AN ECONOMY QUALITY AMPLIFIER

1/-

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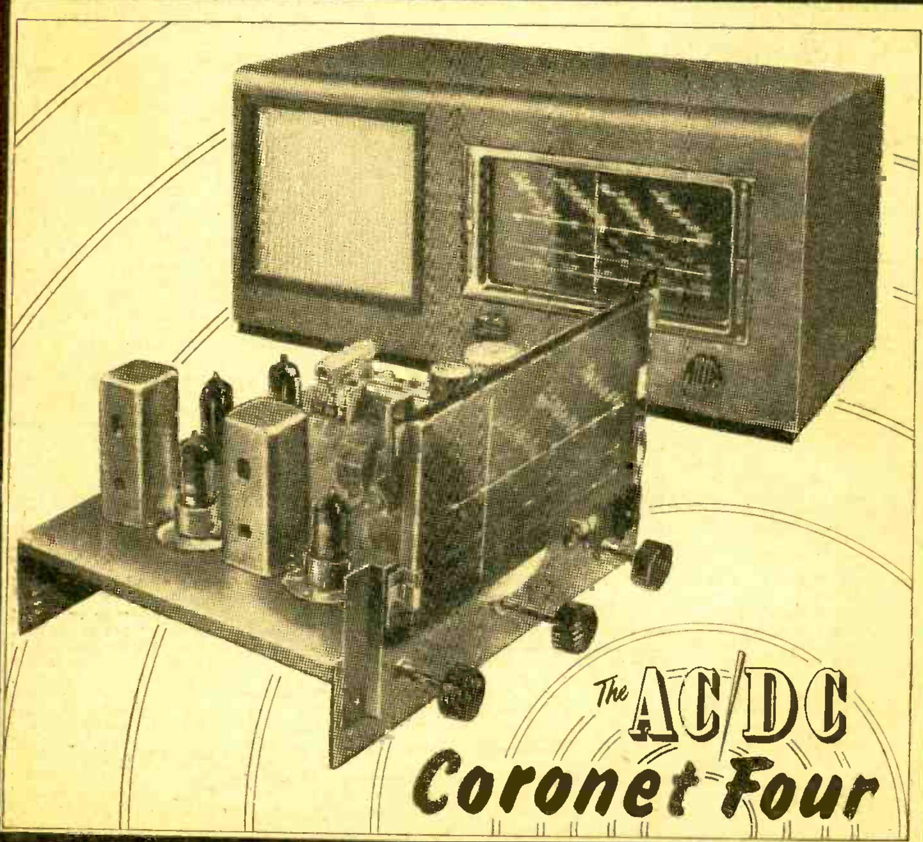
F.J.CAMM

PRACTICAL WIRELESS



The AC/DC Coronet Four

IN THIS ISSUE:

- A BINOCULAR SCOPE
- FULL COMPASS ELECTRONIC ORGAN
- BEGINNER'S GUIDE TO RADIO
- AN ELECTRONIC TIMER
- PROBLEMS OF V.H.F.
- A HANDY TEST OSCILLATOR
- TRANSMITTING TOPICS

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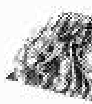
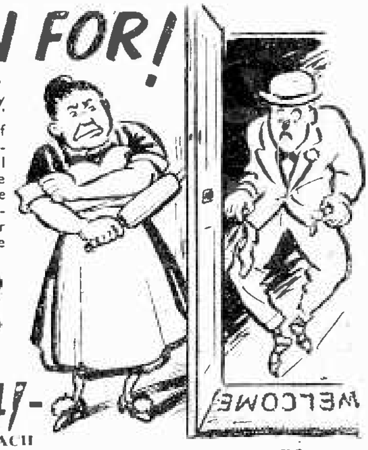


The stunning reception you get when you fit one of these really powerful units in compact form, is more proof that OSMOR "Q" Range Coilpacks provide quality and performance right out of proportion to their midget size and modest cost. They have everything that only the highest degree of long practised technical skill *can* ensure extra selectivity, super sensitivity, adaptability. Size only 1¾" x 3½" x 2¼", with variable iron-dust cores and polystyrene formers. Built-in trimmers. Tropicalised. *Prealigned*, receiver-tested and guaranteed. Only 5 connections to make. All types for Mains and Battery superhets, and T.R.F. receivers. Ideal for the reliable construction of new sets, also for conversion of the 21 Receiver, TR1196, Type 18, War-time Utility and others. Send to-day for particulars!



SEPARATE COILS A full range is available for all popular wavebands and purposes. Fully descriptive leaflet and connection data available. Just note these "plus points":

Only 1in. high. Packed in damp-proof containers. Variable iron-dust cores. Fitted tags for easy connection. Low loss Polystyrene formers.

4/- EACH

With OSMOR Lines—you're on the right lines

A spotlight on another of the "specials" in the OSMOR "Q" coil range.

45 K/c. Tape Recorder Oscillator Coil

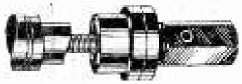
Type QT8

A centre tapped wave-wound coil as illustrated, for TRUVOX and Similar tape-decks. Single screw fixing. Fitted tags. **7/6** each

TWO for the Price of ONE!

The NEW OSMOR CHASSIS CUTTER

An inexpensive but invaluable tool of entirely new design. Cuts two hole sizes with any one reversible punch and die; and can be operated with a spanner or tommy bar. Blanks easily removed. **For use on Steel up to 18 s.w.g; Brass and Dural up to 16 s.w.g. Aluminium and Copper up to 14 s w.g.**



P. Pat. 11325/53

Type	Hole Sizes	
1	1in. x 1⅛in.	Illus. Price List on Request
2	⅞in. x 1⅛in.	
3	¾in. x 1¼in.	
4	1⅜in. x 2in.	

Tommy Bars available

The OSMOR "JIFFY PUNCH"

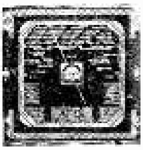
for cutting smaller holes neatly and quickly with one blow of a light hammer.

P. Pat. 11324/53

Type	Hole Size	
1	¼in.	Illus. Price List on request
2	⅜in.	
3	½in.	

For use on Steel up to 20 s.w.g. Brass and Dural up to 18 s.w.g. Aluminium and Copper up to 16 s.w.g.

DIALS



Type A GLASS DIAL ASSEMBLY (as illus.), measuring 7 in. x 7in. (9¼in. x 9¼in. overall) mounts in *any* position on or above the chassis and works with any type of drive. Choice of two 3-colour scales—G1 (L.M.S.) or G2 (M.S.S.). Price complete, **24/6**. P. & P., **1/6**. Pulley assembly for right-angle drive if required, **1/9**. Escutcheon **4/-**.

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Overall size 5¾in. sq., Printed Area 4in. sq. Cream back-ground, 3-colour. **Type M1**, L.M.S. waves, **M2**, L.M. waves. **M3**, M. & 2/S waves. Price **3/6** each. Pointer, **1/6**.

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No Compromise T.R.F. Tuner Midget Mains Receiver. Sensitive 2-Valve Receiver; Television Converter. (Special coils in cans available), etc., etc.

I.F.s. 465 kc. Permeability-tuned, with flying leads. Standard size 1⅜in. x 1⅜in. x 3½in. For use with OSMOR coilpacks and others, **14/6** pair. PREALIGNED, **1/6** extra.

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OSMOR "JAR-RACK"

(If you're a generous husband you'll buy one or two for your wife's larder, she will appreciate the extra space they make!) Holds 1 lb. jam jars with or without lids. Easily removed, cannot fall out. Just the thing for the tidy "HAM" or Radio Dealer.

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Type 2 (as illustrated) for screwing under a shelf, **5/9** each, holds 6 jars. Length 18in., enamelled green.

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Type	Metres
1	141-250
2	218-283
3	267-341
4	319-405
5	395-492
6	455-567
7	1450-1550
8	410-550k/c

This is a device on the well-known "wave - trap" principle, which will reject an undesired signal when inserted in the aerial lead. Easily tuned to eliminate any one Station within the ranges stated. Fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.

7/6 Post Free | Complete with full instructions—nothing to add.

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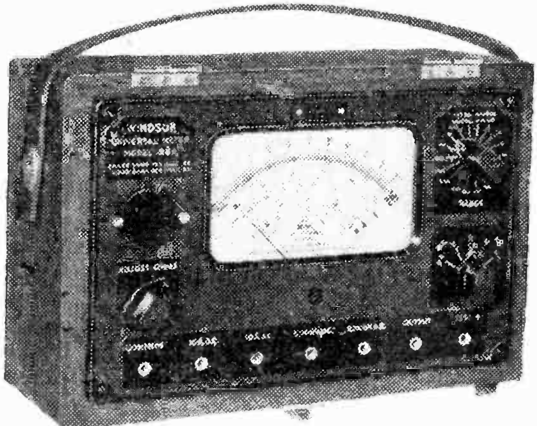

Taylor Model 88A multirange universal meter

20,000 o.p.v. D.C. 2,000 o.p.v. A.C.
Five inch scale with knife edge pointer and anti-parallax mirror. Instantaneous overload protection. Buzzer for continuity testing. Hardwood case, detachable cover, carrying strap.

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Volts D.C. 0 — .1 — .25 — 1 — 2.5 — 5 — 10 — 25 — 50 — 100 — 250 — 500 — 1,000 — 5,000.
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Milliamperes A.C. 0 — .25 — 1 — 2.5 — 5 — 10 — 25 — 50 — 100 — 250 — 500 — 1,000.
Amperes D.C. 0 — 2.5 — 10.
Amperes A.C. 0 — 2.5 — 10.
Resistance. 1 ohm to 5 megohms in 4 ranges.
Decibels. −20 to +69 in nine ranges. Zero reference level is 6 mW. into 500 ohms.
Output. As A.C. volt ranges, except 5,000 volts, via a condenser.
Inductance. 0.2 to 200 henries in 2 ranges*.
Capacitance. 1,000 pF to 100μF in 4 ranges*.
* External adaptor, Model 313D, required.

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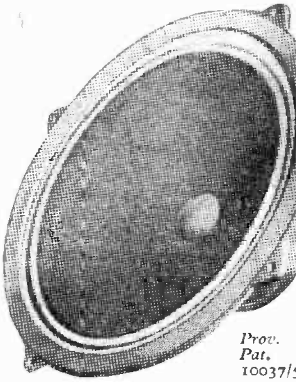

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3 or 15 ohms impedance.

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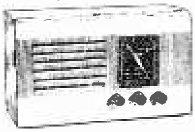

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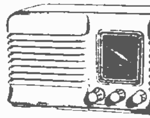

MODEL I. T.R.F. RECEIVER

This is a 3 valve plus metal rectifier TRF receiver with a valve line-up as follows : **6 K7 (HF), 6 J7 (Det) and 6 V6 (Output).** The dial is illuminated and when assembled the receiver presents a very attractive appearance. Coverage is for the Medium and Long Wave bands. Operates on 200/250 volts AC mains.

Plus 2/6 Packing, Carriage, Insur. **£5 . 15 . 0**

MODEL 2. SUPERHET RECEIVER

This is a powerful midget 4 valve plus metal rectifier Superhet Receiver with a valve line-up as follows : **6 K8, 6 K7, 6 Q7, 6 V6.** The dial is illuminated and coverage is for the Short Wave bands between 16-50 metres, the Medium Wave bands between 190-540 metres, and the Long Wave bands between 1,000-2,000 metres. Operates on 200/250 volts AC mains.

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ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR ONE YEAR

NOTE : We would respectfully suggest to those interested in building these receivers that OUR circuit diagrams be compared with those of other firms. Intending constructors can then judge for THEMSELVES which Instruction Booklet is the most comprehensive.

Instruction Booklet and priced Parts List available separately at 1/-. This money will be refunded if circuit diagram is returned as NEW within 7 days.

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(Also available 15 ohms imped.)

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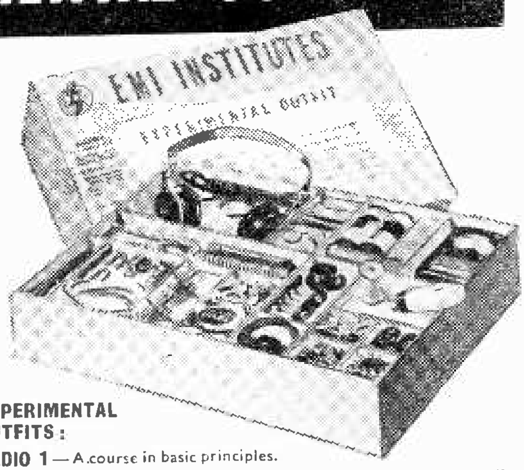

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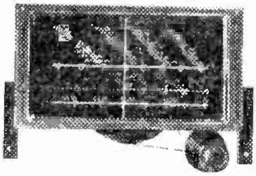
AS SPECIFIED...

BY THE DESIGNER OF THE AC/DC "CORONET" 4



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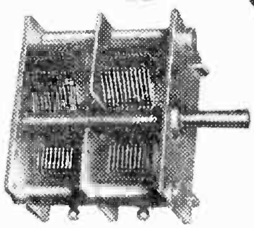
S.L.8. Spin Wheel Drive, precision slide rule with 3 band scale gives perfect control. Ratio 24-1. Constant velocity coupling eliminates Condenser strain and provides isolation from vibration and noise. Glass scale 9 x 4¾ with florentine bronze escutcheon. Price **27/6** complete.



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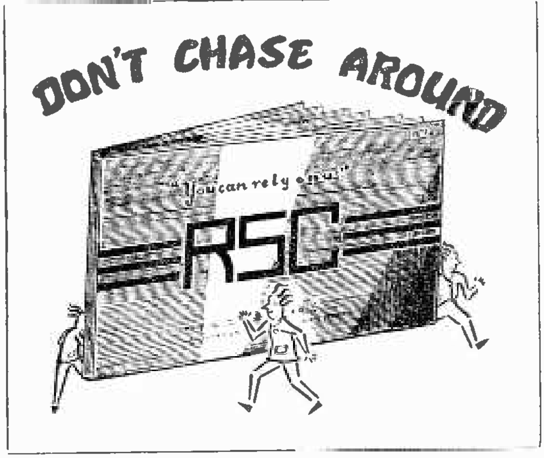

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1G6	6/6	6K7M	7/6	12SQ7GT	8/6	EF36	6/6	GU50	12/6
1R5	8/-	6K8G	9/-	12SG7	7/6	EF39	6/6	XP2V	4/-
1S4	8/-	6K8GT	9/-	12SH7	7/6	EK32	6/6	XH (1.5)	4/-
1S5	8/-	6L6G	8/6	12SJ7	8/6	EF91	9/-	VU111	4/-
1T4	8/-	1622	11/-	12SK7	8/6	EL32	7/6	VU133	4/-
1A7GT	10/-	6U5	7/6	12SR7	7/6	EF80	8/6	VU120A	4/-
1C5	8/-	6U5G	7/6	14A7	8/6	EF50 (Red. Syl.)	10/-	CV54	5/-
1LN5	8/-	6L7	7/6	25Z6GT	8/6	EF50 (Ex-Units)	5/-	S130	7/6
2X2	5/-	6N7GT	7/6	25Z5	8/6	SP2	8/6	7475 (VS70)	7/6
3V4	8/-	6Q7GT	8/6	35Z4GT	8/6	VP2	8/6	CV66	6/-
3S4	8/-	6SJ7GT	8/6	25A6	8/6	TDD2A	8/6	VR150/30	8/6
5Z3	8/6	6R7	8/6	35L6	8/6	DK40	9/-	CK510AX	5/-
5U4	8/6	6X5G	8/6	50L6GT	8/6	UL41	9/-	DI	2/-
5Z4	8/6	6SA7GT	8/6	42	8/6	UY41	9/-	AC6PEN	6/6
6A7G	8/6	6SQ7GT	8/6	43	8/6	4D1	4/-	AC5 PENDD	12/6
6AC7	6/6	6SG7	7/6	75	8/6	8D2	4/-	PEN25	6/6
6AG5	7/6	6SH7M	7/6	78	8/6	9D2	4/-	PEN46	7/6
6A8G	8/6	6SK7GT	7/6	80	8/6	15D2	10/-	QP25	6/6
6AM6	9/-	6SL7GT	9/-	866A	15/-	R3	8/6	SP61	4/-
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6C4	8/6	6SC7	10/-	9002	6/-	D42	5/-	HL23/DD	6/6
6C5GT	5/-	6SS7	7/6	9003	6/-	D63	5/-	VP23	6/6
6C6	6/6	6V6GT	7/6	9004	6/-	KT2	5/-	VP41	7/6
6D6	6/6	7C5	8/6	9006	6/-	U52	8/6	U22	8/6
6F6G	8/6	7A7	8/6	954	6/-	U17	10/-	ATP4	4/-
6G6G	6/6	7C7	8/6	955	6/-	U19	10/-	TP22	8/6
6H6GT	5/-	7H7	8/6	956	6/-	Y63	8/6	TH233	10/-
6H6M	8/6	7B7	8/6	1299A	7/6	P2	4/-	41MP	7/6
6J5GT	5/-	7S7	10/-	TZ40	37/6	MU14	8/6	42SPT	6/-
6J5M	8/6	12A6	7/6	931A	50/-	PX25	12/6	215SG	4/-
6J6	9/-	12C8	7/6	EA50	2/-	KT33C	10/-	MS/PENB	7/6
6AK5	9/-	12H6	8/6	EF54 (VR136)	6/-			VT501	7/6
6J7G	6/6	12K7GT	8/6	EF55	12/6				
6J7M	8/6	12K8GT	8/6	EB34	3/6				
6K6	9/-	12Q7GT	8/6						

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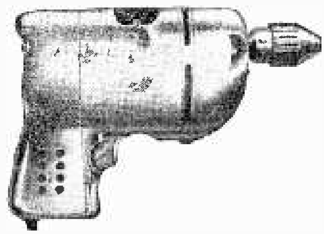

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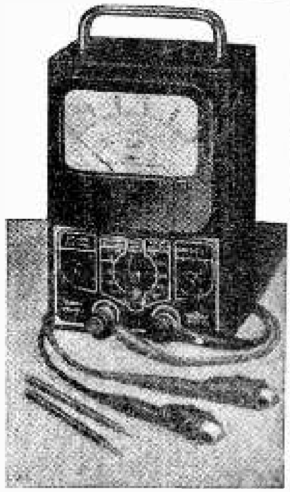

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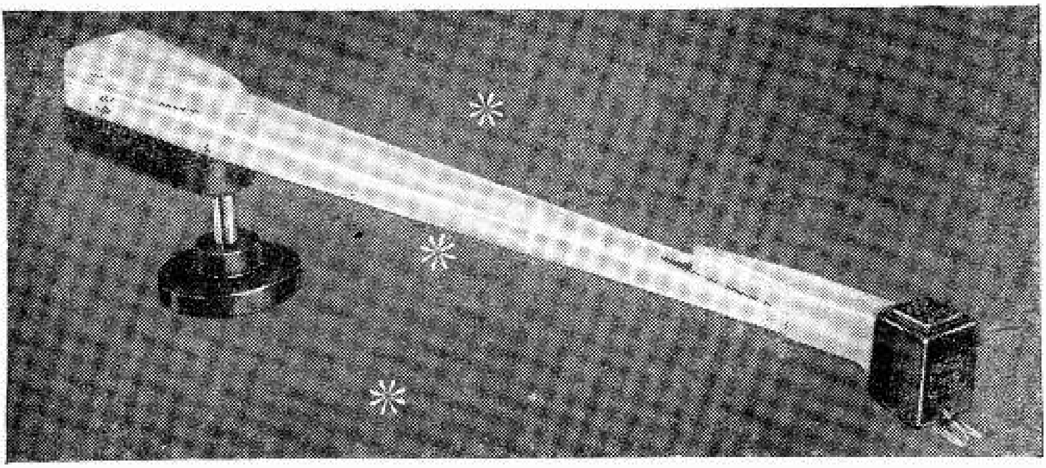
Important Announcement



ABOUT acos HGP 40 AND GP 20 PICK-UPS

We will be frank with you. When we evolved the now famous Hi-g pick-up tracking principle, we felt that it called for the introduction of an entirely new pick-up, complete with arm and new style heads. We called this pick-up the HGP 40.

The interest in the HGP 40 has been tremendous, but it is already clear that there are thousands of owners of that most popular of all crystal pick-ups—the GP 20—who wish to bring it up to date by changing the existing head (GP 19 or GP 19LP) for an HGP 40 head (standard or LP). It cannot be done.

However, we bow to public demand. We are discontinuing the HGP 40 as such. Instead, we are now producing the HGP 39-1 (STD. or LP) pick-up head to fit the GP 20 arm. Its response will be substantially the same as the HGP 40 and the sapphire stylus is easily replaceable. Its price is **£1.12.0** plus 10/3d. P.T.

always well ahead

Acos devices are protected by patents, patent applications and registered designs in Great Britain and abroad

TO SUM UP:

HGP 40 Pick-up is discontinued.

HGP 39-1 (STD. or LP) Heads are available to modernise the GP 20.

GP 20 fitted with HGP 39-1 head will in future be known as the GP 20/Hi-g.

COSMOCORD LIMITED · ENFIELD · MIDDLESEX

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Practical Wireless

EVERY MONTH
VOL. XXX, No. 568, FEBRUARY, 1954

Editor F. J. CAMM

22nd YEAR OF ISSUE

COMMENTS OF THE MONTH *By THE EDITOR*

The Coronet A.C./D.C. 4

SINCE the publication of the blueprint for our Coronet 4, which was given away with our twenty-first birthday number (October, 1953), we have been inundated with letters from readers living in districts where direct current still survives. They have asked for a design for a D.C. version of the Coronet and we have given careful consideration to the problem. We decided against a pure D.C. version, but in favour of an A.C./D.C. receiver, because it is cheaper. The transformer is dispensed with and is replaced by three resistors. Otherwise the performance is identical with the original.

Elsewhere in this issue we give details for building this A.C./D.C. Coronet, which, it will be seen, follows the lines of the original version.

We have received some letters suggesting that in order to cater for both A.C. and D.C. users, *all* of our designs should be A.C./D.C., as this would save the preparation of designs for two separate markets. We welcome correspondence on this subject. We are averse to producing designs for D.C. receivers because of the somewhat limited appeal. Letters on this subject should be marked "A.C./D.C." on the top left-hand corner of the envelope and be addressed to the Editor.

THE SEVENTH AMATEUR RADIO SHOW

THE Radio Society of Great Britain is the only Association in this country which caters for amateurs. The industry was founded by amateurs, but the oak trees which have grown from the small acorns planted in 1922 are no longer interested in acorns. The last exhibition at Earls Court showed that manufacturers have little interest in the home-constructor market, large though it is. At the amateur radio exhibition firms whose livelihood depends upon the amateur exhibited their instruments and components and all reported good business. Representatives of wider radio industries, however, were present, and in a speech which we made on that occasion we suggested that the industry owed a debt of gratitude to the amateur and to the R.S.G.B. for the work they have done and are doing. Something more than lip service to the amateur is required and we suggested that the R.I.C. should very carefully consider offering very special rates to small firms at next year's Radio Show so that amateurs could see the two exhibitions in one. We know that they made such an offer last year, but the prices asked even at the lower rates were too high for firms with comparatively small turnovers. A component exhibition within the larger exhibition would be an additional attraction. The industry draws its skilled personnel from the ranks of amateurs, whose interests are catered for and sustained by the technical press and the R.S.G.B. The R.I.C., therefore, should encourage the movement on the lines we have suggested. A Constructor Section of the National Radio Show is long overdue.

COMMERCIAL TV

WE do not think that many will apply to operate commercial TV under the proposed restrictions. We agree, of course, with the safeguards against abuses, but who can say that the programmes from Luxembourg and Radio Normandie before the war were ostracised by British listeners in favour of the more severe Sunday programmes designed on the Reith formula?

There is a shortage of frequencies usable at the present time which will hamper the introduction of commercial TV for some time. The Report of the TV Advisory Committee, published last July, made it clear that any new TV development should take place in three separate bands of frequencies, apart from the band now being used by the BBC. This latter band is just wide enough to accommodate the stations needed to give the present TV programmes nation-wide coverage. Of the three additional bands, III, IV and V, techniques for using the latter two are not yet fully developed, leaving band III only as the one for which transmitting and receiving equipment can be produced quickly. Within this band two, or at the outside three, channels only can readily be made available for TV. This does not mean that only two or three transmitting stations can be set up, of course, as the number of stations which can be accommodated on each channel without causing interference depends upon the power, range and distance apart.—F.J.C.

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ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate number of sound receiving licences issued during the year ended October, 1953. The grand total of sound and television licences was 13,153,314.

Region	*Number*
London Postal ...	1,690,827
Home Counties ...	1,453,758
Midland	1,296,317
North Eastern... ...	1,679,916
North Western ...	1,306,552
South Western ...	1,023,170
Wales and Border ...	652,758
Total England and Wales	9,103,298
Scotland	1,109,343
Northern Ireland ...	213,603
Grand Total	10,426,244

Telephone Sharers

MR. D. GAMMANS, Assistant Postmaster-General, has stated that through the system of sharing telephone lines, the G.P.O. had been able to provide a telephone service for more than 300,000 new subscribers since the end of the war.

"We have had remarkably few complaints," he said, "and my belief is that most people find the service satisfactory. Sharing may have come to stay, but I should like to do away with compulsory sharing as soon as possible."

Amateurs' Annual Camp

AMATEUR radio enthusiasts in Lancashire and Cheshire have got together and formed their own Army Emergency Reserve.

The unit, the Army Wireless Reserve Squadron of Royal Signals, practise receiving and transmitting in their dens all the year round, but once each year they hold an annual camp for a fortnight for concentrated training.

At this year's camp contact was made with amateurs in the U.S. Military Affiliate Radio Service in Washington, using sets normally working over only 200 miles.

Recording Equipment for Argentine

THE Ministry of Communications of the Argentine recently placed an order for British tape recording equipment, to the value of £30,000.

This is for 32 E.M.I. magnetic tape recorders, similar to those used by the BBC, and for large quantities of recording tape. The order was negotiated by the International Department of E.M.I. through the E.M.I. Subsidiary Company in the Argentine, and initial deliveries were arranged immediately from England.

It is understood that this equipment will be used in Argentina to develop broadcasting facilities throughout the country.

B.I.C.C. Appointment

MR. H. WILLIAMS, M.B.E., T.D., A.M.I.E.E., has been appointed manager of the Worcester branch of British Insulated Callender's Cables Ltd., in succession to the late Mr. C. H. Panting.

Mr. Williams, who completed his education at the Swansea Technical College, joined the former British Insulated Cables Ltd. in 1932. He held a commission in the Territorial Army and was consequently mobilised on the outbreak of war. During his seven years in the army he served mainly overseas, including North Africa, Italy and Greece, as a Staff Officer on the S. and T. Directorate. Mr. Williams was released with the rank of Lieut-Col. in 1946, when he re-joined B.I.C.C. as sales engineer for the South-West area and operated from the Bristol Branch office.

Hongkong and India Link

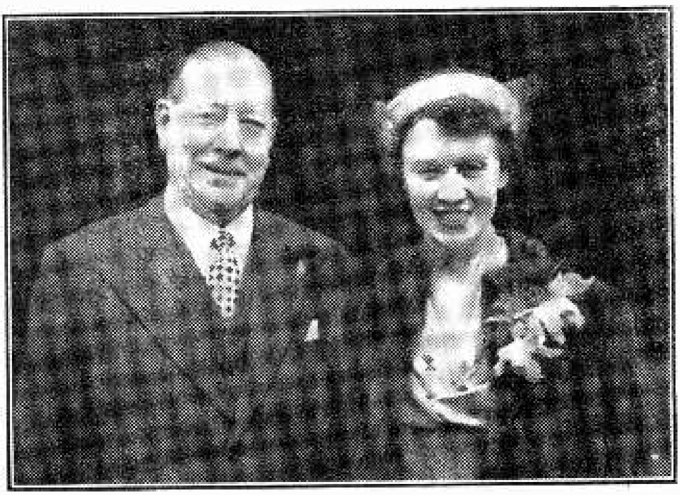
A NEW radiotelephone service between Hongkong and India was opened on Tuesday, December 15th. It is being operated by Cable and Wireless Ltd. at Hongkong, and by the Government of India Overseas Communications Service at Bombay.

The new service was opened by Shri Jagjivan Ram, India's Minister of Communications, who put through the inaugural call to H.E. Sir Alexander Grantham, the Governor of Hongkong.

Obituary

IT is with great regret that we have to announce the sudden death of Mr. K. H. R. Lauben, at the early age of 52, on November 25th, 1953.

Mr. Lauben was a director of E.M.I. Sales and Service, Ltd.



Mr. A. H. Whiteley, founder of Whiteley Electrical Radio, and Miss C. Tobin, daughter of Mr. J. Raymond Tobin, seen after their wedding at Caxton Hall recently.

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in charge of distribution, and had been associated with companies of the E.M.I. Group since 1915. The sympathy of all his colleagues at E.M.I., together with that of his many friends both inside and outside the industry, will go to his widow in her sad loss.

Sales Representative

MR. NORMAN EIGHTEEN has been appointed a Sales Representative to the Recording Equipment Division of E.M.I.

Mr. N. Eighteen.

Mr. Eighteen is already well known in trade circles, having been engaged in the Radio Industry since several years before the war, except for service in the Royal Air Force between 1940 and 1946.

After the war until this new appointment, Norman Eighteen had been Sales Manager to the Radio Department of Hickie and Hickie, Ltd., of Reading.

Mr. Eighteen is already active in contacting dealers and wholesalers all over the country.

Home Service Coverage Improvement

AS part of its plan to make local improvements in the coverage of the Home Service, the BBC has built a new low-power transmitting station at Mousewald, near Dumfries.

The new station took over the service from the present temporary transmitter, which is on the same site, on Sunday, December 13th.

