

A BEGINNER'S 200-1600 METRE SUPERHET

PRACTICAL ^{1/3} WIRELESS

JANUARY
1958

EDITOR: F.J. GAMM



CONTENTS

A TRANSISTOR SQUARE WAVE
GENERATOR

A BEGINNER'S CONSTRUCTIONAL
COURSE

A C.R.L. BRIDGE

TRANSMITTING TOPICS

Etc. Etc. Etc.

MAXI-Q
REGD.

COIL PACKS

CP.3/370pF and CP.3/500pF. These 3 waveband Coil Packs are available for use with either 370pF or 500pF tuning condensers. The coverages are : Long Wave 800-2,000 metres, Med. Wave 200-550 metres, Short Wave 16-50 metres. Designed for use with "MAXI-Q" Glass scale type S2. Retail Price of each unit : 32/- plus 12 9 P.T.—Total 44 9.

CP.3 G. As above but with Gram. position, suitable for use with 500pF tuning condenser : 39/- plus 15 7 P.T.—Total 54 7.

CP.3 F. This Coil Pack is for use with a 500pF tuning condenser and covers the standard Long, Med. and Short wavebands with the addition of the band 50/160 metres. This covers the Trawler Band, Aeronautical and the 80 and 160 metre Amateur bands : 49 - plus 19 7 P.T.—Total 68 7.

CP.3 F G. As CP.3 F but with gram. position : 57 - plus 22 9 P.T.—Total 79 9.

CP.4 L and CP.4 M. These compact 4-station Coil Packs are available for either 1 Long Wave and 3 Medium Wave stations (CP.4 L) or 4 Medium Wave stations (CP.4 M). They are fully wired and require only four connections for use with any standard frequency changer valve. 25/- plus 10/- P.T.—Total 35/-.

CP.4 G and CP.4 M G. As CP.4 L and CP.4 M but with provision for Gram. position. 31/- plus 12 5 P.T.—Total 43 5.

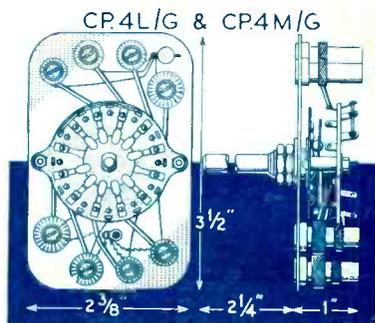
See Technical Bulletin DTB.9 for details of all Coil Packs, 1/6.

GENERAL CATALOGUE covering technical information on full range of components. 1 - post free.

DENCO (CLACTON) LTD. (Dept. P.W.), 357/9 Old Road, Clacton-on-Sea, Essex

STOP PRESS : MAXI-Q PRE-SET F.M. TUNER completely assembled. £12. VARIABLE VERSION, £11. COMBINED POWER PACK AND AMPLIFIER. £5.10.0.

Trading Terms for direct postal orders : C.W.O. plus appropriate postal charges.



*Trace the Trouble
in a Trice*



PIFCO

ALL-IN-ONE RADIOMETER

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

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

Obtainable from your local dealers.

Write for informative folder to :—

★ ONLY
32/6
COMPLETE

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

ADCOLA

PRODUCTS LIMITED
(Regd. Trade Mark)

SOLDERING EQUIPMENT

ILLUSTRATED

3/16" Detachable
bit type (List
No. 64)

Protective Shield
(List No. 68)

Catalogues sent
FREE

Telephones :
MACaulay 4272
& 3101



British and
Foreign Pats.

Reg. Designs,
etc.

Head Office, Sales :

**ADCOLA
PRODUCTS
LTD.**

**Gauden Road,
Clapham High
St., London,
S.W.4**

BARGAINS TO CLEAR

4 watt 3 valve Amplifier. Built to Hi-Fi standards with a control panel which can be used separately or fixed to chassis. Separate bass and treble controls. A.C. mains operated. £4 19 6 plus 5% post and insurance.

A.C. Superhet 5 Valve Chassis. Medium and two Short, unused but less valves and mains transformer. Uses standard oval range, 27 6 again coil pack worth much more, non-callers add 6 6.

A.C. Superhet 7 v. 5 Waveband Chassis. H.F. stage. Tuned, less valves and power pack. Slightly soiled. Coil pack worth twice as much. Circuit diagram supplied. £2 15 - carriage and insurance 7 6.

