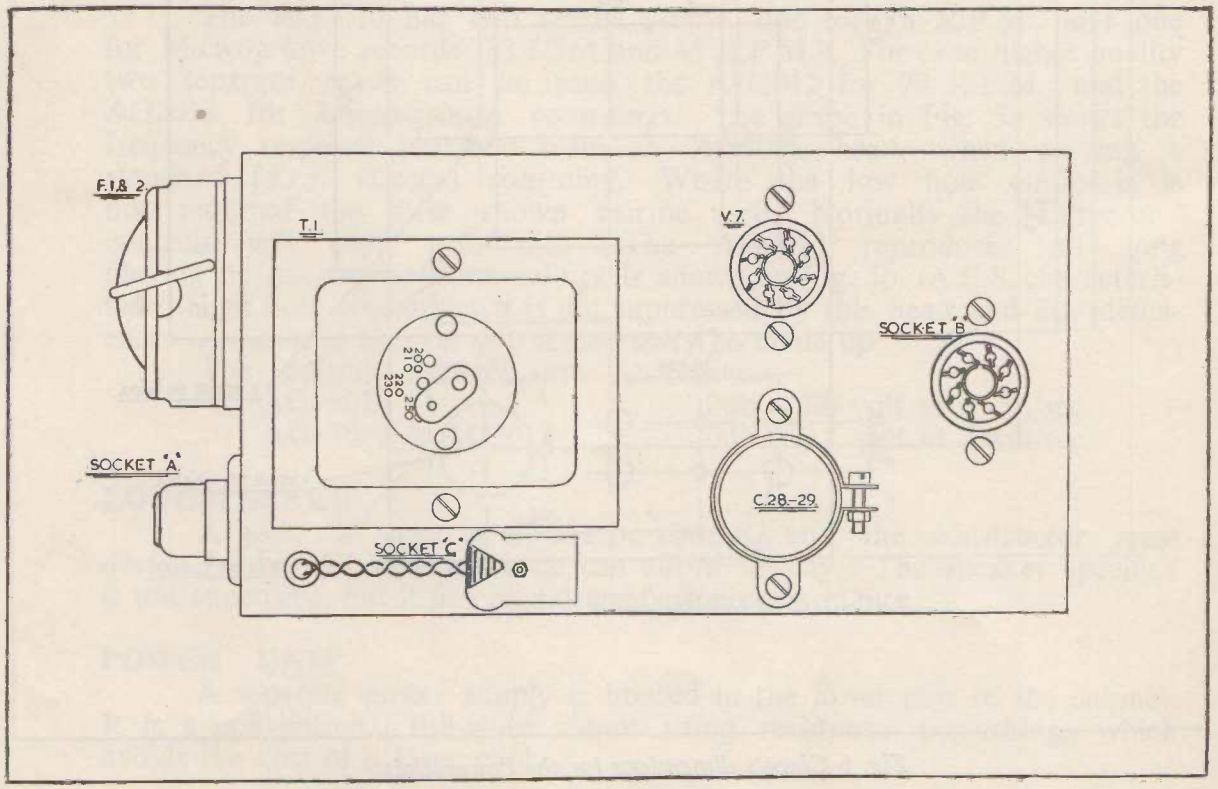


Fig. 7 (above) Theoretical circuit of Power Supply. Fig. 8 (below) Top Chassis Layout.



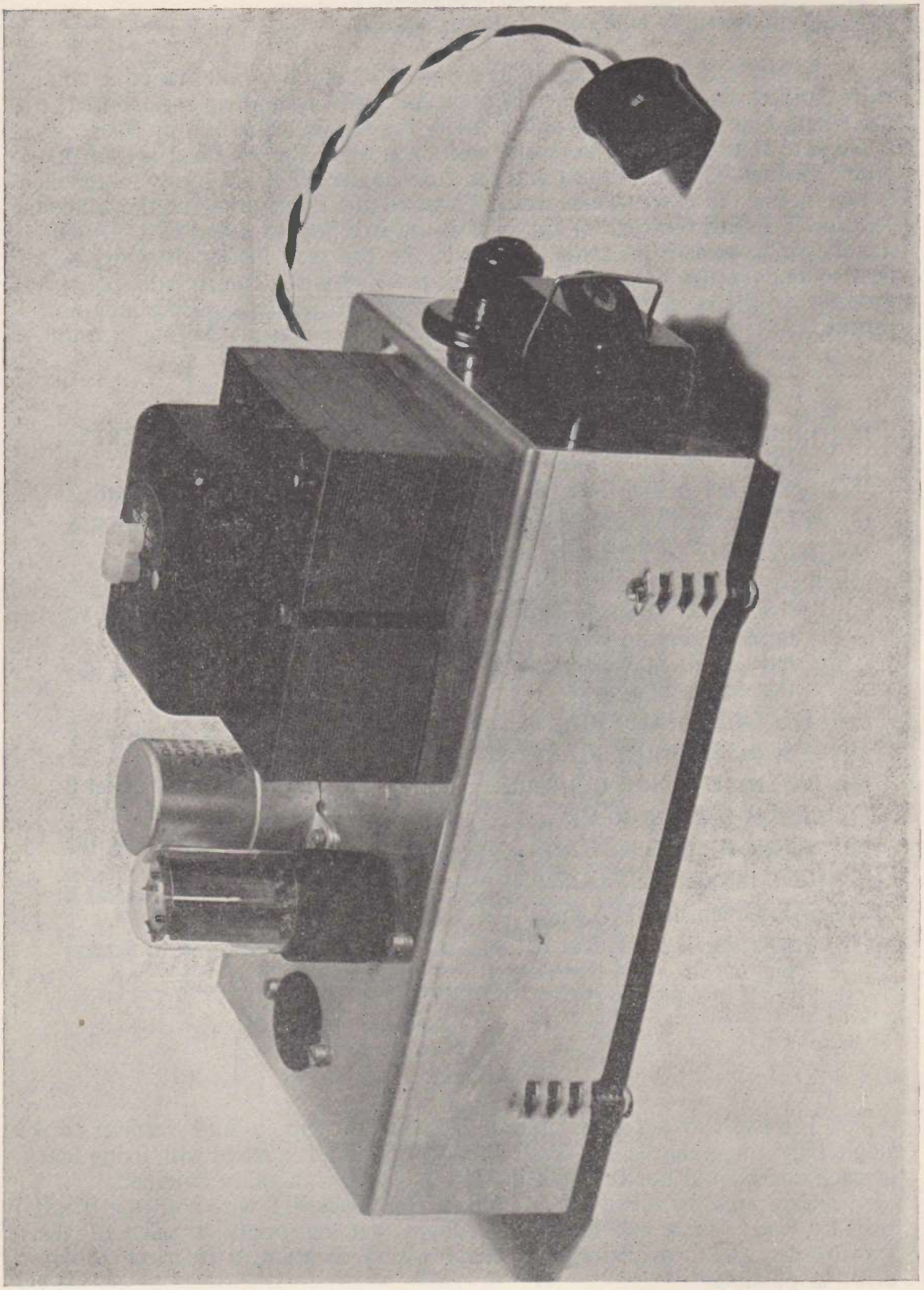


Fig. 9 The Completed Power Supply

Power-pack assembly and Point-to-Point wiring.

Mount **C28-29** by means of its fixing clip, the two international octal valve holders for **V7** and **Socket B,** note that a 5 way tagstrip is anchored to one fixing bolt on V7 holder and a solder tag to one fixing bolt on Socket B, make sure that the spigot keys are positioned as in the practical layout diagram. **Socket A** (mains input) and the fuse holder **Fl/2** are now mounted. Lastly mount the power transformer **T1,** make sure the lettering on the voltage selector is facing the rear of the chassis towards Socket A and Fl/2. Up-end the chassis to present the same view as in the practical layout drawing, it is best to remove the voltage selector plug until wiring is completed. Insert a grommet in the hole in the left hand corner of the chassis. Wiring may now proceed, references and codings are marked on the practical wiring diagram.

(1) Connect **Socket A** No. 1, to **Fl/2** Tag D.
(2) **Socket A** No. 2, to **Fl/2** tag A.
(3) **F1/2** tag B, to **Socket B** tag 6.
(4) **F1/2** tag C, to **T1. Black.**
(5) Pass **Yellow** leads 1 and 2 from **T.1** through grommeted hole and connect to flat 2-pin 5 Amp. socket, this forms **Socket C.**
(6) **T.1. 1st Brown,** to **V.7,** tag 2.
(7) **T.1, 2nd Brown,** to **V.7,** tag 8.
(8) **V.7,** tag 8, to **Socket B,** tag 1.
(9) **Socket B,** tag 1, to **C29.**
(10) **Socket B,** tag 2, **to C28.**
(11) **C28,** through **R37** to **C29.**
(12) **T.1. Green,** to **TS/A,** tag 1.
(13) **TS/A,** tag 1, to **Socket B,** tag 7.
(14) **TS/A,** tag 1, through **C27** to **TS/A** tag 2.
(15) **T.1. White,** to **TS/A** tag 2.
(16) Strap **TS/A** tag 2, to **TS/A** tag 3 (chassis).
(17) **T.1. 1st Red HT,** to **V7** tag 4.
(18) **T.1. 2nd Red HT,** to **V7** tag 6.
(19) **T.1. Black HT,** to **TS/A** tag 3.
(20) **T.1. 1st Mauve,** to **Socket B** tag 8.
(21) **T.1. 2nd Mauve,** to **Socket B** tag 3.
(22) **Socket B** tag 8, to **solder tag** on fixing bolt.
(23) **T.1. 1st Maroon,** to **Socket B** tag 4.
(24) **T.1. 2nd Maroon,** to **Socket B** tag 5.

NOTES.

The five-way tag strips used on this power supply and receiver are single tag fixing—that is, tag 3 is bolted to chassis. Tag strips with fixing tags at each end should not be used unless the wiring is suitably modified.

Care must be taken not to confuse **T.1 Black HT** wire with the Black primary lead. These two leads are brought out on opposite sides of the transformer and provided the practical wiring diagram is referred to no error is possible.