The new transmitter will have a power of 2 kW. and this will extend the area of improved reception to include Lochmaben, Lockerbie and Annan. Like the present temporary transmitter the new station will radiate the Scottish Home Service on 371 metres (809 kc/s) and will operate in the evenings only from 4 p.m.

B.I.R.E.

THE following meetings will be held during January, 1954:

Scottish Section. *Thursday, January 7th*, 7 p.m., at the Department of Natural Philosophy, The University, Edinburgh—"Radio Astronomy," H. Seddon (University of Edinburgh).

North Western Section. *Thursday, January 7th*, 7 p.m., at the College of Technology, Manchester—"The Manchester University Computor," D. B. G. Edwards (University of Manchester).

North Eastern Section. *Wednesday, January 13th*, 6 p.m., at Neville Hall, Westgate Road, Newcastle-upon-Tyne—Short Papers by students.

Scottish Section. *Wednesday, January 20th*, 7 p.m., at the Department of Natural Philosophy, The University, Edinburgh—Film evening.

Thursday, January 21st, 7 p.m., at the Institution of Engineers and Shipbuilders, Glasgow—Film evening.

West Midlands Section. *Tuesday, January 26th*, 7.15 p.m., at Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton — "Microwave Measuring Instruments," P. M. Ratcliffe (Marconi Instruments, Ltd.).

700th "In Town To-night"

ON January 2nd, Home Service listeners heard the 700th edition of "In Town To-night." Since the programme began in 1933, thousands of interesting visitors to London have been brought to the microphone, and the present series has run for three-and-a-half years, interrupted only by the death of King George VI and the Coronation.

It was first devised by Eric Maschwitz, then Variety Director, with Bill Hansen as its first producer. The two names most intimately connected with the programme, however, are those of C. F. Meehan and Peter Duncan, who have both been editor and producer, Duncan taking over from Meehan six years ago and still keeping up the high standard.

In order to maintain a fresh and topical atmosphere, "In Town To-night" has been broadcast for the last few months without the use of a script.

Transistor Hearing Aid

WHEN the Zenith Radio Corporation in America began producing an all-transistor hearing-aid in 1952, their representatives and salesmen found that, although the instrument had stood up to laboratory trials, it failed after a few days under field tests.

Now the company have begun producing a new version of the hearing aid which is described as "many times as resistant to failure" compared with the first model. It operates for one month on a fifteen-cent battery.

Twice a Week

"MIDDAY Music Hall" has reverted to twice-weekly in the Home Service.

The Monday series will still have Bill Gates as compère, while the Friday series will have four compères: they are Michael Miles, John Forde, David Jacobs and Peter Bathurst. Each month the Friday show will have a resident top-of-the-bill artist and vocal group. During January they are Cyril Fletcher and the Song Pedlars respectively.

Both shows will have separate orchestral accompaniment, the BBC Variety Orchestra under Paul Fenoulhet providing the music each Monday and the Augmented BBC Revue Orchestra under Harry Rabinowitz each Friday. The production is by Australian-born Trafford Whitelock, who has been in charge of "Midday Music Hall" since its inception a year ago.

Jet Landing Precaution

AMERICAN Navy jet pilots are now able to determine whether they are flying down to an aircraft-carrier at a safe enough speed for landing.

They are aided by a radar speed-measuring device developed by the Raytheon Manufacturing Co. which is installed aboard the aircraft-carrier to "watch" each 'plane as it comes in to land. If the jet is flying too fast or too slow the new radar equipment informs the landing officer, who signals his orders to the pilot and either guides him in to a landing or waves him off to circle round for another attempt.

Series on Spanish Music

DURING the first quarter of this year, Spanish music from the thirteenth to the twentieth centuries will be presented and discussed in a series of twenty-five programmes.

A lot of the music will be broadcast for the first time, and some of the early editions have been recorded in Spain by a BBC team under Lionel Slater, who has collaborated with Roberto Gerhard, the editor of the music series.

Associated with the music programmes will be productions of plays from the classical Spanish drama, including Cervantes' "Don Quixote," "The Cid," and "The Mayor of Zalamea," by Calderon.

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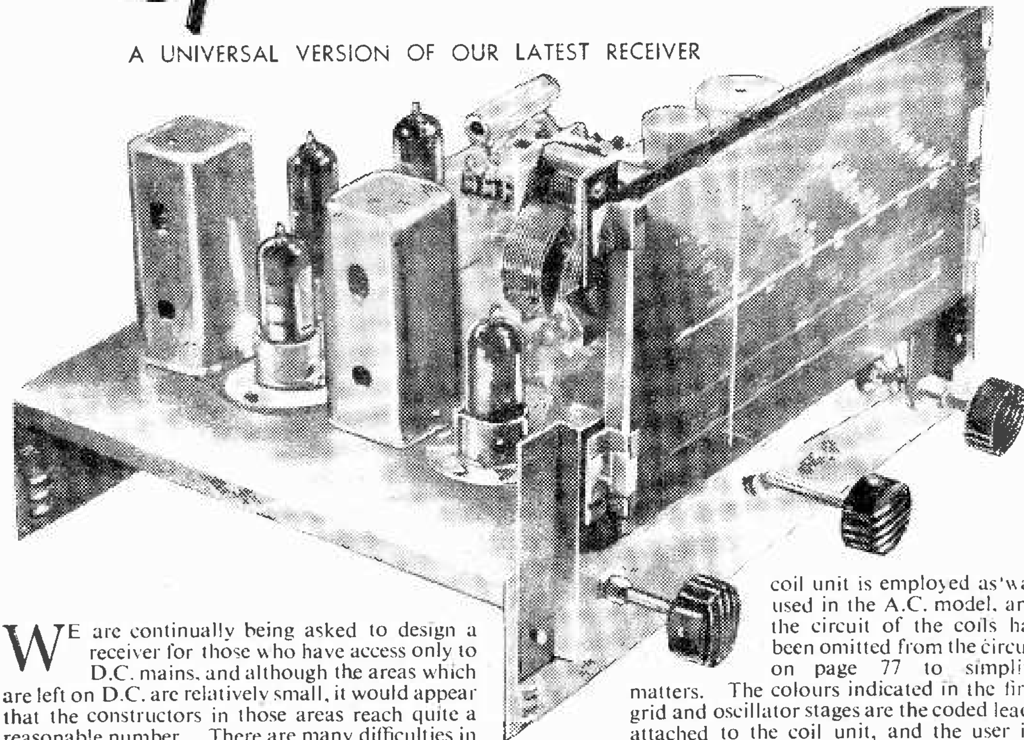
THE AC/DC Coronet Four

A UNIVERSAL VERSION OF OUR LATEST RECEIVER



WE are continually being asked to design a receiver for those who have access only to D.C. mains, and although the areas which are left on D.C. are relatively small, it would appear that the constructors in those areas reach quite a reasonable number. There are many difficulties in the way of a D.C. design, and an examination of makers' catalogues will show that the number of D.C. receivers produced is almost infinitesimal. The practice is to make a receiver which is a compromise between the straightforward D.C. circuit and an A.C. arrangement and, of course, as with any compromise, something has to be sacrificed in both directions. The Coronet Four which was recently published aroused considerable interest—not only on account of the general features of the design, but also due to the small number of components employed and the consequent simple layout and minimum amount of wiring required. As soon as the details were published we received the usual spate of requests from D.C. users, and a few simple tests showed that this receiver lent itself admirably to modification on the A.C./D.C. principle, and that little general modification would be needed. The main part of the circuit was maintained, and the principal changes were those called for in the essential power supply, and the different valves which were then available resulted in a slight modification in the A.V.C. circuits. Beyond this, the circuit is just as in the original.

The Circuit

A reproduction of the circuit will be found on page 77, from which it will be seen that it consists of a three-valve superhet, plus a half-wave rectifier which is included in the mains section. The same coil unit is employed as was used in the A.C. model, and the circuit of the coils has been omitted from the circuit on page 77 to simplify matters. The colours indicated in the first grid and oscillator stages are the coded leads attached to the coil unit, and the user is, therefore, not concerned with the actual coil arrangement. The unit is, of course, of the three waveband type covering a short waveband from 16 to 50 metres, the medium waveband from 190 to 550 metres and a long waveband from 800 to 2,000 metres. Tuning is carried out by a two-gang .0005 μF condenser, and again we have used the J.B. unit which, with the special SL8 type spin-wheel drive, is matched to the coil unit and thus the full-vision station-name dial will be found accurately calibrated on each range, without the necessity for the constructor to use a signal generator or any similar test-gear. This is one of the principal features of the design and removes the main difficulty which has hitherto beset the home-constructor when constructing the superhet type of circuit. Provided that the coloured leads are not cut and that the wiring is carried out exactly as shown in either the layout on page 76 or on the full-size blueprint which is available, the coils will be found to line-up satisfactorily and the receiver will function straight away. Standard I.F. transformers are also employed, but a slight modification is required here unless those designed specially for this receiver are used. These are known as Type "U" and more will be said about these later.

The second valve is a double-diode-pentode of the H.F. type with variable-mu characteristics. In the A.C. version the double-diode section was not included in this stage, but formed part of the output valve.

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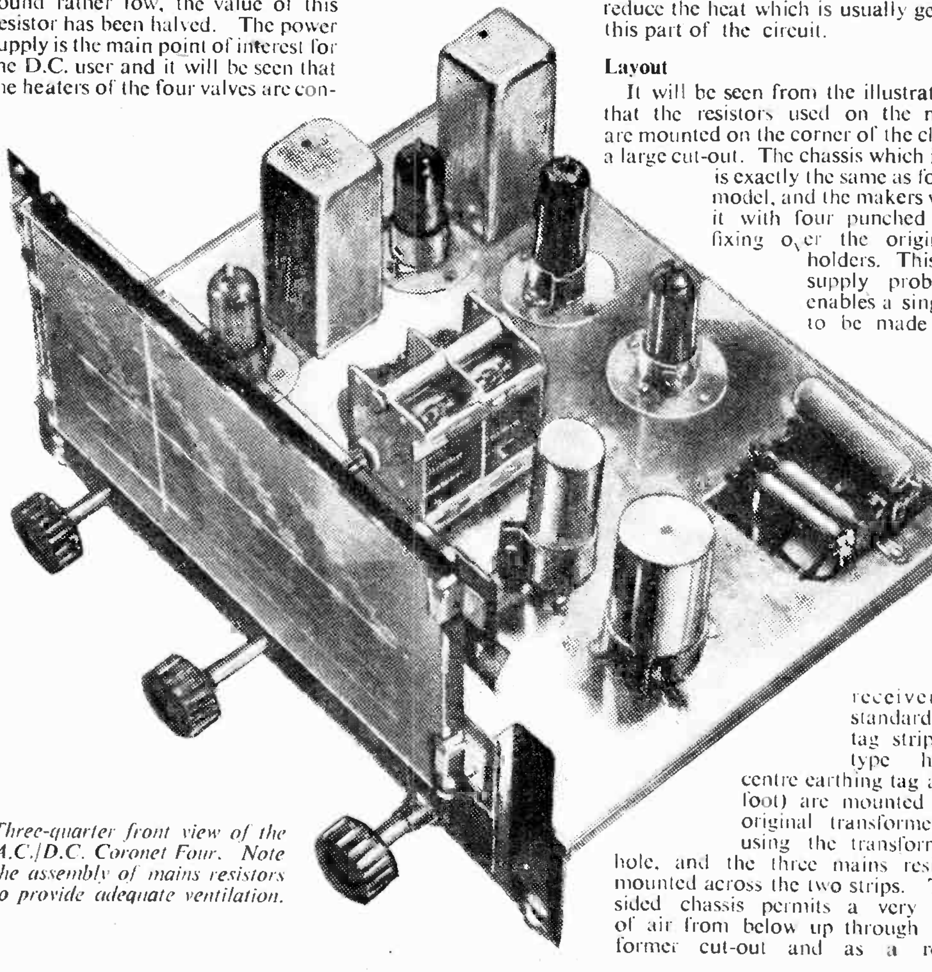
This enabled a delay biasing voltage to be obtained for the A.V.C. circuits—the bias of the L.F. pentode section proving sufficient. Transferring the diodes to the I.F. valve, however, renders it necessary to find some voltage source to provide the delaying volts, and this is not available in the cathode circuit of the I.F. stage. However, it is not a difficult matter to provide a potentiometer across the total H.T. source, using fixed resistors, and so provide a tapping point at any desired voltage. The potentiometer in this circuit consists of a 20 MΩ resistance and a 680 kΩ resistor in series, the junction of the two being taken to one of the diodes, the other acting as the signal rectifier. The remaining part of this circuit is more or less as in the A.C. model, a load resistor of 470 kΩ being used, with an H.F. filter formed by a 47 kΩ resistor in association with two 100 pF condensers. On the output stage the same bias components are employed and thus it has been possible to make the two lists of components almost identical so far as the smaller items are concerned. A.V.C. decoupling resistors and condensers are the same, but one change is made in the value of the H.T. smoothing resistor. In the A.C. model this is 2 kΩ but in view of the fact that the efficiency on D.C. mains of 200 volts will be found rather low, the value of this resistor has been halved. The power supply is the main point of interest for the D.C. user and it will be seen that the heaters of the four valves are connected in series with two resistors of high-wattage rating, one of these being short-circuited (or omitted) for low-voltage mains supplies. A connection from one side of the mains is made to the anode of the half-wave rectifier (through a surge-limiting resistor) and this valve merely acts as a series resistor on D.C. whilst providing rectification on A.C. The receiver in operation from A.C. supplies is just as hum-free and quiet as the original A.C. model. It will be seen that the usual protecting condensers are inserted in the aerial and earth leads as the chassis is "live" to one side of the mains supply, and the usual precautions must, therefore, be observed in handling the set, inserting and removing aerial and earth leads, etc. The voltage adjustment provided by the two resistors is a compromise, and it will be noted that the two points have been marked 200-230 and 230-250 volts. Obviously, therefore, on 250 volts mains better results will be obtained than on 230 and the same in the case of the low voltage. The extra 20 or 30 volts does make a difference, but this is unavoidable unless a specially-tapped mains dropping resistor is used, and this has been deliberately avoided in this receiver, not only from the point of view of being able to use standard and easily obtainable parts, but also in the attempt to reduce the heat which is usually generated in this part of the circuit.

Layout

It will be seen from the illustration below that the resistors used on the mains side are mounted on the corner of the chassis over a large cut-out. The chassis which is specified is exactly the same as for the A.C. model, and the makers will supply it with four punched discs for fixing over the original valve-holders. This simplifies supply problems and enables a single chassis to be made for both receivers. Two standard five-way tag strips (of the type having a centre earthing tag and fixing foot) are mounted over the original transformer cut-out, using the transformer fixing hole, and the three mains resistors are mounted across the two strips. The open-sided chassis permits a very free flow of air from below up through the transformer cut-out and as a result the



Three-quarter front view of the A.C./D.C. Coronet Four. Note the assembly of mains resistors to provide adequate ventilation.

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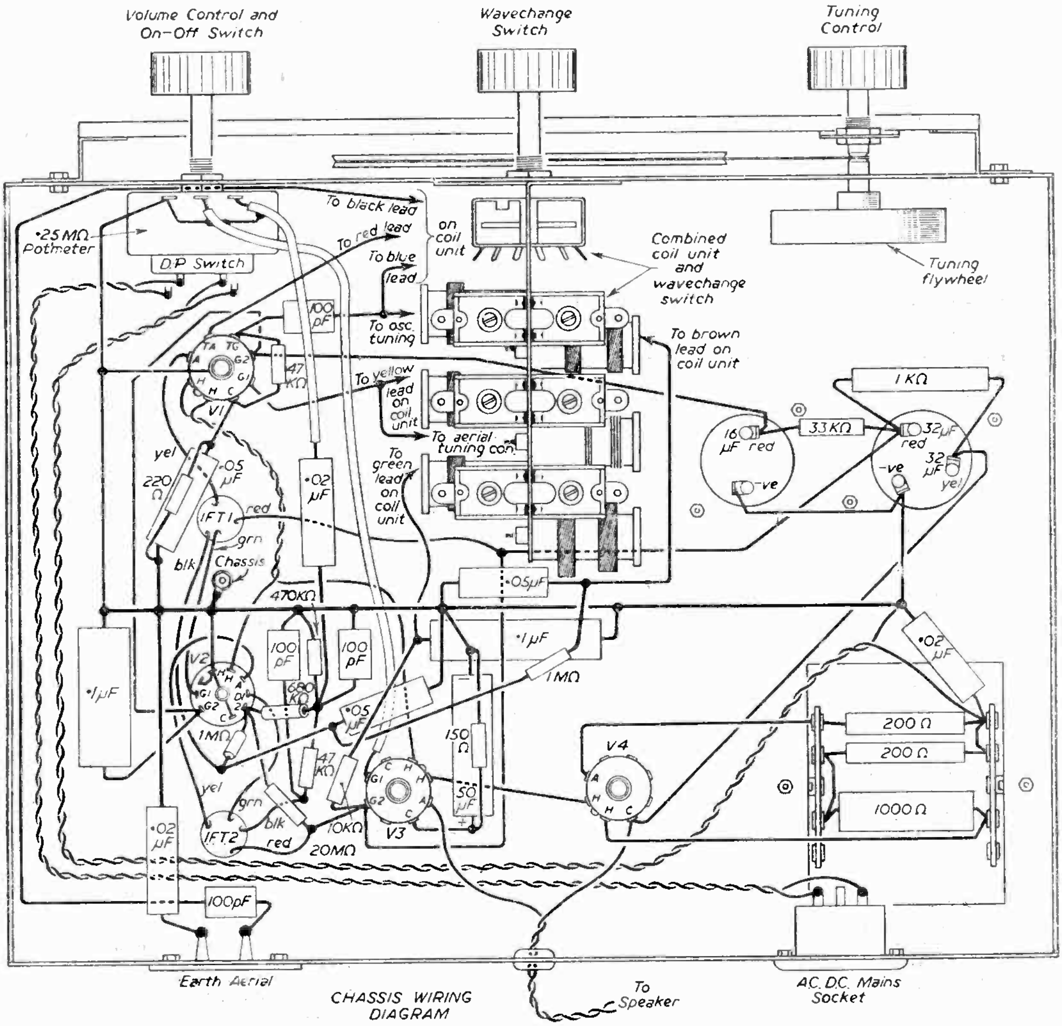
resistors run very nice and cool, and they are well clear of other components. The diagram be'ow is to scale and the holes may be taken from this diagram if you do not wish to obtain a drilled chassis from Denco, and the valveholders should be mounted with the pins in the orders shown on the wiring diagram. Note that three of the valves are of the B8A type whilst one is a B9A, and this is V2—between the two I.F. transformers. The latter should be of the Roding Type "U," and the first transformer (I.F.T.1) is then the one with a red spot. If, however, you have obtained the original pair of transformers or are converting the original receiver, then the transformer with a green lead projecting from the top must be modified, as the new valves are of the single-ended type and have no top caps. To modify the transformer carefully pull out the internal assembly bending out the fixing lugs slightly to avoid damaging the leads, etc. A sheet of insulating material will probably come out with the assembly. Carefully unsolder the green lead and attach a much longer piece of flex to the point from which the lead was removed. Draw this new lead down so that it comes down with the other lead, and then carefully insert the assembly into the can, making certain that the piece of insulating material is not crumpled up and that the adjusting screws come opposite the holes in the side of the can. If you can use a piece of green coloured flex (or green sleeving over ordinary thin connecting wire) it will simplify matter from a wiring point of view, and also at any later period should you wish to use the transformer in another receiver. The same form of construction should be followed as for the original receiver, the transformer and coil unit being left until last. Mount the valveholders and the two smoothing condenser blocks, the mains socket, aerial and earth strips and volume control. The two five-way tag strips may be left for the time being. The first lead to be put into position is the main



Wiring diagram of the A.C./D.C. Coronet Four.

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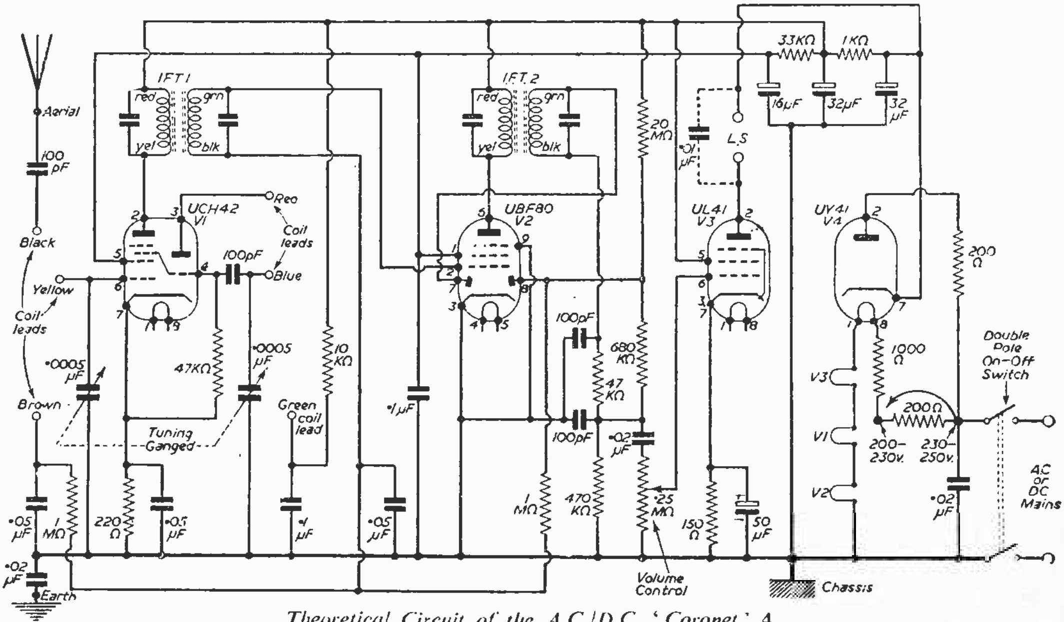
earthing bus-bar. This is merely a length of fairly heavy gauge tinned copper wire joined between an earthing tag inserted under one of the fixing nuts for IFT1, and the negative tag of the double 32 μF condenser. If you do not have a length of heavy-gauge wire available, simply twist together two or three pieces of the standard tinned-copper connecting wire. It should stand fairly rigid between the two points mentioned, and all earthing connections are then made to it. In the wiring diagram the draughtsman has shown the wire as though it runs past the tag, but this is only to simplify the wiring, and the .1 μF condenser and other components seen on the left of the tag are joined to the earthing wire where it rises from the tag. It should be understood, of course, that the wiring has been "squared up" to make all points clear, but in actual practice certain components are joined direct from one point to another.

(To be continued.)



Theoretical Circuit of the A.C./D.C. 'Coronet' 4.

LIST OF COMPONENTS

1—.25 M Ω volume control with D/P switch, type SG/1 with 1½in. spindle.—Reliance Manufacturing Co.

1—Coil pack, type R.L.30
2—I.F. transformers, type "U" } Roding Labs.

1—2-gang .0005 μF tuning condenser with type SL8 spin-wheel drive and dial. — Jackson Bros.

1—Metal chassis, type CH.12 (12in. x 9in. x 2½in.). —Denco.

3—B8A valveholders
1—B9A valveholder } Ediswan Clix.

1—Mains connector, type P.350
3—Control knobs, type K.365. } Bulgin.

1—8in. loudspeaker with transformer to match UL41 valve.—Whiteley Electrical.

Valves

1—UCH42
1—UBF80
1—UL41
1—UY41 } Mullard.

Resistors

1—1 K Ω (5 w.)
1—1 K Ω (10 w.)
2—200 Ω (5 w.)
1—33 K Ω (1 w.)
1—10 K Ω (1 w.)
1—20 M Ω
2—1 M Ω
1—470 K Ω
2—47 K Ω
1—220 Ω
1—150 Ω } ½ w.
} Radio Resistor Co.

Condensers

1—32+32 μF (350 v.w.), type CE27LE
1—16 μF (350 v.w.), type CE26L
1—50 μF (12 v.w.), type CE32B
2—.1 μF (350 v.w.), type CP46S
3—.05 μF (350 v.w.), type 343
3—.02 μF (500 v.w.), type CP34S } T.C.C.
4—100 pF (silver mica), type 101SMP

1—Aerial/earth socket strip
2—5-way tag strips (centre E)
4—Rubber grommets
Two dozen 6B.A.×⅜in. bolts and nuts; connecting wire and sleeving; 1 yd. screened single flex. Multicore solder. } Sterns Radio.

One cabinet—Tallon.

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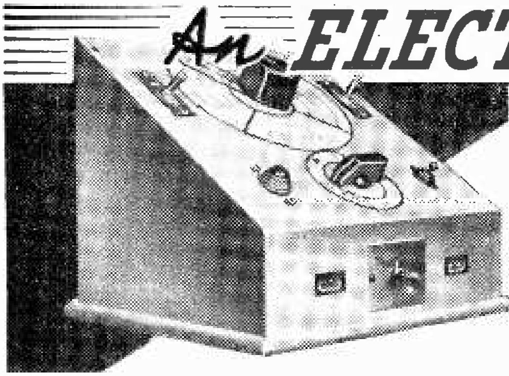
An ELECTRONIC TIMER



A USEFUL ACCESSORY FOR THE EXPERIMENTER, AMATEUR PHOTOGRAPHER, ETC.

By J. R. Hulse

A COMBINATION of radio and photography is not always ideal in the way of hobbies, due to lack of time and money, but some of the readers in the same position as myself may be interested in the following unit, which was interesting to construct and extremely useful when finished.

Apart from its obvious use as a photographic accessory it will provide a *useful* and accurate visual timing device (which can also be adapted to give an audible warning) of any time interval from one second to two minutes, in seconds, with quite a high degree of accuracy.

In its present form (Fig. 1) the unit has two output sockets—A and B—which will give the following.

Output socket A will provide either a 230 volt A.C. continuous supply for enlarger adjustment, or one which is switched on at the press of a button and will then automatically switch off again after any set interval up to two minutes.

Output socket B is independent of the unit, and provides an additional 230 volt A.C. supply with its own switch in a handy position for a safelight, etc.

An indicator lamp L is transformer coupled to socket A to give a visible timing indicator for development, etc.

The unit has four switched ranges (via S1) of 30 seconds each—giving 30, 60, 90 and 120 seconds respectively—and the fine control spreads the 30 second steps over an arc of roughly 270 degrees, thus giving quite an accurate degree of setting.

Technical Details

The unit depends for its action on the fact that a valve in a state of conduction will abruptly cease to conduct if a heavy negative charge is placed on the grid, in respect to cathode. If this charge is then lowered gradually the valve will commence to conduct again once the charge becomes lower than the cut-off point of the valve. If a high-resistance relay is placed in the anode circuit it will be held in the closed position while the valve conducts, but will open as soon as the valve ceases to pass current.

To store the charge a large value condenser C is placed between grid and cathode and the charge is allowed to leak away by placing a resistance R across it. Assuming a set value of C and the charge, then by varying R it will be possible to determine the time interval between the opening and closing of the relay (Fig. 2). C must *not* be an electrolytic, and must be of high quality.

It was finally decided that if the instrument were to be really accurate the resistance R must be capable of fine adjustment, particularly in the case of the higher ranges. For this reason, and because it was found difficult to obtain a high value potentiometer (5 or 6 MΩ), R was made up of three preset 2 MΩ resistances, switched by S1, and a 2 MΩ variable resistance (the fine control). See Fig. 3. The final circuit is shown in Fig. 4.

Sequence of Operation

When switched on by S3 lamp L will light up. When the valves warm up V1 will conduct closing the relay, thus opening contacts XY and closing XZ, the indicator lamp L will go out showing that there is no voltage on socket and the unit is ready for use.

Switch S4 to timer and adjust timing controls to required interval—this is done by switching S1 to the required range and adjusting the fine control to the right setting.

When the button P is pressed the circuit of V2 is completed, thus V2 will conduct charging up C1 and placing a negative potential on V1 grid. V1 will cease to conduct allowing the relay to open—thus opening contacts XZ, and closing contacts XY—so supplying power to socket A and lamp L. The charge on C1 will leak away through the timing resistors until it reaches the cut-off point of V1,

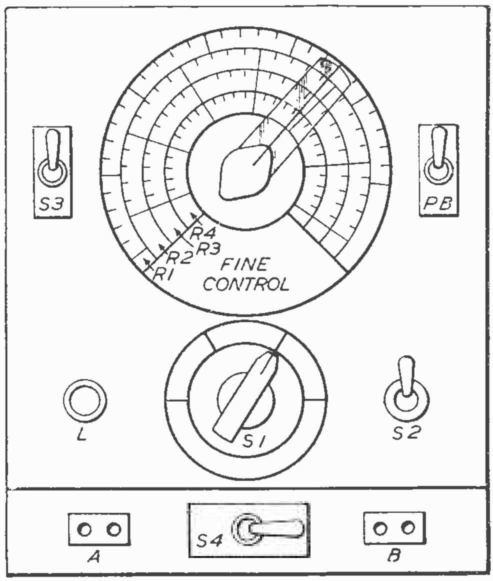


Fig. 1.—Details of the controls and panel layout.

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which will commence to conduct again, closing the relay and breaking the supply to socket A and lamp L.

By pressing the button P the same process can be repeated *ad infinitum*, thus making possible the production of a large number of prints from one negative without variation in exposure.

If S4 is turned to the other position C power will be present continually on socket A for adjustment of enlarger, focusing, etc.

As will be seen from the circuit, socket B and S2 are quite separate from the main circuit, being connected between the mains input tags.

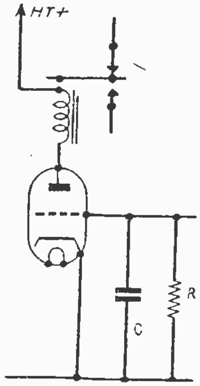


Fig. 2.—Relay operating circuit.

