BUILDING THE 'SEVEN-FIVE' SUPERHET

PRACTICAL WIRELESS

1/-

MARCH 1956

EDITOR: F.J.CAMM

Trace the Trouble in a Trice

PIFCO

ALL-IN-ONE RADIOMETER

- ★ Circuit Test
- ★ L.T. & H.T. Tests
- ★ mA Test
- ★ Valve Test

Use the PIFCO All-in-One RADIOMETER for the practical testing of all types of radio and electrical apparatus. You can carry out continuity and resistance tests, check H.T., L.T., and G.B. voltages, also Household Appliances, Car Lighting Systems, Bell Circuits, etc. May be used on A.C. or D.C. mains.

Obtainable from your local dealer.
Write for informative folder to :—

★ ONLY **32/6** COMPLETE

PIFCO LTD., WATLING ST., MANCHESTER 4
and 36-37, UPPER THAMES ST., LONDON, E.C.4

CONSTRUCTORS build these at

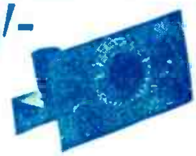
DOWN-TO-EARTH PRICES

PERSONAL PORTABLE RADIO 30/-

This little set was designed to give you a real personal portable radio that you can enjoy anywhere without disturbing others. Use it on camping trips, in bed, in your office, or just anywhere.
Send 2/- for layout, Wiring diagram and Components Price List.

1v SHORT-WAVE RADIO

30/-



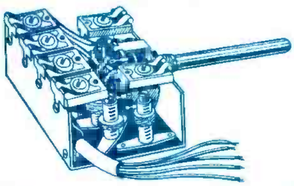
- ★ Covers 10-100 metres.
- ★ World-wide reception.
- ★ Low drain valve.
- ★ Picture diagram and instructions for beginners.
- ★ Assembling time 1 hr.

This 1 valve S.W. receiver can be built from our list of components for 30/-, including valve and 1 coil covering 20-40 metres. Provision is made to increase to 2 or 3 valves if required. All components can be purchased separately and are colour-coded so that the beginner can build this set quite easily.
Send 2/- for specification, wiring diagram, layout and price list to :—

R.C.S. PRODUCTS (RADIO) LTD
11 OLIVER ROAD, LONDON, E.17. Mail order only.

REPANCO HIGH GAIN SUPERHET COIL PACK

TYPE LMS



Size
$2\frac{5}{8} \times 2\frac{3}{8} \times 1\frac{1}{3}$in.
Long Wave 900-2,000 m.
Medium Wave 190-550 m.
Short Wave 16-60 m.
Aligned before Despatch.

36/-
Inc. Tax
Complete with 5-valve Superhet Wiring Diagrams

Send S.A.E. for Catalogue of Complete Range of Coils.

REPANCO HIGH-GAIN LOW-NOISE BAND III CONVERTER

Self-contained Power Supply. Easy to Build. Envelope of comprehensive wiring plans and instructions, 1/9 (post free).

RADIO EXPERIMENTAL PRODUCTS LTD.
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Phone : 62572

Finest Soldering? Always specify ERSIN MULTICORE to be *precise*

Wherever precision soldering is essential, manufacturers, engineers and handymen rely on MULTICORE. There's a MULTICORE SOLDER just made for the job you have in hand. Here are some of them.

SIZE 1 CARTON
4 specifications for radio enthusiasts.
5/-

HANDYMAN'S CARTON
Sufficient for 200 average joints. **6d.**

TAPE SOLDER
MELTS WITH A MATCH!
Real tin/lead solder containing cores of Ersin Flux. Needs no soldering iron or extra flux.
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PER CARD

Bib GIFT PACK
The ideal present for any electrician or handyman—a Bib Stripper, Tape Solder and Insulated Screwdriver on a presentation card—all for **5/-**

MANUFACTURERS ARE INVITED TO WRITE FOR DETAILS OF BULK PACKS AT BULK PRICES

MULTICORE SOLDERS LTD.
MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS (BOXMOOR 3636)

FOR VALVES—GUARANTEED NEW AND BOXED

ALPHA

0Z4	6/-
1A3	6/-
1A5GT	6/6
1A7	11/6
1C5GT	8/9
1H5GT	10/6
1N5GT	10/6
1L4	6/6
1LD5	6/9
1R5	8/-
1S5	7/6
1T4	7/6
1U5	8/-
2X2	4/-
3A4	7/-
3Q4	9/6
3Q5	10/-
3D6	5/6
3S4	8/6
3V4	8/6
4D1	3/-
42	8/-
5U4G	8/6
5Y3GT	8/6
5Z3	8/6
5Z4G	8/9
6A7	10/6
6A8G, GT	10/6
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6AG5	6/6
6AK5	6/6
6AL5	7/-
6AM5	5/-
6AM6	7/6
6AQ5	9/-
6AT6	8/9
6B4	5/-
6B8	4/-
6BA6	8/-
6BE6	8/-
6BW6	8/6
6C4	7/-
6C5GT	7/6
6C6	6/6
6C9	10/-
6D3	7/6
6D6	7/3
6F6G	7/6
6F6M	8/6
6F11	13/-
6F13	13/6
6F15	13/6
6G6G	4/-
6H6	3/6
6J5/GT	5/-
6J5M	6/6
6J6	7/6
6J7G	6/6
6K6GT	6/6
6K7G, GT	5/9
6K7	6/9
6K8G	8/9
6K8GT	9/6
6L1	18/6
6L6G	9/-
6L7M	7/6
6N7	7/-
6Q7G, GT	9/-
6SA7GT	8/-
6SG7	7/6
6SH7	6/-
6SJ7GT	8/-
6SK7	5/6
6SL7	8/-
6SN7	8/-
6SQ7	9/3
6SS7	8/-
6U4GT	15/-
6U5G	8/6
6U7G	9/-
6V6G, GT	7/6
6X4	8/-
6X5GT	7/9
7B6	9/6
7B7	9/-
7C5	8/6
7C6	9/-
7H7	8/-
7Q7	8/-
7R7	8/6
7S7	9/-
7Y4	8/6
75	10/6
77	8/-
80	8/6
807	6/6
8D2	2/9
9D2	3/9
9001	5/6
9002	5/6
9004	5/6
9003	6/-
954	2/-
955	4/9
956	3/6
10C2	12/6
10F1	12/6
10F9	12/6
10P13	11/6
12A6	6/9
12AH7	6/9
12AT7	9/-
12AU7	9/6
12BA6	10/-
12BE6	10/-
12C8	8/-
12H6	5/-
12J5	6/-
12J7	9/6
12K7	9/6
12K8	11/-
12Q7	9/6
12SC7	7/6
12SG7	7/6
12SH7	5/6
12SJ7	8/6
12SK7	6/6
12SQ7	8/6
12SR7	7/6
20D1	10/6
20L1	12/6
25L6GT	8/6
25U4GT	10/-
25Y5G	11/6
25Z4G	9/-
25Z6GT	8/6
35L6GT	9/-
35W4	10/-
35Z4GT	9/-
50L6GT	9/-
AC/P	6/9
AC6/PEN	6/6
ATP4	6/6
AZ1	10/6
DH73M	10/-
EABC80	13/6
EAC91	10/-
EAF42	12/6
EB41	8/-
EBC41	11/-
EBF80	11/6
ECC81	8/6
ECC84	12/6
ECH35	13/6
ECH42	10/6
ECH81	13/6
ECL80	10/6
EF22	8/6
EF41	11/6
EF42	13/6
EF80	10/-
EF86	10/6
EL2	12/6
EL41	11/6
EL84	12/-
EM34	11/6
EM80	12/6
EY51	13/6
EZ40	10/-
EZ41	11/-
EZ80	12/6
E1148	2/-
EY91	7/-
FW4/500	10/-
GZ32	12/6
H30	5/-
HL2	5/6
HL23DD	7/6
HP211C	6/9
KL35	8/6
KT2	5/-
KT33C	10/6
KT66	10/6
KTW61	7/9
KTW63	8/6
KTZ41	6/-
LP220	6/9
MH4	5/6
MS/PEN	5/-
N78	12/6
N709	12/-
P41	9/-
P215	5/-
PEN25	8/-
PEN46	8/6
PEN220A	4/-
PCC84	13/6
PCF80	13/6
PCF82	12/6
PCL83	12/6
PL81	13/6
PL82	11/6
PL83	13/-
PP225	5/-
PY80	10/-
PY81	11/6
PY82	10/6
QP21	7/6
SP22	6/-
SP220	6/9
U22	8/-
U329	13/6
U403	10/-
U404	9/-
UB41	8/-
UBC41	11/-
UCH42	11/-
UF41	11/6
UL41	11/6
UY41	10/6
VR21	3/-
VR53	6/6
VR54	2/-
VR55	7/6
VR56	6/-
VR57	8/-
VR65	3/6
VR65A	3/3
VR66	3/9
VR91	5/6
VR91SYL	7/6
VR92	2/-
VR105/30	7/6
VR116	4/-
VR119	4/-
VR136	7/-
VR137	5/6
VR150/30	8/-
VP23	8/-
V870	3/-
VT52	8/-
VT501	6/-
VU39	8/9
VU64	9/-
VU111	3/6
VU120A	3/-
W77	8/6
W61	8/-
X65	10/-
X66	11/6
Y63	9/-
150A(B)	4/6
12SC7	2/6
AZ31	10/6
5R4GY	9/6

YAXLEY TYPE SWITCHES

	each
1 Pole, 4-Way	1/6
2 Pole, change-over	1/3
3 Pole, 3 Bank, 3-Way ...	1/6
4 Pole, 2-Way	1/9
2 Pole, 3-Way with Black Knob	1/6
5-Way, 2 Pole, 3 Bank... ...	2/-

VOLUME CONTROLS, ETC.

	each
Miniature Volume Controls double pole switch, 2 Még. r. ...	4/6
Standard Controls, single pole switch, 2 Meg. r. and ½ Meg. r.	3/6

VALVEHOLDERS

B7G, B9A, B9G, etc., Moulded Types	9d.
B7G with Screening Cans ...	1/6
Ceramic international Octal ..	1/-
Duodecal Paxolin	9d.

CABLES, ETC.

	yard
Twin Flat Transparent Mains Flex 14/0076	3d.
Screened Cable, Singles ...	6d.
Twin ...	7d.
Push Back Wire, 14 Strands ..	2d.
Semi Air Spaced Co-axial Cable	9d.
Solid 1/0022	7d.
Stranded 7/0076	8d.

★ ★ ★ ★ ★ ★ ★

Build this Excellent Kit for Yourself!

Alpha 3 valve T.R.F. Kit

£5 . 10 . 0

★ Easy to Build.

★ Valves 6J7, 6K7, 6V6GT plus metal rectifier.

★ Walnut cabinet.

Full instructions, point to point wiring diagram, circuit diagram, and full shopping list 1/-. All components may be purchased separately.

MAINS DROPPING RESISTANCES

	each
725 ohms Erie tap at 600 ohms	1/6
650 ohms taps at 375 ohms, 500 ohms, 5 ohms, 30 ohms ...	2/6
770 ohms Mains Dropper for Midget Radios with a tap at 425 ohms, size 3in. long x ⅜in. dia.	1/3
Dagole Mains Dropper .3A, cement coated with 2 sliders ...	3/9
.2 amp. as above, 1,200 ohms ...	3/9
Green Vitreous Mains Dropper, 1,328 ohms, 2 taps	1/3
Zenith Mains Dropper, 919 ohms	2/-

C R T ISOLATION TRANSFORMERS

Type NR9

Ratio 1–1.25 giving a 25% boost on secondary. Particularly suitable for High Definition Receivers. Four types available to cover most tube heaters.

NR 9A 2 volt: NR 9B, 4 volt; NR 9C, 6.3 volt; NR 9D, 10.8 volt; NR 9E, 13.3 volt.

With Tag Panel and Solder Tags. 10/6 each.

Type NR12

Mains input: 220/240 volts.

Multi output: 0-2-4-6.3-7.3-10 and 13 volts.

Input has two taps which increase output volts by 25% and 50% respectively.

This transformer is suitable for most Cathode Ray Tubes in Medium Definition Receivers.

The MOST versatile Low Capacity C.R. Transformer with Universal Output.

With Tag Panel and Solder Tags. 21/- each.

Type NR14

A most useful transformer for use with 2 volt Tubes with falling emission.

Input: 230/240 volts.

Output: 2-2¼-2½-2¾-3 volts at 2 amps.

With Tag Panel and Solder Tags, 17/6 each.

★ ★ ★ ★ ★ ★ ★

SPECIAL PURCHASE:

G.E.C. Cabinet Loudspeakers, Cat. No. BC1955, 8in. P.M. Moving Coil Loudspeaker Unit, 2/4 ohms, with Volume Control. Price 60/- each.

★ ★ ★ ★ ★ ★ ★

PHIFCO ALL-IN-ONE RADIO METER

Tests L.T. 0-6 v. A.C./D.C., H.T. 0-240 v., A.C./D.C., M/A 0-30. Black Bakelite Case. Internal Battery for Circuit Testing. Price 32/6 each.

VARIABLE CONDENSERS

	each
3 gang .0005 mfd.... ...	5/9
2 gang .00035 mfd. ...	5/9
2 gang .0005 mfd. with feet and trimmers	7/6
2 gang Midget with dust cover .00035 mfd. with trimmers	8/6
2 gang Midget .0005 mfd.	7/6

T.S.L. FERRO-MAGNETIC AERIAL ROD

A length of Ferrite rod with full instructions for winding Medium or Medium and Long Wave internal aerials. 6/- each.

STC RECTIFIERS

RM 1 ...	3/10	RM 3 ...	5/-
RM 2 ...	4/3	RM 4 ...	16/-

SMALL SUB-CHASSIS

	each
With 2 valveholders for 954, 955 type of valves	5/-

PENCIL RECTIFIERS

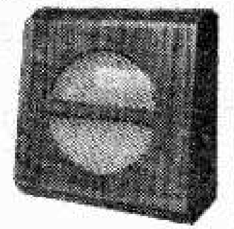
K 3/25 ...	5/8	K 3/50 ...	8/8
K 3/40 ...	7/6	K 3/60 ...	9/8
K 3/45 ...	8/2	K 3/100...	14/8

HEATER TRANSFORMERS

Primary 230 v.

Available:

	each
2 volt ½ amp	4/6
4 volt 1.5 amp	5/-
5 volt 2 amp.	10/-
6.3 volt 1½ amp.	6/-
2 volt 3 amp.	7/9
4 volt 3 amp.	10/-
6.3 volt ½ amp.	5/-
6.3 volt 3 amp.	9/-
12 volt .75 amp.	5/-



LOUDSPEAKER CABINETS

This attractive walnut finished cabinet is available for 6½in. or 8in. speaker units. Metal speaker fret, complete with back and rubber feet.

6½in. type:
Measures 9¼in. x 8¾in. x 4½in. at base. Price 16/6 each.

8in. type
Measures 10¾in. x 10¾in. x 5in. at base. Price 20/6 each.

5in. type:
Measures 6¾in. x 4¾in. x 7in. 16/6

LOUDSPEAKER UNITS, ETC.

	each
5in. Types by Elac., Lectrona, Celestian, etc.	17/6
6½in. Types by Goodmans, Rola, R. & A.	18/6
8in. Types by Goodmans, Plessey, R. & A.	19/6
10in. Types by R. & A., Celestian, etc....	25/6
6½in. Wafer Speaker by Truvox, suitable for Car Radio, etc. ...	20/-
12in. Plessey Lightweight ...	35/-
Elliptical Speakers, Goodmans 4in. x 7in.	19/6

All above are P.M. Speakers, Standard 2-4 r. Speech Coil.

TELEVISION TABLE

Size of top, 19½in. x 19½in. Height, 18in. Rounded legs which unscrew for transit. 40/- each, carriage 3/-.

CONNECTOR LEADS

Red single lead with wander plug and socket, 4d. each.

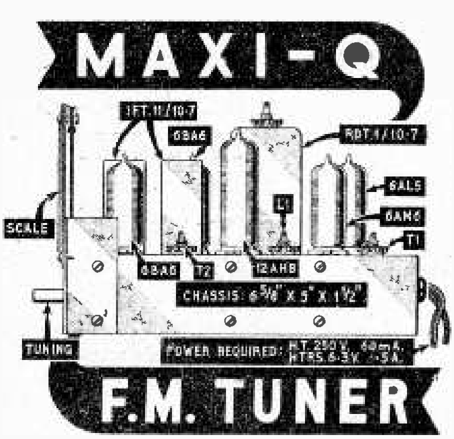
WHEN ORDERING PLEASE QUOTE "DEPT. P.W."

ALPHA RADIO SUPPLY CO.

5/6 VINCES CHAMBERS VICTORIA SQUARE LEEDS I.

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 9d.; 20/- add 1/-; 40/- add 1/6; £5 add 2/- unless otherwise stated. Minimum C.O.D. fee and postage 2/3.

MAIL ORDER ONLY



The Guaranteed components described below have been acclaimed by thousands as the finest obtainable.

Full constructional details, point-to-point wiring diagram and alignment instructions are given in our Technical Bulletin DTB.8, Price 1/6.

F.M. SCALE. A bronze finished scale with yellow markings (0-20 Log) for use with all types of F.M. tuners or receivers. Consisting of metal scale, pointer, cord drive spindle, pulleys, 2¼in. drum, cord, and instructions for the assembly of the cord drive. The scale measures 5⅞in. x 3in., and is for a cabinet aperture of 4in. x 1⅞in. Price 9/-.

RDT.1/10.7 MC/S. A transformer for use in ratio discriminator type circuits. Can size 1⅜in. square x 2¼in. high. Secondary winding of bifilar construction, iron dust core tuning, polystyrene formers and silver mica condensers. Price 12/6.

PDT.1/10.7 MC/S. A miniature phase discriminator transformer for use in frequency modulation detector circuits where the limiter/Foster-Seeley type of circuit is employed. Designed for carrier deviation of $\pm$75 Kc/s. Qk=1.5. Screening can 1⅜in. x 13/16in. square. Price 9/-.

IFT.11/10.7 MC/S. A miniature I.F. transformer of nominal frequency 10.7 Mc/s. The transformer is primarily intended for the I.F. stages of frequency modulation receivers and converters. The "Q" of each winding is 90 and the coupling critical. Dimensions as PDT.1. Price 6/-.

IFT.11/10.7/L. As IFT.11/10.7, but with secondary tap for limiter input circuits. Price 6/-.
Coils Type L1, T1 and T2. These coils are specially designed for use in the "MAXI-Q" F.M. TUNER. Price 3/11 each.
Chassis and screens for the above unit, completely punched in aluminium, 7/6.
Obtainable from all reputable stockists, or in case of difficulty direct from works. GENERAL CATALOGUE covering technical information on full range of components, 1/- post free.

STOP PRESS: Available to retail customers only. "Maxi-Q" F.M. Tuner Unit assembled and valved at £7/2/6 plus £2/17/- P.T., also Power Pack at £3. OSRAM F.M. TUNERS completely assembled and valved at £22 plus £8/16/- P.T.

Coil Turret CT.7/B. This turret has been specially designed for use in the "Britannia" communications receiver described in the October and November Issues of the "R.S.G.B. Bulletin," Price £3/15/-.

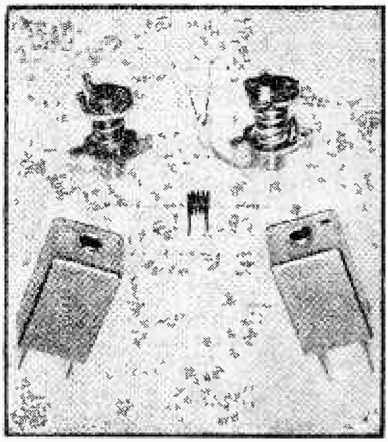
DENCO (CLACTON) LTD.,
357/9, OLD ROAD, CLACTON-ON-SEA, ESSEX.

Mullard 5-10 T.C.C. Printed Circuit Chassis, 7/9 (plus 1/- postage). The metalwork and coils for the "Viewmaster" Band III converter will be available shortly.

TELETRON MK 2. BAND III CONVERTER COILSET

The Teletron Mk. 2 converter uses a high gain Cascode connected twin triode in a fully neutralized circuit, which is provided with a high frequency compensating Inductor, and coupled via a special network to a triode-pentode mixer, whose output can be adjusted to any channel in Band I.

Circuit Diagram 3d.



For Channels 7, 8 and 9

**SIMPLE CONSTRUCTION
COMPLETE WIRING DIAGRAM
HIGH GAIN—LOW NOISE**

Thousands of Mk. 2 Converters are now providing the I.T.A. channel 9 programme at ranges of upwards to 60 miles from the Croydon Transmitter.

COMPLETE PRECISION COILSET — — 17/6

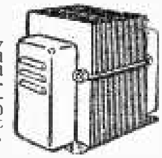
Available from leading component stockists

Trade enquiries to sole distributor : **S. MOZER, 95 Kendal Ave., London, N.18** EDM. 7707

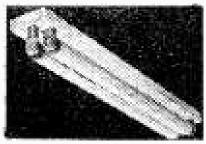
THE TELETRON CO., LTD., 266 Nightingale Rd., London, N.9. HOW. 2527

TRANSFORMER SNIP

11/6

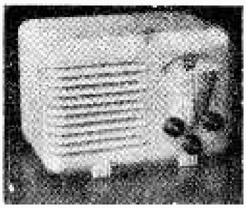


Post 2/- Fully shrouded — standard 200-250 v. primary 280-0-280 at 80 m a. 6.3 v. at 3 amp., 5 v. at 2 amp.



THE TWIN 20

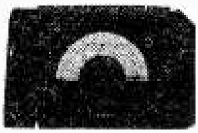
This is a complete fluorescent lighting fitting. It has built-in ballast and starters — stove enamelled white and ready to work. It is an ideal unit for the kitchen, over the work-bench, and in similar location. It uses two 20-watt lamps. Price, complete less tubes, 29/6, or with two tubes, 39/6. Post and insurance 5/-. Extra 20-watt tubes, 7/6 each.



MAINS-MINI

Uses high-efficiency coils—covers long and medium wavebands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £4 10 0, plus 3/6 post. Constructional data free with the parts, or available separately 1/6.

R1155 YOURS FOR £3
and 12 monthly payments of 11/6



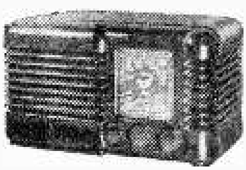
The R1155 is considered to be one of the finest communication receivers available to-day. Its frequency range is 75 kc/s to 18 Mc/s. It is complete with 10 valves and is fitted in a black metal case. Made for the R.A.F. so obviously a robust receiver which will give years of service. Completely overhauled and guaranteed in perfect working order. Price £8 19/6, or £3 deposit, balance by 12 monthly payments of 11/6. Carriage and Transit Case 15/- extra. Mains Power Pack, with built-in speaker, £5 10 -, or in polished cabinet, £6 15 -.

RADIO CONTROL

Essential parts including valve, paxolin panel, coil formers, etc., etc., to build regenerative receiver, given in September "Practical Mechanics," price 14/6 plus 2/- post.

1956 T.R.F.

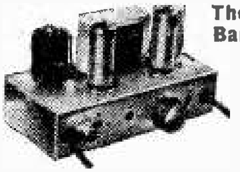
32/6



For the benefit of those who already have a loud-speaker and odds and ends, the "1956 T.R.F." is available in basic form. This contains all the essential items, i.e., prepared metal chassis, 3 valves, mains transformer, gang condenser, coil, volume control, valve holders, smoothing condenser, bias condenser, 6 paper and metal condensers, 7 resistors and data. The total list value of all the items is 52/6, but as a Special Offer to publicise the set, we offer all for 32/6, plus 2/6 post and insurance.
Remember, if pleased with results you can add the extra parts to make the "de luxe" set as illustrated.

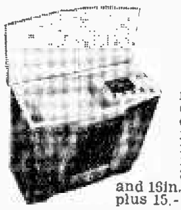
THIS MONTH'S SNIP

The "ESTRONIC" Band III Converter



To-day's best value in Band III converters suitable for your T.V. or money refunded. Complete ready to operate, 59/6 non mains or 85/- mains, post and insurance 3/6.

CABINETS FOR ALL



We undoubtedly hold the largest stock of cabinets in the country. All are made of the finest plywood, veneered and polished and all radio and motor boards are left uncut to suit your own equipment. The top one is The Bureau, walnut finished and highly polished, size approximately 30in. high, 32in. wide, and 18in. deep. Price 16 guineas plus 15/- carriage and insurance.

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This is a two-station "master" unit comprising an A.C. mains operated push pull amplifier with built-in P.M. speaker which acts as microphone or loudspeaker, depending on whether switch is set to "talk" or "listen." Needs only another P.M. to act as "slave." Complete in polished cabinet ready to work. Price only £4 19 6, plus 3/6 carriage and insurance.

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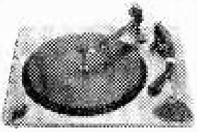

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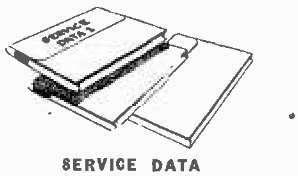
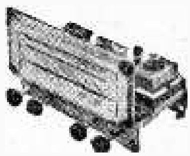


SERVICE DATA

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, Emerson, 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.

THE CLEVELAND ORGANTONE



5 valve superhet covering Long, Medium and Short waves. Miniature valves—low loss coils—permeability—tuned I.F.S.—full A.V.C.—variable negative feedback—gram. position—4 watts output—particularly fine tone. Price £11/10/0. Carriage and insurance, 7/6.

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Parts suitable for making a multi-meter to measure volts, milliamps and ohms. Kit containing all the essential items including moving-coil meter, resistors, range selector, calibrated scale, etc., etc., is only 15/-, plus 1/6 post and packing.

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PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXII, No. 593, MARCH, 1956

EDITOR : F. J. CAMM

24th YEAR OF ISSUE

COMMENTS OF THE MONTH BY THE EDITOR

An Unnecessary Scare

THE *Daily Sketch* recently saw fit to publish an article warning handymen about using electrical hand-drills because a man was electrocuted using one, and we were informed that a Government expert had said: "Don't use hand-drills on voltages above 125 A.C. or 250 D.C." The expert concerned was stated to be Mr. J. Cowan, chief electrical inspector of mines. We were also told that in the past Government factory inspectors had said the same. The newspaper went on to give some advice to its readers. It said: "Get an expert to fit a step-down transformer to cut the voltage to within the safety margin." This advice, of course, is patently incorrect, and the case quoted had nothing whatever to do with handymen drills, or other electrical apparatus, for that matter, used in the home. Provided that the apparatus is connected to a three-point plug and properly earthed, such tools may be used without fear and with safety. Whatever tool is being used, it can be dangerous if the user is careless. As well to argue that a pocket knife is dangerous because people occasionally cut their hands with it or that it would be used to commit suicide. The fact that hundreds of thousands of electrical hand-drills are in use in the homes of this country every day is sufficient evidence that they are not dangerous if properly used and installed. The position may be a little different when using heavy duty (industrial) electrical apparatus, such as that in use in coal mines, where heavier current is passing.