A.C. 4 Valve Superhet. complete with valves but less scale and unused. Circuit diagram supplied. 39 6 plus.

Note that the above three chassis although unused still need tuning. On account of low price an allowance is given. Not, or small, can technical assistance be given.

1 mfd. 350 v. small tubular metal. Made by Dubilier 2 6 per dozen.

Germanium Diodes. B.T.H. with wire ends, pair each of 2 - dozen.

Midjet I.F. Coils. dust coated, size 12 x 1in. 465 Kcs. 4 6 pair.

Standard size I.F. Coil. dust coated 465 mc s. 4 6 pair.

Coil Pack for Superhet. 465 Kcs. I.F. Medium and 2 short waves. 9 6.

Cathode Ray Tube. VCR 97. Instrument type, new. 7 6 each, out make 3 6.

Bakelite 5 amp. electric wall switch. "Hivatt" 9d. each or 8 - per dozen.

Series, parallel and off-electric wall switch. made by Crabtree. Price 1 3 each or 13 6 per dozen.

Amplifier, ex-Government unit III. contains one double triode and one triode. 6 6. post and insurance 2 6.

Connecting wire. PVC covered 24 swg. copper. 2 6 per 100 ft. or 7 coils different colours for 10 s.

Screening coils. by very good make new and unused. 4 6 complete.

Choke. 200 m.a. first-class. Made for Services—new. 6 6. post 1 6.

10 v. Superhet 13 meters. ex-Govt. but unused. Complete with valves. Easily converted for Band III. 39 6. carriage and packing 7 6.

Mains Transformer. 250-0-250, 60-0-110 m.a. 6 3 v. Standard mains input. Half-branded. 12 6. post and insurance 2 6.

R.F. 25 Tuning Unit. New, unused and complete with valves. 9 6. post 2 6.

Cathode Ray Tube. VCR 517. 8 6 each, carriage 2 6.

Mains Lead. metal screened to stop interference. 9d. yard.

Thermo-couple. mounted on valve base, useful for experiments and schools. 6 6 each.

Midjet push-pull input transformer and push-pull output transformer to match. 8 - the pair.

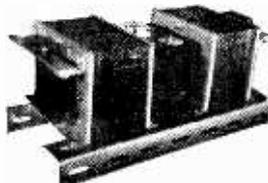
Note: Orders for small components over £2 are post free, otherwise please add sufficient.

MAINS-MINI

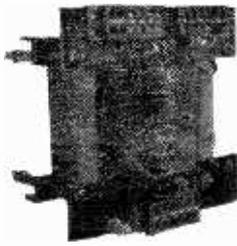
Uses high-efficiency coils, covers long and medium wave-bands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £4 10 0. plus 3 6 post. Constructional data free with the parts, or available separately 1/6.

MAINS ISOLATION TRANSFORMER

Makes servicing safe, also makes the adjustment for differences in mains voltages very simple. Input tapped 200-250 v. output tapped 200-250 v. Continuously rated at 500 watts, intermittent rating 2,000 watts. Cable entry by terminal blocks, two separate sections for suppressing mains interference. Size approximately 14 in. x 6 in. x 6 in., weight approximately 40 lbs. Price £5 12 6. Carriage and insurance 7 6 (up to 250 miles).

**500 WATT STEP DOWN TRANSFORMER**

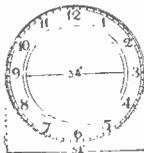
With output tapped from 110 v.-155 v. on 3 volt step-down massive transformer which will stand considerable overloading. Price 45 - plus 5 - carriage up to 250 miles.



6 ft. 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 9 post free; special quotes for large quantities.

CLOCK CASE

Also suitable for barometer or other instrument. Nicely polished. Price 4 6, post and packing 1 6.



Clock numerals to suit these cases etched on metal. 2 6. Post 9d. if ordered separately.

THIS MONTH'S SNIP 19 RANGE TEST METER

Fine instrument in bakelite and metal case, large easily-read scale and long pointer. 2,000 ohms per volt movement, brand new and recent manufacture. Voltage ranges 0-1,200 volts A.C. and D.C. in five ranges each, D.C. current 0-300 m.A. in three ranges, capacity 0-1 mid. in two ranges. Resistance 0-2 meg. in two ranges. Inductance 0-1,000 H. Decibels -20 to +46. Complete with test probe. Price £4 15 0. Post and insurance 3 -.