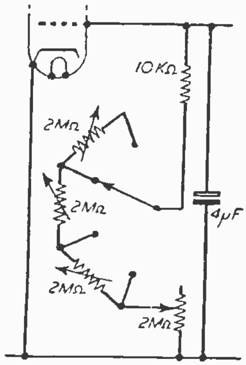


Fig. 3.—Details of the resistor adjustment.

The condenser C2 is a high value electrolytic, about 50 μF 50 volt being suitable, which is placed across the coil of the relay to prevent relay chatter, and to give a slight time-lag before the relay opens, thus ensuring a full charge on C1. The relay should have a fairly high resistance, 5-10 KΩ being suitable, and should be capable of a single-pole, double-throw action.

T1 is a normal heater transformer, supplying 6.3 volts to the valves. T2 was an old speaker transformer which on test was found to give roughly 5 volts; this was sufficient to supply the indicator lamp, which is of the type with a variable light opening (red).

The preset resistors are on a sunken panel at the back of the unit to allow access for adjustment.

The valves used depend almost entirely on the supply to hand. In this unit a 6SN7 strapped as a

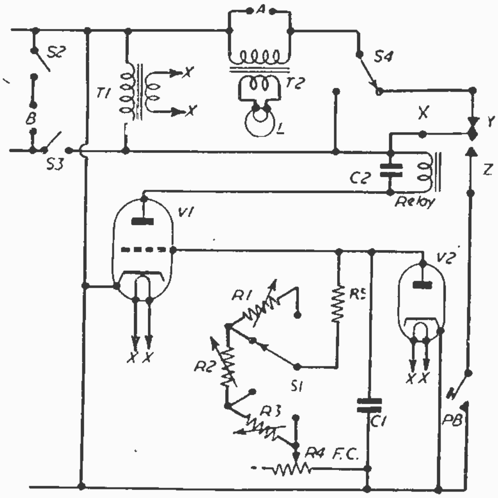
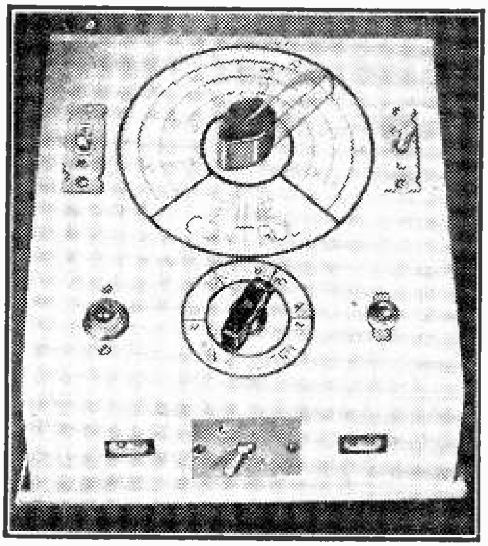


Fig. 4.—Final circuit of the Timer.

single triode was used for V1, and a 6J5 with anode and grid strapped as V2. The only provisos are that V1 must pass sufficient current to close the relay positively, and should have a fairly high cut-off point.

The switches S3 and S4 are of the same appearance, being war-surplus aircraft equipment switches with luminous tips. For the sake of a balanced appearance the press button was of this type also, being spring-loaded to stay in the off position.



View of the pane and controls.

Layout

After the calibration points had been ascertained the two dials were drawn on thin white card with Indian ink, and finished with a protective coat of colourless nail varnish. The case was made of three-ply and ½in. wood.

The arrangement of the parts in the case is purely a matter of convenience as there appears to be no interaction, but care must be taken to mount the relay away from the heat of the valves. A rectangular hole is cut in the back of the case and covered with gauze to provide ventilation.

To adapt the unit to give an audible warning, all that is necessary is to fix a light striker to the relay armature so that when the relay is closed it will just touch a bell head—the top of a small cycle bell will do—thus when the relay closes an audible ping will be heard coinciding with the end of the timing interval (Fig. 5).

This method will, of course, only work with a relay which has a wide range of movement.

Calibration

This can easily be carried out with the aid of a clock or watch which has a second hand.

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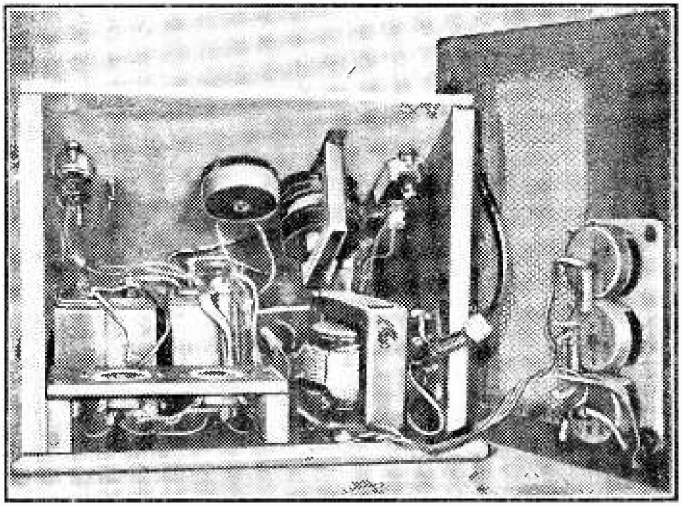
LIST OF COMPONENTS

R1, R2, R3 — 2 MΩ presets.
R4—2 MΩ volume control.
R5—10 KΩ.
C1—4 μF. 450 v.w.
C2—50 μF, 50 v.w.
T1, T2 — See text.
S1—1 Pole, 4 way.
S2, S3 — 1 Pole, on-off.
S4—1 Pole, 2 throw.
P.B.—Spring loaded on-off.
Relay—See text.
V1—6SN7. 6J5, V2—6J5, 6X5 — See text.
Indicator lamp.
A, B — 2-pin sockets.



View of the interior of the timer.

Set S1 to range 1 and adjust the fine control until a delay of exactly 5 seconds is obtained; mark the point and repeat in 5 second steps up to 30 seconds.

Switch to range 2 and adjust the fine control to a point a little above its starting point. Adjust preset R3 until the delay is exactly 30 seconds. mark the point and continue the calibration in 5 second steps as in the case of range 1 up to 60 seconds.

The ranges 3 and 4 are calibrated in the same way, using presets R2 and R1 to set the starting point.

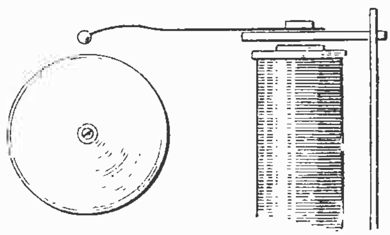


Fig. 5.—How the relay may be adapted to give an audible signal.

Radio Help for Motorists

ON St. Andrew's Day the Automobile Association announced two important developments for the benefit of Scottish motorists. For the first time Scotland is brought into the A.A. radio network by the introduction of radio road patrols by day and a radio-controlled night breakdown service in Glasgow and the surrounding districts. The principal object is to ensure speedier help for motorists and motor cyclists when a breakdown occurs.

The scheme falls into two parts: from 9 a.m. until 6 p.m. a number of the patrols, equipped with two-way radio, will be on duty within a radius of 20 miles from the city centre. They will be in constant touch with the A.A. Headquarters. In addition, from 6 p.m. until midnight and during week-ends, specially designed A.A. radio-controlled breakdown vehicles will be in operation. They will deal with requests for emergency assistance within a radius of 10 miles from the Association's office in West George Street, Glasgow, which will be manned throughout the twenty-four hours. In the event of trouble on the road, all a member need do is to telephone Glasgow Central 5845 when the nearest radio patrol or breakdown vehicle will at once be directed to help him.

As well as providing assured assistance for stranded motorists, radio control will greatly increase the Association's ability to give prompt and efficient road service in a variety of ways.

Book Review

"BATTERY CHARGERS AND CHARGING," by Robert A. Harvey, B.Sc. (Eng.), A.M.I.E.E, Published on November 2nd, 1953, by Iliffe and Sons. Ltd. Size 8¾in. x 5½in. 400 pages. 284 illustrations. Price 35s. net. (postage 1s. 2d.).

THERE has been steady progress in the design of storage batteries over the last 25 years, but during this same period there have been fundamental changes in the methods used for battery charging and control. This book describes all these new methods together with the older methods which are still in current use.

The construction and chemistry of each type of storage battery is first explained, and there is a description of the fundamental principles of charging together with much general information on charging technique. The book then describes how the principles are used in various specialised applications. These include electric vehicles and locomotives, emergency lighting and power systems, power stations, telephone exchanges, mines, ships, aircraft, railways, trolley buses, cars and commercial vehicles, and generating plant for country houses and other isolated buildings. Home chargers for car and radio batteries, and charging arrangements for commercial garages and radio and electrical shops, are dealt with in a special chapter.

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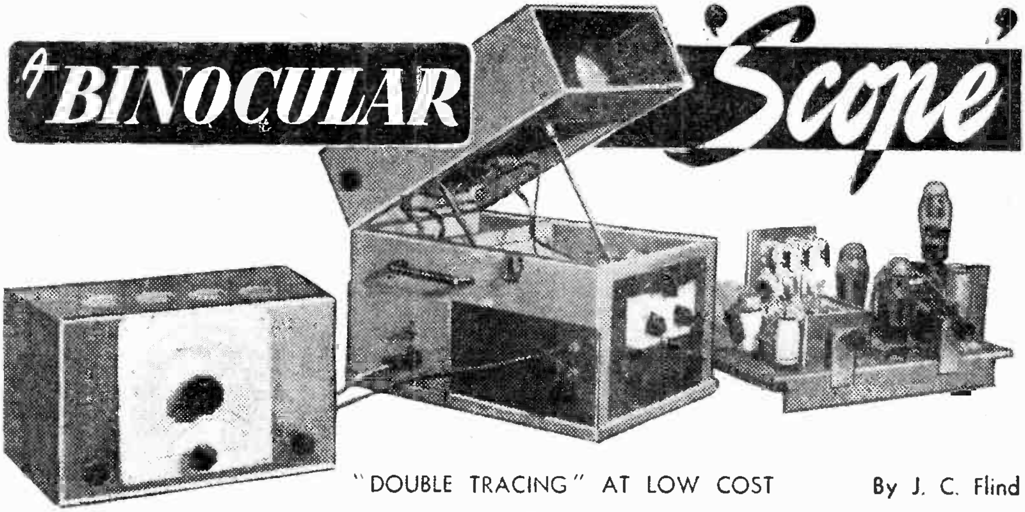
A BINOCULAR 'Scope'



"DOUBLE TRACING" AT LOW COST

By J. C. Flind

(*Continued from Page 13 January Issue.*)

ACTUALLY, it will be found that the operation of shift will involve some degree of defocusing of the trace. This is due to "astigmatism" caused by the mean potential between the pairs of plates differing from the potential on the final tube anode, and it can be overcome by resorting to a push-pull shift circuit. This, however, involves the use of ganged potentiometers, and in the interests of economy and simplicity it was decided to do without this refinement. It will be seen that X and Y plates are not connected directly to the sliders of the shift controls, but that 5-megohm resistors R1, R3, R6 and R8 are interposed.

The corresponding X and Y plates are joined, also through 5-megohm resistors R2, R4, R5 and R7 to the centre tap of R9 and R10, so that they are held at the same D.C. potential as the final anodes of the two tubes.

The next link in the potentiometer chain consists of the three components in series, VR5, R11 and VR7 for No. 1 tube, and their counterparts VR6, R12 and VR8 for No. 2. The values are the same in each case: VR5 and VR6 are each 1 megohm, R11 and R12 are 5,000 ohms, and VR7 and VR8 each 100,000 ohms.

VR5 and VR6 are the focus controls, and work by varying the D.C. voltage applied to the No. 2 anodes, while VR7 and VR8 adjust the brilliance of the trace, by varying the amount of negative bias given to the tube grids. This is, of course, represented by the difference in potential between the cathodes, connected respectively to the junction between VR5 and R11 and VR6 and R12, and the grids themselves which are connected to the sliders of VR7 and VR8. The purpose of R11 and R12 is to prevent any danger of damage caused by the tubes being inadvertently run at zero bias. If brilliance is found to be insufficient they may be reduced in value, say to 2,000 ohms. Note that the grids are decoupled to negative H.T. by the capacitors C5 and C6, each of .1 μF.

As soon as the power pack and the tube unit have been built they can be temporarily plugged together and a test made to ensure that the tubes are working properly and that the brilliance, focus and shift controls are operating satisfactorily. It will, in all probability, be found necessary to reverse one or two of the connections so that the controls work in the desired direction, and, if later complication is to be avoided, now is the time to attend to these points.

The only remaining job to be done on the C.R.T. unit is to provide the connections which are to bring to the tubes the impulses from the timebase and from the two Y-amplifiers. These can consist of three lengths of plastic twin flex, soldered respectively to the connectors for the Y-plates of both tubes and for the X-plates of No. 2, which are linked with the corresponding plates of No. 1 through .1 μF condensers, marked C1 and C2. The reason for these is, of course, that if there were a direct D.C. connection it would be impossible to operate the X-shifts independently on both tubes. From the A.C. point of view, however, the .1 μF condensers form virtually

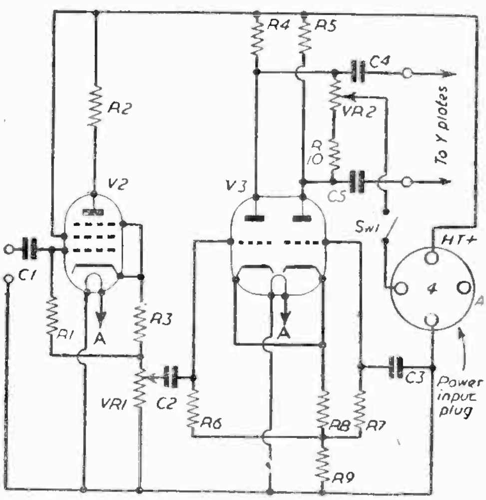


Fig. 4.—The "Y" Amplifier showing sync control.

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a short-circuit, so that when they receive impulses from the timebase the two tubes work in unison.

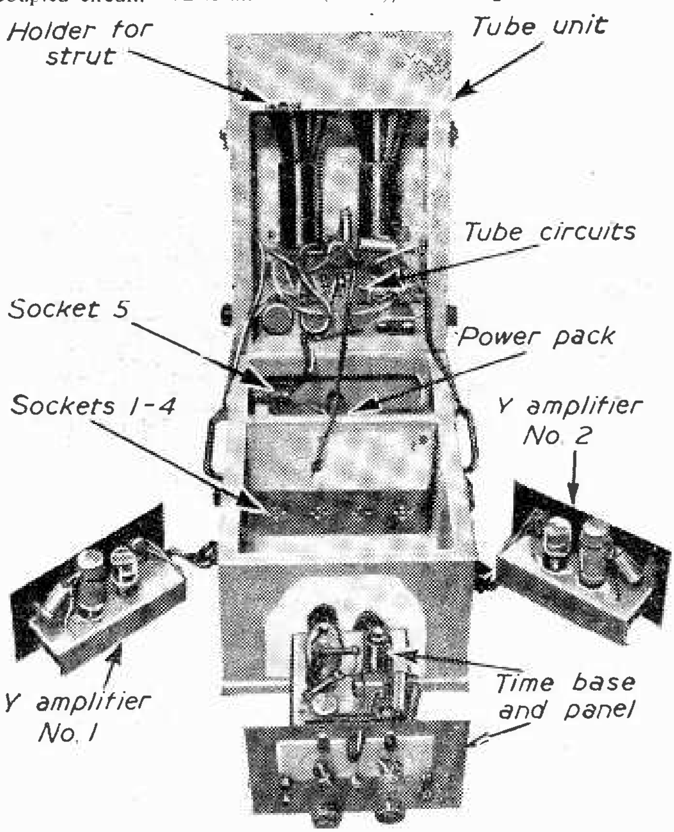
There is no need to screen the connecting leads as the sensitivity of the tubes is not high. The leads can conveniently terminate in miniature two-pin plugs, so that the connection with the X and Y amplifiers can be made or broken as desired.

The Y-Amplifiers

As one of the purposes of this instrument is the comparison of two distinct traces produced under as far as possible identical conditions, the two Y-amplifiers are duplicates of one another. (Perhaps they might better be described as "mirror images" as the layouts are arranged in reverse, to permit of the panels being located on the sides of the main case, one on the right and one on the left, with the input terminals and gain controls conveniently near the front.)

Two essential requirements had to be fulfilled: (1) the input resistance had to be as high as possible, so as to eliminate interaction or interference with the circuits under examination, and (2) the output had to be in push-pull, to avoid defocusing of the traces on the tubes. These objects, together with an all-over amplification factor of about 25, are achieved by the use of a pentode, connected as a cathode follower, as the input valve V2, and following this with a double triode V3, used in a cathode-coupled circuit. V2 is an SP61 (VR65), this being the most inexpensive pentode at present on the surplus market, and for V3 the choice fell on the 6SL7, which has a high amplification factor and low heater current, added to which, in this valve all the electrodes are brought out to the base pins, which makes it very convenient to wire up.

Each of the Y-amplifiers is made up on a chassis 2½in. × 7½in. and 2½in. deep, and from the circuit diagram, Fig. 4, it will be realised that the construction offers few difficulties. In view of the high input resistance the input terminal and its associated metal-cased .1 μF condenser, C1, and the 2-megohm resistor R1 are mounted as close as possible to the top cap of V2, and no hum troubles have been experienced. If, however, high frequencies are to be investigated, it may be advisable to replace the input terminal with a shielded coaxial socket, despite the sacrifice in convenience of connection which this entails. The input terminals and the 5,000 ohm gain control VR1 are mounted at the end of the panel nearest to the operator, and the output from V3 is taken, via a pair of .1 μF condensers, C4 and C5, to a miniature two-pin socket bolted to the chassis so as to make convenient contact with the Y-plate flying leads which, it will be remembered, are fitted to the tube unit. The output is connected also to a pair of terminals at the rear of the panel, so that in case of need there is direct access to the C.R.T. plates.



The Assembly "opened out" and the parts identified.

The value of the anode resistor R2 is not critical—in the original model it is 5,000 ohms, but if preferred it may even be omitted entirely and the anode of V2 taken directly to the H.T. line. R3 is the normal bias resistor—in this case 250 ohms.

The V3 circuit is a quite conventional cathode coupled symmetrical push-pull arrangement, and component values are as follows:

C2 and C3	each	.1 μF.
R4 and R5	,,	100,000 ohms.
R6 and R7	,,	1 megohm.
R8		1,000 ohms.
R9		10,000 ohms.

Up to this point the two Y-amplifiers are identical in design, but the question of synchronisation has now to be considered.

Obviously it would be superfluous to synchronise the timebase to both the Y-amplifiers, so an "internal sync" circuit is fitted only to No. 1, which is associated with the left-hand C.R.T. The circuit is very simple, consisting only of a fixed 200,000 ohm resistor, R10 and a 250,000 potentiometer, VR2, connected in series across the anodes of V3: according to the position of the slider of VR2, therefore, the operator can take any proportion of the amplifier output, from zero to 100%, for injection into the timebase. The potentiometer used is a switched volume-control, and is so arranged that at the minimum setting the switch SW1 is opened and the sync disconnected entirely.

The connection to the timebase is

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'AVO' *Precision* ELECTRICAL TESTING INSTRUMENTS

Registered Trade Mark

A dependably accurate instrument for testing and fault location is indispensable to the amateur who builds or services his own set.

D.C. Voltage	A.C. Voltage
0—75 millivolts	0—5 volts
0—5 volts	0—25 ,,
0—25 ,,	0—100 ,,
0—100 ,,	0—250 ,,
0—250 ,,	0—500 ,,
0—500 ,,	

D.C. Current	Resistance
0—2.5 milliamps	0—20,000 ohms
0—5 ,,	0—100,000 ,,
0—25 ,,	0—500,000 ,,
0—100 ,,	0—2 megohms
0—500 ,,	0—5 ,,
	0—10 ,,

GUARANTEE: The registered Trade Mark "Avo" is in itself a guarantee of high accuracy and superiority of design and craftsmanship. Every new AvoMinor is guaranteed by the Manufacturers against the remote possibility of defective materials or workmanship.

The UNIVERSAL AVOMINOR

(as illustrated) is a highly accurate moving-coil instrument, conveniently compact, for measuring A.C. and D.C. voltage, D.C. current, and also resistance: 22 ranges of readings on a 3-inch scale. Total resistance 200,000 ohms.

Size: 4⅝ins. x 3¾ins. x 1⅞ins.
Nett weight: 18 ozs.
Price: **£10 : 10 : 0**

Complete with leads, interchangeable prods and crocodile clips, and instruction book.

The D.C. AVOMINOR

is a 2¼-inch moving coil meter providing 14 ranges of readings of D.C. voltage, current and resistance up to 600 volts, 120 milliamps, and 3 megohms respectively. Total resistance 100,000 ohms.

Size: 4⅛ins. x 3⅛ins. x 1⅛ins.
Nett weight: 12 ozs.

Complete as above
Price: **£5 : 5 : 0**

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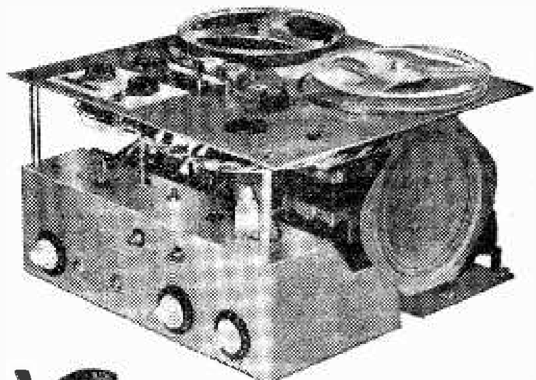

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Constructor Envelope with easy step-by-step instructions and simple wiring diagrams **6/6**

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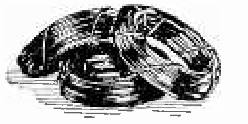
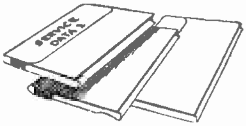


CONNECTING WIRE SNIP

P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils, 2/9 each. Colours available : Black, Brown, Red, Orange, Pink, Yellow, White, Transparent. 4 coils for 10/-.



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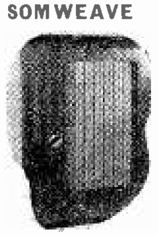
100 service sheets, covering British receivers which have been sold in big quantities, and which every service engineer is ultimately bound to meet. The following makers are included : Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.
Our folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers " all dry," etc., which have been imported into this country. Names include Sparton, Emmerson, Admiral, Crossley, R.C.A. Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc., etc. Price for the folder of 100 sheets is £1. Post free.

SOMWEAVE



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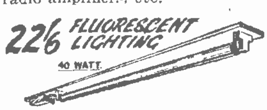


Complete kit comprises Hi-craft 40 watts control unit, starter lamp, lamp holders, clips and wiring diagram. Price less tube, 22/6, plus 1/6 post. With tube 30/-, carriage and insurance 3/6. Tubes 7/6 each, carriage free, minimum quantity 6 tubes.

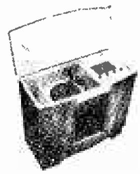
SUPERHET RADIO by BEETHOVEN

Chassis size approx. 9½ x 7½ x 8½, fully aligned and tested—110-240 volt A.C. mains operation Large clear edge-lit dial. Three wave bands. Complete with five Mullard valves & Rola loud speaker ready to operate. Special cash with order price this month, £8 17s. 6d., carriage and insurance 7/6d. Terms, £3 0s. 0d. deposit, balance over 12 months.

THIS MONTH'S SNIP

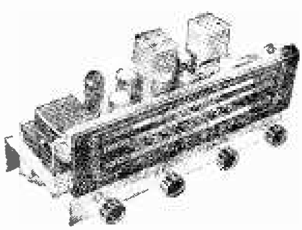
A 70gn. RADIOGRAM FOR ONLY 40gns.

(Or £14.0.0 deposit.)



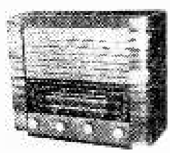
This Cabinet has all the properties which combine to make it a beautiful piece of furniture and yet a most up-to-date radiogram. Externally, it is beautifully figured walnut; internally, it is white sycamore. The radio section is raised to a comfortable operating level and beyond the auto changer is a compartment for storing your most popular records. We are most proud to offer this cabinet and feel sure that every purchaser will be equally proud to own one. It can be supplied complete as a working radiogram, the price being £42.0.0, carriage and insurance £1. Alternatively, the cabinet may be purchased separately, price £18.18.0, or with record changer, but uncut radio board, price £30.0.0. The radio chassis incorporated in the complete model is our popular 5-valve A.C. mains Superhet, covering 3-wave bands (long, medium and short) and with volume and tone controls, multi-coloured, edge-lit dial, etc. The record changer incorporated in all models is the latest Collaro 3-speed (Type No. RC531) with the famous Collaro " Studio " pick-up.

THE " WINDSOR "



This is a 5 valve A.C. superhet, covering the usual long, medium and short wavebands. It has a particularly fine clear dial with an extra long pointer travel. The latest type loctal valves are used and the chassis is complete and ready to operate. Chassis size 15in. x 6in. x 6in. Price £9.19.6 complete with 8in. speaker. Carriage and insurance 10/-. H.P. terms £3 7/- deposit. Table model cabinet to suit—37/6 plus 3/6 postage and insurance.

TABLE RADIO CABINET

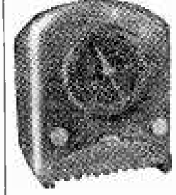


Due to a special purchase, we are able to offer this very fine cabinet, size approx. 16 x 16 x 7—walnut veneered and satin finished. Complete with 3 colour, 3 waveband glass scale at only 37/6, carriage and packing 3/6. This cabinet is the correct one for the chassis above.

A FEW REMAIN

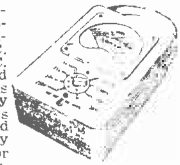
This Cabinet is offered below cost. It is suitable for a televisor using tube size varying from 12in. to 17in., its overall dimensions being 3ft. 5in. high, 1ft. 4in. deep, 1ft. 10in. wide. It is complete with plywood back and " Bowler Hat." Originally made for a very expensive televisor and really good quality. Unrepeatable. Offered at £6.19.6, carriage, packing, etc., 12/6. **Note.**—These are cut for 12in. tubes, but the holes for the controls are not drilled.

MAINS MIDGET RADIO



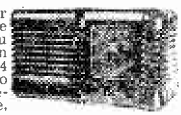
This is an excellent little radio in an attractive cabinet to which can be affixed transfers, thus making it extra suitable for nursery or child's bedroom. The circuit is a T.R.F. for A.C. mains operation. All the parts—bakelite cabinet, valves, knobs, back—in fact, everything will cost you only £3 15s. 0d., plus 2/6 postage. Construction data free with the parts, or available separately at 1/6.

MULTI-METER KIT



The Multimeter illustrated measures D.C. volts, D.C. m-Amps and ohms. It has a sensitivity of 200 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts, including 2in. moving-coil meter, selected resistors, wire for shunts, 8-point range selector, calibrated scale, stick-on range indicator and full instructions for making are available as a kit, price 15/-, plus 9d. post and packing.

MAKE A RADIO

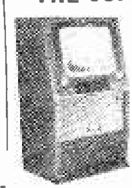


Using our parts in one evening you can make an all mains 4 valve radio with bakelite case, then you will be giving a £12 present which costs you only £6 1s. 6d. or £3 2s. 0d. deposit and 12 monthly payments of 11/6. (Carr. and insurance 5/-).

AUTO-RADIOGRAM 31gns.

Cabinet £12.10.0. Full size walnut Console *plus 15/- carriage.* 5 valve all-mains superhet **Radio.** 3 waveband, coloured illuminated scale, fully guaranteed **£9.19.6** *plus* 7/6 *carriage & insurance.* **Auto Change Unit** by Collaro with pick-up for long playing and standard records **£11.10.0.** *plus* 7/6 *carriage and insurance.* **SPECIAL OFFER.** Three units for **31** gns., or **£10.16.8** deposit and balance over 12 months. *plus* £1 *carriage and insurance.* Booklet of photos, circuit, diagrams, etc., 2/6.

THE SUPERIOR 15in.



Up to the minute big picture TV for only £37.10.0. A 20 valve televisor for the amateur constructor, all components, valves and 15in. Cossor Cathode Ray Tube cost **£37.10.0** plus **£1** carriage and insurance or **£12.10.0** deposit and 12 monthly payments of **£2.11.6.** **Constructor's envelope giving full details and blueprint 7s. 6d.** Returnable within 14 days if you think you cannot make the set.

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made by means of one of the pins of the same 4-pin plug which carries the heater and H.T. supplies to this sub-chassis. The socket into which this particular pin fits is, as was shown in Fig. 2, connected to one of the "next-door" sockets, and this in turn will go to the sync input of the timebase itself.

As No. 2 Y-amplifier carries no sync control, advantage was taken of the vacant space on the panel to fit a three-way two-pole switch (not shown in the circuit diagram), allowing the output from this amplifier to be reversed at will. This, of course, makes it possible to invert the trace on No. 2 tube, and will be found useful when the signals being compared happen to be out of phase. In the third position of this switch, the Y-plates are disconnected entirely from the amplifier, but not from the terminals, so eliminating any possibility of false readings or accident when the C.R.T. is being fed direct from an outside source.

The Timebase

The timebase fitted to the original instrument is of the familiar gas-triode type, simply because one of these valves happened to be available, and this particular circuit, which is very reliable and easy to manage, operates up to about 30 kc/s, covering all the writer's immediate requirements. If later on a hard-valve timebase, working up to higher frequencies, should become necessary, the unit design of the 'scope will permit one to be built and plugged in as an alternative to the original, without disturbing any of the other sections of the instrument.