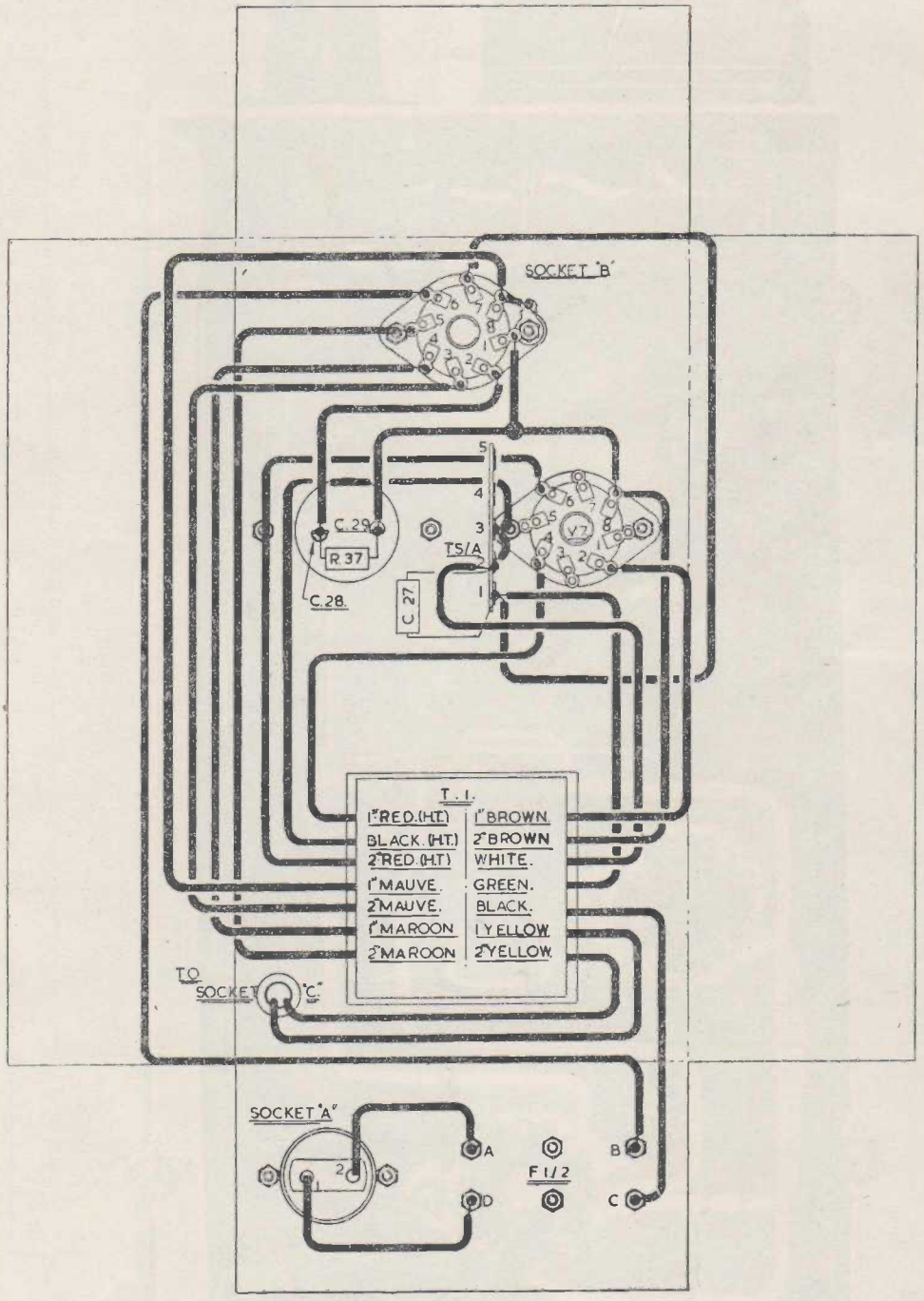


Fig. 10 Practical wiring of Power Pack

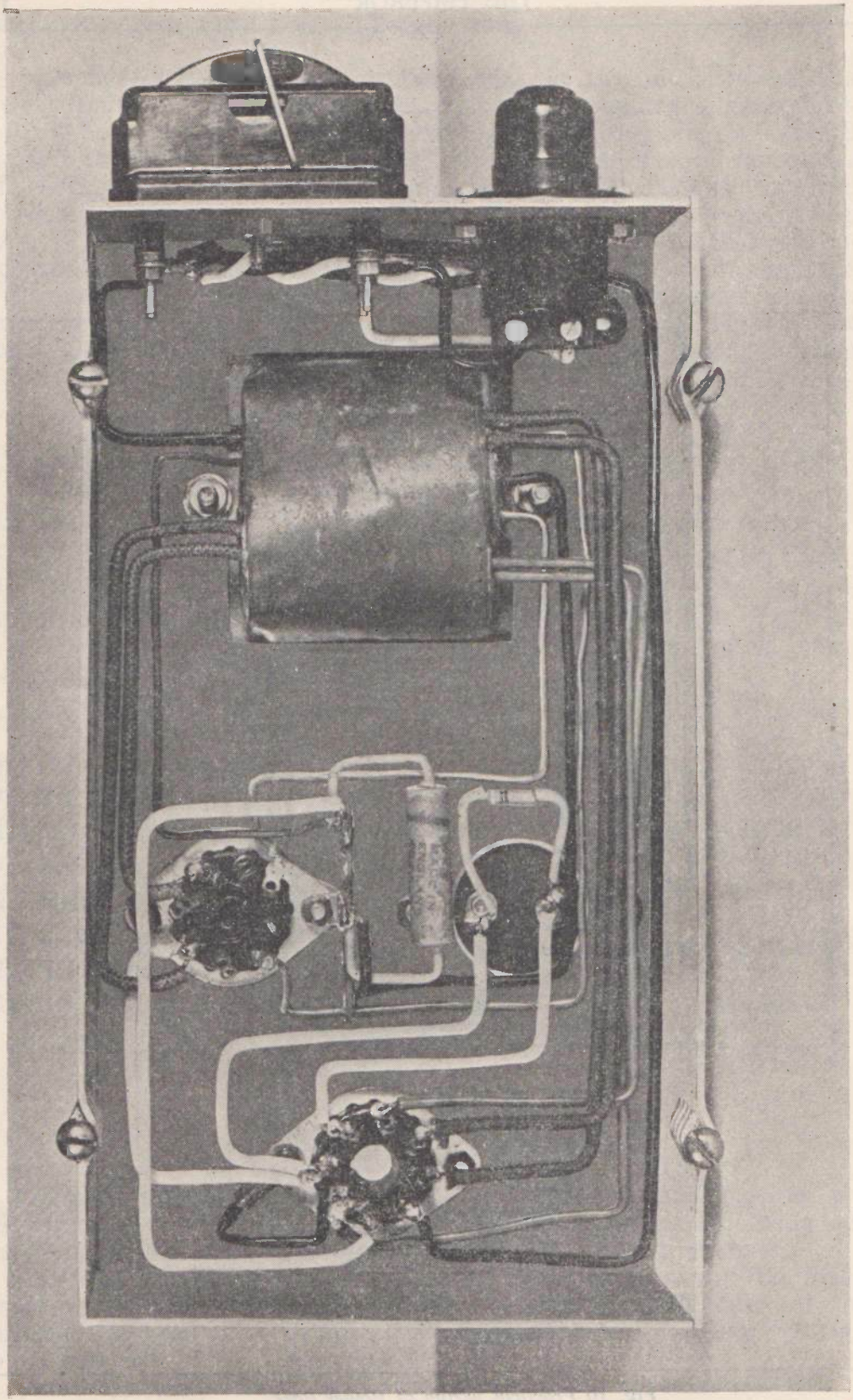


Fig. 11 *Underchassis wiring of Power Pack*

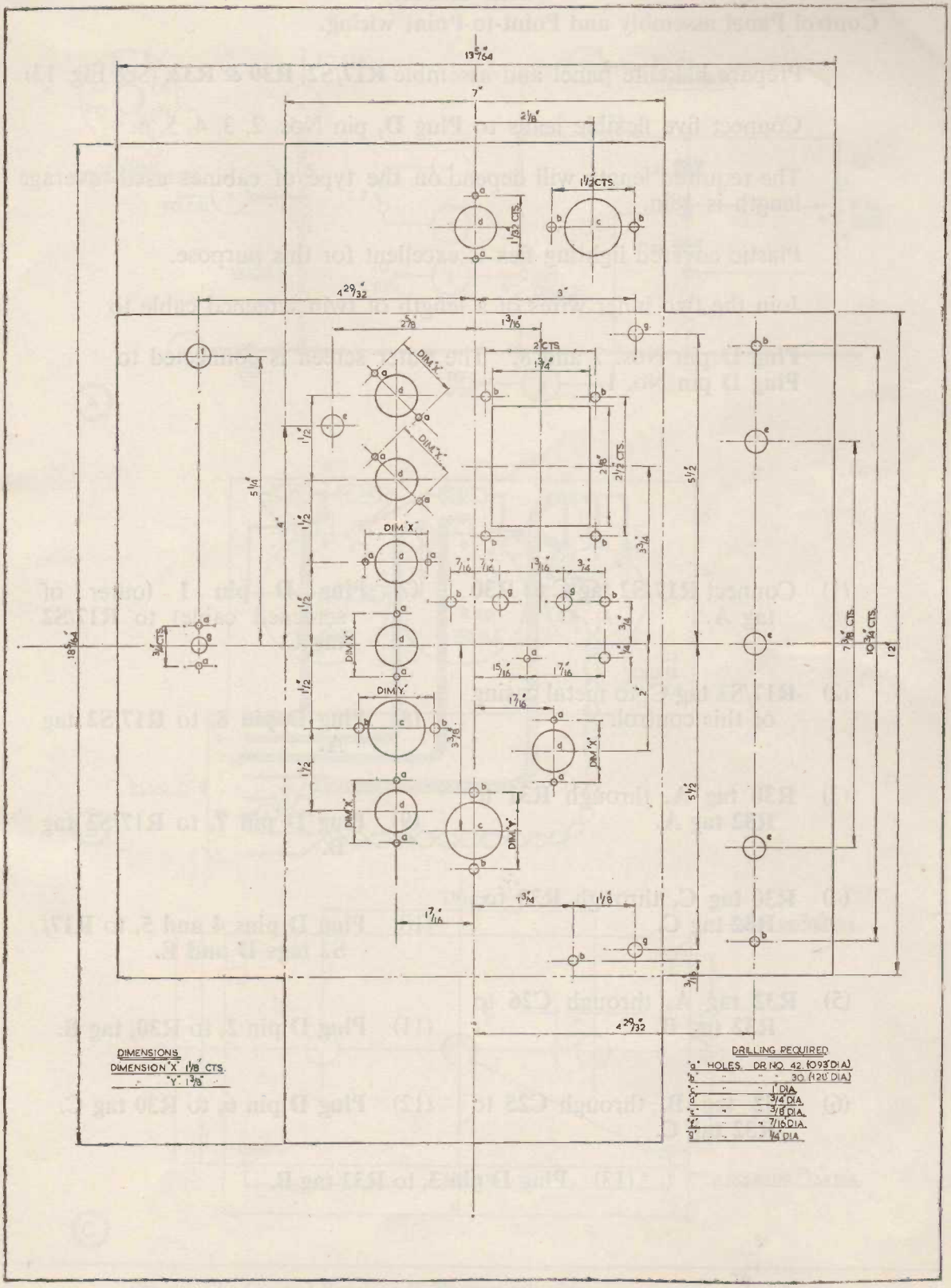


Fig. 12 Receiver Chassis Dimensions

Control Panel assembly and Point-to-Point wiring.

Prepare bakelite panel and assemble **R17/S2, R30 & R32.** (See Fig. 13).

Connect five flexible leads to **Plug D,** pin Nos. 2, 3, 4, 5, 6.

The required length will depend on the type of cabinet used, average length is 18in.

Plastic covered lighting flex is excellent for this purpose.

Join the two inner wires of a length of twin screened cable to

Plug D pin Nos. 7 and 8. The outer screen is connected to **Plug D** pin No. 1.

(1) Connect **R17/S2 tag C** to **R30 tag A.**

(2) **R17/S2 tag C,** to metal casing of this control.