QUERIES re RECEIVERS

NOT every journal has a free advice bureau, and it is becoming a habit of one or two of them when queries are asked concerning receivers described in their pages to pass them over to us. We must decline to answer such questions, as in our view they should be answered by the periodical concerned. Whilst dealing with this matter we must express astonishment at the reluctance of some manufacturers to deal with technical queries from those who have purchased their receivers. The usual answer is to go to the nearest dealer or to write to PRACTICAL WIRELESS about it. Here again, we must flatly decline to act as an advisory service for set manufacturers. They have sold the set and taken their profit; no doubt, in assessing prices an allowance was made for service and technical queries. We deplore this attempt to force the public into the hands of dealers. If manufacturers, in their instruction leaflets, gave circuit diagrams and a list of component values, a great deal of simple servicing could be undertaken by the user himself. One manufacturer refused to disclose the value of a condenser which a reader could quite easily have replaced himself. The estimate from the dealer was for 35s.! It is not in the best interests of the radio trade that the servicing of receivers should be made unnecessarily expensive. I am not, of course, referring to major troubles which require expensive test apparatus, but where the reader does possess this the service department of the firm concerned should be ready to answer technical queries and has a moral responsibility to do so.

LOWER SALES

PERHAPS the foregoing accounts in some measure for the lower radio sales recently reported by the B.R.E.M.A., which reports that sales of receivers and radiograms are much lower than they were a year ago. For example, last October 123,000 radio sets were sold, in November only 95 sets, and the total sales for October and November (218,000) was only 48 per cent. of the sales for the last three months of 1954.

"BEGINNER'S GUIDE TO RADIO"

THE "Beginner's Guide to Radio," which was a revised and amplified form of the series of articles on that subject which appeared in this journal, rapidly went out of print, and a second edition is now on the press, and it is hoped that it will be ready shortly. If you wish to make sure of yours, you should order it now, through your bookseller. Incidentally, a similar series of articles, entitled "A Beginner's Guide to Television," commenced in the February issue of *Practical Television* and, similarly, will be republished in book form when it is complete.
—F. J. C.

OUR NEXT ISSUE, DATED APRIL, WILL BE PUBLISHED ON WEDNESDAY, MARCH 7th.

Round the World of Wireless

By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of November, 1955, in respect of receiving stations situated within the various postal regions of England, Wales, Scotland and Northern Ireland. The numbers include licences issued to blind persons without payment.

Region	Number
London Postal	1,399,471
Home Counties	1,351,830
Midland	1,079,776
North-eastern	1,413,708
North-western	1,084,534
South-western	879,046
Wales and Border Counties ...	554,390
Total England and Wales ...	7,762,755
Scotland	980,038
Northern Ireland	212,831
Grand Total	8,955,624

Norway Buys British Transmitters

CONGESTION existing in the low and medium frequency bands is causing many broadcasting authorities to make more use of the Very High Frequencies (V.H.F.).

The latest authority to do so is the Norwegian Telegraph Administration, who have placed an order with Marconi's Wireless Telegraph Co., Ltd., for 11 Marconi 5 kw. frequency modulated V.H.F. broadcasting transmitters and a quantity of phasing equipment.

The transmitters to be supplied are of a new design; their simplicity in operation will make them particularly suitable for unattended working.

The contract was obtained by Marconi's through their Norwegian agents, Norsk Marconikompani A/s.

Token Imports

THE Board of Trade announce that the token import scheme will continue in 1956 for imports from Canada and the United States of America on the same basis as in 1955. A notice to importers will be issued shortly by the Import Licensing Branch of the Board of Trade.

Record Catalogue—Increased Price

OWING to the high printing cost of the new Decca-group microgroove record catalogue, which is complete to April, 1955, and comprises 704 pages, Decca are only able to supply it to dealers in quantities of not less than six at the terms of 7s. 6d. retail price less 25 per cent. discount, packing and post free.

A new combined Decca-group quarterly catalogue, covering the period May to December, 1955, is also now available, price 2s. 6d., and this will be subject to the usual trade discount of 33⅓ per cent.

Solar Power-generator for Algeria

PROFESSOR TROMBE, builder of the great solar power-generating station at Mont-Louis, in the French Pyrénées, and who was in charge of the installation of the first similar power station in Algeria, at Bouzarea, is about to begin on the installation of a second power station in Algeria at Colomb-Béchar, South Oran district.

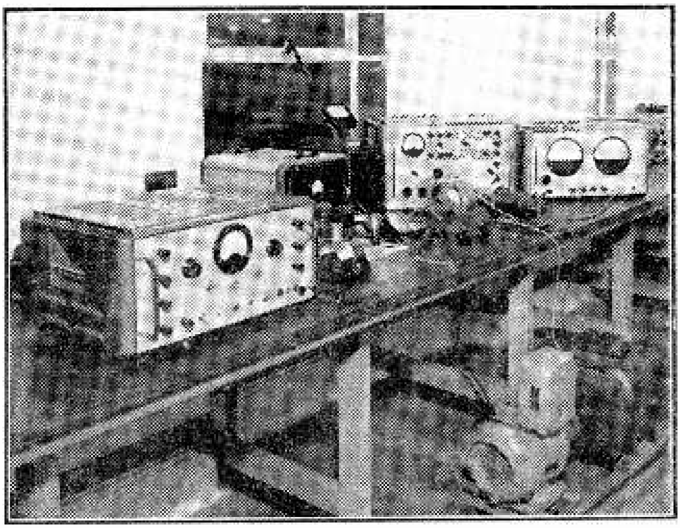
It will develop 1,000 kwh.; the solar power-generating station at Mont-Louis produces only 750 kwh.

The Radio Trades Examination Board Granted Incorporation

THE Board of Trade has now granted incorporation under the 1948 Companies Act to the Radio Trades Examination Board. The board was formed in 1942 by the co-operation of industry, the retailers and the appropriate professional body.

The principal object of the board is the promotion of technical training of radio mechanics and technicians which is a practical contribution to stimulating the recruitment of properly trained technicians to the radio and electronics industry. For the present its main activities are the holding of examinations leading to the award of the Radio and Television Servicing Certificates.

One of the features of the Radio Servicing Certificate Examination is that the large majority of candidates enter through an approved course of study. No fewer than 98 technical colleges are providing a three-year part-time course for this examination. In the post-war years 2,625 candidates have presented themselves for the board's examinations.

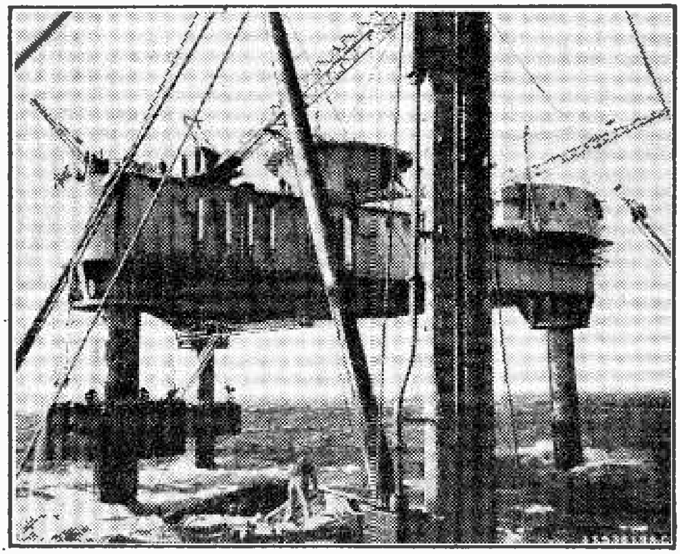


An experimental voltage control hook-up at the New Electrical Engineering Laboratories of the College of Technology, Birmingham, the performance of which is to be determined using the Solartron Transfer Function Analyser OS.103/VP.253 and Stabilised Power Supply SRS.151A.

10-kw. F.M. Transmitter

TO provide high-grade interference free reception of the Home, Light and Third programmes over a considerable part of the BBC's Welsh and West Regions the first of six 10-kw. frequency modulated transmitters is undergoing operational trials at Wenvoe. The frequency is 94.3 Mc/s.

Designed and manufactured for the BBC by Standard Telephones and Cables Limited, these transmitters incorporate the very latest techniques in Very High Frequency broadcasting. In order to ensure uninterrupted service these transmitters will work in parallel, one pair for each programme. In addition a special combining network has been designed by S.T.C. engineers in co-operation with the BBC to permit the operation of three transmitters carrying different programmes into a single aerial.



A view of the first of several off-shore early warning radar stations to be operated by the United States Air Force, which is near completion 100 miles east of Cape Cod, Massachusetts.

TV and Radio Sales

SALES of television receivers during November, according to the Monthly Retail Survey published in January by the British Radio Equipment Manufacturers' Association, amounted to 210,000 sets—72,000 sets lower than in the record month of October, when the public rushed to buy sets in anticipation of purchase tax changes in the interim Budget.

Public interest in radio receivers and radiograms has not been maintained at the same level as a year ago. In November sales of radio receivers amounted to 95,000 sets compared with 123,000 in October.

Radiogram sales of 24,000 in November were 33 per cent. below those for October. "The general interest in television would appear to have drawn off, at least temporarily, purchasing power for our products from sound receivers and radiograms," the survey concludes.

There was no significant movement in the percentage of radio products sold on hire purchase or credit terms.

Obituary

THE death on December 4th of Mr. A. A. Kift has severed yet another link with the pioneering days of radio and electronics.

Mr. Kift, who was trained as an electrical engineer at Finsbury Technical College, joined the staff of Marconi's Wireless Telegraph Co., Ltd., in 1902. After a further specialised course at the Marconi Training College (then at Frinton) he was appointed to the engineering staff of the company. At that time the liners of the White Star fleet were being equipped with wireless, and one of his earliest assignments was concerned with the installations aboard the first half-dozen of these.

During his long career Mr. Kift's work for the company, afloat and ashore, ranged from Labrador to the Black Sea coast, with erection of wireless stations in Britain interspersed with his foreign travel. Mr. Kift was in his 75th year.

Multi-channel Radio System for Ecuador

AN important contract for one of the most ambitious and adventurous Multi-channel Radio telephone/telegraph systems ever undertaken has been placed with Marconi's Wireless Telegraph Co., Ltd., by the Government of Ecuador. This contract, which will bring more than a million dollars to Britain, was won by Marconi's despite keen competition from French, German and American firms, and marks a notable advance by a British company into the important South American communications market.

This order upon Marconi's calls for the supply of radio, carrier telephone, voice frequency telegraph and teleprinter equipment, as well as complete power plants, towers, aerials and buildings. Marconi's will be responsible for advising the Authority on the new telegraph system and on trunk operations: this will include a manually operated telex service and, possibly, an inter-city dialling service.

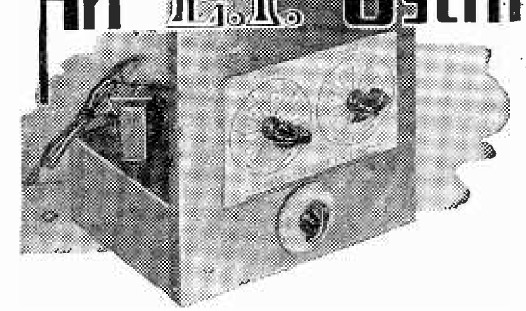
Retirement of Mr. H. T. Sayer

THE retirement is announced of Mr. H. T. Sayer, Engineer in Charge of the Croydon establishment of Marconi's Aeronautical Division.

Mr. Sayer has completed over 40 years' service with the company, 32 years of which have been spent more or less continuously with the Aeronautical Division, mainly at its Croydon establishment.

Mr. Sayer first came into air radio during the 1914-18 war, when he served with the R.N.A.S. and the R.A.F. He went to Croydon Airport—then the home of British civil aviation—during the 1920s, and eventually became Engineer in Charge of the Marconi aircraft radio servicing organisation there. During the second World War he renewed his association with the Royal Navy, when he became an instructor at the Admiralty Signals Establishment.

An L.F. Oscillator-Modulator



A USEFUL INSTRUMENT FOR TESTING LOUDSPEAKERS, AMPLIFIERS, AND OTHER AUDIO EQUIPMENT

By F. W. Austin

TWO very real problems are involved in the design of a low-frequency oscillator, particularly if it is to be relied upon to any extent; these are the range covered by the instrument and its ability to *hold the frequency* at any level of modulation. There are quite a number which vary in signal by as much as a complete semi-tone when the volume control/attenuator is rotated from minimum to maximum setting. This is usually caused by the attenuating network being either an integral or supplementary part of the frequency-determining components. Another cause can be the lowering of the H.T. feed to the oscillator by virtue of increased current consumption at full modulation level. In these circumstances, if any load is to be placed on the apparatus the modulation should be derived from a source other than the oscillator proper. The circuit arrangement to be described, although by no means perfect, has been evolved by practical experiment with these considerations borne in mind.

Frequency Range

Almost the entire piano keyboard can be covered by a single variable potentiometer (frequency control), but such an arrangement makes the higher frequencies extremely cramped at one end of the control. Therefore it is suggested that a decade system of control be used by those constructors who require fine adjustment. The author used two controls; the main one for low frequencies, and approach to higher frequencies being a half-megohm component with a subsidiary control of 50 k. in series for both higher frequencies and for subdividing the main control into steps of ten. A further control in series (10 k. w/w. pre-set) is dealt with later in this article. Fig. 2 shows frequency and division markings.

General Construction

There appears to be nothing in any way critical about the layout, as it was first built as a very rough "hook-up" and when results were satisfactory it was rebuilt in its present form. Results were identical, but a layout of main components is given for those interested (Fig. 3). Although many are capable of working from the circuit (Fig. 1) using any components to hand, they would do well to keep strictly to specified parts relating to the oscillator stage itself. This is because T1 (oscillator transformer) originally incorporated was an ex-Government surplus inter-valve component which failed to oscillate at higher frequencies. An attempt to rectify this was made by making the grid condenser smaller in value, but to no avail. The transformer finally used (Wearite type 232) has a centre-tapped secondary winding, but no use is made of this and pins 2 and 3 (clearly marked on the component) should be joined together as per the circuit diagram. Another important component is the .25 μF paper condenser shunted between the cathode and earth line (first section of 6SN7). Here it serves two purposes, first setting the lowest frequency of oscillation and secondly minimising the effect on frequency of the .01μF inter-valve coupling condenser which is taken from the same point.

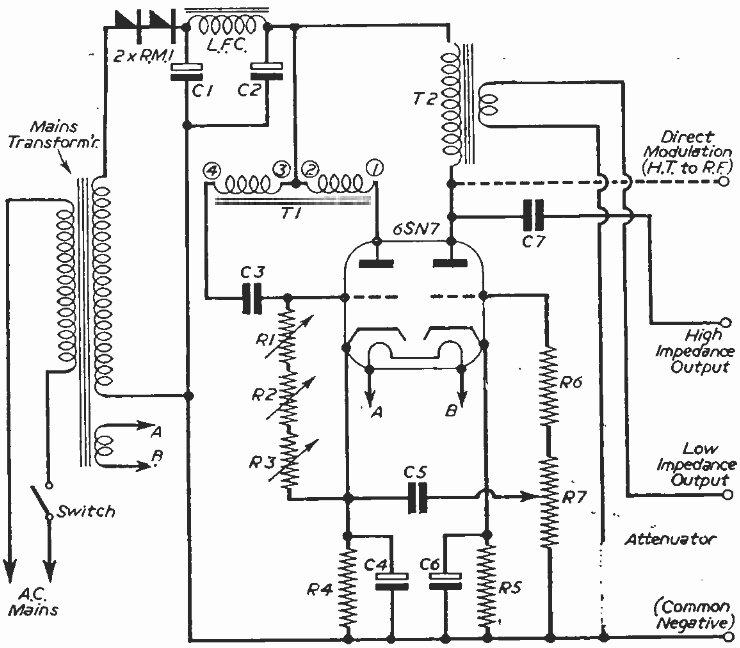
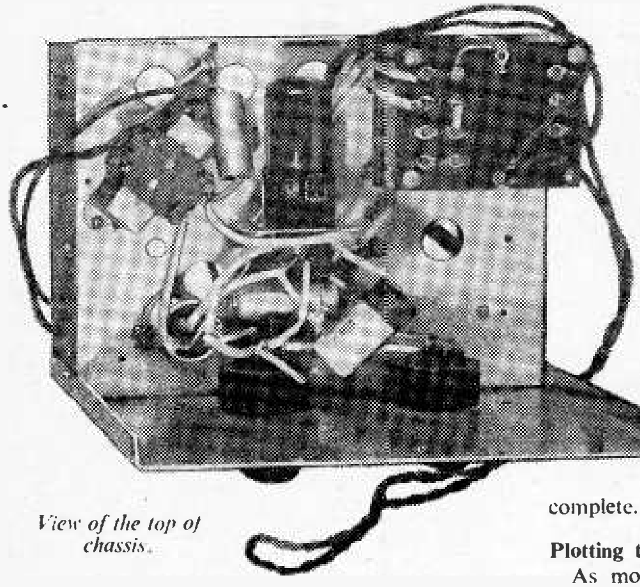


Fig. 1.—Theoretical circuit of the instrument described here.



View of the top of chassis.

Frequency Response Output

It would be imprudent to expect a constant output at all frequencies from such a modest design, in fact it is a laboratory problem (constant output) and is to a large extent the reason for the high prices of high-grade commercial generators.

There is, however, a convenient way out of this situation. This is by plotting various points around the volume control/attenuator in frequency giving a level output on the A.C. range of a multi-range testmeter. Although this is far from accurate (being dependent on the *frequency* characteristics of the meter *rectifier*) it will be realised that if the same meter is used for measuring the output of an amplifier using the oscillator for input the results will be comparative and reasonable. A study of Fig. 2 will clarify this somewhat, showing as it does frequency markings bending in a return path (to give level output of 1 volt). This is a straightening out of the frequency response curve which is given very roughly for guidance in Fig. 4. This was obtained by using a 3 ohms "dummy" load on the output transformer secondary winding (with volume full on) in conjunction with the 10 volts A.C. range of meter.

PARTS LIST

Condensers
- Electrolytic 32-32 μF., 350 v.w. (C1/C2).
- .01 μF. (small mica) 600 v.w. (C3, C5).
- .25 μF., paper, 350 v.w. (C4).
- .1 μF., paper, 350 v.w. (C7), 50 μF., 12 v.w. (C6).

Resistors
- 10 k. (w/w. preset) Potentiometer (R1).
- 50 k. (Linear Carbon) Potentiometer (R2).
- 500 k. (Linear Carbon) Potentiometer (R3).
- 250 k. Potentiometer (s/p switch) (R7).
- 5.6 k., ½ watt (R4), 1 k., ½ watt (R5). 50 K., ¼ watt (R6).

Miscellaneous
- Mains Transformer: Secondary 250 v.—RMS (60 mA), 6.3 v. (1 amp).
- 2 rectifiers RM1 (SenTerCel) Smoothing choke 40 mA.
- T1—Wearite A.F. Transformer (Type 232).
- T2—Output Transformer 7,500/3 ohms.
- 1 valve 6SN7.
- 1 octal v/holder. Chassis: 8½in. x 6½in. x 3in.
- Panel, case, knobs, etc. (to suit individual).

Setting Highest Frequency

Before attempting calibration it is necessary to set the pre-set potentiometer to the highest frequency at which the instrument will oscillate. The two panel controls (coarse and fine frequency) should be turned fully clockwise and an output meter connected to the secondary winding of output transformer. The potentiometer is then turned clockwise until a quite noticeable falling-off in output occurs. Retract the control slightly and the adjustment is complete.

Plotting the Frequency

As most frequency calibration is dealt with in terms of tens, hundreds and thousands of cycles per

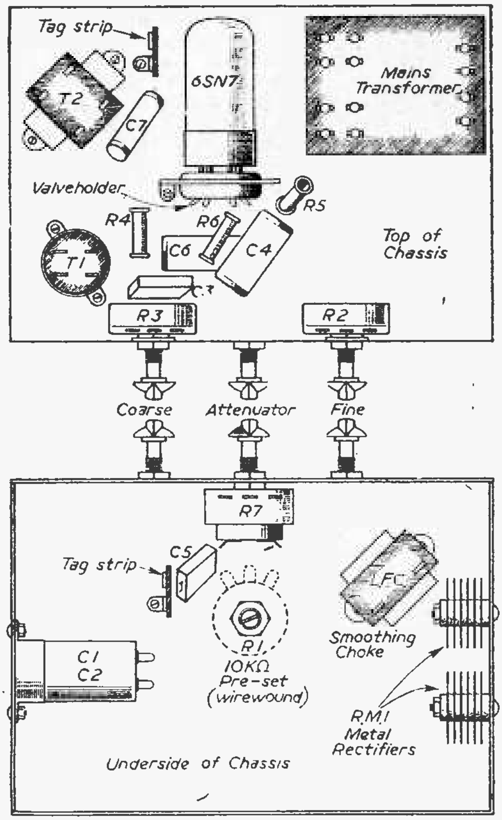
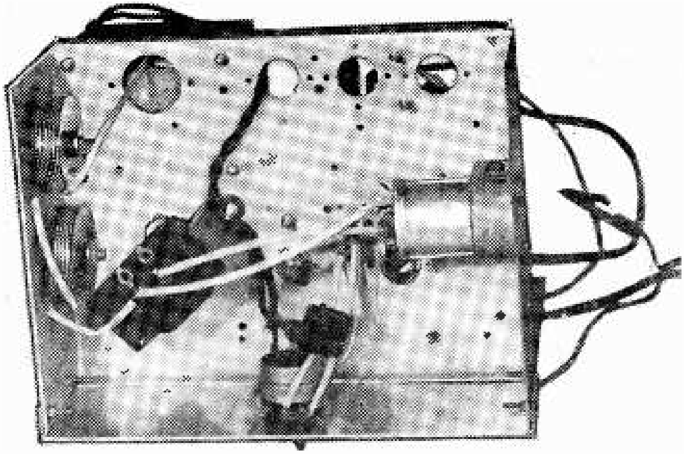


Fig. 3.—Layout of components.

second we can mark the scales by making use of a correctly tuned piano. It will be found that the nearest approach to 500 c.p.s. is the note "B" in the "middle C" scale. The actual frequency of this note is 512 c.p.s., but working to the nearest serves our purpose. The nearest to 400 c.p.s. is the note "G," being two whole tones below the one previously located. Nearest to 300 c.p.s. is the note "D," being two and a half tones (or three white piano keys) below the last. With these known and marked on the scale we can find almost any others likely to be required; 250 cycles being octave below "B"—200 cycles an octave below "G"—150 cycles an octave below "D", etc.



View of underside of chassis.

Applications

There are many purposes for which this instrument will be found useful. The low-impedance output can be used for comparing the performance of various loudspeakers (switched alternately with a double-pole, double-throw switch) or L.F. amplifier response plotted. In this application a resistance-ladder attenuator could be employed to save overloading input to the amplifier.

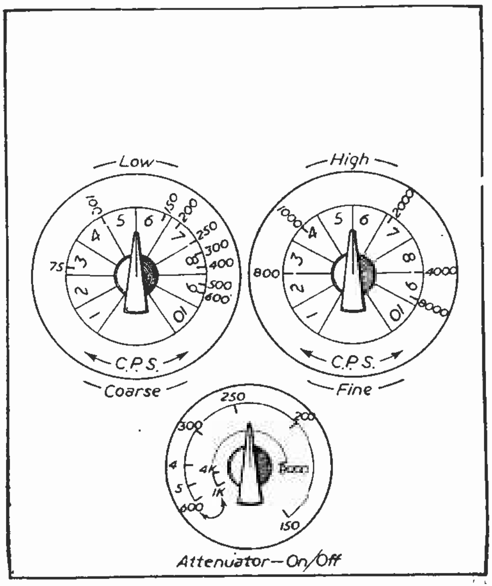


Fig. 2.—Frequency and division markings on the dials.

The high-resistance output is very suitable for injection into commercial signal generators which have an "external mod." switch position. Some of these, by the way, need quite a large input to modulate and the instrument has been found entirely adequate on an early type Taylor Model 60 All-Wave Generator. Injection is made into the audio output socket of the generator via a suitable jack-plug. The dotted line in the circuit diagram is for supplying variable modulation to a single R.F. oscillator; this point being used for the H.T. positive supply line.

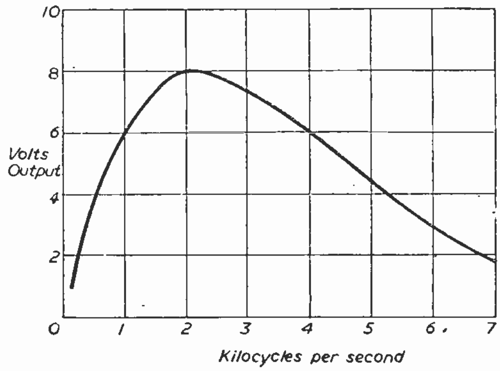


Fig. 4.—Curve showing frequency response (full modulation).

Irish VHF Transmitter

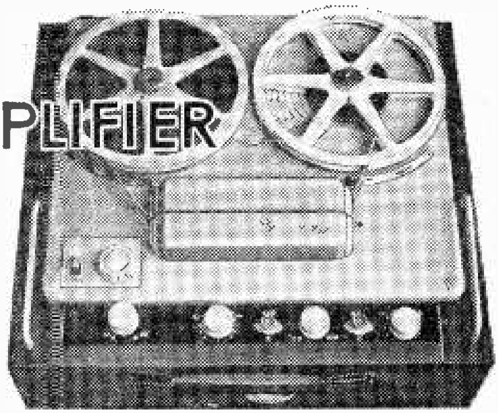
TO attempt to counter continued and worsening interference affecting medium wave bands all over Europe, a new BBC V.H.F. transmitter on Divis Mountain, goes into operation shortly.

Aerials have been erected and all that is now necessary to complete the transmitter are some parts yet to be delivered from the manufacturers.

With the new station, from which the Light Programme will be relayed on 90.1 Mc/s, the Third Programme on 92.3 Mc/s and Home Service on 94.5 Mc/s, the BBC hope they have found the answer to the "almost insoluble" question of interference.

It is believed that areas in the Republic which receive clear television signals from the Belfast transmitter on Divis, will also receive the V.H.F. transmission on sets made for it, or existing ones fitted with a V.H.F. tuner.