It was considered imperative that the output should be in push-pull, and also that variation of the trace amplitude should be possible without in any way affecting the frequency settings. These requirements were met by feeding the timebase output to the C.R.T.'s through a cathode-coupled push-pull amplifier, once again built round a 6SL7. This valve is switched so that it can act when desired as an X-trace amplifier, independently of the timebase.

Turning to the circuit diagram, Fig. 5, it will be seen that the external connections to the timebase chassis are brought in by two separate plugs engaging respectively with the power-pack sockets Nos. 2 and 3, one pin of each plug being earthed to the chassis. No. 3 plug carries the heater supplies for V4, and in addition serves to connect the "internal sync" from Y-amplifier No. 1 to the grid of V4,

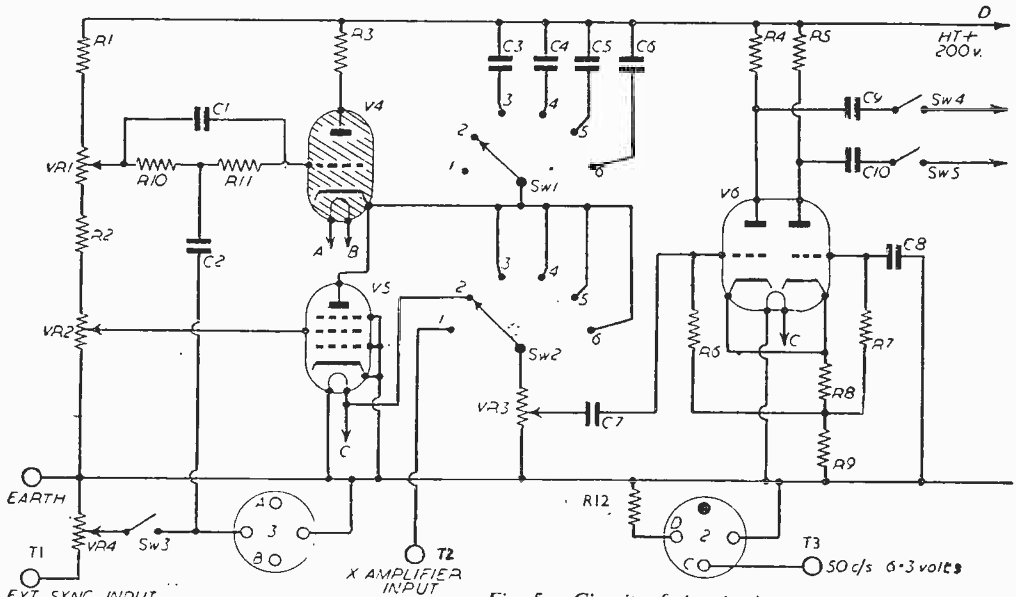

Fig. 5.—Circuit of the timebase.

LIST OF PARTS FOR FIG. 5.

R1 25,000 ohms.	VR1 100,000 ohms.	C1 .0001 μF.	C6 .004 μF.
R2 25,000 ohms.	VR2 20,000 ohms.	C2 .01 μF.	C7 .1 μF.
R3 500 ohms.	VR3 2 megohms. (and double-pole switch)	C3 .5 μF.	C8 .1 μF.
R4 100,000 ohms.		C4 .1 μF.	C9 .1 μF.
R5 100,000 ohms.		C5 .02 μF.	C10 .1 μF.
R6 1 megohm.	VR4 1 megohm. (and single-pole switch)	SW1/2 2 bank 6-way Yaxley type.	
R7 1 megohm.		SW3 Associated with VR4.	
R8 1,000 ohms.		SW4 and SW5 Associated with VR3.	
R9 10,000 ohms.		Valves: V4 EN31 gasfilled triode or similar type.	
R10 100,000 ohms.		V5 VR65 (SP61).	
R11 100,000 ohms.		V6 6SL7.	
R12 15,000 ohms. (5 watts)			

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while No. 2 brings in the heater supplies for V5 and V6 and, at pin " D ," the H.T. supply of 200 volts.

Between " D " and the chassis there is a 5 watt bleeder resistor, R.12, the purpose of which is to swamp any variations in H.T. current arising from alterations in the setting of the fine frequency control VR2, which might otherwise result in excessive fluctuations in H.T. voltage.

From the H.T. line to chassis runs the potentiometer chain formed by R1, VR1, R2 and VR2 : VR1 sets the initial grid bias given to V4 and thus the amplitude of the trace. Unfortunately, it also affects the frequency, and for this reason the author has not employed it as an amplitude control, this function being entrusted to VR3 the amplifier gain control. VR1 is not, therefore, brought out to the front panel but is a pre-set control mounted on the chassis and varied when necessary by a screwdriver. VR2, the slider of which runs direct to the screen of V5, governs the current passed through that valve and hence the frequency of operation of the timebase cycle.

The basis of this type of circuit is the charging of a condenser—one of the bank C3/C6—through V5 and its subsequent rapid discharge through V4, and the values given in the components list give complete coverage of all frequencies from 12.5 c/s up to over 30 kc/s.

The suppressor, signal grid and cathode of V5 are joined to chassis, and it operates as a " constant-current pentode ", i.e., the current passed does not vary appreciably with rises and falls in anode voltage. This makes it eminently suitable for use as a timebase control. The anode resistor of V4 has a considerable influence on the time taken by the " flyback," but it should not be unduly reduced in the endeavour to speed this up, as this may result in overloading.

The six-way two-bank switch SW 1/2 selects, in its positions 3 to 6, one of the timebase condensers to be charged, and so operates as a coarse frequency control, at the same time carrying the output, taken from the junction of the cathode of V4 and the anode of V5, to the gain control which precedes the amplifier valve, V6.

Synchronisation

As is well known, a small fraction of the alternating voltage under examination will, if injected at the grid of V4, hold the timebase itself in step with the " work," and provision has been made here for the timebase to be synchronised either with an external source or, as already mentioned, with the amplifier Y1.

The sync input runs to the junction of R10 and R11 in the grid lead to V4, and is connected through C2 to one pin of plug No. 3. It will be remembered that this in turn runs to one pin of plug No. 4 and from there through the switch and potentiometer fitted on No. 1 Y-amplifier to a tapping across the output of that unit.

The external sync input consists of a potentiometer VR4 running from a terminal T1 on the front panel to the chassis, and having its slider connected to C2. VR4 is a switched volume-control, wired so that when it is turned to the minimum position SW3 opens, thus disconnecting it entirely.

It will be seen that the timebase can be operated as desired, either with " external " or " internal " synchronisation, or entirely free-running.

The X-Amplifier

This single-valve cathode-coupled push-pull amplifier, once again built round a 6SL7, follows the pattern already described in the section on the Y-amplifiers and is fed through the gain control VR3. This volume control is of the type carrying a double-pole on-off switch (SW4/5) and this is wired in the anode leads, so that in the minimum position the timebase and the X amplifier are disconnected from the X plates of the C.R.T.'s. The output from V6 runs, as in the case of the Y-amplifiers, to a miniature two-pin socket screwed to the back of the panel, and ready to engage with the appropriate lead from the C.R.T. unit.

In position 1 of the coarse-frequency-control switch SW 1/2, the timebase is disconnected from the amplifier, and the input comes instead from a terminal T2 on the front panel, marked " X-amplifier." In position 2 the input comes from the " live " end of the 6.3 volt A.C. heater supply, thus providing at will a sinusoidal 50-cycle trace as an alternative to the usual saw-tooth pattern.

This arrangement is highly convenient when using the 'scope as an A.C. valve-voltmeter ; all one has to do is to set the switch to position 2, and with the Y-amplifier gain set at zero adjust the X gain so that the resulting straight-line trace just fills six divisions on the screen, and a fraction over. If the source of the voltage to be measured is then connected to the X-input terminals and the switch moved to position 1, the figure can be immediately read off.

Construction

The timebase chassis has to provide room for the three valves and for the two-bank switch, also for the pre-set potentiometer VR1, all other controls being brought out to the front panel. Fig. 1 suggests a layout, and a suitable chassis size is 6in. x 7½in. x 2½in. deep. As before, it is bolted to the front panel, but not to the case, so as to facilitate withdrawal. There are four panel controls, respectively the fine and coarse frequency controls, VR2 and SW 1/2, the external sync control, VR4 and lastly the X-amplitude control, VR3.

Also on the front panel are the terminals already mentioned, T1, the external sync input T2, for direct input to the X-amplifier, and a third, T3, which runs to the 6.3 volt heater supply. This provides a useful 50-cycle source which can be quickly connected to either of the Y-amplifiers for frequency checking monitoring or sync purposes. Other terminals are provided to facilitate connection to the chassis, and a further pair give direct access to the X-plates of the C.R.T.

Yet another refinement is a switch permitting the impulses to the X-plates to be reversed if desired.

Setting-up is comparatively simple. When the timebase has been constructed and plugged in, set the coarse frequency control to position 3 and the fine-frequency control to the slowest speed. Make a direct connection from T3 to the input of one of the Y-amplifiers, so that a 50-cycle signal is produced. Switch on and allow to warm up for a couple of minutes, and then adjust VR1, which should be fitted to the chassis in such a way that it can be easily got at with a screwdriver until four complete sine-waves are shown on the screen. The timebase will then be running at 12.5 c/s, which is as slow a speed as is convenient in practice ; below this rate flicker becomes troublesome.

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On Your Wavelength

By Thermion

The Amateur Radio Exhibition

THE seventh Amateur Radio Exhibition held at the Royal Hotel, London, in November had, like its predecessors, an atmosphere entirely different from that which pervades Earls Court. The visitors to the latter consist chiefly of non-technical members of the public more interested in cabinet styles and prices rather than technical progress. Visitors to the Amateur Radio Show, organised by the Radio Society of Great Britain are almost entirely keen technical amateurs. The exhibition is on a much smaller scale, of course, than the Earls Court show, and attendances are correspondingly much smaller. But directly you enter it the atmosphere seems charged with a mysterious enthusiasm. Groups of visitors gather round each stand and discuss the technical aspects of the apparatus on view with greater interest than is seen at Earls Court. Every stand attendant is technical, which of course is desirable with a "gate" which consists almost entirely of highly technical amateurs interested in both transmitting and receiving. The Amateur Radio Show is staged not only to sell exhibitors goods, but as a forum for the dissemination of technical knowledge. One meets more old friends there than at the larger national show, where the keen amateurs are lost among so many.

One speaker at the inaugural luncheon made a pointed suggestion to the Radio Industry Council who organise the Earls Court show. It was that the industry owes it to the R.S.G.B. to let them have space at Earls Court at a nominal price, or even free of charge, as a mark of appreciation of the work of the society in training the personnel on which the industry was founded, and from the members of which it still draws its most highly skilled men. It does, in fact, provide a valuable pool of technicians.

The price of space for a stand at Earls Court is beyond the means of the society and of the firms who manufacture apparatus for amateurs. If this exhibition could be included in the National Radio Show it would enable amateurs to see both. Indeed, it would permit the R.S.G.B. to organise an even bigger display. It would be disastrous if the R.I.C. by neglect, forced this amateur show to be abandoned.

The appended letter from Mr. J. Pickering, of Gower Street, W.1, bears on this subject :

"In a recent article in PRACTICAL WIRELESS you stated that the home construction of sets was still very active, and yet I spent hours at the last Radio Show looking in vain for stalls which featured components for home constructors. One would think that the big firms of today which built up their reputations on their components and their kits would still cater for the home constructor. Think of the thousands of sets that were made up from kits—like the Cossor Melody Maker, the Mullard Master 3, the R.C. Threesome and hosts of others.

Looking round the Radio Show one would think that the constructors' market was dead, and then one looks again, this time at the advertisement pages of PRACTICAL WIRELESS, and realises that it is far from defunct, and in fact it is still a flourishing business.

Pictorial Circuits

THE antis and pros continue to bombard me about the merits or otherwise (according to the point of view) of pictorial circuits. One of my younger readers, Master T. Powys-Tybb, aged 15, of Downside School, Somerset, has decided views on the matter. He says, without any equivocation, that they are useless, and that he finds circuit diagrams extremely easy to understand. He thinks the parts cannot easily be identified in a pictorial diagram, and that unless the components in hand are identical with those shown the reader is likely to be even more confused. Some condensers look like resistances. True, but they are marked in a pictorial diagram as such, and confusion surely could not arise. He feels that if a beginner will not take the trouble to understand circuit diagrams at the beginning, he will never understand them. A beginner, says he, should learn to walk before he can run, but I would not adopt the drastic advice Master Powys-Tybb gives of giving up radio altogether. One hopes that a pictorial will gather into the fold one who would otherwise be lost to it, and hope that as his interest grows he will learn circuitry symbols. Totting up the ayes and nayes in this discussion they are about equally divided, and so it must be left to editorial discretion when to include a pictorial *as well as* a theoretical circuit. When both are given, surely the pictorial helps the beginner to follow the theoretical ?

Too Highbrow ?

HOW difficult it is to please all. Here is Mr. C. Harrison, of Chester, complaining that we are too highbrow. Compare this complaint from an old reader aged 64, with that of the correspondent quoted above, aged 15 ! Mr. Harrison takes as an example our January issue, and says that the articles on the Binocular Scope, Soundmaster, Electric Organ, and Coastal Power Beacons are of no use to him ! Maybe, but they are to many others.

No issue of any periodical or newspaper can contain articles every one of which will appeal to every reader. A wide variety of tastes have to be catered for, and I think the ingredients of our monthly printers' pie are a nicley blended pabulum.

Is Mr. Harrison interested in more than *one third* of his daily newspaper? I doubt it. How many letters of protest would the Editor receive if he published, as Mr. Harrison desires, circuits using basket coils and old pattern valves. *Some* readers may have them, but very many more have not, and there would be protests from all over the country asking us why we incorporated components which could not be obtained.

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TRANSMITTING TOPICS

PRINCIPLES OF SINGLE-SIDEBAND TRANSMISSION EXPLAINED

By Wm. A. Hope

SINGLE-SIDEBAND techniques are gaining increasing popularity among many amateurs (especially on 80 metres) and the purpose of this article is to give, briefly, the operational principles of both transmission and of reception.

Theoretical Aspects of S.S.B. Transmission

Single-sideband suppressed-carrier (S.S.B.S.C.) techniques have the following advantages over the conventional amplitude-modulated transmissions.

(a) Telephony transmissions are rendered more effective since interference from other sources is partially eliminated.

(b) In normal modulation techniques, two sidebands are radiated with the carrier frequency ; thus, by transmitting only one sideband the bandwidth of transmission is effectively halved.

(c) Since no intelligence is conveyed by the carrier itself, we can partially, or wholly, suppress it, thus effecting a great saving in transmitter power. There is an effective gain of about 10db. over the average A.M. transmission.

Carrier Suppression

We have just stated that the carrier must be suppressed, and under the above heading we will discuss just how this is done. Carrier suppression can be effected by either a sharp crystal filter or by a balanced modulator unit. The carrier frequency, together with the audio voltage, is so introduced into the balanced modulator that only the sidebands appear in the output. Figs. 1A and 1B show two types of commonly used balanced modulators. In type A, R.F. drive and audio voltage are applied in push-pull while the output is in parallel. In type B, the R.F. drive is in parallel for both valves, while the audio voltage and output are in push-pull. In both circuits, fc is the carrier generated frequency, modulated by an audio voltage of frequency fm ; hence we see that the only components of output are the sidebands fc+fm and fc−fm. Since the modulator valves are run under linear operating conditions, it is advisable to use bias feed to the screen-grids, as shown, while using S.G. modulation ; although anode modulation is quite practicable. Since the circuits are completely balanced, for all values of modulation voltage, the signals from the two valves cancel out. Using push-pull audio voltage, the audio voltages on the separate valves are 180 degrees out of phase,

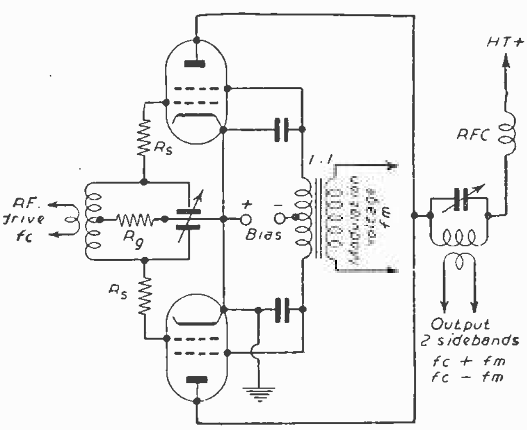

Fig. 1A.—One circuit for a balanced modulator.

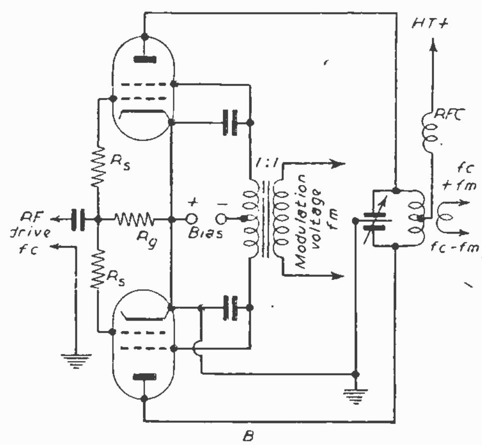

Fig. 1B.—Another circuit for balanced modulation.

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resulting in an increase of anode current in one of the modulator valves only ; thus, frequencies of fc+fm and fc−fm are produced and, since the modulator is not balanced when considering the sidebands, these appear in the output. The modulator valves should constitute as close a match as is possible, and the author recommends that all tolerances, both voltage and component values, should not exceed 5 per cent. of their nominal value. This is very important since the amount of carrier suppression is entirely dependent on the close matching of the modulator ; bearing in mind that a 25db. reduction in carrier level has been obtained in practice.

under consideration. In designing the linear amplifier, it should be borne in mind that, for efficient harmonic reduction, the L to C ratio of the tank circuit should be fairly high. Swamp resistors in the control grid leads will, of course, be necessary if the valves are biased, in order to present a fairly constant load to the grid circuitry. All voltages supplying the amplifier must be well regulated and smoothed. This applies more to the bias supplies probably than the rest, since erratic variation in grid voltage will lead to non-linearity in the stage. Fig. 3, the alternative method, shows the audio voltage split up into two equal parts, 90 degrees out of phase with each other.

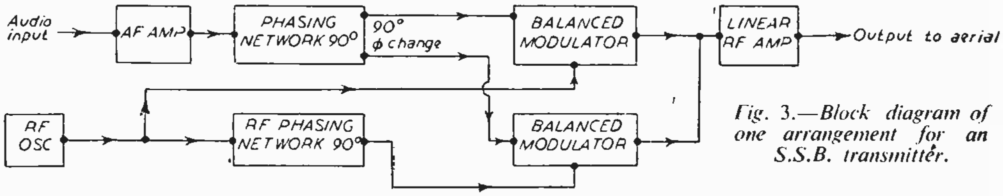

Fig. 3.—Block diagram of one arrangement for an S.S.B. transmitter.

Generation of S.S.B. Signals

Figs. 2 and 3 give block diagrams of the two systems for generating S.S.B. signals. From Fig. 2 we note that following the balanced modulator circuit we have a sideband filter, the purpose of which is to accept one sideband and reject the other. Because of circuit constants, the amateur must construct filters which will operate efficiently from roughly 15 to 20 kc/s. Crystal filters, using multiple crystals, are used commercially to give perfect sideband filtering at frequencies up to 500 kc/s ; thus, from an amateur viewpoint, the filter must be constructed to accommodate lower frequencies. From Fig. 2 we see that both the L.F. carrier and the modulating voltage are combined by the balanced modulator giving component outputs of f_1+fm and f_1−fm only. Normally the upper sideband is rejected by the filter and the remaining component of output f_1−fm is passed on to the frequency changer section, where the single sideband is combined with the output of a separate local oscillator running at high frequencies ; thus producing the required transmitter frequency as the main component of the frequency changer stage. This output is then amplified by a single stage of linear R.F. amplification. Essentially, the Class A amplifier, while being an excellent linear amplifier, is not over-efficient for our purpose, since it is about 50 per cent. efficient at its full power rating. Efficiencies of about 70 per cent. can be obtained by using a Class B stage, running under full output conditions ; thus valves operating under Class B conditions will make excellent linear R.F. amplifiers provided that the valve itself is designed for use at the frequency

The oscillator output is also split up into two equal parts, again 90 degrees out of phase, and the R.F. and audio halves are paired off and applied to two balanced modulator circuits. The outputs of the modulators do not contain the R.F. oscillator component but only the sidebands generated therein. Because of the phase relationships between the modulators, one sideband is entirely eliminated and the amplitude of the other increased. Linear amplification is once again used to energise the aerial circuitry. Basically, these are the simple facts about S.S.B. generation, and now we must ask ourselves, " Which is the better system ? " The filter combination has gained favour with some in that once correctly adjusted readjustment is not normally necessary for some considerable time. One disadvantage of this system is that numerable stages are required for this system ; and frequency conversion, after modulation, is essential. The phase shift network, although fundamentally simpler, can be lined up only by means of an oscilloscope.

Linear Amplifier Adjustments

The loading of the grid and plate circuit is critical and control over these should be effected from the front panel. The oscilloscope is the ideal test instrument for critical adjustment of the R.F. amplifier. Using a pure sine wave from an audio oscillator, on 100 per cent. modulation, at different frequencies f_1 and f_2, but of equal amplitude, the output envelope of the transmitter will take the form shown in Fig. 4. This is a direct reproduction of what is obtained in practice from a correctly adjusted linear amplifier. In S.S.B. circles, this test is called the " two tone

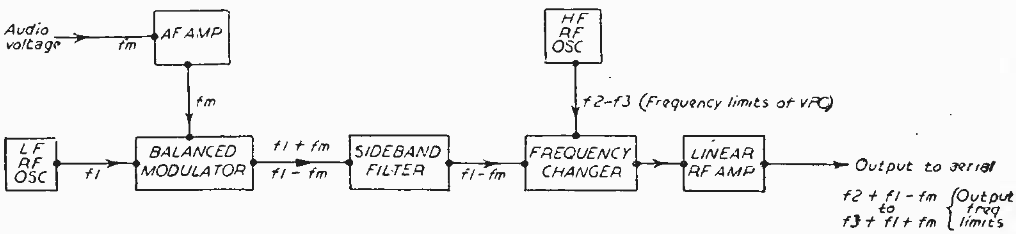

Fig. 2.—This is another S.S.B. block schematic.

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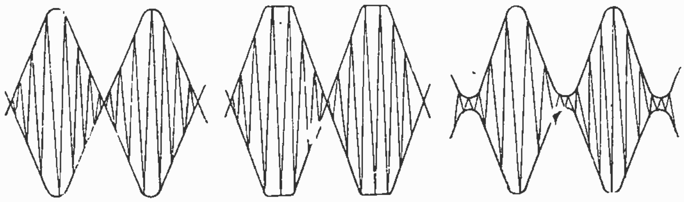
test," and is of great value in judging the degree of amplifier adjustment, especially if the envelope peaks are "flat" rather than "rounded." Fig. 5 shows this peculiarity. If the waveform is of the distorted form depicted in Fig. 6, then incorrect bias on the linear amplifier stage is indicated. Bias should be adjusted separately on each valve for perfect "two tone" envelope, as per Fig. 4. If the output impedance of the tank circuit is designed for 70-80 ohm co-axial cable, then a non-inductive resistor network presenting the correct impedance to the output stage should be connected across the output link. The R.F. drive and tank circuit coupling must now be adjusted until the positive peaks of the envelope, obtained in the "two tone" test, are on the point of flattening out. This is the critical loading point and coincides with maximum transference of energy to the aerial circuitry for the impedance stated.



Figs. 4, 5 and 6.—Two-tone waveforms, in which the two sine-wave frequencies are separated by 1.5 Kc/s.

Reception of S.S.B. Signals

It is surprising the number of people who believe that special receiving equipment is essential for the reception of such signals. This is not so! Using the station receiver, we proceed as follows. Since no carrier is transmitted, we must provide one at the receiving end. The receiver B.F.O. provides this, and is a necessity in S.S.B. reception. Upon first tuning in an S.S.B. signal, the first thing we notice is that the receiver "S" meter fluctuates violently and no carrier is heard. Switch off the A.V.C. system and switch on the B.F.O. Up to now we have detected a transmission which conveys no intelligence whatsoever. Alter the B.F.O. pitch control until the signal becomes readable: whereupon the R.F. gain and audio controls can be advanced. Final adjustment to tuning and B.F.O. pitch will ensure complete audibility of the signal.

The author has found a few transmissions having a small amount of carrier, although fairly weak, and the following procedure was adopted. Adjust the B.F.O. pitch and correct peaking of bandspread condenser to restore the position of maximum intelligibility. On detuning to one side of the correct position, we will find that the "speech" will appear to sound metallic; and on tuning to the other side the speech will sound "boomy," like the effect obtained when a gramophone record is played at an extremely slow speed. Once perfection has been obtained, the practice of tuning in S.S.B. transmissions will speed proficiency. The author advises the reader to listen to the S.S.B. transmissions of the following amateur stations who frequently radiate in the 3.5 Mc/s amateur band:—

DL6WL; G3CU; G2NH; G800 and the American station W4YCM.

Experimental Circuitry

Fig. 7 shows a simple S.S.B. exciter unit using the selective filter technique. The triode portion of the 6K8 frequency changer generates a crystal

(*Concluded on page 122.*)

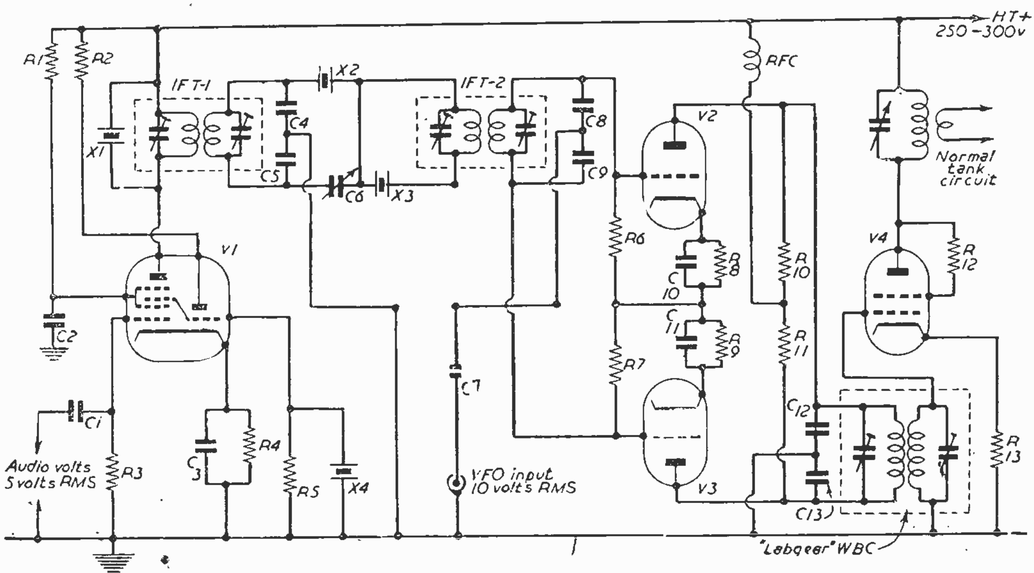


Fig. 7.—An experimental S.S.B. exciter unit. (A list of values will be found on p. 122)

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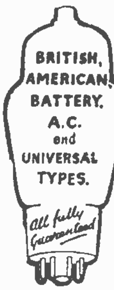

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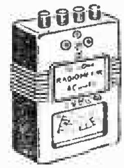

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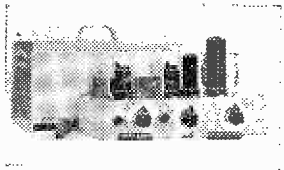

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The Beginner's Guide to RADIO

The Tenth Article of a Series Explaining the Fundamentals of Radio. This Month Condensers are Further Considered

By F. J. CAMM

Electro-magnets

AN electro-magnet is formed if a solenoid is wound on a core of soft iron. If an iron core is inserted in a solenoid it will be found that the flux will be considerably increased beyond what it would be if air were used as a core. This increase of the flux varies with different qualities of iron and also depends on the extent to which the iron fills the magnetic circuit. This effect is known as *permeability*, and it is a property which is sometimes used for tuning purposes.

Like the resistance in an electric circuit *reluctance* is the opposition which has to be overcome in a magnetic circuit before the flux can be established. The reluctance or magnetic resistance of a piece of particular material depends upon its length l, cross section a and permeability μ.

Mutual Induction

Now consider a coil A, Fig. 41, joined to a battery and switch and placed near or *inductively coupled* to a coil B across the terminals of which is joined a resistance R. When the switch in circuit A makes contact the current takes a fraction of a second to reach a maximum steady value. The magnetic field created by this current cuts the coil B and an electro-motive force is induced in it which will cause a momentary current to flow through the resistance R. When circuit A is broken B will be cut by the decreasing number of lines of force and a reverse or *back EMF* will be momentarily induced in B. Thus each circuit will exert an inductive effect on the other. In other words, they act and react on each other and hence the term *mutual induction.*

Mutual induction, then, is defined as follows: If a current changing in one circuit at the rate of 1 ampere per second produces in the other circuit an EMF of 1 volt, then the pair of circuits are said to have a coefficient of mutual inductance of 1 henry.

When the currents in the two coils are in such direction that the magnetic fields oppose each other, then the effective inductance of the two coils will be decreased by the amount of mutual induction. If, on the other hand, the direction of the currents is such that the magnetic fields do not oppose but assist each other, then the effective inductance of the two coils will be increased by the amount of the mutual inductance. This effect occurs in coupled oscillatory circuits.