(3) **R30 tag A,** through **R31** to **R32 tag A.**

(4) **R30 tag C,** through **R33** to **R32 tag C.**

(5) **R32 tag A,** through **C26** to **R32 tag B.**

(6) **R32 tag B,** through **C25** to **R32 tag C.**

(7) **Plug D pin 1** (outer of screened cable) to **R17/S2 tag C.**

(8) **Plug D pin 8,** to **R17/S2 tag A.**

(9) **Plug D pin 7,** to **R17/S2 tag B.**

(10) **Plug D pins 4 and 5,** to **R17/S2 tags D and E.**

(11) **Plug D pin 2,** to **R30, tag B.**

(12) **Plug D pin 6,** to **R30 tag C.**

(13) **Plug D pin 3,** to **R32 tag B.**

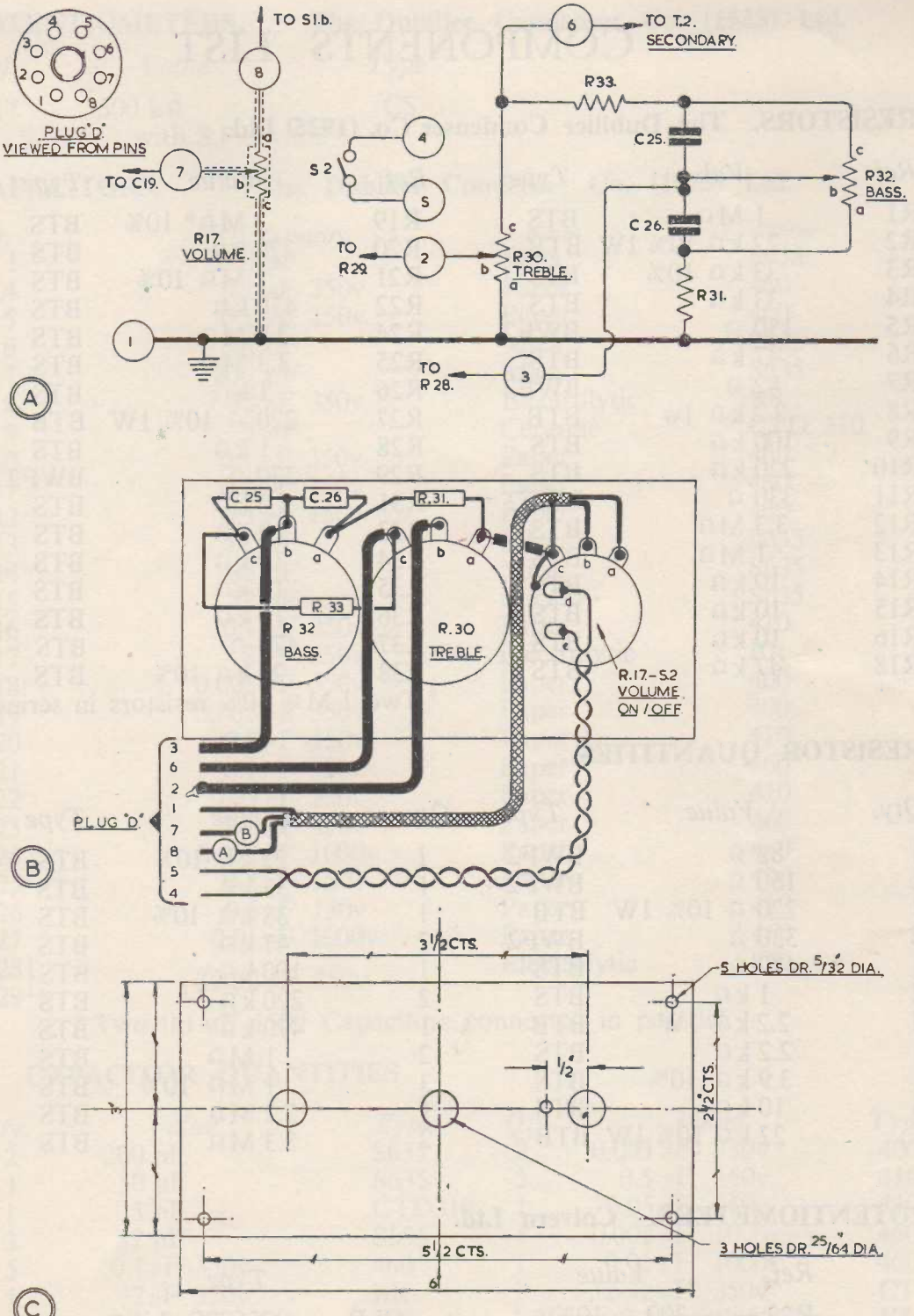


Fig. 13 The Control Panel (*A*) *Theoretical wiring*
(*B*) *Practical wiring*
(*C*) *Drilling Details*

COMPONENTS LIST

RESISTORS. The Dubilier Condenser Co. (1925) Ltd.

Ref.	*Value*	*Type*	*Ref.*	*Value*	*Type*
R1	1 MΩ	BTS	R19	2 MΩ* 10%	BTS
R2	22 kΩ 10% 1W	BTB	R20	220 kΩ	BTS
R3	33 kΩ 10%	BTS	R21	1 MΩ 10%	BTS
R4	33 kΩ	BTS	R22	470 kΩ	BTS
R5	150 Ω	BWF2	R24	2.2 MΩ	BTS
R6	47 kΩ	BTS	R25	3.3 MΩ	BTS
R7	82 Ω	BWF2	R26	1 kΩ	BTS
R8	2.2 kΩ 1w	BTB	R27	220 Ω 10% 1W	BTB
R9	100 kΩ	BTS	R28	1 kΩ	BTS
R10	220 kΩ	BTS	R29	330 Ω	BWF2
R11	330 Ω	BWF2	R31	2.2 kΩ	BTS
R12	3.3 MΩ	BTS	R33	3.9 kΩ	BTS
R13	1 MΩ	BTS	R34	10 kΩ	BTS
R14	10 kΩ	BTS	R35	10 kΩ	BTS
R15	10 kΩ	BTS	R36	10 kΩ	BTS
R16	10 kΩ	BTS	R37	470 Ω	BTS
R18	47 kΩ	BTS	R38	22 kΩ 10%	BTS

* Two 1 MΩ 10% resistors in series.

RESISTOR QUANTITIES

Qty.	*Value*	*Type*	*Qty.*	*Value*	*Type*
1	82 Ω	BWF2	1	22 kΩ 10%	BTS
1	150 Ω	BWF2	1	33 kΩ	BTS
1	220 Ω 10% 1W	BTB	1	33 kΩ 10%	BTS
2	330 Ω	BWF2	2	47 kΩ	BTS
1	470 Ω	BTS	1	100 kΩ	BTS
2	1 kΩ	BTS	2	220 kΩ	BTS
1	2.2 kΩ 1W	BTB	1	470 kΩ	BTS
1	2.2 kΩ	BTS	2	1 MΩ	BTS
1	3.9 kΩ 10%	BTS	3	1 MΩ 10%	BTS
6	10 kΩ	BTS	1	2.2 MΩ	BTS
1	22 kΩ 10% 1W	BTB	2	3.3 MΩ	BTS

POTENTIOMETERS. Colvern Ltd.

Ref.	*Value*	*Type*		
R23	300 Ω 10%	CLR	905C/9S	Linear
R30	1 kΩ	CLR	4001/15	Linear
R32	20 kΩ	CLR	4001/15	Linear

COMPONENTS LIST—continued

POTENTIOMETERS. The Dubilier Condenser Co. (1925) Ltd.

Ref.	*Value*	*Type*
R17	500 kΩ with S.P. switch	CS

CAPACITORS. The Dubilier Condenser Co. (1925) Ltd.

Ref.	*Capacity*	*Form*	*Type*
C 1	200 pF	Mica	S635
C 4	0.1 μF 350v	Paper	460
C 5	0.1 μF 150v	Paper	460
C 6	50 pF	Mica	S635
C 7	200 pF	Mica	S635
C 8	32 μF 350v	Electrolytic	BR
C 9	5 pF	Ceramic	CTD 310
C10	0.1 μF 350v	Paper	460
C11	0.1 μF 150v	Paper	460
C12	0.1 μF 150v	Paper	460
C13	82 pF	Mica	S635
C14	82 pF	Mica	S635
C15	82 pF	Mica	S635
C16	0.1 μF 350v	Paper	410
C17	8 μF 250v	Electrolytic	BR
C18	0.003 μF 350v	Paper	400
C19	0.003 μF 350v	Paper	400
C20	0.5 μF 150v	Paper	410
C21	0.1 μF 350v	Paper	460
C22	0.05 μF 250v	Paper	410
C23	0.1 μF 350v	Paper	460
C24	0.002 μF 1000v	Paper	460
C25*	0.2 μF 150v	Paper	410
C26	0.5 μF 150v	Paper	410
C27	0.01 μF 1000v	Paper	460
C28} C29}	32-32 μF 350v	Electrolytic	CT

* Two 0.1 uF 150v Capacitors connected in parallel.

CAPACITOR QUANTITIES

Qty.	*Value*	*Type*	*Qty.*	*Value*	*Type*
2	200 pF	S635	2	0.003 μF 350v	400
1	50 pF	S635	2	0.5 μF 150v	410
1	5 pF	CTD310	1	0.05 μF 250v	410
3	82 pF	S635	1	0.002 μF 1000v	460
5	0.1 μF 350v	460	1	0.01 μF 1000v	460
1	32 μF 350v	BR	1	32-32 μF 350v	CT
5	0.1 μF 150v	410	1	Vertical Mounting Clip	V3.
1	8 μF 250v	BR			

COMPONENTS LIST—continued

Valve-holders. Plugs and Sockets		McMurdo Instrument Co. Ltd.
4	B8A	Type BM8/E
1	B9A	Type BM9/UC.1
1	B9A	Type BM9/U
3	Int. Octal	Type B8/U
2	Octal plugs and covers.	Type BL8/USP
1	Screening Can.	Type 75
1	3 pin plug.	Type AA3/UB
1	3 pin socket.	Type B3/US.

	Coils & Transformers.		Manufacturer.
L1-6	Coil Pack	Type CP3/500.	Denco (Clacton) Ltd.
I.F.T.1	1st I.F. Trans.	Type 158,	Allen Components Ltd.
I.F.T.2	2nd I.F. Trans.	Type I.F.T.6. or	Denco (Clacton) Ltd.
T1	Mains Transformer.	Type MT 16A	Denco (Clacton) Ltd.
		Pri. 200/250v.	
		Sec. 250-0-250v. 100mA.	
		5v. 2A	
		6.3v. 2A	
		6.3v. 1.5A	
T2	Output trans.	Type OP5A.	Denco (Clacton) Ltd.

Valves.	Mullard Ltd.		
2	EF 80	1	GZ 30
2	EL 41	1	ECH 42
1	EAF 42		

Switch.	Walter Instruments.
1	2 pole change over rotary Type TD.

Record Changer.	Philips Electrical Ltd.
1	Changer Type AG 1000 G/OOS
1	High Fidelity head Type AG 3012.
1	High Fidelity head Type AG 3013.

Loud Speaker	Whiteley Electrical Radio Co. Ltd.
1	10in. 3Ω P.M. Type HF 1012.

Chassis.	Denco (Clacton) Ltd.
1	9in. x 5in. x 2½in. Type CH20.
1	12in. x 7in. x 3in. Type CH19.

COMPONENTS LIST—continued

TUNING CAPACITOR	TYPE	MANUFACTURER
C2 2 × 500pF		
C3	M G	Jackson Bros. (London) Ltd.
SPIN WHEEL DRIVE		
Cat. No. 4863	S.L.8	Jackson Bros. (London) Ltd.

