Published in Great Britain by the Proprietors and Publishers
Data Publications Ltd 57 Maida Vale London W9
Printed by A Quick & Co Ltd Oxford House Clacton on Sea England
Obtainable abroad through the following Collets Subscription Service Continental Publishers & Distributors Ltd William Dawson & Sons Ltd *Australia and New Zealand* Gordon & Gotch Ltd *South Africa* Central News Agency *Holland* "Radio Electronica"
Registered for transmission by Magazine Post to Canada (including Newfoundland)

The "Mayfair" Televisor, Part 3

VOLUME 11
NUMBER 4
NOVEMBER
1957

The RADIO Constructor

RADIO · TELEVISION · AUDIO · ELECTRONICS

The 'Contessa'

Transistor Superhet Portable

Included in this issue
AUDIO STAGE FOR BEGINNER'S S.W. RECEIVER
BLACK-SPOTTER FOR CATHODE MOD TELEVISORS
TWO-VALVE "Y" AMPLIFIER
AUTOMATIC FREQUENCY CONTROL
VIBRATOR BASING DATA (conclusion)

DATA Publications 1/9

PREMIER RADIO COMPANY

B. H. MORRIS & CO. (RADIO) LTD.

Open till 6 p.m. Saturday — (Dept. R.C.11) 207 EDGWARE ROAD LONDON W2 — Telephone AMB 4033 PAD 3271

Build the New "MAYFAIR" *Televisor*

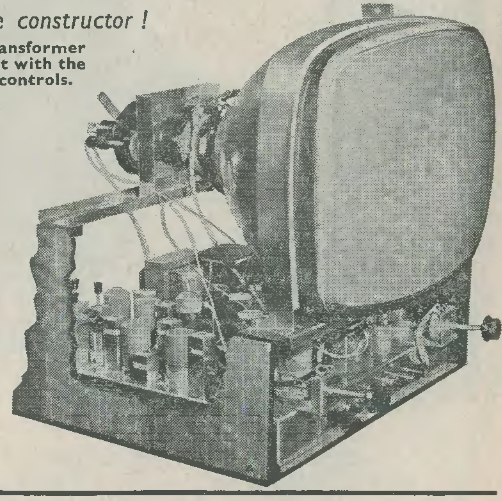
which gives complete **SAFETY** *to the constructor !*

These Televisors use a double wound mains transformer which gives you complete safety from contact with the mains supply when handling the chassis or controls.

★ B.B.C. & I.T.A. DESIGN ★
WITH NEW TURRET TUNER

MAY BE BUILT FOR **£33·7·11** *PLUS COST OF C.R.T.*

Build in 5 easy stages. Full construction details available. Instruction Book 3/6 post free.

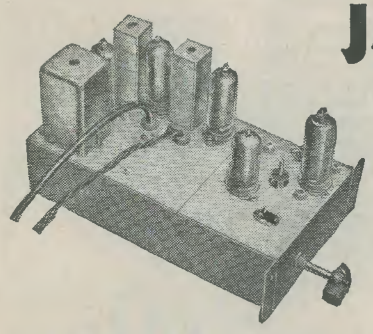


Build the Premier one valve Battery Receiver as shown on BBC TV
This Receiver contains a DAF96 valve and a pair of 4000 ohm headphones and is powered by a combined 67½ and 1½ volt battery. Price complete with headphones but less battery 45/- Battery 8/3 extra.
Send for free Diagram.

WHY **buy surplus or re-conditioned tubes when these fully guaranteed wide angle tubes are available? The latest type 17" rectangular tube at £17 (incl. tax), post and packing 21/- extra.**

JASON "Mercury"

SWITCHED FM TUNER



Build it with an authentic JASON KIT

The success of Jason Switch Tuned FM Units is already well known. It is due largely to their stability and all-round good design. Now you can build one for yourself with this authentic Jason 5-valve Kit in which the Switch Tuned Front End comes to you assembled and aligned ready for building in, and with station-marked scale plate.

- Complete Kit, including assembled Front End with 2 valves (we regret we are unable to supply remaining valves).
£9.0.0

- Switch Tuned Front End only with 2 valves, ready wired, tested and aligned.
£6.5.0 *Inc. £1.15.0 P/Tax*

- **POWER PACK KIT** *suitable for use with above* **£2.1.9**

- *Please send S.A.E. for complete list of components and prices*

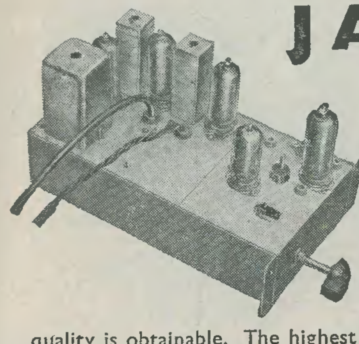
JASON MOTOR & ELECTRONIC CO. **328 CRICKLEWOOD LANE LONDON NW2**
Telephone SPEedwell 7050

All correspondence to
162 HOLLOWAY ROAD LONDON · · N7
NORth 6295/6/7

CLYNE RADIO LTD.

18 TOTTENHAM COURT ROAD LONDON W1
(50 yards only from Tottenham Court Road Tube)
MUSeum 5929/0095

Monday-Friday 9-6 p.m.
Saturday 9-1 p.m.



JASON

SWITCH TUNED FM FEEDER KIT

(AS DESCRIBED IN THIS ISSUE)
Designer approved kit

This excellent unit enables the selection of Home, Light or Third programme at the touch of a switch. Complete freedom from drift is ensured by the incorporation of Automatic Frequency Control. When used in conjunction with a suitable amplifier superb quality is obtainable. The highest standards of efficiency and reliability that are the well-known features of the Jason Standard and Fringe Model FM Tuners have been maintained.

SPECIAL PRICE FOR THE COMPLETE KIT £9.19.6 *Plus P. & P. 2/6*
or send 2/- for our itemised price list and the instruction book

FM POWER PACK KIT. We can supply complete kit for power pack suitable for the above F.M. tuner or any other similar type. Price for the complete kit is **37/6** only or **52/6** for ready assembled unit. This pack is extremely small, incorporating valve rectifier type 6X4 and built on chassis size only 6 x 4 x 1½in. Optional extra for power pack, Bulgin Octal Plug **2/3.**

IMPORTANT ANNOUNCEMENT

Our **NEW BRANCH** *is* **NOW OPEN** *at*
162 HOLLOWAY ROAD LONDON N7 Telephone NORth 6295/6/7

Situated approximately half-way between "Nags Head" and Highbury Corner. One minute from HOLLOWAY ROAD and DRAYTON PARK Tube stations. Two doors from the NORTHERN POLYTECHNIC. Early closing Thursday at 1 p.m. Open all day Saturday until 5.30 p.m. The service that we are noted for at Tottenham Court Road is available! Old and new friends welcome.

ALL MAIL ORDERS and **CORRESPONDENCE** in future to **HOLLOWAY ROAD** please.

TRANSISTORS ! ! ! SURPLUS—P.N.P. RED SPOT (Audio/Experimental Applications) 10/- ea. **BLUE SPOT,** R.F. up to 1·6 Mc/s. 15/- ea. **WHITE SPOT,** R.F. up to 2·5 Mc/s. 20/- ea. **STANDARD—BRIMAR** T.S.1 18/- ea. **MULLARD** OC70 21/- ea. OC71 24/- ea. OC72 30/- ea. (ALL POST FREE)

We carry the most up-to-date and comprehensive valve stocks in London at most competitive prices. Send stamp for list. Our new 109 page comprehensive catalogue is now available at 2/- post free. Containing invaluable information on our kits of parts, chassis, components, transistors, loudspeakers, cabinets, etc., etc. This book is a "must" for all constructors ! ! !

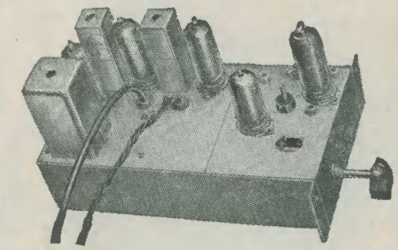
The sign assuring you of IMMEDIATE and CAREFUL attention

Smith's of EDGWARE ROAD

"MERCURY"

SWITCHED FM TUNER UNIT

(Designer approved kit)



Front end completely wired and tested with two valves, inc. P.T.	**125/–**
1 Chassis and Side Panels	9/6
1 Discriminator Coil (Type L12)	11/6
2 I.F. Coils (Type L4) per pair	11/6
2 Heater Chokes	1/6
3 B9A Valveholders	3/–
3 Tag Panels	1/–
1 Knob	1/–
15 Resistors	3/9
2 0.05μF paper tubular	1/8
1 0.01μF ceramic	9d.
2 50pF silvermica	1/4
5 5,000pF ceramic	3/4
2 1,000pF ceramic	1/4
1 500pF ceramic	8d.
1 200pF ceramic	7d.
2 GEX34 crystal diodes	8/–
Audio cable	8d.
Flex	6d.
Nuts and Bolts	2/6

Total £9·9·1

Special Price if purchased at one time

£8·8·0

Postage 2/–

PLEASE INCLUDE SUFFICIENT POSTAGE

H. L. SMITH & CO. LTD. 287/9 Edgware Road London W2 *Telephone* Paddington 5891

G2AK · THIS MONTH'S BARGAINS · G2AK

SPECIAL OFFER!

D104 CRYSTAL HAND MIKES

List £6.0.0 complete with 6ft of cord and plug

VERY LIMITED QUANTITY AVAILABLE. ONLY **£3.10.0** *each. DON'T BE TOO LATE*

ABSORPTION WAVEMETERS. 3.00 to 35.00 Mc/s in 3 switched bands, 3.5, 7, 14, 21 and 28 Mc/s. Ham bands marked on scale. Complete with indicator bulb. A *must* for any Ham Shack. **Only 17/6** each post free

Full range of **Denco, Repanco** *and* **Eddystone coils** *and* **components** *available. Also most comprehensive range of* **Hi-Fi equipment** *in the Midlands including* **Quad, R.C.A., W.B. Leak, Rogers,** *etc.*

HEADPHONES, H.R. type. 4,000 ohms. Very sensitive, only **12/6** pair, post 1/6. **C.L.R. type** (low res.) **8/6**, post 1/6

AMERICAN BREAST MIKES. Swivel head, push-to-talk and lock-on switch; excellent job, only **12/6**, post 1/6

BRITISH BREAST MIKES, complete with pair h.r. 4,000 ohm phones in wooden carrying case. New W.D. stock, unrepeatable at **17/6**, post 2/–

SEMI-MIDGET I.F. TRANSFORMERS. 10.7 Mc/s and 465 kc/s (can be used as 10.7 Mc/s and 465 kc/s only), **9/11** per pair, postage 9d.

TWIN FEEDER. 300 ohm twin ribbon feeder, similar K25, **6d.** per yard. K35B Telcon (round), **1/6** per yard. Post on above feeder and cable, 1/6 any length

PANL HOME CRACKLE. Black, 3/– tin, postage and packing 8d.

COLLINS MODULATION TRANSFORMERS. P.P. 807s 20W audio to parr. 807s. Beautiful job. **12/6** each carr. paid

REPANCO TRANSEVEN

Portable, using 7 transistors. Complete kit of parts including wiring plan and instructions. NOW AVAILABLE FROM STOCK

Send for building instructions and priced parts list, **1/6**

RACK MOUNTING PANELS. 19" x 5¼", 7", 8¾" or 10½" black crackle finish, **5/9, 6/6, 7/6, 9/–** respectively, postage and packing 2/–

AERIAL EQUIPMENT

COPPER WIRE 14g. h.d.; 140' 17/–, 70' 8/6; 7/25 stranded: 140' 10/–, 70' 5/–. Plus 2/– p & p

RIBBED GLASS INSULATORS, 3" 1/6 each or 6 for 7/6. 12 or more post free.

HEAVY DUTY SHROUDED CHOKES. 10H, 150mA, 80 ohms. Only 10/–, p and p 2/6

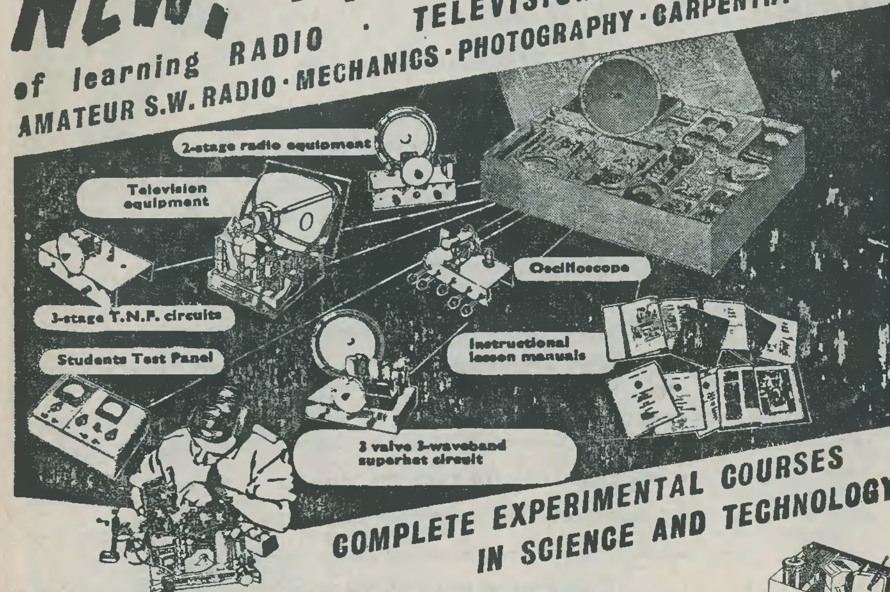
PLEASE PRINT YOUR NAME AND ADDRESS

CHAS. H. YOUNG LTD Dept. 'R' 110 DALE END BIRMINGHAM *Telephone* Central 1635

NEW! – THE PRACTICAL WAY

of learning RADIO · TELEVISION · ELECTRONICS

AMATEUR S.W. RADIO · MECHANICS · PHOTOGRAPHY · CARPENTRY etc. etc.



COMPLETE EXPERIMENTAL COURSES IN SCIENCE AND TECHNOLOGY

NEW —completely up-to-date methods of giving instruction in a wide range of technical subjects specially designed and arranged for self-study at home under the skilled guidance of our teaching staff.

NEW —experimental outfits and lesson manuals are despatched on enrolment and remain the student's property. A tutor is allotted to each student for personal and individual tuition throughout the course.

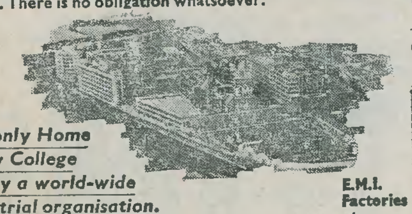
In the case of radio and television, specially prepared components are supplied which teach the basic electronic circuits (amplifiers, oscillators, detectors, etc.) and lead, by easy stages, to the complete design and servicing of modern commercial radio and television receivers.

If you are studying for an examination, wanting a new hobby or interest, commencing a career in industry or running your own full-time or part-time business, these practical courses are ideal and may be yours for moderate cost. Send off the coupon to-day for a free Brochure giving full details. There is no obligation whatsoever.

SUBJECTS INCLUDE:-

RADIO
SHORT WAVE RADIO
TELEVISION · MECHANICS
CHEMISTRY · PHOTOGRAPHY
ELECTRICITY · WOODWORK
ELECTRICAL WIRING · DRAUGHTSMANSHIP · ART, ETC.

COURSES FROM 15/- PER MONTH



The only Home Study College run by a world-wide Industrial organisation.

E.M.I. Factories at Hayes.

Send without obligation your FREE book.
E.M.I. INSTITUTES, Dept. 179X, London, W.4

NAME .... Age .... (if under 21)
ADDRESS ....

BLOCK CAPS PLEASE

I am interested in the following subject(s) with/without equipment

.... Nov./57

(We shall not worry you with personal visits)

EMI INSTITUTES

–Part of "His Master's Voice", Marconiphone, etc. etc.

REPANCO

HIGH GAIN COILS and QUALITY COMPONENTS
for the constructor

TRANSISTOR COMPONENTS

FERRITE SLAB AERIAL TYPE FS2. A new super-sensitive aerial, Long and Medium Wave, specially designed for transistor portable receivers. Complete with fixing brackets. Length $5\frac{1}{2}''$ ... **13/6**

COMBINED OSCILLATOR AND 1st I.F. TRANSFORMER TYPE OT1 (315 kc/s), fully screened, $\frac{13}{16}'' \times \frac{13}{16}'' \times 1\frac{3}{4}''$ ... **11/6**

2nd I.F. TRANSFORMER TYPE TT2 (315 kc/s), $1'' \times \frac{5}{8}''$ dia. ... **5/-**

3rd I.F. TRANSFORMER TYPE TT3 (315 kc/s), $1'' \times \frac{5}{8}''$ dia. ... **5/-**

PUSH-PULL INTER-STAGE TRANSFORMER TYPE TT4. Ratio 1:1 ct. Stack $1\frac{3}{8}'' \times 1\frac{1}{16}'' \times \frac{7}{16}''$ **8/6**

PUSH-PULL OUTPUT TRANSFORMER TYPE TT5. Ratio 15:1 ct. Stack $1\frac{3}{8}'' \times 1\frac{1}{16}'' \times \frac{7}{16}''$ **8/-**

MINIATURE RANGE—For pocket receivers

FERRITE SLAB AERIAL TYPE FS3. Medium Wave only. With fixing grommets. Size $3'' \times \frac{3}{4}'' \times \frac{5}{32}''$ **7/6**

OSCILLATOR COIL TYPE XO8. Medium Wave only. Overall size $\frac{1}{2}''$ dia. x 1". Enclosed in Ferrite pots ... **5/-**

I.F. TRANSFORMER TYPE XT6. Suitable for 1st and 2nd I.F. 455 kc/s. Size $\frac{1}{2}''$ sq. x $\frac{11}{16}''$ ... **10/-**

I.F. TRANSFORMER TYPE XT7. Designed for 3rd I.F.T. or detector I.F.T. 455 kc/s. Size as XT6 ... **10/-**

PUSH-PULL INTERSTAGE TRANSFORMER TYPE TT9. Ratio 1:1 C.T. Radiometal Core. Size $\frac{3}{4}'' \times \frac{5}{8}'' \times \frac{13}{32}''$ ... **12/6**

PUSH-PULL OUTPUT TRANSFORMER TYPE TT10. Ratio 8:1 C.T. Matched to 3 ohm speaker. Size as TT9 ... **12/6**

Practical and Theoretical circuits enclosed with each Repanco Transistor Component

HIGH GAIN COILS

Dual-range Miniature Crystal Set Coil with circuit, type DRX1 ... **2/6**

Dual-range Coil with Reaction. With 2 mains, 2 battery and Transistor Circuit type DRR2 ... **4/-**

Ferrite Rod Aerial, Long and Medium Wave. With fixing brackets, type FR1 **12/6**

Matched pair TRF Dual-range Coils with Reaction. With mains, battery and feeder unit circuits, type DRM3 pr. **8/-**

Pair Dual-range Superhet Coils. With mains and battery circuits, type SH4 pr. **8/-**

Miniature I.F. Transformers, pre-aligned, 465 kc/s $\frac{13}{16}'' \times \frac{13}{16}'' \times 1\frac{3}{4}''$, type MSE ... **12/6**

REPANCO EASY-TO-BUILD RECEIVERS

Constructors' Envelopes of easy wiring plans, instructions and detailed price lists of components

THE HIWAYMAN ... **Envelope 1/6** (post 3d.)
Four-valve superhet Dual-range Portable using Ferrite Rod Aerial

REPANCO ONE-VALVE ... **Envelope 9d.** (post 3d.)
Beginner's Dual-range Radio Set for use with headphones

REPANCO FM TUNER UNIT ... **Envelope 1/6** (post 3d.)
Using 4 EF91, 1 EB91, 1 EM80 Valves, Ratio Detector

REPANCO "THREE DEE" ... **Envelope 9d.** (post 3d.)
Dual-range Transistor Radio using 3 Transistors and Crystal Diode. Amazing loud-speaker reception from $7\frac{1}{2}$ volt battery supply

REPANCO "TRANSEVEN" ... **Envelope 1/6** (post 3d.)
A new 7 Transistor superhet Portable with preset station tuning using Repanco transistor components

---

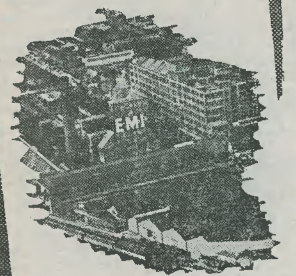
MAIL ORDER and TRADE—
RADIO EXPERIMENTAL PRODUCTS
LIMITED
33 MUCH PARK STREET COVENTRY
Telephone 62572

WHOLESALE and EXPORT—
REPANCO LTD
O'BRIENS BUILDINGS
203-269 FOLESHILL ROAD COVENTRY
Telephone 40594

Wanted!
QUALIFIED MEN AND WOMEN!

Industry and Commerce offer their best posts to those with the qualifications — appointments that will bring personal satisfaction, good money, status and security. As part of a modern industrial organisation, we have skilled knowledge of what is required and the best means of training personnel for its present day and future requirements. We specialise also in teaching for hobbies, new interests or part-time occupations in any of the subjects listed below. Write to us to-day for further information. There is no obligation of any kind.

OUR BACKGROUND!



The E.M.I. Factories at Hayes, England.

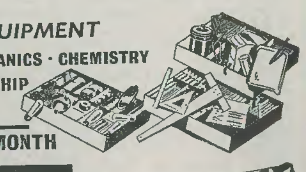
PERSONAL & INDIVIDUAL TRAINING IN—

Accountancy
Advertising
Aeronautical Eng.
A.R.B. Licences
Art (Fashion, Illustrating, Humorous)
Automobile Eng.
Banking
Book-keeping
Building
Business Management
Carpentry
Chemistry
City & Guilds Exams
Civil Service
Commercial Subjects
Commercial Art & Drawing
Customs Officer
Draughtsmanship
Economics
Electrical Eng.
Electrical Installations
Electronics
Electronic Draughtsmanship
Eng. Drawing
Export
General Certificate of Education
Heating & Ventilation Eng.
High Speed Oil Engines
Industrial Admin.
Jig & Tool Design
Journalism
Languages
Management
Maintenance Eng.
Mathematics
M.C.A. Licences
Mechanical Eng.
Metallurgy
Motor Eng.
Painting & Decorating
Photography
P.M.G. Cert.
Police
Production Eng.
Production Planning
Radar
Radio
Radio Amateurs (C&G) Licence
Radio & Television Servicing
Refrigeration
Sales Management
Sanitary Eng.
Salesmanship
Secretaryship
Shorthand & Typing
Short Story Writing
Short Wave Radio
Sound Recording & Reproduction
Telecommunications
Television
Time & Motion Study
Tracing
Welding
Workshop Practice
Works M'gement
and many others

Also courses for GENERAL CERTIFICATE OF EDUCATION, A.M.I.H.&V.E., A.M.S.E., A.M.Brit.I.R.E., A.M.I.Mech.E., A.M.I.E.D., A.M.I.M.I., A.F.R.Ae.S., A.M.I.P.E., A.M.I.I.A., A.C.C.A., A.C.I.S., A.C.C.S., A.C.W.A., City & Guilds Examinations, R.T.E.B.Serv. Cert., R.S.A. Certificates, etc.

The only Home Study College operated by a world-wide manufacturing organisation

NEW! Courses with PRACTICAL EQUIPMENT
IN RADIO · TELEVISION · MECHANICS · CHEMISTRY ELECTRICITY · DRAUGHTSMANSHIP PHOTOGRAPHY, ETC., ETC.
COURSES FROM 15/- PER MONTH



EMI INSTITUTES

POST THIS TODAY — FREE

E.M.I. INSTITUTES, Dept. 179K, London, W.4

NAME .... AGE .... (if under 21)

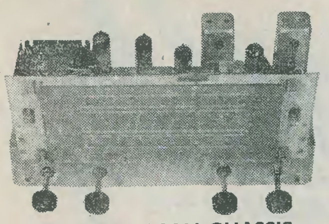
ADDRESS .... BLOCK CAPS PLEASE

I am interested in the following subject(s) with/without equipment

.... Nov./5

(We shall not worry you with personal visits). IC92

—Part of "His Master's Voice", Marconiphone, etc. etc.



1957 RADIOGRAM CHASSIS

THREE WAVEBANDS — FIVE VALVES
S.W. 16 m.–50 m. — LATEST MULLARD
M.W. 200 m.–550 m. — ECH42, EF41, EBC41,
L.W. 800 m.–2,000 m. — EL41, EZ40

12 month Guarantee. A.C. 200/250V, 4-way switch. Short-Medium-Long-Gram. A.V.C. and negative feed-back. 4.2 watts. Chassis 13½" x 5½" x 2¼". Glass dial 10" x 4½" horizontal or vertical available. 2 pilot lamps. Four knobs, walnut or ivory, aligned and calibrated. Chassis isolated from mains. Immediate Delivery

BRAND NEW £10.10.0 Carr. 4/6

TERMS: Deposit £5 . 5 . 0 and 6 monthly payments of £1.
MATCHED SPEAKERS 8" 17/6, 10" 25/–, 12" 30/–

Recommended for above Chassis

R.C.S. SCOOP

HIGH FIDELITY AUTOCHANGER

COLLARO 1957 MODEL RC456

For 7", 10", 12" Records 16, 33, 45, 78 r.p.m.

4 SPEEDS — 10 RECORDS

WITH STUDIO "O" PICK-UP

BRAND NEW IN MAKER'S BOXES

OUR PRICE £9.15.0 Post free

Terms: Deposit £5.5.0 and 6 monthly payments of £1

B.S.R. MONARCH 4-SPEED AUTOMATIC RECORD CHANGERS

1957 MODELS

Brand new and fully guaranteed 12 months

NOT JOB LINE REJECT STOCK

Designed to play 16, 33, 45, 78 r.p.m. Records 7", 10", 12". Lightweight Xtal pick-up, turnover head, two separate sapphire styli, for standard and L.P.

OUR PRICE £8.15.0 each. Post free

Terms: Deposit £5 and 5 monthly payments of £1.
CUT OUT BOARD 14" x 12½", 6/–.

COLLARO 4-speed Motor and Turntable with selecting switch for 16, 33, 45 and 78 r.p.m. records, 200-250V a.c. 50 c.p.s. Also **HIGH FIDELITY** Lightweight Pick-up with Acos Xtal turnover head, separate sapphire stylus for L.P. and standard records. **SPECIAL OFFER £4 . 12 . 6**, post 2/6. 14" x 12½" Cut Out Board 6/–

AMPLIFIER/PORTABLE RECORD PLAYER CABINET. Size 17½" x 13½" x 7", Motor Board 16½" x 12¼". Space for any Single Record Player, Twin Speakers and Amplifier, etc. **Bargain price 45/–** Supplied Cut Out for above if required

I.F. TRANSFORMERS 7/6 pair
465 kc/s slug tuning miniature can 2½" x 1" x 1". High Q and good band width. By Pye Radio. Data sheet supplied.
Wearite M800 I.F. transformers 465 kc/s, **12/6 pair**

NEW AND ENLARGED SHOWROOMS NOW OPEN

C.R.T. ISOLATION TRANSFORMERS

For Cathode Ray Tubes having heater-cathode short circuit and for C.R. Tubes with falling emission.
Type A. Low leakage windings. Ratio 1:1.25 giving a 25% boost on secondary: 2V, 4V, 6.3V, 10.3V, 13.3V, **10/6** each; ditto with mains primaries, **12/6** each. All with tag panel and solder tags.
Type B. Mains input 220/240V. Low Capacity. Multi Output 2, 4, 6.3, 7.3, 10 and 13V. Input has two aps which increase output volts by 25% and 50% respectively. This transformer is suitable for all cathode ray tubes. With tag panel, **21/–** each. Ditto for 6 volt tubes, only **17/6** each.
Type C. Low capacity wound transformer for use with 2V tubes with falling emission. Input 220/240V. Output 2-2¼-2½-2¾-3V at 2A, **17/6** each.
All isolation transformers are individually boxed, labelled and clearly marked with relevant data.
NOTE.—It is essential to use mains primary types with TV receivers having series connected heaters.

RESISTORS. All values. 20% 10 ohms to 10meg. ¼W **4d.**, ½W **4d.**, 1W **6d.**, 1½ **9d.**, 2W **1/–**
HIGH STABILITY. ½W 1%, **2/–**. All preferred values 100 ohms to 10 meg. Ditto 10%, **6d.** each

WIRE-WOUND RESISTORS 25 ohms–10,000 ohms: 5 watt **1/3**; 10 watt **1/6**; 15 watt **2/–**
15,000 ohms–50,000 ohms, 5W, **1/9**; 10W, **2/3**

WIRE-WOUND POTS. Pre-set min. TV type. Knurled slotted knob. All values 25 ohms to 30 K, **3/–** each. 50K, **4/–**. Ditto Carbon Track 50K to 2 Meg, **3/–**
3W Lab. Colvern, etc. Standard size Pots., 2¼" Spindle high grade. All values, 100 ohms to 50K, **5/6**; 100K, **6/6**
W/W EXT. SPEAKER CONTROL 10Ω, **3/–**
O/P TRANSFORMERS. Heavy duty 50mA, **4/6**. Multi-ratio push-pull, **6/6**. Miniature 3V4, etc., **4/6**. Small pentode **4/6**. Hygrade push-pull 7 watts, **15/6**
L.F. CHOKES 15/10H 60/65mA, **5/–**; 25/20H, 100/120mA, **11/6**; 20/15H, 120/150mA, **12/6**; 5H, 250mA, **15/–**. **MAINS TRANS.** 350-0-350, 80mA, 6.3V tapped 4V 4A 5V tapped 4V 2A, ditto 250-0-250 80mA, etc., **22/6**

CRYSTAL MIKE INSERT by Acos
Precision engineered. Size only 1⅛" x 3/16". Bargain. Price **6/6** — No transformer required

HEATER TRANS. Tapped 200/250V 6.3V 1½A, **7/6**
ALADDIN FORMERS and cores. ¼" **8d.**; ⅜" **10d.**
0.3" FORMERS 5937/8 and cans TV1/2. ¾" sq. x 2⅞" and ⅝" sq. x 1⅜", **2/–** complete with cores
SLOW MOTION DRIVES. Epicyclic ratio 6:1, **2/3**
TYANA. Midget Soldering Iron. 200/220V or 230/250V, **16/9**. **SOLON MIDGET IRON**, 25W, **24/–**
MAINS DROPPERS. 3" x 1½". Three adj. sliders, 0.3A 750 ohms, **4/3**; 0.2A 1,000 ohms, **4/3**
LINE CORD. 0.3A 60 ohms per foot, 0.2A 100 ohms per foot, 2-way, **6d.** per foot; 3-way **7d.** per foot
MIKE TRANSF. 50:1, **3/9**; 100:1, Potted **10/6**
LOUDSPEAKERS. P.M. 3 ohm. 2½" square, **17/6** 5" R.A. **17/6**, 7" x 4" Goodmans **21/–**, 3½" sq. Elac, **21/–**, 8" Plessey **19/6**, 6½" Goodmans **18/6**, 10" R.A. **30/–**, 12" Plessey **30/–**, 8" M.E. 2.5K field tapped, o.p. transformer **24/6**. 15 ohm Plessey 10W 12" with Tweeter **97/6**
CRYSTAL DIODES. G.E.C. **2/–**; GEX34 **4/–**;
40 CIRCUITS FOR GERMANIUM DIODES, 3/–
CRYSTAL SET, complete kit **12/6**. Construction book **1/–**. **TUNING AND REACTION COND.** 100pF, 300pF, 500pF, **3/6** each
H.R. HEADPHONES 4,000 ohms, brand new, **16/6** pr
SWITCH CLEANER Fluid, squirt spout, **4/3** tin
TWIN GANG CONDENSERS. 365pF, miniature, 1⅞" x 1½" x 1⅝", **10/–**. 0.0005 standard with trimmers, **9/–**; less trimmers, **8/–**. Midget **7/6**; 50pF single, **2/6**

SUPERHET COIL PACK 27/6
Miniature size 2½" x 2¾" x 1½". High Q dust cored coils. Short, Med., Long. Gram. switching with connection diagram and circuit. 465 kc/s i.f.

Written guarantee with every purchase

Aluminium Chassis. 18 s.w.g. Plan, undrilled, with 4 sides, riveted corners and lattice fixing holes, with 2½" sides. 7" x 4", **4/6**; 9" x 6", **5/9**; 11" x 7" **6/9**; 13" x 9", **8/6**; 14" x 11", **10/6**; 15" x 14", **12/6**; 18" x 16" x 3", **16/6**

Volume Controls

Midget size
Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Meg.
No. S2 S.P.Sw. D.P.Sw.
3/– 4/– 4/9
Linear or Log Tracks

80 Ω Coaxial cable

Semi-air spaced Polythene insulated ¼" dia. stranded core. Ideal Band III **9d.** yd. Losses cut 50%.

FRINGE QUALITY
Air-spaced Coaxial **1/6** yd

Co-axial Plugs 1/– — **Double Socket 1/3**
Sockets 1/– — **Outlet Boxes 4/6**
Balanced Twin Feeder per yd, **6d.** 80Ω or 300Ω
Twin Screened Balanced Feeder, 1/– yd, 80 ohms
Trimmers. Ceramic, 30, 50, 70pF, **9d.**; 100pF, 150pF, **1/3**; 250pF, **1/6**; 600pF, 750pF, **1/9**. Philips **1/–** each
BLACK CRACKLE PAINT. Air drying, **3/–** tin
P.V.C. CONN. WIRE, 10 colours, single or stranded, **2d.** yd. Sleeving 1, 2 mm **2d.**, 2, 3 mm **3d.**, 6 mm **5d.** yd
5" RADIO SCREWDRIVERS, 6d. each
NEON MAINS TESTER SCREWDRIVERS, 5/6
MULTICORE SOLDER, 60/40, 18 s.w.g., **3d.**, 16 s.w.g., **4d.** yd; ¼lb **2/6**
Sentercel Rectifiers. E.H.T. Type Fly-back. Voltages: K3/25 2kV, **5/–**; K3/40 3.2kV, **7/–**; K3/45 3.6kV, **Mains Type** RM1, 125V 60mA, **5/–**; RM2 100mA, **6/–**; RM3 120mA, **8/–**; RM4 250V 275mA, **16/–**; RM5, **20/–** **7/6**; K3/50V 4kV, **8/–**; K3/100 8kV **14/6** 50 cps voltage 30% of above ratings.
Miniature Contact Cooled Rectifiers. 250V 50mA, **8/6**; 250V 85mA, **9/6**
Coils. Wearite "P" type, **3/–** each. Osmor Midget "Q" type adj. dust core, from **4/–** each. All ranges
Teletron. L. & Med. T.R.F., with reaction, **3/6**
Ferrite Rod Aerials. M.W., **8/9**; M. & L., **12/6**
T.R.F. Coils A/HF, **7/–** pair. **H.F. Chokes, 2/6**

HANDY VOLTMETERS
2" Twin Range 0–25V, 0–250V d.c. with leads and Leather case, **12/6** each

Condensers. New stock. 0.001µF 7kV T.C.C., **5/6**; ditto 20kV, **9/6**; 100pF to 500pF Micas, **6d.**; Tubular 500V 0.001 to 0.01µF, **9d.**; 0.05, 0.1, **1/–**; 0.25, **1/6**; 0.5, **1/9**; 0.1/350V, **9d.**; 0.1/600V, **1/3**; 0.1/2,000V, **4/–**
Ceramic Condensers. 500V 0.3pF to 0.01µF, **10d.**
Silver Mica 10% 5pF to 500pF, **1/–**; 600pF to 3,000pF, **1/3**; Close tolerance, (plus or minus 1pF), 1.5pF to 47pF, **1/6**; ditto 1% 50pF to 815pF, **1/9**; 1000pF to 5000pF **2/–**.

NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350V	2/–	100/25V	3/–	8+16/450V	5/–
2/450V	2/3	8+8/500V	6/–	16+16/500V	6/–
4/450V	2/–	16+16/500V	6/–	6,000µF 6V	6/6
8/450V	2/3	**CAN TYPES**		32+32/350V	4/6
8/500V	2/9	Clips	3d.	32+32/450V	6/6
16/450V	3/6	16/450V	3/6	64+120/275V	7/6
16/500V	4/–	32/350V	4/–	60+100/350V	11/6
32/450V	5/6	64/350V	5/6	100+200/275V	10/6
25/25V	1/9	100/275V	5/6		
50/25V	1/9	50+50/350V	7/–	1,000+1,000/6V	6/6
50/50V	2/–	500/12V	3/–		

Full Wave Bridge Selenium Rectifiers. 2, 6 or 12V 1½A, **8/9**; 2A, **11/3**; 4A, **17/6**
Charger Transformers. Tapped Input 200/250V for charging at 2, 6 or 12V 1½A, **15/6**; 2A, **17/6**; 4A, **22/6**

12/6 PURETONE RECORDING TAPE
1,200ft on standard 7" metal reels. Spare reels 5" metal, **1/6**; 7" metal, **2/3**
FERROVOICE 1,200ft Plastic Tape, **25/–**

Please address all Mail Orders correctly as below

CHAMPION (VHF) FM TUNER

88 to 96 Mc/s

5 MULLARD VALVES and SUPERHET TUNING HEART

Maroon and cream receiver styled cabinet 6" x 12" x 6". Features: This is a self-powered 200/250V a.c. VHF (FM) Adaptor with operating and servicing data, and a screened lead for connection to pick-up sockets of any radio, radiogram or amplifier.
Brand new with 12 months guarantee. List price **16 gns. Our price 10 gns.**, carr. 4/6

BBC Beginners I valve radio kit in stock

JASON FM TUNER COIL SET, 26/–. H.F. coil, aerial coil, oscillator coil, two i.f. transformers 10.7 Mc/s, detector transformer and heater choke. Circuit and component book using four 6AM6, **2/–**. J.B. Chassis and dial, **19/6**. Complete kit, **£5.18.6.** With Jason superior calibrated dial, **£6.15.0.**

Wavechange Switches. 2 p 2-way, 3 p 2-way, short spindle, **2/6**; 5 p 4-way 2 wafer, long spindle, **6/6**; 2 p 6-way, 4 p 2-way, 4 p 3-way, long spindle, **3/6**; 3 p 4-way, 1 p 12-way, long spindle, **3/6**; Wave change "MAKITS," 1 wafer, **8/6**; 2 wafer, **12/6**; 3 wafer, **16/–**; 4 wafer, **19/6**; 5 wafer, **23/–**; 6 wafer, **26/6**
Toggle Switches, s.p. 2/–, d.p. **3/6**, d.p.d.t. **4/–**
Morse Keys, good quality, **2/6**

Knobs, Gold Engraved. Walnut or Ivory. 1⅝", diam., **1/6** each. 'Focus,' 'Contrast,' 'Brilliance, 'Brilliance-On/Off,' 'On-Off,' 'Volume,' 'Volt-On/Off,' 'Tone,' 'Tuning,' 'Treble,' 'Bass,' 'Wave-change,' 'Radio-Gram,' 'S.M.L.-Gram,' 'Record-Play,' 'Brightness.' Ditto, not engraved, **1/–**

Valveholders. Pax. int. oct, **4d.** EF50, EA50, **6d.** B12A, CRT, **1/3**. Eng. and Amer. 4, 5, 6, 7 and 9 pin, **1/–** MOULDED Mazda and int. oct, **6d.**, B7G, B8A, B8G, B9A, **9d.** B7G with can, **1/6**. VCR97, **2/6**. B9A with can, **2/6**. **Ceramic**, EF50, B7G, B9A int. oct., **1/–**. B7G with can, **1/9**; B9A with can, **2/9**
Speaker Fret. Gold cloth, 18" x 25", **5/–**; 25" x 36", **10/–**. Expanded metal, silver, 15¾" x 9½", **2/–** each; 14½" x 12", **3/–** each
Tygan. 4' 6" wide, **10/–** ft; 2' 3" wide, **5/–** ft.

All Boxed VALVES New & Guaranteed

1R5	8/6	6K8	8/6	EABC80	8/6	EZ81	11/6
1S5	8/6	6L6	10/6	EB91	6/6	EI148	1/6
1T4	8/6	6Q7	10/6	EBC33	8/6	HABC80	12/6
3S4	8/6	6SA7	7/6	EBC41	10/6	HVR2A	7/6
3V4	8/6	6SN7	8/6	EBF80	8/6	MU14	10/6
5U4	8/6	6V6G	7/6	ECC84	12/6	P61	6/6
5Y3	8/6	6V6GT	8/6	ECF80	10/6	PCC84	12/6
5Z4	10/6	6X4	7/6	ECF82	10/6	PCF80	10/6
6AM6	8/6	6X5	7/6	ECH42	10/6	PCF82	10/6
6B8	5/6	7S7	8/6	ECL80	8/6	PCL82	10/6
6BE6	7/6	12A6	7/6	ECL82	12/6	PEN25	6/6
6BH6	10/6	12AH8	10/6	EF39	7/6	PL82	10/6
6BW6	8/6	12AT7	10/6	EF41	10/6	PY80	10/6
6BW7	8/6	12AU7	10/6	EF50	5/6	PY81	10/6
6CH6	10/6	12AX7	10/6	Equip.		PY82	10/6
6D6	7/6	12BE6	10/6	EF50	8/6	SP61	5/6
6F6	7/6	12BH7	10/6	Sylv.		UBC41	8/6
6H6	3/6	12K7	8/6	EF80	10/6	UCH42	8/6
6J5	6/6	12Q7	8/6	EF92	5/6	UF41	8/6
6J6	7/6	35Z4	10/6	EL32	5/6	UL41	8/6
6J7	8/6	80	8/6	EL84	10/6	UY41	8/6
6K6	6/6	954	1/6	EY51	11/6	U22	10/6
6K7	5/6	EA50	1/6	EZ40	10/6	X79	10/6

RADIO COMPONENT SPECIALISTS

337 WHITEHORSE ROAD WEST CROYDON

Tel. THO 1665 — *Catalogue 6d.*

OPEN ALL DAY (Wed. 1 p.m.)

Buses 133 or 68 pass door. S.R.Stn. Selhurst. **48-hour Postal Service.** P & P. 1/–, over £2 post free C.O.D. 1/6 (Export C.W.O. post extra no H.P.)

The
Radio Constructor
incorporating THE RADIO AMATEUR

CONTENTS FOR NOVEMBER

VOL. 11 NO. 4
NOVEMBER 1957

ANNUAL SUBSCRIPTION 25/– including postage

Editorial and Advertising Offices
57 MAIDA VALE LONDON W9

Telephone
CUNningham 6141 (2 lines)

Telegrams
DATABUX, LONDON

Editor
C. W. C. OVERLAND, G2ATV

Advertising Manager
F. A. BALDWIN, AMIPRE

Opinions expressed by contributors are not necessarily those of the Editor or proprietors.

NOTICES

THE EDITOR invites original contributions on construction of radio subjects. All material used will be paid for. Articles should preferably be typewritten, and photographs should be clear and sharp. Diagrams need not be large or perfectly drawn, as our draughtsmen will redraw in most cases, but all relevant information should be included.

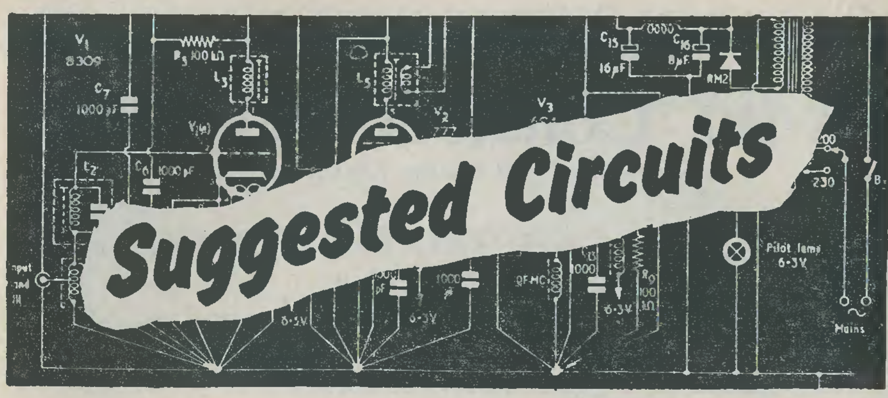
All MSS must be accompanied by a stamped addressed envelope for reply or return. Each item must bear the sender's name and address.

TRADE NEWS. Manufacturers, publishers, etc., are invited to submit samples or information of new products for review in this section.

QUERIES. We regret that we are unable to answer queries, other than those arising from articles appearing in this magazine; nor can we advise on modifications to the equipment described in these articles.

ALL CORRESPONDENCE should be addressed to THE RADIO CONSTRUCTOR 57 Maida Vale London W9

REMITTANCES should be made payable to "DATA PUBLICATIONS LTD."



The circuits presented in this series have been designed by G. A. FRENCH, *specially for the enthusiast who needs only the circuit and essential relevant data*

No. 84. A BLACK-SPOTTER CIRCUIT FOR CATHODE MODULATED RECEIVERS

Although the introduction of new television transmitters, both in Band I and Band III, is gradually ensuring complete coverage of the U.K., the fact cannot be overlooked that viewers still reside in districts where signal strength is of "fringe area" level only. By the use of sufficiently sensitive receivers and carefully placed aerials, it is usually possible for fringe area viewers to obtain programmes of good entertainment value, devices such as flywheel sync and gated a.g.c. helping to maintain a locked picture of steady contrast level. Under these conditions, unfortunately, the entire receiving system is working at maximum sensitivity, with the result that impulsive interference is liable to have a far worse effect on the reproduced picture than is the case when a receiver is operated in a strong signal locality.

Several common types of noise limiter circuit are available for reduction of the effects of interference, the more frequently encountered types consisting of simple pulse limiters. These circuits normally work by preventing interference pulses from reaching an amplitude higher than that of peak white, with the result that, although the interference still appears on the screen, it does so at reduced intensity. A far better method of overcoming the effects of impulsive interference is by the use of a "black-spotter," this being a device which causes interference pulses having an amplitude higher than peak white to appear on the screen as black spots or lines, whereupon they become much less noticeable. The possibility of adding a black-spotter to a conventional receiver having a cathode-modulated tube (the circuit arrangement employed in practically all commercial televisors) is discussed in this month's article.

Principles

Before proceeding further the writer would like to point out that, although the circuitry and principles employed in the black-spotter circuit which is to be described are very simple, he feels that its installation in a televisor should be carried out by constructors having a fair working knowledge of television theory and practice. The main reason for making this statement is that the method of applying the black-spotter pulse to the tube itself is liable to depend to a very large extent upon the existing circuit around the tube, and care needs to be taken if tube operating conditions are not to be altered unwisely.

The process of obtaining the black-spotter pulse is quite simple, and the basic circuit required is illustrated in Fig. 1. The purpose of the black-spotter is that of amplifying pulses appearing at the video output anode which exceed a certain amplitude, and of applying these, with the *same* polarity, to the grid of the c.r.t. Thus, if an interference pulse at the video output anode causes the c.r.t. cathode to go heavily negative—thereby tending to increase beam current—an even larger negative pulse is applied to the c.r.t. grid by the black-spotter amplifier. The nett result is that beam current is reduced instead of being increased during the period of the pulse, and the interference appears on the picture at black level.

The first problem incurred in designing a black-spotter amplifier is that of obtaining a source of video, and of amplifying interference pulses from this source such that the output has the same polarity. If it is to be effective the black-spotter amplifier must also be extremely quick-acting as, otherwise, the start of interference pulses on the picture may not be blacked out. In order to ensure quick-acting operation it is advisable to keep the number of valves employed to a minimum. An excellent choice for a black-spotter amplifier capable of meeting these requirements would be the use of a single grounded-grid valve. The fact that a grounded-grid amplifier requires an input signal at relatively low impedance raises no difficulty since, if its input is taken from the video output anode, a relatively low source impedance is automatically available. A grounded-grid black-spotter amplifier can also be made to provide its own delay voltage quite easily, all that is required being to apply a fixed voltage to its grid. This voltage can be provided by a high resistance potentiometer connected across the h.t. supply.

It was stated earlier that the black-spotter amplifier should be fed from the anode of the video output valve. The reason for this is that it is necessary to obtain a video signal of good amplitude, and to ensure that no a.c. couplings with short time constants appear between the video output and the black-spotter input. For ideal results the black-spotter input cathode should be connected direct to the video output anode, giving thereby a d.c. coupling. Unfortunately, the video output anode is at a fairly high h.t. potential, and a d.c. coupling of this would result in insufficient h.t. voltage being available for the black-spotter amplifier from the receiver power supply. Methods of obtaining higher h.t. voltages for the black-spotter amplifier from, say, the boosted h.t. line or a separate power pack are unattractive; this being due to the poor regulation given by the boosted h.t. supply, and the somewhat cumbersome nature of the separate power pack scheme.

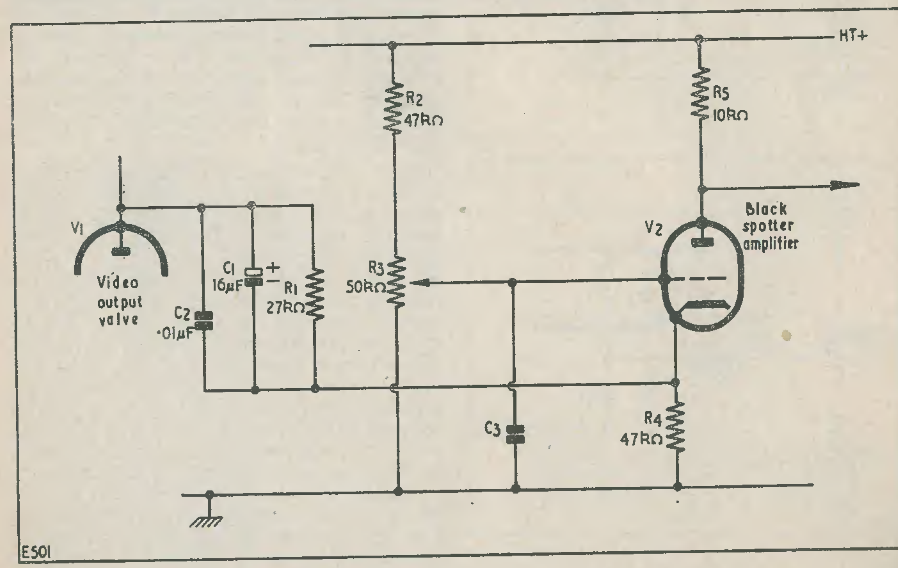


Fig. 1

In the circuit given in Fig. 1 the problem of feeding video information to the black-spotter amplifier is solved in compromise fashion, the cathode of the black-spotter amplifier being held at an h.t. potential lower than that at the video output anode, and video coupling being provided by a "partial a.c. coupling" having the relatively long time constant of 0.25 seconds. (C_1 multiplied by R_1 and R_4 in parallel.) In this arrangement C_1 becomes charged to a voltage which is equal to approximately one-third of the average potential of the video output anode above chassis, and the coupling is adequate under almost all practical conditions. Incidentally, the purpose of the 0.01μF condenser,

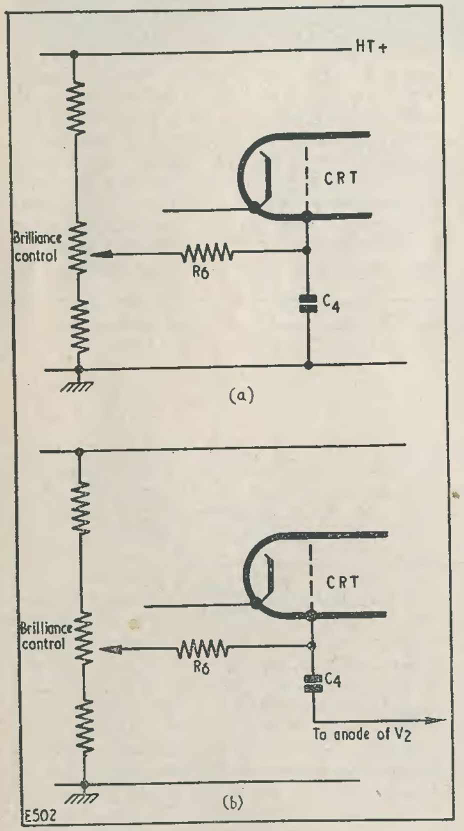


Fig. 2

C_2, connected across C_1 is merely that of ensuring that pulse fronts are passed to the cathode of V_2 without loss of sharpness due to possible inductive reactances in C_1. It is very probable that C_2 could be omitted when a good quality modern electrolytic condenser is employed in the C_1 position. Despite this, it would still be worth while having C_2 in circuit when the device is being brought into initial working order, even if it is found that the condenser may be later cut out of circuit without loss of efficiency.

Since the video amplifier anode is feeding the cathode of the c.r.t., it follows that picture information and interference pulses will be negative-going. The black-spotter amplifier, V_2, employs a valve having a short grid base and whose grid is held, by means of R_3, to a potential which is negative to the cathode for all picture levels including peak white. On the arrival of an interference pulse whose amplitude is greater than peak white, the increased negative excursion of V_2 cathode brings it within the grid base of the valve. The valve then conducts, causing a negative, amplified, pulse to appear at its anode. This amplified pulse is applied to the grid of the c.r.t., and the interference pulse becomes blacked out.

It is interesting to note that, when V_2 conducts, it draws current from the electrolytic condenser C_1, instead of from the h.t. negative line. The high value of capacity chosen for C_1 has the secondary advantage of ensuring that the cathode of V_2 remains at a reasonably steady potential, even during long periods of interference. V_2 is liable to run into grid current conditions during interference periods, but the values of R_2 and R_3 limit this current to a safe value when these periods are long.

Since the components in the cathode circuit of V_2 are certain to add additional capacity across the video anode load, it is important to keep this capacity to a low value. To ensure that this requirement is met, C_1, C_2, R_1 and R_4 should all be mounted well clear of the chassis or of any other metal work which is at chassis potential. A typical choice for V_2 would be one-half of an ECC81 (the remaining half being unused). However, the type of valve employed in the V_2 position should not present too critical a choice, as all that is required is a reasonably short grid base and a low capacity between cathode and heater. In receivers having series heater strings it would probably be most advisable to heat V_2 by means of a separate heater transformer (one side of whose secondary is connected to chassis) rather than to attempt to insert it into the heater chain, where it requires to be fairly close to the earthy end.

The setting up of the black-spotter circuit after it has been installed in the receiver is very simple. The potentiometer R_3 should be initially set so that the slider is at the earthy end of its track, and the receiver contrast control adjusted for a correct picture. The slider of R_3 is next brought up until the peak white sections of the picture change to black. The slider is then turned back very slightly from this position.

Connections to the C.R.T.

The above has described the operation of the black-spotter circuit, and it has been possible to give definite details of its circuit and of its operation. Unfortunately, the same remark cannot be made about the application of the black-spotter pulses to the grid of the c.r.t., this being due to the very probable existence of a frame flyback blanking circuit, combined possibly with grid current limiting components. In all the circuits which follow, especially those in Fig. 4, the tube operating conditions will be slightly altered by adding the black-spotter circuit, insofar that modifications to the tube grid connections may alter grid current surge conditions for the periods immediately after switching on or switching off the receiver. It is possible only to generalise on the circuitry used in particular receivers in an article of this nature, and whilst the risk of exceeding tube limiting values in the modified arrangements is low, constructors who wish to do so should consult the appropriate tube literature or seek advice beforehand from the manufacturers.

Dealing with uncomplicated arrangements first, Fig. 2 (*a*) illustrates a simple c.r.t. grid circuit wherein frame flyback blanking pulses are *not* fed to the grid of the c.r.t. All that happens here is that the brilliance potentiometer applies a variable potential to the grid via the limiting resistor R_6, and that the grid is decoupled to chassis via C_4. To enable the black-spotter circuit to work, C_4 should be disconnected from chassis and connected direct to the anode of the black-spotter, whereupon the circuit arrangement is complete (Fig. 2 (*b*)). The extra resistance inserted between the grid of the c.r.t. and chassis (via the negligible impedance of the h.t. supply) by R_5 will not affect definition. It is advisable, before reconnecting C_4 of Fig. 2 (*a*) in its new position, to ensure that it has not developed any leakiness in service. If, in the original circuit, C_4 had a value considerably greater than 0.002μF, it should be reduced to this value in the new position.

Fig. 3 (*a*) illustrates what will probably be the most commonly encountered c.r.t. grid circuit. In this arrangement the brilliance network appears as before, but we now have a capacity or capacitive network (C_5) connected to chassis, into which frame blanking pulses (usually from the frame output transformer secondary circuit) are injected via a series resistor, R_7. If the particular receiver being handled has the basic circuit shown in

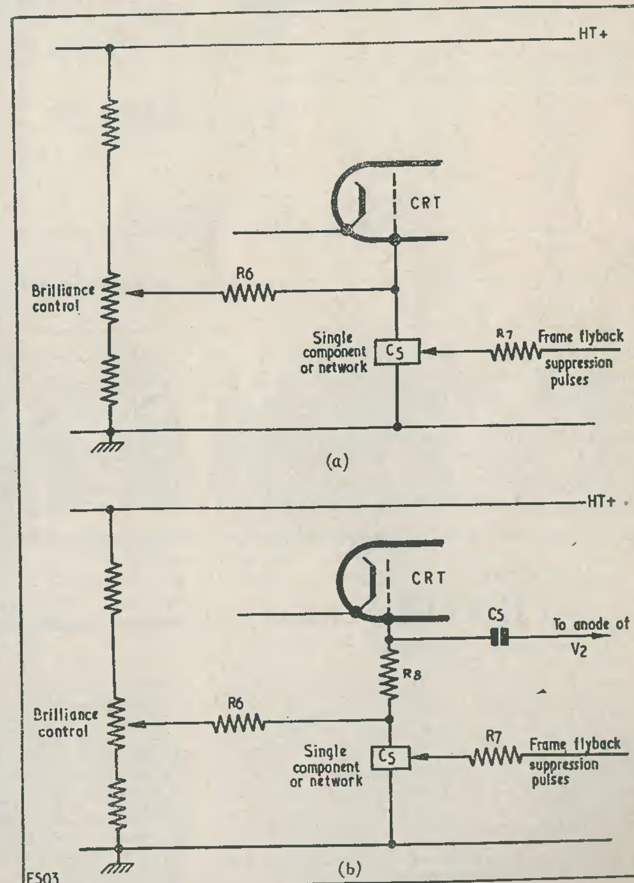


Fig. 3

Fig. 3 (*a*), it may be altered to that of Fig. 3 (*b*). In Fig. 3 (*b*) the condenser C_5, which feeds the black-spotter pulses to the grid, has a value which is not greater than that originally decoupling the grid to chassis. Normally, a 0.002μF condenser will meet this requirement very adequately. It will be noted that an additional resistor, R_8, is now inserted between the original capacity to chassis and the grid. The next step consists of checking experimentally whether the change to Fig. 3 (*b*) has not excessively reduced the effectiveness of the frame blanking circuits. This test may be carried out by initially fitting a 100kΩ resistor in the R_8 position, and reducing the value of R_7, if necessary, to bring frame flyback suppression to an acceptable level. It would probably be inadvisable to reduce R_7 to a value lower than one-quarter of its original value. If difficulty is experienced in obtaining adequate blanking, the value of R_8 may be reduced (to a minimum of 25kΩ), or the value of C_5 reduced. In many receivers frame flyback blanking pulses are considerably larger than is really necessary, whereupon the extra integration given by R_8 and C_5 does not adversely affect the results obtained in practice. In such receivers the modified circuit would not have to undergo the experimental procedure just outlined, as it would function immediately it was installed. In some televisors it will be found that the grid of the tube is connected up in a circuit similar to that of Fig. 4, wherein a resistor is inserted in series with the c.r.t. grid with the sole purpose of reducing surges. It is possible to bring the black-spotter circuit into operation here by connecting a 0.002μF condenser directly between the anode of V_2 (Fig. 1) and the c.r.t. grid. However, for the reasons mentioned above it would be advisable to ensure that tube limiting conditions are not exceeded when this modification is carried out.

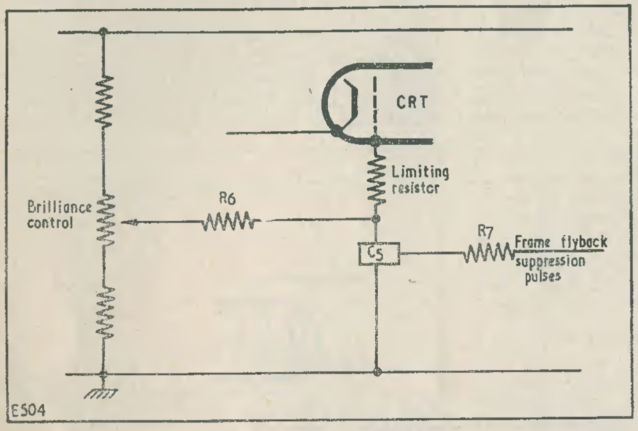


Fig. 4

TRADE *review*

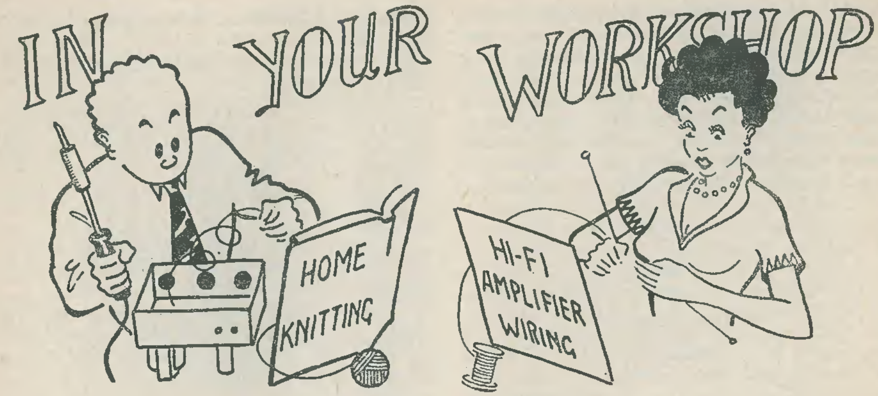
Messrs. R. Fagelston, 46 Hardwicke Road, London, N.13, has forwarded to us a sample "Universal" Chassis Construction Kit. This consists of eleven pairs of chassis side panels, each pair a differing length, which may be bolted together to form a really firm foundation for a chassis deck. These aluminium channel sections are all 2in in width and the smallest is 4in in length—the longest being 14in, the whole range of 11 pairs varying in 1in lengths. All parts are interchangeable, and the basis for practically any size of chassis can be assembled. Additional sections could be used for volume control panels or as rack amplifiers with suitable front panels added. Idea for printed circuits or prototype chassis, they have the great advantage of being suitable for use over and over again.

Also submitted from the same firm is a selection of miniature metal cased electrolytic capacitors specially designed for use with transistors. Varying in length from 4/5ths of an inch for the 25μF 6V working type to 2/5ths of an inch for the 1.6μF 6V working type, eight values are at present available. In addition to those specified above, others available are: 16μF at 12.5V; 8μF at 25V; 8μF at 6V; 5μF at 12.5V; 2.5μF at 25V and 5μF at 40V working respectively. Trade enquiries are invited.

Kendall & Mousley Ltd., 18 Melville Road, Birmingham 16, have sent a few of the close tolerance resistors of which they hold large stocks both for the trade and the home constructor. Any value from 1 ohm to 10MΩ in the 1% tolerance range is available, and in the 5% range stocks are held up to as high as 100MΩ. Also stocked are potentiometers suitable for ratio arms of bridges, from the small 2in one up to 3½in in diameter—larger sizes can be obtained to order, these being supplied with ball-bearing mounted spindle. Capacitors of 100, 1,000 and 10,000pF are readily available in the 1% tolerance range. For the inexpensive standards at the low end of the bridge, there are ceramic capacitors in the range of 3pF to 820pF, all at 2% tolerance.

Mullard Ltd., Mullard House, Torrington Place, London, W.C.1, have now published their Autumn 1957 edition of the Mullard Pocket Data Booklet. Of 72 pages, in stiff card cover, it includes all the latest information on valves, tubes, transistors, germanium diodes and thermistors, etc.

IN YOUR WORKSHOP



Aided by his able assistant Dick, Smithy the Serviceman continues to run the Workshop

"WELL, THAT'S A NICE NEW-LOOKING SET," commented Dick approvingly, as Smithy pointed to a television receiver which had come to the head of the queue for repair. "We don't often get them in here as fresh from the factory as this! What's wrong with it, Smithy?"

"Probably nothing at all," replied the Serviceman, a little aggrievedly. "The customer had it in his home for a week, then a friend of his told him he could improve its performance just by making one or two minor adjustments. The friend had the back off and, after a few minutes, that was that! So far as I can gather the set is OK on sound, but there's no picture. I should imagine that it just needs setting up properly again."

"OK," said Dick cheerfully, carrying the set over to the bench. "I daresay that will be the last time that particular set-owner lets other people mess around with his receiver. By the way, isn't this cabinet rather shallower than usual?"

"Ninety degree tube," commented Smithy succinctly, returning to his work.

Linearity Coils

Peace reigned over the workshop during the next few minutes as Dick worked on the televisor. He first of all checked to see whether the valves were firmly seated in their holders and that no obvious fault was evident. He then switched on the set, adjusted it to the local channel, plugged in an aerial and allowed it to warm up. As Smithy had stated, the sound circuits seemed to be in good order. Shortly after the sound had become audible, a faint whistle from the line output stage indicated that the efficiency diode had reached operating temperature, and Dick waited a few further moments for the e.h.t. rectifier to warm up. However, no raster appeared, despite adjustments to the brilliance control. The ion trap magnet seemed to be too far up the neck of the tube, so without bothering to check for the presence of e.h.t. Dick gave it an exploratory turn. A faint glimmer of light from the screen rewarded his efforts, and turning brilliance down as necessary he soon had the ion trap magnet set up in its correct position. Both frame and line circuits were well off frequency, and Dick next adjusted these, finishing off with the picture shift, and the frame amplitude and linearity controls.

"Job done," he announced contentedly, as a nicely linear Test Card C showed up on the tube face. "I reckon our customer's friend must have waggled every knob he could lay his hands on."

"He must, indeed," agreed Smithy, who had been watching Dick out of the corner of his eye. "You know, the mental processes of these meddlers just about has me baffled.

You'd think that if something obviously went wrong with the picture after they'd made one adjustment, they'd set that adjustment back to where it was before carrying on to anything else. However, they seem to be incapable of thinking in terms like that. Fortunately, most people prefer to leave internal adjustments on t.v. sets severely alone, when they aren't too sure about what they're doing."

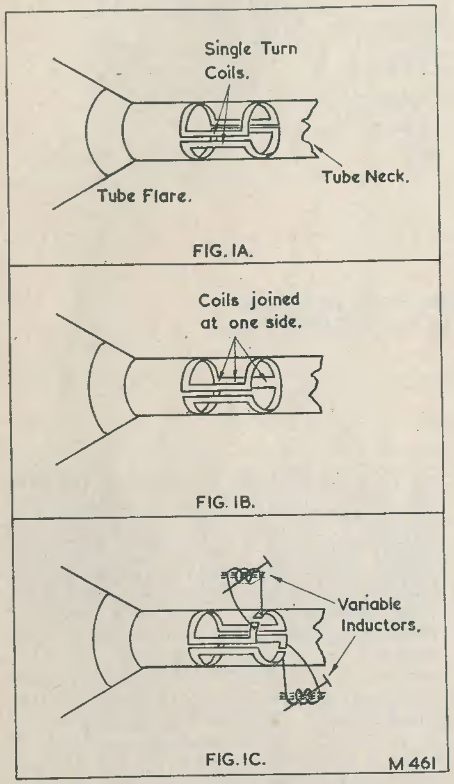


Fig. 1 (a). A pair of shorted-turn line linearity coils fitted to the neck of a cathode ray tube. 1 (b). An alternative version in which the two coils are joined together. 1 (c). The action of the linearity coils may be controlled by inserting variable inductors, as shown here

"It would seem the sensible thing to do," Dick said, picking up the cabinet back preparatory to re-fitting it. "By the way," he added, after a thoughtful pause, "a rather peculiar thing has just occurred to me. Our friend, the Wrecker, didn't touch the line linearity control at all. Nor, come to think of it, did I."

Dick scratched his head and looked inside the cabinet again.

"In fact," he continued, sounding somewhat puzzled, "this set just doesn't *have* a line linearity control! Have you any idea why that should be, Smithy?"

The Serviceman peered into the cabinet and grinned.

"It's got a line linearity control all right," he chuckled, "but it's one of those new types which fit directly onto the tube neck."

"I seem to remember reading something about them some months ago,"[1] said Dick. "Is it one of those controls which used a shorted-turn technique?"

"That's right."

"Oh," remarked Dick, thoughtfully. "From what I remember, the device consists of a couple of rectangular coils fitted onto the tube neck, which for some mysterious reason give you excellent line linearity as a result. To be perfectly honest, though, I don't really understand how the idea works."

"Well, it's simple enough when you get down to the basic facts," replied Smithy. "The first thing to remember is that, if you were to operate the average television line output stage without any form of linearity control at all, the left-hand side of the picture would be opened out and the right-hand side compressed. The primary object of the conventional type of linearity control is, then, to compress the left-hand side and open out the right-hand side."

"And that," chimed in Dick, "is why the usual type of linearity control uses a permanent magnet and a ferrite core inside a coil. The coil is in series with the line deflector coils so that the line current flowing through it changes direction about a third of the way along the scan—that is, when the line output valve takes over from the booster diode. At the beginning of each line scan the current in the coil magnetises the ferrite core with the opposite polarity to the field given by the permanent magnet, with the result that the total magnetising force is low, the core has high permeability, and the coil possesses high impedance. At the end of the scan the current in the coil assists the magnetising force from the magnet, causing the ferrite core to lose permeability and the coil to present a low impedance. The high impedance of the coil at the beginning of the scan causes the left-hand side of the picture to compress; and the low impedance at the end of the scan causes the right-hand side of the picture to open out. Which is just what you want for good linearity."

[1]*Mullard Outlook*, Jan 1957

"Well, well, well," commented Smithy, impressed. "You've certainly got that off pat! After an explanation as comprehensive as that I only have to add that the correction given by the average line linearity control is of an approximate character only, this being due to the fact that the opening out and cramping of the line scan do not usually fall as neatly into the left- and right-hand sides of the picture as one would like. Also the changes in permeability in the ferrite core do not exactly balance out the changes in linearity over the scan. Nevertheless, the ordinary type of linearity control does give quite acceptable results, as we all know.

"The new type of linearity control works on a different process altogether. There are several possible versions, but the simplest type consists of two flat single-turn coils mounted on the surface of the tube neck like this (Fig. 1(*a*)). The coils are nothing more or less than single "shorted turns" and they can be made from thin copper foil or any similar metal. The coils are intended to lie between the deflector yoke and the neck of the tube.

"As you are doubtless aware, when a conductor is placed in a magnetic field which is changing in strength, a current is induced in that conductor. This current increases if the rate of change of the field is increased; and vice versa. Also the induced current in the conductor creates its own magnetic field, this opposing that which is applied. With the shorted turn coils we are considering here we have the case where a changing magnetising force—that given by the line deflector coils—causes a current to be induced in the shorted turn coils. This induced current then causes a field to appear which opposes that given by the deflector coils. Since the current induced in the shorted turn coils is proportional to the rate of change in the deflecting field, it follows that this current will be greater at the beginning of the scan than at the end, with the consequence that the opposing magnetic force will also be greater at the beginning of the scan than at the end. Summing it up, therefore, the shorted turn coils apply a large opposing field when the deflecting field is changing rapidly, and a small opposing field when the deflecting field is changing slowly. So far as the electron stream inside the tube is concerned, we then find that deflection efficiency is lower when the deflecting field is changing rapidly, and higher when it is changing slowly; giving you, therefore, the conditions needed for obtaining a linear scan."

"I see," said Dick, thoughtfully. "If you can visualise the basic fact that the opposing magnetic field from the shorted turn coils is proportional to the *rate* of change of the deflecting field, everything else seems to fit into place. Incidentally, will all the commercial versions of shorted turn linearity coils look like those you have just shown me?"

"Not necessarily," said Smithy. "It is possible to use several versions of the fundamental idea. You can, for instance, join the two coils together at one side like this (Fig. 1(*b*)). They still work in the same way as the two separate coils, but they are easier to manufacture. The necessity for providing some form of adjustment to the coils may also cause different versions to be used by individual set-makers. One way of varying the mount of correction the coils give consists of changing their position; say, by sliding them forwards or backwards along the neck of the tube. Another method consists of inserting variable inductors in series at either end (Fig. 1(*c*)). Varying these inductors then alters the amount of correction given. As you can see, there are quite a number of ways in which the linearising effect of the coils may be varied. From the serviceman's point of view it is doubtful whether the linearising coils could cause much trouble if they were of the simple shorted turn variety (Figs. 1(*a*) and 1(*b*)), and in most instances they would be preset in position before the receiver left the factory. It might be necessary to re-adjust the coils if a new tube were fitted, but the service manual would probably give all the information required for that particular operation."