Fig. 42 shows a section of fixed condenser. It will be seen that the metal plates are separated by the dielectric, which, of course, insulates the two sets of plates to which the connecting wires are attached. The dielectric may be air, paper, glass or mica.

Another type of condenser in general use to-day is the *electrolytic condenser*. In this type two plates of different metals are used and they are immersed in a chemical solution or paste. When a potential is applied, it causes a film to form over one of the plates, and this film forms the insulator or dielectric. Electrolytic condensers have positive and negative poles and it is the positive pole which takes this film. The result of the film formation is to cause the flow of current to cease and so the two plates form the two electrodes of a condenser.

Variable Condensers

Fig. 44 (reproduced from the December issue) shows a *variable condenser*. This is mainly used for tuning purposes. It consists of a series of fixed and moving plates which do not touch one another, and, indeed, are insulated from one another. The air space between the fixed and moving plates forms the dielectric. It is termed a variable condenser because the capacity is variable. It is necessary to vary the capacity of this condenser which is, of course, connected in parallel with the tuning coil (one end of which is connected to the aerial and the other to earth) in order to tune the receiver to the desired wavelength. On the medium waveband receivers are designed to tune from about 200 metres to about 550 metres. Thus the moving condenser vanes should be half in (or half out) of the fixed plates when receiving a station on a wavelength of between 300 and 400 metres. In passing it may be mentioned that the moving plates are always connected to earth in order to eliminate what is known as hand capacity. If connected the other way round the tuning would

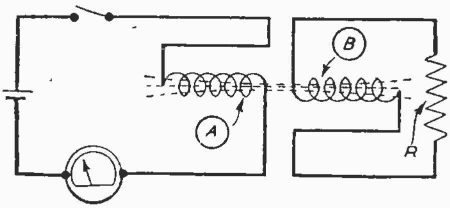

Fig. 41.—Circuit illustrating mutual induction.

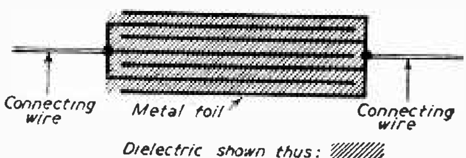

Fig. 42.—A diagrammatic representation of a fixed condenser.

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be affected when the hand is placed on the tuning knob, the hand itself providing additional capacity to earth. The earliest variable condensers were of the straight-line capacity type in which the plates were semi-circular with the spindle in the exact centre. In this type the capacity changes in proportion to the angular movement of the tuning knob. That is to say, for every 10 deg. movement of the tuning knob the capacity will vary by exactly the same amount. As the wavelength of the tuning coil is not directly proportional to the capacity of the variable condenser the use of this type caused all the stations to be bunched together at one end of the tuning scale but widely separated at the other.

To eliminate this trouble and ensure that stations were more evenly distributed around the tuning scale the square-law condenser was introduced. This has vanes which are not semi-circular and the capacity does not vary in proportion to the angular movement of the tuning knob. For example, if 30 deg. on the dial represents 300 metres and 90 deg. movement represents 400 metres, then a 60 deg. movement would indicate 350 metres. For station identification this is admittedly extremely useful although it does not overcome entirely the disadvantages of the straight-line capacity type. For example, it is often found easier to separate two stations at 310 and 300 metres than it is to separate two stations of exactly the same power working on wavelengths of 500 and 510 metres respectively. It will be observed that in both cases the stations differ by 10 metres, but actually one pair will be closer together on the tuning scale than the other. A square-law condenser is so termed because the capacity increases as the square of the angular movement of the moving plates; and it will therefore have a straight wavelength curve instead of, as in the old semi-circular type, a straight-line capacity curve. The wavelength will vary directly as the movement of the plates. In other words, if a movement of 10 deg. of the moving plates varies the wavelength say 10 metres, then every 10 deg. movement will vary the range by 10 metres. Of course, this will depend to a large extent on whether the set is a "straight" or a super-het, length of aerial, design of tuning coil, etc.

Other types of variable condenser are the *straight-line frequency* and Log-law condenser, or more correctly a logarithmic condenser. With the logarithmic condenser where each set of moving vanes can be moved separately, it is simply a matter of advancing one set in front of the other, so that ganging is accomplished at the top of the dial, when the special shape of the vanes will result in ganging being preserved throughout the whole length, provided, of course, the trimmers have been adjusted to equalise odd capacities.

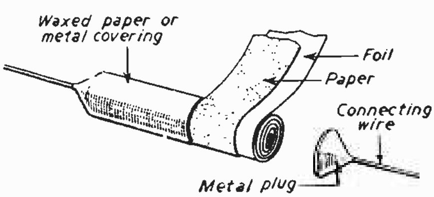

Fig. 43.—Details of the ordinary type of small 'paper' condenser

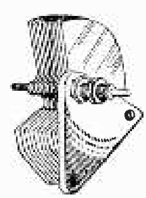

Fig. 44.—A variable condenser.

Condenser Values

The following short table gives approximate values for condensers:—

Aerial Condensers, .0001-.0003 μF.

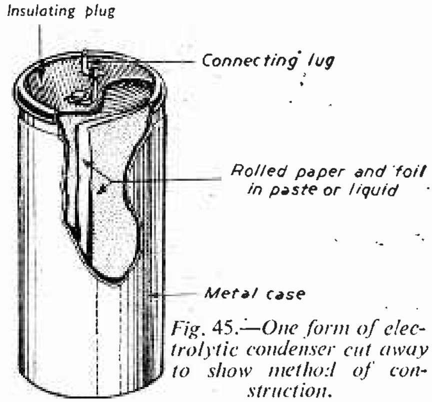

Fig. 45.—One form of electrolytic condenser cut away to show method of construction.

Aerial Tuning Condenser, M.W., L.W. .0005 μF, S.W. .0001 μF, U.S.W. .00005 μF.

Anode Tuning Condenser, M.W., L.W., .0003 or .0005 μF.

Anode Coupling Condenser, .0001-.0003 μF.

Grid Condenser, .0001-.0003 μF.

Detector Anode Bypass Condenser, .0001-.0005 μF.

Resistance-capacity Coupling Condenser. .01-1 μF.

Decoupling Condenser H.F. (M.W., L.W. and S.W.), .1-1 μF, U.S.W. .001 μF—.1 μF.

Decoupling Condenser (L.F.), 2-8 μF.

Smoothing Condenser (Mains Unit), 2-60 μF.

Condensers in Series and Parallel

Unlike coils and resistances, condensers connected in parallel will have a total capacity equal to the sum of the values of each condenser, whilst condensers connected in series will have a total capacity equal to

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

The effect of connecting condensers in parallel is to increase the capacity and in series to reduce it.

The capacity of a fixed condenser depends upon the number of plates and their total area. The usual formula for finding the area of a condenser is as follows (dimensions in inches):

$$C = \frac{0.225 \times a \times K \times N}{1{,}000{,}000\ D}$$

Where K = the dielectric constant
N = the number of insulating strips
D = the thickness of the insulating material in inches
a = the area of one metal plate in square inches

Therefore, to find the capacity of a condenser consisting of, say, 6 copper foil plates each 1in. by ½in. with mica insulators each 0.002in. thick, proceed as before:

$$C = \frac{0.225 \times 1 \times 0.5 \times 6 \times 5}{1{,}000{,}000 \times 0.002}$$
$$= \frac{3.375}{2.000}$$
$$= .00168\ F.$$

(To be continued)

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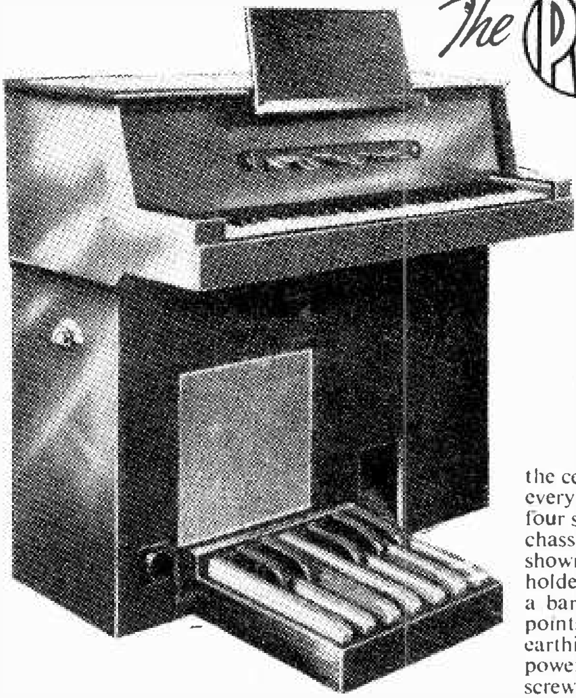

The PW FULL-COMPASS Electronic ORGAN

This Month Details are Given of the Wiring of the Note Generator Chassis

By W. J. Delaney (G2FMY)

(*Continued from page 34 January issue*)

THE note generators are the heart of the instrument, and some time will have to be spent in selecting the parts for this part of the organ. As shown in the circuit last month, the essential condensers have been given references and Table 1 on page 96 and 97 lists these values and the actual components which were used in the original. It will be seen that, apart from the odd values required, there is quite a large number of components to crowd into the chassis, and the method of construction adopted will not permit of the usual wiring diagram. However, if the arrangement to be described is adopted it will be found very simple, although a little tedious, but odd bits and pieces may be made up as time permits and the instrument gradually assembled, thereby adding to the interest. First, with regard to the odd values of condensers. There are certain values in the "pF" range which are obtainable, although they may have to be ordered direct, as the average radio shop will not carry them; but the others must be made up by using two in parallel. For instance, in the original a .01 μF and a .002 μF made up the .012 μF, although if you have access to a bridge it may be a simple matter to find a .01 μF which is sufficiently high to cover the .012 μF value. Different units were made up with various odd values to see what tolerances could be used, and it was found that 10 per cent. will cover all values satisfactorily, so by preparing a list of values and by the side of it marking in the lowest and highest values at 10 per cent., you are left a fairly wide range in which to find either single or combined values.

Assembly

The valveholders should be mounted on the generator chassis and before anything further is done the centre spigots should be joined to pins 4 and 5 on every holder, and, in addition, pins 3 and 8 on the rear four should also be joined to this common point. The chassis should be placed on the bench in the position shown in Fig. 20. Then from pin 8 on the right-hand holder (this is the one nearest the 5 k variable resistor), a bare wire should be run round to link up all the points just mentioned. This forms a common earthing bus and is joined to the pin shown on the power socket as well as to a tag fitted to the holding screw nearest to it, as shown in Fig. 20. After the variable resistor has been mounted, the three .1 μF condensers should be placed in the position shown, and the two resistors joined in series should be connected to pin 1 of the first valveholder, with the junction of the resistors taken to one end of the condenser, the other end being joined to the earthing wire. The condensers should be flat against the chassis, and the resistors should stand straight up. Run a lead round from the first resistor to the next, on to the remaining one, and then along the chassis to the power socket (anode pin), as shown. To simplify matters only part of the wiring is given, but each of the two chains is identical as far as layout is concerned, and they may all be wired together—putting all the .1 μF condensers in place first, for instance, or each chassis may be dealt with separately. As each is wired you will find simplification will suggest itself, and as the work is repetitive the last few chains will prove very easy.

After wiring the first anode, all the coupling condensers (C6, C7, C8 and C9) should be wired direct between the valveholders, again keeping them right down on the chassis. Next the condensers between pins 2 and 7 and the earthing wire should be put in (C10, C11, C12, C13), again placing these as shown. Standing up vertically from the spigot of the valveholders, solder two 1 MΩ resistors and also standing vertically from pins 2 and 7 solder a 2in. length of wire. Over these latter slip a 1½in. length of insulated sleeving and bend over the wire to keep them from falling off. The coupling, feedback and discharge condensers (that is, the two .05s and C1, C2, C3, C4 and C5) are now made up into small block units, together with the 220 kΩ anode resistor. The condensers are laid side by side, using one or two as required for C1, etc., and scotch tape is wrapped

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round them tightly to hold them in a block. The lead on the end .05 μF condenser is regarded as the master, and all the leads from the other condensers on that side are taken across and soldered to it, together with the end of the 220 kΩ resistor. The projecting lead is afterwards cut off to about ½in. and a short length of sleeving pushed over, and there is then only one lead to connect to each anode pin. The block is placed in position vertically, and at the top the lead from the .05 μF nearest the front runner is the output lead, the next .05 μF being soldered to one of the 1 MΩ resistors standing up from the valve-holder, and the remaining condenser(s) being taken down to the earthing line.

The blocks alternate on each side of the valve-holders, and the centre row alternate with the odd blocks of the outer rows. In this way the chassis are fully packed and at all times any connection is accessible. Needless to say, a long, thin soldering iron such as the Tyana is essential. Incidentally, the theoretical circuit (Fig. 16) last month showed the heater pins 4 and 5 taken to the power supply plug with pin 9 earthed, but it will be found easier to reverse this as above described, then pins 3, 4 and 5 may all be joined together and to the spigot, with a short wire from pin 8 to the spigot to complete the earthing. When the wiring so far described has been completed, it will be seen that there are four 1 MΩ resistors missing on each chain, these being the resistors joined between the grid of each triode and the feedback condenser. These are the only really critical components in the unit and they are left till last so that they may be individually selected.

Oscillator

The oscillator components are next required and these consist of 12 small units made up from four condensers and three 470 kΩ resistors. The condensers, values of which are shown in Table 2, are simply held close together with the resistors soldered across the ends and the whole bent up to the smallest

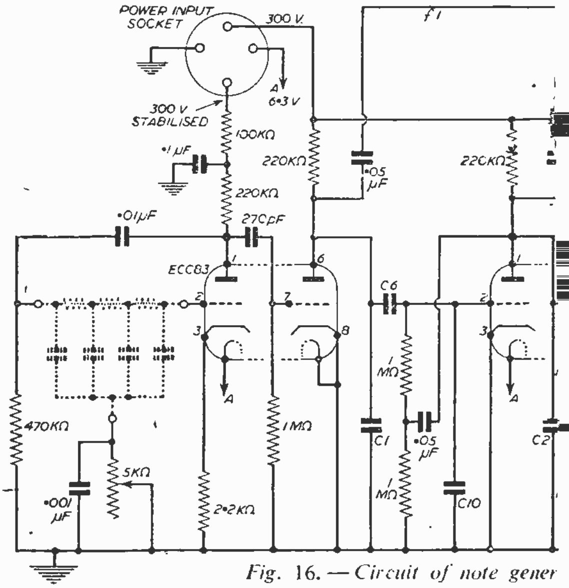

Fig. 16.—Circuit of note gener

LIST OF VALUES—TABL

	C C♯ D	E♭ E F	F♯ G G♯	A B♭ B	
C1	.015 μF	.012 μF	.01 μF	.8200 pF	
C2	.018 μF	.015 μF	.012 μF	.01 μF	
C3	.033 μF	.027 μF	.022 μF	.018 μF	
C4	.068 μF	.056 μF	.047 μF	.039 μF	Up to
C5	.12 μF	.1 μF	.082 μF	.068 μF	10%).
C6	330 pF	270 pF	220 pF	180 pF	ular (ſ
C7	680 pF	560 pF	470 pF	390 pF	
C8	1500 pF	1200 pF	1000 pF	820 pF	Odd val
C9	3900 pF	3300 pF	2700 pF	2200 pF	compo-
C10	2700 pF	2200 pF	1800 pF	1500 pF	
C11	4700 pF	3900 pF	3300 pF	2700 pF	
C12	8200 pF	6800 pF	5600 pF	4700 pF	
C12	.018 μF	.015 μF	.012 μF	.01 μF	

PARTS FOR FOUR-TONE GENERATOR

12—Pre-set 5,000 Ω resistors (Egen).
36—B9A valveholders with skirt and screens (McMurdo).
16—Five-pin valveholders, Type VH77 (Bulgin).
36—ECC83 valves (Mullard).

CONDENSERS

12—.1 μF Type CP46S
108—.05 μF Type CP37S
12—.01 μF Type CP33S
12—.001 μF Type CP110N
12—270 pF Type 425SNP
(T.C.C.)
Plus additional values as shown in Tables 1 and 2.

RESISTORS

60—1 MΩ
48—1 MΩ (see text)
12—470 kΩ
72—220 kΩ
12—100 kΩ
12—2.2 kΩ
(Dubilier ½-watt 20% Type B.T.S.)
Plus 36 470 kΩ for oscillator units.
Four chassis 10in. by 6in. with front runner (Denco).

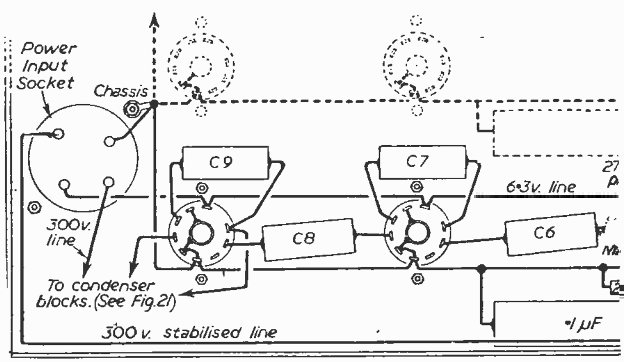

Fig. 20.—Main wiring and

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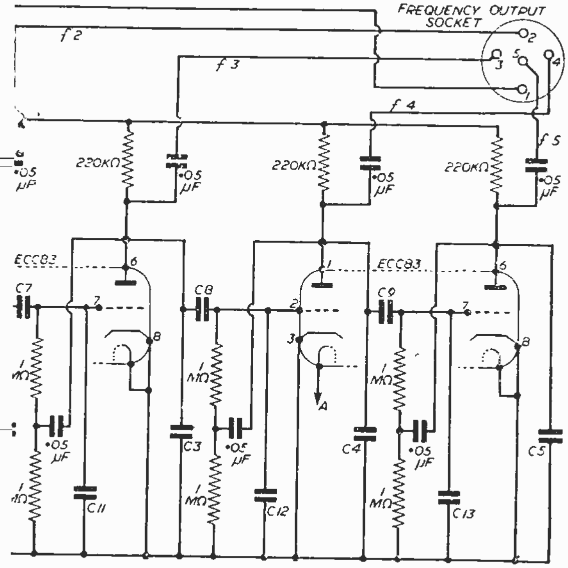


tor for one note—five octaves.

E 1

Remarks

4700 pF—Suflex (500 v.w. Above 4700 pF—T.C.C. tub- Metalmite, etc.) 10%.

ues made up by paralleled nents, i.e., .012 = .01 plus .002.

Table 2

OSCILLATOR UNITS

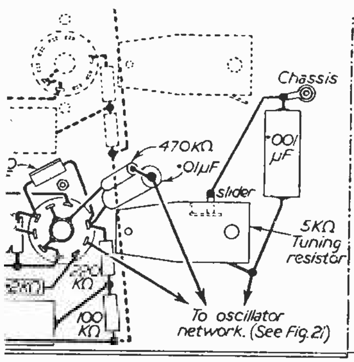
(capacity values)

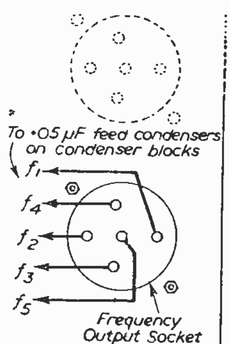
C, C♯, D	**500 pF**
E♭, E, F	**400 pF**
F♯, G, G♯	**350 pF**
A, B♭, B	**270 pF**

possible space, making quite certain that no bare wires touch, of course. From pin 1 of V1 a .01 μF condenser is connected, again adopting the idea of permitting it to stand vertically. From the top lead a 470 kΩ resistor is joined to earth, and the small oscillator units just made are connected between pin 2 of V1 and the top of the .01 μF condenser, so a short wire is connected to pin 1 and left upstanding to facilitate connection. The .001 μF condenser between each variable resistor and earth is laid flat on the chassis, and the common end of the tuning block and the condenser are joined to the same tag on the resistor, the other resistor tag being joined to the earthing wire.

Tuning the Units

Assuming that some power is available the units may be tuned, but a stabilised H.T. source of 300 volts is needed for the oscillators, so that the constructor may defer the tuning until everything is completed, or proceed to select the tuning units for each note. The output from each stage may be taken for this purpose to any simple single-stage amplifier or even plugged into the pick-up sockets of a broadcast receiver, but although each tuning unit should cover four or five notes, it will be found that the pitch is varied according to the H.T. voltage—and it is this fact which is used to incorporate the vibrato, the H.T. applied to the oscillator being varied by the drop across the vibrato oscillator anode.. Assuming, therefore, that you have your stabilised 300 volt supply and a suitable heater supply, plug in the valves for a single chain, and mark the chassis so that you will get them in order in the body of the organ, running sequentially, when viewed from the rear, with the lowest note on the right (see page 31 illustration last month). This will avoid crossing the leads when wiring to the distribution strip. Starting with C, connect one of the three " C units " between the V1 and the variable resistor, setting this to a midway position. Connect the .05 μF condenser which is joined to pin 6 of V1 to the headphones or pick-up sockets and a note should be heard, adjusting the variable resistor should run the note up and down over about four or five semi-tones and it should be a





layout for each channel.

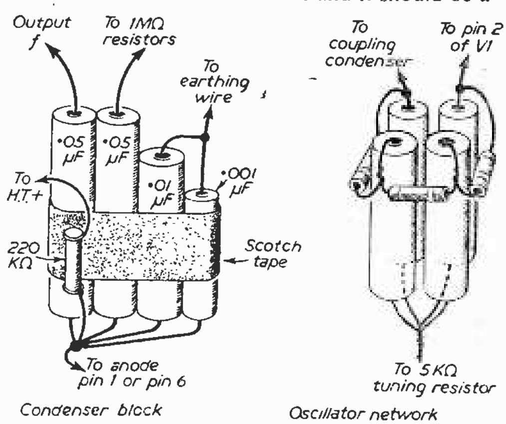


Fig. 21.—Details of the condenser blocks and oscillator units.

good clean note. A piano or similar musical instrument is needed to find the right pitch for each note, and the top B on the piano should then be sounded, whilst the resistor is adjusted to see if that oscillator note can be brought within range. If not, then one of the other B units should be tried, and in this manner you will find that a unit is available for each note. The normal 10 per cent. tolerances will take care of variations and nothing more critical is needed. When the fundamental or highest note has been obtained, connect the output lead to the top of the .05 μF condenser joined to pin 1 of the next valve. No note will be heard as there is no feedback resistor in position. Take a number of 1 MΩ resistors and cut the wire ends down to about ⅜in. in length and make small rings at the ends of the wire with a fine nosed pair of pliers.

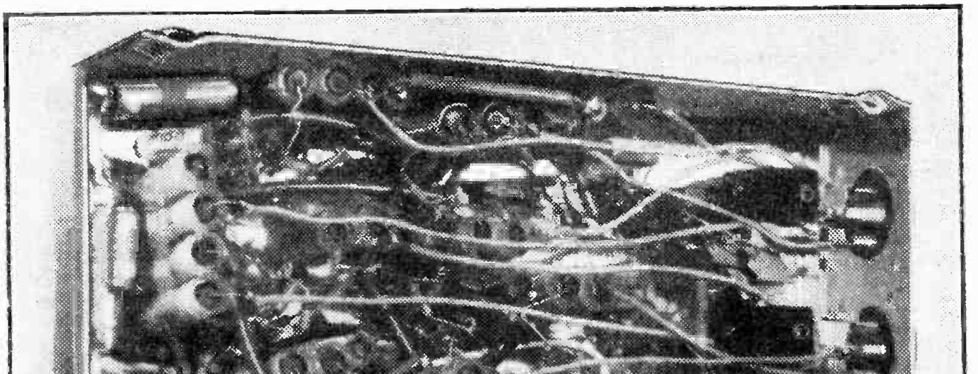
Bend the wires at right-angles to the resistor and it will be found that the two ring ends may then be dropped over the upstanding wire from the grid pins and the upstanding 1 MΩ resistor. Drop one of the resistors over one of the resistors (it is immaterial which one is used) and the wire from pin 2 of V2. If the resistor is not too far out a note will be heard which is an octave below that just found on the oscillator. If so, the resistor is simply soldered into position and you proceed to the next stage, and so on. If it is found, however, that the note from the next stage is of the same pitch as that of the previous stage it means that the 1 MΩ resistor is either too high or too low in value. In such a case, leave the resistor in position and carefully turn the adjusting screw of the tuning resistor. If it is found that as the note is flattened it suddenly drops an octave, this means that the resistor in position is *too high* and a lower value must be used. If, on the other hand, the note only drops to the required octave when the original is sharpened, then a higher resistance is required. If it is possible to obtain access to a bridge the resistors may first be measured, putting all low ones in one box and all high ones in another.

Proceed in this way until all the chains produce five notes octavely related, and the 12 chains each produce one semi-tone in the normal musical scale. In most cases it will be found that the three notes on each chassis will each cover the three. That is, on the C, C♯ and B chassis, for instance, the C chain will tune up to B, whilst the B chain will tune down to C.

Connecting Cables

The tone generator chassis have to be connected to the distribution strip at the rear of the organ, and for this purpose I used five-way screened cable of the colour-coded type. Screening is necessary, but single- or twin-screened leads may be used if preferred. The four chassis are placed on the shelf already referred to, and to the rear of the section carrying the keyboard a strip of metal or a single heavy wire is anchored, running from one end to the other. Across this is screwed a series of metal clips, of a size suitable for clamping the screened leads just mentioned. If five-way cable is employed you will need 12 clips, and the screened leads should be cut about 2ft. 6in. long and the screening removed from one end to such a length that there is a maximum of about 14in. left free. To the other ends Bulgin five-way plugs, type P.71, are attached. The clips or clamps are then fitted so that the cable is held firmly, and at the same time the strip or wire under the clips will connect them all together.

(To be continued)



This view of the underside of one of the chassis shows the condenser blocks and general layout.

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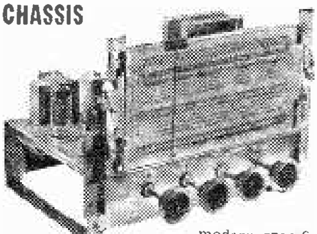

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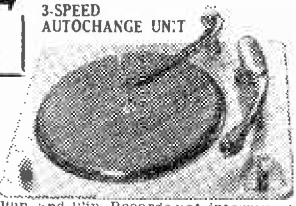

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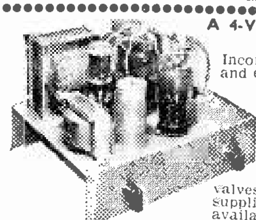
- Minimum baseplate size 15in. x 12½in. with height above 4½in and below baseplate 3in.
- Brand new in maker's cartons, complete with mounting instructions.

"PERSONAL SET" BATTERY ELIMINATOR

A complete kit of parts to build a Midget "All-dry" Battery Eliminator, giving approx. 60 volts and 1.4 volts. This Eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet receiver requiring H.T. and L.T. voltage as above or approx. to 69 volts. The kit is quite easily and quickly assembled and is housed in a light aluminium case, size 4½in. x 1½in. x 3½in. Price of complete kit with easy-to-follow assembly instructions, **42/6**. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled Unit 7in. x 2½in. x 1½in. Price **47/6**.

A 4-VALVE QUALITY "PUSH-PULL" 6-8 watt AMPLIFIER for A.C. mains.



Incorporating Negative Feedback, Filter Input Circuit and employing 6V6s in Push-Pull. A simple arrangement is provided to enable either a magnetic-crystal or lightweight pick-up to be used, and is suitable for use with Standard or long-playing records. A tone control is incorporated, and the 10-watt output transformer is designed to match 2 to 15 ohm speakers. The overall size of the assembled chassis is 10in. x 8in. x 7½in. high, and full practical diagrams are supplied. Price, including drilled chassis and valves, of complete kit, **£6/17/6**. Price of assembled chassis, supplied ready for use, **£8/12/6**. Full descriptive leaflets are available separately for 1/-.

GENUINE REDUCTION

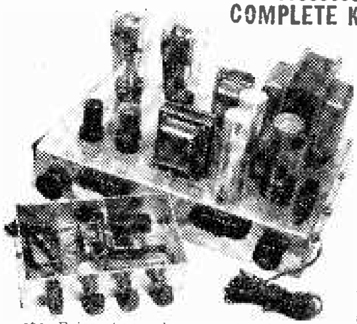
The Collaro Model 3RC/514. 3-speed non-autochange Record Player. (Normal price £12/6/7.)

£6/19/6

(Plus 5/- carr. and ins.)

Incorporating the NEW ORTHO-DYNAMIC HI-FI Magnetic Head filled with TWIN ALLOY STYLUS AND MATCHING TRANSFORMERS, TOGETHER WITH PICK-UP WEIGHT ADJUSTMENT. These Units are quite new and contained in maker's original cartons, complete with mounting template.

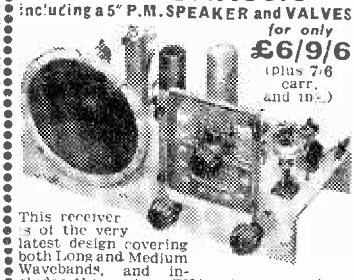
COMPLETE KIT for 12 WATT HIGH FIDELITY "Push-Pull" AMPLIFIER



Designed for A.C. mains 200 to 250 volts, employs 6 valves plus rectifier, with negative feed-back, and comprises a main amplifier chassis and a remote controlled Pre-amplifier and Tone Control Unit, incorporating four controls—bass, treble, main volume or mixing control, and a radio, gram, microphone selector switch. This control unit measures only 7 x 4 x 2in. The measured frequency range of the amplifier with this unit shows an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 50. It can be seen, therefore, that ample correction is provided to suit any type of pick-up with any type of recording. Input voltage for maximum output is 70 mV. 6.3 volts at 2 amps. and 30 mA. H.T. is provided for tuning unit, etc. Price of complete kit, Amplifier and Control Unit including drilled chassis and valves **£14**. Complete specification and layout 2/-. We can also supply completely assembled and ready for use at **£17**. Please add 7/6 carr. and insurance.