A *High-Power* TAPE AMPLIFIER

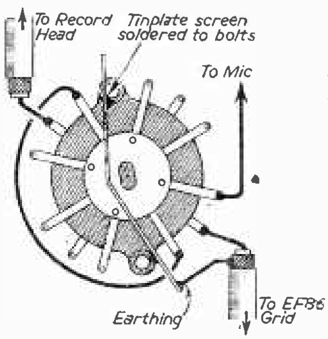


A 5-VALVE, PLUS MAGIC EYE, CIRCUIT WITH TONE CONTROL

By B. L. Phillips

THE circuit consists of a five-valve high-gain amplifier using the following valve line-up: V1 low-noise pentode EF86, V2 and V3 6SN7 (or equivalent), V4 and V5 EL84s in push-pull. The power-pack consists of one RM4 metal rectifier supplying high tension, smoothing choke, and filament transformer. In the circuit a reliable tone control is inserted in the signal path between V2 and V3, which is operative on both recording and playback. It consists of a treble boost/cut control (VR2). Bass notes are at a fixed boost level, both on record and playback, to remedy the usual 6 db loss inherent in tape recording.

On recording one EL84 is switched as an oscillator on a frequency of 45 kc/s and supplies approximately 150 volts of 45 kc/s A.C. for erasing. The oscillator coil is a Lane KA/1. The cathode of V3 (recording output), which has, on playback, a resistor of 40 KΩ to earth for phase-splitting purposes, is biased correctly for use as an output valve to supply the recording head with about 4-6 mA of audio by switching C12 and R14 (1 KΩ) to earth in place of the 40 KΩ. This also "deadens" the remaining EL84 by virtually earthing its control grid.

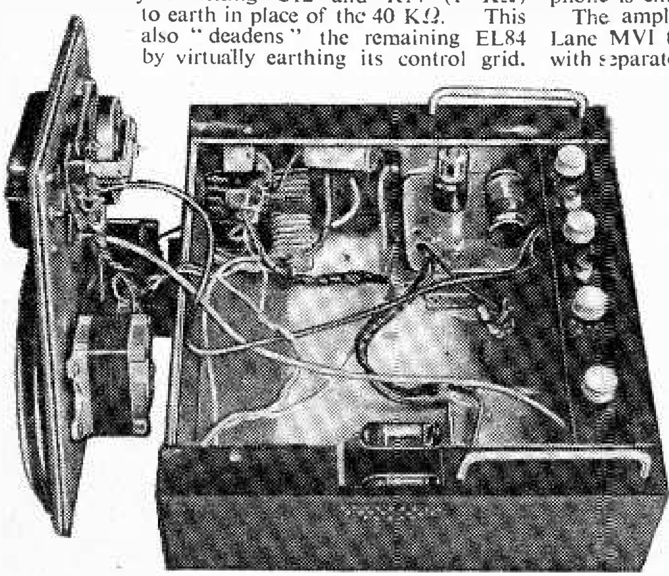


The object of the small screen is to prevent instability on recording due to the output (to record head) being near the input (mic.) The screen prevents feedback, and no instability occurs

The switch screen.

Monitoring of the recorded signal is carried out by a 6U5 magic-eye. The correct level is obtained when the segments just begin the move on loud passages. The bias supply to "excite" the tape is fed via VR3, a 200 KΩ wirewound potentiometer. This allows a wide variation in bias level to suit all makes of tapes. There are two inputs to the amplifier which, by operating the two switches, can be made operative on both recording and playback. Input 1 is for low-gain inputs where fairly high signal levels are already available before the amplifier takes over (i.e., pick-ups, radio-tuner output, etc.). Input 2 is for high-gain inputs where low-level microphones and L.P. pick-ups can be connected. A crystal microphone is eminently suitable.

The amplifier is recommended for use with the Lane MVI tape deck, or any high-impedance deck with separate record/erase heads.



An interior view to show the general disposition of parts.

Construction

All "earthy" leads should be earthed at a common point at each valve. Grid and anode leads should be as short and direct as possible. Signal leads to switches, etc., should consist of screened cable (either screened microphone cable or coaxial). Leads carrying mains A.C. (i.e., valve heater leads) should be tightly twisted to keep down the field and placed away from signal leads. Leads carrying bias and erase current should be run in screened lead.

Chassis

The circuit is built on two separate chassis. Chassis I comprises V1 and V2/V3 valves, while chassis II completes the arrangement with the two EL84s and oscillator circuit. The output transformer (Radiospares heavy duty model, 15 w.) with the rectifier and filament transformer is mounted inside the recorder cabinet. All

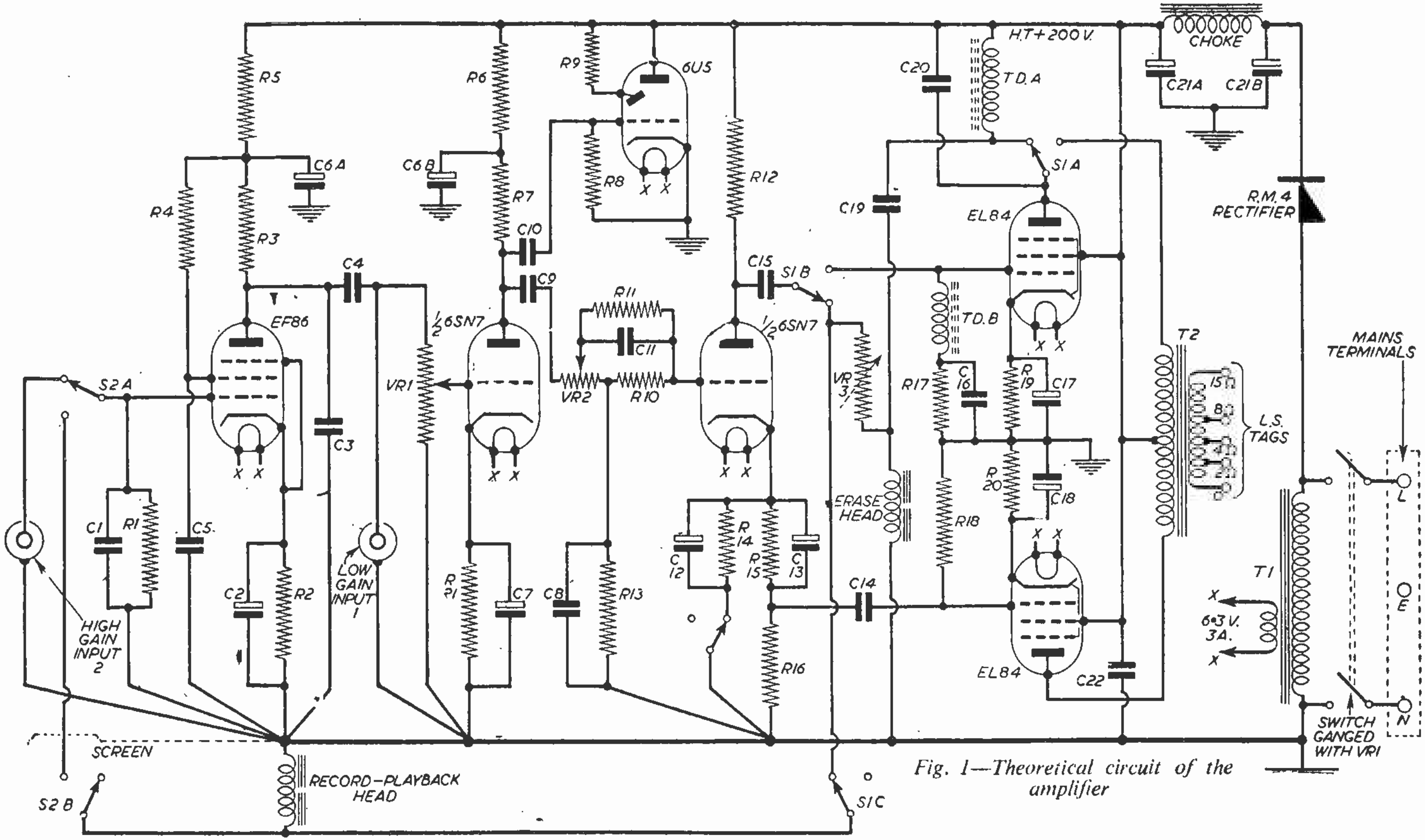


Fig. 1—Theoretical circuit of the amplifier

COMPONENTS

Capacitors

C1—250 pF 350 v.W.
C2, C7, C12, C13—25 μF 25 v.W.
C3—300 pF. 350 v.W.
C4, C5—0.1 μF 350v.W.
C9, C15, C14 & C19—0.1 μF 350v.W.
C20, C16, C22—0.002 μF 500 v.W.
C8, C10—0.005 μF 500 v.W.
C11—100 pF. 350 v.W.
C6A & B—16 μF. 350 v.W.
C17 & C18—50 μF. 25 v.W.
C21 A & B—32 μF. 500 v.W.

Resistors

R1—250 K Ω ¼ watt.
R2, R21—2.2 K Ω ¼ watt
R3—200 K Ω ¼ watt
R4, R7—270 K Ω ¼ watt
R5, R6—22 K Ω ½ watt
R8—1 M Ω ¼ watt
R9—200 K Ω ¼ watt
R10, R13—500 K Ω ¼ watt
R11—1 M Ω ¼ watt
R14—1 K Ω ½ watt
R15—5 K Ω ½ watt
R12, R16—40 K Ω matched 1% 1 watt
R17—270 K Ω ½ watt
R18—270 K Ω ½ watt
R19, R20—270 Ω 1 watt

VARIABLES

VR1—0.5 M Ω. D.P.S.T. volume.
VR2 100 K Ω treble.
VR3 200 K Ω wire-wound.

controls except the oscillator switch are mounted on a three-ply sub-panel which screws down on to the recorder cabinet. All connections are easily accessible, and each chassis can be withdrawn for maintenance, etc. The amount of heat developed in the cabinet is quite intense, but by cutting a square out of the cabinet base below the EL84s and a small slot at one side of the tape deck, this heat is quickly dissipated. The cabinet is mounted on four rubber feet which, apart from preventing scratches on prized table-tops, lifts the base of the cabinet up, allowing a free passage of air through the vents.

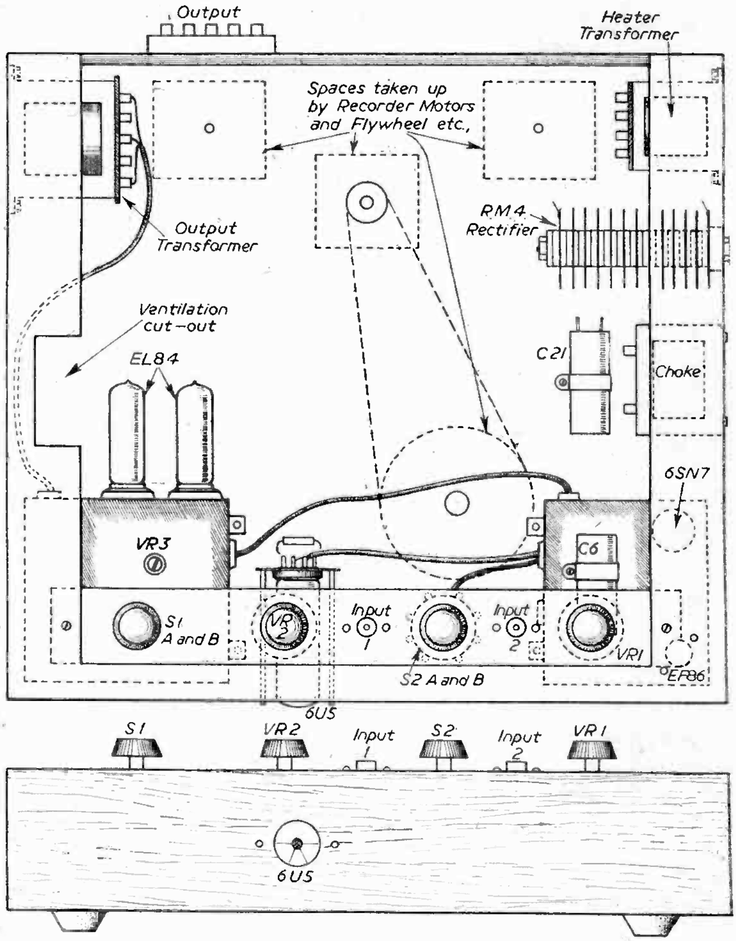
Performance

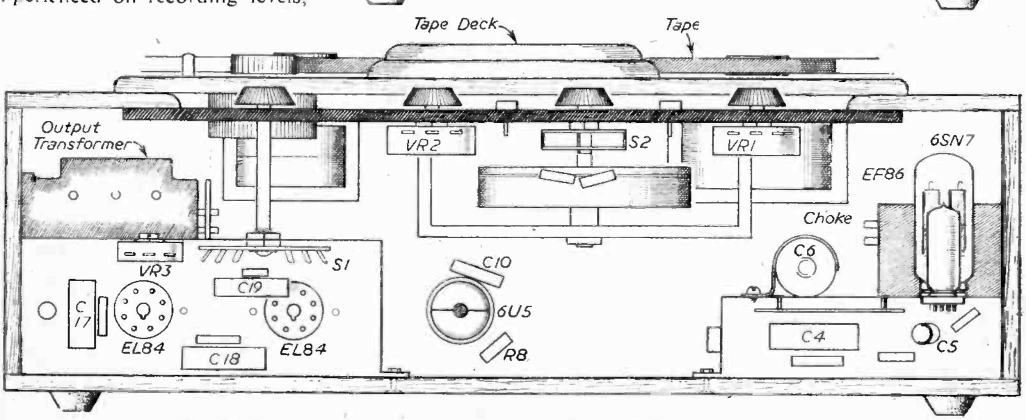
Although no negative feedback is used the quality is excellent. Negative feedback can be arranged by earthing the "O" tag on the O/P transformer secondary, and taking a lead from the 8 Ω tag back to the cathode of V2 via a low-value resistance. The value of R21 will have to be reduced and C7 dispensed with.

This results in quite a reduction in gain though, and was found annoying, because more switching has to be introduced to restore the cathode of V2 to its correct bias on recording.

The frequency response is (judging by ear on a recorded L.P. record) approximately 40-10,000 cps flat. Playing a record straight through the amplifier the response is much better, about 30-15,000 cps. Hum level on recording is virtually non-existent at all recording levels, in spite of the fact that a half-wave rectifier only is used for H.T. No trouble has been experienced on recording levels, although the magic-eye circuit is rather unconventional.

NOTE:—If a different make of oscillator coil is used, and it is found that a suitable level of bias cannot be fed to the record head, a resistance of approximately 50 KΩ may be inserted between



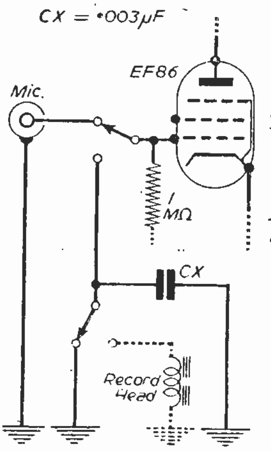


Figs. 2 and 3.—Layout and part of the wiring, with principal items identified.

the S1.B switch contact to the head and the 200 KΩ (V23) bias attenuator connected to the head side of this resistance. This should cure this trouble, although with the oscillator coil specified no trouble should be experienced.

On no account is the earth line of the amplifier to be earthed at any point, and the mains lead must go to a three-pin plug, not connecting the earth, so that the live and neutral pins are always the correct way round.

The arrangement so far described has worked quite satisfactorily, but experiments have been carried out with a view to simplifying the design. It has also been found possible to arrange for the indicator to be wired to give a more positive indication, and the modifications will be given next month.



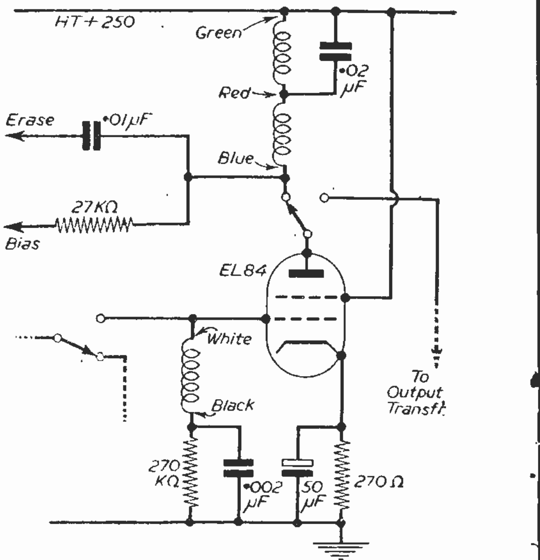


Fig. 4 (above).—Details of the first stage. Fig. 5 (right).—Details of the erase oscillator circuit.

News from the Clubs

EXPERIMENTERS' CLUB
Hon. Sec.: Brian C. Smith, 9, St. Margaret Road, Westgate-on-Sea, Kent.

AFTER the recent article in PRACTICAL WIRELESS several young enthusiasts wrote in. Many more are needed before we can print a magazine. Until then please send in notes and articles to the secretary who will put them in a folder and send them to the various members.

New members will be welcome. Age limit is 21 years and we cater for radio, chemistry and astronomy. Enrolment forms may be obtained from the secretary. *Please enclose* a stamped envelope in all correspondence that requires an answer.

BURY RADIO SOCIETY
Hon. Sec.: J. E. Hodgkins, 24, Beryl Avenue, Tottington, Nr. Bury, Lancs.

AN attempt is being made to revitalise the Bury Radio Society. All hams and SWL's in the Bury area who are interested should write to the Hon. Sec. at the above address.

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: C. H. Bullivant (G3DIC), 25, St. Fillans Rd., Catford, S.E.6.

THE highlight during December was the annual Christmas Party which was attended by some 40 members and friends and took place at the club rooms on Friday 16th. During the party a constructional contest was held and the judges on this occasion were G3FRB, and G3HLX. The first prize went to G2WI for a very fine communications receiver, the second prize to R. Poppi for a 14 Mc/s converter and the third prize to G3FVG for a heterodyne frequency meter.

On the 2nd December, D. Bennett gave a talk on the various tests carried out on seagoing radio equipment whilst on the 9th and 23rd constructional evenings were held.

A total of 17 stations took part in this year's Christmas morning club net on Top Band.

Programme for February:
17th—Constructional Evening and Ragchew
10th—Quiz.
24th—Junk Sale.

Meetings are held every Friday at the club rooms 225, New Cross Rd., London, S.E.14, at 7.30 p.m. where visitors and new members will receive a warm welcome. Details of membership can be had upon application to the Hon. Secretary.

EAST KENT RADIO SOCIETY
Hon. Sec.: Mr. D. Williams, Llandogo Bridge, Canterbury.

THE society continues to meet at "The Two Brothers," Northgate Street. Last meeting 38 members were present for the annual general meeting. The society has now obtained rooms for permanent headquarters and hopes to move in about three weeks. Raffles and Lectures held and the society hopes to have about 4 D/F sets in action this year. VS1HD has written to join the society on return to this country. A Social Evening is being planned for end of February. New members and visitors in the district welcome.

TORBAY AMATEUR RADIO SOCIETY
Hon. Sec.: L. H. Webber (G3GDW), 43, Lime Tree Walk, Newton Abbot.

IN the absence of the President and the Chairman, there was no formal meeting in December, and there was only a small audience for the month's recorded lecture "Interplanetary Travel," by G2WS. This was, however, something new to the members, and was voted as exceptionally welcome.

A Christmas card was read by all members, via G3AVF, from ZL2ARL (ex-G8FA)—who was well known to many members when he lived at Teignmouth some years ago. An Air Mail letter was written by several members to him, via G3AVF, wishing him the compliments of the season.

THE SLADE RADIO SOCIETY
Hon. Sec.: Mr. C. N. Smart, 110, Woolmore Road, Erdington, Birmingham, 23.

THE following are the Programme dates for the remainder of the quarter:

February 17th—"Junk Sale."

March 2nd—"Characteristics and Application of Selenium Rectifiers" by Mr. P. Barker, assisted by Mr. J. A. Browning, of Standard Telephones and Cables Ltd.

March 16th—"Electronic Musical Instruments" by Mr. D. Wilson (Member).

LOTHIANS RADIO SOCIETY
Hon. Sec.: John Good, 24, Mansionhouse Road, Edinburgh, 9.

THE following forthcoming events should be noted:

February 9th—Radio & Television Interference and the Radio Amateur, by W. T. Bell of the G.P.O. Engineering Department, London.

February 23rd—Police Radio, by Chief Inspector N. W. Bruce, B.E.M., M(Brit)I.R.E. Meetings are held at 7.30 p.m. at 25, Charlotte Square, Edinburgh.

Morse Classes and instruction for R.A.E. now being given.

A club library has now been formed.

STOKE-ON-TRENT AMATEUR RADIO SOCIETY
Hon. Sec.: A. Rowley (G3JWZ), 37, Leveson Road, Hanford, Stoke-on-Trent.

THE meetings continue on Thursday evenings at the society's H.Q.

The Morse Lessons, which are being given from 7.30 p.m to 8.0 p.m., receive great support from those members who are learning the code.

One of the society's members took the G.P.O. morse test recently and passed with flying colours.

Also for the benefit of prospective amateurs, a series of lectures, covering the requirements of the R.A.E., has started.

New members and visitors are always welcome.

VARIABLE SELECTIVITY

ONE METHOD OF SOLVING THE PROBLEM OF INTERFERENCE

By A. M. St.CLAIR

It is well known that a receiver having a fixed R.F. band-width is not capable, under present-day conditions, of achieving optimum results from many of the transmissions within its range. A two- or three-position selectivity switch, while still far from the ideal, offers some amelioration; but only the very highest quality communications receivers are fitted with a continuously variable pass-band control. This article describes such a system, suitable for inclusion in amateur designed and built

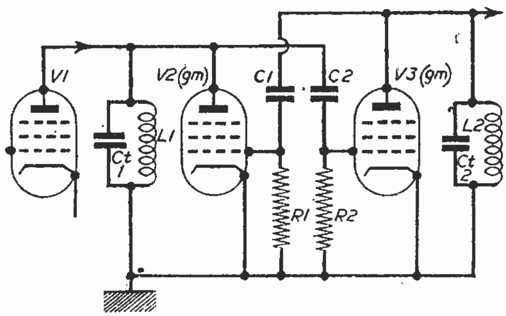


Fig. 1.—Basic circuit for the arrangement described here.

apparatus, easily made automatic in operation, and without the use of any moving parts.

Such a consideration, naturally enough, is achieved only at a certain cost: the use of one or two extra valves. Nevertheless, while this fact precludes its use in commercial sets, it will not greatly deter the genuine DX fan, who takes a pride in having the best set he knows how to build.

Variation of selectivity in a communications-type receiver is best accomplished by changing the coupling factor in the inter-stage (I.F.) transformers. This can be done by a mechanical movement of the coils within the cans, which is a tricky problem in production engineering and unsatisfactory for the home-constructor; or by a variable top-capacity coupling condenser, which is not too good, not only because it has both ends "hot," but also because it introduces large detuning effects; or by means of coupling valves.

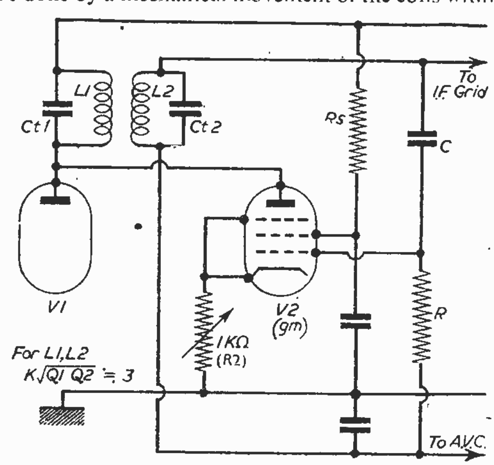


Fig. 4.—An alternative version.

The Circuit

For the latter method, the basic circuit is shown in Fig. 1. There is no mutual coupling (inductive coupling, that is) between the coils. And, since band-pass characteristics do not arise in a tuned filter unless coupling exists in both directions, two valves are used to provide the necessary linkage. The incorporation of the coils into a single "transformer" is discussed later. The action of the circuit is as follows.

V1 is the frequency-changer, or the first I.F. amplifier, if two stages are used, and it is decided to control the second. The network C2—R2 feeds a portion of the I.F. output to the grid of V3, where it is amplified, and appears across L2. A portion of this voltage is now fed via C1—R1 to the grid of V2, the anode current of which provides the necessary back coupling.

It is now obvious, since the only coupling between L1 and L2 is by means of V1 and V2, that the effective co-efficient of coupling K(eff.) is dependent upon the slope of the valves; and since this can be varied by means of grid bias, the system provides a basis for a method of continuously variable non-mechanical bandwidth control.

Assuming that C1 = C2, R1 = R2, and that V1 and V2 are of the same type, the coupling between the tuned circuits is the same as would be obtained by the use of a top-capacity coupling condenser of capacity gm. R1. C1. Now, for top-capacity coupling we have (see Fig. 2) $K = \frac{Cc}{\sqrt{Ct1.Ct2}}$. Hence, referring back to Fig. 1, we get, for the valve-coupled arrangement, $K(\text{eff.}) = \frac{gm\ R1.C1}{\sqrt{Ct1.Ct2}}$. Taking critical coupling as the design centre, we make use of the well-known relationship $K\sqrt{Q1.\ Q2} = 1$, giving $gm\ C1.\ R1 = \sqrt{\frac{Ct1.Ct2}{Q1.\ Q2}}$. If the tuned circuits are also identical, this becomes $gm\ C1.\ R1. = \frac{Ct1}{Q1}$. Taking,

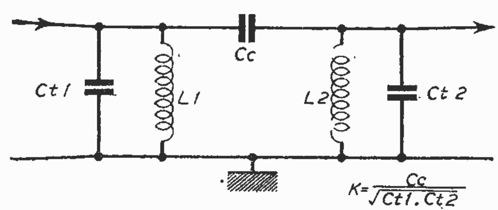
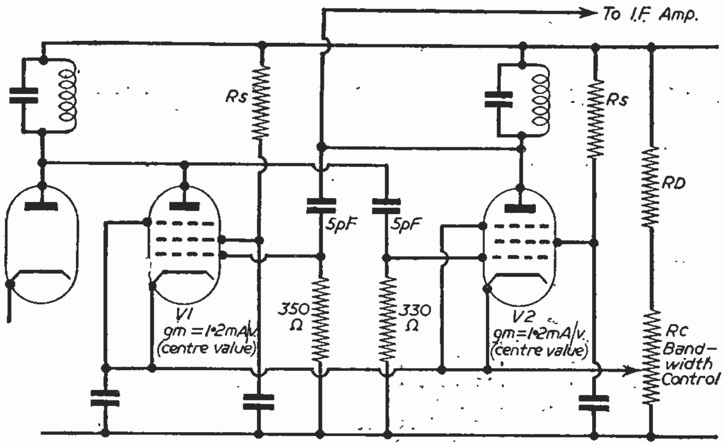


Fig. 2.—Equivalent circuit for top-capacity coupling.

for example, a "Q" of 60, and trimmers of 120 pF., gm C1. R1. $=2.10^{-12}$.