SUNDRIES

11	5 way tag-strips	T.20	Bulgin
1	Plug and Socket	P.20	Bulgin
1	Twin fuse-holder	L1033/C3	Belling Lee
1	Co-ax socket	L734/S	Belling Lee
1	Co-ax plug	L734/P	Belling Lee
1	5 amp. plug	P28	Bulgin
1	5 amp. socket	P29	Bulgin
1	Radio-Gram Cabinet		Laskey's

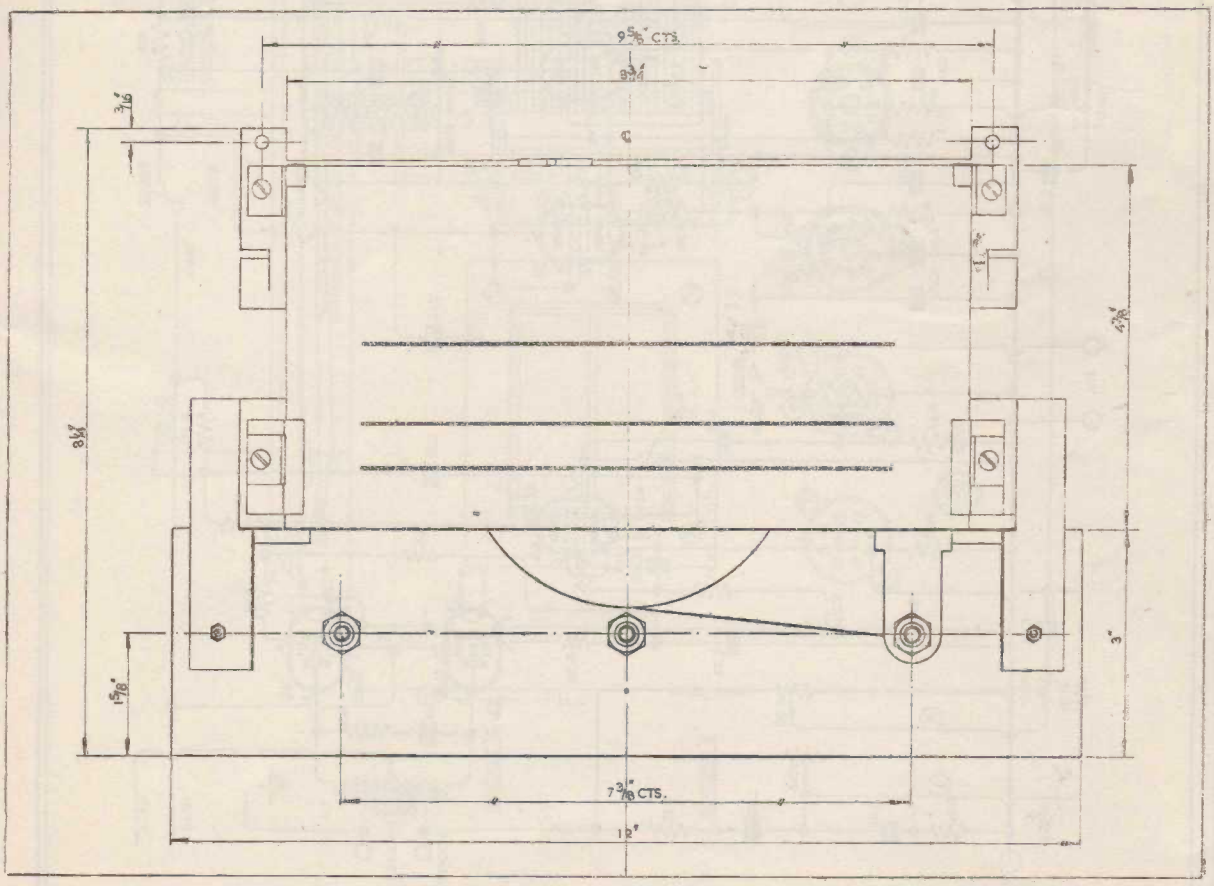


Fig. 14. Front of Chassis showing dial measurements.

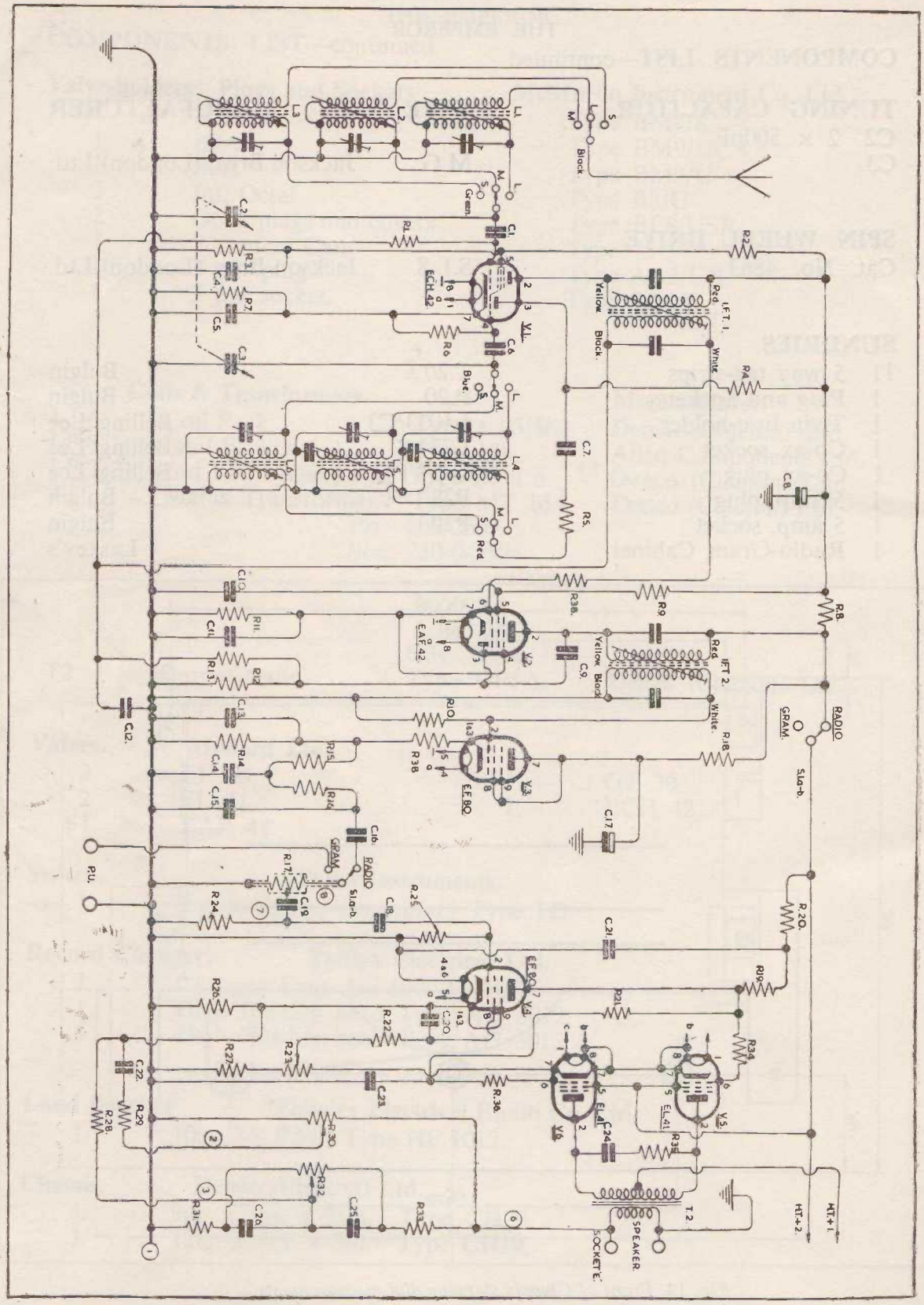


Fig. 15 Theoretical Diagram

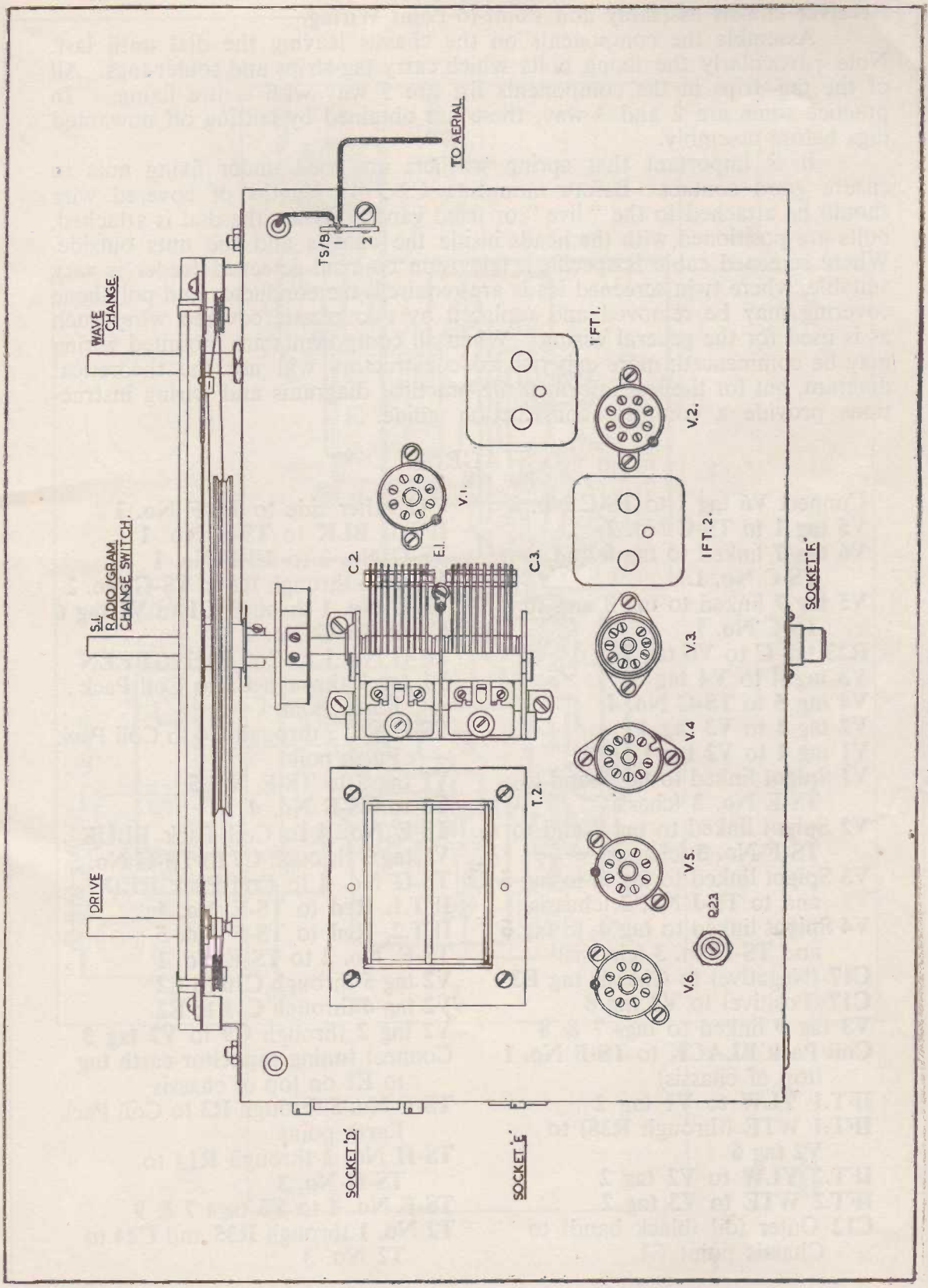


Fig. 16 Top Chassis Layout

Receiver chassis assembly and Point-to-Point Wiring.

Assemble the components on the chassis leaving the dial until last. Note particularly the fixing bolts which carry tag-strips and solder-tags. All of the tag-strips in the components list are 5 way with centre fixing. In practice some are 2 and 3 way, these are obtained by cutting off unwanted tags before assembly.