Dick was quiet for a moment.

"If two single shorted turns can be joined together along one side to make them easier to manufacture," he remarked, eventually, "couldn't you carry the whole process a stage further by doing away with coils altogether and replacing them with a thin metal cylinder fitting right round the neck of the tube? You could say that this cylinder consisted of an infinite number of shorted turn coils all joined together, and it should give you just the same end effect: that of creating an opposing magnetic field proportional to the rate of change in the deflecting field. What is more," he added, warming to his subject, "you would then also be able to control the amount of correction you got by the simple process of moving the cylinder in and out between the tube neck and the deflector coils."

"That's quite a good idea," commented Smithy.

"I knew I was a bit of a genius," said Dick modestly. "Still, I suppose somebody's thought of it already."

"I regret to have to say so," Smithy commiserated. "As far as I know that idea has been used in American sets for quite some time. I think it has more effect on width than on linearity, incidentally."

"Just my luck," grumbled Dick despondently. "There just aren't any bright ideas left these days at all. Quite honestly, I really don't know how my poor old patent agent struggles along right now!"

Smithy laughed.

"Patent agents seem to be quite capable of scraping a living somehow or other," he remarked, "but *we* won't be if we keep on gassing away like this."

With which comment he returned to his own bench, leaving Dick to tidy up the receiver which had started the discussion.

frown on his face he glanced quickly at the receiver's screen, whereupon his expression changed to one of startled surprise. The top of the picture was now perfectly linear. It was the bottom part that was compressed!

"Smithy, I'm seeing things," he called out. "Just now I started off with a picture which was compressed at the top. I turn my back for one moment only, whereupon it immediately becomes compressed at the bottom."

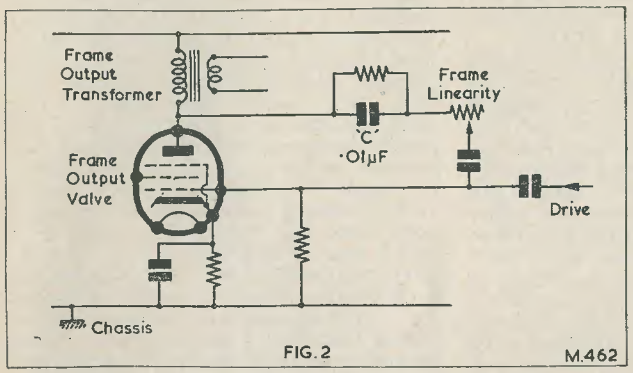


Fig. 2. Part of the frame output transformer circuit referred to in the text. When the lower plate of condenser "C" was accidentally short-circuited to chassis the sudden application of h.t. voltage to the condenser terminals caused its intermittent o/c condition to clear for a while

An Intermittent

Dick soon finished work on the set with the ninety degree tube, and he then returned it to the shelf reserved for completed jobs. He next transferred his attention to another televisor—a somewhat older model this time—and carried it over to his bench. A quick glance at the job ticket attached to one of its knobs revealed the customer's complaint. (A small part of Smithy's business came from a neighbouring retailer, and the Serviceman always insisted on customer information being provided with each set before it was passed on to him.)

" 'Top of picture compressed.,'" announced Dick, reading from the label. "In other words, a nice sticky case of frame non-linearity. Trust me to pick an awkward one!"

With which comment he switched on the receiver and examined the picture it presented. The receiver confirmed the legend on the label, the top part of the picture on its tube being very badly compressed. Dick soon found that it was impossible to clear the fault with either of the frame linearity controls. He next tried changing the frame output and frame oscillator valves, but to no avail.

After these preliminary checks, he took the service sheet for the receiver from Smithy's files, and with its aid made a few quick voltage tests around the frame output circuit. There was nothing obviously wrong. With a

"Take it easy," chuckled Smithy, leaving his job and wandering over. "There's probably quite a simple explanation."

The Serviceman examined the picture given by Dick's receiver and then adjusted its linearity controls. With the aid of these he was able to clear the compression at the bottom of the picture, whereupon the frame scan became completely linear.

"Well," he remarked, a little thoughtfully. "It looks as though we have won ourselves an intermittent receiver. It's obvious that the intermittent cleared during the short time you took your eyes off the screen. The reason for the cramping at the bottom was merely that you—and, possibly, the retailer—had been twiddling the linearity controls whilst the fault *was* on. Despite the fact that the set is OK now, we're still duty bound to find the fault. If we leave the set as it is you can be certain that the fault will come back again once the set is in the customer's house, with consequent loss of reputation on our part. I don't have to tell you how difficult intermittents are to locate, so I think we ought to look for clues, however remote they may be. Were you, for instance, doing anything to the receiver during the time the fault cleared?"

"Oh yes," exclaimed Dick, pointing to part of the circuit in the receiver's service sheet (Fig. 2). "I was just having a quick check with the meter for 'obvious' faults in the

frame output components. As you've told me, it is quite often well worth while devoting a few seconds prodding around for obvious faults before delving deeply into troubles which may not be too easy to diagnose. One of the things I did was to check that the 0.01μF feedback condenser ("C") hadn't gone obviously short-circuit by seeing if a full h.t. reading existed on its earthy side. Come to think of it, I may have accidentally short-circuited this side of the condenser to chassis with one of the test prods whilst taking the reading. Would that give us a lead?"

"It *could* do," said Smithy, not too optimistically. "I notice that the condenser concerned is a moulded paper component. Condensers of this type do occasionally go open-circuit. There is the added fact that you caused the full h.t. voltage to be suddenly applied across the condenser when you shorted its earthy side to chassis. It sometimes happens that intermittent paper condensers become serviceable again for a while after having been subjected to a 'shock' of this nature. Anyway, let's see if that has occurred in this case."

With these words Smithy lightly tapped the suspect condenser three or four times with the plastic handle of a screwdriver. At the last tap the picture shuddered, the top momentarily closed, and then opened out again. Smithy then gripped the body of the condenser and gently tugged it, first in one direction and then the other (Fig. 3). Suddenly the picture reverted to its faulty condition and stayed that way.

"Well, it certainly *seems* to be the condenser," commented Smithy, "but we won't be certain till we've put a new component in its place and given the set a soak test."

Dick soon soldered a new condenser into position, whereupon the receiver reproduced a picture with normal frame linearity. After this he pushed the set to the back of the bench, where he could keep an eye on it. He next picked the faulty condenser off the bench and was just about to throw it into the waste box when a thought occurred to him.

Q.E.D.

"Talking of condensers," he exclaimed, "I've very nearly let you get away without giving me a solution to that problem you set last time! You know, the one about the chap who wanted to buy the 'bargain condenser parcel.' Quite honestly, I couldn't make head or tail of it myself."

"Oh that," replied Smithy, laughing. "I should have thought you'd have had no difficulty there. Anyway, if you remember, all the bargain condenser parcels mentioned in the problem were the same, and each had four condensers in it. The condensers could be 1, 2, 3, or any other whole number of microfarads, there being no fractions or decimals."

"That bit's easy!" said Dick.

"Right," continued Smithy. "Now the next bit of information you were given was that the product of the condenser values came to 36 and that their sum was equal to the

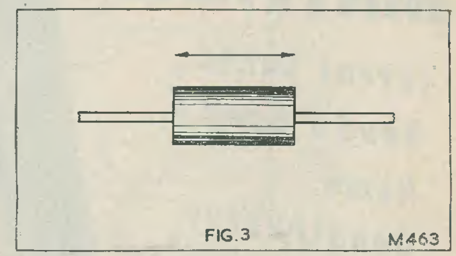


Fig. 3. A paper condenser which is intermittently o/c may occasionally be identified by moving it back and forth in the same direction as its lead-out wires

date next Tuesday. Now we don't know the date next Tuesday, but there's nothing to stop us writing down the possible combinations of condenser values whose product is 36, and to put the sum after each combination. Like this:

36—1—1—1 (39)
18—2—1—1 (22)
12—3—1—1 (17)
9—4—1—1 (15)
9—2—2—1 (14)
6—6—1—1 (14)
6—3—2—1 (12)
4—3—3—1 (11)
3—3—2—2 (10)

"You will note that only two combinations have the same sum, that is: 14. With the result that, if the date next Tuesday didn't help the customer, it was obvious that date was 14. If the sum had been, say, 17, the customer would have been able to pinpoint the combination with certainty.

"This now leaves us with two choices of combination. The salesman said finally that the condenser in each parcel with the largest value was 500 w.v. Of the two combinations adding up to 14 only one has a single condenser larger than the others."

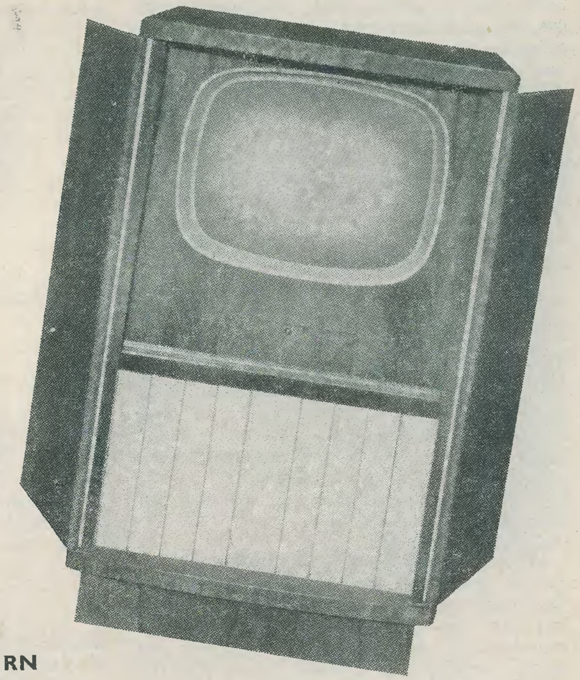
"So that the answer," said Dick, who had been following Smithy's explanation closely, "is that the condensers in each bargain parcel were 9μF, 2μF, 2μF and 1μF."

"Q.E.D.," said Smithy in agreement. "In other words: Quite Easily Done."

The

MAYFAIR

Turret Tuned Band 1-Band 3 Home Constructor TELEVISOR



PART 3

by **S. WELBURN**

This month S. Welburn continues his description of the "Mayfair" home-constructor televisor by discussing the assembly of the timebase section and sound i.f. strip

This article, the third in the series describing the construction of the Mayfair televisor, brings the receiver almost to completion. In the last two issues the power pack and vision i.f. strip were dealt with, and we now proceed to the timebase unit and the sound i.f. strip. In the fourth and final article in the series, which will appear next month, instructions will be given for the assembly of the various units into the complete Mayfair chassis. The connections to the turret tuner will also be dealt with in this fourth article.

The Timebase Chassis

The circuit of the timebase section is given in Fig. 7. In this diagram the function of sync separator is carried out by an EF50, V_1, this being fed with a video signal from the anode of the video output valve (see Fig. 4). The video applied to the grid of the sync separator is negative-going, whereupon the sync pulses represent positive peak levels in the video waveform. The sync separator is biased back in leaky-grid fashion by the input signal, with the result that the positive peaks correspond to zero grid-cathode potential. The picture information then appears outside the grid base of the sync separator and is not, in consequence, handled by the valve.

Line sync pulses are fed from the anode of the sync separator via C_2 to the screen-grid of the line oscillator, V_4. This valve, another EF50, functions as a blocking oscillator. An effective triode anode is given by strapping the screen-grid and suppressor of V_4 together, these two elements being connected to the primary of the blocking oscillator transformer TR_2. The secondary of the transformer then connects to the control grid of the valve, and also to the grid leak and condenser network provided by R_{25}, R_{26} and C_{13}. The length of time for which the valve remains cut off during each cycle of timebase oscillation is varied by R_{26}, and this resistor thereby functions as the line hold control. The anode current of the line oscillator valve is controlled by its effective triode oscillator

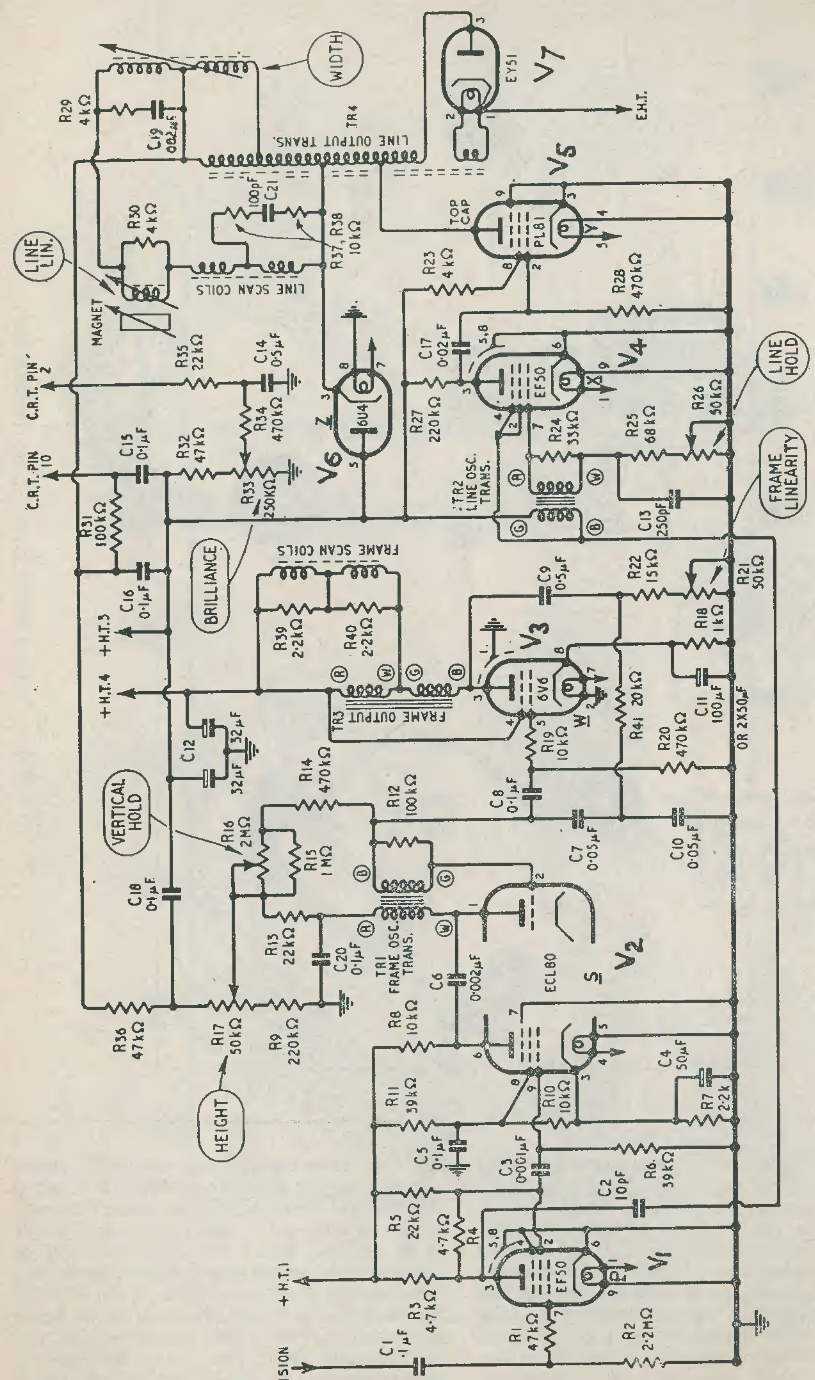


Fig. 7. The circuit of the timebase section

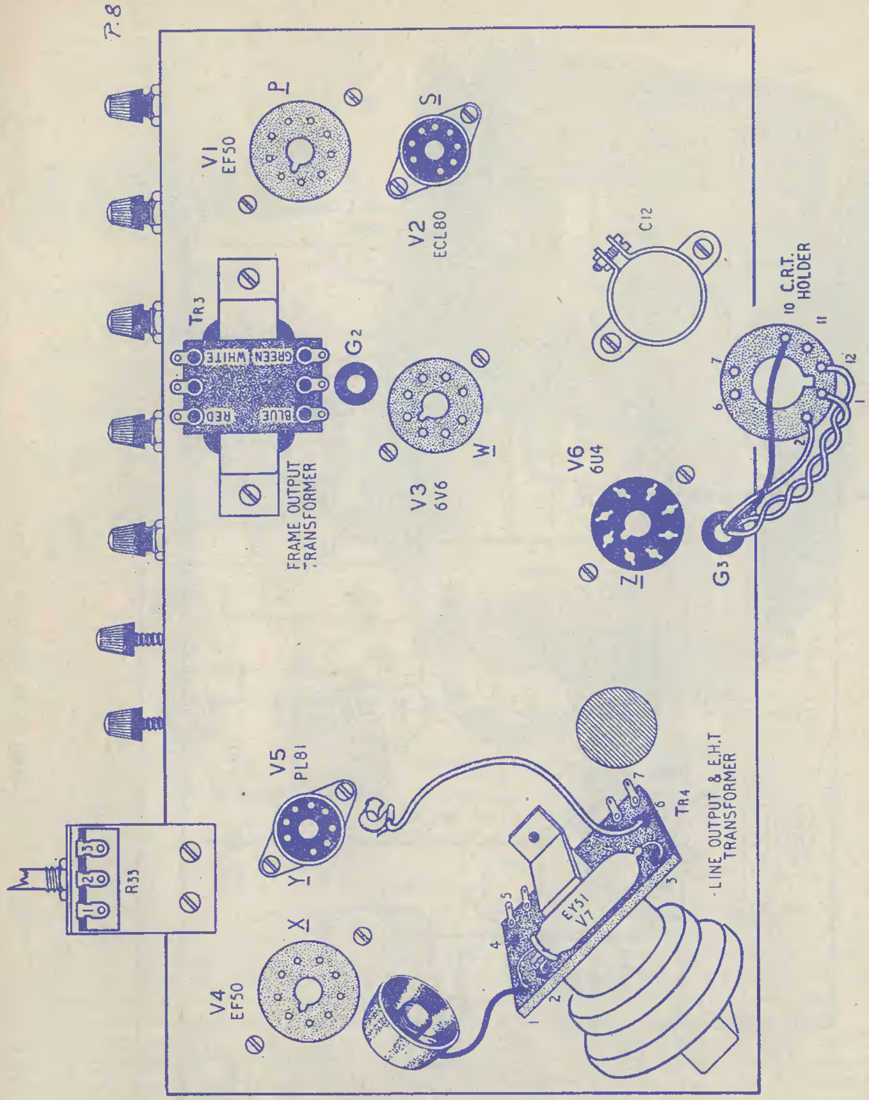


Fig. 8. Above-chassis layout of the timebase unit

section, and a line drive voltage appears across R_{27}. This drive is applied to the grid of the PL81 line output valve, V_5, via condenser C_{17}. The PL81 anode connects to the line output transformer in normal fashion, a conventional booster diode circuit being employed here. A scan drive voltage is tapped from the line output transformer winding and is fed to the line scan coils via the linearity control and part of the width control. One-half of the line scan coils is "balanced out" by R_{37}, R_{38} and C_{21}, these components having the effect of reducing the capacitive coupling between the line and frame scan coils, and of thereby obviating cross-talk. The condenser C_{16} acts as a reservoir for the boosted h.t. voltage from the line output transformer circuit; and this voltage is applied, via R_{31}, to the first anode of the c.r.t., and, via R_{36}, to the frame oscillator. E.H.T. is also obtained from the line output stage, this being rectified in normal manner by the EY51, V_7.

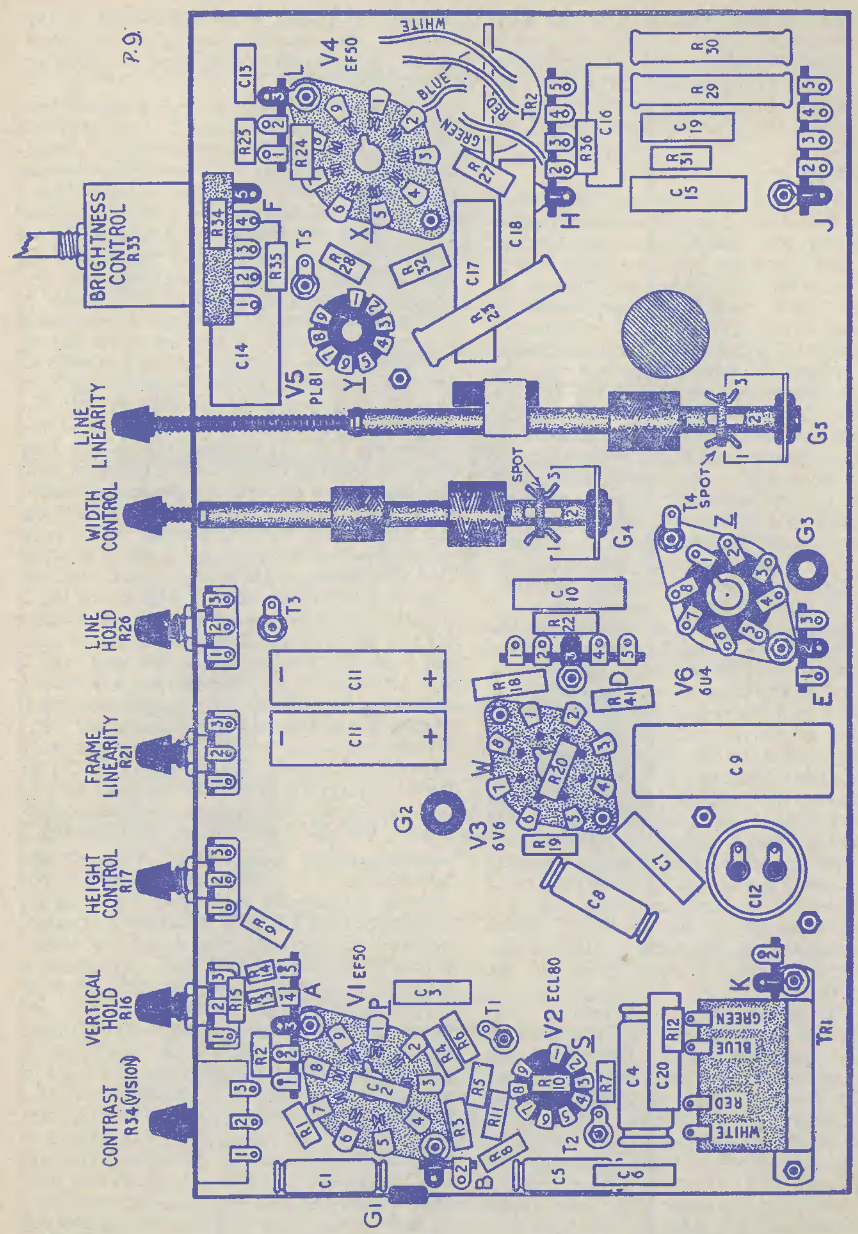


Fig. 9. Timebase component layout below the chassis

In the frame timebase the triode section of the ECL80, V_2, functions as a blocking oscillator, sync pulses being obtained from its pentode section. Frame amplitude is controlled by R_{17}, this varying the h.t. potential applied to the frame oscillator; whilst frame frequency is controlled by R_{16}, which alters the positive standing bias applied to the triode grid. The frame sawtooth waveform is fed to the grid of the 6V6 frame output valve via condenser C_8, and thence to the frame output transformer and frame scan coils. The latter are damped by the resistors R_{39} and R_{40}, these components being included to prevent ringing after flyback. A comprehensive feedback loop is employed in the frame output stage, its overall effect being varied by adjusting R_{21}, the frame linearity control.

Construction

The layout of the timebase section is illustrated in Figs. 8 and 9, these providing views above and below the chassis respectively, and showing the positions which should be taken up by the components. It will be noted that each component is designated either with its circuit reference or with a letter (or letter and number) reference. These references will be quoted in the assembly instructions which follow. When a tag on a tag-strip is shown as black, this infers that that particular tag is used also for mounting purposes and is, in consequence, at chassis potential. An important point peculiar to this particular chassis concerns the connections to the anti-corona tags on the line output transformer TR_4. These connections should be made such that the solder joint is left with a smooth, rounded, surface, in order to prevent corona.

The first components to mount are the valveholders P, W, X and Z, these being fitted to the underside of the chassis. The mounting screws of valveholder P also secure 5-way tag-strip A and 2-way tag-strip B. One of the mounting screws of valveholder X secures 3-way tag-strip L, whilst the mounting screws of valveholder Z secure 3-way tag-strip E and earthing tag T4. Valveholder Z must be an amphenol component. Valveholders S and Y above the chassis come next. The mounting screws of valveholder S secure earthing tags T1 and T2, and one mounting screw of valveholder Y secures earthing tag T5. Fig. 9 shows clearly the positions of the various tags and tag-strips referred to, and also indicates the correct orientation of the valveholders.

The frame oscillator transformer, TR_1, follows, and 2-way tag-strip K is secured by one of its mounting screws. This component is succeeded by the line oscillator transformer TR_2, the 5-way tag-strips D, F, H and J, and the grommets G1, G2 and G3. Next fitted are the brightness control bracket complete with the control (R_{33}) itself. Fit also the contrast control R_{34}, the vertical hold control R_{16}, the height control R_{17}, the frame linearity control R_{21}, and the line hold control R_{26}. Mount condenser C_{12}, with the aid of its clip, also the frame output transformer TR_3 and the line output transformer TR_4. Finally mount the width and line linearity controls. These are retained in position by two brackets, the coil formers being inserted into grommets G4 and G5 in these brackets.

It may be found more convenient if the formers are inserted into the grommets before the controls and brackets are fitted to the chassis.

Wiring up now commences. Connect one lead of condenser C_1 to tag 1 of tag-strip A. (The remaining lead is connected into circuit during final assembly.) Connect C_2 between pin 3 of valveholder P and tag 2 of tag-strip A; and connect C_3 between pin 2 of valveholder P and pin 9 of valveholder S. Connect the positive end of C_4 to pin 3 of valveholder S, and its negative end to earthing tag T_2. Connect C_5 between pin 8 of valveholder S and earthing tag T2. Connect C_6 between pin 6 of valveholder S and the white tag of transformer TR_1; C_7 between tag 2 of strip K and tag 5 of strip D; C_8 between tag 2 of strip K and pin 6 of valveholder W; C_9 between tag 1 of strip E and pin 3 of valveholder W; and C_{10} between tags 3 and 5 of strip D. Half of the condenser wiring is now completed, and the next component to handle is C_{11}, this being connected between earthing tag T3 and pin 8 of valveholder W. C_{13} is next connected between tags 2 and 3 of strip L; C_{14} between earthing tag T5 and tag 3 of strip F; C_{15} between tag 2 of strip H and tag 2 of strip J; C_{16} between tags 2 and 4 of strip H; C_{17} between pin 2 of valveholder Y and pin 3 of valveholder X; C_{18} between tags 2 and 3 of strip H; C_{19} between tag 4 of strip J and tag 4 of strip H; and C_{20} between tag 1 of strip K and the red tag of transformer TR_1. Finally connect one tag of C_{12} to pin 4 of valveholder W; and the other tag of C_{12} to tag 2 of strip H. (As both sections of C_{12} have the same value, its tags are interchangeable in this particular circuit application.)

The resistors come next. Connect R_1 between pin 7 of valveholder P and tag 1of strip A; R_2 between tags 1 and 3 of strip A; R_3 between tag 2 of strip B and pin 3 of valveholder P; R_4 between pins 2 and 3 of valveholder P; R_5 between pin 2 of valveholder P and tag 2 of strip B; R_6 between pin 9 of valveholder S and earthing tag T1; R_7 between pin 3 of valveholder S and earthing tag T2; R_8 between pin 6 of valveholder S and tag 2 of strip B; and R_9 between tag 3 of strip A and tag 1 of R_{17}. Next connect R_{10} between pins 3 and 8 of valveholder S; R_{11} between pin 8 of valveholder S and tag 2 of strip B; R_{12} between the green and blue tags of transformer TR_1; R_{13} between tag 4 of strip A and tag 2 of R_{16}; R_{14} between tag 5 of strip A and tag 3 of R_{16}; and R_{15} between tags 2 and 3 of R_{16}. Connect together the following pairs of circuit points: tags 1 and 2 of R_{16}; tag 2 of R_{16} and tag 2 of R_{17}; tag 3 of R_{17} and tag 3 of strip H.

R_{18} is next connected between pins 2 and 8 of valveholder W; R_{19} between pins 5 and 6 of valveholder W; and R_{20} between pins 2

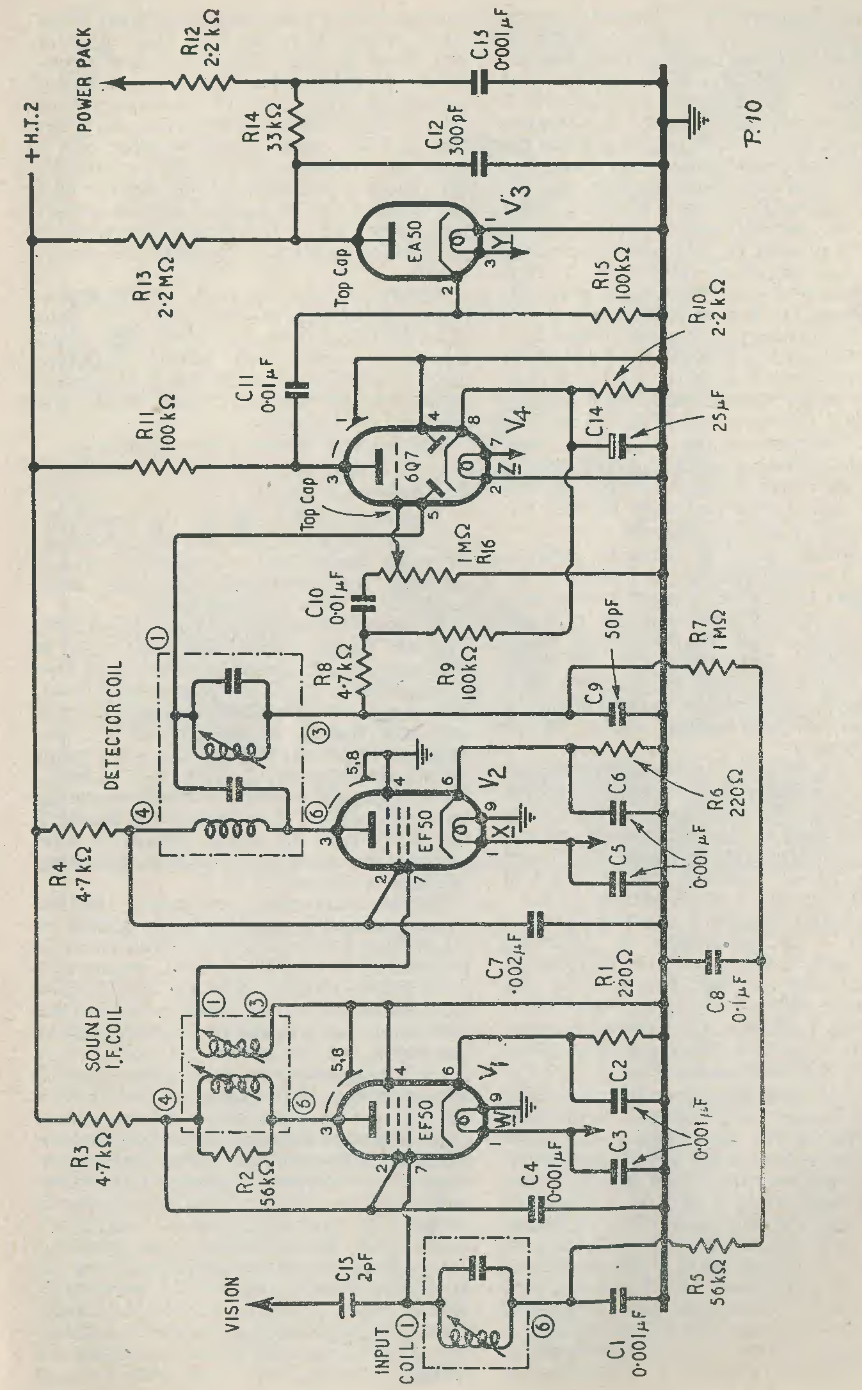


Fig. 10. The circuit of the sound i.f. strip

and 6 of valveholder W. Connect together tags 1 and 2 of R_{21} and tag 2 of strip D. Connect R_{22} between tags 2 and 4 of strip D; R_{23} between tag 2 of strip H and pin 8 of valveholder Y; R_{24} between tag 2 of strip L and pin 7 of valveholder X; and R_{25} between tags 1 and 2 of strip L. Connect together the following four circuit points: tags 1 and 2 of R_{26}, tag 3 of R_{21}, and earthing tag T3. Connect tag 3 of R_{26} to tag 1 of strip L. Next connect R_{27} between pin 3 of valveholder X and tag 2 of strip H; R_{28} between earthing tag T5 and pin 2 of valveholder Y; R_{29} between tag 5 of strip H and tag 4 of strip J; R_{30} between tag 5 of strip H and tag 5 of strip J; R_{31} between tag 2 of strip J and tag 4 of strip H; and R_{32} between tag 2 of strip H and tag 1 of strip F. Connect tag 3 of R_{33} to tag 1 of strip F. Connect tag 2 of R_{33} to tag 4 of strip F. Connect tag 1 of R_{33} to tag 5 of strip F. The resistors are completed by connecting R_{34} between tags 3 and 4 of strip F; R_{35} between tags 3 and 2 of strip F; R_{36} between tags 3 and 4 of strip H; and R_{41} between tags 4 and 5 of strip D.

The width and line linearity controls follow. Connect together tag 1 of the width control, tag 1 of the line linearity control, and tag 5 of strip H. Connect tag 2 of the width control to tag 7 of the line output transformer TR_4. Connect tag 3 of the width control to tag 4 of strip H. Connect tag 3 of the line linearity control to tag 5 of strip J. Tag 2 of the line linearity control is left unconnected.

Next comes the valveholder wiring. Connect together pins 4, 5, 6, 8, 9 and the centre spigot of valveholder P, earthing these at tag 3 of strip A. Connect together pins 5, 7 and the centre spigot of valveholder S, and earthing tag T2. Connect together pin 4 of valveholder S, pin 1 of valveholder P, pin 7 of valveholder W, pin 7 of valveholder Z, and pin 1 of valveholder X. Connect together pins 5, 6, 8, 9 and the centre spigot of valveholder X, and earthing tag T5. Connect together pins 2 and 4 of valveholder X and tag 2 of strip A. Connect together pins 3, 4, 9 and the centre spigot of valveholder Y and earthing tag T5.

The line oscillator transformer, TR_2, follows. Connect its blue lead to pin 2 of valveholder X; its green lead to tag 2 of strip H; its red lead to pin 7 of valveholder X; and its white lead to tag 2 of strip L. Next connect together tag 5 of strip A, tag 2 of strip K, and the blue tag of TR_1. Connect the red tag of TR_1 to tag 4 of strip A; and the white tag of TR_1 to pin 1 of valveholder S. Connect the green tag of TR_1 to pin 2 of valveholder S. Connect together the following pairs of circuit points: pin 8 of valveholder Z and earthing tag T4; pin 5 of valveholder Z and tag 2 of strip H; pin 3 of valveholder Z and tag 4 of the line output transformer TR_4; tag 4 of strip H to tag 5 of TR_4; tag 4 of strip D to tag 1 of strip E; pin 3 of valveholder W to the blue tag of frame output transformer TR_3; pin 4 of valveholder W to the red tag of TR_3; and the white and green tags of TR_3. Also connect together pins 1 and 2 of valveholder W and tag 3 of strip D. Fit a top cap connector to a 4-in flexible lead and connect this to tag 6 of the line output transformer TR_4. This top cap connector is intended to be fitted to the PL81 line output valve.

Finally, connect the EY51 to the appropriate tags of TR_4, as shown in Fig. 8. Also fit an e.h.t. lead from tag 1 of the line output transformer, this lead having sufficient length, and being terminated with the correct connector, for the c.r.t. with which the receiver is to be used.

The timebase section is now complete.

The Sound I.F .Strip

The sound i.f. strip is the last sub-assembly which involves any major wiring. Both its design and its construction are relatively uncomplicated, and may consequently be dealt with quite quickly.