**THIS MONTH'S SPECIAL BARGAINS**

E.S. HOLDER. panel mounting, bakelite insulated. 2 -.

FLUORESCENT TRANSFORMER. 200-210 v. tapped mains input; 6.3, 3 amp. output. Ex-equipment but unused. 6 6 each.

THERMAL DELAY UNIT. 6.3 v. operated, switches on or off, 3/6.

VANLEY SWITCH. 4 position, 6 pole, 3 bank. 2 6.

500 Kcs. CRANK. 10X E 500, Plug-in type. 6 6.

5-0-5 CENTRE zero millimeter. 2 1/2 in. 12 6.

BALANCE METER. 10D 137-2, will function as highly sensitive 7-34v. 45 - each.

12 in. HIGH FLUX (12,000 lines) SPEAKER

3 ohm speech coil, 37 6. plus 3/6 post and insurance.



Wrap our heater cable around the pipes in your loft to prevent a freeze-up. 21 yards £1 1 - post free.

FLUORESCENT LIGHTS

These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the work-bench and in similar locations.

Single 40. 1 ft. 3 in. long, uses a 40 watt tube.

Twin 20. Uses 2 20-watt standard tubes. Price for either type 39 6; with tubes. Carriage and ins. up to 150 miles 5/6, up to 250 miles 7 6.

THE CLEVELAND ORGANTONE

5 valve 3 waveband superhet covering Long, Medium and Short waves. Ostran miniature valves—low loss iron coils—permeability—tuned I.F.S.—tall A.V.C.—variable negative feedback—gram. position—4 watts output—partially fine-tune. Chassis size 7 in. x 7 in. x 7 in. approx. Tested in difficult areas where exceptional results have been obtained. Price £11 10 0 or £2 0 0 deposit, plus 7 payments of £1 10 0. Carriage and ins. 10 -.

DON'T BE CAUGHT LIKE THIS



CAR STARTER CHARGER KIT

All parts to build 6- and 12-volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following:

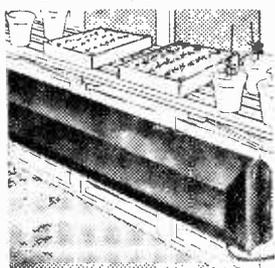
- Mains transformer..... 22/8
 - 5-amp. rectifier..... 17/6
 - Regulator Stud Switch..... 3/6
 - Resistance Wire..... 2/6
 - Resistance Former..... 2/6
 - Mains on off Switch..... 2/6
 - 0.5 amp. Moving Coil Meter..... 12/6
 - Construction Data..... 1/6
- or if bought all together price is 52/6. plus 3/6 post and packing.

MINIATURE MOTOR



Size only 2 1/2 ins. long by 1 1/2 ins. diameter—American made—laminated poles and armature—intended for 28 volt D.C. but O.K. on lower D.C. voltages and A.C. mains, through step-down transformer—price 10/6, post, etc., 2/- Transformer to suit, 12/6 post free.

INSTANTUS HEATER



Convecter heater, 1 kW. rating, 4 ft. long, made from heavy gauge sheet steel (galvanised). Can be used for greenhouse, workshop, aviary, etc., etc. Price £2.10/-, or with thermostat, £4.5/-, carriage 5/- GUARANTEED 5 YEARS.

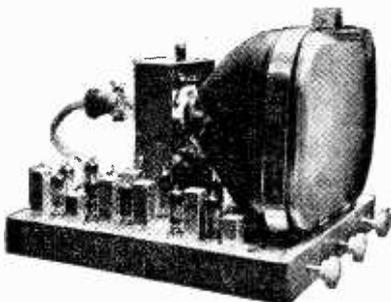
2 KW MODEL. Free standing thermostatically controlled, £5.17/6.
500 WATT MODEL. For very small greenhouses, 27/6. Carriage 5/-.

CRYSTAL MICROPHONE

Miniature crystal type has high gain and is suitable for all purposes—tape recorders—amplifiers. Price 4/9, post and ins. 9d.



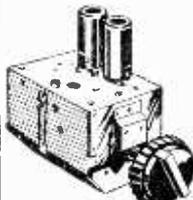
Build This in an Evening



Undoubtedly the most up-to-date television for the home constructor. You can build it in an evening and the set when finished will be equal to a factory-made equivalent. What other constructor T.V. has all these features?