It is important that spring washers are used under fixing nuts to ensure good contact. Before mounting C2-3 4" lengths of covered wire should be attached to the " live " or fixed vanes. When the dial is attached, bolts are positioned with the heads inside the chassis and the nuts outside. Where screened cable is specified, television co-axial screened feeder is very suitable, where twin screened leads are required, the conductor and polythene covering may be removed and replaced by two plastic covered wires such as is used for the general wiring. When all components are mounted wiring may be commenced; more experienced constructors will use the theoretical diagram, but for the less informed the practical diagrams and wiring instructions provide a complete construction guide.

STAGE 1

Connect **V6 tag 1** to **TS-C No. 2**
V5 tag 1 to TS-C No. 2
V6 tag 7 linked to **tag 8** and to **TS-C No. 1.**
V5 tag 7 linked to **tag 8** and to **TS-C No. 1.**
R23 tag C to **V6 tag 7**
V3 tag 4 to **V4 tag 5**
V4 tag 5 to **TS-C No. 4**
V2 tag 1 to **V3 tag 4**
V1 tag 1 to **V2 tag 1**
V1 Spigot linked to **tag 8** and to **TS-E No. 3** (chassis)
V2 Spigot linked to **tag 8** and to **TS-F No. 3** (chassis)
V3 Spigot linked to **tag 6**, to **tag 5** and to **TS-J No. 3** (chassis)
V4 Spigot linked to **tag 4**, to **tag 6** and **TS-I No. 3** (chassis)
C17 (Negative) to Chassis tag **E3**
C17 (Positive) to **V3 tag 8**
V3 tag 9 linked to **tags 7 & 8**
Coil Pack BLACK to **TS-B No. 1** (top of chassis)
IFT.1 YLW to **V1 tag 2**
IFT.1 WTE (through **R38**) to **V2 tag 6**
IFT.2 YLW to V2 tag 2
IFT.2 WTE to V3 tag 2
C12 Outer foil (black band) to Chassis point E1
C12 other side to **TS-F No. 1**
IFT.1. BLK to **TS-F No. 1**
TS-G No. 2 to **TS-F No. 1**
V1 tag 6 through **R1** to **TS-G No. 2**
TS-G No. 1 through **C1** to **V1 tag 6**
C2 to TS-G No. 1
TS-G No. 1 to Coil Pack **GREEN**
V1 tag 7 through **C5** to Coil Pack **Earth** point
TS-E No. 5 through **C4** to Coil Pack **Earth** point
V1 tag 5 to **TS-E No. 5**
C3 to **TS-E No. 4**
TS-E No. 4 to Coil Pack **BLUE**
V1 tag 3 through **C7** to **TS-G No. 5**
TS-G No. 4 to Coil Pack **RED**
IFT.1. Red to **TS-E No. 1**
IFT.2. Red to **TS-F No. 5**
TS-F. No. 2 to **TS-E No. 1**
V2 tag 5 through **C10** to **E2**
V2 tag 4 through **C11** to **E2**
V2 tag 2 through **C9** to **V2 tag 3**
Connect **tuning capacitor earth tag** to **E1** on top of chassis
TS-E No. 5 through **R3** to Coil Pack **Earth** point
TS-H No. 2 through **R14** to **TS-H No. 3**
TS-F No. 4 to **V3 tags 7 & 9**
T2 No. 1 through **R35** and **C24** to **T2 No. 3**

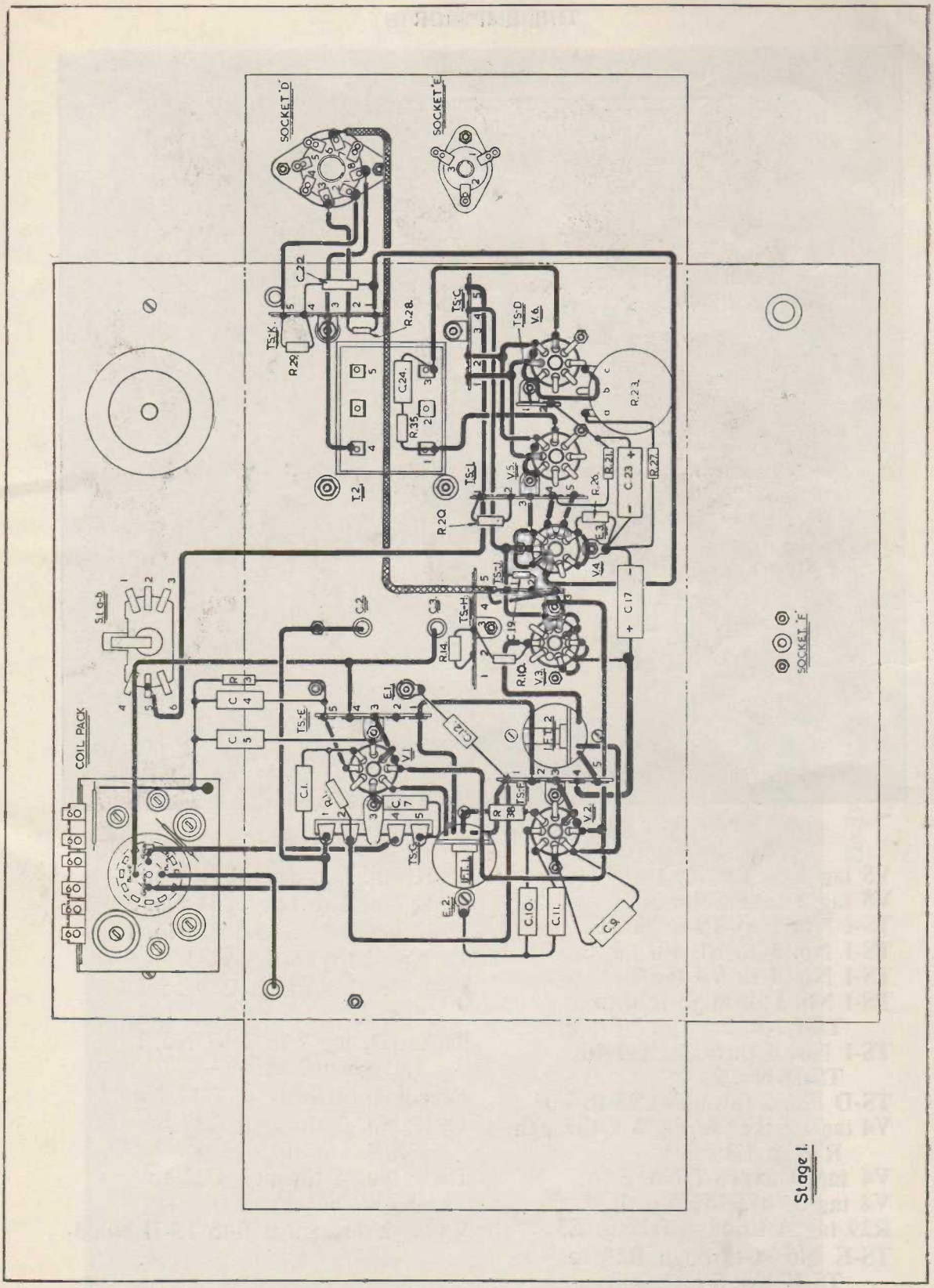


Fig. 17 Practical Wiring Stage 1

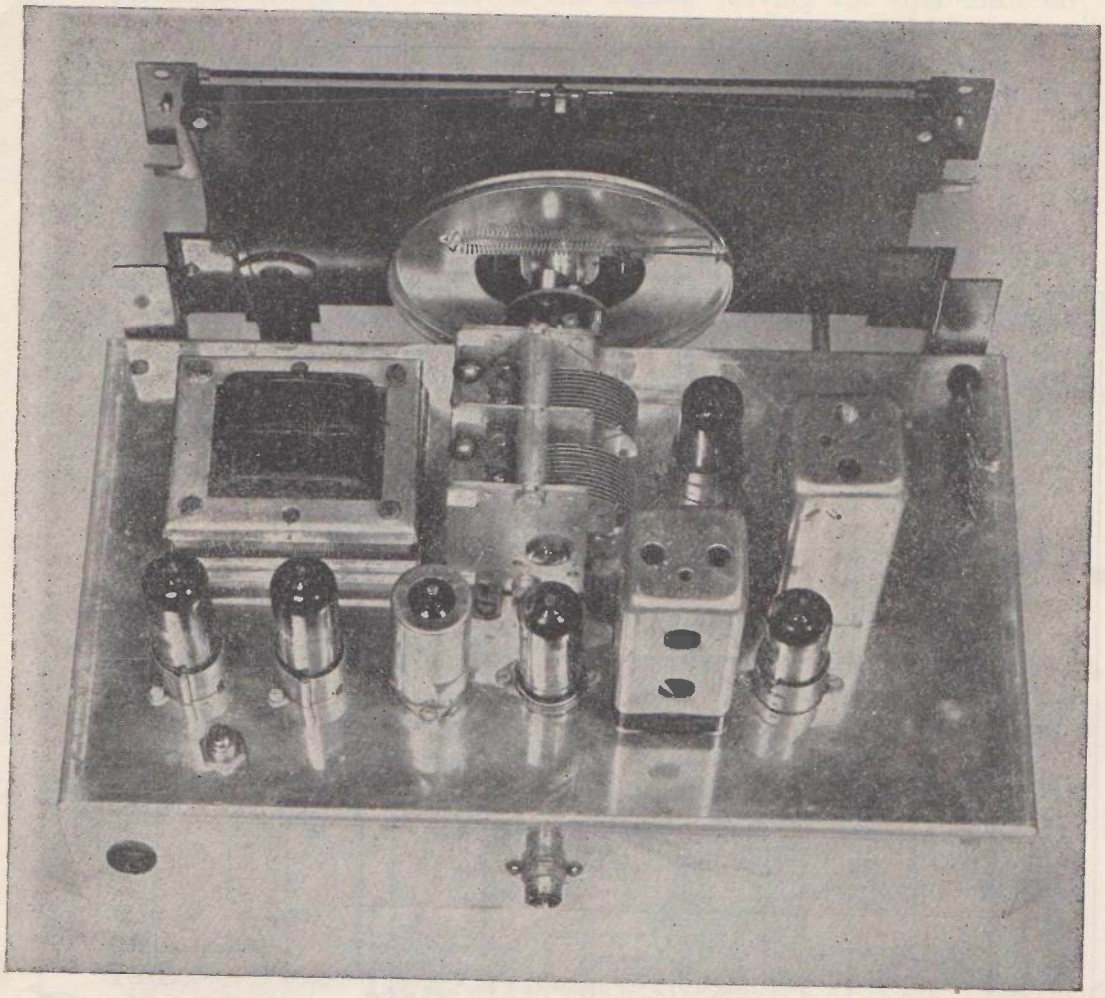


Fig. 18

V5 tag 2 to **T2 No. 1**
V6 tag 2 to **T2 No. 3**
TS-I No. 1 to **TS-C No. 5**
TS-I No. 1 to **S1 a-b tag 5**
TS-I No. 4 to **V4 tag 7**
TS-I No. 1 through **R20** to **TS-I No. 2**
TS-I No. 4 through **R21** to **TS-D No. 2**
TS-D No. 2 through **C23** to **E3**
V4 tag 1 linked to **tag 9** & through **R26** to **E3**
V4 tag 8 to **TS-I No. 5**
V4 tag 3 to **TS-K No. 1**
R29 tag A through **R27** to **E3**
TS-K No. 4 through **R29** to **TS-K No. 5**
TS-K No. 5 to **Socket D No. 2**
TS-K No. 2 to **Socket D No. 3**
TS-K No. 3 to **Socket D No. 1**
T2 No. 4 to **TS-K No. 3**
TS-J No. 2 through **C19** to **TS-J No. 1**
Socket D, tag 7 to **TS-J No. 1**
in screened cable :—
screening earthed to TS-J No. 3
TS-K No. 2 through **R28** to **TS-K No. 1**
TS-K No. 4 through **C22** to **TS-K No. 1**
V3 tag 2 through **R10** to **TS-H No. 3**