THIS AMPLIFIER COMPARES WELL WITH THE WILLIAMSON AND SIMILAR DESIGNS AT A FRACTION OF THE COST.

A COMPLETE
4 VALVE T.R.F. CHASSIS
including a 5" P.M. SPEAKER and VALVES for only **£6/9/6** (plus 7/6 carr. and ins.)



This receiver is of the very latest design covering both Long and Medium Wavebands, and includes the modern BVA miniature valves. The line up being 12BA6—12AT6—12A6—35W4. It incorporates Permeability Tuned Coils thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including Speaker is 10½in. x 4½in. x 6½in. An attractive Bakelite Ivory finished Cabinet size 11½in. x 5½in x 6½in. is available for 16/6 (plus 2/6 carriage and insurance).

A DUAL CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

This comprehensive PRE-AMPLIFIER and TONE CONTROL UNIT provides full control of Bass and Treble in conjunction with a main Volume Mixer Control. Can be used with any Amplifier and any Pick-up, the range of frequency control provided by the unit affording ample compensation for all types of Pick-up and all natures of recordings, i.e., English, American and Long-Playing, without recourse to Pick-up correction. The extreme flexibility of the Bass and Treble Controls is such that the level of Bass and Treble can be set to suit any conditions irrespective of the volume output of the Amplifier.

The Unit measures only 7in. x 4in. x 2in., including self-contained Power Supply, and can be accommodated either on or away from the main Amplifier, i.e., in the front panel of a Cabinet or any other position. Price, including drilled chassis, valves (6SN7 and 6J5), **£3/16/9**. Complete assembly data is available separately for **1/3**. Completely assembled and ready for use, **£5/5/-**.

The COLLARO
Model A.C. 514 Record Player

£3/19/6 (Plus 5/- Carr. and Ins.)

RIM DRIVE 78 r.p.m. complete with the COLLARO Plug in type MAGNETIC HEAD and 10 inch TURNTABLE. These are COMPLETE BRAND NEW UNITS for A.C. Mains 200-250 volts.

STERN RADIO Ltd.
109 & 115, FLEET STREET, E.C.4.
TELEPHONE : CENtral 5812/3/4

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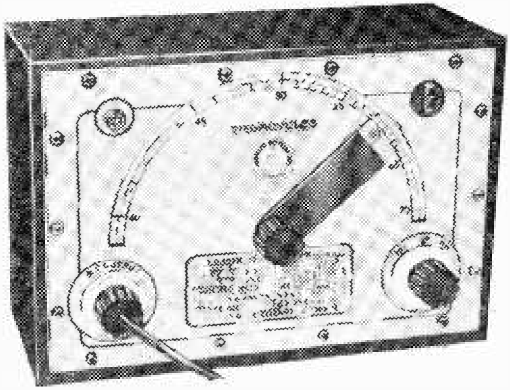
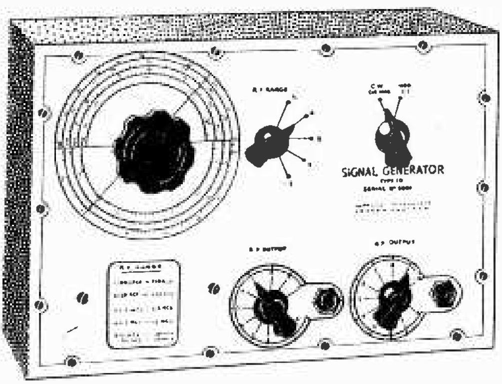
PATTERN GENERATOR TYPE 4



Price £8.0.0 (Postage and packing 3/6 extra.)

● 40-70 Mc/s ● A.C. mains operation ● Direct calibration. CHECKS: Frame and line time base frequency and linearity ● Vision channel alignment ● Sound channel and sound rejection circuits ● Vision channel bandwidth, etc.

SIGNAL GENERATOR TYPE 10



Price £7.10.0 (Postage and packing 3/6 extra.)

● 100 Kc/s to 100 Mc/s ● Modulated or unmodulated carrier ● Direct calibration ● Adjustable 400 c.p.s. AF signal ● Stable RF oscillator ● Large, easily read scale ● A.C. mains operation.

Obtainable only direct from the manufacturers. Send for full technical details or call at address below.

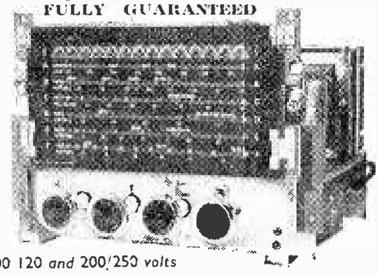
HOMELAB INSTRUMENTS LTD.,
615-617, HIGH RD., LEYTON, LONDON, E.10
Telephone: LEY 5651

DIRECT FROM THE MANUFACTURER

DULCI RADIO/RADIOGRAM CHASSIS

Built to Highest Technical Standards

FULLY GUARANTEED



All chassis $11\frac{1}{2}$in. x 7in. x $8\frac{1}{2}$in. high. Latest type valves 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Flywheel tuning. Negative feedback over entire audio section. Engraved knobs. 3 tone positions for radio and gram.

For A.C. Mains 100 120 and 200/250 volts

Model B3.—Long. Medium. Short 5 Valves. Output $3\frac{1}{2}$ watt	**£12/12/0**
Model B3.—Plus Push Pull Stage 6 Valves. Output 6 watt	**£15/15/0**
Model B3.—Double Feature with P/Pull & R.F. Stage. 7 Valves Output 6 watt	**£18/18/0**
Model B6.—Six Wavebands. Med.Long. 4 Short. (3 Bandspread.) 5 valves. Output $3\frac{1}{2}$ w.	**£15/15/0**
Model B6.—Plus Push Pull Stage 6 Valves. Output 6 watt	**£18/18/0**
Model B6.—Double Feature with P/Pull & R.F. Stage. 7 Valves. Output 6 watt	**£23/2/0**

ALL PRICES TAX PAID

Escutcheon for 9in. x 5in. dial, 4/9 extra. Matching speakers P.M. type 3 ohms. 8in. or 10in. available. **Chassis sent under money back guarantee conditions against remittance.** Free particulars from the manufacturers.

THE DULCI CO. LTD.,
99 VILLIERS RD., LONDON N.W.2. *Telephone: Willesden 7778*

POLYSTYRENE INSULATION

Polystyrene is a glass clear, transparent, thermoplastic material and should not be confused with such material as celluloid, cellulose acetate, perspex, etc., which are comparatively poor radio insulators. POLYSTYRENE is stocked in the following forms and sizes:

SHEET: $\frac{1}{8}$in. thick, **$1\frac{1}{4}$d.** per sq. inch, $\frac{3}{16}$in., **$1\frac{1}{2}$d.** $\frac{1}{4}$in., **2d.**; $\frac{3}{8}$in., **3d.**

ROD: $\frac{3}{16}$in. dia., **1/-** per foot; $\frac{1}{4}$in. dia., **1/4**; $\frac{5}{16}$in. dia., **1/9**; $\frac{3}{8}$in. dia., **2/1**; $\frac{1}{2}$in. dia., **3/9**; $\frac{5}{8}$in. dia., **4/8**; $\frac{3}{4}$in. dia., **5/11**; 1in. dia., **15/-**

TUBE: $\frac{3}{8}$in. O/D x $\frac{1}{4}$in. I/D, **1/5** per foot.

DENFIX POLYSTYRENE CEMENT

This useful solution consists of clear polystyrene thermo plastic material dissolved in a quick drying solvent. When dry this varnish contains all the properties of pure polystyrene. It is, therefore, very low loss at radio frequencies and can be used for cementing or impregnating coils, etc.

BOTTLES: $\frac{1}{2}$oz., **1/-**; 2oz., **1/10**; 4oz., **3/6**; 6oz., **5/-**; 8oz., **6/6.**

Send 9d. for General Catalogue giving details of our other components.

DENCO (CLACTON) LIMITED
357/9, OLD ROAD, CLACTON-ON-SEA, ESSEX.

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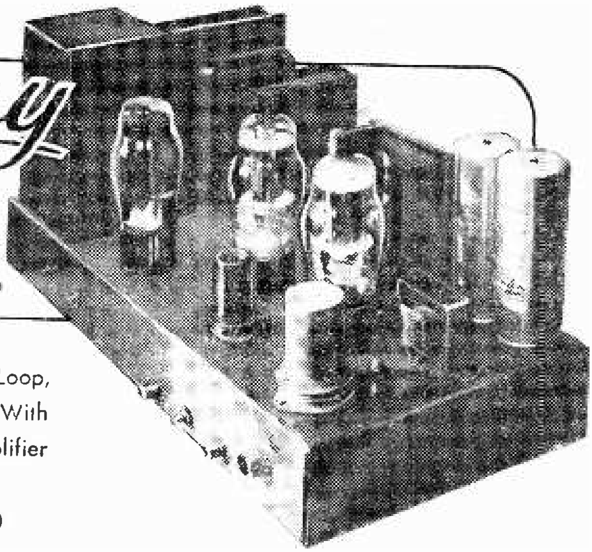
AN *Economy* QUALITY AMPLIFIER



A High Gain, Low Cost, Four Feedback Loop, Main Amplifier, 6/8 Watts Output With Negative Feedback Tone Control Preamplifier

By C. J. White, Assoc.Brit.I.R.E.

(Continued from page 16, January issue)

GOING through many pick-up specifications it could be seen that a fairly safe figure would be about 60 millivolts; this covers most of the quality pick-ups and, indeed, microphones, so that we shall settle for this figure which gives a gain required of some ten times at middle frequencies. This will easily take care of Tape/TV and Mix. inputs, and as we have already covered the microphone input in the discussion on Gram, we can now leave them to decide how all the foregoing is to come about (Figs. 1 and 2 give frequency response obtained at different T.C. positions).

Pre-Amplifier

As we have decided to incorporate a parallel T network in our T.C. pre-amplifier, it follows that we shall have to use a feedback circuit. Now, this negative feedback is already a desideratum, for it will ensure and maintain in a good design the high quality of our main amplifier, so that what we have

LIST OF COMPONENTS

VR1—250 KΩ log.
VR2 and S4—5 KΩ.
VR3 and S5—250 KΩ.
VR4—10 KΩ log.
S1/2/3—3-bank, 5-way, single pole.
V1/V2—6SL7 valve.
1 I.O. valveholder.
1 5-pin plug and socket.
6 Pye sockets and plugs.
1 paxolin strip, $8\frac{1}{2}$in. × 3in. × $\frac{1}{8}$in. or $\frac{1}{4}$in.
1 chassis, 11in. × 5in. × 5in. (with lid if possible).
4 knobs.
1 pointer knob.
3ft. $\frac{1}{4}$in. co-axial (for internal wiring).
12ft. $\frac{1}{4}$in. co-axial with 2 Pye plugs (interconnection).
12ft. 5-core flex (6.3 A.C. and H.T.) (interconnection).
3in. × 3in. × $\frac{1}{8}$in. perspex or celluloid to cut 3in. diameter selector switch dial escutcheon.

RESISTANCES

R1—220 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R2—220 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R3—1.2 MΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R4—2.2 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R5—330Ω Erie Type 8 ($\frac{1}{2}$-1 watt).
R6—220 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R7—220 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R8—100 KΩ Erie Type 9 ($\frac{1}{4}$-$\frac{1}{2}$ watt) ±5%.
R9—100 KΩ Erie Type 9 ($\frac{1}{4}$-$\frac{1}{2}$ watt) ±5%.
R10—50 KΩ Erie Type 9 ($\frac{1}{4}$-$\frac{1}{2}$ watt) ±5%.
R11—1.2 MΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R12—2.2 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R13—22 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R14—100 KΩ Erie Type 9 ($\frac{1}{4}$-$\frac{1}{2}$ watt).
R15—15 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).
R16—67 KΩ Erie Type 8 ($\frac{1}{2}$-1 watt).

CAPACITORS

C1—300 pF. 350 v. wkg. T.C.C. 425 SMP.
C2—32 μF 350 v. wkg. electrolytic.
C3—0.1 μF 350 v. wkg.
C4—0.03 μF 250 v. wkg.
C5—0.1 μF 350 v. wkg.
C6—180 pF. 350 v. wkg. ± 2% T.C.C. 401 SMP.
C7—180 pF. 350 v. wkg. ± 2% T.C.C. 401 SMP.
C8—360 pF. 350 v. wkg. ± 2% T.C.C. 501 SMP.
C9—0.25 μF 350 v. wkg.
C10—0.03 μF 250 v. wkg.
C11—0.04 μF 250 v. wkg.
C12—50 μF 12 v. wkg.
C13—0.2 μF 350 v. wkg.
C14—1.0 μF 350 v. wkg.
C15—32 μF 350 v. wkg. electrolytic.

NOTE. C6, C7 and C8 may have to be made up by using two in parallel for each. This may also apply to C4, C10, C11 and C13.

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to do now is to combine a negative feedback tone-control circuit with the parallel T network, always keeping in mind that the whole must be economical. From the preceding paragraphs we can arrive at a figure of 200 times for the total gain required, which will include the feedback plus the bass and treble lifts. This amount of gain puts out of consideration the single triode, and turning to the pentode—though this amount of gain is possible—circuit conditions would be rather tight, particularly in view of the complications that the parallel T net work will involve. Going from the pentode to the double triode, it can very readily be appreciated that it is able to fulfil all our requirements quite easily and, in particular, it is very reasonably priced.

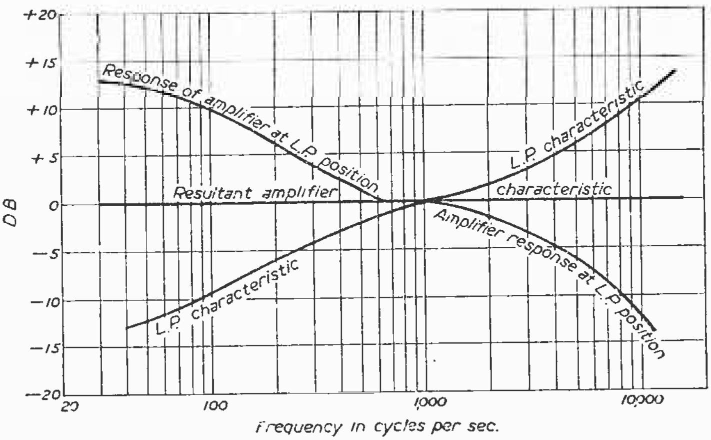


Fig. 2.—Further response curves.

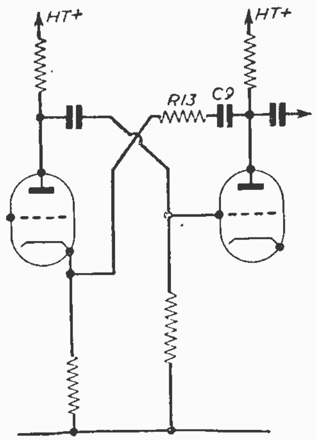


Fig. 4.—Circuit analysis at middle frequencies.

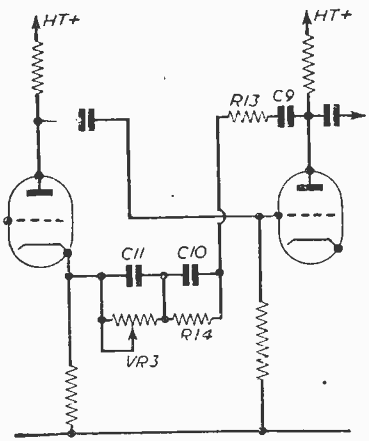


Fig. 5.—Circuit for bass boost.

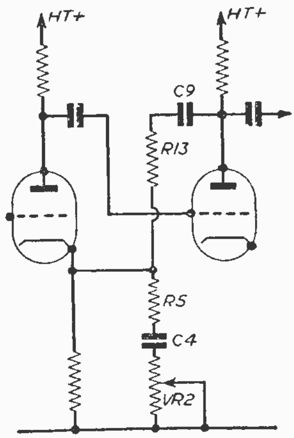


Fig. 6.—Treble boost circuit.

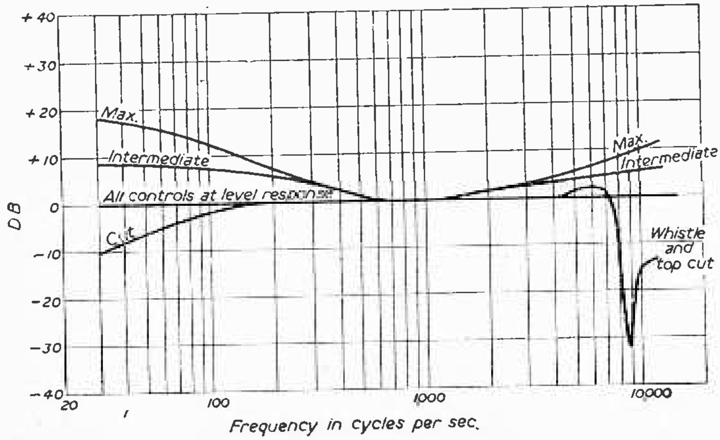


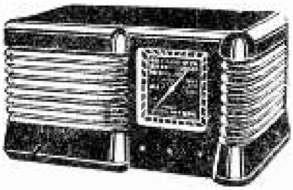
Fig. 1.—Response curves at various settings of the controls.

Using, then, the 6SL7 double triode for our preamplifier, the complete circuit diagram is given in Fig. 3. In order to show quite clearly the multiple uses to which this valve is put, the circuit is broken up into the following figures. Fig. 4 shows the circuit as it is effective at middle frequencies—that is, a straightforward two-valve triode amplifier with negative feedback from the anode of V2 to the cathode of V1. Fig. 5 is the same circuit but with the added impedance of the condenser C10 and C11 (one or both) increasing the gain at bass frequencies only, the resistance R14 being used to limit the gain and correct the shape for L.P. equalisation. Fig. 6 gives the circuit with treble

CABINET as illustrated, 11½ x 6½ x 5½in. in walnut or cream, complete with T.R.F. chassis, 2 wave-band scale, station names, new waveband, backplate, drum, pointer, spring, drive spindle, 3 knobs and back. **22 6.** P. & P., 3 6.

As above with Superhet Chassis. **23 6.** P. & P. 3 6.

As above complete with new speaker to fit and O.P. trans., **35 -.** P. & P. 3 6, with Superhet Chassis, **36 -.** P. & P. 3 6.



Used metal rectifier. 240 v. 50mA., **4 6** ; gang with trimmers, **6 6** ; M. & L. T.R.F. coils, **5 -** ; 3 obsolete Ex Govt. valves, 3 v h and circuit, **6 6** ; heater trans., **6 -** ; volume control with switch, **3 6** ; wave-change switch, **2 -** ; 32 x 32 mfd., **4 -** ; bias condenser, **1 -** ; resistor kit, **2 -** ; condenser kit, **4 -.**

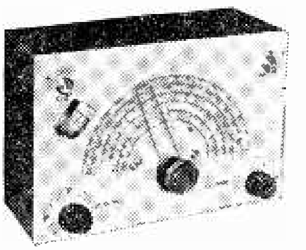
M & L. Superhet Coils with circuit **6 6** ; iron cored 465 IF's, **7 6** ; min. gang, **5 6** ; volume control with switch, **4 -** ; wave-change switch, **2 6** ; heater trans., **7 6** ; 4 v h, **1 6** ; 4 obsolete Ex Govt. valves, metal rectifier and Xtal diode with circuit, **14 6** ; 25 x 25 mfd., **1 -** ; 16 x 16 mfd., **3 3** ; condenser kit (17), **7 6** ; resistor kit (14), **3 6.**

Used 4 valve plus metal rec. A.C. mains, 200/250 superhet. Valve line up 6K8, 6K7, 6Q7 and 6F6. Medium wave in mahogany cabinet, size 14½ x 9 x 7½in. These have been checked and are in first-class working order, and have a first-class performance, 6½in. P.M. speaker, P. & P. 5 -. **£3/19/6.**

Used 5 valve A.C. mains 200 250 3-waveband superhet. Complete in outstanding walnut cabinet, size 22 x 14 x 10½in. Valve line up, 6K8, 6K7, 6B8G, 6F6 and U50 rec., 8in. P.M. speaker. In first-class working order, **£7 19 6.** P. & P. 12 6. We have a few of these in A.C. D.C., price as above.

All dry A.C. mains battery unit. 200 250 v. Metal case size 8 x 5 x 3in., by famous manufacturer incorporating Westinghouse metal rectifiers 3 500 mfd., 16 + 24 mfd., mains trans., 3 smoothing chokes, output 90 v. 10 mA., 1.4 v., .25 amp. P. & P. 2/6. **39/6.**

COMPLETELY BUILT SIGNAL GENERATOR. Coverage 110 Kc s-320 Kc s., 300 Kc s-900 Kc/s., 900 Kc s-2.75 Mc s., 2.75 Mc s-8.5 Mc s., 8.5 Mc s-25 Mc s., 17 Mc s.-50 Mc s., 25.5 Mc s.-75 Mc s. Metal



case 10 x 6½ x 4½in., size of scale 6½ x 3½in., 2 valves and rectifier, A.C. mains 230 250 v. Internal modulation 400 c p.s. to a depth of 30 %. Frequency calibration accuracy plus or minus 1 %. Modulated or unmodulated R.F. output continuously variable 100 milli-volts. Post and packing 4 -. **£4 5 0. 34 -** deposit, three monthly payments of £1.

High impedance plastic recording tape by famous manufacturer. 1 200 feet complete on spool, **17 6.** P. & P. 1 6.

Amplifier Case. black rexine covered, leather carrying handle, chrome plated corners, rubber feet, felt lined, detachable lid. External dimensions 13½ x 13½ x 9½in. **£1.** P. & P. 2 6.

Pr. 200 250 v., secondary 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volt at 2 amps., **13 -.**

Drop thro' 280-0-280, 200 mA., 6 v. 5 amps., 5 v. 3 amps., **27 6.**

Heater Transformer. Pri. 230-250 v. 6 v. 1½ amp. **6 -** ; 2 v. 2½ amp., **5 -.** 2 4 or 6 v at 2 amps., **7 6** ; 2 v. 2½ amp. and 6 v 0.6 amp. E.H.T. insulated, **8 6.** P. & P. each 1 -.

R.I. MAINS TRANSFORMERS, chassis mounting, feet and voltage panel. Primaries 200 250.

300-0-300 60 mA. 6.3 v. 1 a., tapped at 4 v. 6.3 v. 2 a. tap 4 v.. **13 6.**

350-0-350 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a.. **13 6.**

350-0-350 70 mA. 4 v. 5 a. 4 v. 2.5 a.. C T.. **18 6.** P. & P. on the above transformers 2 -.

500-0-500 125 mA. 6 3 v. C.T. 4 a. 6.3 v. C.T. 2 a. 5 v. C.T. 2 a.. **27 6.**

500-0-500 120 mA. 4 v. C.T. 4 a. 4 v. C.T. 4 a. 4 v. C.T. 2.5 a.. **27 6.**

500-0-500 250 mA. 4 v. C.T. 5 a. 4 v. C.T. 5 a. 4 v. C.T. 4 a.. **39 6.**

P. & P. on the above transformers 3 -.

32 mfd., 350 wkg.	2 -
16 x 24 350 wkg.	4 -
4 mfd. 200 wkg.	1 3
40 mfd. 450 wkg.	3 6
16 x 8 mfd., 500 wkg.	4 6
16 x 16 mfd., 500 wkg.	5 9
8 x 16 mfd., 450 wkg.	3 9
32 x 32 mfd. 350 wkg.	4 -
32 x 32 mfd., 350 wkg. and 25 mfd., 25 wkg.	6 6
25 mfd., 25 wkg.	11d.
250 mfd., 12 v. wkg.	1 -
16 mfd., 500 wkg., wire ends	3 3
8 mfd., 500 v. wkg., wire ends	2 6
8 mfd., 350 v. wkg., tag ends	1 6
50 mfd., 25 v., wkg., wire ends	1 9
100 mfd. 350 wkg.	4 -
100 200 mfd., 350 wkg.	9 6
16 16 mfd., 350 wkg.	3 3
Ex Govt. 8 mfd. 500 v. wkg., size 3½ x 1½. 2 for.	2 6
60 100 mfd., 280 v. wkg.	7/-
16 32 mfd., 350 wkg.	6/-
50 mfd., 180 wkg.	1 9
65 mfd., 225 wkg.	1 6
8 mfd., 150 wkg.	1 6
60 100 mfd., 280 wkg.	8 6
50 mfd., 12 wkg.	11d.
32 32 mfd., min., 275 wkg.	4/-
50 mfd., 50 wkg. 8 mfd., wkg., wire ends	1/9
Miniature wire ends moulded 100 pf., 500 pf., and .001 ea.	7d.

Partridge fully shrouded mains transformer. input 200 250 secondary 350-0-350 175 mA. 6.3 v. 7 amp., 5 v. 3 amp., p p 3 -. **35 -.**

Partridge fully shrouded pushpull transformer. PRI 6.000 ohms. SEC 15 ohms. p p 2 -. **20 -.**

Partridge fully shrouded choke. 15 Hen. 180 mA., p p 2 -. **15 -.**

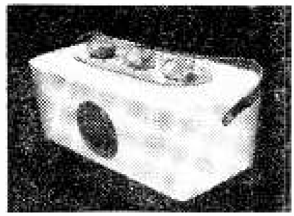
Partridge fully shrouded choke. 5 Hen. 120 mA., p p 2/-. **8 6.**

CONSTRUCTOR'S PARCEL. comprising chassis 12½ x 3 x 2 in. cad. plated 13 gauge, v h., IF and trans. cut-outs, backplate, 2 supporting brackets, 3 waveband scale, new wavelength station names. Size of scale 11½ x 4½in., drive spindle, drum, 2 pulleys, pointer, 2 bulb holders, 5 paxolin international octal valve holders, 4 knobs, and pair of 465 IF's. **16 6.** P. & P. 1/9.

AS ABOVE. but complete with 16+16 mfd. 350 wkg. and semi-shrouded drop thro' 250-0-250 60 m a., 6 v. 3 amp. Pri. 200-250, and twin-gang **31 6.** P. & P. 3 -.

5in. M.E. field coil 750 ohms with O.P. trans., **17 6.** P. & P. 1 -.

Germanium crystal diode. 2 3. post paid.



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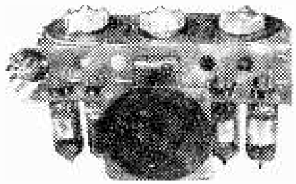
3in. P.M. SPEAKER to fit above, **10 -.** Miniature output transformer, **5 -** Miniature wave-change switch, **1 6.** Miniature 1-pole 4-way used as Volume and Off. **1 6.** 4 B7G valveholders, **2 4.** Midget twin gang ½in. dia., ½in. long and pair medium and long-wave T.R.F. coils ½in. long x ½in. wide ; complete with 4-valve all-dry mains and battery circuit, **8 6.** Condenser Kit, comprising 11 miniature condensers, **3 6.** Resistor Kit, comprising 15 miniature resistors, **4/6.** The above receiver (less valves and batteries) could be built for approximately **51 -.** P. & P. 2 6. Valves to suit above **10 -** ea. Point to Point Wiring Diagram **1 -.**



View of chassis as it would look when assembled with valves inserted.

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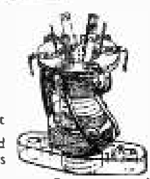

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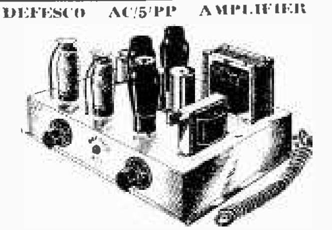

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lift, this effectively short-circuiting the feedback at high frequencies and so increasing the gain. Fig. 7 is the parallel T network inserted between the anode of V1 and the grid of V2, it being shorted out by the switch S4 of VR2 when not in use. The condenser C8 does not affect the frequency response with the normal audio-frequency range because of the feedback between V2 and V1. Fig. 8 is the bass cut, being simply a reduction of capacity in the output condenser.

Construction

Construction should present little difficulty, but in order to preserve the completely negligible hum level of the main amplifier it is essential to avoid earth loops in the wiring; this often means extra constructional work and to the uninitiated appears unnecessary and ridiculous. The chief example of this in this amplifier is the method of mounting and wiring the input/output sockets. The six Pye sockets are mounted on a paxolin strip with clearance holes drilled in the chassis, then insulating washers are slipped on the other side before the nuts so that the outer part does not make contact with the chassis, and an earth busbar is made with three pieces of 16 s.w.g. tinned copper wire twisted together, which is soldered to each outer part of the socket in turn, right along the inside top of the chassis. This is the H.T.— busbar to which all earth returns must be made. It may seem contradictory to some that here they are being instructed to make all returns to this busbar when the writer has been stressing that earth loops should be avoided by separating H.T. negative from earth, but because of the fact that one side of the output is earthed it is very necessary to complete the earth/H.T.— circuits in this way so that between the main amplifier and the T.C. there is only one direct earth/H.T. connection (apart from the screening of the chassis). As most of the components are of the

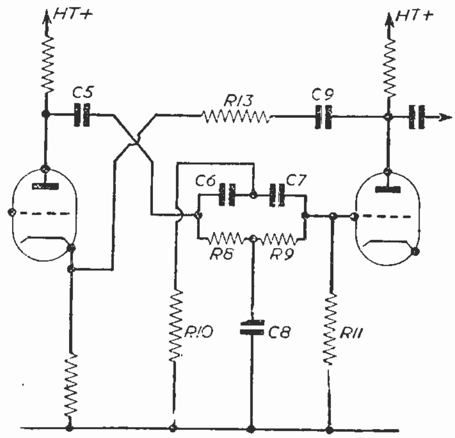


Fig. 7.—Treble cut arrangement.