The circuit of the sound i.f. strip is given in Fig. 10. In this diagram the input signal is obtained, via C15, from the anode of the first i.f. amplifier in the vision i.f. strip (see Fig. 4). This input voltage is applied across the input coil and, thence, to the grid of V_1. V_1 amplifies in normal fashion, its output being passed, via the sound i.f. coil to V_2. V_2 feeds, in its turn, into the detector coil, this operating in a conventional circuit using one diode of the 6Q7, V_4. An a.g.c. voltage is also obtained from the diode circuit, this being fed back to the grid of V_1.

The detected signal is next passed, after the volume control R_{16}, to the triode section of the 6Q7 for a.f. amplification. This triode is followed by an EA50, V_3, which operates in a noise limiter circuit. The a.f. output from the noise limiter is then finally passed to the a.f. output valve in the power pack section (see Fig. 1).

Layout diagrams showing wiring above and below the sound i.f. chassis are provided by Figs. 11 and 12 respectively. As occurred in previous layout diagrams, all components are identified by circuit or letter references. Assembly commences by mounting valveholders W, X, Y and Z below the chassis, taking care to ensure correct orientation. Tag-strips A, B and D follow. The mounting screw of tag-strip B secures earthing tag T3 above the chassis; and that of tag-strip D secures earthing tag T2 above the chassis. Fit earthing tag T1 and grommets G1, G2 and G3. Finally, mount the coils. As with the vision i.f. coils, tag 1 of each coil is

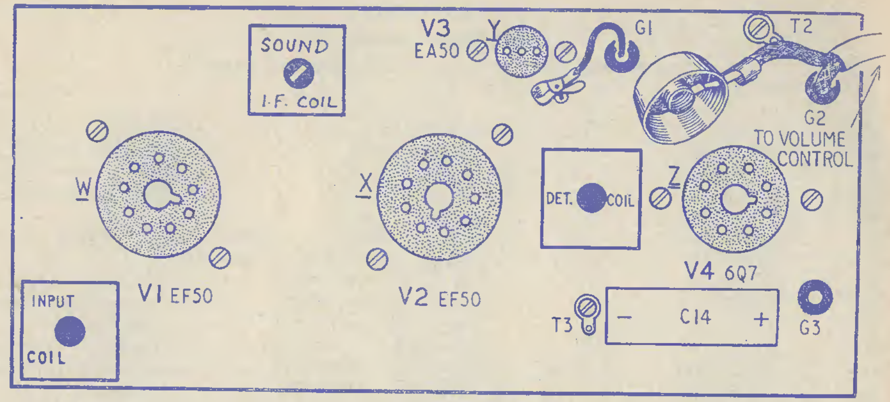


FIG. 11

INPUT COIL

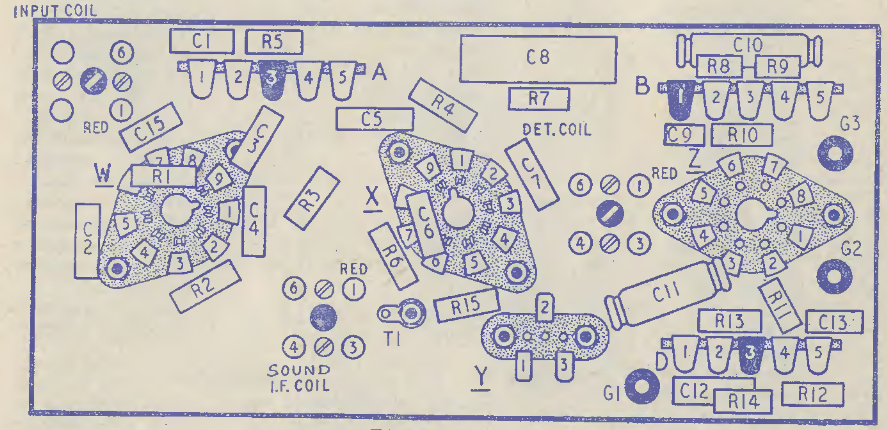


FIG. 12

Fig. 11. The sound i.f. strip layout above the chassis. Fig. 12. Below-chassis layout of the sound i.f. strip

marked with a red spot, the remaining tags being numbered 3, 4 and 6 in a clockwise direction looking down at the base of the coil. Coil tag numbering is shown clearly in Fig. 12. Ensure that the coils are fitted with correct orientation.

Wiring up commences by connecting tag 1 of the input coil to pin 7 of valveholder W; and tag 6 of this coil to tag 1 of tag-strip A. The sound i.f. coil is connected up next. Tag 1 of this coil connects to pin 7 of valveholder X, tag 3 to earthing tag T1, tag 4 to pin 2 of valveholder W, and tag 6 to pin 3 of valveholder W. The sound i.f. coil is followed by the detector coil. Tag 1 of this coil connects to pin 5 of valveholder Z, tag 3 to tag 2 of tag-strip B, tag 4 to pin 2 of valveholder X, and tag 6 to pin 3 of valveholder X.

We now carry on to the condensers. Connect C_1 between tags 1 and 3 of strip A; C_2 between pins 5 and 6 of valveholder W; C_3 between pin 1 of valveholder W and tag 3 of strip A; C_4 between pins 2 and 9 of valveholder W; C_5 between pins 1 and 9 of valveholder X; C_6 between pins 6 and 8 of valveholder X; C_7 between pins 2 and 4 of valveholder X; and C_8 between tag 4 of strip A and tag 1 of strip B. Complete the condensers by connecting C_9 between tags 1 and 2 of strip B; C_{10} between tags 3 and 5 of strip B; C_{11} between pin 2 of valveholder Y and pin 3 of valveholder Z; C_{12} between tags 1 and 3 of strip D; C_{13} between tags 3 and 5 of strip D; C_{14} between earthing tag T3 and pin 8 of valveholder Z (negative end to T_3 and positive end travelling through grommet G3);

PARTS LIST
Timebase Section
(Components marked * are fitted during final assembly)

Resistors

R_1	47kΩ ½W
R_2	2.2MΩ ½W
R_3, R_4	4.7kΩ ½W
R_5	2.2kΩ ½W
R_6	39kΩ ½W
R_7	2.2kΩ ½W
R_8	10kΩ ½W
R_9	220kΩ ½W
R_{10}	10kΩ ½W
R_{11}	39kΩ ½W
R_{12}	100kΩ ½W
R_{13}	22kΩ ½W
R_{14}	470kΩ ½W
R_{15}	1MΩ ½W
R_{16}	2MΩ variable
R_{17}	50kΩ variable
R_{18}	1kΩ 1W
R_{19}	10kΩ ½W
R_{20}	470kΩ ½W
R_{21}	50kΩ variable
R_{22}	15kΩ ½W
R_{23}	4kΩ 10W wire-wound
R_{24}	33kΩ ½W
R_{25}	68kΩ ½W
R_{26}	50kΩ variable
R_{27}	220kΩ ½W
R_{28}	470kΩ ½W
R_{29}, R_{30}	4kΩ 10W wire-wound
R_{31}	100kΩ ½W
R_{32}	47kΩ ½W
R_{33}	250kΩ variable
R_{34}	470kΩ ½W
R_{35}	22kΩ ½W
R_{36}	47kΩ ½W
R_{37}, R_{38}*	10kΩ 1W
R_{39}, R_{40}*	2.2kΩ ½W
R_{41}	20kΩ ±5%

Condensers (all paper unless otherwise specified)

C_1	0.1μF 350 w.v.
C_2	10pF mica
C_3	0.001μF
C_4	50μF electrolytic, 25 or 50 w.v.
C_5	0.1μF 350 w.v.
C_6	0.002μF mica
C_7	0.05μF 350 w.v.
C_8	0.1μF 350 w.v.
C_9	0.5μF 350 w.v.
C_{10}	0.05μF 350 w.v.
C_{11}	100μF electrolytic, 20 or 50 w.v. (two 50μF components may be used in parallel)
C_{12}	32+32μF electrolytic 350 w.v. with mounting clip
C_{13}	250pF mica
C_{14}	0.5μF 350 w.v.
C_{15}, C_{16}	0.1μF 350 w.v.
C_{17}	0.02μF 350 w.v.
C_{18}	0.1μF 350 w.v.
C_{19}	0.002μF mica
C_{20}	0.1μF 350 w.v.
C_{21}*	100pF mica or ceramic

Valves

V_1, V_4	EF50
V_2	ECL80
V_3	6V6
V_5	PL81
V_6	6U4/6W4
V_7	EY51

Inductors

TR_1	Frame Oscillator Transformer (Premier Radio)
TR_3	Frame Output Transformer (Premier Radio)
TR_2	Line Oscillator Transformer (Premier Radio)
TR_4	Line Output Transformer (Premier Radio)
1*	Scan Coil Assembly (Premier Radio)
1	Width Control Coil (Premier Radio)
1	Line Linearity Coil (Premier Radio)

Chassis and Chassis Components

1	Timebase Chassis, fully punched (Premier Radio)
1	Bracket, control mounting (Premier Radio)
2	Brackets, width and linearity coil mounting (Premier Radio)
2	Valveholders B9A
2	Valveholders B9G
1	Valveholder Amphenol, int. oct. (for 6U4, 6W4)
1	Valveholder int. oct.
3	5-way tag-strips, end tag earthed
2	5-way tag-strips, centre tag earthed
2	2-way tag-strips
1	3-way tag-strip, end tag earthed
1	3-way tag-strip, centre tag earthed

Miscellaneous

5	Grommets
3	Yds. 2mm sleeving
3	Yds. tinned copper connecting wire (22 s.w.g.)
8	Yds. p.v.c. covered wire
1*	Phosphor-bronze strip 5in × 1in (Premier Radio)
1	Knob (brightness control) (Premier Radio)
	Nuts, screws, solder tags, etc.

and C_{15} between pin 7 of valveholder W and tag 2 of strip A. This completes the condenser wiring.

The resistors are wired up in the following manner. Connect R_1 between pins 6 and 9 of valveholder W; R_2 between pins 2 and 3 of valveholder W; R_3 between pin 2 of valveholder W and tag 5 of strip A; R_4 between pin 2 of valveholder X and tag 5 of strip A; R_5 between tags 1 and 4 of strip A; and R_6 between pins 6 and 9 of valveholder X. Carry on to R_7 between tag 4 of strip A and tag 2 of strip B; R_8 between tags 2 and 3 of strip B; R_9 between tags 3 and 4 of strip B; R_{10} between tags 1 and 4 of strip B; and R_{11} between tag 4 of strip D and pin 3 of valveholder Z. Complete resistor wiring by connecting R_{12} between tags 2 and 5 of strip D;

Sound I.F. Strip
(Components marked * are fitted during final assembly)

Resistors

R_1	220Ω ½W
R_2	56kΩ ½W
R_3, R_4	4.7kΩ ½W
R_5	56kΩ ½W
R_6	220Ω ½W
R_7	1MΩ ½W
R_8	4.7kΩ ½W
R_9	100kΩ ½W
R_{10}	2.2kΩ ½W
R_{11}	100kΩ ½W
R_{12}	2.2kΩ ½W
R_{13}	2.2MΩ ½W
R_{14}	33kΩ ½W
R_{15}	100kΩ ½W
R_{16}*	1MΩ variable, with switch

Condensers

C_1, C_2, C_3, C_4, C_5, C_6	0.001μF
C_7	0.002 μF
C_8	0.1μF 350 w.v. paper
C_9	50pF mica
C_{10}, C_{11}	0.01μF 350 w.v. paper
C_{12}	300pF mica
C_{13}	0.001μF
C_{14}	25μF electrolytic, 12 or 25 w.v.
C_{15}	2pF

Valves

V_1 V_2	EF50
V_3	EA50
V_4	6Q7

Coils

1	Input Coil (Premier Radio)
1	Sound I.F. Coil (Premier Radio)
1	Detector Coil (Premier Radio)

Chassis and Chassis Components

1	Sound I.F. Chassis, fully punched (Premier Radio)
1	Valveholder, int. oct.
2	Valveholders, B9G
1	Valveholder, B3G
2	5-way tag-strips, centre tag earthed
1	5-way tag-strip, end tag earthed
1	Screened top-cap connector
1	Diode anode clip

Miscellaneous

3	grommets
1 yd.	2mm sleeving
1 yd.	tinned copper connecting wire (22 s.w.g.)
1 yd.	screened wire
8 in.	5mm sleeving
6 ins.	p.v.c. covered wire
1*	Knob (volume control) (Premier Radio)
	Nuts, screws, solder tags, etc.

R_{13} between tags 1 and 4 of strip D; R_{14} between tags 1 and 5 of strip D; and R_{15} between pin 2 of valveholder Y and earthing tag T1.

Valveholder wiring has next to be carried out. Connect together pins 4, 5, 8, 9 and the centre spigot of valveholder W and earth to tag 3 of strip A. Connect together pins 4, 5, 8, 9 and the centre spigot of valveholder X and connect to chassis via earthing tag T1. Connect together pins 1, 2 and 4 of valveholder Z and earth to tag 3 of strip D. Connect together pin 1 of valveholder W, pin 1 of valveholder X, pin 3 of valveholder Y and pin 7 of valveholder Z. Next connect pin 1 of valveholder Y to earthing tag T1; tag 5 of strip A to tag 4 of strip D; and pin 8 of valveholder Z to tag 4 of strip B. Connect a 2½in insulated lead to tag 1 of strip D, pass this through grommet G1, and fit an anode clip at its upper end. This is the anode connection for V_3.

Two screened leads follow. Connect the inner conductor of a 12in screen lead to tag 5 of strip B and the outer braiding to pin 1 of valveholder Z. Run this lead above chassis through grommet G2. Connect a 15in screened lead to a screened top cap connector, making sure that the braiding is soldered to the screen of the connector. Insert a 6Q7 into valveholder Z (V_4) and fit the top cap to this valve. Connect the braiding of the screened lead to earthing tag T2, ensuring that the free lead to the top cap is of adequate length. The two screened leads are then passed through an 8in length of 5mm. sleeving. They are connected to the volume control during the final assembly.

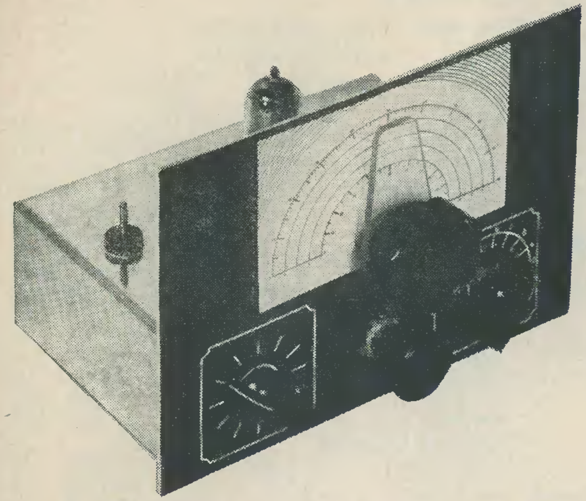
The sound i.f. strip is now complete.

Next Month

In next month's issue final assembly instructions will be given, together with full information on setting up the completed televisor.

● STOP PRESS — SATELLITE

One of our readers, Mr. G. Gimble of Forest Gate, London, E.7, reports that he succeeded in picking up the transmissions from the "Red Moon" on the 5th October at 8.20 a.m. It was also picked up again on the 8th October between 7.05 and 7.25 a.m., when a tape recording was made. The aerial used was 15ft of wire, indoors, and the receiver was the "Globemaster" (an apt name!) which was described in the December 1954 issue of this magazine. We should be pleased to hear of other cases in which reception was obtained on receivers described in these pages.



Adding an *Audio Stage* to the *Beginner's Short Wave Receiver*

by **E. GOVIER**

IN THE AUGUST ISSUE OF THIS MAGAZINE, complete details were given for both assembling and constructing this receiver as a one-valve set. In this issue full details are now given for an additional stage that may be added by the beginner as time and available cash permit. By adding a further audio stage, the l.f. gain is not only greatly increased, but the apparent range of the receiver becomes greater than hitherto.

The addition of this stage has been kept as simple as possible, so that the beginner can have ample confidence in taking a further step forward with regard to receiver construction.

Circuit

This is shown in Fig. 1, where it will be seen that the additional audio stage is constructed around the Mullard DL96, a B7G-based output pentode capable of delivering 0.2 watts into the headphones—more than adequate audio for the average person.

The output is taken from the detector stage (1T4) via C_6 into the grid of the DL96. Also to this grid are connected the grid leak R_4 and the automatic grid bias component R_5, the latter being decoupled by C_7. The inclusion of the resistor R_5 obviates the necessity of a grid bias battery with the consequent expense of continued renewal and additional external connections. The headphones are shown connected into the anode circuit, and the insertion of these completes the anode h.t. supply of the output stage. The suppressor grid of the output stage is internally connected to the earthed filament line. The screen grid is connected direct to the h.t.+ line. The only additional components for the constructor to purchase, apart, of course, from the valve and valveholder, are the short wave r.f. choke, R_4, R_5, C_6 and C_7. Thus it will be seen that the extra components necessary for the addition of this stage have been kept to an absolute minimum consistent with reasonable results.

A further reference to Fig. 4 will show that part of the detector stage has been repeated, insofar as it affects the additional stage. Little else need be said about the output stage, and we now proceed by describing, step by step, the necessary alterations and additions required to complete the two-valve receiver.

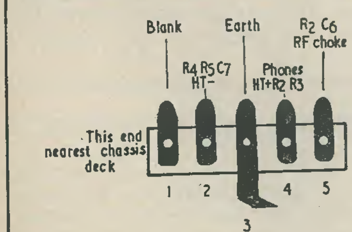


Fig. 2
Tag strip

Preliminaries

Disconnect and remove from the anode of the detector (pin 2) the resistor R_2 (10kΩ), and having done so place this on one side, as it will be required later. Disconnect that end of R_3 (22kΩ) soldered to one side of the headphone output sockets and the h.t.+ input line. Unsolder the earthed connection of the h.t.− lead (previously connected to the earthed solder tag on the chassis backdrop) and remove this from the receiver altogether. Having done this, unsolder from the same earthing tag that wire connected to the central metal spigot of the detector valveholder. Remove from the chassis backdrop the now free earthed tag by unbolting from the chassis. Having completed the above, switch off the iron and proceed to fit the new valveholder on the chassis deck. The position of this is shown quite clearly in the photograph reproduced herewith, and no measurements are deemed necessary as the location is self-explanatory. Having drilled or cut out the chassis, but before drilling the two holes necessary for fitting the holding screws, care should be taken of the orientation of the valveholder itself. It should be noted that pin 7 is nearest the Bandsetting condenser and pins 3 and 4 nearest the chassis backdrop. Having made sure that this is so, fix the valveholder into position and fit under that nut nearest the chassis backdrop the earthing tag previously removed from the backdrop (see under Preliminaries).

In that aperture on the backdrop previously containing the now refitted earthed tag, a screw is fitted to hold into position a five-way tagstrip (see photo of the underside of the chassis). This five-way tagstrip is that type having four "free" tags—two on either side of an earthed holding tag.

Having completed all of the above instructions, we now proceed to solder and wire into position the new components required to complete the output stage.

Wiring the Output Stage

It is best to commence this by wiring into circuit the l.t. supply of the added valve. With a short length of suitably covered wire

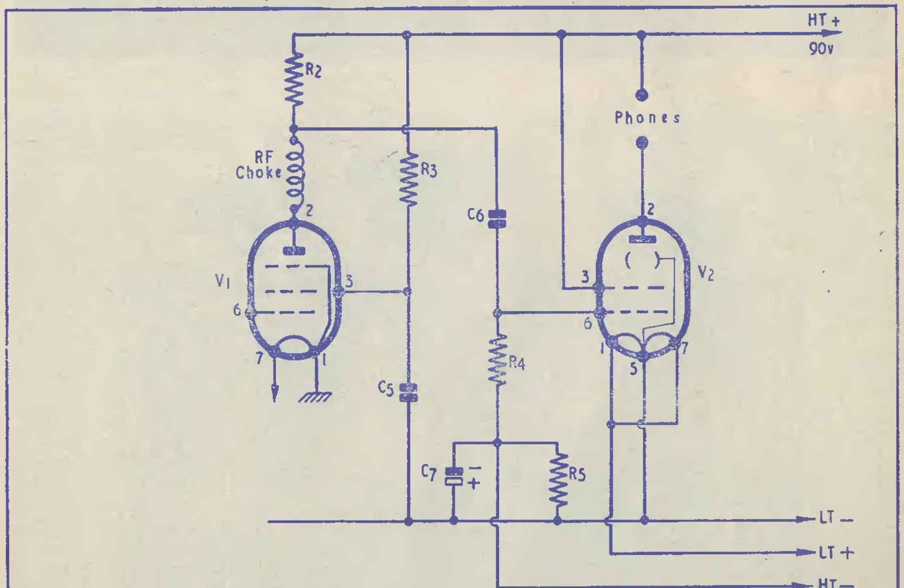


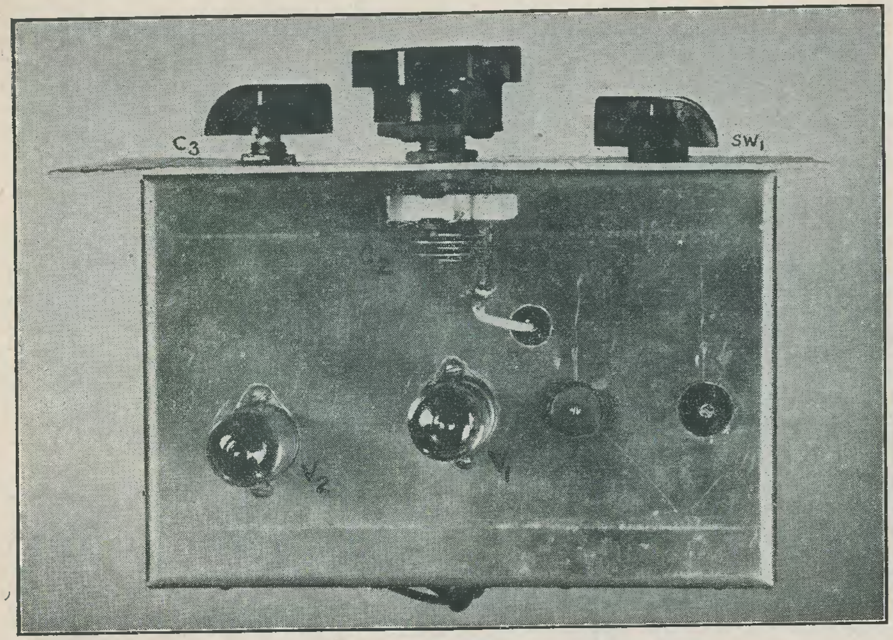
Fig. 1
Circuit of added audio stage

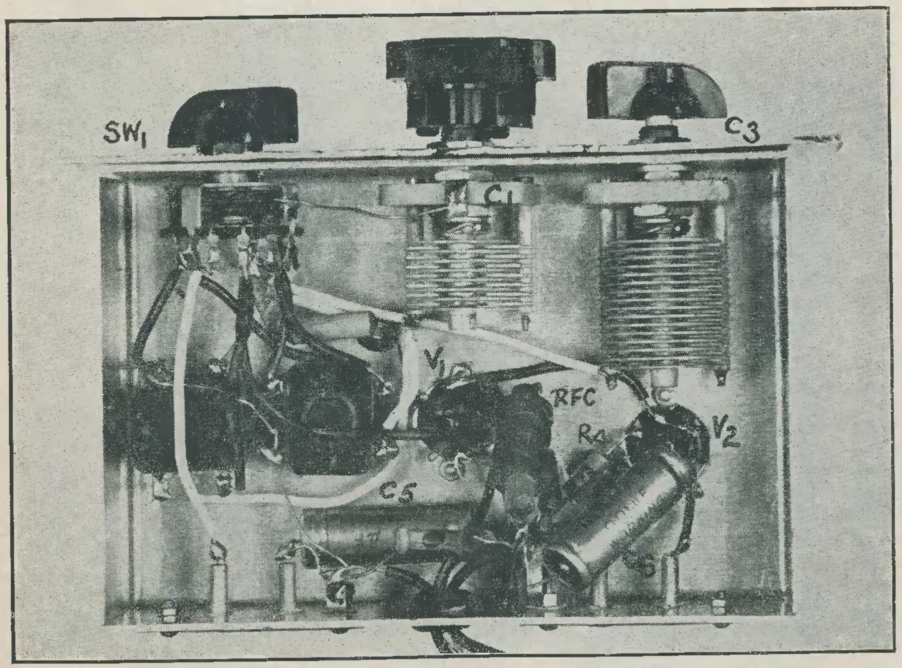
Component List

FOR THE ADDED AUDIO STAGE

R_4	2.2MΩ ½ watt
R_5	470Ω ½ watt
C_6	0.01μF, TCC type CP45W
C_7	25μF 12V wkg. electrolytic

R.F. choke, Teletron SW RF choke
Valve, Mullard DL96 with holder
5-way tagstrip, centre-earthed





Above- and below-chassis views of the Beginner's Short Wave Receiver, two-valve version

join pin 7 of V_1 to pins 1 and 7 of V_2, and follow this by connecting a short length of bare wire from the metal spigot of V_2 to both pin 5 of the same valve and the earthed tag fitted under the valveholder.

From the right-hand tag of the phones output socket, looking at the underside of chassis, connect a length of wire to pin 2 of the output stage. From the right-hand tag of the same strip, solder a length of wire to pin 3 of V_2.

Dealing next with the added 5-way tag-strip, solder to that "free" tag (i.e. not earthed), next but one to the chassis deck (see Fig. 2), a new length of wire sufficient to reach the battery. Feed one end of this through the rubber grommet, and at the far end of this wire affix a battery plug. This wire will, in future, be the h.t.— supply line. Insert through the rubber grommet the old combined h.t.— and l.t.— supply line (see August issue), and solder one end of this to the earthed solder tag contained on the chassis backdrop. This will now become the l.t.— lead only.

From that tag of the tag-strip containing the newly added h.t.— line (2), join one end of R_4, R_5, and the negative side of C_7. Connect the other end of R_5 to the earthed tag on the chassis backdrop and the free end of R_4 to pin 6 of V_2. Connect the positive end of C_7 to the earthed tag on the Ae and E socket strip.

Solder to the earthed tag (3) of the tag-strip the length of bare wire which was previously removed from the central metal spigot of V_1.

To the next "free" tag (4) of the tag-strip (see Fig. 2), solder the now free end of R_3. To the same tag (4) connect one end of R_2 (10kΩ), the other end of this now being soldered to the next tag (5). Returning to tag 4, solder a short length of wire from this to the nearest socket of the headphone output strip. Also to tag 4 connect one end of the previously discarded h.t.+ line, having first fed this through the rubber grommet.

To tag 5 (see Fig. 2) solder both one end of the r.f. choke and C_6. Connect the other end of the r.f. choke to pin 2 of V_1. Solder the other end of C_6 to pin 6 of V_2.

This completes the wiring instructions for the new stage, and the chassis should now appear as shown in the photographs. Note that C_7 is not visible, being located underneath C_5. Note also that the connecting wires of both the r.f. choke and C_6 should be suitably covered with short lengths of systoflex in order to prevent short circuits occurring.

Having completed the above, it now remains to insert the two valves and to connect the battery, headphones, aerial and earth to the receiver.

Dead Spots

Depending somewhat on the length of the aerial used with this or any "straight" receiver, it may be found that over certain frequency ranges of the receiver "dead spots" may occur, i.e. no reaction is obtainable. By far the easiest method of curing this source of trouble is to insert into the aerial lead, near to the receiver input, a small 100pF variable condenser. This condenser should *not* be earthed in any way, but merely be inserted in series with the aerial input (see Fig. 3). To achieve this satisfactorily, mount the condenser on a small panel of Perspex or Polystyrene. Connect the rotor (moving) vanes to the aerial lead-in and the stator (static) vanes to the receiver input.

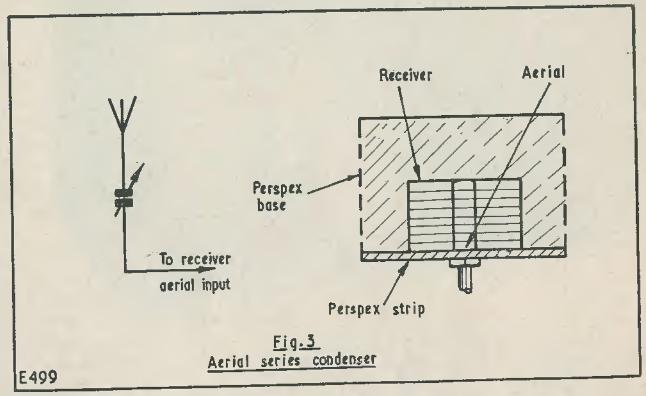
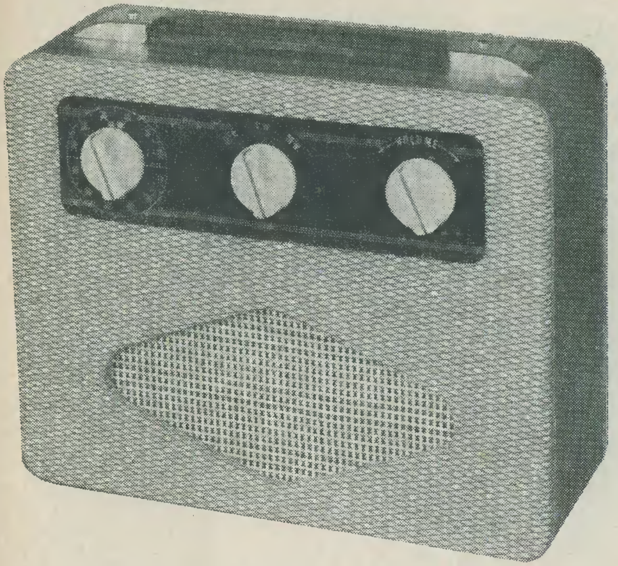


Fig. 3
Aerial series condenser

It will be found that where dead spots occur, variation of this condenser will effectively eliminate them. It will also be found by experience that various settings of this condenser will increase the signal strengths of stations at certain frequencies. This is by virtue of the fact that the condenser electrically shortens the aerial, and thereby causes the latter to resonate at, or near, that frequency in use by the station being received.

Conclusion

It is hoped that this short series of two articles has helped some of our beginner readers to make a start in the hobby by constructing and operating their very own short wave receiver. Many delightful hours may be spent by the enthusiast listening on this simple little receiver to programmes radiated from all parts of the globe.



The Contessa

6-Transistor Portable Superhet

Introducing a new transistor portable which has been designed especially for home-constructor use. The superhet circuit employed by the receiver utilises six high-performance transistors.

Part I

by **D. PETERS**

SINCE THE INTRODUCTION OF TRANSISTORS to the amateur market several years ago, equipment made with these devices has proved to be a subject of very great interest amongst home-constructors. *The Radio Constructor* has done much to satisfy readers' demands in this particular field; and this present receiver, the *Contessa*, is the latest design to be offered. The *Contessa* receiver employs a high-gain superhet circuit, functions both on medium and long waves, and is capable of being built very easily by the amateur. As will be seen from the step-by-step wiring diagrams which follow in this and the succeeding article, no part of the chassis is over-cramped and, despite the compact layout, care has been taken to avoid details which are liable to result in "fiddling" assembly.

The complete receiver employs six Ediswan transistors, the design taking advantage of the characteristics of the particular types chosen for each individual stage. It is possible that reasonable results could be obtained by the use of transistors alternative to those recommended, but this point cannot be guaranteed. The component values specified are applicable to the Ediswan types only.

A particular bugbear in home-constructed receivers is that of providing a presentable housing for the completed chassis. In the case of the *Contessa* a suitable cabinet is available from Henry's Radio Ltd. As may be seen from the photograph of the completed set which accompanies this article, this cabinet gives the receiver a very stylish and modern presentation. The cabinet dimensions are 9in by 7in by 3¼in. Henry's Radio also supply a suitable Perspex chassis, this being already drilled to take the components used in the *Contessa* design, and fitted with brackets for the ferrite frame and the controls.

The Circuit

The complete circuit of the receiver is illustrated in Fig. 1. The circuit arrangement employed is that of a fairly conventional transistor superhet, and it should be noted that a.g.c. is employed in the i.f. section.

Aerial pick-up is provided by the ferrite frame assembly, this consisting of the two coils $L_{1(a)}$ and $L_{1(b)}$ fitted to a ferrite core. Of these two coils, $L_{1(a)}$ is that which is tuned, and it connects directly across one gang, $VC_{1(a)}$ of the tuning condenser when switch $S_{1(a)}$ is in the Medium wave position. On the Long wave position of $S_{1(a)}$, loading coil L_2 is connected in series with $L_{1(a)}$. The coupling coil $L_{1(b)}$ provides the necessary low impedance output for the mixer, TR_1, bias current for this transistor being obtained from the h.t. negative line via R_1. TR_1 oscillates in a conventional feedback circuit, $L_{3(b)}$ providing the tuned coil and $L_{3(a)}$ the feedback winding. For Long wave reception an additional capacity, TC_3, is connected across the tuned circuit by $S_{1(b)}$. The resistor R_3, in series with the emitter, has a nominal value of 1kΩ. In one or two isolated cases it may be desirable to slightly adjust the value of this resistor to accommodate the particular transistor employed, and this process is described in greater detail in the second article.

The collector of TR_1 feeds into the i.f. transformer IFT_1 in normal fashion, the secondary of this transformer coupling into the base-emitter circuit of TR_2. TR_2 operates as an earthed emitter amplifier, the stabilising components R_6 and C_5 helping to ensure a constant performance. An a.g.c. voltage is applied to the base of TR_2 via R_5, this voltage causing the bias on the base of the transistor to decrease by an amount proportional to the signal strength available at the detector.

TR_2 couples into the third transistor TR_3 via IFT_2, this latter transistor also operating as an earthed emitter amplifier and also having stabilising components. It should be noted that the secondaries of IFT_1 and IFT_2 are coupled to the transistors which follow them by the low impedance paths to the emitters provided by C_4 and C_7 respectively. Transistor TR_3 connects to IFT_3 whose secondary, in its turn, feeds into the detector circuit.

An Ediswan CG12E, or Mullard OA71, is specified for the D_1 function, it being found that these types provide optimum detection efficiency when used with the a.f. components required by TR_4. It is important to ensure that the diode is connected with the polarity illustrated in the diagram as incorrect operation of the a.g.c. circuit will otherwise result. When the diode is connected as shown, an increase in signal strength causes the upper end of the volume control, across which the detected signal voltage appears, to become more positive with respect to chassis. At the same time, however, R_{12} forms part of the potentiometer network providing bias for TR_2, whereupon this positive potential results in a decrease in the negative potential applied to TR_2 collector. In consequence the gain of TR_2 is reduced, and the function of an a.g.c. circuit is achieved.

The a.f. appearing across the volume control R_{12} is tapped off by its slider and applied to the first a.f. amplifier TR_4. TR_4 functions as a driver for the two output transistors TR_5 and TR_6, these operating in Class B push-pull. The output transistors finally connect to the output transformer T_2, and thence to the speaker. In order to achieve optimum output efficiency it is advisable to ensure that the value of R_{16} is such that the combined collector current of TR_5 and TR_6 is equal to 4mA. With most transistors the value specified for this resistor, 5kΩ, will ensure that the correct current is obtained. The test for collector current is carried out after assembly has been completed.

A frequency selective negative feedback loop finally couples the secondary of the output transformer to the input circuit of TR_4, thereby helping to ensure that good audio quality is obtained without the excessive hiss so frequently encountered in transistor-operated equipment.

Construction

It is intended in this, and the article which follows, to give full constructional details for the receiver. These details will include a step-by-step description of the wiring.

The first part of the construction which has to be tackled is that of mounting the major components to the chassis. Since the chassis is supplied ready drilled, it is possible to commence this process immediately. It must be pointed out that the chassis should be handled with some care during assembly, in order to prevent damage to the brackets for the controls and the ferrite frame aerial.

Figs. 2 and 3 give under-chassis and above-chassis views respectively, these diagrams illustrating the positions taken up by the i.f. transformers, the oscillator coil $L_{3(a)}$–$L_{3(b)}$, the tuning condenser, volume control, wave-change switch, the two a.f. transformers, and the tags and tag-strips. The tags, incidentally, are numbered individually in Fig. 2 in order to assist in providing identification in later wiring diagrams.