STAGE 1 COMPLETE

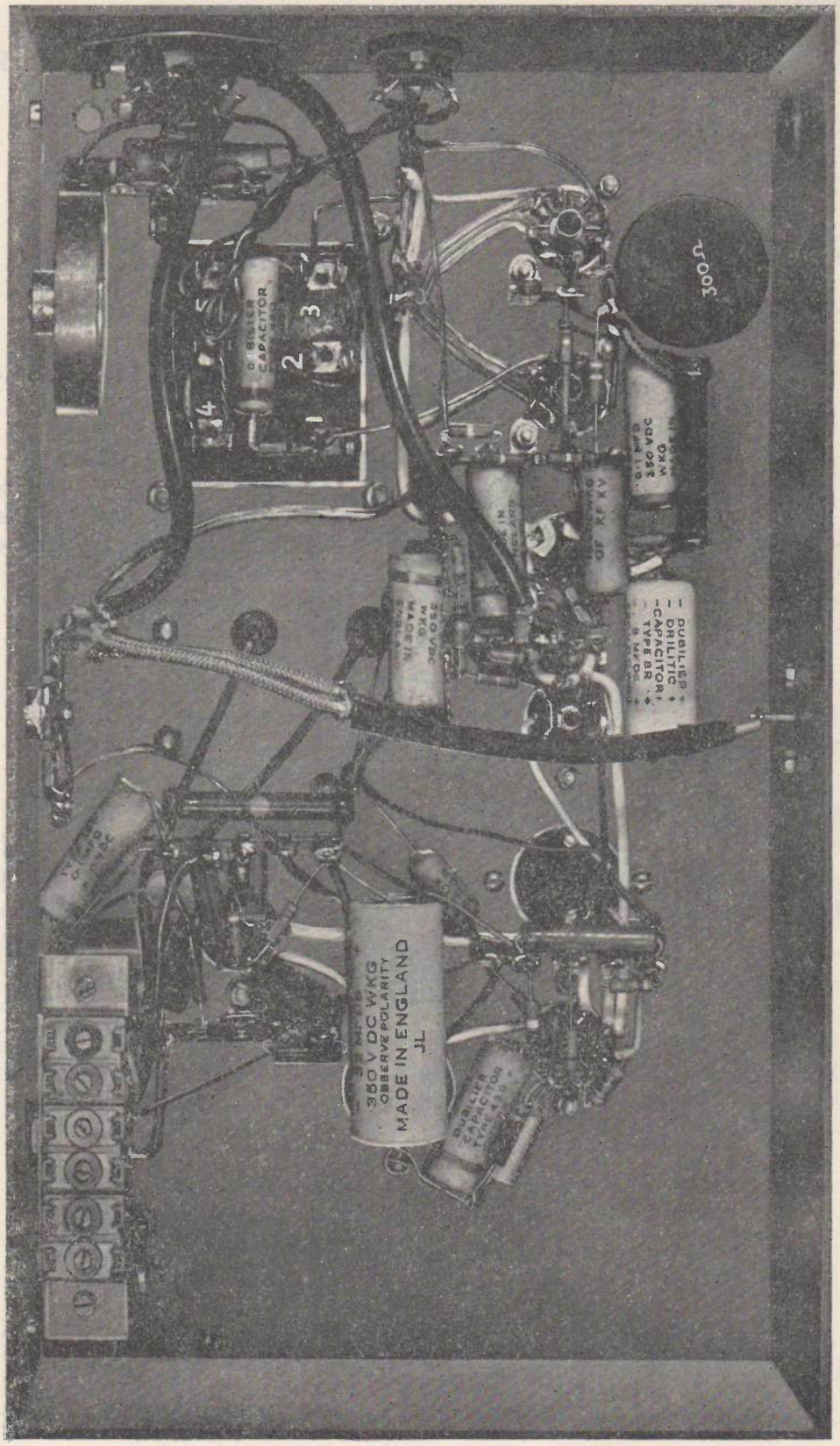


Fig. 19 Underchassis view of Receiver

PRACTICAL WIRING STAGE 2

V5 tag 6 through **R34** to **TS-I No. 4**
TS-I No. 2 through **C21** to **TS-J No. 3**
TS-I No. 2 through **R19** to **TS-I No. 4**
R23 tag b through **R22** to **TS-I No. 5**
TS-I No. 5 through **C20** to **V4 tag No. 1**
V5 tag 5 to **V6 tag 5** and to **TS-C No. 5**
V1 tag 4 through **C6** to **TS-E No. 4**
V1 tag 7 through **R6** to **V1 tag 4**
TS-G No. 5 through **R5** to **TS-G No. 4**
TS-E No. 1 through **C8** to **E2**
TS-F No. 2 through **R8** to **TS-F No. 5**
TS-F No. 5 to **TS-E No. 2** and to **S1 a-b tag 4**
V2 tag 3 through **R12** to **TS-F No. 3**
V2 tag 3 through **R13** to **TS-F No. 1**
TS-E No. 5 through **R2** to **TS-E No. 1**
V1 tag 3 through **R4** to **TS-E No. 1**
V1 tag 7 through **R7** to **TS-E No. 3**
V2 tag 4 through **R11** to **E2**
V2 tag 5 through **R9** to **TS-F No. 2**
IFT 2 Black to **E1**
V3 tags 1 and **3** linked through **R38** to **TS-H No. 2**
TS-H No. 2 through **R15** to **TS-H No. 4**
TS-H No. 4 through **R16** to **TS-H No. 5**
TS-H No. 2 through **C13** to **E1**
TS-H No. 4 through **C14** to **E1**
TS-H No. 5 through **C15** to **E1**
TS-H No. 5 through **C16** to **TS-H No. 1**
TS-H No. 1 Via screened lead to **S1 a-b tag 3**
Earth Screening at **E1**
TS-F No. 5 through **R18** to **TS-F No. 4**
V4 tag 2 through **R25** to **TS-J No. 3**
V4 tag 2 through **C18** to **TS-J No. 2**
T2 No. 5 to **Socket D No. 6**
S1 a-b No. 2 to **Socket D No. 8**
(Screened cable bonded to S1 a-b tag 1 screening)
T2 No. 4 to **Socket E No. 1**
T2 No. 5 to **Socket E No. 3**
TS-J No. 2 through **R24** to **TS-J No. 3**
Socket F to **S1 a-b tag 1** via screened lead
(Screening to be earthed to E1 by bonding the braiding)
V1 Pin 3 through **R4** to **TS-E No. 1**

Attach 8 single or 4 twin lengths of plastic covered flex to Plug B. These flexible wires should be approximately 18″ long and are connected to the main chassis as follows :—

Pin 1 to **T2 tag 2**
Pin 2 to **TS-C No. 5**
Pin 3 to **TS-C No. 4**
Pin 4 to **TS-C No. 2**
Pin 5 to **TS-C No. 1**
Pin 6 to **Socket D No. 4**
Pin 7 to **Socket D No. 5**
Pin 8 to **TS-D No. 3**

Wire up the pilot bulb holders in thin twin flex, feed through grommeted chassis hole by TS-K and connect to TS-C Nos. 3 and 4.

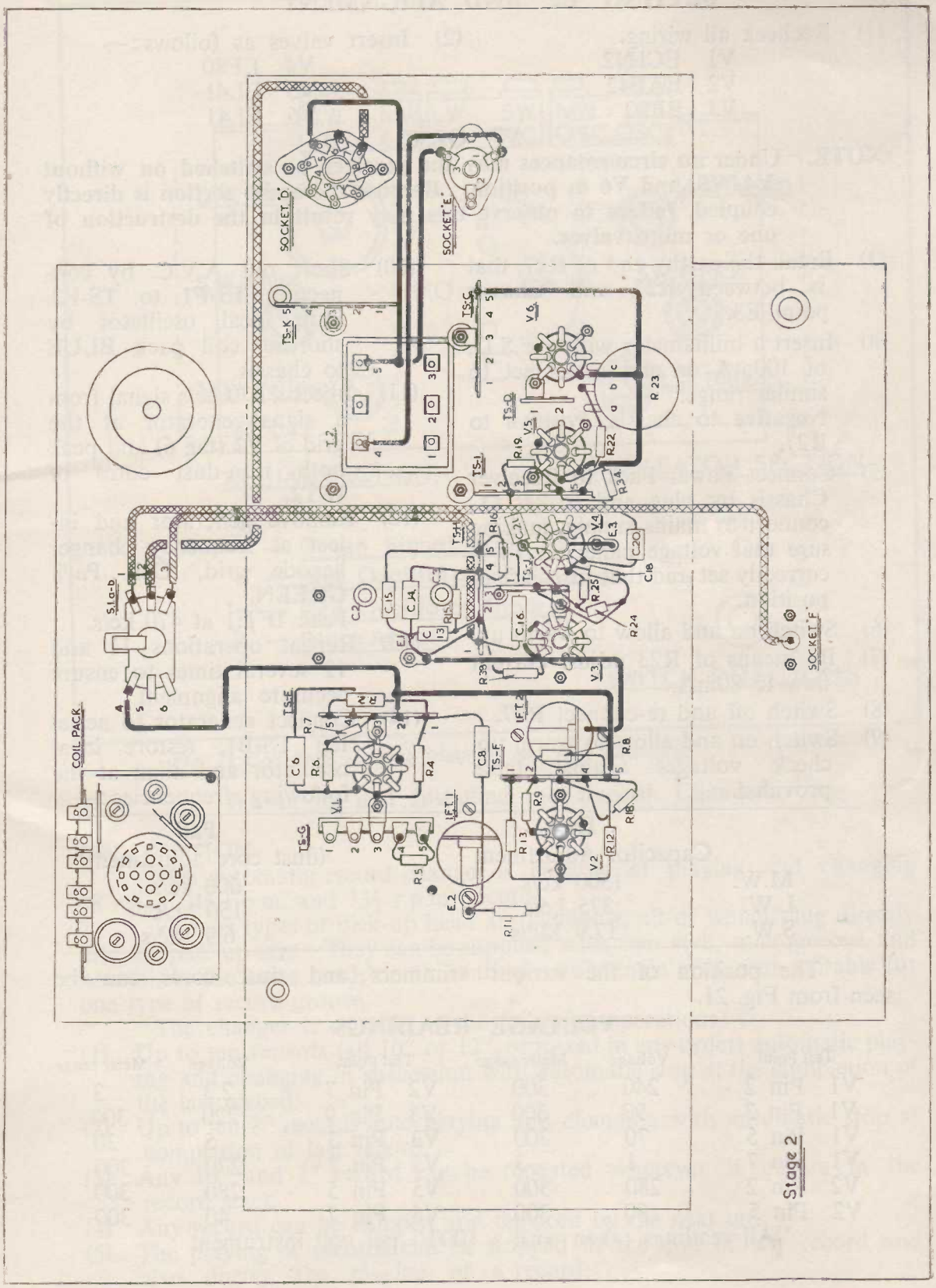


Fig. 20 Practical Wiring Stage 2

SETTING UP AND ALIGNMENT

(1) Recheck all wiring.