Taking into consideration permissible circuit damping, the characteristics of suitable valves, etc., this figure may be satisfied by: C1 = 5pF., R1 = 330 ohms, gm = 1.2 mA/V. An infinite number of solutions exists, of course, and, subject to the above considerations, the availability of materials may well be the determining factor.



Rs, RD, Rc — Values depend upon chosen valves to give correct range of gm.

Fig. 3.—The arrangement in practical form.

A Practical Arrangement

Fig. 3 shows this circuit in a practical form. Any variable-mu valves are suitable, provided that gm can be swung above and below the value required for critical coupling. It is obviously impossible to give more than a sample set of component values, since these are determined by the coils, trimmers and valves which it is proposed to use, but those quoted are fairly typical.

There is no objection to having both coils in the same can, provided that care is taken to eliminate inductive coupling. To this end the following steps should be taken. A well-fitting internal screen of aluminium should be fitted to divide the can into an upper and a lower compartment. The coils should be moved as far apart as possible within the can, taking care not to bring them too close to the top of the can or to the chassis. If at all possible, one coil should be mounted at right angles to the other. The leads from the upper coil should be screened. It is best, of course, though often inconvenient, to have the coils in separate cans.

The circuit of Fig. 3 gives a true variation in coupling, without the detuning effects which would arise if an actual condenser of capacity gmR1.C1. were used. But it uses two extra valves per controlled stage. A very good substitute may be arranged making use of only one additional valve per stage, which has the further advantage of using standard I.F. transformers. In this system, forward coupling is provided in the normal way, while additional backward coupling is supplied, in either an additive or a subtractive sense, by means of a valve. This system has the effect not only of varying K, but also of detuning. Since, however, the detuning is a symmetrical shift of primary and secondary about the central frequency, it is completely unobjectionable; indeed, in the automatically-controlled version it assists in flattening the regulation curve of the receiver.

A version of this method is shown in Fig. 4. It will immediately be observed that it looks rather like an oscillator. (Indeed, the two-valve system looks like a kind of multi-vibrator, though with the low couplings used, and the phase-relationships observed, it does not, in fact, oscillate.) Whether it will function as one or not depends upon two things. First, the sense in which the secondary of the I.F. transformer is connected; and secondly, the slope of the valve. Now, since the system to be described requires the coils to be connected in the sense in which oscillation is possible, it is necessary to contain the slope of the valve within close limits. Hence the "Set Operating Point" control (R2) which is an undecoupled bias resistor, providing negative feed-back.

(*Concluded on page* 210)

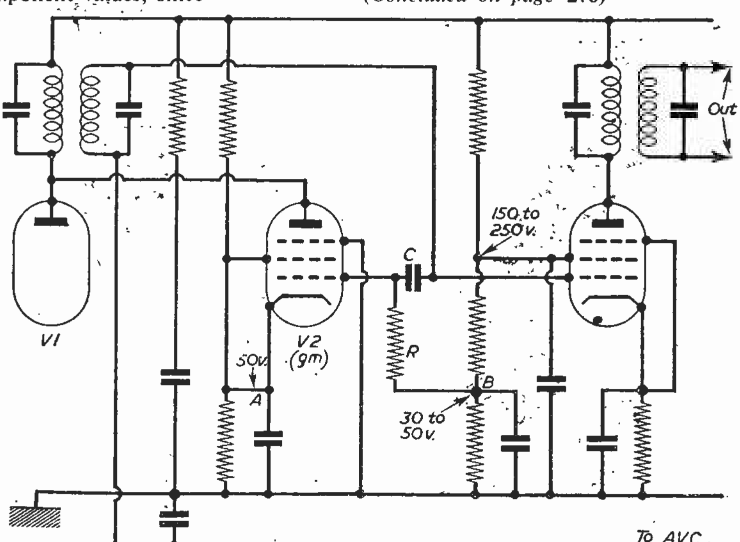


Fig. 5.—This arrangement is inferior to the circuit in Fig. 4.

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A Hi-g pick-up head incorporating the HGP 37-1 turnover cartridge with cantilever sapphire styli. Designed for both standard and microgroove records.

HGP 63-1 Garrard
As HGP 37-1 but slightly longer.
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Separate Hi-g plug-in type heads for standard and microgroove records incorporating the crystal unit as used in the HGP 39-1 above. Available in cream or walnut.

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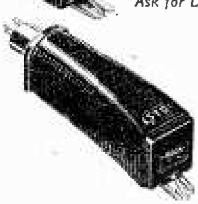

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Separate plug-in type Hi-g heads for standard and microgroove records; fitted with cantilever sapphire styli. The crystal unit is identical to that of the HGP 39-1 above.

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On Your Wavelength

BY THERMION

Careless Correspondents

I CAN sympathise with one of our advertisers who complained to me the other day that he had received a critical letter from a reader because he had not promptly dispatched the goods which he had ordered by post, enclosing a cheque for the amount. The cheque, of course, had been through the bank and the reader had jumped to the conclusion that the dealer who, may I add, is old-established and of high repute, was a shark of the type which invested the turgid seas of radio in the early days when cat whiskers could be sold at 5s. 6d. each. The reader saw something sinister in the matter, and instead of writing to the dealer concerned, he wrote to me. I am always delighted to intercede on behalf of readers who have genuine complaints, and I have always been able to obtain satisfaction for them in the few cases where there has been a genuine trip-up on the part of the advertiser concerned. In this case, however, the simple explanation was that the reader had omitted to put his address on his letter. I was able, of course, to provide the address from the reader's letter to me and the advertiser was able to dispatch the goods immediately with an explanatory note.

My sympathy with the advertiser was aroused because it so often happens that readers in their haste to dash off a note to me often omit their address, and I am unable to reply. I refuse to publish letters where the full name and address of the correspondent is not given.

Before presuming, therefore, that your letter has been ignored or that the advertiser is a swindler, make quite sure that you did put your name and address on the letter. I am all in favour of printed notepaper for this very reason, for if, as sometimes also happens, a reader omits to sign his letter, at least a communication can be sent to the address.

One other point : when sending postal orders to advertisers or even to this journal, will you please see that they are crossed. Then if they are lost they can easily be traced since, when crossed, they can only be cashed through a bank. A further point. Please keep the counterfoil, and also make sure that you actually have included the postal order. I understand from our Post Sales Department that they often receive letters stating that a remittance is enclosed, when the letter arrives without it. No advertiser is infallible, and investigation has nearly always shown that there was a reasonable answer. Readers may safely deal with any advertiser appearing in this journal, secure in the knowledge that we are behind them, and if there is a genuine complaint, we shall secure satisfaction. We only accept advertisements from reliable advertisers, whose main revenue comes from mail order : it is not in their interests to risk having their advertisement banned because of unbusinesslike treatment of their mail order custom. We like to hear from any reader who feels that he has a genuine complaint.

I must say that conditions to-day are vastly different from what they were in the 'twenties, when I was kept busy investigating (not in connection with P.W.) complaints as a result of what could not be described as anything but swindles.

There was one fancy device in a neat bakelite case which you interposed between the aerial and the set, which claimed to amplify the signal. Upon opening one of these specious gadgets, it merely consisted of a casing filled with pitch. Fortunately, these get-rich-quick tricksters are now entirely out of the business, and some of them have had lengthy sentences in which to reflect upon the evils of their ways.

The club racket was another aspect of the early days of radio on which I spent considerable time, and readers may therefore understand my caution when dealing with any new club in desiring to have the fullest possible information. Excepting the old-established and recognised clubs, in general I do not advise any reader to join those clubs formed by an individual who becomes the proprietor, secretary and treasurer of it for life, and which does not produce a balance sheet, have an annual general meeting, and an annual election of officers. Some of these early clubs were patent frauds, run from the corner of a kitchen table. You paid five shillings a year in return for "technical advice" on all your queries, and an illustrated, duplicated "magazine." One such club, which I soon unearthed, was passing along queries from its members to me. The method was to send an omnibus letter asking about 20 queries at a time, with one coupon, of course. I joined that club to see how it worked, and was most amused a few days later to find a query I had asked appear word for word in one of these omnibus letters addressed to this office. I took strong action, demanded to know the names and addresses of every one of the members and forced this charlatan to refund all of the subscriptions, which amounted to a sum of well over £600.

Just one more example of the methods which were adopted. One of these common swindlers had some notepaper printed stating that he was a B.Sc., in charge of testing laboratories, and his method was to write to manufacturers of components and offer to issue a testimonial as to their performance in a set he was specially designing. In one case he gave a recommendation for a tuning unit, listing all of the stations he had received on the set, and my attention was drawn to the matter because some of the stations had been off the air for several years. When I called upon this wily gent, I found that he kept a small radio shop and was doing a roaring trade retailing the components he had fraudulently obtained in this way. All advertisers were immediately informed, and one or two demanded payment for the components he had obtained under threat of legal action. Once he was on the manufacturers' lists, he, of course, received a supply of new components regularly from each of them. Perhaps it is for these reasons that some of my readers become suspicious on the once-bitten-twice-shy principle. I am glad to be able to say that such methods do not apply to-day.

PRACTICAL AMPLIFIER DESIGN

A NEW SERIES 2.—TUNED AMPLIFIERS

By R. Hindle

(Continued from page 91 Feb. Issue)

Complete constructional details for various types of tuned amplifier. A series of articles forming a sequel to the theoretical series published some time ago.

THIS unit would be little use without some sort of detector, so the simplest form of detector, a germanium crystal unit, is incorporated. The unit thus becomes a very simple form of radio feeder unit for feeding any sort of audio amplifier.

In this case a tuned circuit is used at both grid and anode of the valve in the conventional way; only the medium wave range is incorporated for the sake of simplicity. It was made clear in the description of the previous unit that as a result of adopting this form of circuit there is more risk of instability and so a valve of lower gm is used. Also, there is more likelihood of overloading and so a volume control is incorporated. A variable-mu valve permits variation in gain by adjusting the bias and this is done by means of a variable resistance in the cathode circuit. R2 in series with the volume control prevents reduction of bias below the specified minimum. The valve chosen to satisfy both these requirements, i.e., a lower gm and variable-mu characteristics, is the Brimar 6BA6.

Ganged tuning of the two circuits is used with two Osmor adjustable cored coils. The H.T. voltage supplied to the screen grid is dropped by R1 in the circuit given in Fig. 7, and held steady by C2. The detector circuit is also conventional, R4, C6 being the R.F. filter and R5 the load. C7 prevents the D.C. component from being passed on to the audio circuit.

Construction

This unit is built on a chassis uniform with those used for the audio units, being 7in. × 4in. × 1in. deep. A fixing flange ½in. wide is left at the rear of the chassis. Fig. 9 gives the resulting cross-section of the chassis. A bracket, indicated in Fig. 8, has to be made up to hold the volume control above the chassis. Aluminium is used for both chassis and bracket.

COMPONENTS LIST FOR FIGURE 2

R1—47 KΩ ½ watt (Dubilier type BT).
R2—150Ω ½ watt (Dubilier type BT).
C1—50 pF (Dubilier type CTD).
C2, 4—.1 μF 250 v. (Dubilier type 410).
C3—500 pF variable (JB type E).
C5—See text.
L1—Medium-wave pot cored (Osmor QA51).
V1—6AM6 (Brimar).

ALSO REQUIRED:

One chassis.
One Epicyclic drive (JB No. 4511).
Three stand-off insulators, ceramic (JB type D).
One valveholder B7G with skirt (McMurdo).
One tag strip.
One knob.
Three core cable.
Coaxial cable.
Grommets.

Fig. 10 illustrates the drilling as seen from the top of the chassis, but as with the previous chassis, the constructor should check the sizes of his components to see if the same drilling will be suitable. It will be seen that two valveholders are fitted whereas only one valve is to be used. This is an attempt to look ahead. Though a germanium detector is used in the first instance a valve detector can later be tried and possibly another form of amplification-reaction. Meanwhile, the second holder serves as a tagboard for the detector components. The remarks given previously about determining the positions of the valveholder fixing bolts apply here also. It will be seen from the wiring diagram, Fig. 12, that on the back wall of the chassis are mounted the coil L1 (in line with the valves) for which a ¾in. hole is required and an aerial/earth socket strip. Holes are required also where indicated for the power lead and the signal output lead.

Tuning Capacitor

A two-gang capacitor is required to tune simultaneously the two circuits provided in this design and, in keeping with the general design, a miniature component is used. This may be fitted with trimmers, which are required for aligning the tuning but if not (as in the case of the prototype) two 50 pF postage stamp trimmers will have to be fitted. These do not appear in the components list as separate components, so the reader will need to add them to his shopping list if he finds that they are needed. The method of mounting is to solder one tag to the tuning capacitor fixed plate tag and to use a soldering tag screwed to the chassis as indicated in Fig. 11 to anchor the other end. If these are fitted in this manner it will be necessary to make a small aluminium screen to fit close up to the capacitor frame 1¼in. wide and just the same height as the tuning component. This is fixed adjacent to and serves to extend the middle plate of the capacitor frame which serves as a screen between the two halves of the component. It will be appreciated that this screen and the two trimmers are

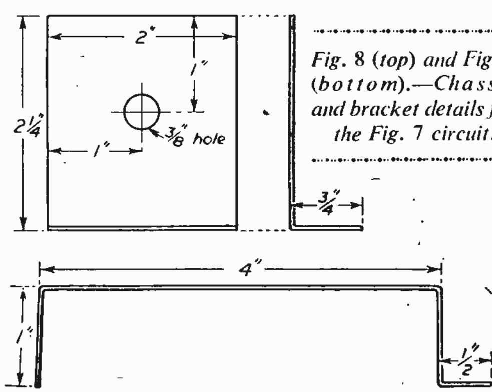


Fig. 8 (top) and Fig. 9 (bottom).—Chassis and bracket details for the Fig. 7 circuit.

required *only* if the tuning capacitor itself is not fitted with trimmers. An epicyclic drive is fitted to the tuner and again a bolt in one of the holes of the capacitor end-plate is used to anchor the drive. There is very little space to spare for this purpose. A 1in. 6 B.A. bolt was used, two nuts run on to the bolt,

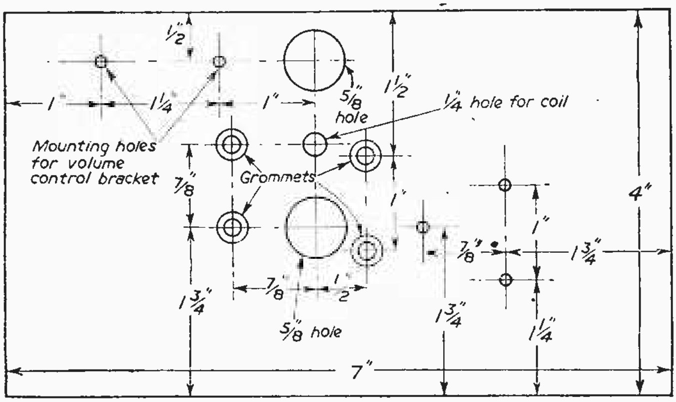


Fig. 10.—Chassis drilling details.

the end of which was inserted through the capacitor frame hole. A half-nut was then fitted to the bolt inside the frame so that the end of the bolt was flush with the face of the nut. The nearest nut on the outside of the frame was then tightened up to the frame to hold the bolt firm and the other nut used to lock the anchor plate of the drive.

COMPONENTS IN FIG. 7

R1—33 KΩ 1 watt (Dubilier type BT).
R2—100 Ω ½ watt (Dubilier type BT).
R3—25 KΩ wirewound pot.
R4, 5—47 KΩ ½ watt (Dubilier type BT).
C1, 4—500 pF 2-gang miniature (Osmor).
C 2, 3, 7—.1 μF 250 volt (Dubilier type 410).
C 5, 6—100 pF (Dubilier type 400).
GD—GD5 (Brimar).
V1—6BA6 (Brimar).
L1—QA11 (Osmor).
L2—QHF11 (Osmor).

ALSO REQUIRED:

Two valveholders B7G, one skirted (McMurdo).
One Epicyclic drive (JB No. 4511).
One socket strip, "A, E."
Two tag strips, two plus earth.
Coaxial cable.
Three or four core cable (see text).

Screening

It is necessary to screen one coil from the other to prevent instability but an easy way out and very effective, too, because of the extension of the screening surface, is to mount one coil above the chassis and the other underneath. To make quite sure of the matter the coils are mounted with their axes at right angles; the one on top is mounted upright and the one underneath is fixed horizontally in the rear wall of the chassis as will be seen from the illustration. The aim, in arranging layout, is to reduce the length of signal leads, particularly those in the first valve grid circuit, to a minimum and the wiring diagram will show how successful this particular design is in this respect. The valveholder accommodating the R.F. amplifying valve was the skirted type but a screening can is not actually necessary and this unit was worked without.

Wiring

The virtue of compactness possessed by the layout must not be thrown away by allowing the wiring to wander about the chassis. The accessibility does, in fact, make wiring easy. First connect heater leads, that from pin 3 going to the centre screen of the socket (not shown on the diagram to avoid obscuring the other leads) and then to chassis via the soldering tag under the valveholder holding down bolt, and pin 4 going to the power input tagboard running close to the chassis. C2 and C3 are then fitted connecting the outside foil to the earth—this end is marked by "OF." The coil and tuning capacitor connections are then put on. Complete then the wiring to the R.F. valve following up with the detector wiring. Leave the coaxial output and the power input leads until last. A three-core lead is required to bring the power into the chassis, as shown, but the constructor may like to introduce a refinement that is generally used by the author in his more ambitious radio designs, providing switching of mains from the feeder chassis. To do this a volume control with single-pole switch is used instead of the one specified. A five-core power lead is then used, the extra two cores breaking in to the connection in the chassis with power pack between one side of mains and the mains transformer. If it is to be used with the audio amplifier and output unit already included in this series it will be an advantage to fit a second power output socket on the output stage chassis alongside that already used to feed the audio amplifier, though if preferred there is no reason why both power cables should not go to the same plug apart from the inconvenience of it.

Using the Chassis

It will be assumed in the following that the unit is to be used with the audio units described in this series and that provision is made as above to connect the power leads to the output stage chassis. Using the A.C. scheme the power outputs to audio amplifier and the feeder are connected in parallel—to work with the Universal version the heater of the valve has to be

Fig. 13.—Plug connections for the inter-chassis couplings.

put in series with the other heaters, leaving the audio amplifier heater at the earthy end.

When power is connected, aerial and earth plugged in and the inter-chassis coaxial connections made the equipment can be switched on and tested. Signals should be obtained without adjusting the trimmers and cores; tune one in, preferably with the vanes most completely meshed if there is a choice, and adjust the cores for maximum response. Now find a station at the high frequency end of the tuning band (i.e., with the moving vanes practically all the way out of the fixed plates) and adjust the trimmers for maximum signal. Return the tuning to the low-frequency end and adjust cores, the high-frequency end and adjust trimmers and so on until satisfied that no further improvement is possible. When first carrying out these adjustments the volume control should be at maximum volume (i.e., with its resistance shorted out), but as adjustment progresses reduce the volume control to keep the signal just audible, under which conditions it is easier to detect optimum tuning.

These three chassis that have been produced to illustrate the principles of amplification now form a complete receiver capable of remarkably good results; the constructor will no doubt have learned quite a lot about amplification in the process and his work will not seem to have been wasted when the finished product can be used as a complete receiver.

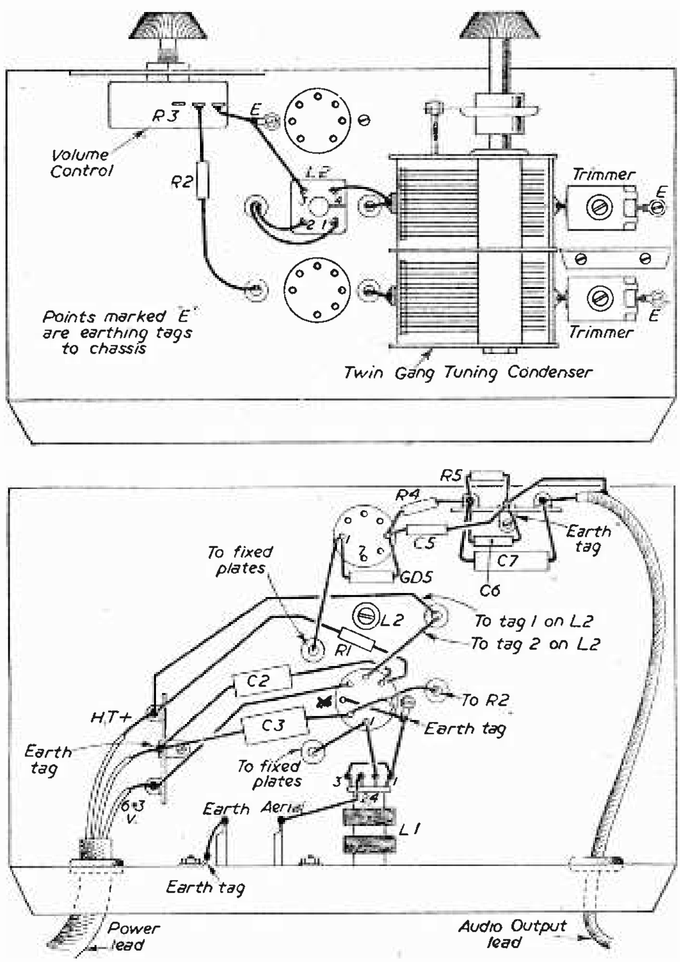
Universal Mains Model

To use this unit with the A.C.-D.C. model power output chassis described in the January, 1955, issue, the construction is exactly the same with the exception of the heater wiring. For this purpose neither side of the heater is earthed but instead both are brought to the power input tagboard, which must now have three tags plug earth. A four-core power lead is required.

Fig. 13 (page 171) gives the method of interconnecting the extra power output socket required on the power chassis; the left-hand one is that already fitted and the other is the extra. The wiring of the former is unaltered except for the extra lead from pin 2 to pin 3 on the extra socket. H.T. and earth leads are in parallel. The power lead from the audio amplifier is now plugged into the new socket instead of the original one; its heater wiring still has one side to earth so that it remains at the earthy end of the chain. The tuner chassis power lead goes to the original socket, its two heater leads going to pins 2 and 3 of the plug so that, in effect, its heater is interposed between that of the 19AQ5 and the audio unit. Care must be taken when testing this type, of course, as the chassis is connected to the mains.

The valve for the universal combination will be the 12BA6 to preserve the .15 amp. standard and it will be necessary to adjust the dropper resistors on the power pack, reducing the resistance to keep the current flowing at the right figure. The best way is to check the current with an A.C. meter but if this is not available the reduction in resistance should be about 80 ohms. Each of the droppers is 700 ohms so rather more than a tenth of the length of one resistor is taken out of circuit.

(To be continued)



Figs. 11 and 12.—Above and below chassis wiring details. If the tuning condenser is fitted with trimmers the two postage stamp trimmers and the screen may be omitted.

A Simple Coil-winder

CONSTRUCTIONAL DETAILS OF A MOTOR-DRIVEN UNIT

By H. W. J. Gumbrell

WE receive many requests from time to time for coil winding apparatus. For commercial purposes a coil winding machine is a rather elaborate piece of equipment, capable of winding various forms of multi-layer coils and with various devices to avoid breaking very fine gauges of wire. However, whilst we have in the past described one or two models the issues are now entirely out of print, and accordingly we give below some details of an instrument built by the writer to carry out the winding of experimental coils. No elaborate equipment such as a lathe is needed, and only the ordinary type of amateur tools are called for. No difficulty should be experienced in building the apparatus and there are no snags which cannot be overcome by the average amateur who is used to ordinary radio construction.

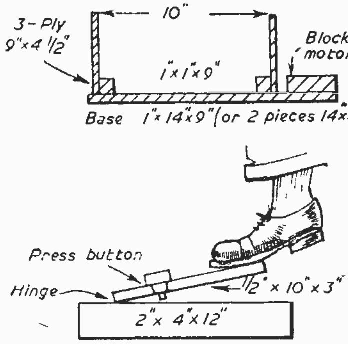


Fig. 2.—Details of mounting and the foot switch.

The requirements which were set out for the winder were merely some form of guide which could be moved along the coil former in either direction and at any speed in relation to the speed of winding, some method of counting the turns, and some form of motive power to avoid the tedium of hand winding larger types of coil or transformer bobbins.

The following are the essential details which should make the construction clear if studied in conjunction with the various illustrations.

Construction

An ex-R.A.F. rotary transformer (type No. 46) from an I.F.F. set, with its convenient gearing, provides the motive power. The gearing can be connected up to Meccano spindles with connectors (part No. 63). These can be drilled out for half their length to fit the spindles already in the motor gearing, and to fit the 2 B.A. rod used to carry the coil being wound. It is perhaps as well to mention that grub screws should be removed before drilling.

The wire guide moves along another length of 2 B.A. rod to which is bolted a Perspex (or ebonite) disc. A rubber-tyred wheel pressing against this disc makes a good infinitely variable gear; one has only to loosen the grub screw and move it along its spindle and retighten. Obviously the farther the rubber tyre is from the centre of the Perspex disc the slower will the latter revolve and the more turns per inch wound on the coil. The required radius may be found by trial and error with a ruler against the wire guide or the following formula used: Radius equals turns per inch divided by 41. This formula

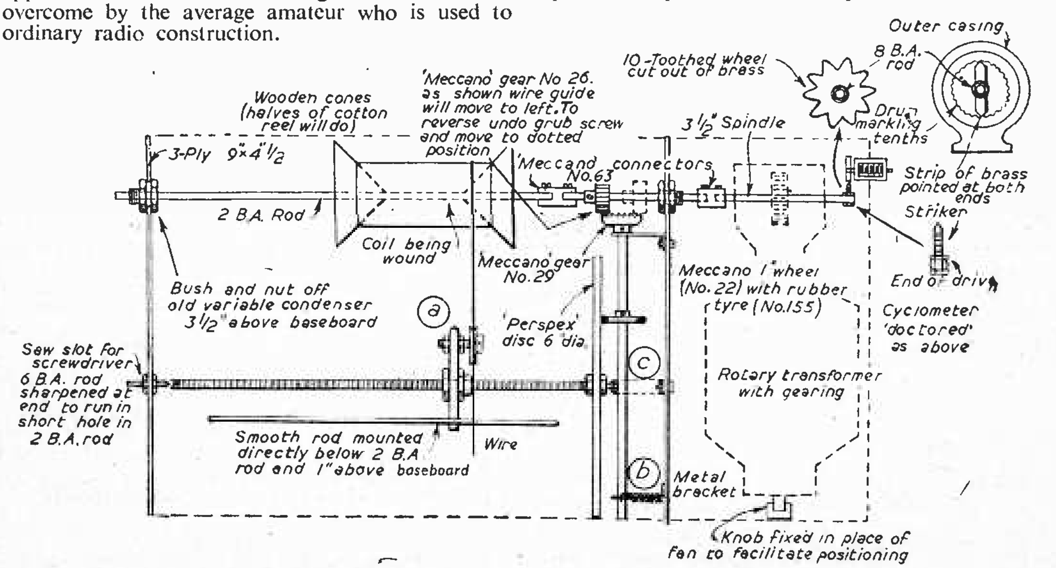


Fig. 1.—General layout of the winder. Details of (a), (b) and (c) will be found on the next page.

takes into account the pitch of 2 B.A. rod and the gearing in the reversing arrangement. For reversing Meccano again comes to the rescue, and the diagram gives all the detail required.