Assembly should proceed in the following manner. First of all mount the i.f. transformers and coil $L_{3(a)}$–$L_{3(b)}$ with 6BA nuts and screws as shown in Figs. 2 and 3. Some of the mounting screws secure tags, and the locations of these are also illustrated. It is important to ensure that the slots in the coil tag-rings take up the positions shown in Fig. 2. If necessary, correct orientation may be obtained by carefully rotating the rubber grommets at the top of the screening cans. The two a.f. transformers are next mounted, ensuring that their lead-out wires pass through the chassis at the points indicated in

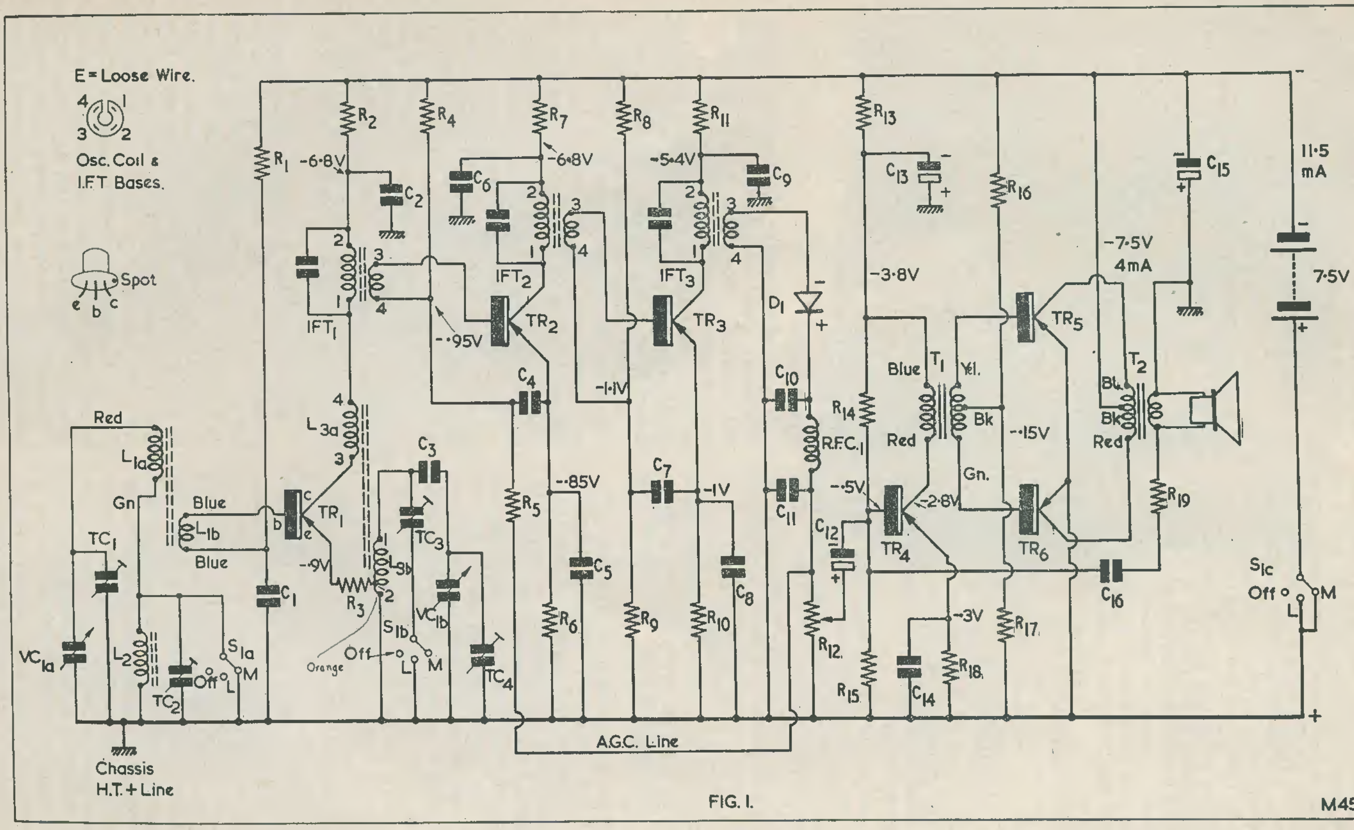


Fig. 1. The circuit of the Contessa *receiver. The voltages given were taken with an Avo Model 8 switched to the 10-volt range, and are relative to chassis. The receiver was working under no-signal conditions, and was set to the centre of the medium wave band, with the volume control in the minimum position*

Fig. 2. The mounting screws for T_1 secure tag 2 and the 4-way tag-strip, and those of T_2 secure tag 1 and the 2-way tag-strip. It should be noted that tag 1 overlaps tag 2: these two tags will later be soldered together. Tags 8 and 9 are next mounted with the aid of 6BA nuts and screws, these being followed by the tuning condenser. Spacing washers should be placed between the underside of the tuning condenser frame and the top surface of the chassis in order to prevent the fixed vane insulated mountings from fouling the chassis. Before the tuning condenser is fitted to the chassis, a short length of tinned copper wire should be soldered to the earth lug between its two tapped mounting holes and passed through the chassis hole indicated in Fig. 2. Care should be taken to ensure that the mounting screws for the tuning condenser are not too long, as they may otherwise make contact with the fixed vanes when they are inserted and tightened.

The volume control and wavechange—on/off switch come next, and it now becomes necessary to refer to Fig. 4 as well as Figs. 3 and 2. Fig. 4 gives a view from the rear of the chassis with the i.f. transformers, oscillator coil and a.f. transformers not shown, and illustrates the positions which should be taken up by the tags of the volume control and the switch. It is desirable to ensure that the bushes of both the switch and the volume control do not project over the front surface of the chassis, as this may lead to difficulty when the latter is later fitted to the cabinet. With some controls it may be necessary to fit a spacing washer to the bush behind the mounting bracket in order to meet this requirement. A shakeproof washer fitted to the bush of the wavechange switch behind the bracket is necessary in any event, its purpose being that of preventing rotation when this control is operated during use.

Component List set out for easy reference to Fig. 1

Resistors ($\frac{1}{8}$W)

R_1	220kΩ
R_2	1kΩ
R_3	1kΩ (see text)
R_4	33kΩ
R_5	4.7kΩ
R_6	1kΩ
R_7	1kΩ
R_8	33kΩ
R_9	10kΩ
R_{10}	500Ω
R_{11}	1kΩ
R_{12}	10kΩ potentiometer log law
R_{13}	1kΩ
R_{14}	20kΩ
R_{15}	4.7kΩ
R_{16}	5kΩ (see text)
R_{17}	100Ω
R_{18}	100Ω
R_{19}	100kΩ

Condensers

C_1	0.01μF 150V Hunts
C_2	0.01μF 150V Hunts
C_3	0.001μF mica
C_4	0.01μF 150V Hunts
C_5	0.01μF 150V Hunts
C_6	0.01μF 150V Hunts
C_7	0.01μF 150V Hunts
C_8	0.01μF 150V Hunts
C_9	0.01μF 150V Hunts
C_{10}	0.01μF 150V Hunts
C_{11}	0.1μF 150V Hunts
C_{12}	5μF 25V Daly
C_{13}	5μF 25V Daly
C_{14}	5μF 25V Daly
C_{15}	5μF 25V Daly
C_{16}	500pF mica

Variable Condensers

$VC_{1(a)}$, $VC_{1(b)}$	365+365pF J.B. 2-gang type "O"
TC_1	60pF Philips concentric trimmer
TC_2	100pF compression trimmer
TC_3	700pF compression trimmer
TC_4	60pF Philips concentric trimmer

Coils

$L_{1(a)}$, $L_{1(b)}$	Teletron type FRM2
L_2	Teletron type TL1
$L_{3(a)}$, $L_{3(b)}$	Teletron type FTO2
IFT_1, IFT_2	Teletron type FT3E
IFT_3	Teletron type FT3D
RFC_1	Henry's Radio

Transformers

T_1	Repanco type TT4
T_2	Repanco type TT5

Transistors and Diode

TR_1	Ediswan XA.102
TR_2, TR_3	Ediswan XA.101
TR_4	Ediswan XB.103
TR_5, TR_6	Ediswan XC.101
D_1	Ediswan CG.12E or Mullard OA71

Miscellaneous

$S_{1(a)}$, $S_{1(b)}$, $S_{1(c)}$ 3-way 3-pole miniature rotary switch
Cabinet, drilled chassis, dial plate and knobs, Henry's Radio
Speaker, 7in × 4in elliptical, 3Ω, Elac
Battery, 7½V Ever-Ready type AD38, and plug
6 transistor holders, Henry's Radio
1 4-way tag-strip, end tag earthed
1 2-way tag-strip
6BA nuts and screws, wire, sleeving, etc.

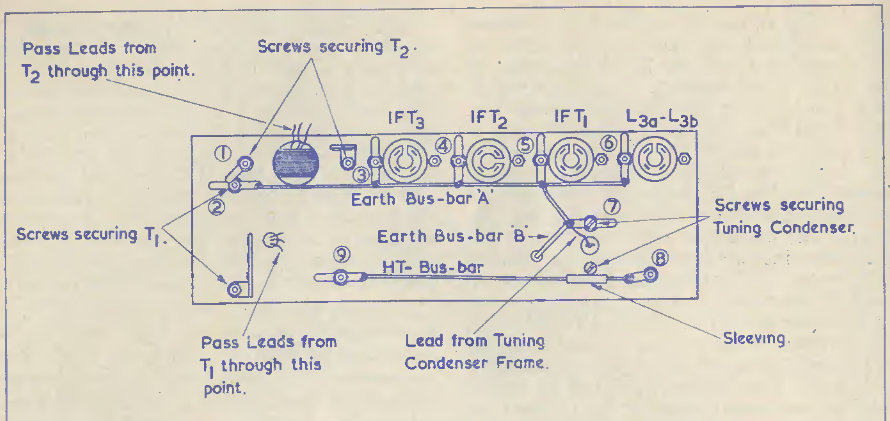


FIG. 2

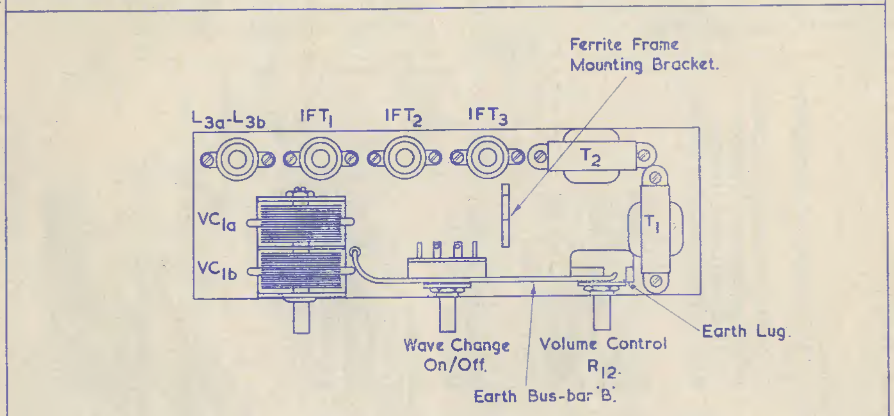


FIG. 3

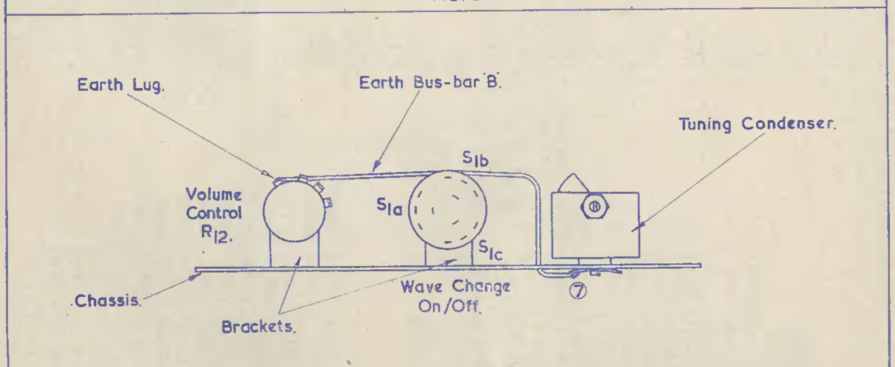


FIG. 4

M459

Fig. 2. Mounting the first components and the bus-bar wires to the chassis. Fig. 3. Top view of the chassis, showing the position taken up by the above-chassis bus-bar wire. Fig. 4. View from rear of chassis, illustrating volume control and switch tag positions

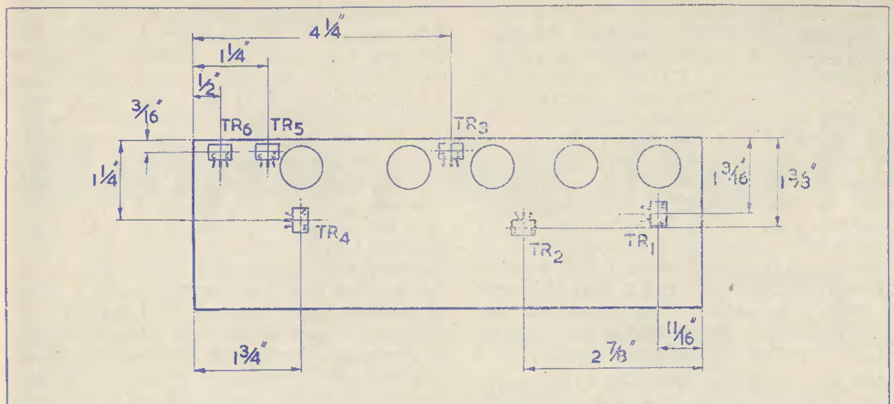


FIG. 5.

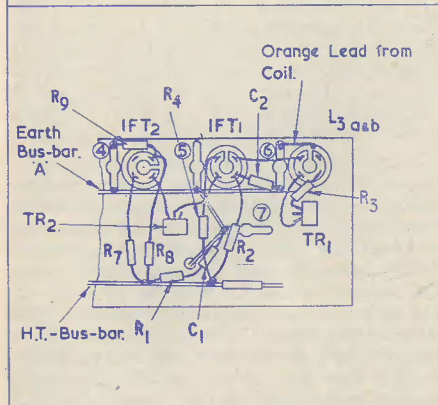


FIG. 6.

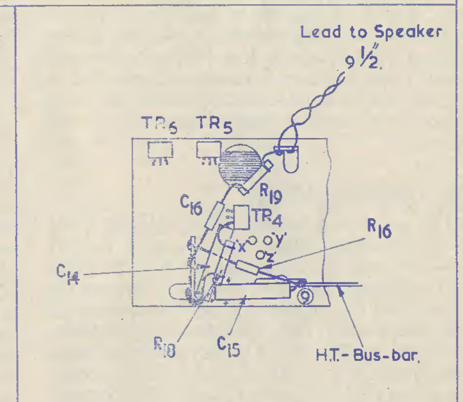


FIG. 8.

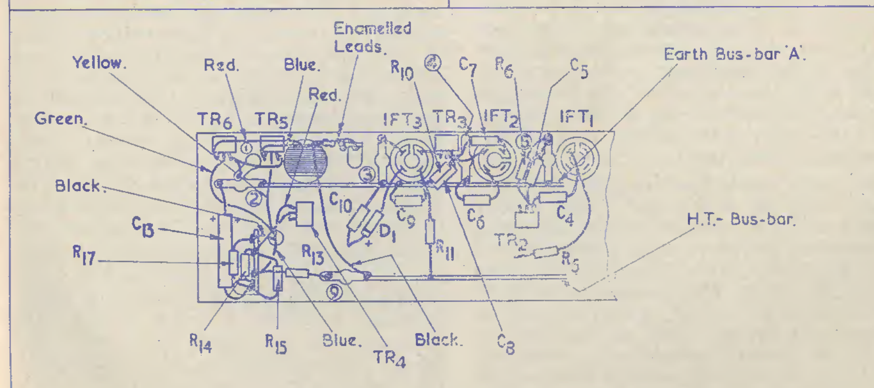


FIG. 7.

M460

Fig. 5. The transistor holders are fitted in the positions shown here. Fig. 6. The preliminary wiring around TR_1 and TR_2. Fig. 7. The second stage in under-chassis component wiring. Fig. 8. Completing the wiring around the 4-way tag-strip

The two under-chassis bus-bars may now be soldered into position. These bus-bars should consist of heavy-gauge tinned copper wire around 16 s.w.g.; and they are shown in Fig. 2. The h.t. negative bus-bar comes first, this being soldered between tags 8 and 9. A short length of sleeving should be fitted over this bus-bar at the point indicated in the diagram in order to prevent accidental short-circuit to the adjacent tuning condenser mounting screw. The wire marked "earth bus-bar A" in Fig. 2 is next soldered in, it connecting at this stage to tags 2, 3, 4, 5 and 6. The overlapping tags, 1 and 2, may also now be soldered together. The lead from the tuning condenser frame should be soldered to tag 7, and this tag connected to tag 5.

The final soldering operation to carry out at this point is that needed to secure "earth bus-bar B." This wire is soldered at its two ends: one end, below the chassis, at tag 7; and the other end, above the chassis, at the volume control earth lug. The route over which earth bus-bar B travels is indicated in Figs. 2, 3 and 4, and it is advisable to use a heavy gauge of wire here in order to achieve rigidity.

The Transistor Holders

The transistor holders follow, these being secured to the chassis with Durofix or any similarly reliable adhesive. Fig. 5 provides an under-chassis view which illustrates the location of the holders and also indicates the transistors which they will later accommodate. It will be noted that the holders are marked in Fig. 5 with the letters "E" and "C" in order to indicate which contact accepts the emitter and which the collector of the appropriate transistor. (The centre contact is the base connection.) The constructor is strongly advised to similarly mark the transistor holders in his receiver in order to prevent errors later. An alternative idea consists of marking the holder at the collector contact only, this being done with a spot of distinctively coloured paint.

When the adhesive securing the transistor holders has set, wiring up of the various components may commence. The first part of the circuit to connect up is that associated with the under-chassis components around TR_1 and TR_2. The necessary wiring is shown in Fig. 6. All wiring should be covered with sleeving unless the risk of short-circuit to adjacent conductors is obviously negligible. For the sake of clarity some of the resistors and condensers in Fig. 6 and succeeding diagrams are shown as being rather smaller than they are in practice. The junction of R_1 and C_1 in Fig. 6 should be left available for the connection later of a third lead.

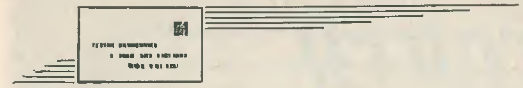
Further wiring is carried out in Fig. 7. In this diagram the transformers T_1 and T_2 are connected up and much of the i.f. and detector circuitry is completed. Only one end of R_5 is connected up at this stage, its free end being connected later. The junction between the diode D_1 and C_{10} should be left available for a third connection later. The positive sign adjacent to D_1 in Fig. 7 indicates the "cathode" connection; this end is indicated by a line around the body in the case of the Mullard OA71. The connections to T_1 and T_2 need little explanation, but it should be pointed out that it is advisable to fit a piece of sleeving over the black lead from T_2, as this has to travel over rather a long distance. A temporary connection between this black lead and the h.t. negative bus-bar is all that is required for the time being, as it will need to be broken when the collector currents of TR_5 and TR_6 are checked after completion. The two enamelled leads from T_2 provide the secondary connections, and it is advisable to connect these with temporary joints only to the 2-way tag-strip. The reason for this is that they may have to be reversed if feedback happens to be positive instead of negative.

A few final a.f. connections are made in Fig. 8. Several points need to be enlarged on insofar as this diagram is concerned; one of these being that C_{15} should not be allowed to approach the front edge of the chassis too closely in case it fouls the loudspeaker when the receiver is inserted into its cabinet. It will be noted that the speaker leads are also fitted at this stage. These are provided by a length of twin flexible wire, and it is advisable to strip their free ends ready for connection to the speaker, and also to identify the lead which connects to the earthy tag of the 2-way tag-strip. The reason for this last requirement is that the speaker frame will be earthed to this wire later. (Identification will, of course, be automatic if the speaker leads heve different colours.) The length of the speaker leads is 9½in. In Fig. 8 three chassis holes are designated by the letters "X," "Y" and "Z." These holes are referred to in a later step in construction. The connection of R_{19} to the 2-way tag-strip need be of a temporary nature only at this stage.

(In answer to several queries, screws—strictly called "machine screws"—are threaded the entire length; whereas bolts are threaded for only a small portion, the remainder of the shank being plain and usually the same diameter as that across the outer edges of the thread.—Ed.)

Next Month

In next month's issue the wiring of the *Contessa* will be completed. Details will also be given of final checking and alignment.



Buying by Mail?

It is probable that you, the reader, are one of the majority of home constructors who rely on the various Mail Order firms for the supply of component parts. The purpose of this short article is to suggest ways in which you can help such firms to give the quick and efficient service which both they and you wish.

One of the first things to bear in mind is that these firms are daily handling many hundreds of orders similar to yours, and anything which causes your particular order to be held up will result in hundreds of other orders being given preference over yours. A "pile-up" just cannot be allowed to happen, for obvious reasons. It seems too obvious to mention, but an amazing number of letters contain no name or address; this magazine, too, receives its share! It is equally obvious that the name and address should be easily legible—however good *you* may think your handwriting is, do please write your name and address in BLOCK CAPITAL LETTERS (like that) in full and at the top of your order. In full, because unofficial abbreviations can cause difficulties. In one case known to us, a young enthusiast recently abbreviated "Essex" to "SX," and only quick-wittedness on the part of the girl dealing with his order prevented it being posted to Sussex. Most firms employ girls to open the letters and write out the orders. While these girls are keen and efficient, if they cannot read the writing or decipher the name, then the order is passed over to be dealt with later after the other orders have been sent.

The same sort of thing will happen if you mix technical enquiries with your order. The person dealing with the order will most probably have to refer it to another department for technical advice, and once again other orders are speeding on their way whilst yours is resting in a "pending" tray. With regard to technical queries, it should be remembered that mail order firms specialise in the supply of components, kits, etc., and whilst they are usually pleased to answer enquiries regarding such items, they are not able to maintain large workshops and staff in the form of a free technical advice bureau. Every day, requests are received asking for the designing of special circuits, advice on modifications to existing equipment, and for advice on the servicing of some equipment or other. However regretfully, such requests must inevitably be turned down—but it all means extra expense and, possibly, further delay to your order.

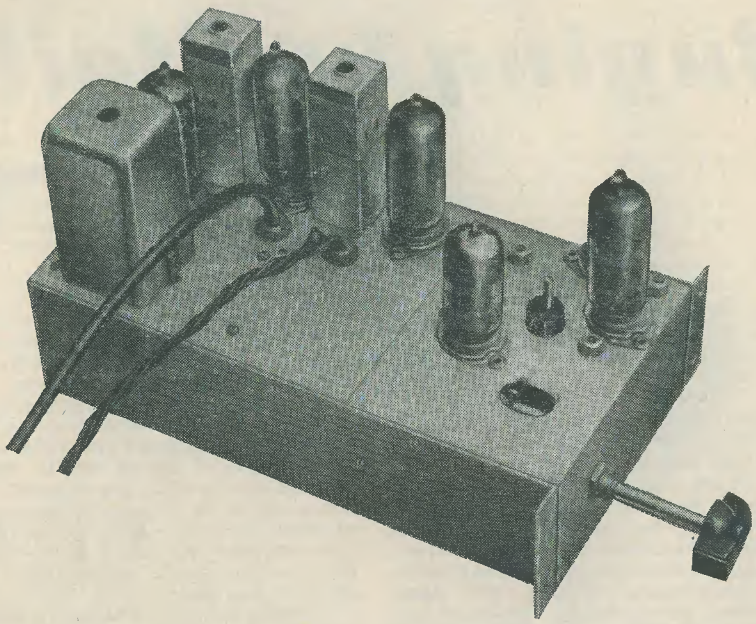
There are some firms which will undertake the alignment and servicing of home-built apparatus, but others are not equipped for such work—so it is best to write first giving full details of the equipment and the service required. Labour and overheads are expensive items these days, and it is a wise plan to ask for an estimate before giving orders to proceed with the work.

When enclosing a remittance, money and postal orders and cheques are quite safe in ordinary letters, *but cash should always be registered.* Remember that if you have had no previous dealings with any particular firm and the amount involved is a substantial one, they *may* wish to have your cheque cleared before despatching the order.

In cases where the item ordered is a book or catalogue or some small component, you may wish to make payment by sending postage stamps. Most firms are quite pleased to receive these—but only if they are "unlicked." Many customers stick their stamps on to the letter and thus render them almost useless; even if only a corner is stuck, it is awkward for the handler. Put your stamps in loose, and put "Stamps Enclosed" in large writing on the letter.

Your attention to the points mentioned above will ensure that *your* order will be dealt with as soon as possible.

The Mercury



SWITCHED F.M. TUNER

Part 2

A new Jason kit described by **G. BLUNDELL**

The circuit operates in the following manner. Two voltages appear at the diode anodes which vary in relative phase as the station or signal frequency varies. One of these voltages is derived through mutual coupling between anode coil and diode coil, and is in phase with the anode current. The second is derived by condenser coupling from the limiter anode circuit and is in phase with the anode voltage. The phase of the voltage and current in the anode (primary) circuit of the discriminator is only 0° when the programme frequency is exactly in tune with the coil. Either side, the phase angle varies.

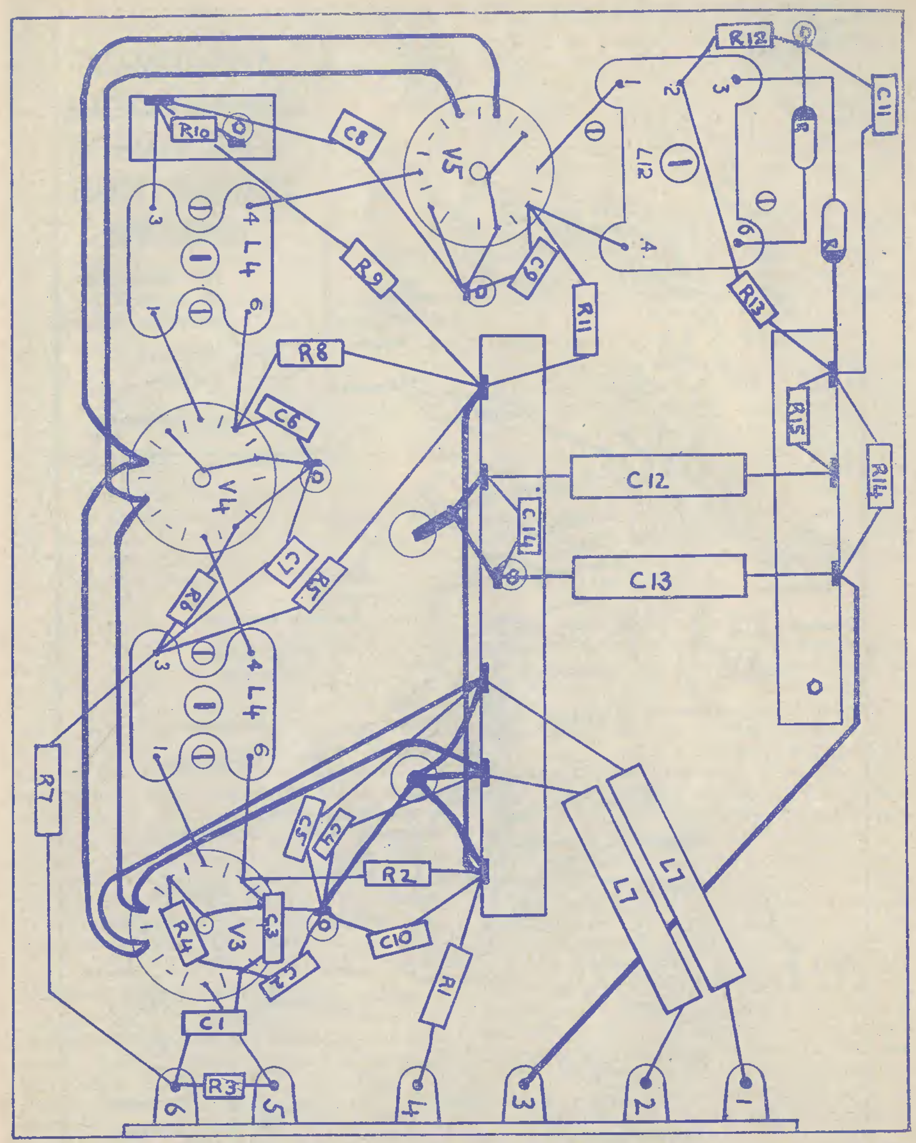
The summation of the voltages at the diode anodes, and rectification, results in the modulation signal appearing across the integrating condenser C_{11}, while a steady d.c. voltage also appears at this point, which is proportional to the mistuning of the signal. This is fed back to the reactance valve to reduce the mistuning of the signal. The reduction in mistuning in this design is about 10 i.e. an unusable mistuning of, say, 100 kc/s is reduced to a negligible amount of 10 kc/s.

In fact, 100 kc/s represents the total drift from cold over a number of hours, and the unit should, therefore, come into tune immediately when switched on.

Output Voltage

This is approximately 0.75 volt after the de-emphasis circuit R_{15}–C_{12}. The tuner should connect into an amplifier impedance of 0.5MΩ. Connecting to a lower input impedance will give a slight top boost.

If the output voltage is too great for the amplifier concerned, then the first stage may be overloaded. In this case the voltage divider shown on the circuit diagram should be used.



"*Mercury*" *Point-to-Point Wiring Diagram. The pin numbers for* L_{12} *are correct, superseding those given in the circuit in last month's issue.*

I.F. Alignment

Check first for voltages as shown on the circuit diagram. These are the voltages under no-signal conditions, and with a rail voltage of 180 volts. At this voltage the current consumption is approximately 40mA. The supply voltage should always be within the range of 145–180 volts, and the current will then be 30mA at the lower voltage and 40mA at the higher one. At lower voltages the oscillator may fail to function correctly, and at voltages higher than 200 the heat dissipation is unnecessarily increased.

Do not attempt the alignment unless some results are achieved at the outset. The coils supplied by Jason are approximately aligned,

Reproduced by kind permission of the B.B.C.

and it should be possible to obtain reception from the local transmitter. An indicator of some sort will be required; an oscilloscope may be used, or a 10-volt meter with a 10,000 ohms-per-volt movement. Alternatively, a valve voltmeter may be used.

Connect the indicator to the junction of C_7 and R_6 using a 100kΩ resistor in series with the indicator. The resistor should be mounted close to the above junction, the object being to prevent detuning of the i.f. transformer by the capacity of the leads from the indicator.

A signal generator should be connected to the grid of V_3, and IFT_1 (Type L4) aligned to produce a symmetrical bandwidth of approximately ± 200 kc/s around 10.7 Mc/s. This will not be achieved by stagger tuning, but by virtue of the fact that the i.f. transformers are overcoupled. Transfer the 100kΩ and indicator to the junction R_{10} and C_8, and align IFT_2 (Type L4).

To adjust the Discriminator, transfer the indicator to the junction of R_{15} and C_{12} and the generator to grid of V_3, adjusting the primary for maximum reading and the secondary for zero. Adjust the secondary so that the reading is approximately 1 volt negative and it will be possible to accurately tune the primary anode coil by peaking this negative reading. Finally readjust the secondary to zero output voltage.

To check the tuning of the i.f. secondary coil L_s in the converter, feed in the generator signal to a turn of wire wound round the glass part of the ECF80. The other side of the generator is, of course, connected to chassis as is normal. This is an inefficient method of injecting the signal and, therefore, the output of the signal generator may have to be increased. The advantage of the method is that the circuit being aligned is not disturbed by connection of the generator. Adjust L_s to optimum gain and bandwidth.

Alignment using a Wobbulator

Alignment by means of a wobbulator is by far the best method of achieving the ideal result, since the effect of each adjustment is very much clearer. Faults are also more readily observed, particularly instability, which is immediately seen by distortion of the curve just prior to the stage under adjustment bursting into oscillation. Experience soon shows just how fast the curve shown on the screen should rise, and more rapid increases of the rise in effect predict instability prior to any actual trouble being experienced.

Connect the scope to the junction of C_7 and R_6, using a 100kΩ resistor in series to prevent detuning effects. Set the wobbulator to 10.7 Mc/s and sweep width to approximately 1 Mc/s. Feed into the wobbulator or the output lead a 10.7 Mc/s signal, then adjust the amplitude of this signal to give a small mark on the cathode ray tube trace around which the curve should be balanced.

Connect the wobbulator to the grid of V_3 and align IFT_1 (Type L4); transfer the indicator to junction R_{10}–C_8, and align IFT_2 (Type L4). Feed into the anode circuit of converter as outlined previously and adjust L_s.

To align the discriminator, connect the scope to junction of R_{15}–C_{12} and the wobbulator to the grid of V_3. Adjust secondary for balance of S-shaped detector curve and primary for optimum amplitude and balance.

Tuning Core Positions—A Warning

The coils are approximately pre-tuned when received and, therefore, the final tuning of the core may entail withdrawing this somewhat. It is, however, possible to obtain a false peak by adjusting so that one of the cores lies midway between the windings of each coil. Both cores appear to peak tune, but the resultant gain will be not only of a low order but the bandwidth will be very wide. If in doubt, measure the depth of the core within the former.

Setting the Converter

Note carefully that the converter is pre-tuned and that only the station selector—the 4BA brass thread with slot—should be adjusted; except, of course, the i.f. secondary L_s as outlined in the i.f. instructions.

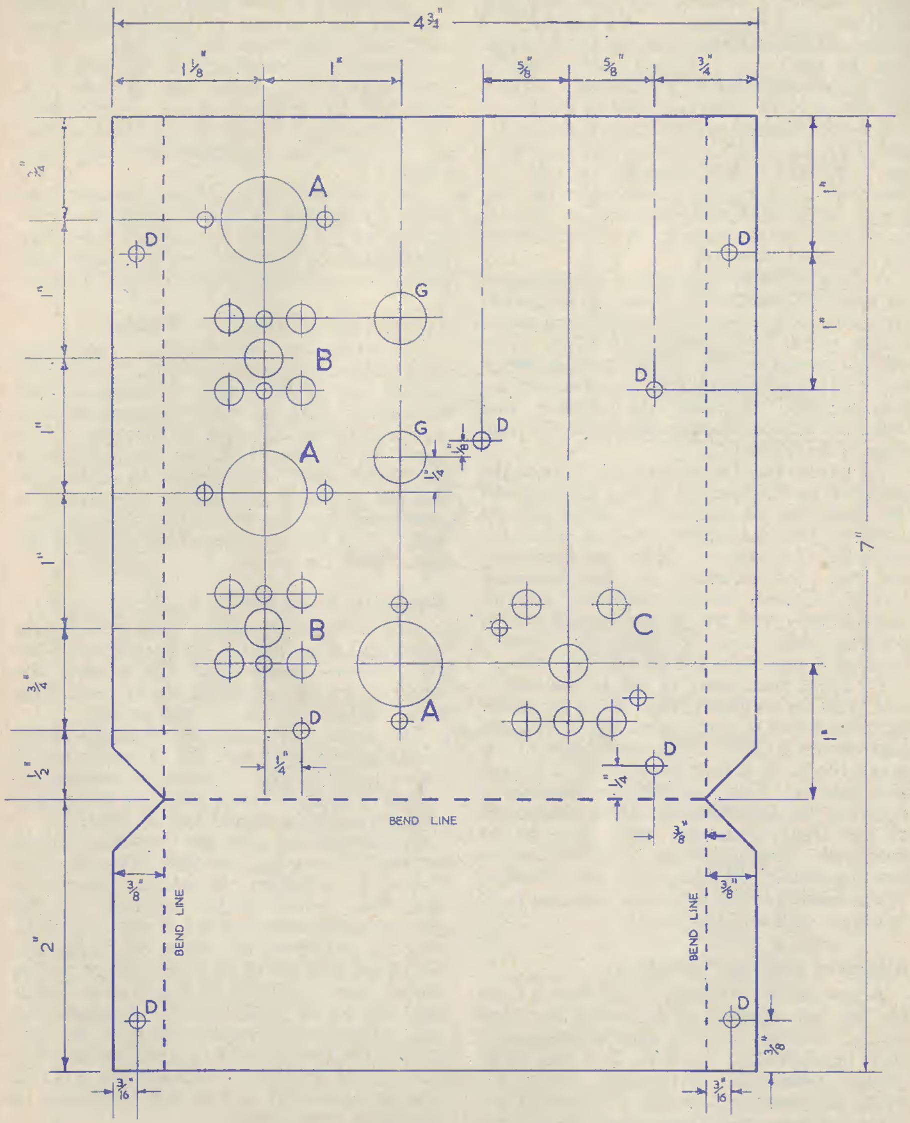
The aerial coil is already pre-tuned to the middle of the band, and the r.f. anode coil is also already tuned. The actual interstation tuning is effected by the loops on the switch wafer, and these should not be altered.