(2) Insert valves as follows:—

V1 ECH42
V2 EAF42
V3 EF80
V4 EF80
V5 EL41
V6 EL41
V7 GZ30

NOTE. Under no circumstances may the receiver be switched on without V4, V5, and V6 in position. Because the audio section is directly coupled, failure to observe this may result in the destruction of one or more valves.

(3) Break the earthy end of **R27,** that is between **R27** and Chassis point **E3.**

(4) Insert a milliameter with a F.S.D. of 100mA or multimeter set to similar range.
Negative to chassis, **Positive** to R27.

(5) Connect Power Pack to Receiver Chassis by plug and socket D., connect to mains supply, making sure that voltage panel on T1 is correctly set and that fuses are in position.

(6) Switch on and allow to warm up.

(7) By means of R23 adjust current flow to 80mA.

(8) Switch off and re-connect **R27.**

(9) Switch on and allow to warm up, check voltages against table provided.

(10) Short out A.V.C. by connecting **TS-F1** to **TS-F3.** Stop local oscillator by shorting coil pack **BLUE** to chassis.

(11) Inject a 470 kc/s signal from a signal-generator at the grid of **V2 (tag 6)** and peak both iron-dust cores of **IFT2.**

(12) Remove generator and inject at frequency changer hexode grid, Coil Pack **GREEN.**
Peak IFT.1 at 470 kc/s.

(13) Repeat operations 11 and 12 several times to ensure accurate alignment.

(14) Connect generator to aerial tag TS-B1, restore local oscillator and align at the following frequencies :—

	Trim Capacitor Adjustment	**Pad** (dust core adjustment)
M.W.	1500 kc/s	600 kc/s
L.W.	375 kc/s	150 kc/s
S.W.	17.9 Mc/s	6.9 Mc/s

The position of the various trimmers and dust cores can be seen from Fig. 21.

VOLTAGE READINGS

Test Point	Voltage	Meter range	Test Point	Voltage	Meter range
V1 Pin 2	240	300	V2 Pin 7	2.3	3
V1 Pin 3	90	300	V3 Pin 9	220	300
V1 Pin 5	70	300	V3 Pin 3	5	30
V1 Pin 7	1	3	V5 Pin 2	270	300
V2 Pin 2	280	300	V5 Pin 5	280	300
V2 Pin 5	80	300	V6 Pin 7	40	300

All readings taken with a 1000Ω per volt instrument

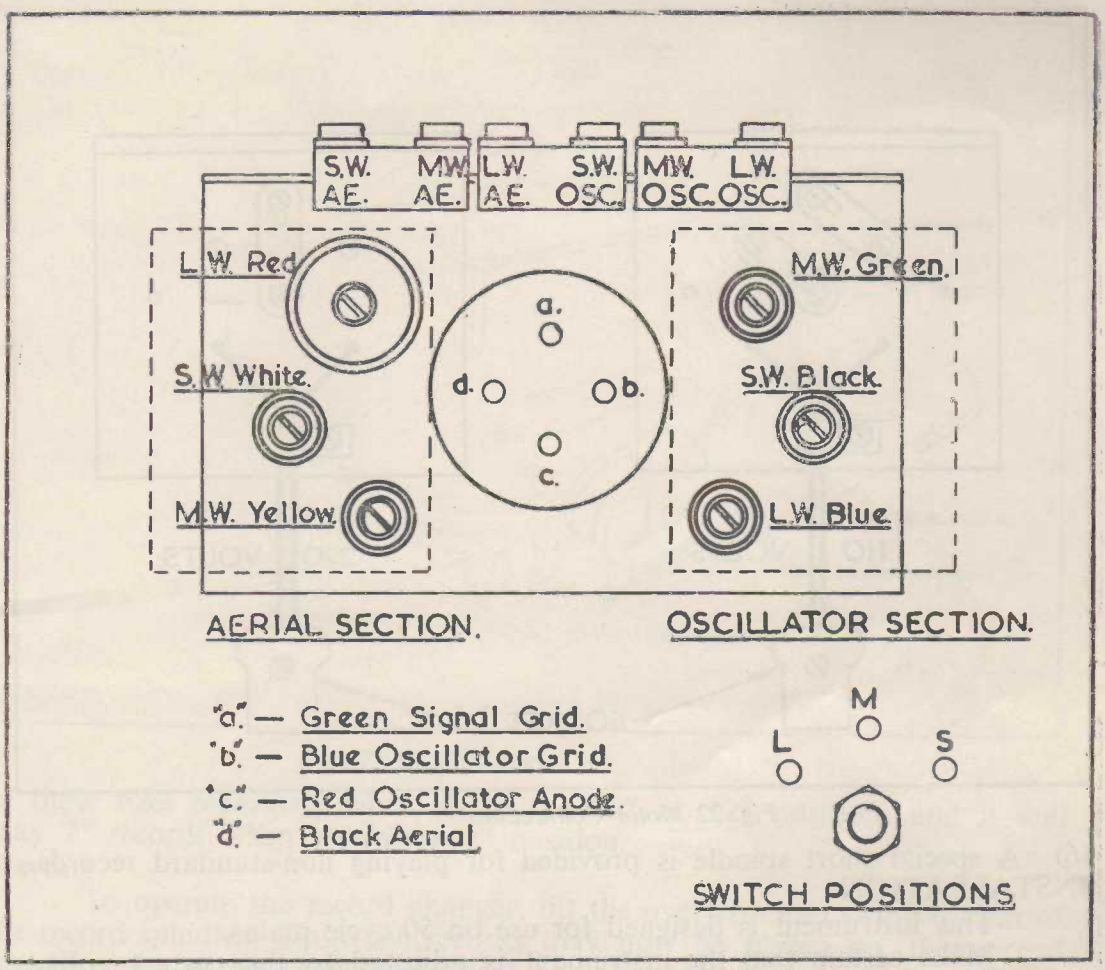


Fig. 21 *Coil Pack showing trimmers and Iron dust-cores*

Wiring up and Installing the Record Changer

DESCRIPTION

This automatic record changer is capable of playing and changing 78 r.p.m., 45 r.p.m. and 33⅓ r.p.m. records.

Various types of pick-up head are available, all of which plug directly into the pick-up arm. They can be supplied with two styli, microgroove and normal, in the same head, or alternatively with single styli, each suitable for one type of record groove.

The changer is capable of the following operations:—

(1) Up to ten records (all 10″ or 12″, or mixed in any order) automatic playing and changing in succession with automatic stop at the completion of the last record.
(2) Up to ten 7″ records auto playing and changing with automatic stop at completion of last record.
(3) Any 10″ and 7″ record can be repeated wherever it occurs in the record stack.
(4) Any record can be stopped and replaced by the next one.
(5) The playing of records can be stopped at the end of any record and also during the playing of a record.

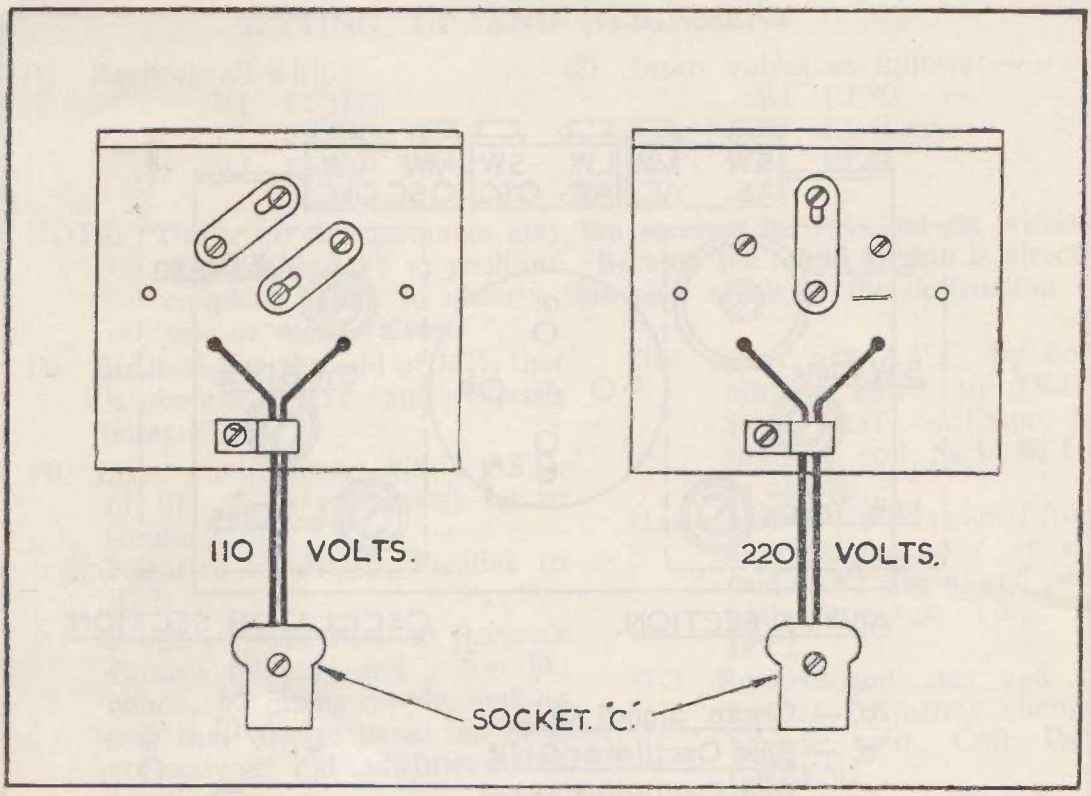


Fig. 22 Motor Connections

(6) A special short spindle is provided for playing non-standard records.

INSTALLATION

This instrument is designed for use on 50 cycle mains.

Make certain that the instrument is adjusted to the correct voltage (see Fig 22). The AG1000G is suitable for both 110 volts and 220 volts, and in this particular case the latter setting is required.

A drilling template with instructions for installation is provided with the changer.

OPERATION (see Fig. 23)

Before placing any records on the spindle, adjustment of the pick-up head, speed selector and record selector switches should be made.

Pick-up Head

These are marked in accordance with the stylus radius. The RED spot is suitable for microgroove, i.e. all long playing $33\frac{1}{3}$ and 45 r.p.m. records, whilst the GREEN spot is suitable for normal, i.e. 78 r.p.m. records.

Record Speed

The speed selector lever should be set to the correct speed according to the records which it is required to play. This must be done while the motor is running. The pick-up arm should be lifted off its rest and, once the turntable is rotating, the selector lever should be put in the appropriate position. The motor will stop as soon as the pick-up arm is resting again on the microswitch rest.