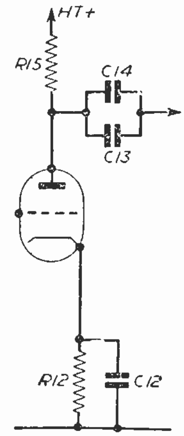
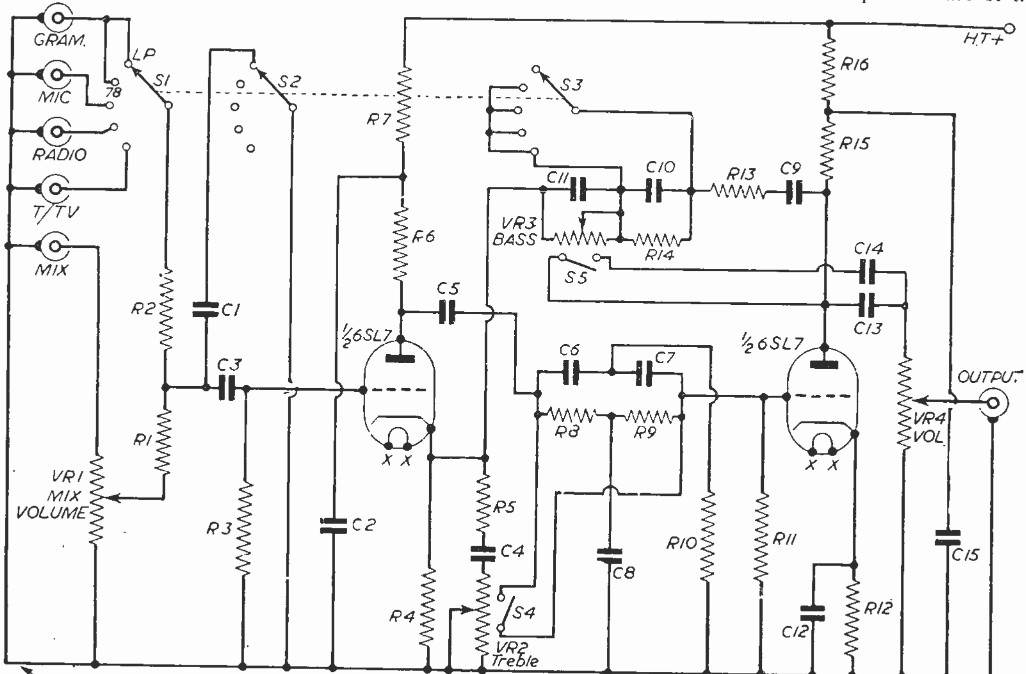


Fig. 8.—Bass cut circuit.



N.B. This earth wire must not be taken to chassis. Earth is connected via output plug and socket. Chassis is taken to earth pin on 5-pin Power socket.

Fig. 3.—Theoretical circuit of the tone-control pre-amplifier described this month.

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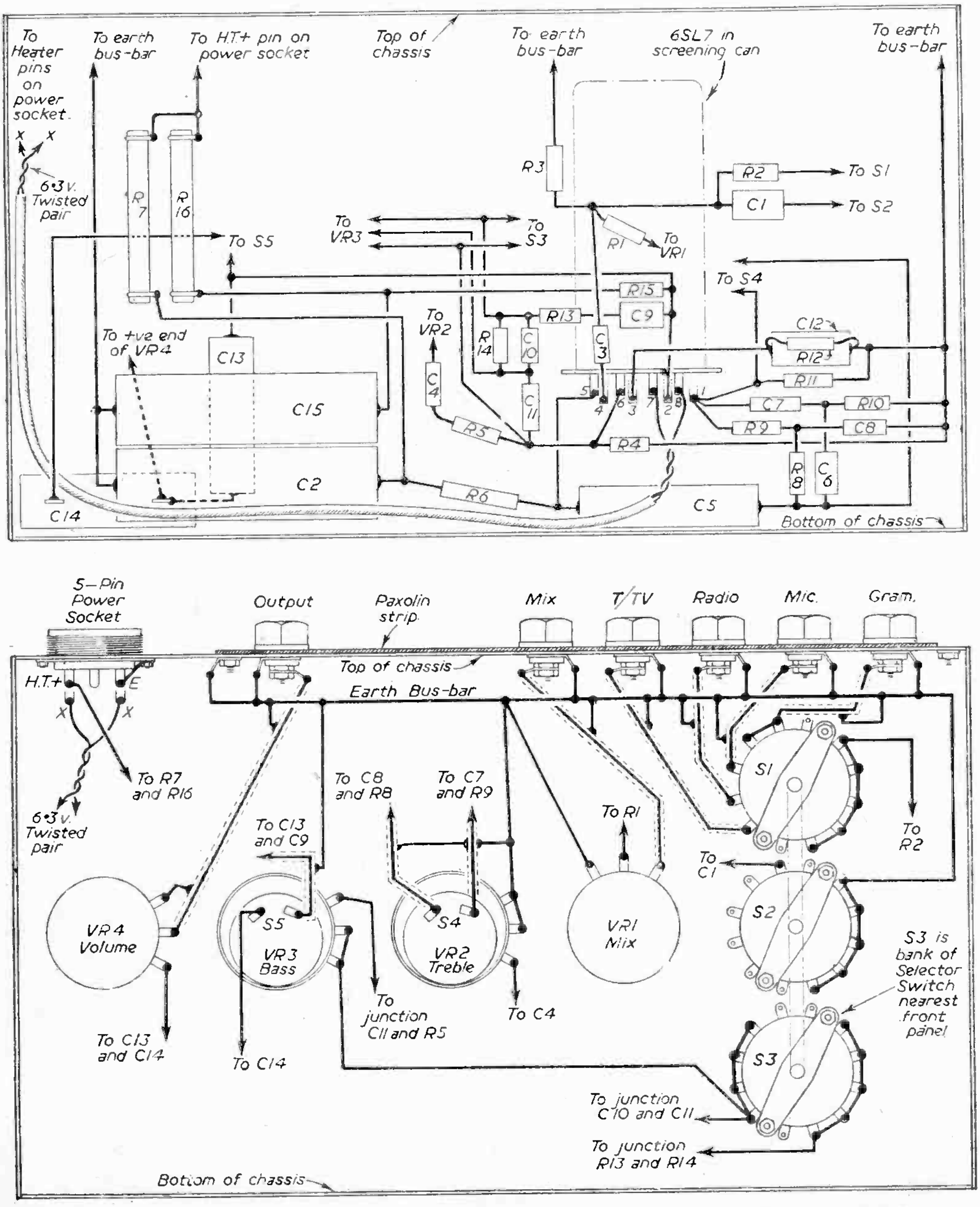
miniature type they are best mounted as a self-supported string around, but close to, the valveholder, with the short co-axial leads going away to the different points. This can be done away from the chassis and when finished is easily inserted, bolted up and soldered. When connecting the outers of the co-axial to the earth busbar it will be found best to unravel about an inch and then twist together to use as a pigtail, rather than attempt to solder a wire direct to the outer screening. Watch also that only one end of the screening of each wire is taken to the busbar. Fig. 9 gives the layout; major dimensions only are shown, as most components are grouped round the valveholder. The two illustrations below (Figs. 10 and 11) are the point-to-point wiring diagrams.



Figs. 10 and 11.—Top and below chassis wiring diagrams of the tone-control pre-amplifier.

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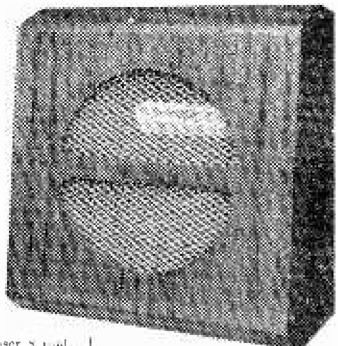

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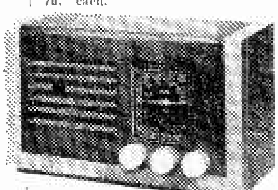

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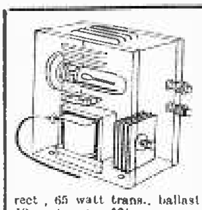

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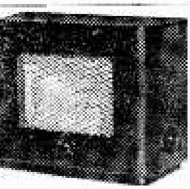

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In use the main point to watch is to avoid over-loading the input, crystal and the ordinary high output pick-up will have to have fixed attenuators (just two resistances to suit the pick-up) to reduce the output below 0.5 volt, which is the maximum the pre-amplifier will accept. The output co-axial can be anything up to 12ft. in length without deterioration of quality, and a point here to note is that the outer is the H.T.— connection to the amplifier: connect it up before switching on. The table above gives voltage and current measurements.

VOLTAGE AND CURRENT TABLE

V1 and V2=6SL7 double triode.
V1—Eg=100 v.
V1—Ec=1.2 v.
V1—Junction of R6 and R7=260 v.
V2—Ea=280 v.
V2—Ec=1.5 v.
V2—Junction of R15 and R16=310 v.
Total current V1 and V2=2.0 mA.
All taken on 20,000 ohm per volt meter

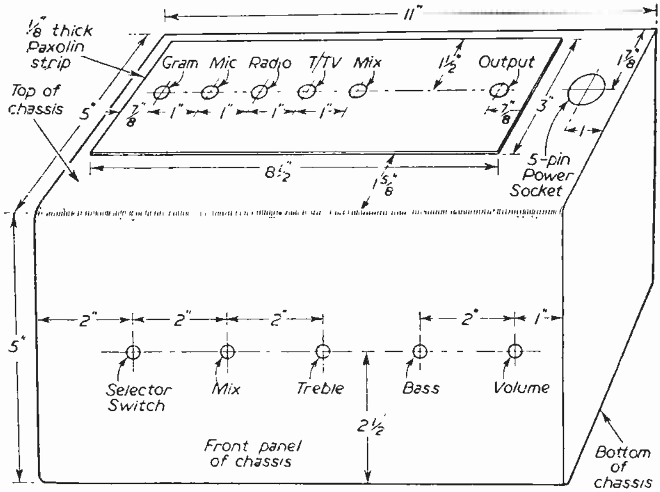

Fig. 9.—Details of the chassis for the tone control pre-amplifier.

It would be incomplete to conclude without some mention of the cost which, including the valve and interconnecting wires, amounts to not more than £3.5.0.

Extended Use of Tape Recordings

DURING recent years the BBC has been expanding its facilities for recording sound programmes on magnetic tape. New recording equipment has been installed on a considerable scale, and a scheme now being carried out will bring the total of new tape recording and reproducing machines to some 180 at a cost of about a quarter of a million pounds.

The magnetic tape system of recording has certain advantages over disc recording—and some disadvantages. Each has its particular application in broadcasting, and in the BBC the two systems are complementary—about 60 per cent. of the requirements being best met by a magnetic tape system and the remaining 40 per cent. by the disc system.

Among the advantages of the tape-recording system for broadcasting, as apart from providing a means of high-quality recording and reproduction, are: recorded material can be erased from the tape and the latter used repeatedly; it lends itself to precise editing; being lighter and less vulnerable to mechanical shock it is more suitable for mobile work; there is less deterioration during repeated reproduction than takes place on disc recordings. The ability to make repeated use of the recording medium is of particular importance when considerably more material has to be recorded in order to obtain that which is required for the actual programme as, for example, in the recording of the songs of wild birds, where it is not uncommon to record continuously for an hour or more to obtain a bird song lasting a few minutes. Another example was during the recent Test Matches when the ball by ball commentary broadcast to Australia was recorded throughout on tape, those parts of the commentary dealing with the highlights of the play subsequently being transferred to disc to provide a concise sound picture of the series for historical record purposes; the recording was afterwards erased from the tape and the latter released for further use.

The magnetic tape-recording equipment has been supplied to the BBC by Electric & Musical Industries, Ltd., the Radio Gramophone Development Co., Ltd., and the British Ferrograph Recorder Co., Ltd.

L.F. Crystal Testing

A NEW low-frequency quartz crystal activity test is now being produced by Salford Electrical Instruments, Ltd. Covering a frequency range from 50 to 2,000 kc/s. and known as the QC 166 test set, it is complementary to the older QC 57 test set which covers frequencies from 1 to 20 Mc/s. Need for a test set of this kind has arisen because of the many recent additions to the low-frequency range of quartz crystals. Its use is specified in Quartz Crystal Specification R.C.S.271 and the ranges covered embrace all Service requirements. The new QC 166 set, which is available in a commercial as well as a Service form, was developed in the Research Laboratories of The General Electric Co., Ltd.

Operating Principle

The new test set, although it necessarily incorporates a modified circuit, operates on the same principle as the older high-frequency test set, in that it measures the apparent resistance, or the equivalent parallel resistance, of the crystal. The operator can, by measuring this property, determine the quality of a crystal, because the amplitude of oscillation in most crystal oscillator circuits is determined by the apparent resistance of the crystal shunted by the circuit input capacity, the behaviour of crystal and oscillator being similar to a parallel tuned circuit.

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Building the "SOUND-MASTER"

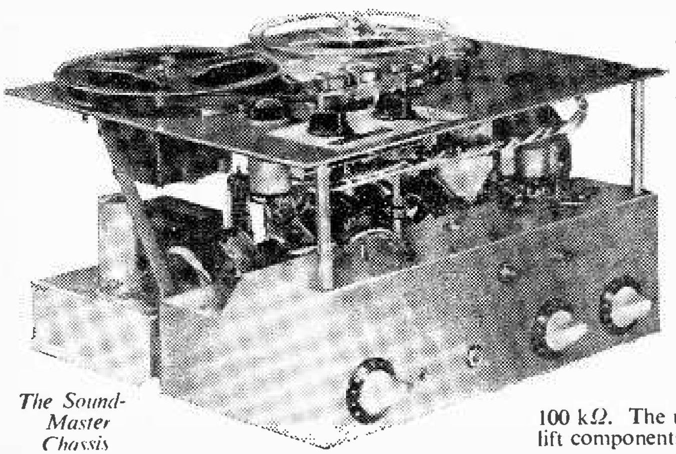
FURTHER DETAILS OF THE LATEST HIGHLY EFFICIENT HOME CONSTRUCTOR TAPE RECORDING UNIT

WE have already received a few enquiries from prospective builders of this kit, chiefly in regard to the price and its general performance. As with any home-constructor design, either emanating from this office or sponsored by us, we regret that we cannot make comparisons between them and other designs. Apart from the policy of making such comparison there is also the big question of individual preferences. We are often asked the same thing in regard to radio receivers and television equipment but it is difficult for us to say that such-and-such a receiver is better than another one. Firstly, there is the big question of cost, and you cannot compare objects which do not cost the same amount. Then there is the question of what the user is expecting for his money. The parts for the Soundmaster will cost something in the region of £50, but as with any home-constructor equipment, expense may be saved by obtaining certain substitute parts. By looking through the advertisements in our pages you will find, for instance, that certain firms may put up kits of parts such as resistors or condensers, and these will be offered at a slight discount over the total cost of the individual items. Unless the constructor is very experienced, however, we do not recommend that any departure should be made from the items which are specified. One addition might be made to the published instructions and parts, and that is to attach a 3in. square of paxolin (or ordinary stiff cardboard may be used, if desired) to the top of the chassis immediately below the magic-eye indicator. Although the clamping screw should hold this firmly, rubbing the top of the indicator or pushing on it may result in it being pushed down and the tags or leads from the holder will then come into contact with the chassis. This is just a precaution which may not be needed in all cases, but we have found that inquisitive people have a habit of pushing where anything may be pushed, and this may therefore well be a source of danger.

Recording

So far as the actual recording is concerned there is really nothing to equal a practical demonstration. Descriptions of the movement of the magic-eye indicator with different recording levels do not convey a true picture and, therefore, it is best to use a few feet of tape over and over again in trying out different recording depths and settings of the various controls in order to gain experience and note the actual results with each individual recorder. Half an hour spent in this way will reveal more than pages of descriptive matter.

There is just one point which may be mentioned and that is the rate of recording. The capstan which drives the tape is controlled by the frequency of the mains and is thus constant, but the tape may be moved from spool to spool at varying speeds by means of a form of gearing. The drive is taken by means of a belt, and the main capstan pulley and the drive pulley have two different diameter grooves on them. By placing the belt in the two positions, therefore, two different speeds may be obtained. A further two-speed change may be effected by placing a sleeve over the capstan top (this sleeve is normally retained in position by the screw top and it is kept in the centre of the motor-board). By means of suitable combinations of these pulleys and sleeve, therefore, it is possible to obtain driving speeds of 3¾in., 7½in. and 15in. a second. The speeds are used according to the materials being recorded, the highest fidelity being recorded at the highest speed. For all normal recording material the 7½in. speed will be found adequate, but there may be occasions when a particularly high-fidelity record is required, and then the pulleys should be adjusted to give the higher speed of travel. At this speed certain modifications may be made to the equipment. If it is intended to do a fair amount of recording at 15in. per second, condenser C9 should be reduced to about 860 pF and R14 taken down to 100 kΩ. The user may also prefer to replace the top-lift components L1 and C9 by a 220 kΩ resistor.



The Sound-Master Chassis

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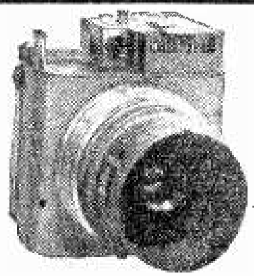

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Lens 5in. F/4 with internal iris diaphragm stops to F/11, fixed focus set at infinity, screw-in housing project 5¼in. Focal plane shutter, speeds 1/60th to 1/1,000th of a second and time, fitted in film magazine designed for 5¼in. wide film, picture size 5¼in. x 5¼in. Shutter release and rewind spindle fits standard spanner. Hand operated as it stands. Nett weight 17 lbs. Packed in fitted transit case 42 lbs. Dimensions: Body 6¼in. x 9in. x 9¼in., overall including lens housing 11¼in. x 9in. x 9¼in. Provision for external motor drive (not supplied). Lens housing grooved for fitting to aircraft camera port. A precision Air Survey Camera, could be adapted for Laboratory, Industrial or Portraiture use.
ASK FOR P/H302. **£4/19/6** Each CARRIAGE PAID

14in. F 5.6 LENS FOR F24 CAMERA Complete with Iris, Filter, Mount and Extension. In transit case.
ASK FOR P/H563. **£6/19/6** Each CARRIAGE PAID

RECORDER MK.11 24 Volts
This unit is an Auto Camera for 16 mm. Film, the shutter can be operated at single shot or one frame per half-second continuously. The Recorder requires a cassette, or Magazine (not supplied) to hold 25 ft. of 16 mm. Film. The Optical Unit has an F4.5 lens and Prism Reflector system, for right angle operation through the side of the case. There is also an Iris Control for Dull or Bright Exposures and a Film Footage Indicator. The whole unit is powered by a 24 volt Motor, which consumes only 0.5 of an amp. Dimensions 4¼in. x 4in. x 1in. Contained in Transit Case. Dimensions: 9¼in. x 6in. x 2¼in.
USED GOOD CONDITION.
ASK FOR P/H883. **27/-** Each POST PAID

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EITHER UNIT **10/-** Each CARRIAGE 2/- extra

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Contains: Motor Generator input 12 v. 3.8 a. Output 480 v. .04 a. D.C. with a gearbox operating a switching mechanism to detube the receiver at time intervals. Data available for converting to 250 v. 50 c/s use as motor.
Plus: 4 VR65A (SP41) 2/VR92 (EA50), 2 CV6 (Det. 20) Valves, etc., etc.
Metal Case, dimensions: 12in. x 12in. x 8in. Weight 24 lbs.
ASK FOR P/H961. **19/6** Each CARRIAGE PAID

26 WATT OUTPUT TRANSFORMER
Parmeko type AF5084/1A. (Mfg. Surplus.) Primary: 6,600 ohms C.T. Sec's 3.5, 5, 7.5 or 10 ohms. Dimensions: 3¼in. x 2¾in. x 3¼in. Fully shrouded. Weight 3 lbs.
ASK FOR P/H565. **19/6** Each POST PAID

FOR EXPORT ONLY WIRELESS SET NO. 38 MK.11.
Range 7.7-9 m/cs 5 valves and all accessories. Complete (less batteries) and unused in original wood case. 4 complete units per case.
ASK FOR P/H519/4. **£20/0/0** per case of 4 sets
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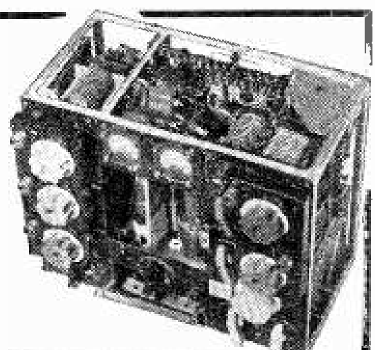

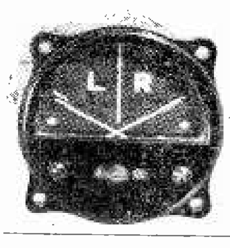

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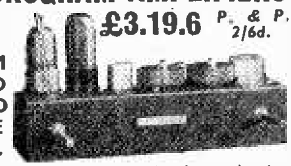

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PROBLEMS OF V.H.F.

AN ENGINEER EXPLAINS THE DIFFICULTIES OF TRANSMISSION AND RECEPTION ON THE VERY SHORT WAVELENGTHS

By F. E. Apps

THE reception and transmission of very high frequencies has been responsible for very much research work, owing to the very difficult problems that V.H.F. brings into play. The main problems to be dealt with are:

(1) The tuning circuit, which is limited to the frequency required.

(2) The electron transit time of the valves used in the V.H.F. portion of the receiver or transmitter.

The first problem was difficult, as the conventional circuit with inductance and capacity had to be ruled out, owing to the very small physical and electrical dimensions necessary for very-high-frequency and centimetre wavelengths.

This led to the design of the resonant cavity (see Fig. 1). Note how this device was built up from the two plates of a condenser (of very low capacity), paralleled by short straight wires (also of very low inductance), thus giving a parallel LC circuit of very low LC value and consequently of very high frequency. These resonant cavities do not lose a lot by radiation, as does the conventional circuit, as the whole of the energy is enclosed inside the tube or rectangular box. The walls of the box also give quite a large area for conducting current, thus eliminating the losses due to skin effects in the conventional circuit. It is due to these last two facts that the resonant cavity has a high Q factor.

Resonant cavities can be made adjustable as regards wavelength by varying the distance between the two plates forming the condenser. One plate is fixed and the other is made so it can be moved nearer or further away from the fixed plate. The Q factor of a resonant cavity can be stated as

$$Q=\pi\,\frac{\text{Energy stored}}{\text{Energy lost per }\tfrac{1}{2}r}$$

The walls cannot be perfect conductors, so the fields in the cavity penetrate the walls slightly and thus lose a little energy by skin effect. The Q can then be stated as

$$Q=\frac{\lambda}{3\sqrt{2}\delta}$$

where δ = skin depth.

The frequencies that can be employed on a resonant cavity may be calculated from the following according to whether the cavity is a cylinder, a rectangle or a sphere.

For a cylinder $\lambda = 2.6 \cdot$ radius.

For a rectangle $\lambda = 2.83 \times \frac{1}{2}$ of 1 side.

For a sphere $\lambda = 2.28 \times$ radius.

λ is in centimetres.

A resonant cavity that is too small for a given wavelength will not oscillate. As electromagnetic energy and also electrostatic energy oscillate to and fro inside the resonant cavity they resemble in themselves wave guides. There will be harmonics of the fundamental frequency present.

Performance

The performance of a valve at very high frequencies is controlled by the following:

(i) Physical spacing of valve elements.
(ii) Physical length of active elements.
(iii) Inductance of valve elements } See Fig. 2.
(iv) Inter electrode capacities. }
(v) The electron transit time.

In dealing with (i) and (ii), to reduce their effects to a minimum, very small spacings are used, the distance between cathode and control grid often being of an order of two or three thousandths of an inch. The elements are supported by discs to keep down microphony. The interelectrode capacities depend upon the physical proportions of the elements and their spacing.

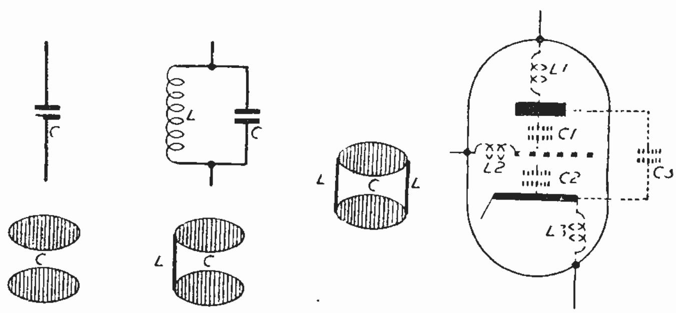
The manner in which a valve is used can also determine its efficiency in very-high-frequency work. If the control grid never goes positive then electron transit time becomes greater. Should the control grid become positive early in the cycle, then there is more time for electrons to be accelerated to the grid and the valve works well at the higher frequencies. Conversely, should the control grid be positive for less than ½ ∼, there is less time for electrons to be accelerated to grid and valve is not so efficient for high frequencies.

The electron transit time is principally the time required for electrons to move from the cathode to the grid.

In a triode the time is

$$t=\frac{5\times 10^{-8}}{\left(Eg+\frac{Eb}{\mu}\right)^{\frac{1}{2}}}S$$

where S = cathode to grid distance in c.m.s.
Eg = control grid voltage.
Eb = Anode voltage.
μ = amplification factor.



Figs. 1 and 2.—A diagrammatic explanation of inductance and capacity and "strays" in a valve.

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For a tetrode

$$t = \frac{5\times 10^{-8}}{\left(E_g + \frac{Esg}{\mu cg}\right)^{\frac{1}{2}}} S$$

where S = cathode-grid distance in cms.
Eg = control grid voltage.
Esg = screen grid voltage.
μcg = control grid amplification factor.

It will be noticed that in the case of the tetrode, the anode voltage effect is not taken into consideration, as its effect is generally small.

In a triode, grid current attains an appreciable value only, when the grid is positive with respect to the cathode. If the grid is negative, this current may be as small as 10^{-12} amperes. It may thus seem that effective grid loading is very low when a valve is connected in a circuit. In reality the grid loading increases with the applied frequency and consequently, unless valves are designed to overcome this, they will have a frequency limitation.

Grid Current

If one goes into detail regarding this point, one must consider an electron leaving the cathode and passing the grid on its path to the collector or anode. As the electron approaches the grid, a charge will be induced on the grid which will change as the distance between electron and grid decreases. This charge on the grid will be grid current and will be in such a direction as to cause grid current to flow. The energy that causes this grid current is supplied by the electronic velocity and it is consequently decelerated. When the electron passes the grid, the reverse takes place, and the amount of energy lost by the electron as it approaches grid is equal to the amount it gains as it leaves. Thus under these conditions net grid loading is zero. Now the velocity of an electron, even by low voltage, is quite high, and transit time of the electron in passing from cathode to plate is very small compared with the period of the voltage applied to the grid, in the case of any frequencies other than U.H.F. or V.H.F. In this case, grid loading is negligible. When, however, as in the case of V.H.F., the electron transit time is no longer small compared with the period of the applied grid voltage, then grid loading becomes formidable. This happens owing to the fact that the energy supplied by the electron to the grid on its path from the cathode, exceeds the amount of energy that is returned by the grid, as the electron proceeds from grid to anode. This causes a resultant energy loss in the grid circuit. This must be made up by the grid driving force and is thus a load on it. This loading will increase as the driving frequency increases until it reaches a point where the valve will no longer act.

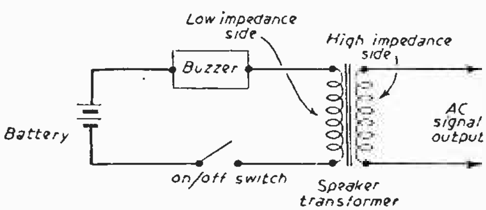
Having dealt with these two main points in V.H.F., there still remains the snag of inter-electrode capacities and lead inductances to be overcome. Normally, these values are small and do not cause trouble, but in frequencies above 100 megacycles, they are very important. They can cause loss in radio-frequency voltage in the lead inductance: series resonance may occur between the L and the C at some particular frequency, when it will act as a short-circuit across the input.

A Handy Test Oscillator

AN AID FOR THE EXPERIMENTER

By W. S. Fowler

WHEN testing circuits and fault-finding on receivers, a local signal is often needed. By applying this to the different stages of a set and working *backwards* from the power stage, it is possible to localise a fault to within a small section of the circuit. The production of this local signal, however, usually entails the purchase or construction of an expensive "signal generator."



Circuit of the oscillator.

The following gadget has been made and used with success by the writer, and can be constructed in ten minutes from the experimenter's "spares box." All that is needed is a flashlamp battery, a buzzer or electric bell, and a step "down" or output (speaker) transformer.

As will be seen from the diagram, the buzzer is connected to the battery (via an on/off switch if desired) through the *low* resistance or output side of the transformer. When the circuit is completed the buzzer will function in the normal manner and, in doing so, will cause an interrupted current to flow through the transformer winding. This interrupted current contains an A.C. "component" which will appear across the high impedance winding of the transformer. Two leads are taken from this winding, and these form the test leads for introducing the signal into the receiver.

Incidentally, it is possible to use an induction or "shocking" coil in the same manner, and the resulting signal can be used for testing both the audio- and the radio-frequency sections of the receiver.