An old cyclometer is used to provide the counting. As shown, each tenth of a mile division registers one turn and, with the top of the coil moving away from the operator, as is more convenient, it counts backwards. This difficulty is more easily solved mathematically than mechanically, although the central 8 B.A. spindle lashed to the tenths drum could be fixed direct to the coil drive and rotate once for every turn in the positive direction.

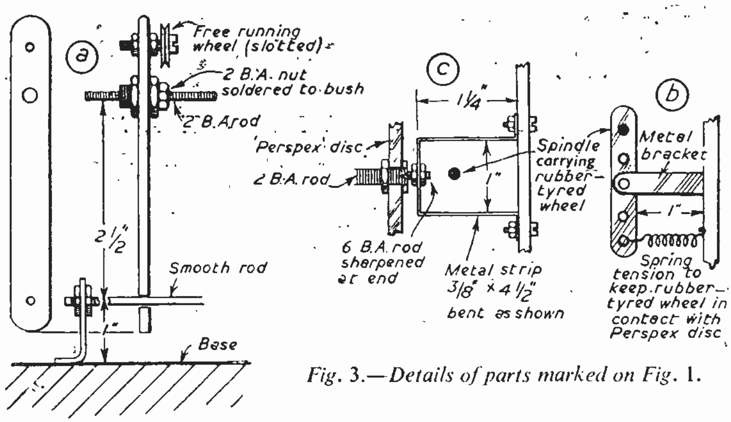


Fig. 3.—Details of parts marked on Fig. 1.

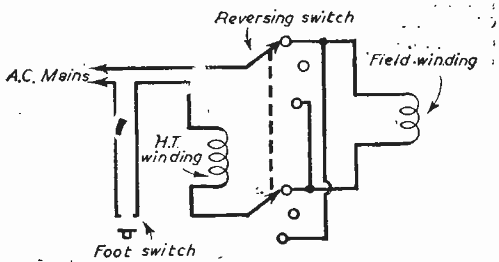


Fig. 4.—Wiring of the switch and rotary transformer.

Operation

To put the wire guide into position opposite the start of the winding push the rubber-tyred wheel away from the disc by means of the sprung lever and spin the 2 B.A. rod in the appropriate direction.

When the end of one layer is reached carry out a routine such as this : (1) Jot down the numbers and work out the number of turns wound so far ; (2) change gear ; (3) insert paper between layers, turning the coil round in the process with the knob on the end of the motor where the fan was ; (4) carry on with the next layer.

Incidentally, the reversing switch is useful to restore the *status quo* should one forget to reverse gear, but the gear should be left as it is until the unwanted turns have been wound off as, of course, with the motor reversed the direction of the wire guide is also reversed.

New R.S.G.B. President

MR. R. H. HAMMANS, G2IG, President-Elect of the Radio Society of Great Britain, is currently Chief Engineer to Granada Television Network, Ltd., who are the Independent Television programme contractors for weekdays in the North Region.

Mr. Hammans, who has held an amateur transmitting licence since 1929, is Vice-chairman of the Society's Technical Committee and a past winner of the Norman Keith Adams Prize.

During the early 1930s Mr. Hammans installed ship-to-shore radio equipment for International Marine Radio Company. He joined the BBC in 1935, in which service he remained until taking up his present appointment a few months ago. Whilst with the BBC Mr. Hammans undertook the first radio link television outside broadcast ever to be transmitted in a public service—Wimbledon 1937. From 1939 to 1943 he was at Tatsfield Receiving Station, from which he was transferred in 1943 to the Transmitter Drive Section of the BBC. After three years he went back into television, in the Planning and Installation Department. During the succeeding nine years in that department he became head of the Television Unit.

In amateur radio circles Mr. Hammans has made many technical contributions to the R.S.G.B. Bulletin. He has specialised in the design and construction of measuring equipment and communications receivers for amateur frequencies.

Mr. Hammans delivered his presidential address to the Society at a meeting at the Institution of Electrical Engineers on Friday, January 27th, 1956. He discussed the single side-band system of transmission, which system he consistently uses with great success from his home station in Orpington, Kent.

Mr. Hammans has represented the R.S.G.B. at International Amateur Radio Union Conferences in Paris, Lausanne and Amsterdam, and is a member of the I.A.R.U. Region 1 International Committee.

Coaxial Cable: Uses for Odd Pieces

SOME HINTS ON MAKING USEFUL COMPONENTS

By "Serviceman."

A SHORT time ago, while visiting the workshop of a fellow constructor, I happened to glance into his waste paper basket. I saw there, amongst the usual collection of discarded technical scribbles, scraps of wire, broken resistors and so forth, several pieces of 80-ohm coaxial. They varied in length from a couple of inches to about a foot. When I pointed them out to him and asked if he could really afford to throw away such valuable material, he looked quite surprised. It transpired that he had been modifying his aerial system; he had bought what he estimated to be just enough cable for the job, and considered it no loss to throw away the left-overs. Before I left every scrap had been transferred to the "spares box"—so very different from the W.P.B.!

Now, this neglect of the possibilities of ordinary coaxial as a circuit element, so common in the ranks of the amateur, is really quite easy to understand. For nearly all the books which deal with the subject do so in a highly technical manner. The earnest enquirer, on taking a volume on resonant line theory down from the shelves of the local library, is instantly confronted with conductances and leakances, and then rapidly plunged into a sea of hyperbolic functions and complex variables. But in spite of all this, once you know the practical methods to use, you may depend upon it that coaxial resonators will work as well for you as for the finest of mathematicians—perhaps better!

Short lengths of coaxial make excellent tuned circuits. Considerations of bulk on the one hand and falling efficiency on the other, fix their most useful working range at 50-500 Mc/s, which covers a wide group of amateur constructors' interests.

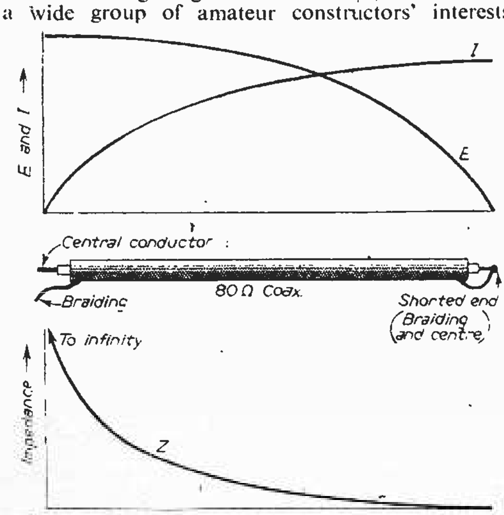


Fig. 1.—Short length of coaxial cable and the impedance, voltage and current curves.

Within this range they will not only do all that the conventional tuned circuit can do, but they will often do it better. They offer an extremely high "Q," freedom from direct radiation, compactness and great versatility in application to physical layout.

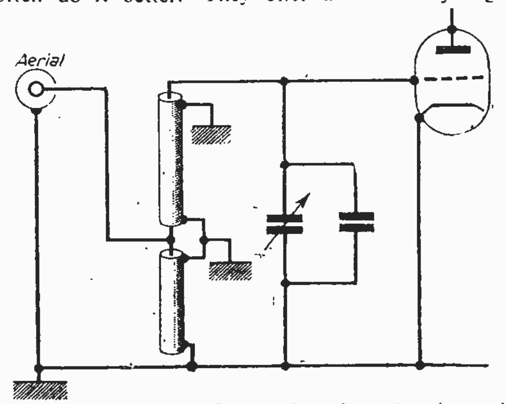
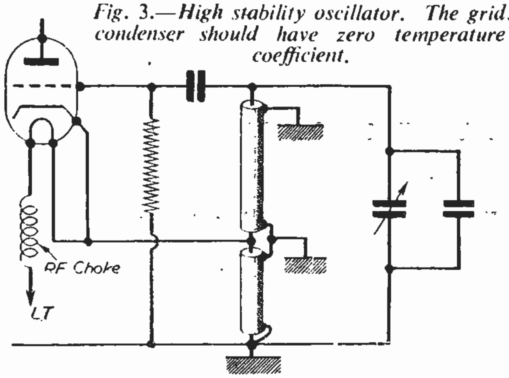


Fig. 2.—Aerial coupling and R.F. tuning (tapped line, braiding earthed at three points).

An Example

How are we to achieve these results as required, without the higher mathematics? Let us start with a piece of cable one quarter-wavelength long (for the exact meaning of one quarter-wavelength, see below). Let us short-circuit one end. This is shown in Fig. 1. Now apply a voltage of the appropriate frequency at the open end, and let its value be E volts. The distribution of voltage and current along the line are then as in the top graph. This is really common sense—we would expect the voltage to drop to zero at the short, and the current to rise to a maximum at the same point; it may be complicated to prove, but it is not difficult to see! Now let us derive the effective impedance at every point in the line. This is done, as in Ohm's Law, by dividing the voltage by the current. This gives us the lower graph, which is derived from the upper one by taking points on the E curve, and dividing these voltage values by the corresponding current figures from the I curve. Once again, as common sense would dictate, we find that the impedance at the short-circuit is zero. (I have actually seen this deduced as the result of a page and a half of calculations!). But look at the input end—that curve is going up and up, and in theory, with a perfect line, would reach infinity. And that is really the whole secret. With certain values of L and C, a parallel-tuned circuit offers a (theoretically) infinite impedance to certain signals—those having a frequency $\frac{1}{2\pi\sqrt{L.C.}}$ With a given length, a short-circuited piece of coaxial offers

Fig. 3.—High stability oscillator. The grid condenser should have zero temperature coefficient.



(theoretically) infinite impedance to certain signals—those having a frequency which makes the line effectively one quarter-wave long. The two things are equivalent, except for considerations of efficiency and convenience.

To practical cases then. I will not presume to offer the instruction on the preparation of open and short-circuited ends on a length of coaxial; however, before discussing circuits, a practicable means of making tappings may not come amiss. It is shown in Fig. 4. To prepare, for example, an 8in. length, tapped at 3in. from the short, cut 5in. and 3in. lengths, and join as illustrated. Incidentally, when cutting lengths it is not usually necessary to make allowance for end stripping, except at the highest frequencies; and even then such allowanse is largely a matter for trial and error. These things are not nearly so critical as some appear to think.

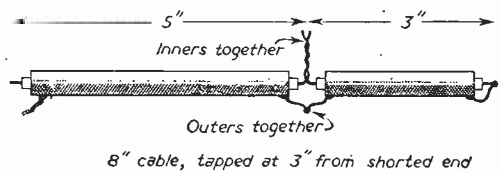


Fig. 4.—A short length of coaxial cable and method of connection.

Fig. 2 shows aerial coupling and R.F. tuning, Fig. 3 is an oscillator and Fig. 5 an R.F. coupling. It will be noticed that in each case the line is tuned by means of a variable condenser in parallel with a fixed one. The connection of capacity across a line has the effect of increasing its length, and the variable, therefore, is a convenient means of tuning. The presence of the fixed condenser has two purposes; firstly, it enables us to use shorter lines than would otherwise be needed, thereby increasing compactness; and secondly, it will be found when using lines that normal values of capacity swing in the variable component tend to give rather wider frequency coverage. Since this is not desirable in, say, the oscillator of a superhet (as it may affect the het volts), and since stages to be ganged together must be constructed similarly, the fixed condenser is included in all the diagrams.

Simplified Diagrams

The diagrams have been kept as simple as possible, in order to preserve the emphasis on the methods of using the lines. Thus, the valve is shown as a triode; it may well be, but you can also use pentodes or tetrodes, while the circuit of Fig. 3 may be used for the triode section of a frequency changer. All that is necessary is to see that the valve selected is suitable for the frequencies to be covered. In Fig. 3, A.V.C. can be supplied in the normal way. In Fig. 5, the line is not shorted, but is shunted at one end by a condenser C1. This is because the central conductor is used to carry H.T. to the anode of the valve. The value of C1 should be large enough to appear substantially a short-circuit to the frequencies concerned—say, 5,000 pF at 50 Mc/s, down to 500 pF at 500 Mc/s. In all the diagrams the outer screening is shown earthed at several points. This has been found in general to be the best procedure, though it is not usually necessary to observe "single point earthing" for the earth connections.

What lengths to cut? Fundamentally, we start from a quarter-wavelength of the highest frequency to be covered, i.e., if we wish to tune from 80-100 Mc/s, we take 100 Mc/s, which is 3 metres, and divide by 4, giving 75 centimetres, or about 30in., which would not be very compact. However, this figure applies only to air-cored cable. For cables having polythene or similar cores, wavelengths within the cable are all shortened to approximately 2/3, which at once brings the length down to 20in. This is still rather long, and so we fall back on the fixed condenser already mentioned in this connection. In the end we find that, with a 20 pF fixed condenser and a 5-25 pF variable, we can cover the range quite nicely with about 6in. to 8in. of cable, much depending, of course, on the input capacity of the valve concerned, and the strays in the circuit.

It is a drastic cut, isn't it, from 30in. to about 7in.? Well, I mentioned that these things might well work better for you than for many a pure theoretician. I know a man who can eye a piece of coaxial for a moment or two, cut and strip it, stick it in a circuit, and get results just like that—and he wouldn't recognise a hyperbolic function if he met it in the street! The best way is to try it and see. Arrange your circuit; cut your cable longer than you need; cut it down, an inch at a time to start with, then more accurately as you reach the desired frequency. In the case of a tapped cable, cut both ends each time, keeping the sections proportional. Try various tapping ratios.

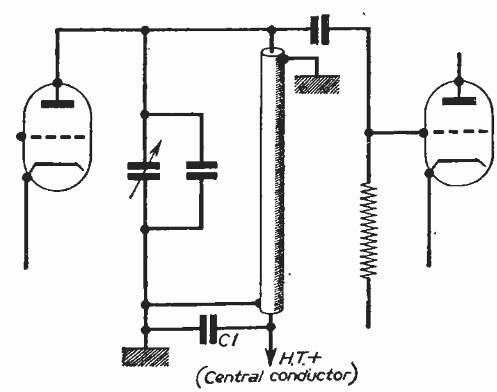
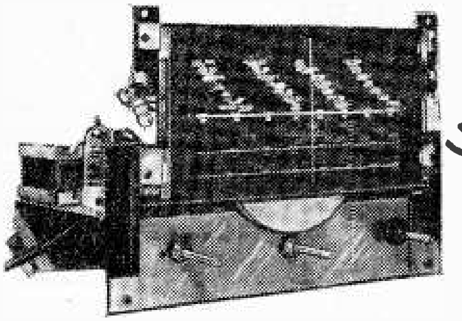


Fig. 5.—R.F. coupling.

MAKING THE "Seven-Five" SUPERHET



A PRE-ALIGNED RECEIVER WITH PUSH-PULL OUTPUT

MANY would-be constructors of superhet receivers are put off by the supposed difficulties of alignment of this type of circuit, and while it is true that accuracy of tuning in this respect is of paramount importance for a first-class performance, the incorporation of the "pre-aligned" components now generally available to the amateur can remove nearly all of the terrors which beset the earlier constructors.

The eight-valve superhet radiogram, described some time ago, is a case in point. No doubt many amateurs not in possession of a signal generator and other test gear did not tackle the job, and the writer has spoken with several people who have expressed this opinion personally. For these people and others like them, therefore, the receiver to be described in this series of articles has been developed. All signal and intermediate-frequency circuits normally requiring careful alignment have been chosen from the Osmor range of pre-aligned parts, and no instruments are necessary in order to trim the set for peak performance. A voltmeter check is useful, of course, but even this need not be considered essential.

In addition to a high efficiency R.F. and I.F. design, advantage has been taken to include a paraphase type phase-splitter and push-pull output amplifier in the circuit with an economy of valves by the use of combined triode-pentodes, the triodes forming the splitter with the pentodes acting as the audio output amplifiers. In addition, the use of a double-diode R.F. pentode in the I.F. stage brings the I.F. amplifier, detector and A.V.C. diode into a single envelope. The receiver is, therefore, effectively a seven-valve design, using only five actual valves (including the rectifier), and should appeal to many constructors who are looking for a general purpose, though simple to build receiver with these interesting features.

It should be remembered, of course, that the push-pull output does not put the receiver in the extremely "Hi-Fi" class or public address category; it remains in the class for which it was designed—a good quality table model chassis with an output of about 2½ watts, together with adequate sensitivity and selectivity on three wavebands and provision for gramophone reproduction if required.

The Circuit

The complete theoretical circuit diagram is given in Fig. 1, where the simplicity of the design is apparent at first glance.

The aerial connects through an anti-modulation hum network C1, C2 and R1 to the R.F. section of the Osmor coil pack, the wiring of which is already completed by the manufacturers as shown in the broken lines. The frequency-changer is an all-glass triode-hexode type X78 (or X79 may be used), with the oscillator working as a bottom-capacity coupled type of circuit; again, this part of the design is ready wired in the coil unit. Tuning of the R.F. and oscillator circuits is accomplished by the twin-gang VC1 and VC2, respectively.

The I.F. output at 465 kc/s is tuned in the first I.F. transformer, IFT1, which is pre-aligned by the manufacturers, and then feeds to the control grid of the variable-mu pentode section of V2, valve type EBF80. The circuit is conventional, and the I.F. output is further tuned in the second transformer, IFT2. Detection takes place in one of the diodes of the EBF80, and the audio signal is filtered and developed in the network R11, R12, C11 and C12. R12 forms the volume control and additionally carries the mains on-and-off switch.

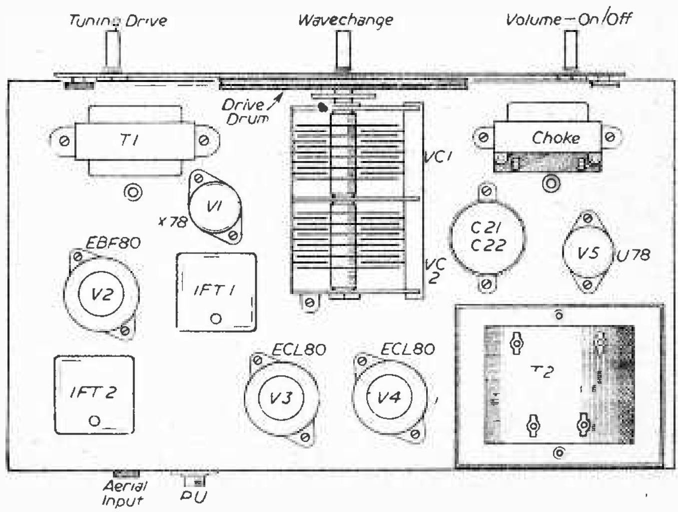
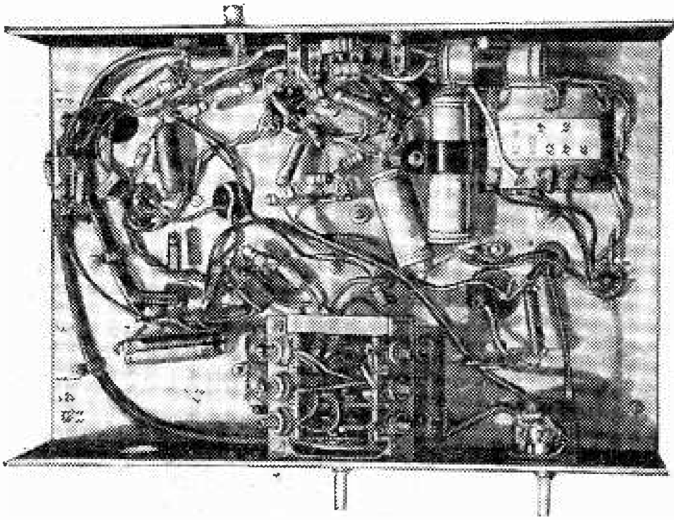


Fig. 3.—General view of the chassis showing valve layout.

The I.F. signal at the anode of V2 feeds through C8 to the second diode of V2 and A.V.C. is developed across R10, R7 and R8, which are effectively in series as the diode load. Part of this voltage is tapped off and applied to V1 and V2 signal grids as control.



Underside view of the chassis showing wiring.

It should be noted that delay is derived across R28 in the common negative lead from the power pack (a matter of about -2 volts), which is also used as standing bias for V1 and V2 cathodes in place of the more usual cathode resistors.

The audio signal developed across the volume control R12, is now applied to the grid of V3A, the first triode section of V3 proper which (like V4) is an ECL80 triode-pentode.

V3A and V4A form two triode resistance-capacity stages, the latter being fed from the junction of two resistances, R19 and R20, respectively, joining their anodes. This circuit has a large degree of self-balancing action, for the grid potential of V4A depends not only upon R19 and R20, but also upon the anode voltages of the valves. If the gain of V4A falls for any reason the output at the anode falls also, and the current through R19 and R20 decreases. The voltage drop across R19 consequently falls and the grid potential of V4A increases. This increases the input to this valve and the fall in output is not equal to the drop in gain initially occurring. R19 and R20 are not equal in value, and are critical within five per cent. of the given values.

The stages are decoupled by R23 and C16, and biased by R15 which forms a part of the total bias applied to the pentode sections. The anode decoupling is necessary as the valves are not balanced from the point of view of the H.T. rail.

The push-pull connections of the pentode sections are conventional, being fed from the anodes of the triodes. The screens are fed from the decoupled point on the H.T. feed, and the anodes connect to the centre-tapped output transformer T1. C20 and R26 form a fixed tone corrector, while C19 which is wired between anode and cathode of V4B, and the stoppers R24 and R25 prevent any possibility of parastic oscillation. The dropper-smoother resistance R27 permits the valves to work within their rated anode dissipations.

Little need be said about the power supply which is derived from a small mains transformer and full-wave rectifier V5 (U78). All the valves and the rectifier are fed from the 6.3 volt winding on the trans-

VALVE BASE C

Valve	1	2	3	4	
X 78	Sc.	Hex. G.	H.K	H	[illegible]
EBF 80	Sc.	G	K	H	[illegible]
ECL 80	Tri. An.	Tri. G.	K	H	[illegible]
U 78	A1	—	H	H	[illegible]

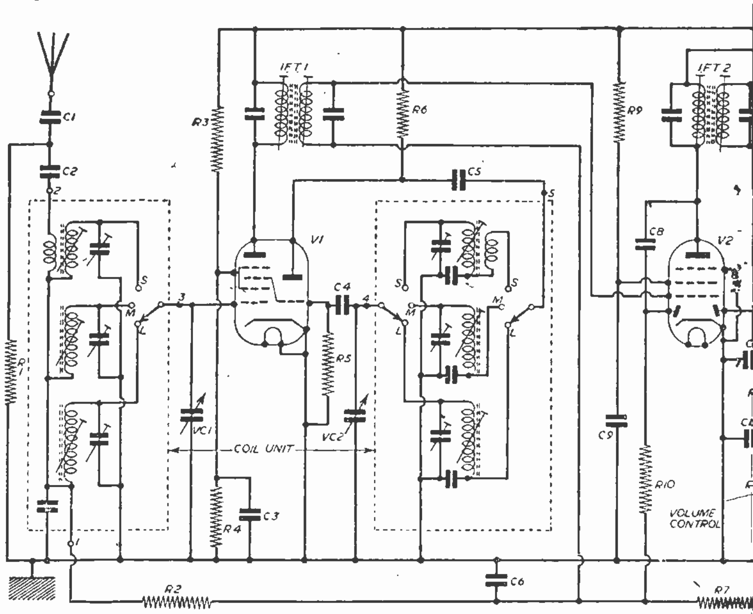


Fig. 1.—Theoretical circuit

former, and the five-volt winding (normally used for a rectifier) now supplies the dial lamps. These latter are rated at the usual six volts and are well protected, therefore, against the common burn-outs experienced when they are run from the valve supply line.

Particular note should be made of the fact that the negative pin of the reservoir electrolytic C23 is *not* wired to chassis (earth), but to the centre-tap of T2, and if a metal-cased condenser is used here it must be insulated from the chassis.

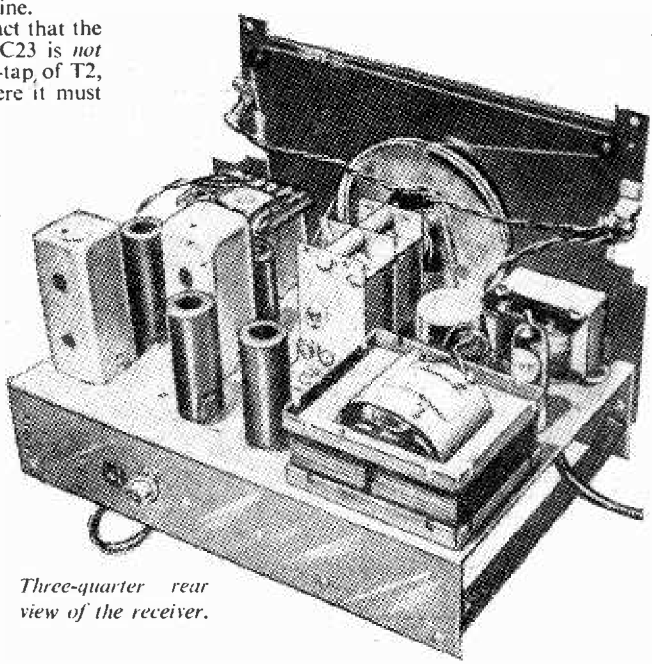
ONNECTIONS

5	6	7	8	9
. An.	Osc. An.	Osc. G.	—	—
H	An.	D1	D2	Supp.
H	Pen. An.	Supp.	Sc.	Pen. G.
—	A2	K	—	—

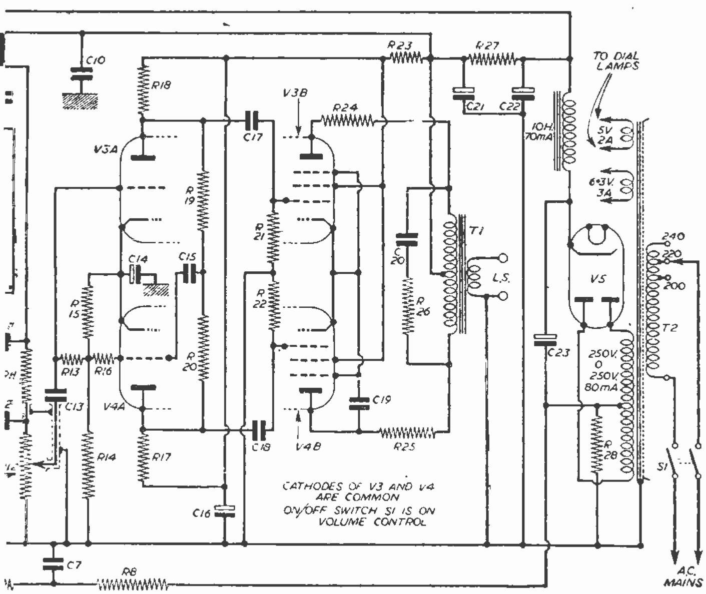
Construction

Fig. 2 on page 185 shows the chassis drilling detail which is later bent up to form a chassis measuring $11\frac{1}{4}$in. by $7\frac{1}{2}$in. by $2\frac{1}{2}$in. deep. All holes are shown except those for the tuning gang and the scale, output transformer and choke; these are best marked through from the actual components as the alignment of the gang and scale particularly is bound to vary slightly from model to model.