Record Size

The record size selector switch should be set before the unit is operated. The gramophone will play 10″ and 12″ records mixed or either

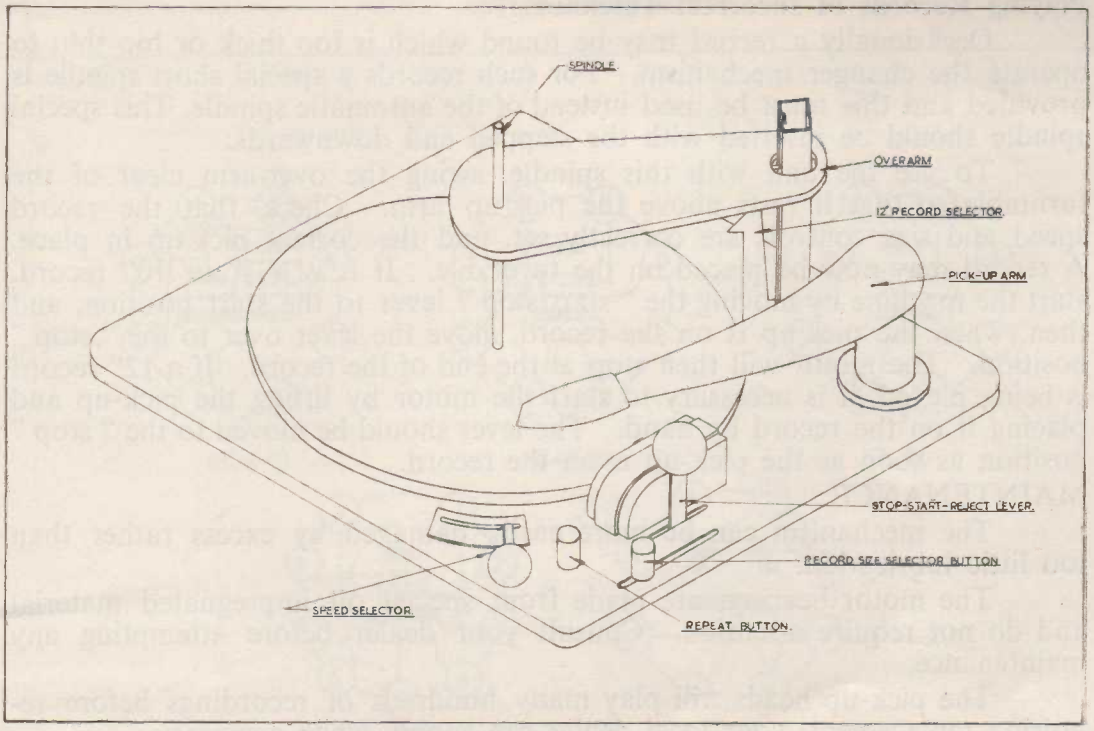


Fig. 23 Control Location

of these sizes separately when set to the 10″ or 12″ position, and it will play 7″ records when set to the 7″ position.

Starting

To operate the record changer, lift the over-arm and swing it clear of the record spindle. Up to ten records may now be placed on the record spindle and the over-arm swung back and slipped over the spindle so that it rests over the records. Start the instrument by moving the " start/stop/reject " switch towards the start position, and release it as soon as the mechanism has engaged.

Stopping

The motor will automatically stop when all the records on the spindle have been played. To stop the instrument at the end of any record, move the " start/stop/reject " lever to the stop position during the playing of the record. To stop the motor before a record is finished, first move the lever forward to the reject position and immediately over to the stop position.

Rejecting

If it is desired to reject part of a record move the " start/stop/reject " lever to reject and then release it. The next record will then drop and the gramophone will continue to play the remaining records normally.

Repeating

To repeat a particular record, press the " repeat " button any time after it has dropped on to the turntable. Only 7″ and 10″ records can be repeated.

Removal of Records

To remove records from the turntable, the record spindle must be withdrawn. When replacing the spindle, turn it until it drops fully. The ledge on which the records rest will then be facing the overarm support column.

Playing Records of Incorrect Thickness

Occasionally a record may be found which is too thick or too thin to operate the changer mechanism. For such records a special short spindle is provided and this must be used instead of the automatic spindle. This special spindle should be inserted with the stepped end downwards.

To use the unit with this spindle, swing the over-arm clear of the turntable so that it rests above the pick up arm. Check that the record speed and size controls are correctly set, and the correct pick up in place. A record may now be placed on the turntable. If it is a 7″ or 10″ record, start the machine by moving the " start/stop " lever to the start position, and then, when the pick up is on the record, move the lever over to the " stop " position. The motor will then stop at the end of the record. If a 12″ record is being played, it is necessary to start the motor by lifting the pick-up and placing it on the record by hand. The lever should be moved to the " stop " position as soon as the pick-up is on the record.

MAINTENANCE

The mechanism can be more easily damaged by excess rather than too little lubrication.

The motor bearings are made from special oil impregnated material and do not require attention. Consult your dealer before attempting any maintenance.

The pick-up heads will play many hundreds of recordings before requiring replacement; your local dealer can supply when necessary.

NOTE.—**NEVER** change the motor speed when the turntable is stationary.

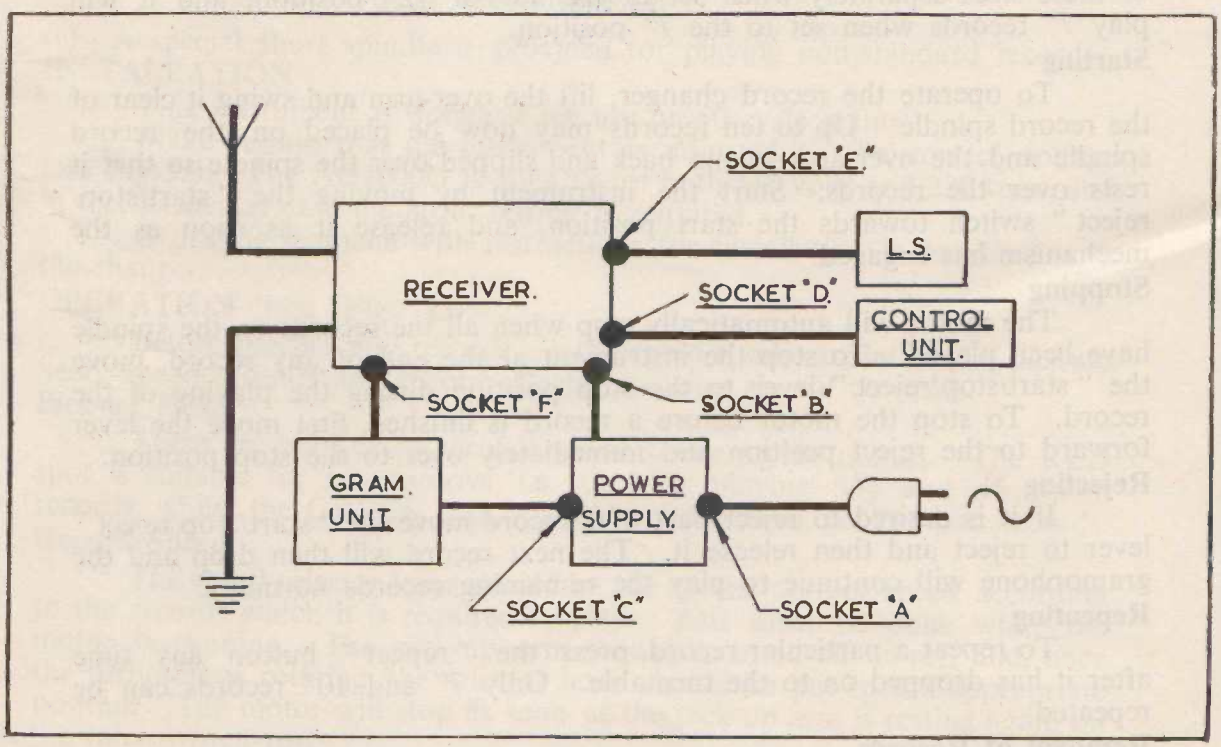


Fig. 24 Block Schematic showing inter-socket Connections

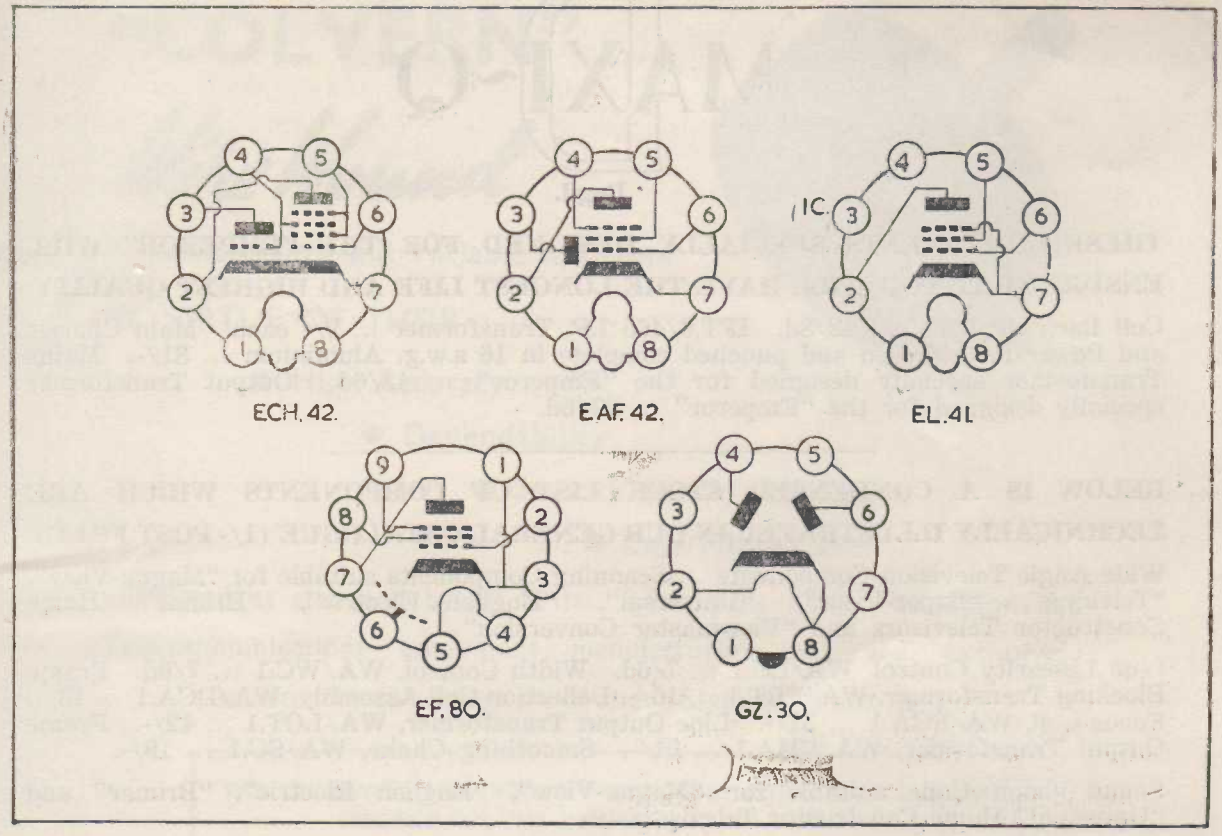


Fig. 25 Valve pin connections of Types used for The Emperor

Conclusion

After the receiver has been aligned and the record changer wired, the various units can be assembled into the cabinet. Fig. 24 shows how the various units are plugged together. The control panel is mounted on the side of the cabinet, either a slot can be cut, or holes drilled to take the control spindles. This latter arrangement will necessitate obtaining controls with longer spindles and it is preferable to cut a slot. Engraved knobs can be purchased in several colours and sizes from most good supply houses, the choice is left to the constructor.

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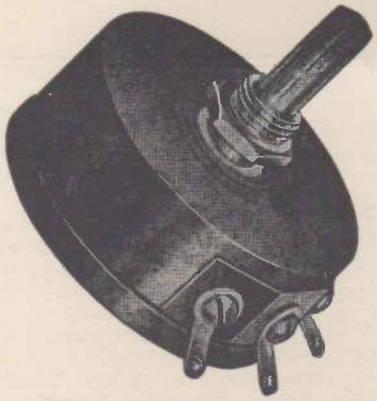

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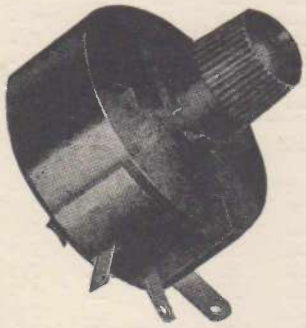

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