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By F. J. CAMM

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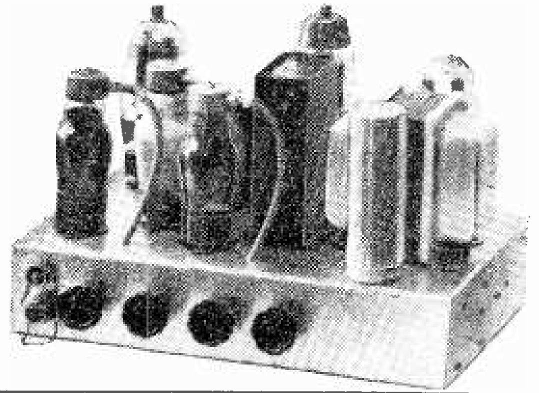

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5U4G	10/6	6V6GT	8/9	EB91	8/9
5Z4G	9/6	6X5GT	8/9	EF91	9/9
6AL5	9/9	8D2	2/11	MU14	9/6
6F6G	7/9	807	6/11	MS Pen	5/9
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32μF 350 v	3/6	64μF 450 v	4/9
25μF 25 v	1/3	8-8μF 350 v	3/9
50μF 12 v	1/3	8-8μF 450 v	3/9
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350-0-350 v 100 mA, 6.3 v-4 v 4 a, c.t. 0-4-5 v 3 a **23/9**
350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a ... **29/11**
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350-0-350 v 100 mA 0-4-6.3 v 4 a, 0-4-5 v 3 a **25/9**
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0.2, 350-0-350 v. 80 m.a., 6.3 v. 3 a., 5 v. 2 a.	17/6
0.2 a. 350-0-350 v. 80 m.a., 4 v. 4 a., 4 v. 2 a.	17/6
0.3, 250-0-250 v. 100 m.a., 6.3 v. 4 a., 5 v. 3 a.	23/-
0.3 a., 350-0-350 v. 100 m.a., 6.3 v. 4 a., 5 v. 3 a.	23/-
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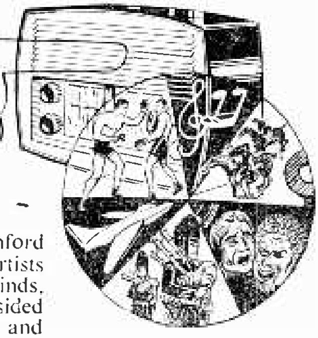

By MAURICE REEVE

"Have a Go"

IT is good to have this with us again. Wilfred Pickles is one of those rare specimens, a radio personality; he is, in fact, one of radio's major figures, to be classed with C. H. Middleton, Sir Walford Davies, Tommy Handley and a few others, almost all men and almost all provincials. There is a certain tang in their unseen presences as well as the delightful brogues of their speech. Londoners and varsity men always seem so standardised and massed produced. That is why, I suppose, the former are invariably one-job men.

Mr. Pickles seemed almost doomed to extinction in that miserable affair "Can I Come In." "I'm on my way out" would have been far more appropriate and nearer the mark. His popularity should quickly rise again. "Have a Go" may not be everybody's cup of tea. But at least it can claim that when it is not at its best it is quite harmless and inoffensive, which is more than most of the light entertainments can. They are seldom anything to write home about at best, and when below this, which is nearly always, they are matter for national uprisings and parliamentary protests. When "Have a Go" is good, it is very good indeed. The pianist, Harry Hudson, didn't, on my only hearing so far, seem quite as versatile as Violet Carson.

Piano Music

The 13 programmes illustrating a century of French piano music, designed by Edward Lockspeiser, are excellently calculated to show off France's well-nigh incomparable contribution to this branch of music. How fortunate the instrument which, after being served by a dynasty of masters from Bach to Brahms, can claim the loving attentions of Fauré, Debussy, Ravel, Saint-Saëns and many others. The programmes are being, for the most part, very well played.

As much cannot be said for Lily Kraus, who played two Beethoven sonatas as though they had been written by her countrywoman, Cecile Chaminade.

Interviews

The "unscripted interview" with C. B. Fry was extremely disappointing—not one question was put to him about his athletic or football or scholastic prowess, which, I believe, still remains unique. A great opportunity was missed of doing justice to one of our most colourful personalities.

"Journey Down the Rhine" was very pleasant and evocative, though too much was heard of English and other trippers and far too little of the Rhinemaidens and the Lorelei, etc.

Light Music

The series of light orchestral concerts, styled "I Know What I Like," is a good one. They introduce first-class music, excellently played by the Concert Orchestra under Stanford Robinson, good artists for the solos of all kinds, and the whole is presided over in most genial and benevolent fashion by a famous radio personality. A welcome Sunday feature.

The "Quiz"

The essence of a good "quiz" programme is the testing of keen intelligence and receptive with worthy questions, affording the audience the excitement of a constant battle of wits with a reasonable percentage of defeats for the experts. Some recent examples in the various quiz programmes constantly before the public have been the reverse of this, and have lacked flavour and spice in consequence.

Plays

Two good Maugham plays were given last month, "The Breadwinner" and "The Letter." The former is a brilliant satire on the folly of constantly toiling for money which others thoughtlessly squander. The unfortunate breadwinner finally goes on strike by "walking out" on it all and, incognito, getting a little peace and quiet satisfaction on his own. "The Letter" is a very exciting story of Eastern blackmail, murdered lover, grossly deceived husband, gin slings and tropical heat, etc., etc., all to the famous Maugham recipe. Robert Harris was the breadwinner and Googie Withers the "authoress" of the letter that caused so much trouble. Both, I thought, gave first-class representations, aided by most of the well-known and popular members of the BBC drama companies.

"The Exhibitionists," by Cocteau, translated and adapted by Peter Watts, was to my mind a brilliant study, by what the *Radio Times* critic calls "a minor master," of the shallowness of those who act only for the effects they make off stage, though on the boards they are the idols of all who behold them. This production was graced by the presence of Dame Edith Evans.

"The Rose Without a Thorn," by Clifford Bax, displays that much married sovereign, Henry the Eighth, at his most self-pitying and ignoble, and his ruthless treatment of the fifth of his series of inamoratas, Catherine Howard. It is in many ways a tender and powerful passage. James Mason was surprisingly robust as the King, and strikingly reminiscent of Charles Laughton in voice at odd moments. Pamela Kellino won all our sympathy as Catherine. Cyril Luckham, Catherine Campbell, Alex. Davion, Elizabeth Gray, Kenneth Fortescue, etc., gave realism to the court circle.

I did a smart piece of detective work in "The Grayling Case," a good thriller. Though set in 1943 during the blitzes one of the characters 'phoned from a call-box and three pennies could clearly be heard to drop through the slot!

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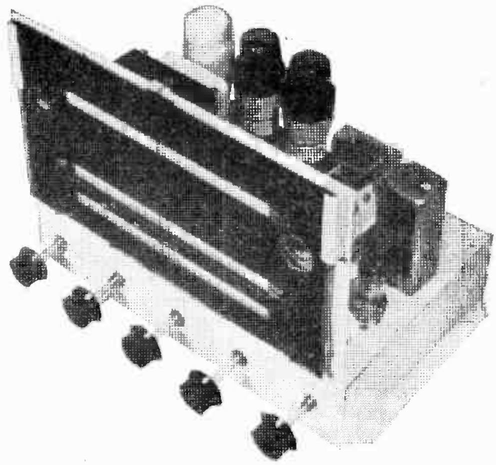
ARMSTRONG RADIOGRAM

TEST REPORT AND REVIEW OF THE LATEST AUTO-CHANGER

WE recently had an opportunity of testing the new Armstrong radiogram illustrated below. This model incorporates the unit seen on the right which is the standard FC.38 superhet chassis, which includes a push-pull output stage delivering a full eight watts. Included in the circuit are full-range treble and bass controls giving boost and cut, and the tuning range covers from 190 to 550 metres, from 1,000 to 2,000 metres, and on the short waves a range from 16 to 50 metres. The three-stage L.F. section is of the R.C.C. type and the two output valves are 6P25's.

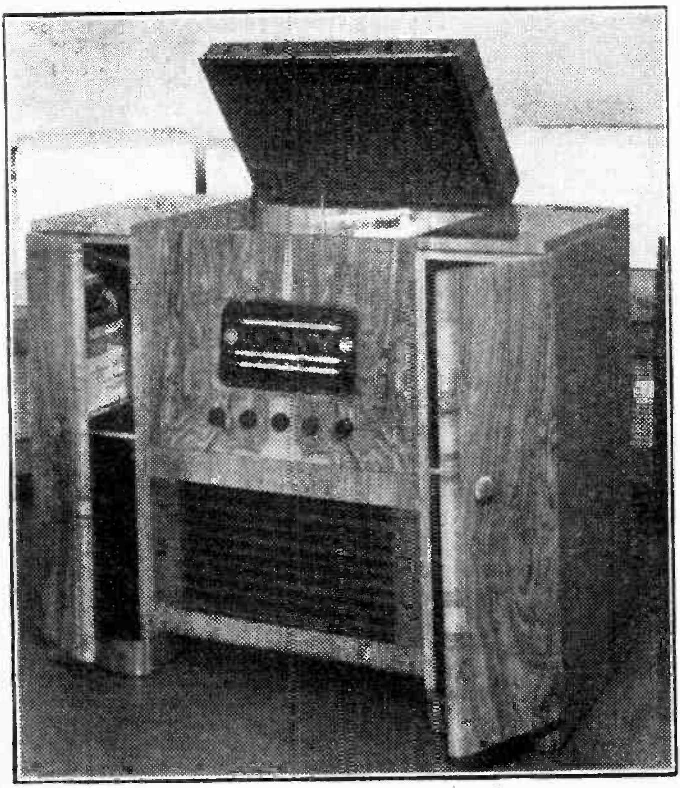
The autochange mechanism is a standard Collaro model 3RC532, giving three speeds and suitable for use with 7in., 10in. and 12in. records, and has a changing mechanism and crystal pick-up head of the turn-over type.



This is the chassis fitted to the radiogram.

The Cabinet

The illustration below shows the appearance of the cabinet, which has two side cupboards for record storage, these being lined with felt. Apart from the fine appearance of the cabinet the makers have gone to some trouble to provide facilities for the user to obtain the most pleasing reproduction—individual listeners having their own idea as to what is "best." The chassis is carried on a shelf which cuts off the lower section of the cabinet, and there is a movable back portion for this section, held in position by wooden clamps. A portion of the bottom (facing the floor) is open, and adjustment of the wooden partition enables the user to set the available area somewhat after the manner of a bass reflex chamber, and in this way the reproduction may be balanced to the room furnishings and the listener's preference for bass or top. In conjunction with the tone-control circuits, this therefore provides one of the most interesting reproducers we have yet seen, as every taste may be catered for. Our tests showed that the receiver was very sensitive, giving a very wide selection of stations, and the adjustment of the tone chamber with the various controls enabled any desired balance of reproduction to be obtained. The complete equipment costs only 69 guineas, including tax, and the overall size of the cabinet is 41in. wide by 35in. high and 19in. deep. The two side cupboards measure 13½in. by 8in. by 17½in.



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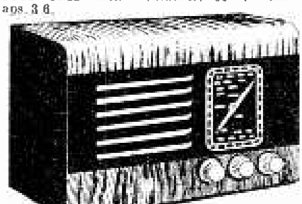
LYNX, choke, 3 h. 250 ma., 13/6.

MAINS TRANS. Made in our own workshops to high grade specification. Fully inter-leaved and impregnated. Heater Trans., tapped prim. 0-200 v. 250 v., 6.3 v. 1½ amps., 7/6 ; ditto 6.3 v., 3 amps., 10/6 ; ditto, 12 v., .75 amp., 7/6. 350-0-350, 80 ma., 6.3 v. 4 a., 5 v. 2a., ditto 300-0-300, ditto 250-0-250, 21/-. Viewmaster, auto type, 35/-. Telekinq, 30/-. Lynx, 30/-. Coronet, 30/-. Super Visor, 30/-.

SOUNDMASTER SPECIALS. — Mains Trans., 55/-. L.F. Choke, 10/6. O P Trans., 5/6. Envelope, 6/6.

GOODMANS WIDE ANGLE DUOMAG TYPE FOCUS UNIT with centraliser, 35/- ; Elac ion traps, 3/6.



WOODEN WALNUT CABINET. — 12in. x 7in. x 5in. complete with punched chassis, TRF or superhet dial, back-plate, drum, drive, spring, pointer etc., 28/6 plus post 2/-.

TYANA — Midget Soldering Iron. 200/220 v. or 230/250 v., 16/9. **TYANA TRIPLE THREE** — Complete with detachable bench stand, 19/6. **NEW SOLON MIDGET IRON.** — 25 w. 19/6. IDEAL FOR RADIO CONSTRUCTORS.

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TAG STRIPS. 2- or 3-way 2d. ; 4- or 5-way, 3d. ; 6-way, 4d. ; 9- or 10-way, 6d.

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TOGGLE SWITCHES EX-GOVT. "On-Off," 9d. Ersin M'core solder 60/40, 16G., 5/6 ½ lb. ; 4d. yd. ; T.C. wire 18 to 22 s.w.g., per yd., 2d. PVC Connecting wire, 10 colours. Single or Stranded 2d. yd. B7G Valveholder and Screening Can., 1/6. V'holders, octal, pax., 4d. ; moulded, 6d. ; EF50, B7G, 9d. ; moulded, 9d. ; ceramic, 1/- ; B8A, B9A, 1/- ; B12A (CRT), 1/3, etc. 2 K. 5 w. H.D. w w Pots, 4/6. 10 K Colvern w w Pot, 1in. spindle, 3/6.

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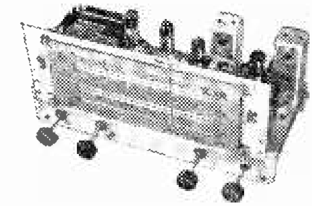

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THREE WAVEBANDS FIVE VALVES

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1R5	8/-	6J7	8/6	12SH7	5/6		5/6
1S5	8/-	6K6	7/6	15D2	2/6	British	7/6
1S4	8/-	6K7	6/6	35L6	10/6	Sylvania	
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3S4	8/-	6P28	19/6	OZ4	8/6	EF91	9/-
3V4	9/-	EF80	10/6	50L6	9/6	EF92	8/6
3D6	8/-	6L6	10/6	807	10/6	EL32	9/6
7D4	2/6	6P25	15/-	GZ32	15/-	7C6	9/6
5Z4	10/6	6Q7	9/6	9001	7/6	EY51	12/6
6X4	9/-	6SA7	8/6	9006	7/6	EY91	8/6
6AG5	7/6	6SH7	6/6	CV6	3/6	HVR2a	7/6
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6AT6	9/-	6SN7	11/-	DK91	8/-	PY80	11/6
6B8	10/6	6U5(Y63)	8/-	DF91	8/-	PY81	11/6
6BA6	7/6	6V6	8/-	DAF91	8/-	PY82	10/6
6BE6	8/6	6X5	9/-	DL92	9/6	PEN25	8/6
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6C4	10/6	7S7	9/6	EL18	4/6	U22	9/6
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6D6	7/6	9D2	5/6	6AL5	7/6	VR116	6/6
6F6	7/6	12A6	7/6	EB91	7/6		
6F12	9/6	12AT7	10/6	EBC33	9/6	ECL80	12/6
6G6	9/-	12AX7	10/6	EC91	7/6	25L6	10/6
6H6	6/6	12K7	10/6	EF36	7/6	25Z6	10/6
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SPECIAL PRICE PER SET :
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6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... ... 37/6

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1/275 v. B.E.C.	2/-	16/450 v. T.C.C.,	3/6
2/450 v. B.E.C.	2/3	16/500 v. Dubilier,	4/-
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8/450 v. B.E.C.,	2/3	60/350 v. T.C.C.,	6/6
8/500 v. Dubilier	2/9	250/350 v. B.E.C.,	8/6
10/500 v. Dubilier,	2/6	8/16/450 v. B.E.C.,	5/-
16/500 v. Dubilier,	4/-	8/16/500 v. Dubilier,	5/6
8/8/500 v. Dubilier,	4/6	16/16/450 v. B.E.C.,	5/6
16/350 v. B.E.C.	3/-	16/16/500 v. Dub.,	6/-
32/350 v. Dubilier	4/-	32/32/275 v. Dub.,	4/3
32/500 v. Dubilier,	5/-	32/32/350 v. + 25/25 v.	
32/32/500 v. Dub.,	7/6	in same can B.E.C.,	6/6
50/150 v. Dubilier	4/-	60/100/350 v. Hunts,	11/6
25/25 v. Dubilier,	1/9		
50/12 v. T.C.C.,	1/9		
50/25 v. Dubilier,	1/9		
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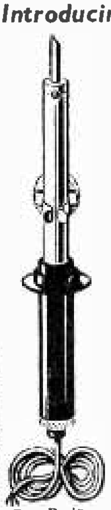
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½ meg. v/c. w/sw., 6/6 ; ready punched chassis, (Univ.) 12/6 ; B8A and B9A v/holders, 1/- each ; P350 connector, 3/9 ; Knobs, 11d. ea ; WB speaker, 48/6 ; transformer, 8/6 ; NEW MULLARD Valves, UCH42, 21/3 ; UBF80 19/11 ; UL41, 17/3 ; UY41 13/11 (£3.12.4 set of 4) ; Resistors, 10 w., 2/3 ea. ; 5 w., 1/10½ ea ; 1 w., 8d. ea ; ½ w., 6d. ea : Condensers, CE27LE, 11/6 ; CE26L, 4/9 ; 50 mf., 2/9 ; Paper tub, 1/- ea. ; 100 pf, 9d. ea. ; Sundries : socket strip to screened flex, inclusive, 7/8 ; Cabinet, £3 ; Solder, 9d. length or 5/- carton ; Elec. clips (2), 4d. ea. C.W.O. or C.O.D. (cabinet C.W.O. only). Postage to £3 1/-, to £5 1/6, over £5 2/-. C.O.D. charges extra.

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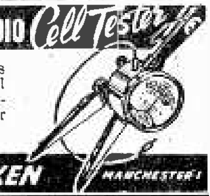

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1LN5	6/-	6SS7	7/6	77	5/6
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3D6	2/-	7B7	7/-	210LF	2/-
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5Y3	8/-	7C6	7/-	5763	8/6
5Z4	8/-	7C7	8/-	EB91	6/6
6B8G	5/-	7D3	6/6	EF39	6/-
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OPEN TO DISCUSSION

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Communication Receivers

SIR,—" Puzzled " comments on the lack of communication receiver kits (superhet) offered by manufacturers. May I state that the problem is to find a satisfactory circuit. Can any reader help ?—P. H. MEADE (Stradbrook, Blackrock, Dublin).

Volume Controls

SIR,—I have been trying to find a reliable volume control which can be constantly operated. In an ordinary radio most of the better-known makes prove quite O.K., but when mounted on a foot-operated control for an electronic musical instrument, where it is continually being swung backwards and forwards, it soon becomes noisy. I have found that the Dubilier and similar types, which are more or less all metal and can therefore be perfectly screened (when connected to the earth), are less troublesome, but still won't stand up to long use in the position mentioned. Has any reader found any way out of this difficulty? I might mention that I tried a very expensive proper foot-control supplied specially for the purpose, but it did not last many weeks. Are there still available any stud-type controls which were on the market before the war?—R. W. FRANCIES (N.W.5).

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

Modifying R1155

SIR,—With reference to Mr. J. Cook's article in the December, 1953, issue of PRACTICAL WIRELESS, on modifications to 1155 type receiver.

It seems he has " missed the point " regarding the I.F. circuits, which are not in the true sense I.F. transformers, but condenser coupled chokes. This is due to the 2 pF. coupling condenser in the first two I.F. stages and a 10 pF. coupling in the last stage. Due mainly to the low values of these condensers coupling is loose, consequent selectivity being high. As Mr. Cook states, this results in a drastic loss of high frequencies.

To overcome this and make the set suitable for local reception, by far the best method is to alter the values of these three coupling condensers.

The first two do not have a great deal of effect, but slight improvement is obtainable by increasing them to 30 pF. (or less). Above this value no difference was noted. The last stage, however, which Mr. Cook totally neglects, seems to be the determining factor. In my own set, using an infinite impedance detector, alteration to this last condenser has a telling effect.

The solution, therefore, seems to be either to leave the first two stages alone or alter them according to taste, and definitely to modify the last stage.

This is best done by removing the existing coupling condenser altogether and bringing leads to a front panel control.

There is plenty of room below chassis just beside the tag panel for a 100 pF. variable condenser, the fixing holes of which must be insulated from either side since both sides are " hot." Also it is preferable to have insulated shaft coupling as well.

Varying this condenser has the effect of an infinitely variable selectivity control, giving variable coupling down to about 2 pF. (This is capacity of leads and minimum capacity of condenser.) At maximum capacity not much improvement is obtained above 100 pF.

For those who are a little wary of removing I.F. " cans," the modification is simply carried out by connecting the condenser leads to the last I.F. valve anode and detector grid (or diode anode) respectively, and leaving the 10 pF. condenser in place.

I have carried out several other modifications such as an extra I.F. stage (which, incidentally, is situated in the section of the B.F.O. can previously occupied by a host of D.F. components), high gain R.F. valve, aerial trimmer, dial light, etc., which makes this set a very useful addition to anyone's shack. Hoping this information will be useful to PRACTICAL WIRELESS readers.—C. R. WEST (Derby).

Interval Timer

SIR,—I read with interest the article by E. Booth on " A Simple Interval Timer " in the September issue of PRACTICAL WIRELESS. I am rather a beginner to radio, but I understood the circuit and instructions completely except for one main point. I do not know if it is through my inexperience or perhaps through an error in printing, but in the circuit or description I can find no value for the condenser labeled " C_3." The description says that this condenser must be an electrolytic and that it must have a working voltage of at least 250 v., but it does not seem to say how many (micro) farads it should be. I wonder if you would be so good as to tell me this value for C_3.

I realise also that the value for the variable resistance R, which determines the period which elapses before the alarm rings, must be found by experiment, but I wondered if you could please tell me the approximate value of this resistance for a

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period of, say, one minute. (I intend to use a P.O. relay and a VPT4 valve from an old radio set—if these factors affect the value of R.)—R. N. J. SUTTON (Poulton-le-Fylde).

[*C_3 can be 4μF or greater. For one minute duration we suggest C_1 should be 8μF, and R=4 Megohms as a basis for experiment, R being varied until the required duration is obtained.*—ED.]

South Africa Wants Reports

SIR,—May I draw the attention of readers to the fact that the South African Broadcasting Corporation radiates an English programme for listeners overseas on Tuesdays, Thursdays and Saturdays on 19.7 m. between 10.15 a.m. and 3.45 p.m. and on 25.1 m. between 4 p.m. and 10.35 p.m. Also, the local broadcasting short wave transmitters operate as follows:

English: 62.3 m. 4.45 a.m.-6.40 a.m. G.M.T.
49.4 m. 6.30 a.m.-3 p.m. G.M.T.
91.2 m. 3.10 p.m.-9 p.m. G.M.T.

Springbok Radio (Commercial):
89.4 m. 4 a.m.-10 p.m. G.M.T.

We have had reports from Australia, U.S.A. and many other parts of the world, but as far as I know, not one from Great Britain. If readers would oblige us with reports we would be extremely grateful.

May I express my thanks for such an excellent record of service your magazine has, and wish it every success for the next 21 years.—G. M. YOUNG (South African Broadcasting Corporation, Maraisburg Station, Main Reef Road, Johannesburg).

Radio-controlled Models

SIR,—I have been interested for a long time in model control by radio, and am unfortunately not in a position where I can see the surplus stores. In controlling a boat, which is my main interest, there are a number of movements required—forward, astern, port and starboard being only four of the essential movements. In addition, the motors have to be controlled at at least full and half speed, so that a fairly complex arrangement is needed. Some years ago I read how a French amateur (I think) had built a series of tuned reeds which appears to give a limitless range of actions, and only needs a simple transmitter with a mike into which one could hum—provided one has a sufficiently musical ear. Alternatively, a series of tuned oscillator circuits could be made to develop the required notes. This system seems to me to be ideal in simplifying the multiple control scheme and I am surprised that there has been nothing on it from a constructional point of view. I wonder if any readers have any practical data to offer, or can state where I could read the necessary constructional information. I am sure a radio-controlled models section would be welcome this summer.—G. PAISH (Devon).

TRANSMITTING TOPICS

(*Concluded from page 90*).

controlled frequency at 460 kc/s while the hexode portion amplifies the audio input prior to modulating the 460 kc/s carrier, in order to produce an output having component frequencies of 460 kc/s, 460 kc/s + fm, 460 kc/s − fm, where fm is the audio modulating frequency under consideration. These three components are applied to the complex crystal network where the upper sideband is rejected and the carrier is suppressed to a value of approximately 50-70db below the peak sideband power. Crystals X_1 is at 462.5 kc/s, X_2 at 458.75 kc/s and X_3 is at 460 kc/s. The above values are based on the assumption of a standard sine-wave audio voltage input to the 6K8 hexode portion of frequency 2,500 cycles at 5 volts R.M.S. amplitude. Thus it is evident that the component frequencies at 462.5 kc/s and 460 kc/s are eliminated and the lower sideband passes on to the 6J5 push-pull frequency stage, where it is combined with the V.F.O. output (10 volts R.M.S.) to produce outputs from 3.685 kc/s to 3.8 kc/s. Since the frequency changer circuit is balanced, the V.F.O. fundamental frequency component will be eliminated from the output applied to the Labgear Wide-Band Coupler on 80 metres. Using wide-band technique, the R.F. drive to the 6V6 amplifiers is wholly flat over the frequencies mentioned previously.

Filter Alignment Procedure

Remove the 460 kc/s crystal from its socket and inject an unmodulated signal at 458.75 kc/s from a signal generator, noting the voltage across the grid leak of one of the 6J5's, then adjust the trimmers on the 460 kc/s transformers for maximum voltage on the voltmeter. Now increase the frequency of the generator until a sharp dip in the meter reading is obtained; this should be at the series resonant frequency of crystal X_3 (*i.e.* 460 kc/s). Return the generator to 459 kc/s and peak up all the trimmers on the I.F. transformers for maximum voltage as before. Adjust the phasing condenser (Cph) of X_3 for minimum voltage. Tune to 462.5 kc/s and adjust the secondary trimmer of the first transformer, if the dip in voltage *is not again* obtained. This procedure should be repeated to ensure correct resonance of all the crystals. Check the bias voltage on both 6J5 grids—they should be nearly equal. If a stage of linear amplification is contemplated prior to direct transmission, the author strongly advises that the Labgear coupler should be peaked correctly to give flat drive over the entire frequency range to be covered in any one band. In conclusion, the author wishes to state that while the circuit shown was purely experimental, there is no reason why it cannot be used in practice provided the operating voltages of the valves do not exceed those of the maker's under test.

LIST OF PARTS FOR FIG. 7

R1—27,000 Ω, ½ watt.
R2—10,000 Ω, ½ watt.
R3—470,000 Ω, ¼ watt.
R4—220 Ω, 1 watt.
R5—47,000 Ω, ½ watt.
R6, R7—470,000 Ω, ½ watt.
R8, R9—4,700 Ω, 1 watt.
R10, R11—15,000 Ω, ½ watt.
R12—27,000 Ω, 1 watt.
R13—200 Ω, 1 watt.
C1, 4, 5, 8, 9—100 pF.
C2, 3, 10, 11—0.1 μF.
C6—15 pF.
C7—50 pF.
C12, 13—30 pF.

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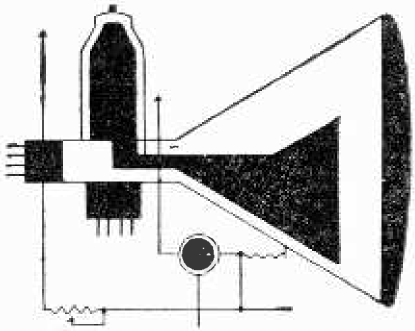

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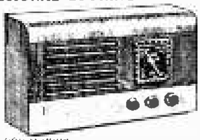

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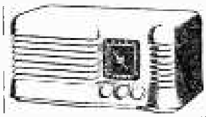

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250-0-250, 80 mA., 6.3 v. @ 4 a. 5 v. @ 2 a. ...	19/6
350-0-350, 80 mA., 6.3 v. @ 4 a. 5 v. @ 2 a. ...	19/6
200-230-250, output 3 v. -30 v. @ 2 a.	17/6
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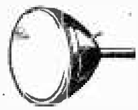

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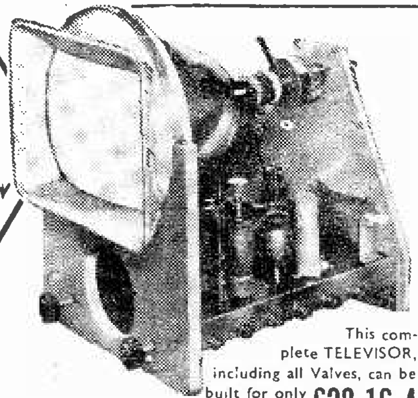

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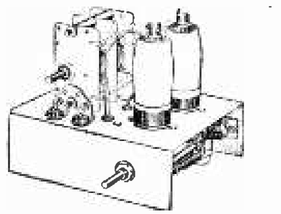

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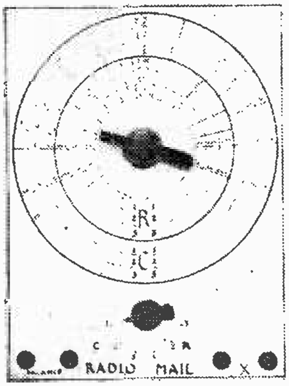

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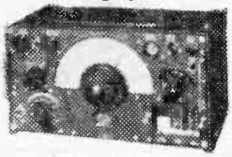

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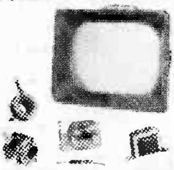

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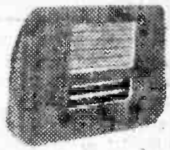

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