If a X79 (9-pin) is to be used in place of the X78 (7-pin) as frequency-changer, the appropriate valve-holder hole marked as FC on the diagram should be made $\frac{3}{4}$in. diameter instead of $\frac{5}{8}$in. diameter. The valves are identical apart from the basing.



Three-quarter rear view of the receiver.



of this new superhet.

Components

The components used in this receiver should be of good make and of the proper values as given in the list, which gives the parts used by the author. Note should be made of the following points: R17, R18, R19 and R20 are 5 per cent. tolerance; C15 should be of paper-cased or ceramic type, not metal-cased; and C23 should be of paper-case or have an insulating jacket if made in metal-case. The fixing clip for the latter should be of the insuloid type in preference to a metal type.

The Osmor type HO coil pack can be supplied in either the standard long, medium and short bands or with the Trawler band in place of long waves. When ordering, state the type and the scale will be supplied by the same manufacturer to suit.

Before mounting any components on the chassis, which should be drilled and bent up in accordance with the dimensions given in Fig. 2 previously, some small changes have to be made to the I.F. transformers as supplied by the manufacturer. Transformer I F.T.1 has a top lead which is intended to go the cap of an I.F. amplifier such as a 6K7, but as the valve used in this receiver is single ended, this lead is no longer necessary above chassis. The transformer should therefore be removed from the can (the whole assembly slides downwards quite easily) and the top lead unsoldered from its tag. In its place a slightly longer wire is soldered and is brought out at the bottom of the assembly along with the other three wires already there. To retain the existing colour code, a green lead is suggested.

The second I.F. transformer, IFT2, should now be removed from its can and the lower black wire unsoldered from its tag. In its place resistor R11 and condenser C11 are soldered, just enough play being left on them to permit their being brought out through the chassis hole provided when the transformer is mounted. This filter is then partly in the I.F. can and partly under chassis: Fig. 4 shows how the components come through the chassis hole when finally fitted. Both transformers should now be replaced in their cans exactly as they were first placed.

Components may now be mounted on the chassis in the positions shown in Fig. 3, on page 179. The valveholders and other light parts are best fitted first, followed by the heavier mains and output transformers and the smoothing choke. The coil unit and tuning condenser should not be fitted until last. When mounting the I.F. transformers, take care to ensure that the core trimming holes face the back of the chassis.

Solder tags should be fitted under the fixing bolts of V1 and V2, also under one of the fixing bolts of the output transformer, above the chassis.

Component Positions

The exact positions of the choke, output transformer and tuning gang are set out from the actual components, and the photographs used in conjunction with Fig. 3 will enable the proper positions to be readily found. The fixing of the tuning gang calls for most care as it must locate with the J.B. type scale drive coupling when the scale assembly itself is fitted to the front edge of the chassis. The height of the gang spindle will vary slightly with different makes, therefore position both scale and gang carefully before marking through on to the chassis the positions of the fixing holes required. The scale is fixed by two 4BA bolts to the chassis front edge, while the gang may require three or four such bolts. If the gang is supplied with rubber grommet-type mountings on the feet, make sure that the wiper tag contacting to the moving vanes is connected to the main chassis by a heavy piece of wire or bonding. Constructors should take care when buying the gang (if it is not of the particular make specified) as many manufacturer's surplus components available very cheaply have the wrong direction of "rotation." For use with the scale specified, the vanes should *close* for a clockwise turn of the spindle. Unless this precaution is taken, the scale cord will have to be rethreaded, and this is not an advisable modification.

Two leads of adequate length should be soldered

(*Continued on page 185*)

LIST OF COMPONENTS

RESISTORS (All Erie ¼-watt, 10%, unless stated otherwise)
R1—10 kΩ
R2—150 kΩ
R3—22 KΩ (1 watt)
R4—33 kΩ (½ watt)
R5, R11—47 kΩ
R6—47 kΩ (½ watt)
R7, R8, R10, R21, R22—470 kΩ
R9—100 kΩ
R13, R16—390 kΩ
R14, R15—100 Ω
R17, R18—180 kΩ 5%
R19—120 kΩ 5%
R20—150 kΩ 5%
R23—3.3 kΩ (½ watt)
R24, R25, R28—47 Ω
R26—15 kΩ
R27—1 kΩ (4 watt)
R12—250 kΩ, carbon log. control with D.P. switch

CONDENSERS (All 350 volt wkg. Hunts or TCC unless otherwise stated)
C1, C2, C13—0.01 μF
C3, C9, C10—0.1 μF
C4, C11—100 pF silver-mica
C5—150 pF silver mica
C6, C7—0.1 μF 150 volt wkg.
C8—33 pF silver-mica or Ceramicon
C12—47 pF silver-mica or Ceramicon
C14—25 μF 12 v. wkg. electrolytic
C15—0.003 μF (not metal-cased type)
C16—16 μF 350 v. wkg. electrolytic
C17, C18, C20—0.005 μF 500 v. wkg.
C19—0.002 μF 500 v. wkg.
C21+C22—32+32 μF 350 v. wkg. electrolytic
C23—8 μF 350 v. wkg. electrolytic (paper cased or with insulating sleeve)

Valveholders:
2 of B7G with 1 screen } Clix
3 of B9A with 3 screens }

Valves:
1 of X78 (or X79). Marconi-Osram.
1 of U78. Marconi-Osram
1 of EBF 80. Mullard.
2 of ECL 80. Mullard

Coil Pack type HO for S.M.L. or S.S.M. } Osmor Radio Products
Prealigned 465 kc/s I.F. transformers }
J.B. type scale and drive to suit above coil pack }

Mains transformer:
250-0-250 v. 70 mA } Douglas Electrical Industries: drop-through type M.T.1
0-6.3 v. 3 amp }
0-5 v. 2 amp }

Choke:
10 H 70 mA. Any reliable make

Output Trans. Push-pull type, ratio 70 : 1 (for 3 ohms speaker). T.R.S., Thornton Heath, Surrey, or Osmor Radio Products.
Speaker: 6in. W.B. HF 610 or 8in. W.B. HF 810

Tag strips:
4 of 6-way, end tags earthed
4 of 3-way, centre tags earthed

Tuning gang: Nominal 500-500 pF swing with fixing feet. (Jackson Bros., etc.)
Insuloid clip for C23
Aerial socket
Co-ax type socket (for P.U. input)
Connecting wire, mains lead, etc.
Few feet of single screened lead
1ft. of twin screened lead

N.B.—The valve screening cans are of the types to suit the valves concerned. The U78 rectifier is left unscreened.

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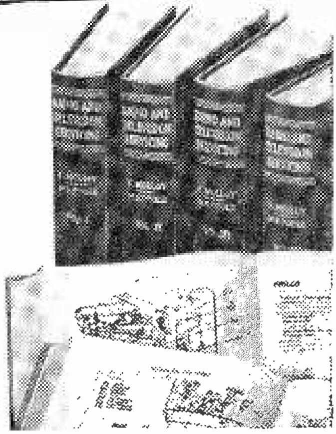

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350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2 a ... 18/9
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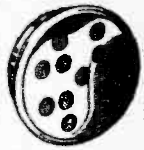

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5, HARROW ROAD, PADDINGTON, LONDON, W.2 TEL.: PADDINGTON 1008/9, 0401 to the fixed vane tags on the underside of the gang before it is finally screwed down, these wires then being threaded through the appropriate holes for eventual connection to the coil pack below the deck.

The coil pack itself may now be fitted. This is single hole fixing, and with the position of the hole as given in the drilling diagram, the unit should just sit comfortably on the floor of the chassis, actually resting on the coil former bases where they project slightly through the paxolin base of the coil pack. If by any chance one or more of the gang fixing bolts should foul the underside of the pack, replace these bolts with countersunk types, the nuts then being above chassis. The fixing nut of the coil pack should be tightened very firmly as the internal earthing of the unit depends on this contact.

Wiring

The wiring is very simple and the layout to be given next month is easily followed. The photograph on page 180 shows the underchassis view with most of the wiring completed.

The following points are worthy of particular note: where metal-cased condensers are used without the plastic sleeve, ensure that the cases do not touch on to "live" tags; R11 and C11, where they emerge from the I.F. can should be well clear of the chassis; the outgoing leads from both I.F. transformer cans should not be tangled round one another more than is absolutely necessary; the screened leads, where used, should have insulated covering, and the braiding should be earthed only at one end—the twin lead from V3 and V4 is earthed at the output transformer end.

(To be continued)

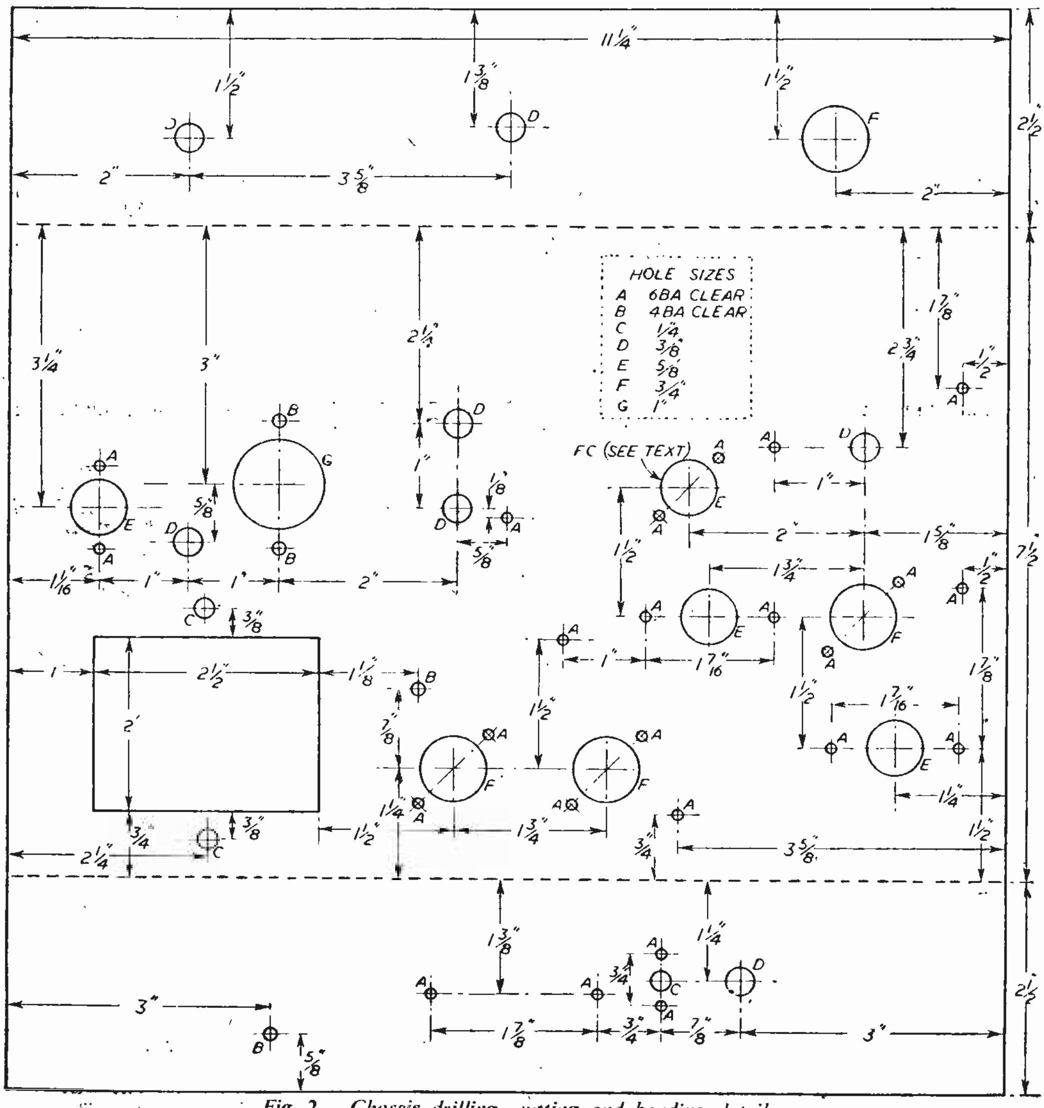


Fig. 2.—Chassis drilling, cutting and bending details.

Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

Plays

THE series of plays, every Monday and Saturday, covering three months in all and grouped under the generic title of " Between Two Worlds ", will have ended by the time these lines appear. They were as uneven in quality and as nebulous and indeterminate in character as the dreadful signature tune preceding each. One was left wondering what the " two worlds " were which had the doubtful privilege of being so bridged. They, too, were as undefined as the plays themselves. Many were by Continental playwrights and probably suffered in their channel crossing. Presumably the mists usually surrounding these island shores were prevalent at the time of their arrival and can be accounted responsible for the difficulty in observing their purport and meaning. They seem as unlikely to reappear as much modern music is—to which they bore a strong resemblance—unless the BBC should be so unwise as to handle them. In summary it might have been a good idea to have called the excellent Wednesday evening ones " Between Two Shadows " during their showing.

Gilbert and Sullivan

These are figures of such monumental stature and Sullivan's music is held in such universal esteem, that the majority of listeners may be blinded thereby to some grave defects in the six-episode serial bearing their name broadcast on Sunday evenings. The music is so enchanting that, the minute it is broken into by an adverse comment or, the spoken word, immediately preceding it, the interruptor is almost bound to be told to hold his tongue and to shut up. But the fact remains that, judging by the first two episodes, it should have been much, much better. It was, by the way, originally done five or six years ago.

The whole thing being, so to speak, a musical entertainment, it was really a life of Sullivan rather than the story of a partnership. Little was told us of Gilbert's early years and the influences moulding his future. And less still about the state of the theatre when they first met ; and over which they were to have such an important and lasting influence. The same hansom cab came clopperty-clopping up the road as we hear in all Victorian programmes, envelopes were torn open and their contents read by various persons, whilst a liberal sprinkling of " my dear Gilbert " and " my dear Sullivan " interspersed their duologues whenever they met. Richard Burden, Clive Morton and Richard Hurdnall were the chief actors, whilst the songs were beautifully sung by Joyce Gartside, Thomas Round, Arnold Matters, Sheila Rex, Edmund Donlevy and Gilbert Wright, BBC concert orchestra was under Charles Mackerras, chorus under Leslie Woodgate, pianist Alan Richardson and production by Vernon Harris. Story by Leslie Bailey.

" Music to Remember "

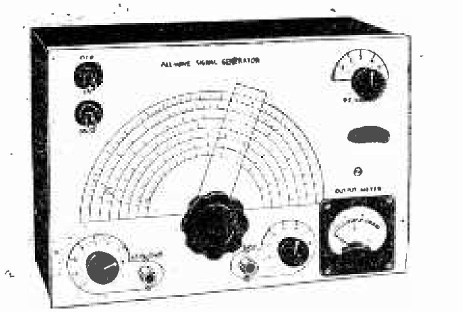
This is a pleasant series, broadcast on Mondays at 7.30 p.m., and lasting an hour. It should prove acceptable to returning office workers and others who like Stravinsky with their steak, and Carmen with their coffee (there is also Tchaikovsky for those who prefer tea). The items are announced by various well-known personalities with a happy mixture of erudition and " this way, madam," humour. They are all given by well-known orchestras before public audiences. " Well Remembered Music " would be a much more accurate title, because I have failed, so far, to spot either any item that is not very, very popular and established, or any of any length. " Music to Remember " rather implies that it is new to the listener, and that he or she might care to " remember " it and switch on next time it turns up.

Capital Punishment

A very interesting programme, of an hour's duration, was given based on the evidence brought recently before the Royal Commission on Capital Punishment. Debarred from reporting on the advisability, or otherwise, of abolishing hanging, it nonetheless heard all views both for and against. The programme had a number of actors reading the evidence as given before the commission, most of which seemed to be against abolition. It was instructive to hear the views of many famous people on this vexed but very important question. From the quiet of one's own armchair, one could form one's own opinion with some degree of detachment and objectivity.

" Music in Miniature "

This proceeds, like Tennyson's " Brook," on its pleasant and ingenuous way. A collection of small pieces and short movements from larger ones, with songs interspersed, all carefully chosen from the best vintages, are played through incognito and without a break. I wonder if this programme ever forms the subject of a quiz in the home circle? It well could do as, although most of the items performed are very well known, there is usually the less hackneyed one to prevent a completely correct list of titles being compiled too often. The absence of piece names reminds one of Debussy, who in his two books of Preludes, placed the titles at the end of each piece to help the reader form his own impressions himself before learning what the composer's were. Would anyone guess " The Girl With the Flaxen Hair " correctly ?



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Three-speed automatic changer, B.S.R. Monarch. current model. Will take 7in., 10in. or 12in. records mixed. Turn-over crystal head, cream finish. VERY LIMITED QUANTITY. A.C. mains 200 250. **£7 15 0.** P. & P. 3/-.

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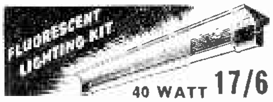
Standard Wave-change Switches, 4-pole 3-way, **1 9** ; 5-pole 3-way, **1/9**. Miniature 3-pole 4-way, 4-pole 3-way, **2 6**. 2-pole 11-way twin wafer, **5/-**. 1-pole 12-way single wafer, **4/-**.



A.C. Mains 230-240. Comprising choke, power-factor condenser, 2 tube holders, starter and starter-holder. No tube or metal work supplied. P. & P., 3/-. **17 6.**

20 watt A.C. or D.C. 200 250 v. fluorescent kit, comprising trough in white-stoved enamel, two tubeholders, starter, holder and barreter. No tube. P. & P., 1/6. **12 6.**

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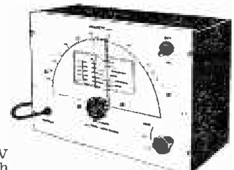

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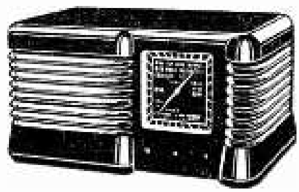

Complete A.C. Mains 3 valve plus metal rectifier T.R.F. kit. In the above cabinet, **£3 15 0.** plus 3 6 P. & P.

PLASTIC CABINET as illustrated, 11¼ x 6½ x 5¾in. in walnut or cream. ALSO IN POLISHED WALNUT, complete, with T.R.F. chassis, 2 waveband scale, station names, new waveband, back-plate drum, pointer, spring, drive spindle, 3 knobs and back, **22 6.** P. & P. 3 6.

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16 x 8 mfd., 500 wkg. ...	4 6	8 mfd., 150 wkg. ...	1 6
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250 mfd., 12 v. wkg. ...	1 -	250 v. 350 mA., 6.3 v. 4 a. twice, 2 v. 2 a.	19 6
16 mfd., 500 wkg., wire ends...	3/3	Auto-trans., input 200 250 HT 500 v. 250 mA. 6 v. 4 a. twice 2 v. 2 a. ...	19 6
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100 mfd., 350 wkg. ...	4/-		

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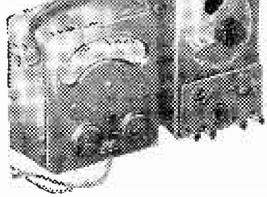
Using TEST INSTRUMENTS



Part 15 of a Series of Articles Dealing with the Practical Application of Standard Test Equipment

(Continued from page 134 February issue)

Alignment Procedure (55)

A NUMBER of commercial receivers now on the market are designed for operation on either A.M. or F.M. signals. The A.M. section of receivers of this kind should generally be aligned before the F.M. section (this is given in the alignment instructions appertaining to the particular receiver), and the alignment procedure in this connection is more or less typical of standard A.M. receivers.

As is common with both modes of reception, the F.M. I.F. transformers are the first to come under adjustment. Using the Cossor 523 F.M. series receivers as a basis for illustration (the method of adjustment differs slightly between receivers, though the method to be described is fairly typical), a 10.7 Mc/s signal (representing the standard F.M. intermediate frequency) deviated plus and minus 300 kc/s is applied to the control grid of the first I.F. valve. In composite A.M./F.M. receivers this valve is frequently the hexode section of the A.M. frequency changer, as the oscillator is switched out of circuit on the F.M. position and the F.M. tuner unit switched in.

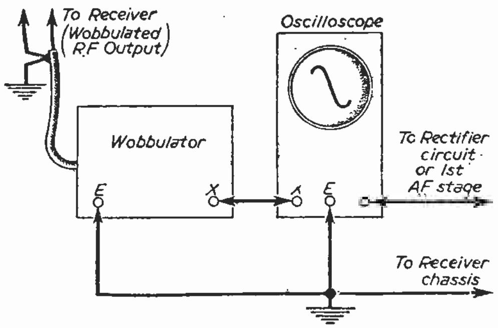


Fig. 70.—Illustrating the method of connecting a 'scope and wobbulator for aligning F.M. receivers.

With the 'scope connected, as described last month, the cores of the second I.F. transformer should be adjusted until a response curve similar to that shown at 73a is obtained on the screen of the C.R.T. A pip will be observed at the 10.7 Mc/s position on this curve; this is produced by the injection of an additional calibrated signal from the wobbulator. Altering the frequency of the associated signal generator will, of course, cause the marker-pip to move along the displayed response curve. This is very useful when making adjustments, as it facilitates tuning for optimum symmetry of response and permits easy assessment of the width of the curve in terms of frequency.

After having made this adjustment satisfactorily, the signal, still deviated plus and minus 300 kc/s, is lightly coupled to the F.M. frequency changer valve. Coupling should not be made direct to the circuit, it being sufficient normally either to connect the signal to the screening can of the valve, and lift the can up the valve so that it disconnects from the chassis, or to couple a few turns of wire round the valve envelope and feed the signal to this.

The primary of the first I.F. transformer (this is often situated on the F.M. tuner chassis) is then adjusted until a curve similar to Fig. 73b is obtained. Before this adjustment is made, however, it is best to detune the secondary of the same transformer; this acts in the same manner as does a damping resistor when band-pass circuits are aligned by the signal generator and output meter method.

Finally, the secondary of the first I.F. transformer is carefully adjusted until a symmetrical response such as that at Fig. 73c is obtained.

Adjusting the Discriminator Transformer (56)

It will be realised that, so far, our aim has been to obtain a symmetrically shaped I.F. response curve, whose width extends plus and minus 200 kc/s either side of the nominal frequency. It is now necessary to transfer the characteristics of this response to the discriminator transformer and adjust the tapped secondary winding so that the two halves of the diode circuit are equally balanced.

Now, if a temporary rectifier circuit has been used for the I.F. alignment this is disconnected, and the "Y" deflection amplifier on the 'scope is con-

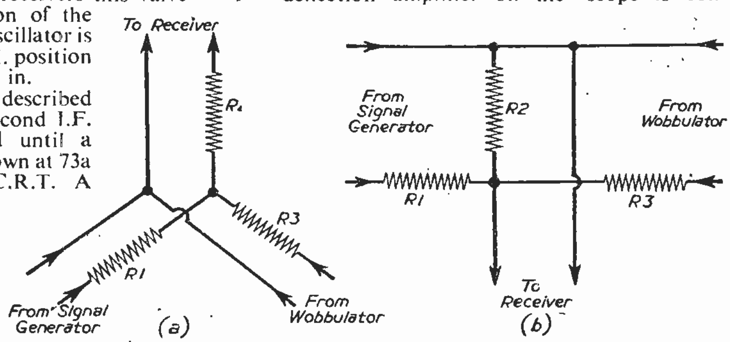


Fig. 71.—Coupling two signals by means of a star network (a) and "T"-pad (b).

nected to the grid or anode circuit of the first A.F. valve.

With the signal capacitively coupled to the F.M. frequency changer valve as before the primary of the discriminator transformer is adjusted for maximum amplitude and symmetry of response, as indicated at Fig. 73d. It should be noted that the curve may this time resolve inverted if the "Y" connection on the 'scope has been transferred from the temporary rectifier circuit to the A.F. valve. If a hump tends to appear on this curve to give it an effect similar to that at Fig. 73e, the secondary of the discriminator transformer should be put more out of balance by detuning.

It now remains to balance the secondary winding with respect to the diodes. This is done by carefully bringing the secondary back into tune, and as it comes into resonance the displayed curve will gradually become asymmetrical. As the correct setting for the secondary trimmer is approached the response curve will look something like that at Fig. 73e. Extra special care should be given to this adjustment, however, and the aim should be for optimum balance relative to the 10.7 Mc/s centre point.

R.F. Alignment (57)

Aligning the R.F. section of any F.M. receiver is a relatively simple matter compared with a three waveband A.M. receiver. It is generally necessary to apply the wobbulated signal to the aerial input socket, and then adjust the local oscillator first at the high-frequency, then at the low-frequency end of the F.M. band (Band II).

The deviation, or sweep, of the wobbulator should be readjusted to 100 kc/s, for it must be remembered that the maximum deviation of the F.M. signals of the BBC is only plus and minus 75 kc/s. The signal was initially wobbulated at 300 kc/s to stretch out the response display horizontally and therefore ease the I.F. alignment process.

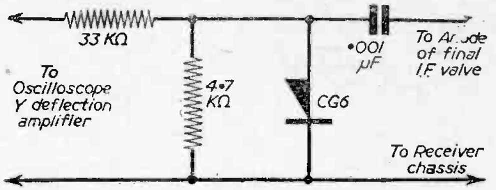


Fig. 72.—Circuit of rectifier system for obtaining a "Y" plate voltage.