In the London area the converter should not require retuning. In other areas, find the station by adjusting the station selector so that the correct station appears on the appropriate position of the switch. After 15 minutes to allow the tuner to warm up, adjust the selector so that the voltage on the output point (junction of R_{15}–C_{12}) is within one volt on all programmes. Alternatively, after 15 minutes short out the a.f.c. by connecting the junction of R_{14}–C_{13} to chassis and tune in the stations. Allowing the a.f.c. to operate again will reduce the mistuning to negligible proportions.

Alignment the Easy Way

The Jason Motor & Electronic Co. will align the tuner providing that the layout diagram has been followed and that the instructions generally, particularly lead lengths, have been faithfully followed as outlined in this series.

It should also be emphasised that the component parts should preferably be obtained from a supplier retailing either

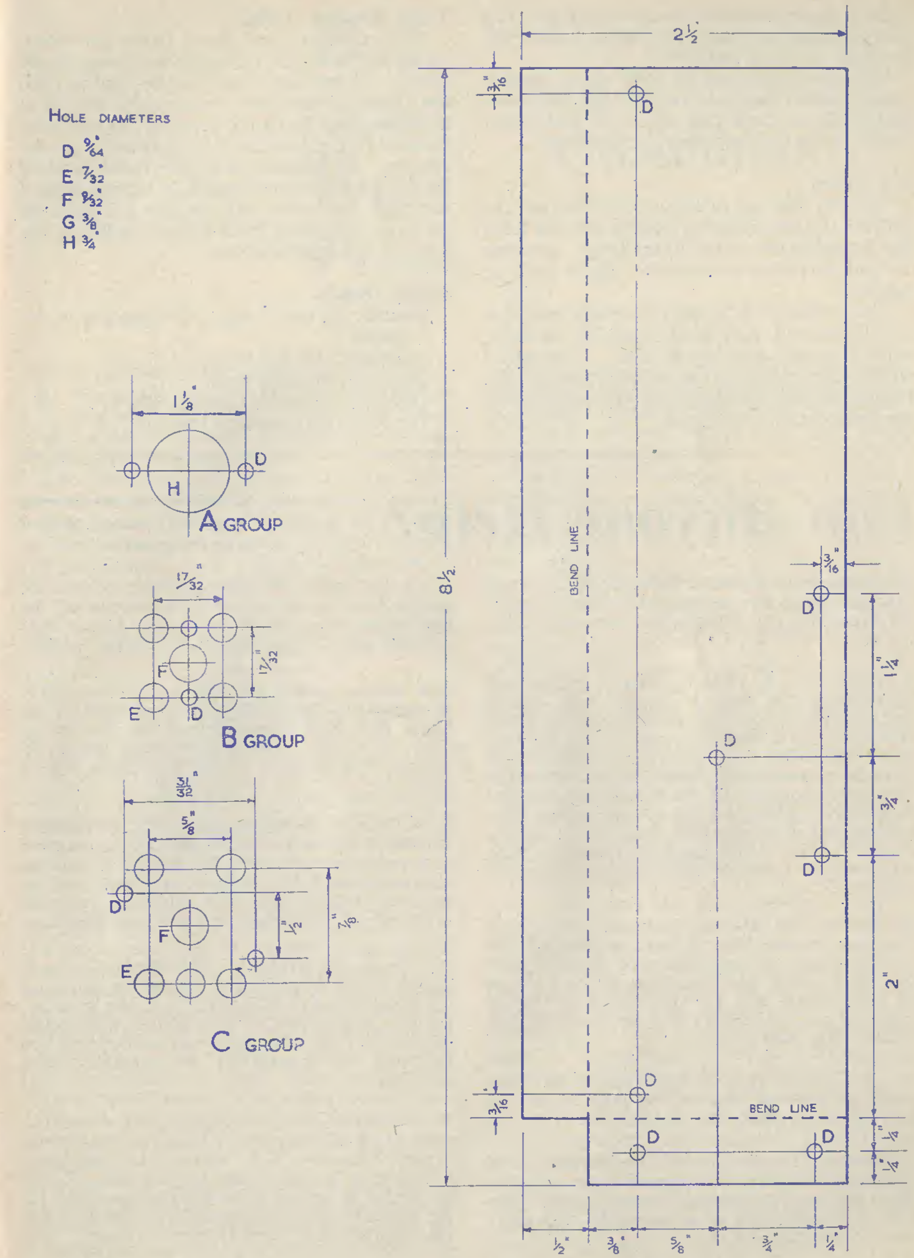


Chassis Drilling Details

Jason, or other manufacturers' equivalents, which are "Designer Approved."

Trouble Shooting

Many possible faults may be circumvented by adopting the correct layout as specified herewith, and it is assumed that this will be done by intending constructors. Condenser C_2 must be of suitable type. Either a ceramic or a non-inductive metallised paper condenser of small physical size is suitable. A mica condenser is usually too large, and



Sidepiece Dimensions (2 off) and Further Drilling Details normal paper condensers are inductive. The use of either of these two latter types will certainly produce instability.

It is very important to earth the centres of each holder. Doing so reduces the anode-to-grid capacity, and this is a very important factor in the final stability of the tuner.

The Aerial

Up to a distance of some 20 miles from the station, the dipole aerial may be formed from flex parted to give arms 2ft 6in long. Between 30 and 80 miles, an outdoor dipole may be needed.

The outdoor dipole may be made from ¼in duralumin rod, each arm being 2ft 6in long, with a centre spacing of ¼in. The aerial should be mounted broadside on to the station in a horizontal position, as the waves are horizontally polarised.

Three Element Aerial

This may be constructed from ¼in diam. dural rod with the dimensions shown in the table. "T" section dural may be used to hold the elements together; 1in approx. section is suitable. A rectangular piece of bakelite may be used to insulate the dipole; the size can be approx. 2in square and ¼in thick, and it should be mounted diagonally on the arm, if mounted outdoors. All the arm parts should be covered with a thick paint, including the joint to the coaxial cable.

Aerial Details

Dipole: 5ft total length, ¼in spacing in the centre.
Reflector: 5ft 4in long.
Director: 4ft 4½in long.
Dipole to reflector spacing: 2ft 8in.
Dipole to director spacing: 1ft 7in.

Can Anyone Help?

Requests for information are inserted in this section free of charge; subject to space being available

C. B. Braithby, G8GI, Schoolhouse, Martin, Lincoln, would like to know a source of supply for type MR-38A Shockproof Mounting Base for the Bendix RA-1B Receiver.

* * *

J. Browne, 73 Victoria Road, Fallowfield, Manchester 14, asks if anyone can supply circuits and information concerning the Royal Navy Air Arm receiver type 78, its ref. no. being 10D/1307. A ticket inside shows it to have been used by 807 Sqdn. based on H.M.S. *Theseus*. The range of the receiver is supposed to be 2.4-13 Mc/s and the voltage supply 26V. Information is particularly required about the crystal monitor which has been removed. Payment will be made or information returned, if desired.

* * *

J. Sorbie, 3 Marine Terrace, Rhosneigr, Anglesey, would like to buy, or borrow, the circuit details of the Electronic Fault Tracer No. 288B which was manufactured by Labgear of Cambridge, and of which they no longer hold details. All letters will be answered and information paid for.

* * *

T. Collier, 27 Newbould Crescent, Beighton, Sheffield, requires and will be glad to pay for any conversion data for the R.1155.

* * *

J. Grant, 153 New Row, Dunfermline, Fife, Scotland, wonders if any reader can tell him the address of the manufacturers of the "Bio Bar" soldering iron, or of any firm who make elements suitable for it.

* * *

C. Warburton, 1 Gransmoor Avenue, Hr. Openshaw, Manchester 11, asks if any reader can give, lend or sell to him any data on the Indicator Unit type 21 regarding its conversion to an oscilloscope. It has no power pack. All replies will be answered by return.

G. B. Brierley, 99 Chessel Street, Bristol 3, would like to buy or borrow details of the Canadian Marconi Transmitter Unit, type 112-912 and Output Tuning Unit type 114-906.

* * *

The Editor would like to hear of any source of supply of the CK507AX valves used in the Cigar Box Radio described in the September issue, as several readers have been unable to obtain from sources which had been selling them.

* * *

K. J. Elson, 36 Winnington Hill, Northwich, Cheshire, wishes to obtain the circuit diagram and any relevant data for the ex-Admiralty receiver type B.46. Any circuits lent will be returned within two days and any expenses defrayed. Alternatively, he is willing to purchase.

* * *

G. Fell (ex-VU2JX), 130 Titford Road, Langley, Oldbury, Worcs, wishes to purchase information such as circuit, and the manual, for the Bendix TA12B Transmitter, and would be glad to hear, also, from any reader who has modified the transmitter for amateur band working.

* * *

W. A. Shalliken, 2nd Engineer, M/V *Herriesdale*, c/o P. D. Hendry & Son, 121 St. Vincent Street, Glasgow, C.2, would like to obtain information on the No. 19 Set, Mk. 2. In particular he wishes to obtain the 6-pin and 12-pin panel socket connections, and also information on the v.h.f. receiver incorporated.

* * *

H. C. Phillips, 119 Seal Road, Kemsing, Kent, asks if any reader can give him information on converting the Command receiver type CBY 46145, 520 kc/s to 1.5 Mc/s, made by the Aircraft Radio Corpn., N.J., U.S.A., to a 12V car radio.

The BSRA *Exhibition*

British **S**ound **R**ecording **A**ssociation

The twenty-first anniversary exhibition and convention of the British Sound Recording Association was held on the 20th-22nd of September at the Waldorf Hotel, London.

The visitor's first reaction was a comparison with the Audio Fair held in April last at the same venue, but it soon became apparent that the object and approach to this exhibition were different. The accent was on technical interest rather than sales endeavour, and many present appreciated the way in which the technical staffs of the various exhibitors were prepared to discuss their secrets frankly and freely.

Those who expected to find many new items of interest were doubtless disappointed; much of the equipment displayed was seen at the Audio Fair and is well known.

Tape recording enthusiasts had the lion's share of the new products, and great interest was shown in a new tape deck, the "Harting." Impressive claims are made for the performance of this deck, which is being handled by two firms, one offering a complete tape recorder at 82 gns., while from the other the same deck will shortly be available, with the basic recording and reproducing amplifier only, at £55. The "Harting" tape deck is a two-speed machine having a single motor drive and incorporating push-button control.

The name of Grundig has long been synonymous with good quality domestic tape recorders, and their latest model, the TK830, would seem to be a worthy addition to their range. It is the first Grundig tape recorder to employ a push-pull power amplifier.

Messrs. Romagna Reproducers were showing and demonstrating the new Revox tape recorder. Though styled along the lines of a domestic recorder, this machine incorporates many "professional" features, separate record and replay amplifiers and provision for 2,400ft reels.

The M.S.S. Recording Co. Ltd., in their demonstration room, exhibited a remarkable piece of apparatus for the testing of ½in computer tape. Recording square waves on each of eight channels, the equipment checks the replay of these pulses and stops, rejecting the tape if any one, on any track, falls below a certain adjustable level.

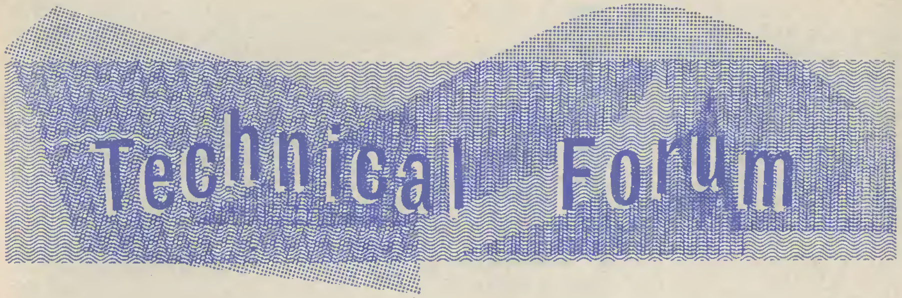
E.M.I. are now offering a tape record that is of tremendous importance to the home constructor of tape recording apparatus. Known as the TBT.1, it contains a range of frequencies from 40 c/s to 10 kc/s recorded to the C.C.I.R. characteristic. With the aid of a suitable voltmeter, the whole replay chain can be checked against the international standard.

Turning to disc reproduction, Goldring introduces the "600" cartridge. Having a diamond L.P. stylus, a flat response to over 20 kc/s is claimed. It is understood that the already well-known "500" cartridge has been improved by stylus modifications. Rogers now have a booster unit designed to allow the use of low output pick-ups with pre-amplifiers otherwise unsuitable by virtue of sensitivity or input impedance.

Among other items of note were transistor microphone pre-amplifiers and a plastic foam loudspeaker surround seen on Wharfdale units.

A.M. and f.m. tuners were well to the fore from many manufacturers, including the Jason switched f.m. tuner which is being described in the October and November issues. This created the personal impression of being a simple yet workmanlike unit.

Finally, mention must be made of the high standard achieved in the equipment entered for the amateur competition. This is one branch of the whole exhibition that deserves to grow, and constructors might well consider joining the association; your correspondent's application has already been sent in! On a stand entitled "The Quest for Quality" could be seen some items of historical interest, a copy of the first electrical recording to be issued, an early B.B.C. microphone, and various other examples. One left with an appreciation of the progress of the last twenty-one years. A. B. S.



Technical Forum

Automatic Frequency Control (A.F.C.)

THE TERM "AUTOMATIC FREQUENCY Control" is not entirely self-explanatory, so perhaps we should commence this month by considering what it is and why it is required. Many husbands must have been amazed at the number of times they have found their wives listening to the radio tuned on a sideband. Obviously the tuning knob had simply been turned until the required station was heard, but no attempt made to swing the dial pointer about its optimum position to locate the correct setting. Now if some circuit were to be incorporated which, once the required signal was first heard, would readjust the local oscillator frequency to bring it right into tune, the whole tuning procedure would be greatly simplified. Well, the a.f.c. circuit accomplishes just that. The effect upon the tuning is rather novel, because as the scale pointer nears a station position the signal quite suddenly comes in loud and clear and right on tune. As the pointer is moved over the station the signal remains unchanged until the edge of the far sideband is reached, when it will disappear and the general background noise increases until the next station is approached. This simplification of the tuning is only one aspect of the use of a.f.c.; its other advantages may be listed as follows:

(*a*) Once the tuning has been set, the a.f.c. circuit will compensate for deviations in the local oscillator frequency due to temperature changes and fluctuations in the mains supply voltage. Temperature effects can be quite troublesome, as those who have to readjust their tuning several times during the first twenty minutes will testify.

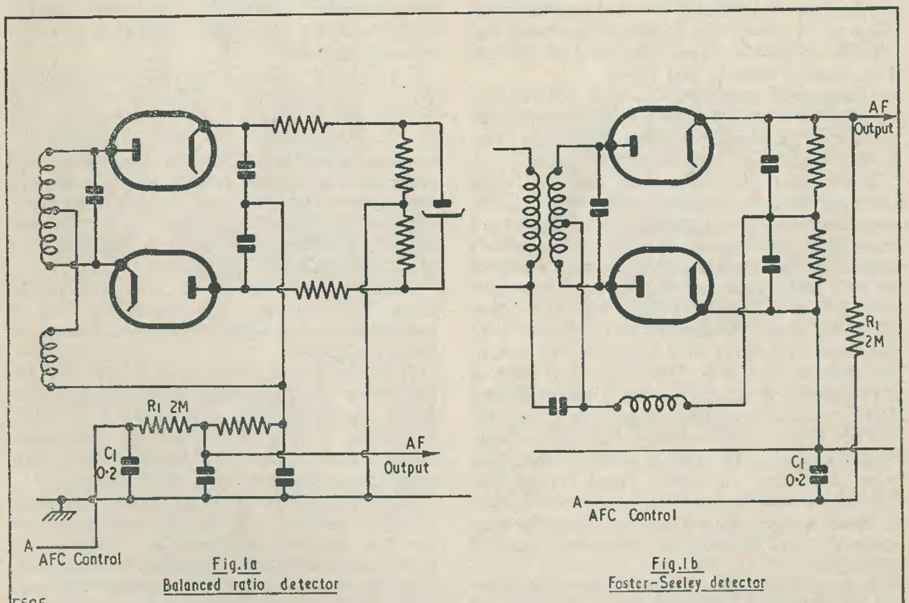


Fig.1a Balanced ratio detector

Fig.1b Foster-Seeley detector

(*b*) It is generally recognised that f.m. receivers are rather more difficult to tune than standard a.m. sets. Thus the advantages of an a.f.c. system in an f.m. receiver are more marked.

(*c*) If a form of preset tuning such as a press button unit is employed, a.f.c. becomes even more important to prevent long-term drift in components from progressively determining the pre-set controls.

Enough has been said of the advantages of a.f.c. to convince the reader that it is a very desirable feature and one which would be incorporated on a great many radio receivers if it were not for the additional cost. However, most constructors are more concerned about performance rather than in saving a few shillings on a receiver, so the following explanation of how a.f.c. may be applied to an f.m. set should prove of interest.

Mode of Operation

An automatic frequency control circuit is required to readjust the local oscillator frequency in a superhet receiver should the required signal be slightly off tune. Thus if the tuning is on the low side, the oscillator frequency must be increased; whilst the reverse must also be applicable. For this to be achieved two separate circuits are required in the receiver. The first must sense the signal frequency and produce a control voltage which rises or falls depending upon whether the tuning is above or below the correct position. The second part of the circuit must employ this control voltage and make the necessary readjustment of the oscillator frequency. The control voltage is obtained from a circuit termed a frequency discriminator. This circuit will be familiar to most readers who are interested in f.m. reception as the ratio detector or Foster-Seeley detector found in nearly all f.m. sets. With certain reservations, the d.c. output from these detectors will rise or fall depending upon whether the receiver is tuned above or below the signal frequency, thus a source of control voltage is available in most f.m. receivers.

The actual readjustment of the oscillator frequency is achieved by a "reactance valve" circuit. In this arrangement the valve is connected up in such a fashion that it presents an effective capacity or inductance across the oscillator tuned circuit, whose valve is controlled by the $grid_1$ voltage. It is well known that by adjusting either the "L" or "C" constants in an oscillator circuit the frequency is made to change, so that the desired effect is achieved by connecting the reactance valve directly across the oscillator tuned circuits.

The General Circuit

In deriving the control voltage from the f.m. detector, a little care is necessary to ensure that it is of the correct polarity and that it is adequately smoothed. The reactance valve arrangement described later requires an increase in grid voltage to reduce the oscillator frequency and vice-versa. Fig. 1 shows the method by which the control voltage is obtained from the two most popular types of f.m. detector, the ratio circuit and the Foster-Seeley. With the former arrangement the control line will also contain the audio signal and this is eliminated by a low pass filter consisting of R_1 and C_1.

The circuit of the reactance valve section is shown in Fig. 2. This valve is connected directly across the oscillator coil and appears as a shunt capacitor across it. It will be recalled that if a voltage is applied across a capacitor the current flowing in it will lead on the voltage by 90°. This condition is simulated by the valve by arranging that its grid voltage should be derived from the anode voltage but advanced in phase by 90°. Thus as the anode current is in phase with the grid voltage, the anode current will lead the anode voltage by 90°. The magnitude of the capacitance presented by the valve in this manner is governed by its mutual conductance and this may be controlled by the grid bias. Hence the bias directly effects the tuning capabilities of the reactance valve. The grid voltage is phase shifted by C_2R_2 with C_3 being of appreciably higher value than C_2 and serving only as a decoupling component. In some circuits C_2 and R_2 will be transposed, in which case the reactance valve appears as a variable inductance across the oscillator circuit. The reader may also have come across circuits in which C_2 appears to have

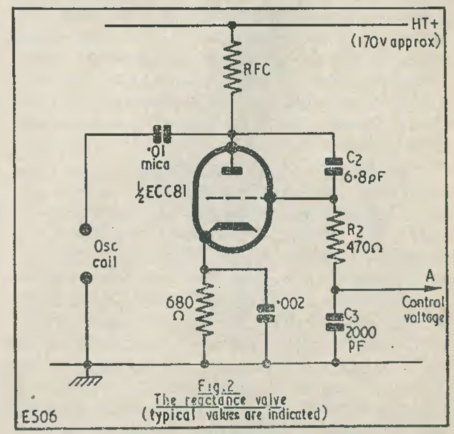


Fig.2 The reactance valve (typical values are indicated)

(*continued on p.* 274)

Radio Miscellany

MY REFERENCES TO THE JOYS OF AMATEUR radio receiver construction of 1923 vintage brought in a surprisingly high number of letters from readers, all of whom looked back on those good old days with sentimental regard. It speaks volumes for the permanency of the interest in our hobby that there should be so many old-timers, yet they nearly all express doubt whether the modern generation get anything like the thrill out of radio that they once knew. The design and construction of receivers of the pre-broadcasting and early broadcasting era was always an exciting business because it was speculative. There were, too, an apparently unlimited number of arrangements you could try with coils of slightly differing patterns and dimensions which could be knocked up in half an hour. Nor was there any difficulty about wire and formers. Every shopping centre worthy of the name boasted a half a dozen shops where everything from sheet ebonite to brass terminals were available in quantity.

Stations were then on what we should now regard as absurdly low power, components were crude and electrically inefficient, while valves at 1 amp. l.t. apiece drained your batteries before you could say "Jack Robinson"—in return for which they gave you very low emission although you did get a cheery and very satisfying glow, particularly from the R. type. Added up, it was quite a thrill to get a B.B.C. station a hundred miles away. That could most easily be achieved by regeneration and with reaction condensers on the brink of oscillation point. Even so, selectivity was so poor that you stood little chance of getting a second B.B.C. transmission while your local was on. Chaps used to wait beside their sets impatient for the last "good-night" and then pounce eagerly on the tuning dial hoping to catch the last few seconds from a station farther afield, just to be sure of the capabilities of their new circuit. Hence, when 2LO cut carrier, there was a bedlam of shrieks and whistles from many thousands of spilling-over reaction condensers. If you were very lucky you might just catch another "good-night" from 5IT (Birmingham) or Manchester. The fans naturally pressed for the B.B.C. to stagger their closing down hours so that they would have long enough to really identify stations, but the B.B.C. wouldn't play ball. However, I do recall one occasion when the B.B.C. became quite human and had a few minutes silence from 2LO to let the knob-twiddlers enjoy their modest "DX-hunting".

The great thing, of course, to get reasonable reception from somewhere other than your local was lots of aerial. Most enthusiasts managed to contrive the full 100 feet—the maximum permitted—a greater length than that was still considered to be taking more than your fair whack out of the available signal! City dwellers naturally had a hard time getting their hundred feet up. Many and ingenious were the ways the crafty types thought up to sweeten their neighbours into allowing the aerial to cross over their garden, or for permission to hook one end of it on the topmost branch of their tallest tree. There was always the danger that just after you spent a bitterly cold November afternoon in getting it up, some local pigeon fancier would demand that you fixed corks at intervals along it so that his homing birds didn't decapitate themselves when touching down in foggy weather. That was, of course, years before radar. Come to think of it, nobody has yet devised a system of beaming their racing pigeons back home, but with the compactness and versatility of the modern transistor there is no knowing what curious developments are yet to come!

HI-FI

Oddly enough, it was quite a number of years before anyone paid serious attention to high fidelity. Even in the early 'thirties when I went with a friend to a Club meeting (at Croydon) where everyone seemed overmuch concerned with "quality reproduction", it was still something novel. He thought they had all gone a bit soft. I should explain he was a traditionalist, and for years the yardstick by which a set had been judged was by the number of "foreign stations" it could receive. Quality didn't matter—as long as the spoken word was understandable. The original was badly mutilated in the microphone and the transmitter, and after all what

sort of reproduction could one expect from a tin trumpet stuck on the end of an earpiece? Valves were not only extravagant with precious l.t.—but very expensive. Hence the popularity of regenerative circuits which, pushed to the extreme, added to the distorted noise emanating from the overloaded earpieces. Then there were the squeaks and whistles from sets for miles around until the B.B.C. earnestly appealed "Please don't do it". My friend, the traditionalist, apparently enjoyed carrying heavy accumulators round to the local garage for re-charging twice a week. It was just one of the crosses every right-thinking amateur ought to bear as evidence of his devotion. It was only with a feeling of deep shame he eventually changed over to the new-fangled dull-emitter valves, and for weeks afterwards he wouldn't have taken much convincing that his manliness was suspect!

a filament rheostat for its associated valve. They were described as being suitable for the reception of speech, spark or c.w., with a Note Magnifier as an optional accessory. The latter, of course, was an early Americanism for an l.f. stage. He also sends a Cosmos list of somewhat later date which describes Cosmos Radiobrix, a similar but more compact idea which was supplied complete with connecting strips. The user was thus able to "try out a different circuit every day". For how long is unspecified. Rather like the early Ford cars. Available in any colour you liked—so long as you chose black!

The Polar Bloc system which touched off this whole business is far from forgotten. News from so far afield as Cyprus came to hand from E.K.C. (10 Independent Recce) who recalls his former science master giving him some parts of the Harmsworth Wireless Encyclopedia, one of which included this

CENTRE TAP talks about *Items of General Interest*

It is nice to think that so many readers recall the excitement and fun of those early days when there was something new to try every week, new stations to log and boast about, and women (unlike their modern counterparts) were, generally speaking, sympathetically indulgent. Every man seemed to possess the inalienable right to a corner of the dining-room to keep his bits and pieces. True, his wife made a pair of curtains to hide it out of sight when he wasn't actually playing with it—but none the less his right to keep it there was unquestioned. When factory sets in sleek looking cabinets with one-knob control came along, the hobby became cast out from the creature comforts of the living room into some unwanted part of the house—usually to an unheated attic. Perhaps the terrific decline in constructional interest that befell us in the middle 'thirties may have been partially due to the fact that many a hard-bitten enthusiast died off—of pneumonia! ! !

Out of the Past

Among the many interesting letters is one from J.P. (Spencer Road, Newport, Mon.) who vividly recalls the early thrills. He feels the nearest comparable experience for the up and coming youngsters of to-day can be found only on short waves. Even that lacks much of the constructional and experimental speculation. He sends along a Peto-Scott booklet "Complete Radio Sets in Parts" from his collection of relics. These units were built on ebonite panels 7in. x 5in., each contained in its separate box and each using

particular issue. It is still at his home (in Derbyshire) and he kindly offered to have it forwarded to me, but happily with so much information coming along so freely from other helpful readers it isn't necessary.

J.E.B. (Station Road, Whitstable), H.R.N. (of H———, Mddx.) who doesn't like publicity, G3JYW (Huddersfield), J.M. (Holloway, N.7) and B.G.A. (Stevenage) all kindly sent along graphic details and drawings. Most of them seem to possess copies of this thirty-four-year-old work. Incidentally, they all appear to have looked it through pretty thoroughly as they are unanimous in picking on the same receiver as being the *piece de resistance* contained in its pages. I will return to this subject a little later.

Meccano-Like

That is the description from H.R.H.'s cheerful letter in condensing to his own words this arrangement of tubular jointed framework to which were fitted 5in. x 4in. (full size) and half size panels each carrying various components using cruciform connections. It was marketed by the Radio Communication Co. who stressed that it was not a glorified unit system. This claim was perfectly justified as terminal connections were eliminated. H.R.N. appears to have a fine collection of modern radio gear as well as a number of museum pieces, and is good enough to invite me to call and see it if I am that way at a convenient time. Perhaps—one day! I hope it's because he regards me

(*continued on page* 274)

A TWO-VALVE "Y" AMPLIFIER

by **R. E. S. COULSON**

This circuit, although essentially simple, has a number of refinements which make it a little out of the ordinary. It is suitable for driving c.r.t.'s of up to 6in diameter (such as the ACR13 or VCR97), and with a smaller tube for use in portable oscilloscopes. It uses two double-triode valves, which in the prototype to be described were miniature B9A-based ECC81's; but if there is plenty of space to spare, as for instance in a bench 'scope, the valves could be octal-based double-triodes, such as ECC31's or even the cheap and very popular RK34's. It is intended for use by constructors who have become "fed-up" with single-ended EF50 circuits, and in simple 'scopes gives a useful gain up to as much as 1 Mc/s.

V_{1a} can be used as either a cathode follower or a normal RC-coupled amplifier, feeding into V_{1b}. There is no bypass condenser across R_2, as it would short-circuit the signal voltages. Selection of amplifier type is by S_{1a} (R_3 is merely the grid resistor for use when V_{1a} is connected as an RC amplifier). V_{1b} is a normal amplifier, except that the cathode bypass condenser is again omitted. The justification for this is that some negative feed-back is applied (and also that it saves money). S_{1b} is the main amplifier control switch, although all the switches are ganged together. VR_1 is the gain control. V_2 is a phase-splitter-cum-amplifier, and provides the push-pull output to the "Y" plates necessary for the removal of trapezium distortion. It operates in the following manner: the signal is fed into the grid V_{2a} and appears, enlarged, in the anode circuit. Some of this voltage then appears across the bleeder chain in the grid circuit of V_{2b}. This voltage is then amplified and appears across R_9, the anode resistor of V_{2b}, and consequently returns to the grid circuit of V_{2b} through R11. The arrangement is thus self-balancing, the outputs from the two anodes being as exactly matched as the two 1MΩ resistors. (If one wanted to match these *accurately* it could be done by filing nicks into the carbon of the lower-value resistor and comparing the two on a Wheatstone bridge, or even measuring the working outputs with a high-resistance voltmeter.)

S_{1b} can also select two other, fixed, voltages; in the writer's case these were from the 50 c/s heater supply via an 0.02µF condenser and from the timebase, using a similar condenser; both were employed for calibration purposes.

In the 50 c/s position the low-gain input socket is isolated from V_2, but is in the output circuit of V_1; in the 50 c/s position of S_1, then V_1 acts as a separate amplifier (something for the gadget fiend!).

It ought to be possible to economise by using an ECC91 (common cathode, B7G base) for V_2, but I have not tried this. If more space is available octal-based valves, like those enumerated above, may be used. If one had masses of space, four single triodes, 6J5's or 7193's, could be used. But as these valves have different characteristics (bias, anode current, etc.), the values of anode and cathode resistors might have to be changed. It is essential to keep the value of R_5 higher than that of R_2, otherwise in the cathode follower position of S_{1a} the grid of V_{1b} may be driven positive, with disastrous results.

The amplifier may be constructed on the 6in × 4in × 2in aluminium chassis for which dimensions and layout are given, but this is not essential.

Parts List	All "Radiospares" components
All resistors	½ watt miniature carbon
R_1	22kΩ (25kΩ if a potentiometer)
R_2	220Ω
R_3	470kΩ
R_4	22kΩ
R_5	270Ω
VR	1MΩ (midget, less switch)
R_6	1MΩ
R_7	220Ω
R_8, R_9	22kΩ
R_{10}, R_{11}	1MΩ
R_{12}, R_{13}	680kΩ
C_1, C_2	0.02µF (500 VDC working)
C_3, C_4, C_5	0.05µF (500 VDC working)
3-pole 4-way rotary switch (miniature)	
Coax plugs, sockets, terminal blocks, chassis	
Valve bases, screening cans	
Mullard valves, ECC81, ECC81 or 12AT7, (12AT7 for above components)	

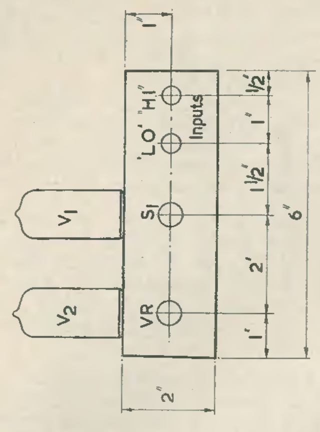


FIG.2. Front View.

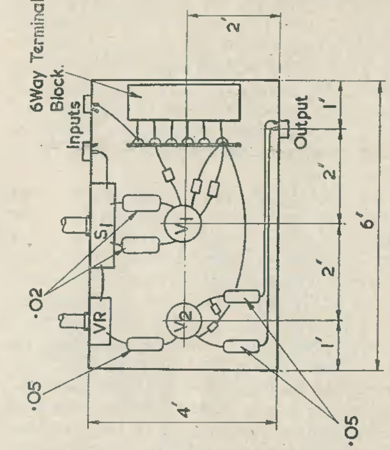


FIG.3. Under-Chassis View.

M464

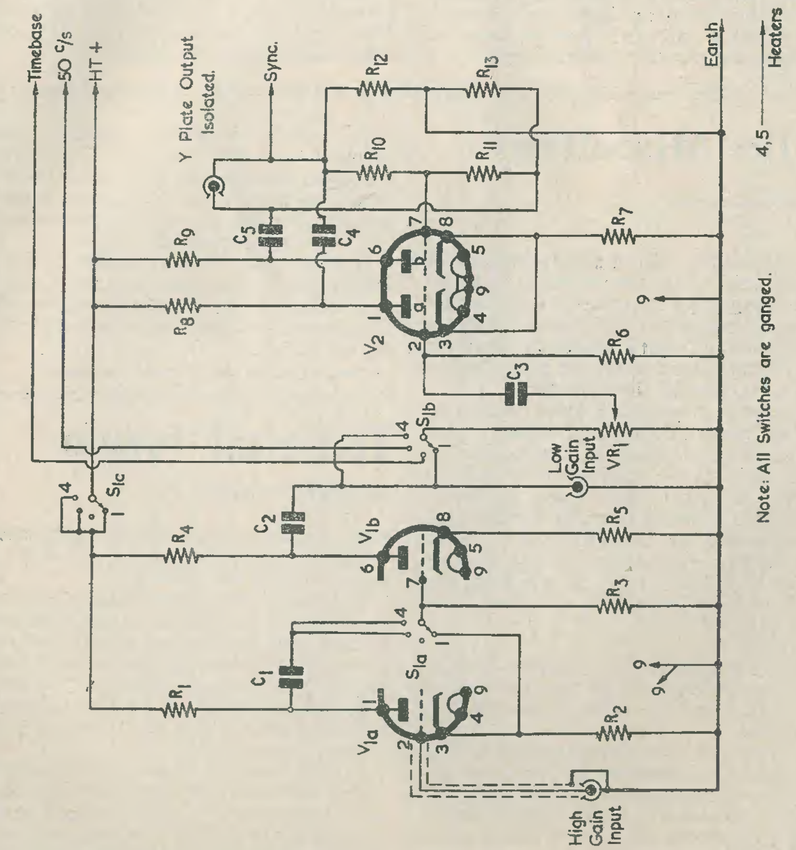


FIG.1.

Construction is fairly straightforward.

First of all wire up the heater circuit with twin-twisted wire (not with earth returns to tags under valveholders!), and if any trouble from hum is experienced, this heater wiring may later be screened and the screening earthed at both ends (but not to the negative heater!). Failing this as a cure for hum, try screening the h.t., 50 c/s, calibration and timebase inputs.

On the prototype, all the leads to and from the timebase and power pack were taken through a six-way cable and two terminal blocks. Any more leads to these terminals are then wired in, preferably in screened wires. Next wire up the inputs, but not with screened wire. If hum is picked up by the high-gain, high-impedance input, fit a shorting plug or switch. The reason for this is that the amplifier has to deal with high frequencies.

Next fit an earth return busbar, running from the input sockets along to the terminal block and then the length of the chassis to V_2, where it is anchored to a stand-off insulator. Earth the busbar at the input sockets only. To this busbar *all* earth returns must be made, with the shortest possible leads.

Wire in the condensers, *short* leads, then wire in the resistors. Try to keep the signal leads "up in the air," and all others out of sight (with sleeving, of course). It is possible to use a tag-board, but remember to keep outputs away from inputs. It may help to reduce hum if screening is fitted round *any* wire near any signal lead, as some hum is bound to be picked up by all leads to the terminal block from the timebase, since the heater supply comes along this cable.

Refinements are easy to suggest; an attenuator could be fitted (see *R.C.*, May 1957, p. 698), or the anode resistor of V_{1a} could be made variable to obtain equal output from that valve in both switch positions, either as a rheostat or as a potentiometer of about 25kΩ.

It is possible to use the circuit of V_2 as the "X," or timebase, amplifier. The author is using an ECL80 triode-pentode working in a Puckle timebase circuit, giving frequencies from 120 c/s to 200 c/s, synchronised in the normal way via a potentiometer and switch. Then the "X" amplifier follows this on the same chassis (10in × 4in × 2in).