With the sweep set at 100 kc/s, the overall response curve will look something like that at Fig. 73f, which is approximately half the width of the curve at 73e, and ideally it should form a straight line, but this is rarely possible owing to the cumulative effect of component and circuit tolerances.

The response resolves on the screen when the oscillator is adjusted to correspond with the applied signal, after first setting the receiver pointer to the appropriate position on the scale.

If there is an R.F. adjustment, this should be set to give maximum output, indicated by maximum vertical amplitude of the trace. Care should be take not to overload the "Y" amplifier, otherwise an increase in output will tend to flatten the ends of the curve instead of causing it to enlarge vertically.

(To be continued)

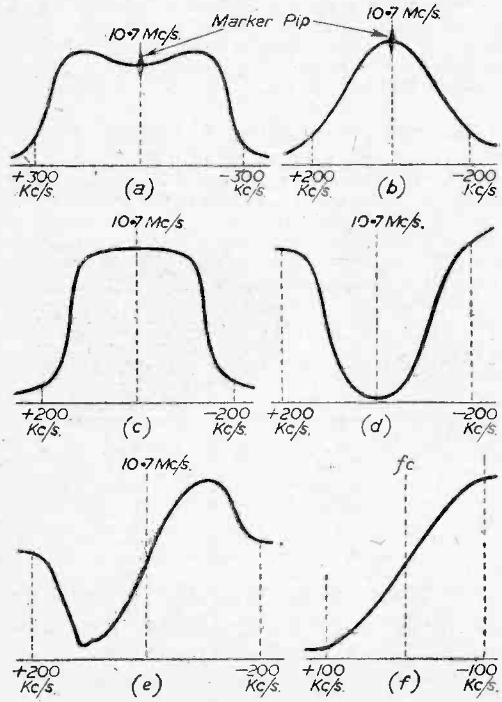
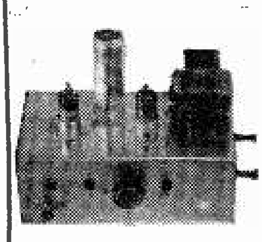


Fig. 73.—Traces obtained during the alignment of F.M. receivers.



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80 ohm CABLE COAX

STANDARD ¼in. diam. Polythene insulated. GRADE "A" ONLY.

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SPECIAL. — Semi-air spaced polythene. 80 ohm **Coax** ¼in. diam. Stranded core. Losses cut 50%. **9d. yd.**

TWIN FEEDER, 80 ohms, **6d.** yd. ; 300 ohms, **8d.** yd.
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50 OHM COAX CABLE 8d. per yd. ¼in. dia.

TRIMMERS, **Ceramic,** 4 pf.—70 pf., **9d.** 100 pf., 150 pf., **1/3** ; 250 pf., **1/6** ; 600 pf., **1/9. PHILIPS** Beehive Type—2 to 8 pf. or 3 to 30 pf., **1/3** each.

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5 w.	25 ohm —	1/3
10 w.	10,000	1/6
15 w.	ohms	2/-
5 w.	15,000 —	
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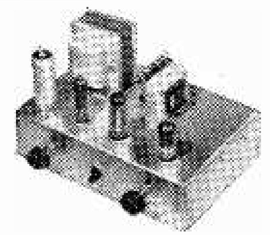

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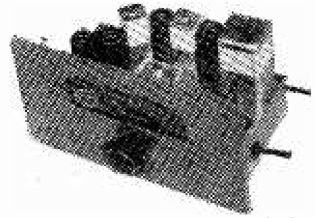

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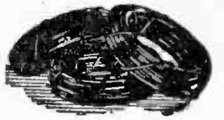

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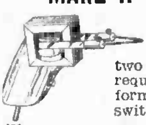

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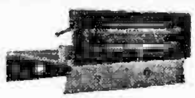

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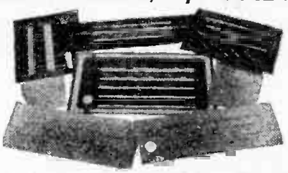

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See page 153 for address

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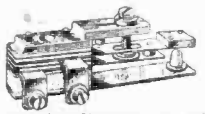

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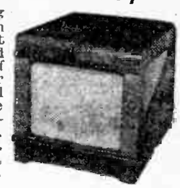

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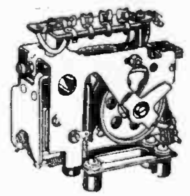

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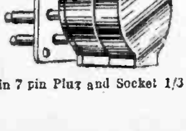

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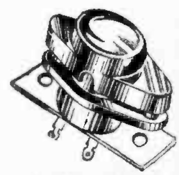

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LEEDS I.

TRANSMITTING TOPICS

TAILORING THE SPEECH

By O. J. Russell, B.Sc., A.Inst.P. (G3BHJ)

WHILE many amateurs devote much time and attention to the R.F. side of a transmitter they are often inclined to let the modulator look after itself. True, some thought may be given to microphone and modulator transformer selection, but the audio side of the modulator is seldom considered deeply. Indeed, now that "clamp-tube" modulation is the order of the day, the modulator as such has practically disappeared, and a very decreased-power speech amplifier suffices as the audio side of the equipment. Beyond ensuring that enough gain exists to swing the carrier, very little attention is given to the audio side, particularly as some "clamp" systems advocated are not precisely "Hi-Fi," and do not require excessive attention to speech-amplifier designs aspects.

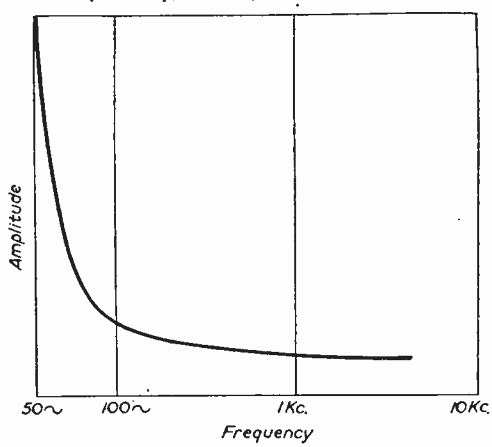

Fig. 1.—Approximate frequency distribution of components in the average Male voice.

Unfortunately, many microphone operators are missing a good deal of efficiency, in the communication sense, by not devoting enough attention to audio design aspects of a communication speech system. This does not mean that super high-fidelity amplifiers are requisite; indeed, while articles have appeared proudly proclaiming that the operator uses his modulator amplifier to reproduce symphony concerts when not on the air . . . such ideas are a retrograde step from the communication aspect. Thus, unless fitted with a variable top cutting control, a truly "Hi-Fi" modulator would occupy a very broad bandwidth compared with a "communications quality" audio channel designed for optimum intelligibility with economy of ether space. It should be firmly impressed that "communication quality," does not imply tinny, distorted speech. Speech can be "tailored" to an economical bandwidth without losing quality, "voice individuality," and without sounding distorted.

However, in the matter of distortion it is a pity that many amateurs do not apply a judicious measure of negative feedback in modulators. Thus, with an anode modulator, feedback in the high-level modulating valves can improve "overload" characteristics, clean up speech, and enable the modulator to cope with appreciable mis-matches in the modulation transformer. In the case of "efficiency" systems, such as grid and screen modulation, negative feedback is even more important, as the widely varying impedance of the grid or screen under modulation may create violent distortion of the audio from the modulator. This can be greatly alleviated by negative feedback, so that although an efficient modulation system operates at a very low audio power level, negative feedback may be needed to reduce inherent distortions. While seldom used in amateur practice, it is possible to use "carrier feedback." In this system part of the R.F. output of the P.A. is rectified and the audio fed back degeneratively to the speech amplifier. Thus, overall negative feedback from the modulated R.F. is obtained, and non-linearities arising from the P.A. itself corrected or diminished. The use of negative feedback principles in modulator design is therefore valuable, and should not be overlooked.

Frequency Range

The above considerations are, of course, obvious ones which derive from good practice in broadcast receiver and amplifier design. Now for some of the less obvious aspects of the audio side of "communication" speech systems. It is an unquestioned "principle" to speak of "boosting the highs" and of "cutting the bass" to achieve "communication" speech. A little reflection will show that this is not quite self-evident. Thus, if the amplitude of any frequency in the voice is the same, that is, audio

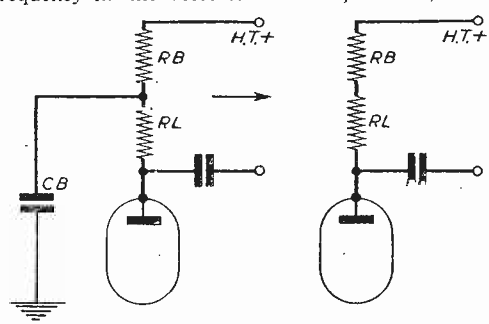

Fig. 2.—At very low frequencies the reactance of the by-pass condenser CB is very high. Thus the effective anode load becomes RB+RL. This may cause unwanted bass boosting.

power is evenly distributed over the voice frequencies, then "cutting the bass" would serve no useful purpose. Indeed, it would merely remove frequencies that might contribute to personality and so destroy the naturalness of the voice. Again, "boosting the highs" is definitely not a good idea, with a fairly uniform distribution of voice frequencies. If we "boost" the highs, we shall over-modulate on the "highs," while the "lows" would still be well below the "over-modulation" level. Clearly, as a restricted bandwidth is also desirable on the crowded amateur bands, we must not boost too much of the "highs," or side-band "splatter" will be grossly accentuated. The basis for this piece of amateur "folk lore" needs careful investigation.

To put the matter on a sound footing, Fig. 1 gives a diagrammatic representation of the frequency to amplitude distribution of energy in a typical male voice. While in the upper register above about 500 cycles the energy content is approximately constant, the energy increases sharply in the deep bass register, so much so that there is something like 100 times as much power in the deep bass as in the 1,000-cycle region. It should be noted that as the ear is much less sensitive to the bass register than the 1,000-cycle region where the ear is most sensitive, the balance of such a frequency distribution does not sound like a "deep" voice, despite the high amplitude of the bass components. It must also be realised that female voices are deficient in high amplitude bass frequencies, so that in fact the basic fundamental frequencies of certain sounds, for example the letter "u," are completely missing from female voices, although the ear notices no difference between the male and female letter "u," other than a moderate pitch difference. This leads us to contemplate the effect of attenuating or removing the extreme bass frequencies.

As far as intelligibility goes, most of the extreme bass can be removed with no effect upon intelligibility. Most male voices are also almost unaffected in quality, except for those with very deep voices, in which case the voice does become "thin." From the point of view of communication efficiency, however, we have gained vastly compared with a "straight-line" audio characteristic. For if our audio amplifier reproduced the lower frequencies we should have something like 100 times the power in the bass as compared with the upper voice frequencies. On increasing the gain, until over-modulation occurs, we should over-modulate on the bass, while the middle register was still some 20 dB below the over-modulation point. In fact almost every amateur who has conscientiously adjusted his aduio level with a cathode-ray modulation indicator to 100 per cent. level, with no over-modulation on peaks, receives reports of "under-modulation." Increasing audio until peaks are definitely over-modulating produces reports of "well modulated." This is often due, unless the modulator includes "audio tailoring," to the bass frequencies overloading the P.A. long before the "middles" have reached the 100 per cent. modulation mark.

In this connection an insidious cause of even further accentuated amplitude in the bass is illustrated in Fig. 2. This shows the by-passed anode feed to a speech amplifier stage. Unless a large by-pass condenser is used, the gain in the bass may be much greater than in the upper register. In fact this type of circuit with appropriate condenser values is sometimes used as a "bass boost" circuit. At very low frequencies the by-pass condenser has no effect, so that the effective anode load is the anode load

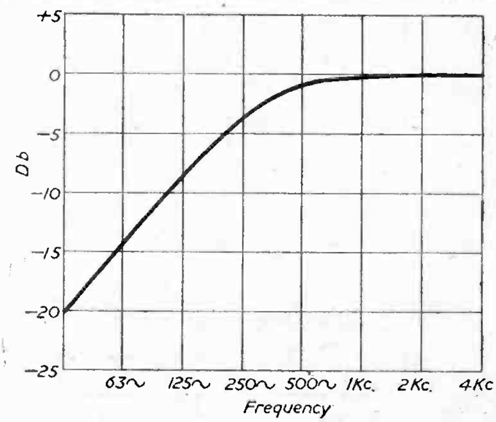

Fig. 4.—Bass attenuation curve suitable for speech "tailoring."

resistor and the by-pass resistor in series; thus the gain at the low bass region may be considerably higher than in the middle register. In the middle and upper register, of course, the by-pass condenser is effective, and the effective anode load is only the actual anode resistor. Thus adequate by-pass condensers are necessary to prevent unintentional bass boosting.

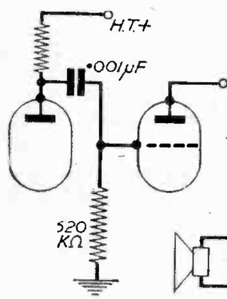

Fig. 3.—Grid coupling values to attenuate bass frequencies.

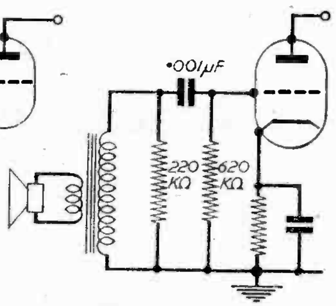

Fig. 5.—Bass correction as applied to a dynamic microphone.

Bass Cut

It is clear, therefore, that the modulator amplifier must attentuate the lower bass register to prevent bass frequencies over-modulating. If this is done, gain can be stepped up so that the middle register of "intelligence carrying" speech frequencies reach the level at which full modulation occurs. If this is done it is clear that an effective 20 bB of speech level gain is achieved. As in many cases where a flat frequency response is used, some over-modulation is tolerated. This will not give quite so much gain, but "splatter" will be eliminated. A modulator with a flat frequency characteristic if adjusted by an oscilloscope to just not over-modulate gives the effect of under-modulation. When the gain is turned up to give "full" modulation reports, the oscilloscope

(Continued on page 197)

reveals appreciable over-modulation occuring on the peaks, and splatter. These effects are eliminated and fuller modulation on the middle register achieved, if the bass is attentuated.

A bass roll-off starting at around 250 cycles will satisfactorily attenuate the bass register. This can be given in many ways. One method is to use a suitable condenser and gridleak value in an inter-stage coupling. Fig. 3 gives values suitable for this roll-off, the shape of which is shown in the graph of Fig. 4. Sharper cut-offs may be obtained by cascading stages. Variation of the coupling condenser value will give varying degrees of bass cut-off frequency of the combination of condenser and gridleak

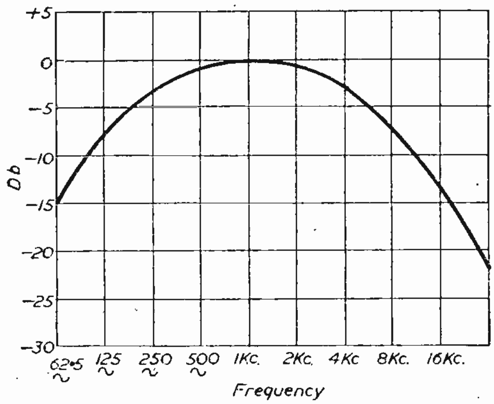

Fig. 6.—A frequency curve for "communication" quality speech.

People with voices of unusually deep timbre may well experiment to obtain an optimum audio characteristic, as one or two microphone operators of unusually deep voices have been heard on the air remarking that a "bass cut" removes their voices as well! However, the extreme bass can still be cut in such cases without impairing intelligibility or seriously damaging voice personality if the bass cut circuits are adjusted to suit these exceptional voices. Thus, generally, a condenser value of twice to three times the figure shown will generally be found adequate to preserve the voice frequencies of a deep voice while still attenuating the extreme frequencies at which audio amplitude is greatest in the voice spectrum.

An Alternative

Owners of a crystal microphone can achieve a "bass roll-off" in an even simpler fashion. If the grid resistor into which the microphone feeds is reduced to 220,000 ohms or 100,000 ohms, instead of the two to five megohms usually employed, this will give an adequate roll-off. In fact the resistor value found most effective can be wired individually across the microphone itself, so that where several mikes are used they can be individually corrected for optimum results and can thus be plugged-in without need for tedious adjustments to the amplifier itself. In this case, of course, the usual high value gridleak inside the amplifier can be retained, as it will not have any appreciable effect upon the much lower load resistor of the crystal microphone. For users of carbon mikes or dynamic mikes a similar bass attenuator can be fitted to the input stage as shown in Fig. 5. This will give the desired drooping bass characteristic and thus compensate the response to give optimum "communication" quality in the bass region.

Upper Register

So much for the bass register, now for the upper register. Here again for communication purposes it is desirable to attenuate the highest frequencies to prevent excessive "spread" of the microphone signal. In crowded bands, radiation of the highest speech frequencies merely adds to inter-station splatter. Moreover, under QRM conditions with high selectivity at the receiving end the highest frequencies are removed by the receiver, so that it does not matter whether they are radiated or not. If an attenuation curve with a cut-off starting at about 3 kc/s is used, then speech intelligibility and crispness is scarcely affected, but signal spread is effectively minimised.

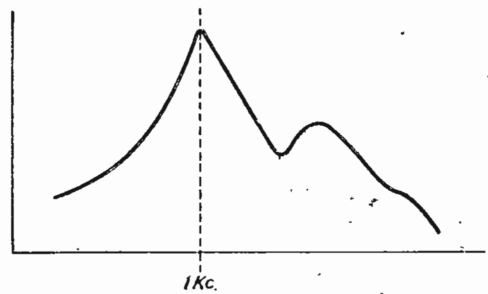

Fig. 7.—Approximate telephone frequency response curve.

Hence the overall speech amplifier characteristic to aim at is shown in Fig. 6, which combines the bass and treble cut-offs recommended. In point of fact such a curve while concentrating on optimum intelligibility gives a quiet Hi-Fi impression and does not mutilate voice quality or blur individuality appreciably. As a contrast, Fig. 7 gives an impression of the overall response of a telephone circuit; despite this no complaints are made that voices cannot be recognised on the telephone! It is clear that far more drastic frequency "tailoring" could be applied in amateur practice without destroying voice individuality.

A Warning

However, a warning must be given. The fact that a restricted voice range is adequate for intelligibility and even pleasing voice quality, does not mean that any type of microphone will do. In fact a microphone of good characteristics is needed. It is also desirable that it should have a flat response devoid of peaks. Obviously if a sharp peak occurs in the response curve, frequencies around the peak will be preferentially boosted. Thus over-modulation may occur at these frequencies despite the fact that the rest of the voice frequency range is well below the 100 per cent. modulation mark. Thus to avoid over-modulation it will be necessary to reduce the general level. However, with a flat microphone response we would be able to boost the overall level. Thus if a 3 dB peak exists in the microphone curve, we have to reduce the general level 3 dB to prevent over-modulation at frequencies near the microphone peak. In fact a 3 dB peak is a small one, yet it has effectively reduced a 100-watt signal to the 50-watt level. A 6 dB peak would lose us some 6 dB of general level if over-modulation is to be avoided, and so on. As peaks of this order or greater are not unusual with cheap microphones, this may seriously reduce modulation capability. Naturally, in the case of speech frequencies, the individual voices may have greatly varying frequency contents, so the problem is not so simple. However, the reason for the statement that "such and such a microphone does not suit my voice" is often that the microphone has a peak coinciding with prominent voice frequencies in the speech of the particular person concerned. This, of course, would greatly accentuate the problem of avoiding over-modulation while maintaining a high average level of the general voice frequencies. This again ties in with the fact

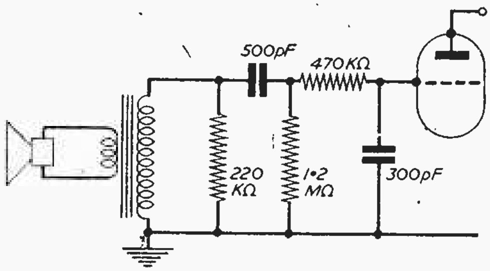

Fig. 8.—Component values to use with a dynamic or carbon microphone for "tailored" speech.

often noticed on the air of how some voices appear to "modulate better" than others. It is clear, therefore, that in individual cases there is a great deal of room for individual variation in voice frequency "tailoring" and microphone selection in the case of "difficult" voices. It is hoped that the above information may be of assistance in such cases. It is also true that most normal voices are adequately catered fo, by the circuits described. Lady operators, however, will seldom need to incorporate "bass cut" due to the higher pitch of female voices. It should be noted that R. Paddon (G2PD) first investigated scientifically the optimum voice frequency ranges for amateur communication effectiveness—although this work was only published in an American journal, and dates back to before the war. But while basically his conclusions have been adopted, one seldom finds a reference to his detailed pioneer work.

Carbon Microphones

Finally, users of P.O. carbon mikes are warned that these have a sharp peak at around 1,000 cycles. This is so sharp that the use of a sharply tuned attenuator is suggested to overcome the disadvantages of this effect. It is also to be noted that many deaf-aid crystal microphone inserts also tend to peak somewhat between 1,000 and 3,000 cycles, so that individual "doctoring" to ameliorate these peaks is needed in some cases. While moderate peaks are of no effect and are in fact unnoticeable in their legitimate use in deaf aids, it will now be appreciated that these peaks may be important in transmitter applications. The fact that these peaks may sharply deteriorate the "modulation capability" of a transmitter if not compensated for, is not widely recognised. However, this may account for the indifferent microphone results of some operators. The means of compensating for such peaks are known, of course. There are from the communication angle better and more

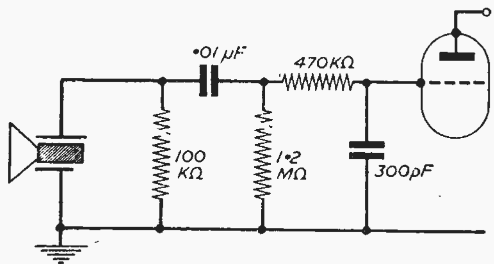

Fig. 9.—Component values for use with a crystal microphone to give "tailored" speech.

effective measures for dealing with the "peak" problem. This it is hoped will be dealt with shortly, as it again offers means of further improving the "communication effectiveness" of an amateur transmitter.

While elaborate tone control circuits could be employed to "tailor" speech to the Fig. 6 type of curve, it is easy to incorporate fixed correction directly at the microphone input. These components may even be wired directly in the microphone (or transformer) to give the required type of "tailored" response. Commercial units are even sold in the U.S.A. to correct crystal microphones.

Fig. 8 shows how a dynamic or transverse carbon microphone may be corrected. Fig. 9 shows how a typical crystal microphone might be corrected. For a crystal mike it is quite feasible to attach the correction circuits directly to the microphone. This would enable individual microphones to be used with standard preamplifiers or with any given speech equipment to give "communication" speech.

"Yeoman Service"

A PHILIPS radio receiver purchased in 1928 was the subject of a letter recently received at the Scottish Regional Office of Philips Electrical Limited from 70 year-old Mr. Tom Annand of Primroschill Drive, Aberdeen.

It told how Mr. Annand had bought the set—Model 2514 (a 2-wave 3-valve fixed A.C. model) from Messrs. Clark, radio dealers, of Aberdeen. Although the set was still in perfect working order and rendering good service, Mr. Annand rightly felt that after twenty-seven years it was in need of general overhauling and cleaning, etc.

R. G. Hawthorn, Philips' representative for Aberdeen, called on Mr. Annand and reported that the set—and the speaker which was purchased at the same time—were operating well on an indoor aerial consisting of a very short length of flex. The seals were still intact. It was decided, however, that, in view of the receiver's great age and the impossibility of replacing components which might show signs of wear and tear, renovation would not be a practical proposition.

Accordingly, Mr. Annand was presented by Philips with one of their latest models—the 341A.

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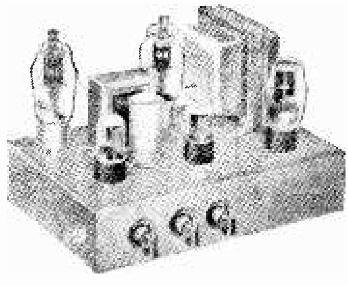

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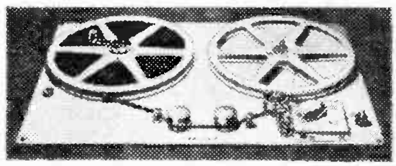

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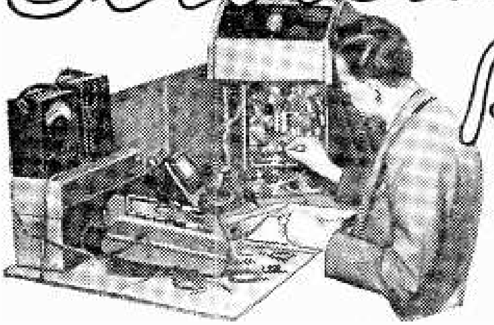


BEETHOVEN MODEL A3348

By Gordon J. King, A.M.I.P.R.E.

THIS is a reasonably conventional type receiver designed round American octal type valves. It is for use on A.C. mains supplies only, and can cater for inputs of between 200 to 250 volts and 100 to 120 volts. A circuit giving normal coverage on long, medium and short waves is built around five valves, one being the H.T. rectifier. The valve line-up is 6K8G triode-hexode frequency changer; 6K7G intermediate frequency amplifier; 6Q7G double diode triode as A.F. amplifier, and signal and A.V.C. rectifier; 6V6G output pentode; 5Z4G H.F. rectifier.

The receiver has provisions for an extension loudspeaker of 2 to 5 ohms impedance, and a crystal or magnetic pick-up. Switching is not provided for the speaker or pick-up, but when the pick-up is employed it is desirable to remove the aerial and tune the set to a quiet part of the band; moreover, the pick-up should be disconnected when the set is used for radio reception.

The four control knobs situated from right to left, looking at the front of the cabinet, perform the functions of tuning, wavechange, volume/mains on-off and tone. Long, medium and short waves are selected by rotating the wavechange knob clockwise.

Circuit Description

The signals in the aerial coil L1 are inductively coupled to the short, medium and long wave aerial coils L2, K3 and L4 respectively, and the required aerial coil is selected by S1A section of the wavechange switch. Tuning is by C1 section of the two-gang tuning capacitor.

The oscillator coils are selected by S1B and S1C sections of the wavechange switch, and the selected oscillator coil is tuned by C2 section of the gang. Coils L5, L7 and L8 are for short, medium and long wave oscillator functions respectively; coil L6 is a feed-back winding for short-waves only.

An intermediate frequency of 465 kc/s is produced in the anode circuit of V1 and developed across the first I.F. transformer (I.F.T.1). From here it is conveyed to the signal grid of V2 for amplification. The amplified I.F. signal appears across the second I.F. transformer (I.F.T.2), and is fed to the signal diode in V3 for demodulation.

The A.F. content of the signal is developed across the 1 megohm volume control, after first being filtered by the associated 33 K. resistor and associated 150 pF capacitors. The A.F. signal is amplified by the triode section of V3, and is developed across the 200 K. resistor in the anode circuit; the 6.8 K. resistor and associated 4 μF electrolytic capacitor provide decoupling.

From the anode of V3 the signal is conveyed to the control grid of the output valve V4, via the 0.05 μF coupling capacitor C5 and the potential divider comprising resistors R1 and R2 in the grid circuit of V4.

Capacitor C6 gives a degree of fixed tone compensation, while a variable tone control arrangement is also provided by means of C7 and the 50 K. variable resistor.

A.V.C.

The I.F. signal appearing at the anode of V2 is passed through the 10 pF capacitor C8 to the A.V.C. diode in V3. This diode is loaded by means of the 1 megohm resistor R3, and across this appears a negative potential with respect to chassis of a magnitude depending on the amplitude of the I.F. signal. This negative potential is used as an A.V.C. bias to control valves V1 and V2.

It is fed to V2 through R4 (a filter resistor) and the secondary winding of I.F.T.1, and to V1 through R4 and R5; decoupling being given by the 0.1 μF

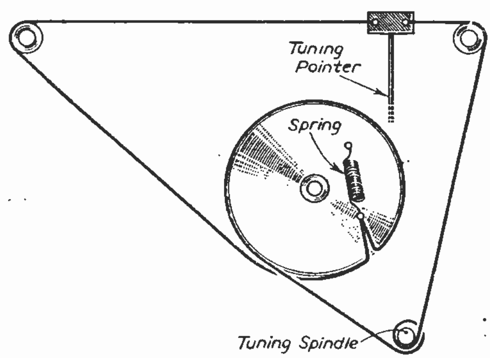


Fig. 4.—Tuning drive adjustment.

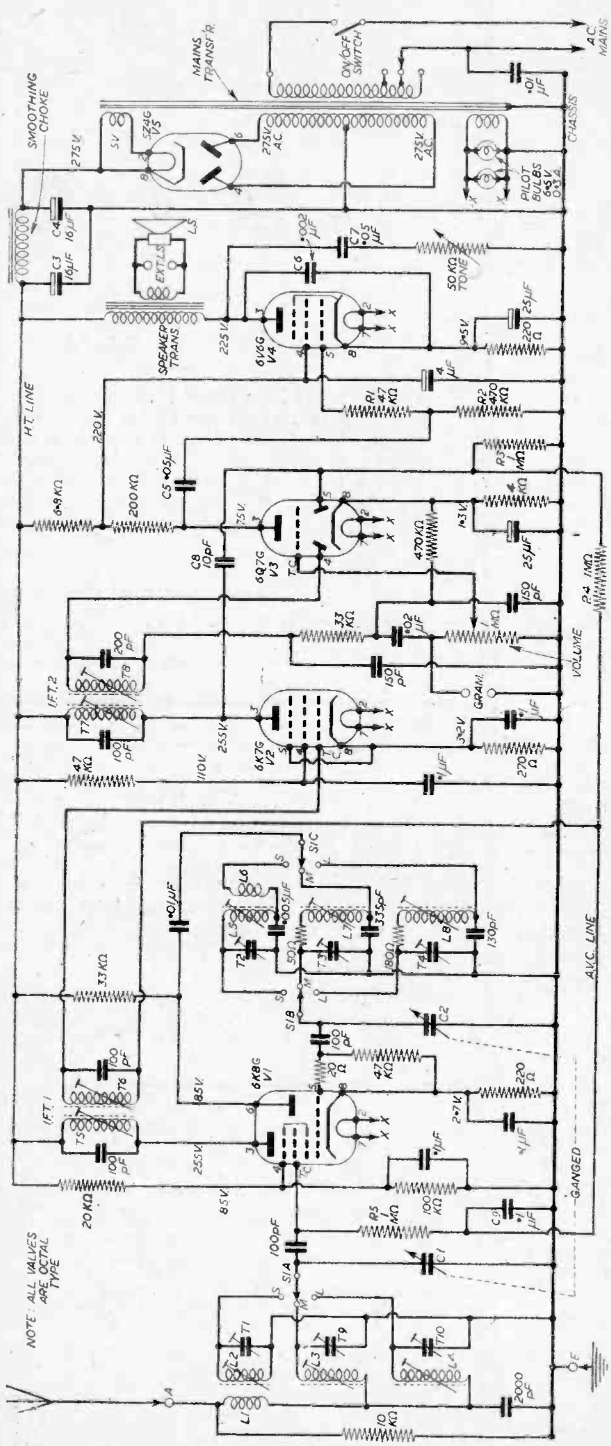


Fig. 1.—Circuit diagram of the Beethoven Model A3348.

capacitor C9. A degree of standing bias is also present on both of these valves as the result of the voltage drop across the associated cathode resistors.

Power Supply

H.T. power is supplied by the full-wave rectifier V5, energised from a 275-0-275 volt H.T. secondary winding on the mains transformer. H.T. smoothing is by the 16-16 μF electrolytic capacitor and the associated smoothing choke. A voltage of about 255 D.C. should be present on the main H.T. line, that is after the smoothing choke. The mains transformer also carries two L.T. windings, one for energising the rectifier heater, and the other for energising the heaters of the remaining valves and the two pilot bulbs.

Alignment Procedure

The I.F. stages should first be adjusted as follows: Connect a properly-loaded output meter across the secondary of the speaker transformer—the loudspeaker can remain in circuit. Mute the local oscillator by shorting C2 section of the tuning gang. Connect the live lead of an accurately calibrated service oscillator or signal generator direct to the signal grid of V1; set the generator to 465 kc/s, switch on the internal modulation, and adjust T8, T7, T6 and T5 (Fig. 3), in that order, for maximum indication on the output meter.

Remove the short from across C2, connect the signal generator, through a dummy aerial, between the aerial and earth sockets. Tune the receiver and signal generator to 150 kc/s (L.W.) and adjust the core of the L.W. oscillator coil L8 and the core of the L.W. aerial coil L4 for maximum output.

Tune the receiver and generator to 300 kc/s (L.W.), and adjust the L.W. oscillator trimmer T4 (Fig. 2) and the L.W. aerial trimmer T10 (Fig. 2) for maximum output. Repeat at 150 kc/s and again at 300 kc/s until optimum tracking is secured.

Tune the receiver and generator to 600 kc/s M.W. and adjust the core of the medium-wave oscillator coil L7 and the core of the M.W. aerial coil L3 (Fig. 2) for maximum output. Retune the 1,400 kc/s M.W., and adjust the M.W. oscillator T3 and the M.W. aerial trimmer T9 (Fig. 2) for maximum output. Repeat at both frequencies for optimum tracking.

Tune the receiver and generator to 6 Mc/s S.W., and adjust the core in the S.W. oscillator coil L5 and the core in the S.W. aerial core L2 (Fig. 2) for maximum output. Retune to 19 Mc/s and adjust the S.W. oscillator trimmer and the S.W. aerial trimmer T1 (Fig. 2) for maximum output. Repeat adjustments at both frequencies until no further improvement can be obtained.

(*Continued on page* 205)

During the whole of the alignment process it is essential to maintain the lowest input signal from the oscillator or generator, consistent with readable deflection on the output meter. Too great an input will bring the A.V.C. system into operation and consequently give rise to misleading output meter indications.

Servicing Notes

The top and underside views of the chassis, showing coil and trimmer positions, are illustrated in Figs. 2 and 3. Fig. 4 shows the mode of tuning pointer and drive cord function. Nylon drive cord is best suited, and when replacement is necessary care should be taken to ensure that the traverse of the pointer corresponds to the relative positions of the tuning gang. This point should also be borne in mind before alignment of the oscillator and R.F. circuits is attempted.

If the receiver is totally dead with not a trace of hum from the loudspeaker, it should be established that H.T. voltage is present at pin 8 of the H.T. rectifier valve V5. If it is not, the rectifier itself is generally to blame ; although heater failure is nearly always responsible, the emission sometimes fails while the heater continues glowing, and at first glance the valve may be considered to be up to standard.

If H.T. is present at the cathode of V5, a meter should be used to follow it along through the smoothing choke and on to the H.T. line. If it is present on the H.T. line, the voltages relating to V4 should be checked. Probably the 'speaker transformer primary will be found to be open-circuited.

If a slight hum is heard from the loudspeaker, but stations cannot be tuned in, it is often a good idea to touch the top-cap of the 6Q7G with the volume-control at maximum. This will result in a loud mains hum if stages V3, V4 and V5 are working. This proves, therefore, that the trouble lies somewhere in stages V1, V2.

Usually, in this case, valve substitution reveals the trouble, but if it does not, then the local oscillator should come under suspicion. The grid and anode oscillator coupling capacitors should be suspected, and the 33 K oscillator anode feed resistor should be checked for continuity.

Excessive distortion, generally accompanied by V4 overheating, nearly always means that C5 is leaky—a good quality capacitor should be used here for replacement. Distortion is also caused by V3's anode load resistor (200 K) becoming high in value ; such a fault, however, does not result in V4 over-heating, though it is generally accompanied by low-volume. Distortion should also lead one to suspect the resistor and capacitor combination in the cathode circuit of V4. A leak in the capacitor would kill the bias for this valve, while the stage would be subjected to negative feed-back if it becomes open-circuit.

General fall-off in sensitivity on all wavebands is sometimes caused by alteration in value or deterioration in goodness of one or more of the fixed tuning capacitors across the windings of the I.F. transformers. Such a fault shows up by "flat" tuning of the associated core during the I.F. alignment process. If one of the capacitors has drifted quite a bit in value it will probably be found impossible to peak the associated core at the intermediate frequency.

Excessive whistling superimposed on the local medium-wave stations is sometimes caused by pick-up in the I.F. channel of a spurious signal which beats with the carrier of the transmission to which the receiver is tuned. This can be cleared by returning the I.F.s to 470 kc/s, and then realigning the oscillator and R.F. stages.

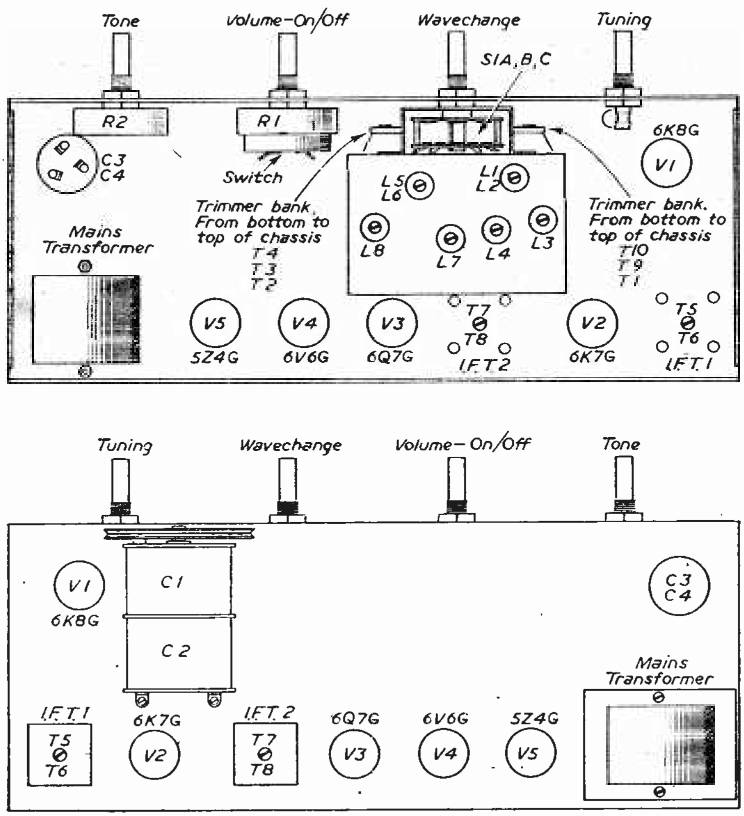
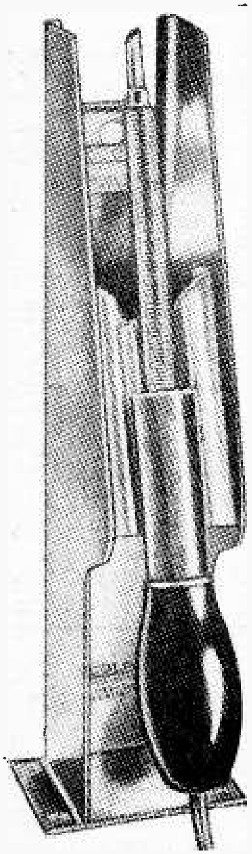


Fig. 2 (Top) and Fig. 3 (Bottom).—Underneath and top views of chassis.

News from the Trade

"ADCOLA" SOLDERING IRON

FOR making connections in modern midget receivers, or for use on printed circuit sheets, some care is called for in keeping the heat from near-by adjacent components, and from the application of excessive heat to the printed circuit or actual component being soldered. Apart from the need for a small soldering bit, therefore, there is also the question of the heat which is generated by the element, as this must be hot enough to make the solder run very quickly so that the iron may be removed almost at once, and the properly soldered joint will then present itself as a bright shiny blob of solder, covered by a thin film of protective resin if a cored solder has been employed. The choice of a suitable iron is, therefore, of paramount importance, and we have recently had the pleasure of using the iron illustrated below, which is made by Adcola Products. This has a 3/16in. bit, which may be detached and replaced when worn, and may be extended to a very suitable length for easy access inside a tangle of components. The main shaft is equally small in diameter, being less than ¼in. and about 6in. in length. It gives just the right amount of heat for all normal radio or television work, is nicely balanced for ease of handling, and is provided with a hook so that it may be suitably placed on a bench in intervals between soldering, or, if required, the stand shown may be used, and the hot tip is thus protected. If long intervals between work are unavoidable, the iron should be switched off to avoid unnecessary burning of the tip, which in use becomes slightly concave. It should, therefore, be periodically filed and the tip kept bright by wiping on an old rag during soldering operations. The price of the iron (List No. 64) is 33s. 6d., and the protective shield illustrated (List No. 68) is 11s. 6d.—Adcola Products, Ltd., Gauden Road, Clapham High Street, S.W.4.



The "Adcola" soldering iron reviewed above

MULLARD POWER TRANSFORMERS AND CHOKES

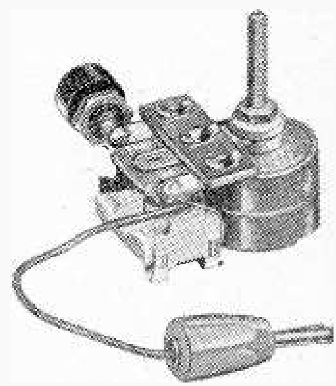
THE Components Division of Mullard, Ltd., is now manufacturing high-frequency power transformers to customers' requirements.

The use of Ferroxcube as the core material enables efficient operation to be achieved over the frequency range 2 kc/s-20 Mc/s. Powers up to 1 kW can be handled. Such transformers are used in aircraft high-frequency power supplies, ultrasonic equipment, R.F. output stages and high-frequency fluorescent lighting installations. In addition to their excellent electrical performance, the weight of these transformers is often less than that of iron-cored components.

Inductances for smoothing and interference suppression are also made by Mullard, Ltd. These range from low-current high-inductance (up to 200 H.) types to high-current low-inductance types used for suppressing power supply circuits.

The larger transformers and chokes use Ferroxcube "U" cores. Where only moderate amounts of power are involved, however, it is possible to use Ferroxcube pot cores, which have the advantages of a low external field and lower winding capacities.—Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

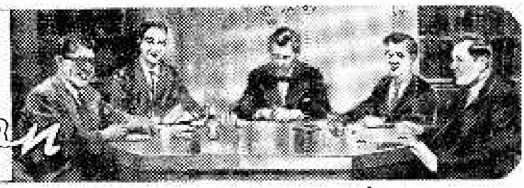
The new Osmor station separator



OSMOR STATION SEPARATOR

ANY improvement in separating closely spaced stations will be welcomed by many listeners. The Osmor company is producing a new type of station separator and claims that an unwanted station within 2 kc/s of the wanted station can be rejected. This performance is attributed to the very high "Q" coils employed, which are adjustable only within very narrow frequency limits in order to keep the core in the centre of the coil and thus maintain the high "Q." Separate high "Q" coils are designed for each station of the M.W. band. Unlike previous types, the new type is completely enclosed in an iron-dust pot in addition to the iron-dust core fixed in the centre of the coil. Only a slight adjustment of each type is possible by a pre-set capacitor. It is necessary to state precisely the station to be rejected. The unit is simply fixed by a 4BA screw and nut at the back of the cabinet in any convenient position. Supplied complete with full instructions. Price, 10s. 6d.—Osmor Radio Products, Ltd., 418, Brighton Road, South Croydon, Surrey.

Open to Discussion



The Editor does not necessarily agree with opinions expressed by his correspondents

"Experiences with Vibrator Supplies"

SIR,—Like your contributor, Mr. Neville Hart, I have to rely on home-generated electricity for lighting, power and wireless, which is why I found his article, "Experiences with Vibrator Supplies" (PRACTICAL WIRELESS, January, 1956) of interest. But, unlike your contributor, I do not find a vibrator unit the best means of converting a 12-volt source into the higher pressure values necessary for supply to wireless valves—that is to say it is not, in my experience, the most reliable nor economical nor the most silent method available.

I have, myself, reverted to a method which was in universal use in the early days of broadcasting and think, perhaps, a few details of this to-day may not lack interest to others, especially to those without the convenience of mains current, but may I first question Mr. Hart's figures of 4 to 5 milliamps given as the input current of the dynamotor he discarded in favour of his vibrator—this must, I think, be a misprint and, no doubt, 4 to 5 amps was the figure intended.

My petrol driven generator is of the dual type, giving both 230 volts A.C. and 12 volts D.C. and I use the latter to charge a six-cell storage accumulator of large capacity which supplies the input current to a rotary converter, the output of which charges a number of the small, glass contained, Exide 10-volt accumulator units (size 7in. by 5in. by 2½in.), which are, of course, series coupled to give the requisite voltage for H.T. supply.

The input to this converter takes approximately 5 amps of current and its output, at the required voltage, is at 195 milliamps, which is just the right charging rate for these small capacity accumulators. In practice, disregarding any H.T. supply I require from time to time for experimental work, I find my daily consumption for broadcast listening averages 84 milliamp/hours per day or 588 milliamp/hours per week, and if one adds to this 25 per cent. for loss in conversion, I find my overall listening requirement to be 735 milliamp/hours per week, which, at the 195 milliamps delivered from the converter, shows that rather less than four hours charging time per week are required to replenish the accumulators (735 divided by 195), also, by this reckoning, only 20 amp/hours per week are taken from the 12-volt storage accumulator (four hours multiplied by 5 amps) or rather less than 3 amp/hours per day, which is not a serious drain on my source of supply and, compared to that which results from the use of a vibrator, which has, of course, to be running all the time one is listening, is hardly of any account at all. Moreover the supply is silent because one does not run the converter while listening, although, in fact, both converter and generator are satisfactorily suppressed against causing interference.—E. R. BENEY (Neatishead).

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 commercial or surplus equipment. We cannot supply alternative details for receivers described 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.

Correspondent Wanted

SIR,—I am 14 years of age and would like to correspond, through the medium of your excellent magazine (of which I am a very keen reader), with an enthusiast of my own age, who is interested in radio and television as a whole.—F. C. BALL, "Fairhaven," 4, Castle Street, Newcastle-Emlyn, Carms., S. Wales.

Ex-Service Sets

SIR,—I should like to correct the information on the frequency range of the T1154B supplied by Mr. Sykes in your January issue.

The coverage of the T1154 range is as follows: T1154, T1154A, T1154B, T1154J, T1154N; 200 kc/s, 500 kc/s; 3.0 Mc/s, 5.5 Mc/s; 5.5 Mc/s, 10 Mc/s. T1154C, T1154F, T1154H, T1154K, T1154M; 200 kc/s, 500 kc/s; 2.35 Mc/s, 4.5 Mc/s; 4.5 Mc/s, 8.7 Mc/s; 8.7 Mc/s, 16.7 Mc/s, T1154D, T1154E, 200 kc/s, 500 kc/s; 2.5 Mc/s, 4.5 Mc/s; 4.5 Mc/s, 8 Mc/s. T1154L, 200 kc/s, 500 kc/s; 1.5 Mc/s, 3 Mc/s; 3 Mc/s, 5.5 Mc/s.

Models "A" and "E" provide only CW/MCW working, all others also provide R/T.—D. J. TYERMAN (N.W.2).

Loudspeakers of the Past

SIR,—I was interested in the subject of early loudspeakers, by Mr. C. H. Gardner (PRACTICAL WIRELESS, January, 1956) and well remember the types he mentions. However, I should like to draw attention to the fact that both the term "Loud Speaker" and the principle of the moving coil were used by Sir Oliver Lodge in a series of articles on the "Development of the Telephone," published in the "Electrical Review," in 1887.

It seems strange, therefore, that some forty years passed before the moving-coil system was developed.

Unfortunately, I no longer have this volume in my possession so must rely on memory though I have no doubt that the details given above will be found substantially correct by anyone sufficiently interested to search the records.—W. G. LEE (Barnet).

A Recording Critic

SIR,—Sapphires are semi-permanent, therefore, they need not be quite so easily replaceable as a metal stylus: this allows the mass of the moving parts to be reduced. The compliance is, therefore, increased, and so less downward weight is required for good tracking—low downward weight is essential, of course, for L.P.s.

One leading manufacturer advises that the sapphire stylus of a particular pick-up should be replaced after 100 L.P. sides have been played, while another suggests 200 L.P. sides.—A. H. STRANGE (N.1).

SIR,—Regarding Mr. Kershaw's query in the January, 1956, issue, perhaps I could be of some assistance, as I am a High-Fidelity enthusiast myself. First, Sapphire stylii exhibit different characteristics depending, of course, on the type and weight of pick-up used, and also the condition of the record. Admittedly, they are much better than osmium or other type stylii in this range, but their hardness does not necessarily mean they can stand any undue strain, other than in the lateral motion. I have used sapphire tips for my L.P.s and have had good results, except in a few instances. Once I dropped the pick-up a short distance on to a record, and the result was a chipped stylus. Which brings up another point here. Some manufacturers have what they term an "all purpose needle." Even though it may be sapphire, its physical dimensions are such that it is unsatisfactory for 78s and L.P.s. Since an L.P. record usually takes a .003 stylus, and a 78 a .001, they usually compromise and use a 2.5 mil stylus. This will result in the needle skating or skipping in an L.P. record and riding the bottom grooving in a 78, causing premature record wear. If you are fortunate enough to have a 20 or 30 power glass, after you play a record check the lead out grooves of the record for tiny bits of the record that may have been gouged out due to improper stylus size or weight. If you intend to use mostly L.P.s, the best bet would be to purchase a diamond stylus. Although the initial outlay is considerably higher than that of a sapphire, its maximum life is more than tripled. Also check to see that your turntable is perfectly level.—THEODORE P. DEPTO (Patton, Penna., U.S.A.).

SIR,—Having made a bold New Year's resolution to take in your paper, I will start off answering the letter of B. L. Kershaw.

Mr. Kershaw is quite right—styluses do wreck records, particularly 78 rev. ones. It is not practical to grind the jewel to a point to suit the grooves, or they would break.

There is also the question of *price* contra *wear*.

The "life" of the comparative "points" is as follows: Osmium, 10 hours; sapphire, 50 hours, diamond, 400 hours.

The best type of pick-up cartridge is the ceramic, which has all the advantages of the magnetic, but none of the bad. Makers' catalogues should be carefully studied. A good "hi-fi" should be obtainable to give a flat response from 30 to 15,000 cps, and a distortion figure of not less than 3 per cent.

I have never used a changer in my disks: I have more respect for them!—J. P. J. CHAPMAN, M.B.K.S., M.S.M.P.E. & T.V. (U.S.A.) (Parkstone, Dorset).

VARIABLE SELECTIVITY

(*Continued from page* 166)

The theoretical method of calculating the product gmR.C. in this case is much more complicated; in practice, however, it will lie between two and three times the value calculated for the first case, and this is the easiest way of obtaining a good approximation. Any inaccuracies can be taken care of by means of the "Set Operating Point" (R2) control.

Testing

In setting up this system, first calculate a reasonable set of values for C, R, and gm. Select an I.F. transformer which is normally over critically coupled. Ascertain, if necessary by experiment, the correct sense in which to connect the coils—that in which, with sufficient coupling, oscillation will take place. For correct operation of the system, a total change of about 10 : 1 in gm is necessary—say from 1.5 to 0.15. This is, of course, readily obtained in a manually-controlled arrangement, and should be possible in the automatic form wherever the A.V.C. voltage available exceeds about six volts. To obtain the maximum degree of control, the value of R2 should be kept at as low a figure as is consistent with stability.

If it is desired to experiment with the method of Fig. 4, but with the coils reversed, that is, in the sense in which oscillation cannot occur, then certain changes must be made. In the first place, an under-coupled I.F. transformer must be used. K.Q.=0.5 or less. Then the undecoupled bias resistor should be omitted. And finally, a positive control voltage is is required, while the valve should have a large standing bias if automatic operation is desired. The standing bias is most readily obtained from taking the cathode to an H.T. potentiometer, while the positive control voltage can come from the screen of an A.V.C. controlled I.F. valve, also suitably potted down. The circuit is outlined in Fig. 5, but it should be said that, apart from inherent stability, this circuit is inferior to that of Fig. 4, resulting in lower gain on weak transmissions and an inferior regulation curve. (The circuit of Fig. 4, actually has both maximum gain and maximum selectivity on the weakest signals!) If it is desired to apply automatic control to Fig. 1, it also has to have positive control volts and, therefore, standing negative bias.

In general, it will be found that, no matter which system is adopted, it is desirable to have both automatic and manual control; the latter is set from time to time, and from station, to suit the personal requirements of the individual listener, while the automatic takes charge of the rest. It is hoped that these notes may help experimenters to find at least a partial solution to their interference problems.

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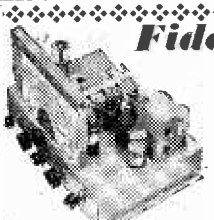

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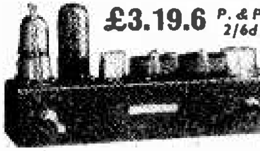

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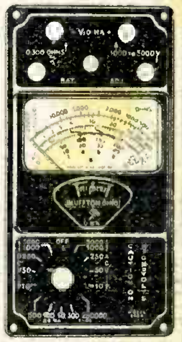

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