Radio Miscellany

(*continued from page 271*)

as an old friend and not simply because he prizes his copy of the Encyclopedia so highly that he is unwilling to entrust it to the tender mercies of the postal authorities. Judging by all the stuff he's got in his shack, I ha'e me doots whether there would be room for the two of us in there at the same time!

J.M. says he often finds himself ruminating about the good old days and wonders what has happened to many of the bearers of names well known during broadcasting's infancy. He asks "How many remember Basil Davis's Concerts from the Marble Arch Pavilion under the call-sign 2XB?" I am afraid I can't. Would it be the holder of the present call G2BZ? If so, he was doing fine when I had my last QSO's with him—that was in 1953-54.

Hang it All !

Space precludes further reference to other letters, but I hope to return to some interesting points raised by "Old Stager" B.G.A. next month.

In conclusion, the titbit mentioned earlier. Those who have access to this early Encyclopedia are recommended to refer to page 1077 (Vol. 2). Here will be found a description of a Hanging Set* for the Dining Room which is both *ornamental* and *useful*. It provided both light and sound simultaneously, besides saving the cost of a chandelier. The batteries, etc., were hidden in the floor above, while the hexagonal horn of the loudspeaker projected through the ceiling, neatly surrounded by eight valves appropriately shaded.

It must have looked something like the Blackpool illuminations, and may help one to understand why a few of the old traditionalists were so reluctant to forsake their bright emitter valves!

* Nothing to do with Capital Punishment.

Technical Forum

(*continued from page 269*)

been omitted entirely, but in such cases its value is simply that of the anode to grid capacitance of the valve.

The sensitivity of the reactance valve will be greatest if it represents a large proportion of the tuning capacitance, so that the value of strays and trimmers across the oscillator coil should be kept to a minimum. Most well-designed circuits will give a shift in oscillator frequency of 100 kc/s for a change in a.f.c. control voltage of 1V.

In last month's issue an f.m. tuner, the "Mercury," was described which employs an a.f.c. arrangement, and it is hoped that this explanation of its basic mode of operation will assist constructors in getting the best results.

VIBRATOR BASING DATA

For base connections and key see July issue

PART 4, conclusion

Compiled by E. G. BULLEY

Type	*Base*	1	2	3	4	5	6	7	*Remarks*
2688	3	S1	P1	R	P2	S2	—	—	5 pin UX base
PJ61	3	S1	P1	R	P2	S2	—	—	5 pin UX base
245	3	S1	P1	R	P2	S2	—	—	5 pin UX base
715	3	S1	P1	R	P2	S2	—	—	5 pin UX base
SP57	3	S1	P1	R	P2	S2	—	—	5 pin UX base
QL6	3	S1	P1	R	P2	S2	—	—	5 pin UX base
5409-4	3	S1	P1	R	P2	S2	—	—	5 pin UX base
541	3	S1	P1	R	P2	S2	—	—	5 pin UX base
8751	3	S1	P1	R	P2	S2	—	—	5 pin UX base
835	3	S1	P1	R	P2	S2	—	—	5 pin UX base
W245	3	S1	P1	R	P2	S2	—	—	5 pin UX base
815	3	S1	P1	R	P2	S2	—	—	5 pin UX base
4SP5	3	S1	P1	R	P2	S2	—	—	5 pin UX base
5409-32	3	S1	P1	R	P2	S2	—	—	5 pin UX base
5411	2	P1	S1	A	S2	P2	R	—	6 pin UX base
522	2	P1	S1	A	S2	P2	R	—	6 pin UX base
T58	2	P1	S1	A	S2	P2	R	—	6 pin UX base
5052525	2	P1	S1	A	S2	P2	R	—	6 pin UX base
712	2	P1	S1	A	S2	P2	R	—	6 pin UX base
PJ58	2	P1	S1	A	S2	P2	R	—	6 pin UX base
246	2	P1	S1	A	S2	P2	R	—	6 pin UX base
600	2	P1	S1	A	S2	P2	R	—	6 pin UX base
SP60	2	P1	S1	A	S2	P2	R	—	6 pin UX base
50A6	2	P1	S1	A	S2	P2	R	—	6 pin UX base
QE6	2	P1	S1	A	S2	P2	R	—	6 pin UX base
5413	3	S1	P1	R	P2	S2	—	—	5 pin UX base
520A	3	S1	P1	R	P2	S2	—	—	5 pin UX base
1211573	3	S1	P1	R	P2	S2	—	—	5 pin UX base
716	3	S1	P1	R	P2	S2	—	—	5 pin UX base
245A	3	S1	P1	R	P2	S2	—	—	5 pin UX base
787	3	S1	P1	R	P2	S2	—	—	5 pin UX base
SP56	3	S1	P1	R	P2	S2	—	—	5 pin UX base
QL6	3	S1	P1	R	P2	S2	—	—	5 pin UX base
5415	3	S1	P1	R	P2	S2	—	—	5 pin UX base
541A	3	S1	P1	R	P2	S2	—	—	5 pin UX base
8752	3	S1	P1	R	P2	S2	—	—	5 pin UX base
800	3	S1	P1	R	P2	S2	—	—	5 pin UX base
5416	3	S1	P1	R	P2	S2	—	—	5 pin UX base
503	3	S1	P1	R	P2	S2	—	—	5 pin UX base
T55	3	S1	P1	R	P2	S2	—	—	5 pin UX base
8618	3	S1	P1	R	P2	S2	—	—	5 pin UX base
707	3	S1	P1	R	P2	S2	—	—	5 pin UX base
PJ55	3	S1	P1	R	P2	S2	—	—	5 pin UX base
270B	3	S1	P1	R	P2	S2	—	—	5 pin UX base
705	3	S1	P1	R	P2	S2	—	—	5 pin UX base
SP50	3	S1	P1	R	P2	S2	—	—	5 pin UX base
5420P	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
2089	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5428	2	R	P1	S2	P2	S1	R	—	6 pin UX base
5431-4	2	P1	S1	RS	S2	P2	RP	—	6 pin UX base
3PV9	2	P1	S1	RS	S2	P2	RP	—	6 pin UX base
5433	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5434	2	R	P1	S2	S1	P2	Blank	—	6 pin UX base
729	2	R	P1	S2	S1	P2	Blank	—	6 pin UX base
SP64	2	R	P1	S2	S1	P2	Blank	—	6 pin UX base
5435	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5436	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
V5868	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5503-12	1	R	P1	P2	Blank	—	—	—	4 pin UX base
5504	2	P1	P1	Blank	P2	P2	R	—	6 pin UX base
5514	1	R	P1	P2	Blank	—	—	—	4 pin UX base
5515	1	R	P1	P2	Blank	—	—	—	4 pin UX base
NP48	1	R	P1	P2	Blank	—	—	—	4 pin UX base
V6648	1	R	P1	P2	Blank	—	—	—	4 pin UX base
5516	1	R	P1	P2	Blank	—	—	—	4 pin UX base
5517-12	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5518	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5610	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
562	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
743	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
786	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
NP65	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
35ZH	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5621	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base
5615-12	2	P1	S1	Blank	S2	P2	R	—	6 pin UX base

SEE THESE FINE BARGAINS AT

The Walk-around Shop

RECTIFIERS. 12 volt 1 amp, 6/–; 12 volt 4 amp, 13/–. Post paid

WALKIE TALKIE TRANSMITTER/RECEIVERS. Type 38. Frequency 7.4 to 9 Mc/s. Valved with 4 VP23's and 1 ATP4. Brand new and complete with 2 pairs of earphones, 2 throat microphones, whip aerial, junction box and canvas satchel. Price **65/–** plus 5/– postage and packing.

TRANSMITTER-RECEIVER. No. 19 Mark 2. Frequency coverage 2–8 Mc/s for R/T.MCW. C.W. Superhet receiver 465 kc/s i.f. B.F.O., etc. Receiver line-up: 6K7 r.f., 6K8 mixer, 2 6K7 i.f.s 6B8 det. Transmitter line-up: 6K8 mixer, VFO EF50 buffer, EB.34 ADC, 807 P/A. This unit incorporates a TX/RX 229 to 241 Mc/s with a local range of 1 mile. Valve line-up: CV6, 2 6K7's and 6V6, also intercom set 2 valve a.f. amplifier 6K7 and 6V6. As new condition and of American manufacture, fully valved, **£3 . 5 . 0**, plus 10/– packing and carriage.

ELECTRIC TIME SWITCH. Beautifully made clockwork mechanism automatically wound by 6 volt solenoid. The time switch can be set for any period between 30 minutes and 44 days. This robust unit is housed in strong bakelite case 4″ in diameter. Price **12/6** post paid.

HEATER TRANSFORMERS. 6.3 volt 1.5 amps; brand new, 6/6, plus 1/– p.p.

PROOPS BROS. LTD. *Open all day Saturday*
Dept. R, 52 Tottenham Ct. Rd. W1
Hours 9-6 p.m. Thursday to 1 p.m. LANgham 0141

NEW CATALOGUE

"60 Pages of Spares"

Price 1/– Post Free

It includes 118 exact replacement Potentiometers and Mains Droppers, Line Output Transformers, Tools, etc., etc. For example:

MAINS DROPPERS. For Philips 209U SMD.1 150Ω + 250Ω + 170Ω + 100Ω **6/5**, Pye V4, V7, SMD 20, 10Ω + 20Ω + 20Ω **5/8.**

OUTPUT TRANSFORMERS. For Ultra Twin **11/9**; Philips 290U **12/9**, 170A **13/6**, etc., etc.

ELSTONE TRANSFORMER RANGE. CRT Isolation, Mains Primary, 2V, 4V, 6.3V, 10.8V, 13.3V, optional 20% boost, **22/–**, etc., etc. State CRT voltage required.

TOOLS. Stead wire cutters **5/6**; Solon Instrument Iron **24/–**, etc., etc.

SERVICE AIDS. Switch cleaner **4/6**; Ersin solder **5/–** and **2/6**, etc., etc.

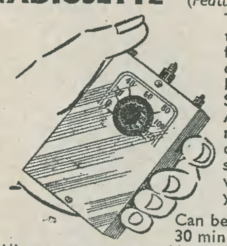
Air Spaced Coaxial Cable, 9d. per yd.

Minimum postage 6d.

M. FOY
6 WYKEBECK GARDENS LEEDS 9

RADIOSETTE

(Featured in June Issue)



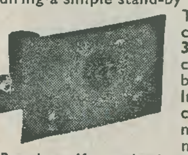
The ideal low cost transistor pocket radio for the beginner. The circuit utilises the new R.C.S. VARILOOP-STICK transistor coil. A specially designed miniature .0004 tuning condenser permits the set to be in a case which fits the palm of your hand.

Can be built in 30 minutes **30/–**

All components are sold separately, full construction data including plan of parts, 2/–

ALL-WAVE RADIO **30/–**

Ideal for the beginner or for those requiring a simple stand-by receiver



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

Postage: Under 10/–, **9d.** *Under 40/–,* **1/6.**
Over 40/–, post free

R.C.S. PRODUCTS (RADIO) LTD.
11 Oliver Road London E17 *Mail Order only*

NEW REVISED EDITION

Radio Amateur Operator's Handbook

INDISPENSABLE TO THE AMATEUR TRANSMITTER AND LISTENER

4th Edition 1957/58

It contains all those details of information which the transmitter and SWL constantly require.

Right up-to-the-minute Amateur Band Prefix lists, both alphabetically and by Country, Zone Boundaries, Call Areas, Mileage Tables, QSL Bureaux, "Q" Code, WWV Skeds, Record Charts, Maps of Dx areas, and much other information, as well as a Frequency/Wavelength Conversion Chart.

Price 3/– postage 3d.

DATA PUBLICATIONS LTD
57 Maida Vale London W9

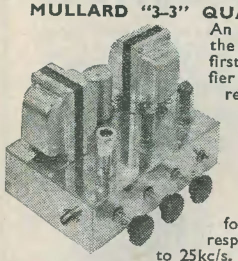
BAND 3 T/V CONVERTER
185 Mc/s—199 Mc/s

Suitable London, Birmingham, Northern and Scottish ITA Transmissions

Mk. 2 Model, Latest Cascode circuit using ECC84 and EF80 valves giving improved sensitivity (12 db) over standard circuits, built-in Power Supply A.C. 200-250V. Dimensions only 6½″×3″, ht. 4″. Simple and easy to fit—only external plug-in connections. Wired, aligned and tested ready for use. State Channel required. Guaranteed. Bargain offer—good results or full refund, only **£3.19.6** Carr. and Pkg. 2/6

CONVERTER ACCESSORIES. Band 1-Band 3 Cross-over Unit, **7/6.** Var. Attenuators 6db-36db, **6/9.** BBC Pattern Filter, **8/6.** Band 3 Aerials—outside single dipole with 4 yds. coax., **13/9.** 3 element Beam, **27/6.** 5 element, **35/–**, etc., etc.

MULLARD "3–3" QUALITY AMPLIFIER



An ideal companion unit to the JASON Tuner. A really first-class 3-valve 3W Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line-up: EF86, EL84, EZ81. Extra h.t. and l.t. available for Tuner Unit addition. Variable treble cut and bass boost controls, sensitivity 100mV for 3W output. Frequency response + or — 1db, 40 c/s to 25kc/s. Complete kit (as illustrated) **£6.19.6,** carr. 3/6. Ready Built **8 gns.**

F.M. TUNER-UNIT (87 mc/s–105 mc/s) by **Jason.** Designer Approved Kit of Parts for only **5 gns.,** post free. Set of 4 spec. valves **30/–,** post free. Illustrated handbook with full details, 2/–, post free. 48-hr. Alignment Service, **7/6,** P. & P. 2/–.

CONDENSERS. Mica or S. Mica. All pref. values. 3pF to 680pF, **6d.** each. Ceramic types, 2.2pF to 5,000pF, **9d.** each. Tubulars, 450V, Hunts and T.C.C. 0.0005, 0.001, 0.005. 0.01 and 0.1, 350V, **9d.**; 0.02, 0.05, 0.1, 500V Hunts, T.C.C., **1/–**; 0.25 Hunts, **1/6**; 0.5 Hunts, **1/9**; 0.001 6kV T.C.C., **5/6**; 0.001 20kV T.C.C., **9/6.**

TRANSISTORS. Mfrs. surplus PNP Junction type. **Audio Type,** 800 kc/s 250mW, **9/6**; **R.F. and L.O. Mixer Type,** 2.5 Mc/s, **19/6.** All tested and guaranteed.

TRANSISTOR COMPONENTS. Midget i.f. transf., 315 kc/s, **5/–**; Ferrite Slab Aerial (dual range), **13/6**; M. and L.W. Osc. and 1st I.F., **11/6**; Push-pull interstage transf., **8/6**; Push-pull output transf., **8/–**; M/coil phone inserts dia. 2″, **4/6**; M/I dynamic inserts dia. 1⅛″, **3/9**

RESISTORS. Pref. values 10 ohms 10 megohms, 20% tol., ¼W, **3d.**; ½W, **5d.** 1W, **6d.**; 2W, **9d.**; 10% tol., ½W, **9d.**; 5% tol., ½W, **1/–**; 1% hi-stab., ½W, **2/–**

PRE-SET W/W POTS. TV knurled slotted knob type. 25 ohms to 30,000 ohms, **3/–**; 50,000 ohms, **4/–**; 50,000 ohms to 2 Megohms (carbon), **3/–**

S.T.C. RECTIFIERS. E.H.T. types, K3/25 2kV, **5/–**; K3/40 3.2kV, **6/9**; K3/45 3.6kV, **7/3**; K3/50 4kV, **7/9**; K3/100 8kV, **13/6,** etc. Mains types: RM1 125V 60mA, **4/9**; RM2 125V 100mA, **5/6**; RM3 125V 120mA, **7/6**; RM4 250V 250mA, **16/–**; RM4B type 250V 275mA, **17/6,** etc.

LOUDSPEAKERS. P.M. 3 ohm. 2½″ Elac, **16/6**; 3½″ Goodmans, **18/6**; 5″ R & A, **17/6**; 6″ Celes., **18/6**; 7″×4″ Goodmans, **18/6**; 8″ Rola, **20/–**; 10″ R. and A., **25/–**

SPEAKER FRET. Expanded bronze anodised metal: 8″×8″, **2/3**; 12″×8″, **3/–**; 12″×12″, **4/3**; 12″×16″, **6/–**; 24″×12″, **8/6, etc.** **TYGAN FRET** (Murphy pattern): 12″×12″, **2/–**; 12″×18″, **3/–**; 12″×24″, **4/–,** etc.

RECORD PLAYER CABINETS

Contemporary style rexine covered cabinet in two tone grey and green. Size 18¼×13½× ht. 8¼″, fitted with all accessories, including speaker baffle board and plastic fret. Space available for all modern amplifiers and autochangers, etc. Uncut record player mounting board 14″×13″. Cut mounting boards available.

Cabinet Price £3.3.0 Carr. and ins. 3/6

2 VALVE AMPLIFIER (to fit above cabinet), modern circuit with EL84 output, ready built, with 6″ speaker and output transformer, **£3 . 12 . 6,** carr. and ins. 2/6.

RECORD PLAYER BARGAINS

SINGLE PLAYERS—3 sp. **BSR** (TU8), **92/6.** 4 sp. **BSR** (latest model, TU9), **99/6.** 4 sp. **COLLARO, 5 gns.** 4 sp. **GARRARD** (4 S.P.), **£7 10 . 0.** Carr. and ins., 3/6.

AUTO CHANGERS 3 sp. **COLLARO** (RC54), **£7 . 19 . 6.** 4 sp. **BSR** (UA8), **£8 . 15 . 0.** 4 sp. **COLLARO** (RC456), **£9 . 15 . 0.** 4 sp. **GARRARD** (RC120/4H), **9½ gns.** Carr. and ins., 4/6. All above models Brand New and Guaranteed. Fitted latest style l'weight Xtal. P.U. with turnoverhead and twin sapphire stylii.

VOLUME CONTROLS Log. ratios, 10,000 ohms–2 Megohms. Long spindles. 1 year guarantee. Midget Ediswan type.

No Sw.	S.P.Sw.	D.P.Sw.,
3/–	**4/–**	**4/9**

Linear Ratio, 10,000 ohms –2 Megohms. Less switch, **3/–**each. **Coax Plugs ,1/2. Coax Sockets, 1/–.** Couplers, **1/3.** **Outlet Boxes, 4/6.**

80 *ohm cable* COAX

STANDARD ¼″ diam. Polythene insulated. Grade "A" only. **8d.** yd.

Special. Semi-air spaced polythene. 80 ohm. **Coax** ¼″ diam. Stranded core. Losses cut 50%. Ideal Band 3, **9d.** yd.

MAINS TRANSFORMERS. Made in our own workshops to Top Grade spec. Fully interleaved and inpregnated. **RADIO AND AMPLIFIER TYPE** 250V 60mA, F.W. sec., 5V or 6.3V 1A rect. 6.3V 2.5A set Htrs., **22/6,** etc. **C.R.T. HTR. ISOLATION TYPE.** Low leakage with or without 25% sec. boost voltage. Ratio 1 : 1 or 1 : 1.25, 2V., 4V, 6V or 13V, **10/6** each. Ditto with mains primaries 200/250V, **12/6.** etc.

L.F. CHOKES—10H 65mA, **5/–**; 15H 100mA, **10/6**; 10H 120mA, **10/6**; 20H 150mA, **15/6.**

OUTPUT TRANSF.—Standard pentode, **4/6**; push-pull 12 watt, **13/6** Small pentode, **3/9.** Midget battery pentode (1S4, etc.), **4/6.**

I.F. TRANSFORMER 465 kc/s

Brand new ex-manufacturer's midget I.F.T., size 2½″×¾″×¾″, dust core tuning. Litz wound coils, High Q. Bargain offer, **7/6** pair.

ELECTROLYTICS—ALL TYPES—NEW STOCK

Tubular Wire Ends		Can Types, Clips **3d.** each	
25/25V, 50/12V	**1/9**	8+8/450V T.C.C.	**4/6**
50/50V, 4/500V	**2/–**	8+16/450V Hunts	**5/–**
100/25V, 2/450V	**2/–**	16+16/450V T.C.C.	**5/6**
8/450V B.E.C.	**2/3**	32/350V	**4/–**
8/500V Dub.	**2/9**	32+32/275V Hunts	**4/6**
8+8/500V Dub.	**4/6**	32+32/450V T.C.C.	**6/6**
8+16/450V T.C.C.	**5/–**	250/350V B.E.C.	**8/6**
16/450V B.E.C.	**3/6**	100+200/275V	**12/6**

MIDGET TRANSISTOR TYPES. 2μF, 4μF, 8μF 6V, **3/6**; 6μF, 10μF, 16μF 3V, **3/6**; 32μF 1½V, **3/6.**

8″ P.M. SPEAKER (3 ohms)

Ex. Mfrs'. Units: Rola, W.B., Celestion, etc. All reconditioned and guaranteed. Ideal Ext. Unit. Bargain, **7/6.** Carr. 1/6.

VALVES—NEW BOXED—ALL GUARANTEED
1R5, 1T4, **7/6**; 1S5, 1S4, **7/6**; 3S4, 3V4, **8/–**; 5Z4, **9/6**; 6AT6, **8/6**; 6K7, **6/6**; 6K8, **8/6**; 6Q7, **8/6**; 6SN7, **8/6**; 6V6, **7/6**; 6X4, **7/6**; 6X5, **7/6**; 7C5, **9/–**; 7Y4, **8/6**; DAF96, **9/–**; DF96, **9/–**; DK96, **9/–**; DL96, **9/–**; 35L6, **10/6**; EABC80, **9/6**; EB91, **6/6**; EBC41, **10/6**; EVC33, **8/6**; ECC84, **12/6**; ECH42, **10/6**; ECH81, **10/6**; ECL80, **10/6**; EF41, **10/6**; EF80, **10/6**; EF86, **12/6**; EF91, **8/6**; EY51 **10/6**; EZ40, **8/6**; EZ80, **8/6**; MU14, **9/6**; PCC84, **10/6**; PCF80, **10/6**; PCF82, **10/6**; PCL83, **12/6**; PL81, **11/6**; PL82, **10/–**; PL83, **11/6**; PY80, **9/6**; PY81, **9/6**; PY82, **8/6**; U22, **8/6**; U25, **11/6**; UY41, **8/6**

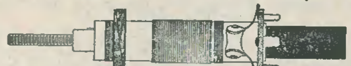
SPECIAL—1R5, 1T4, 1S5, 1S4 or 3S4 or 3V4 per set **27/6**

TRS RADIO COMPONENT SPECIALISTS

70 Brigstock Road
Thornton Heath Surrey

THO 2188. Hours 9 a.m.-6 p.m., 1 p.m. Wed. Terms: C.W.O. or C.O.D. Post and packing up to ½lb **7d.,** 1lb **1/1,** 3lb **1/6,** 5lb **2/–,** 10lb **2/9.** Bargain lists **3d.**

TELETRON Type FX.25



Self-tuned, dual wave Ferrite rod aerial. **15/– each**

Specified for the "Companion" 3 Transistor regenerative pocket receiver.
Type 24 Inductor ... ... **3/6** each

TRANSISTOR I.F. TRANSFORMERS

High Q "potted" construction, with Ferrite screw cores. Mounted in screening cans 1" x $\frac{3}{4}$" dia. **6/6** each. Oscillator coil, **6/6**. Transistor type Ferrite rod aerial for MW band, **10/–**. Selective crystal diode coil type HAX, **3/–** each. Type HAX.L (for LW band), **3/6**. Dual wave TRF coils, type A/HF, matched pair, **7/–**, with adjustable iron dust cores.

FERRITE ROD AERIALS

Wound on high permeability Ferroxcube rod. No external aerial required. Full sensitivity. Ideal for battery portable receivers. Medium wave, type FRM 4" x $\frac{5}{16}$", **8/9**. Dual wave type FRD, 8" x $\frac{5}{16}$", **12/9**. Miniature R.F. Chokes, wound on iron dust cores, with wire end terminations. 2.5 and 5mH, **3/–** each; 10mH, **3/6**. 200mH top lift Inductors, **6/6** each. Bias rejector coils, **4/6** each. Tape oscillator coils for push-pull operation, **8/6** each.

Send 5d. in stamps for complete data and circuits. All types available from advertisers in this Magazine and local component stockists.

THE TELETRON COMPANY LIMITED
266 Nightingale Road . London N9
Telephone HOW 2527

Trade enquiries to sole distributor
S. Mozer Ltd 288 Hedge Lane N13 *Telephone* PAL 1748 *or* EDM 7707

DB5 TV FAULT FINDING

Profusely illustrated with photographs taken from a televisor screen depicting the faults under discussion, and containing a wealth of technical information, with circuits, enabling those faults to be eradicated. Both B.B.C. and I.T.A. transmissions are covered.

PRICE 5/- Postage 5d. **Data Publications 57 Maida Vale London W9**

TV TUBES

BRENTWOOD ELECTRONICS LTD
(The TV Tube Specialists)

10 Victoria Road Brentwood
(2 minutes from Brentwood Station)

Offer the Following

RECONDITIONED TV TUBES

Free postage, packing and insurance in all areas, except Eire. 12 months guarantee on all tubes. 10/– allowed on your old tube.

9"	TV Tubes	£3. 10. 0
10"	,, ,,	£5. 0. 0
12"	,, ,,	£5. 0. 0
14"	,, ,,	£5. 0. 0
15"	,, ,,	£6. 0. 0
17"	,, ,,	£7. 0. 0

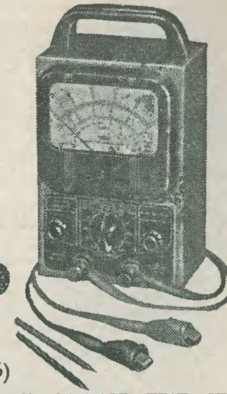
The above includes the latest 14" and 17" rectangular tubes

Business Hours
9 a.m.—8 p.m.
Saturdays
9 a.m.—6 p.m.

★

Mail order terms
Cash with order

Yours by return for only £2·10·0 deposit



(CASH PRICE £12.7.6)

PULLIN SERIES 100 MULTI-RANGE TEST SET

21 ranges AC/DC from 100 microamps to 1,000 volts, sensitivity 10,000 ohms/volt. This is the famous Pullin Series 100, now available brand new on the easiest of terms. Send 50/– deposit, balance to be paid in nine monthly payments of 24/6.

Descriptive literature available on request

HOME RADIO
(Mitcham) LTD.
187 London Road, Mitcham, Surrey
Telephone MITcham 3282

TRANSISTORWISE

29/6 Buys all parts, plastic case and Belphone for the "Reco" one all-wave transistor radio. Uses tuned inductance. Works in most places with indoor aerial. Parts price list, wiring diagram, 1/- P.O.

49/6 Buys the "Reco" Home and Continental transistor 3; receives foreign as well as home stations. All parts including plastic case and balanced armature output, **49/6.** Wiring diagram and parts list, **1/–** P.O.

All parts sold separately

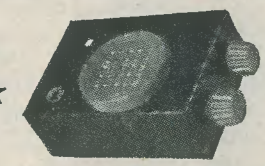
PLEASE NOTE NEW ADDRESS:

THE RADIO EXCHANGE CO

27 HARPER STREET BEDFORD

The Teletron "COMPANION"

Three transistor pocket receiver

★  ★

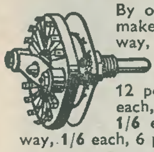
COMPLETE KIT (as spec.) **£4.15.0**
(See our advert September issue)
List of components, circuit diagram, etc. **9d.**

Bridisco crystal sets in attractive bakelite cases (various colours)	19/6
Headphones for above, 125 ohms resistance	12/6
2 pairs for	24/–
Suitable all purposes (worth treble)	

Teletron ferrite aerials:
Medium wave, type FRM 8/9
Dual wave, type FRD 12/9
Teletron I.F. Transistor Transformers each 6/6
(Complete range of Teletron coils in stock)
Postage and packing on above items, 1/–

ELEC-RADIO
172a BLACKSTOCK ROAD HIGHBURY LONDON N5 *Telephone* CANonbury 1672
Callers Welcome

CERAMIC SWITCHES



By one of our best makers, 3 pole, 3 way, **2/6** each, also standard type switches 12 pole, 2 way, **1/6** each, 6 pole, 3 way, **1/6** each, 3 pole, 6 way, **1/6** each, 6 pole, 4 way, **2/6**

6ft UNBREAKABLE MAINS LEAD

This is the type of lead which is fitted to electric razors and similar appliances, makes fine lead for test-meters and any other devices where the flex is subject to continuous bending and kinking. Twin figure eight construction, soft cream p.v.c. covered. Normally costs 2/– per yard—we offer three leads for **3/–** post free; special quotes for large quantities

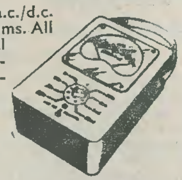
W.D. CIRCUIT DETAILS

Diagrams and other information extracted from official manuals. All **1/6** per copy, 12 for **15/–** American Service Sheets, A.1134, BC.348, BC.312, R.103A, BC.342, RA-1B, R-208, R-1155, R-1124A, R-1132A/R-1481 R-1147, R-1224A, R-1082, R-1355, BC.1206-A/B, B-455-A (or -B), B-454-A (or -B), B-453-A (or-B), Transmitter T1154/ B.D.J.N., Fifty-eight walkie-talkie, Frequency meter BC.221, R.109, 78 receiver, 76 receiver, R28/ ARC5, R1116/A, RA-1B, AR88D, AN/APA-1, 78, 76, R.T.18, CAY-46-AAM-RADAR A.S.B.-3, Indicator 62A, Indicator A.S.B.3, Indicator 62, Indicator 6K, R.F. unit 24, R.F. unit 26, R.F. unit 25, R.F. unit 27, Wireless set No. 19, demobbed valves

ELECTRIC BLANKET WIRE

Waterproof p.v.c. covered, so blanket washable. 16½ ohms per foot, 14 yds ideal for average blanket. **15/–** post free with data

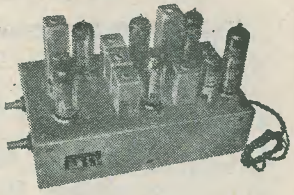
A.C./D.C. MULTIMETER KIT



Measures a.c./d.c. volts and ohms. All the essential parts including 2" moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions. Price **19/6** plus **1/9** post and insurance.

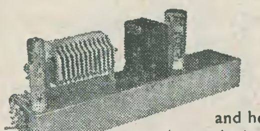
Television Sections

THE I.F. UNIT



Employs 8 miniature valves, sound and vision are at 34/36 and 37.5 Mc/s respectively. Output just over one watt sound. The unit, which can be driven by any standard 24/37 Mc/s turret or other tuner, is beautifully made and contained on a chassis size approx. 8" x 4½" x 2". Complete with valves, made up, ready to work, price **£9 . 12 . 6**

THE POWER UNIT

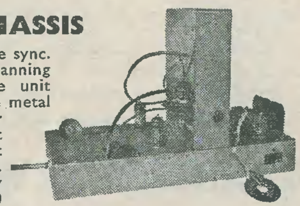


A.C./D.C. working for .3A valves. Rectification is by metal rectifier; smoothing is by a 3H choke and large electrolytic condensers.

Ballast Register has tappings for h.t. and heater current, also fuse and a thermistor to protect the circuit against current surges.

A double pole switched volume control which, although not part of the power unit, is included for the sake of convenience and symmetry. The size of the unit is 15¼" x 3" x 2". It is all wired up and ready to work. Price **£3 . 5 . 0**

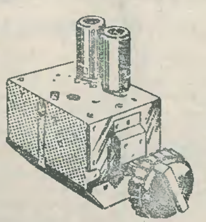
THE TIME BASE CHASSIS



This uses 6 valves and includes the sync. separator, the focus magnet, scanning coils and ion trap. The whole unit measures 15¼" x 6¾" x 2" and the metal work includes tube support for chassis mounting a 14" tube, but up to 21" tube can be scanned but will require separate mounting. Price for unit with valves ready made up and tested is **£12 . 15 . 0**

NOTE.—These three units, although quite separate and usable separately, may also be joined together and then comprise a complete TV less only tuner unit and speaker. Demonstrations at all branches—circuit diagrams, etc., 3/6

TURRET TUNER



Brand new stock, not surplus, with coils for Band I and III, complete with valves PCC84 and PCF80—I.F. output 33/38 Mc/s with instructions and circuit diagram, **79/6**. With knobs **3/6** extra, post and insurance **2/6**

ELECTRONIC PRECISION EQUIPMENT LTD

POST ORDERS SHOULD BE ADDRESSED TO DEPT. 34, 66 GROVE ROAD, EASTBOURNE

Personal shoppers, however, can call at:

266 LONDON ROAD CROYDON
Telephone CROydon 6558. Half-day Wednesday

42/46 Windmill Hill Ruislip Middlesex
Telephone RUIslip 5780. Half-day Wednesday

152/3 FLEET STREET EC4
Telephone FLEet 2833. Half-day Saturday

29 Stroud Green Road Finsbury Park N4
Telephone ARChway 1049. Half-day Thursday

ENTIRELY NEW RANGE SUB-MINIATURE CAPACITORS

Available for the first time in this country, these are the product of a famous manufacturer. The following values are now in stock:

25µF 6V	5µF 12.5V
16µF 12.5V	5µF 40V
8µF 25V	2.5µF 25V
8µF 6V	1.6µF 6V

All at 4/– each

(See review on page 232)

Trade enquiries invited

T.C.C. Sub-miniatures. 32µF 1.5V, 6µF 3V, 10µF 3V, 2µF 12V, 4µF 12V, 8µF 15V **all 4/9 each**

TRANSISTORS

*Yellow/Green (Audio)	10/–
Blue Spot (1.6 Mc/s)	15/–
*Yellow/Red (2.8 Mc/s)	21/–

**With data*

THREE DEE KIT ... ... (Instructions 1/–)	**£5 . 2 . 6**
COMPANION KIT ... ... (Instructions 6d.)	**£5 . 6 . 6**
RADIOSETTE KIT	**£2 . 3 . 0**

All parts sold separately *Price lists available*

TRANSISTOR HOLDERS. Enable transistors to be plugged in and out like valves, without danger from heat of soldering iron. For any type of transistor. Recommended by R.C. (June). **1/–** each, **6** for **5/6**, **12** for **10/9**

"THE MERCURY" FM SWITCHED TUNER

(All parts as specified)

Complete front end (ready built with 2 valves)	**£6 . 5 . 0**
Coils, chokes and transformers	**£1 . 4 . 6**
Condenser set	**9/8**
Resistor set	**5/–**
All other components (including valve-holders, diodes, knob, wire, etc.) ...	**16/7**
Complete kit with 2 front end valves but less EF80's	**£9 . 0 . 0**
Complete Power Pack kit	**£2 . 1 . 9**

All other Jason components stocked

CHASSIS CONSTRUCTION KIT IDEAL FOR THE EXPERIMENTER

Consisting of 11 pairs of aluminium channels, which can be put together to make chassis of almost any size. Can be used over and over again.

(See page 232)

TYGAN—the non-creasing, fadeless, washable speaker fabric in 6 distinctive patterns. Approx. **3/9** square foot. Send **1/–** for samples and quotation for size you require (credited on return). See page 840 of July issue.

LITESOLD SOLDERING IRON. The smallest made, 6" long, weighs ½oz. With ⅛" permanent non-wearing bit. Ideal for transistor assemblies, **21/6** (state voltage). Available for mains or 6 volts.

MULTICORE SOLDER, 4d. per yard (50/50)* 20ft reels (60/40 high tin), **2/6**

*This is the new "SAVBIT" solder, which prolongs the life of the bit up to ten times. Also available in 1lb reels at **14/9**

MULTIWAY CONNECTORS

A range of 5 and 7-pin plugs and sockets, capable of up to 3 amps per pin at mains voltage, and with low contact resistance.

5-pin plug and socket complete	4/–
7-pin plug and socket complete	5/–

Please state flex plug/chassis socket or chassis plug/flex socket

NEON INDICATORS

Miniature mains neon indicators with built-in resistor. Domed front with chrome bezel. Only 1" length and ½" diameter.

Opal, red or amber, **3/10** Green, **4/7**

THE WALTER TAPE RECORDER

A new portable instrument, in smart two-tone case. Uses only two controls. Complete with 600ft tape, spare spool, microphone, etc.

Only 39 guineas complete

SPECIAL OFFER

Recording Tape by famous manufacturer. 1,200 feet on 7" standard spool.

Limited stock at 23/– each

(Normal price 35/–)

Send for Catalogue price **5d.** *Please add postage to above prices*

R. Fagelston (MAIL ORDER)

46 HARDWICKE ROAD · LONDON N13

HENRY'S
(RADIO) LTD

5 Harrow Road Edgware Road
Paddington London W2

Opposite Edgware Road Station

PADdington 1008/9

OPEN MONDAY to SAT. 9–6 THURS. 1 o'clock

SEND 3d. FOR 28-PAGE CATALOGUE

TRANSISTORS
JUNCTION TYPE P-N-P

(British Manufacture)

RED-SPOT 800 kc/s Audio Frequency ...	10/–
BLUE SPOT 1.6 Mc/s Mixer and Frequency Changer	15/–
WHITE-SPOT 2.5 Mc/s R.F. and I.F. Amp.	20/–

All Transistors are Tested and Guaranteed

N.B.—The Red-Spot is similar to Mullard OC71

Transistor Bases **9d.** each

TRANSISTOR PUSH-PULL AUDIO AMPLIFIER
(200 Milliwatts Output)

Build this Push-Pull Amplifier which is ideal for Crysta or Magnetic Pick-up Amplification, Baby Alarm, Microphone Amplifier, etc. Powered by 6-volt Dry Battery lasting for months. **Complete Kit of Parts including 4 Transistors and all Components with Circuit (less Speaker), £4 . 10 . 0**

COLLARO RC456
4 speed auto-changer. Latest type with crystal turnover pick-up **£9 . 15 . 0**

TRANSISTOR SIGNAL TRACER
Complete Kit with 2 Transistors, components, phones, with circuit and plastic case **42/6**

TRANSISTOR SQUARE WAVE GENERATOR
Complete Kit with 2 Transistors, Components, Circuit and plastic case **25/–**

DIODES

B.T.H. Germanium	1/6
Mullard OA74	2/6
IN21	3/6
1N22, 1N23, 1N21A	5/–

MODEL-MAKERS' MOTORS
Two types available, 12 or 24V with ¼" spindle, **10/–** each

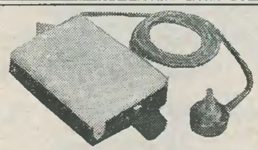
6V VIBRATOR PACKS
Output 120V 30mA. Brand new **12/6**

Valves — Valves — Valves

We have over 300 different types of British and American valves in stock. We give below new types that are available. Send for 28-page Catalogue for further details of valves, components, etc.

DK40	10/–	EF42	14/–	PL81	12/6	6AL5	9/–
DK92	9/–	EF80	9/–	PL82	10/–	6AM6	9/–
DAF96	10/–	EF85	10/–	PL83	12/6	6AQ5	10/–
DF96	10/–	EF86	12/6	PY81	10/–	6AU6	8/6
DK96	10/–	EF89	10/–	PY82	10/–	6BA6	8/6
DL96	10/–	EF92	9/–	PY83	12/6	6BE6	10/–
DM70	9/–	EL41	10/–	U25	14/–	6BW6	10/–
EABC80	10/–	EL42	10/–	UABC80	11/–	6C4	6/6
EAF42	12/–	EL84	11/–	UAF42	11/–	6U4	12/6
EBF80	11/–	EM34	10/–	UBC41	10/–	6X4	7/6
EBF89	11/–	EM80	10/–	UBF89	11/–	7C6	10/–
EBC41	10/–	EM81	11/–	UCC85	11/–	7Y4	9/–
ECF80	14/–	EM85	11/–	UCL82	15/–	12AH8	12/6
ECF82	12/6	EY51	10/–	UCH42	12/6	12AT6	8/–
ECC40	14/–	EY86	12/6	UCH81	12/6	12AT7	9/–
ECC81	9/–	EY91	10/–	UF41	10/–	12AU6	9/–
ECC82	9/–	EZ40	8/–	UF80	12/–	12AU7	9/–
ECC83	9/–	EZ80	10/–	UF85	12/–	12AX7	9/–
ECC84	11/6	EZ81	10/–	UF89	11/–	12BA6	9/–
ECC85	10/–	PABC80	15/–	UL41	10/–	12BE6	10/–
ECH42	11/–	N78	12/6	UL84	11/–	14S7	14/–
ECH81	11/–	PCF80	12/6	UY41	9/–	19AQ5	11/–
ECL80	10/6	PCC84	11/–	UY85	9/6	20L1	14/–
ECL82	14/–	PCF82	11/–	3A5	10/–	35W4	8/–
EF40	12/6	PCL82	12/6	3Q4	9/–	50B5	10/–
EF41	10/–	PCL83	15/–	6L18	12/6	50C5	10/–
						117Z3	8/6

All Valves Tested and Guaranteed



MINI-TWO
2-TRANSISTOR MINIATURE POCKET RADIO

(No Aerial or Earth)

The smallest transistor set offered on the market. Variable tuning. Drilled chassis, plastic case size 3" x 2" x ¾", miniature hearing aid, 2 transistors and all components including 1½ volt battery, circuits and full practical layout diagrams.

Total cost **49/6** complete

"HOMELIGHT"
2-TRANSISTOR PERSONAL PORTABLE

No Aerial or Earth required

Variable Tuning

We can supply all components including 2 transistors, diode, resistors, condensers and miniature hearing aid and plastic case, size 4¼" x 2⅞" x 1⅝", and 1½V battery for 52/6. All items sold separately

COLLARO RC/3/554
3-speed single player with crystal turnover pick-up type "T," **£6.19.6**, carr. 3/6. Brand new in original carton

The *NEW* "TRANSISTOR - 8"
Push-Pull Portable Superhet

This Portable 8-Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set. Simplified construction enables this set to be built easily and quickly into an attractive lightweight cabinet supplied.

Can be built for £11/10/–

TEN STAR FEATURES

★ 8 specially selected Transistors
★ 250 Milliwatts output push-pull
★ Medium and Long Waves
★ Internal Ferrite Rod Aerial
★ 7" x 4" elliptical High Resistance Speaker
★ Drilled plastic Chassis 8½" x 2½"
★ Point to point wiring and practical layout
★ Economical. Powered by 7½V battery
★ Highly sensitive
★ Attractive lightweight contemporary case

We can supply all these items including cabinet for **£11.10.0** All parts sold separately

Send for circuit diagrams, assembly data illustrations and instructions, and full shopping list **1/6**

N.B.—Pair of OC72's supplied at additional cost of **40/–**

Call and hear demonstration model

As featured in August issue and described on page 28

"EAVESDROPPER"
THREE-TRANSISTOR POCKET RADIO

(No Aerial or Earth required)

Variable tuning—medium wave. Total cost, as specified including Transistors, Transformers, Coils, Condensers and Battery, etc., with circuit, plastic case and battery.

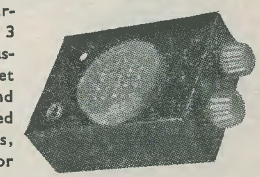
All items sold separately **77/6** POST FREE

With miniature hearing aid	90/–
With balanced armature	82/6

THE TELETRON 'COMPANION'
THREE-TRANSISTOR POCKET RECEIVER

Medium and Long Waves No Aerial or Earth

Tuned R.F. Circuit. Ardente transformers. 3 transistors. Drilled plastic chassis and cabinet size 4¼" x 3" x 1" and all components. Balanced armature, batteries, knobs and transistor holders.



Total cost **89/6**

ALL PARTS SOLD SEPARATELY

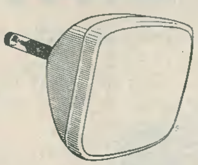
N.B.—Transistor Holders are supplied free with all kits and we would respectfully suggest you use same, both in order to protect the Transistors and to simplify testing, and only those sets using these Holders will be accepted for inspection and testing.

HENRY'S RADIO LTD · 5 HARROW ROAD · LONDON W2

TELEVISION TUBES

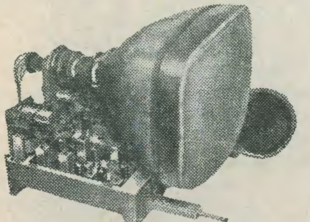
12 MONTHS GUARANTEE

T.V. RECTANGULAR TUBES



17″ £7.10.0 *Terms Available* **14″ £5.10.0**

6 months full replacement, 6 months progressive. Made possible by the high quality of our tubes. Ins. carr. 15/6. **Special offer of 14″-15″-16″ TV Tubes at £5.** Convert YOUR 9″-10″-12″ to our special offer of 14″-15″-16″ TV Tubes at £5. Details of how to "Do-it-Yourself" in our FREE catalogue. **12″ TV Tubes £6.** Guaranteed. 15/6 ins. carr. on all tubes



17″ T.V. CHASSIS £19.19.6
Latest improved circuits. Higher E.H.T. (brilliant picture). Improved sensitivity (for greater range). Chassis easily adapted to any cabinet. 17″ rectangular tube on adapted chassis. All channels. 12 months guarantee on tube, 3 months guarantee on valves and chassis. Valve line-up (5 valves): 6SN7, 6V6, EY51, 2 6D2. Others: 6L18, EL38. 7 6F1. With 5 valves **£21.19.6.** With all valves **£25.19.6. Turret Tuner 50/–** extra. Ins. carr. (incl. tube), 25/–. State B.B.C. channels (and I.T.A. if Turret Tuner required).

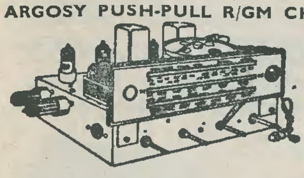
14″ T.V. CHASSIS, TUBE & SPEAKER £13.19.6
As above with 14″ round tube. Less valves. 3 months guarantee. With 5 valves, **£15.19.6.** With all valves, **£19.19.6. Turret Tuner 50/–** extra. Ins. carr. 25/– (incl. tube).

ELECTRIC CONVECTOR HEATERS 99/6
Winter isn't over yet so you will still need a convector heater. Cleaner, cheaper, safer than paraffin. A.C./D.C., switched for 1 or 2 kW. 200-250V. Illuminated grille. Size 26″ x 18″ x $7\frac{1}{2}$″ deep. Ins. carr. 10/6

ELECTRIC FIRES 17/6. Hammered finish. A.C./D.C. 200-250V 750W. Post 3/6

ELECTRIC FIRES 29/6. Pencil element, 1kW. Beautifully finished reflector type. Carrying handle. A.C./D.C. 200-250V. Post 3/6

ARGOSY PUSH-PULL R/GM CHASSIS 139/6



8-valve latest models. 3 w/band and gram switched. Over 10 watts output. Full tone range, 4 knob control. Ins. carr. 5/6. Less valves.

CO-AX. CABLE 6d. yd. Good quality, cut to any length. Allow 1/6 on 20 yds, 45/– 100 yds. P. & p. 3/6

INSULATING TAPE, 1/6 75ft x ½″ wide, finest quality. Large roll in metal container. P. & p. 9d.

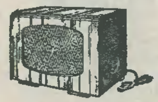
TV AERIAL, 25/6. For all I.T.A. and FM channels. For outdoor or loft. 3-element type. P. & p. 2/6

CAR RADIO AERIALS, 6/9. Whip antennae, 50″ long, collapsing to 11″. One-hole fixing. Post 1/–

HEADPHONES, 1/9. Single earphone and band. C-LR type. Ideal for crystal sets, extension on radio, etc. P. & p. 1/3

A.C./D.C. MIDGET RADIO, 99/6. CCH35, EF39, EBC33, CL33, 35Z4 or metal rec. 3 control knobs. Switched for gram. In attractive brown plastic cabinet. 15″ x $7\frac{1}{2}$″ x 9″. Ins. carr. 5/6

SUPER CHASSIS 99/6
5-valve superhet chassis including an 8″ speaker, 4 control knobs—tone, volume, tuning, w/c switch, 4 wave band, with position for gram p.u. and for extension speaker. A.C. Ins carr. 5/6



BEAUTIFUL EXTENSION SPEAKERS 29/9
Fitted with 8″ p.m. speaker. W.B. or Goodmans. Highest quality. Matching to any receiver. (2-5 ohms.) Switch and flex included. Unrepeatable at this price. Money back guarantee if not completely satisfied. Ins. carr. 3/6

8″ P.M. SPEAKERS, 8/9. At this price you can have one in every room. Let the lady of the house listen to that radio or TV programme! P. & p. 1/9

BOXED **VALVES** 3 MONTHS GUARANTEE

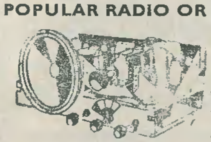
SP61	4/9	6N7GT	4/9	CV18	3/9	EF37	4/9
1S5	4/9	6SG7	3/9	EB34	1/9	EF41	8/9
3A8	3/9	77	3/9	EB91	6/9	EF50	2/9
4D1	2/9	8D2	3/9	ECC81	8/9	EL32	6/9
6B8	3/9	8D3	7/9	ECH42	8/9	EL91	3/9
6F12	7/9	12AU7	5/9	EF39	6/9	PEN45	6/9
6D2	6/9	12BE6	6/9	EF41	8/9	TT11	6/9
6H6M	1/9	2C22	3/9	EF91	7/9	RL37	1/9
6K7	3/9	12SJ7	1/9	DF66	5/9	Z77	7/9

American Types UX All at 3/9 each

18	75	80	25RE	42
78	1D6	6A7	6D6	6C6

Barrettors 301 and 302 also at 3/9 each

POPULAR RADIO OR R/GRAM CHASSIS 39/9



3 w/band and gram, s/het. 5-valve international octal. Ideal table gram, but still giving high quality output. 4 knob control. 8″ p.m. speaker, **7/9** with order. Set of knobs, **2/–**. Chassis 12″ x 6″ x 9″. Less valves. Ins. carr. 5/6

SELF-FEED SOLDERING, 19/6. 6-12V, 100-125V, 6-12V, 200-240V, **35/6.** Made for the American market. Car battery or mains. Export quality. Complete in light carrying case. Reel of solder and spare parts. P. & p. 2/9. Export enquiries invited.

MAINS TRANSFORMERS, 17/6. 425–0–425V sec; 5V at 6A, 6.3V at 12A, 6.3V at 0.6A; 200–250V screened primary. P. & p. 3/6

Send for FREE 1958 Catalogue Liverpool St. to Manor Park Stn.—10 mins. OPEN SATURDAY ALL DAY

DUKE & CO. (Dept. 1) **621/3 Romford Road Manor Park E12** *Telephone* ILF 6001/3

SMALL ADVERTISEMENTS

Readers' small advertisements will be accepted at 3d. per word, including address, minimum charge 2/–. Trade advertisements will be accepted at 9d. per word, minimum charge 6/–. If a Box Number is required, an additional charge of 2/– will be made. Terms: Cash with order. All copy must be in hand by the 8th of the month for insertion in the following month's issue.

PRIVATE

R107. Complete with manual, can be seen and heard 14 Wentworth Hill, Wembley, Middx. £10 o.n.o.

R1155A. Excellent condition, built in output stage, a.c. power pack, extra i.f. stage, £8 including carriage. Skoyles, 84 Beech Avenue, Northampton.

BARGAINS. Amateur clearing meters, units and Radio books, 5/– and 10/– parcels of components. S.A.E. to Box No. E145.

FOR SALE. Loudspeakers, used but in good condition, PM 6/6, p.p. 2/–. Mains energised 3/6, p.p. 2/–. Output trans. with some. Collins, 47 Arnold Road, Tottenham, London, N.15.

NEW SWITCH-TUNED F.M. UNIT with A.F.C. Gold hammer panel engraved with Home, Light, Third, £10.10.0. With internal power supply £12.10.0. Jason unit with Jason dial £8.10.0. Write for details. Box No. E137.

R1155A. Good condition, modified for 160 metres, power pack included, price £9.15.0. 147 Thornton Road, Cambridge.

AT 2/6 PER ITEM, post free. 2-volt HF/LF triodes, OP and SG valves. Acorn triodes 4V/0.2A. Battery type I.V. transformers. 240V/100mA metal rectifiers. Silicon diodes. Box No. E146.

MULLARD PROJECTION UNIT, complete, screen, new tube £7.10.0. 9in to 17in t.v. and radio cabinets from 5/– to 70/–. Petrol generator, 230V a.c. 10A output, press button start, 12-volt charging panel £25. Spalding, 22 Teevan Road, Addiscombe, Surrey. *Telephone* ADD 2040.

FOR SALE. Minimax transistor radio, well built, needs attention £4. R. Waite, Laverna, 1 Fairfield Approach, Wraysbury, Bucks.

12in CONSOLE. "Electronic Engineering," dual speaker, cost £120. New spare condensers, about 25 spare valves, circular indoor aerial. Complete working order. Manuals and blueprint £19. Cameron-Douglas, 60 Ashworth Mansions, London, W.9.

WANTED. The Editor wishes to borrow or purchase a copy of "C.Q." February 1957 issue, containing an article entitled "The Monimatch."

TRADE

TRANSISTORS. OC70, 21/–; OC71, 24/–; OC72, 30/–. Diodes: OA71, 6/–; OA70, 5/–; OA73, 6/–. Steel cases, black enamelled, for instruments, etc.: 9×6×4in, 10/– (p. & p. 2/3); 12×9×4in, 15/– (p. & p. 2/9). C.W.O. SAE list valves, etc. D. J. Morris, 88 Prescott Street, Birmingham 18.

continued on page 287

NEW SURPLUS . . .

1A3	2/6	6SA7M	7/6	1616	7/6	EZ40	8/6
2A3	8/6	6SG7M	7/6	1629	4/–	EZ80	8/6
2X2	3/6	6SJ7M	7/6	EA50	1/6	HK24G	25/–
3A4	7/–	6SK7M	6/6	EABC80	10/–	KT33C	9/6
3A5	9/6	6SL7GT	7/6	EAC91	4/6	PCC84	10/6
3B7	6/–	6SN7GT	6/6	EAF42	10/6	PCF80	12/6
3D6	5/–	6SQ7M	7/6	EB34	2/6	PCF82	11/–
3Q4	8/6	6X4	6/6	EB91	7/–	PL82	9/6
5B/254M	21/–	6X5GT	7/6	EBC33	7/6	PL83	10/6
		7B7	9/–	EBC41	10/6	PCL83	12/6
5R4GY	10/6	7C5	9/–	EBF80	10/–	PY80	9/6
5U4G	8/6	7C6	9/–	EBF89	10/–	PY81	10/–
5Y4G	6/6	7S7	10/–	ECC82	9/6	PY82	9/6
6AC7M	5/–	7Y4	8/6	ECC83	9/6	PY83	11/6
6AG5	3/6	12A6M	7/6	ECC84	11/–	R19	12/6
6AK5	5/–	12AT6	8/–	ECC85	10/6	SP61	3/–
6AL5	7/–	12AT7	9/–	ECF80	13/6	TT11	4/–
6AM6	7/6	12AU6	9/–	ECF82	11/6	U25	12/6
6AQ5	8/6	12AU7	8/6	ECH42	10/6	UAF42	10/6
6AT6	8/–	12BE6	8/6	ECH81	10/–	UBC41	10/6
6AU6	8/6	12C8M	7/6	ECL80	10/–	UBF89	10/6
6B8G	4/6	12Q7GT	9/–	ECL82	13/6	UCC85	10/–
6BA6	8/6	12K7GT	9/–	EF36	4/–	UCH42	10/6
6BE6	7/6	12SC7M	2/6	EF37A	8/6	UF41	10/6
6BR7	11/6	12SK7M	7/6	EF39	5/–	UF89	10/6
6C4	5/–	12SQ7M	8/6	EF41	10/6	UL41	10/6
6C5M	5/6	35L6GT	9/6	EF50	3/6	UY41	8/–
6F6M	6/6	35Z4GT	8/6	EF50(S)	5/6	UY85	10/–
6F8G	4/6	35Z5GT	8/6	EF55	7/6	UABC80	10/6
6G6G	4/6	42	7/6	EF80	9/–		
6J5GT	5/–	50L6GT	9/6	EF85	10/–	VU39	9/6
6J5M	6/–	80	8/6	EF89	10/–	VR150/30	7/6
6J6	4/–	446A	12/6	EF91	7/6		
6K7G	5/6	801A	10/6	EL32	4/–	VR116	4/–
6K8G	9/6	803	20/–	EL41	10/–	VS70	3/–
6K8M	10/6	808	25/–	EL84	10/6	XP1.5	3/–
6H6M	3/6	830B	15/–	EL91	7/6	Z77	7/6
6L7M	7/6	866A	12/6	EM80	10/–		
6Q7GT	9/6	959	8/6	EY51	11/6		

SPECIAL OFFER

Performance Meters No. 2. Comprising 230V 50 c/s mains trans. 250-0-250V 30mA 6.3V $1\frac{1}{2}$A 5V 2A (60mA h.t. may safely be drawn), 20H choke, 5Z4, Y65 magic eye, 2 XEF50, 1 EC52, 1 EA50, dozens of components all in smart grey louvred case 10″ x 9″ x 9″. Made by Parmeko. Brand new and boxed. Unrepeatable component value at only **37/6** each plus 5/– carriage (U.K. only)

Special Valve Offer. 6J6, 6AG5, EL32, TT11, EF39, 6G6G, 6B8G, EF50, **37/6** doz. 12SC7M, **21/–** doz.

Command Receivers BC454B. 3-6 Mc/s. Brand new in maker's cartons with 6 valves, **45/–** each. Few only used, good condition, 1.5-3 Mc/s, **55/–** each

RF24 Units, 20-30 Mc/s. New with 3 SP61, **12/6** each, post paid

Collaro RC4/456. Latest 4-speed record player with Studio 'O' head (single player). New, boxed. Limited quantity **£7.15.0** each, plus 3/– carriage. Model TRE Junior 4-speed with separate Acos Hi-G T/O Head **5 gns.** plus 3/– carriage.

M.C. Meters. $3\frac{1}{2}$″ rd. fl. mtd. ($2\frac{1}{2}$″ dial), 0-1mA, **26/–**; ditto but with very lightly damped movement and scaled **0-10, 18/6** each; 0-30mA, 0-250mA, 0-500mA, 0-2A, **13/6** each; 0-150V a.c. (1mA Basic with Rect.), **28/6**; $2\frac{1}{2}$″ rd. fl. (2″ dial), 0-500μA, **17/6** each; 0-1mA, **21/–**. All post paid

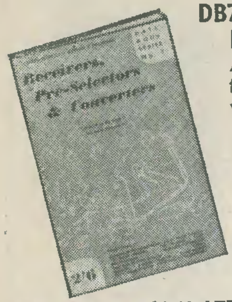
Midget Mains Transformers (same size as std. spkr. o/p). Input 230/250V, o/p 220V 20mA, 6.3V 0.6A Ditto but 175V 25mA, both types **11/9** each, post paid

Transmitter/Receivers. Army Type 17 Mk. 2. Complete with h.r. phones, hand mike and valves. 44-61 Mc/s. In good used condition, **45/–** each or two for **79/6.** Carriage paid

"PANL" Crackle Paint, 3/9 tin, post paid

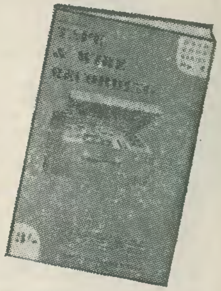
Post 9d. *Free over £2 except where stated*
S.A.E. Enquiries

JOHN ANGLIN
385 CLEETHORPE ROAD GRIMSBY LINCS
Telephone 56315



DB7 RECEIVERS, PRE-SELECTORS AND CONVERTERS

A selection of practical articles, reprinted from past issues of *The Radio Constructor*, which will prove of interest to many radio enthusiasts. **Price 2/6** Postage 4d.



DB8 TAPE AND WIRE RECORDING

A further selection of articles reprinted from the pages of *The Radio Constructor*, covering both the theory and practical applications.
Price 3/- *Postage 4d.*

DATA PUBLICATIONS LTD · 57 MAIDA VALE · LONDON W9

PRECISION WIREWOUND RESISTORS
Eureka wound on strip. 1 to 1,000 ohms, 1% 2/9; 0.5% 3/–; 0.2% 4/3. 1K to 5K, 1% 3/3; 0.5% 3/6; 0.2% 4/9. 5K to 20K, 1% 4/–; 0.5% 4/3; 0.2% 6/–. 0.75W rating. Your value wound to order.
SHUNT FOR 1mA 100 ohm METER
Ranges 10, 100, 1,000mA. 1% accuracy, 7/6
SHUNT FOR 500μA 500 ohm METER
Ranges 5, 50, 500mA. 1% accuracy, 7/6
RESISTOR SETS FOR BRIDGES
12 Wirewound Resistors 1, 2, 2, 5, 10, 20, 20, 50, 100, 200, 200, 500 ohms to give any value from 1 to 1,110 ohms in 1 ohm steps, 0.5% 33/–; 0.2% ±0.01 ohm, 48/–. Ditto but 10 to 11,100 ohms in 10 ohm steps, 0.5% 34/-; 0.2% 49/6.
S.A.E. with enquiries, please. Post extra

PLANET INSTRUMENT CO.
25 DOMINION AVENUE LEEDS 7

QUALITY COMPONENTS

in stock for the

MULLARD 3 VALVE AMPLIFIER
MERCURY SWITCHED FM TUNER
and

510 AMPLIFIERS, FM TUNER circuits	**3/6**
912 AMPLIFIER, FM TUNER	„ **4/–**
RADIO CONSTRUCTOR FM	„ **2/–**
DENCO FM TUNER	„ **1/6**
G.E.C. "FM PLUS" TUNER	„ **2/6**

Price Lists available on request

J. T. FILMER
82 DARTFORD ROAD DARTFORD KENT
Telephone DARTFORD 4057

★ VALVES NEW TESTED AND GUARANTEED

1R5	8/6	6Q7GT	9/6	DK91	8/6	EF92	4/9
1S5	7/6	6SA7	8/–	DK92	9/–	EK32	8/6
1T4	7/6	6SL7GT	8/–	DK96	9/–	EL32	7/6
3S4	7/6	6SN7GT	8/6	DL92	7/6	EL41	10/–
3V4	8/6	6SS7	6/6	DL94	8/6	EL84	10/6
5U4G	8/6	6V6G	7/6	DL96	9/–	EL91	7/6
5Y4G	7/–	6V6GT	7/6	EA50	1/6	EY51	11/6
5Z4G	9/6	6X4	7/6	EB91	6/6	EZ35	8/–
6AG5	6/9	6X5GT	7/6	EBC41	9/6	EZ40	8/–
6AM6	8/6	12AT7	9/–	EBC33	8/6	KT33C	7/6
6AL5	6/6	12AU7	9/–	EBF80	10/–	KT66	11/6
6AT6	8/–	12AX7	9/–	ECC81	10/6	PCF82	11/–
6B8	7/6	12K8GT	10/6	ECC84	11/6	PL81	10/6
6B8G	7/6	12K7GT	8/6	ECF82	11/–	PL82	10/6
6BA6	8/6	12Q7GT	8/6	ECH81	10/6	PY81	10/6
6BE6	7/6	35Z4GT	8/6	ECH42	10/–	PCC84	11/6
6BR7	10/6	35L6GT	9/6	ECL80	10/6	U76	8/6
6BW6	8/6	807	6/9	EF36	7/6	UBC41	10/–
6G6G	4/9	5763	10/6	EF37A	14/6	UCH42	10/–
6J5G	5/6	DAF91	7/6	EF39	5/6	UF41	10/–
6J5GT	6/6	DAF96	9/–	EF41	10/–	UL41	10/–
6K7G	5/6	DF91	7/6	EF80	9/6	UY41	8/–
6K8G	9/6	DF96	9/–	EF85	10/6	W76	8/6
6L6G	9/6	DH76	8/6	EF91	8/6	X65	10/6

Matched Pairs. EL84, **23/–**; 6V6G & GT, **17/–**; 6BW6, **18/–**; KT33C, **19/6**; KT66, **27/6**; 807 **14/6** pair

P.P. Op. Transformers. Mr 3-15 ohms for EL84, 6V6, 6BW6, etc., **18/6**; Op. Pen. 50mA, **5/6**; 30mA, **4/6**
Volume Controls. All values, long spindle. L/S **3/–**, s.p. **4/–**, d.p. **4/9**, ext. spkr. control **3/–**
W.W. Pots. Pre-set **3/–**; 3W long spindle **5/6**, s.p. **6/6**
P.M. Speakers. 3 ohm. 5" **16/6**, 6½" **17/6**, 8" **21/–**, 10" **25/–**, 12" **30/–**
Coaxial Cable. 75 ohm ¼" stranded, **8d.** yd; semi-air spaced, **9d.** yd; screen cable single and twin, **9d.** yd
Coaxial Plugs 1/– each; **Sockets 1/–** each

C.R.T. Isolation Transformers with 25% boost. Low capacity, a.c. mains 200-240V. For 2V, 4V, 6.3V and 13V tubes. All **12/6** each; 1-1 for H.C. shorts **10/6**

Valveholders. 4, 5, 7 pin English and U.S.A. B7G, B9A, 1.0 Mc. B8G, **9d.** each; B7G, B9A with screening can, **1/6**; B12A, **1/3**. Aladdin formers ¼" with core, **8d.** each
Scotch Boy Recording Tape, 1,200ft reels, **27/–**
Jack Plugs, miniature standard **3/–**; **Sockets 3/–**
2-Gang Condensers, .0005 small size, **7/6**
I.F. Transformers, 465 kc/s, small size, **7/6** pair
Capacitors, small mica, 5% 1pF to 100pF, **8d.**; 120pF to 1,000pF, **9d.**; 1,000V wkg. .01, .0015, .0025, .004, .005, **1/–** each
Crystal Diodes, G.E.C., **1/6** each
Headphones, lightweight, 4,000 ohm, **16/6** pair
Ceramic Capacitors, close tol. 500V for V.H.F., **9d.**
Paper Capacitors, tubular, .01, 1,000V, **1/–**; 0.1 to 0.5 500V, **10d.**
Paper Blocks, 4 mfd, 1,000V wkg., **3/6**
Rectifiers, contact cooled, 250V 50mA, **7/6**; 85mA, **9/6**
Reaction Condensers, .0001, .0003, .0005, **4/6** each
Heater Trans. 200/240V, 6.3V, 1.5A, **7/6**
Resistors, ¼ and ½W, insulated, **4d.** and **6d.**; 1W, **8d.** 6W W.W., **1/–**; 10W, **2/–**
Electrolytics. Wire ends. 25/25V, **1/6**; 50/50V, **2/–**; 12/50V, **9d.**; 8/450V, **2/–**; 16/450V, **2/9**; 16/500V, **3/6**; 32/450V, **4/–**; 8+8/450V, **4/6**; 8+16/450V, **4/6**; can types: 16/450V, **3/6**; 16+16/500V, **6/–**; 32/500V, **6/6**; 32/450V, **6/6**; 20+20/450V, **4/6**; 64+120/275V, **7/6**
Wavechange Switches, midget: 1p 12W, 2p 6W, 3p 4W, 4p 3W, 4p 2W, long spindles, **4/6**
Toggle Switches. QMB, s.p.s.t., **2/–**; s.p.d.t., **3/3**; d.p.s.t., **3/6**; d.p.d.t., **4/–**
Chokes, 80mA, 15H, **8/6**; 100mA 10H, **10/6**; 150mA 10H, **14/6**
Solder, Multicore, 4d. yd; Sleeving 2mm, **3d.** yd

P. and p. 9d. to £1; 1/6 to £2; over £2 post free. C.O.D. 2/6

R. COOPER G8BX 32 SOUTH END CROYDON SURREY CROYDON 9186

SMALL ADVERTISEMENTS

continued from page 285

TRADE—*continued*

TRANSISTOR AMPLIFIERS COMPLETE. Assembled 57/6 post free. Work Loudspeaker from Crystal Set or one-valve set, 4½ volt battery only required. Details and booklet 8d., stamps to Morco Experimental Supplies, 8/10 Granville Street, Sheffield 2.

VALVES. EB91, 4/6; PCF80, some EF80 and a few PCC84, all 5/6 post paid, first class, mail only. Posted Sats. Please do not cross P.O. G. Edwards (RC1), 38 Crawford Street, London, W.1.

A.M.I.P.R.E. For details of suitable study courses (only a limited number of students accepted), send for free Syllabus of Instructional Text. I.P.R.E. Conditions of Membership booklet 1/–. *The Practical Radio Engineer* journal, sample copy 2/3. 6,000 Alignment Peaks for Superhets 6/–. All post free from Secretary, I.P.R.E., 20 Fairfield Road, London, N.8.

PANL, recognised for many years as the unique one-coat black crackle finish. Brush applied, no baking. Available by post in ⅛th pint cans at 3/6 from G. A. Miller, 255 Nether Street, London, N.3.

ILLUSTRATED CATALOGUE No. 13 containing over 450 items of Government Surplus and Model Radio Control Equipment, 2/2. Refunded on purchase of goods, 2/6 overseas seamail—Arthur Sallis Radio Control Ltd., Department R.C. 93 North Road, Brighton. *Telephone* 25806.

LEARN as you do it—we provide practical equipment combined with instructions in Radio, Television, Electricity, Mechanics, Chemistry, Photography, etc. Write for full details to E.M.I. Institutes, Dept. RC47, London, W.4.

JOIN THE INTERNATIONAL S.W. LEAGUE Free Services to members including Q.S.L. Bureau Translation, Technical and Identification Depts.—both Broadcast and Fixed Stations, DX Certificates contests and activities for the SWL and Transmitting members. Monthly magazine, "MONITOR," containing articles of general interest to Broadcast and Amateur SWL's. Transmitter page and League affairs, etc. League supplies such as badges, headed notepaper and envelopes. QSL cards, etc., are available at reasonable cost. Send for League particulars. Membership, including monthly magazine, etc., 15/– per annum.—Secretary, ISWL, 86 Barrenger Road, London, N.10.

COILS, COILS, COILS. We can supply coils for all frequencies, r.f. chokes, etc. Send s.a.e. for circuits and data.—The Teletron Co., 266 Nightingale Road, London, N.9.

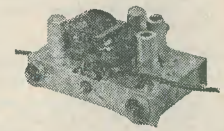
MORSE CODE TRAINING. Special course for Beginners. Full details from (Dept. RC), Candler System Company, 52 Abingdon Road, London, W.8.

FREE. Brochure giving details in Home Study Training in Radio, Television, and all branches of Electronics. Courses for the hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., with other Professional examinations. Train with the college operated by Britain's largest Electronics organisation. Moderate fees. Write to E.M.I. Institutes, Dept. RC28, London, W.4.

SPECIAL OFFER

I.T.A. CONVERTERS

70/- to clear
Post 2/6 C.O.D. 1/6



Only a few dozen. London and Winter Hill areas I.T.A. converter in chassis form. Made by famous manufacturer. Valves PCC84 and ECC81; with power supply. Working and ready for use. Direct switching I.T.A. to B.B.C.; cabinet (walnut) to fit, **10/–**

DROP-THROUGH MAINS TRANSFORMERS. Brand new, 250-0-250V at 60mA; 6.3V at 2½A and 6.3V at ½A. Price **12/6** plus 2/6 post; 1/6 C.O.D.

BAND 3 CONVERTER available for Philips' receivers; complete with power pack. Bakelite case, 8½" x 4½" x 6" high. PCC84 and PCF80. Post 2/6, C.O.D. 1/6. **Price £5.5.0**

Posted orders to Camberley please

Gladstone Radio
3 CHURCH ROAD REDFIELD BRISTOL
(*next door to Lawrence Hill station*) and
82B HIGH STREET CAMBERLEY SURREY

ARTHURS HAVE IT!

Large Stocks of Valves and C.R.T.s
Full Range of Meters available
Avo, Taylor, Cossor, Advance, etc.
Particulars on Request
FM Kit of Parts £5, less valves
(*Ref. Radio Constructor July 1954*)
Amplifier Tape Recorders and Loudspeakers

Jason FM Tuner Unit	**£15 17 0**
Jason Power Pack	**£3 10 0**

Radios and Television always in stock

VALVE MANUALS
Mullard, **10/6**; Brimar No. 6, Osram, Part 1 **5/–**; Osram, Part II, **10/–**
Postage 9d. each extra
Publications "Lodestar" Tape Recorder **3/6**

Goods offered subject to price alteration and being unsold

Arthurs *first* Est. 1919

Proprietors ARTHUR GRAY LTD
OUR ONLY ADDRESS **Gray House**
150-52 Charing Cross Road
London WC2
TEMple Bar 5833/34 and 4765