- ★ No technical knowledge required.
 - ★ All miniature valves.
 - ★ Metal rectifier.
 - ★ Turret Tuner.
 - ★ 12-channel circuitry.
 - ★ Multi-vibrator time bases.
 - ★ Ferrite cube, E.H.T. and scan coils.
 - ★ 35/38 Mc's I.F.
 - ★ Suitable for any modern 12, 14 or 17" tube.
- The building cost (less tube) is only £29.10.0, plus 10/- carriage and insurance, or £16 deposit & 12 monthly payments of 2/-.. All parts guaranteed 12 months. Full information and data, price 3/6.

Turret Tuner

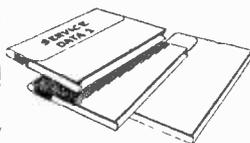


Brand new stock, not surplus, with coils for Band I and III complete with valves PCC84 and PCF90—1.F. Output 33/38 Mc's with instructions and circuit diagram, 79/6. With knobs 3/6 extra, post and insurance 2/6.

THIS MONTH'S SNIP

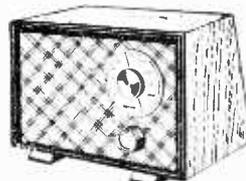
TAPE DECK.—Made by the famous Truvox Company. This contains exactly the same essentials as the current model. Only the styling is different. It also takes the stereophonic head. Specification: 3 E.P.H. shaded pole motors with silent friction drive eliminating wow and flutter. Push-button controls, electrically and mechanically interlocked. Patented electric type push-button controlled brake. Tape loading on the drop-in principle accommodation for reels of 7" diameter. Tracking sense to British and American standards. Playing times: up to 3 hours with L.P. Tape or 2 hours with Standard Tapes. Two tracks side by side with safety gap. Positive azimuth adjustment of Record Player head. High Impedance Heads. Overall size 14 1/2" x 12 1/2" x 5" approx. 120 only of these fine decks offered at non-repeatable price of £17.10.0 or £3.10.0 down and eight monthly payments of £2. Non-callers add 10/- carriage and insurance.

T.V. SERVICE SHEETS



100 sheets covering the most popular post-war Televisions by leading makers—Cossor, Ekco, Ferguson, Pye, etc., etc. Special 25% reduction to P.T. readers who order this month will receive the complete 100 sheets free. 15/- Post and insurance.

OUR 19/6 COLUMN



THE SKYSEARCHER

This is a 2-valve plus-metal receiver set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, 19/6. Post and ins. 2/6. Data free with parts or available separately 1/6. 3-valve battery version also available at the same price.

ALL-MAINS AMPLIFIER



Powerful three-valve Mains amplifier ideal for dances, parties, etc. Complete less chassis, cabinet and speaker (available if required)—data 1/6 (free with parts). Price 19/6, plus 2/6 post and insurance.

'CHIMELITE' 19/6



It is a hall light, as well as a double chime and you can make it in a couple of evenings for the total cost of only 19/6 including instructions, post 2/-—data available separately price 2/-

Simplex Transistor Kit



Makes ideal bedroom radio, uses one transistor and one crystal diode. Complete less case 19/6, case 5/- extra, post and ins. 1/6.

A.C./D.C. Multimeter Kit



Measures A.C./D.C. volts and ohms. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, range selector switches, calibrated scale and full instruction book 19/6 plus 1/0 post and insurance.

ELECTRONIC PRECISION EQUIPMENT, LTD.

Post orders to E.P.E., LTD., Dept. 5, 66, Grove Road, Eastbourne.

286, London Road, Croydon, Surrey. Phone: CRO. 6558. Half day, Wednesday.

42-48, Windmill Hill, Friar-chip, Middx. Phone: RUISLIP 5780. Half day, Wednesday.

152-3, Fleet Street, E.C.4. Phone: FLEET 2843. Half day, Saturday.

29 Stroud Green Rd., Finsbury Park, N.4. Phone: ARCHWAY 1049. Half day, Thursday.

SIGNAL GENERATOR

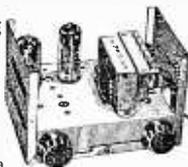
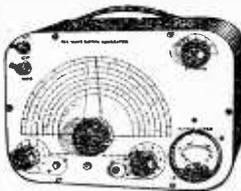
Coverage 120 kc/s, 84 Mc/s. Metal case 10in. x 6 1/2in. x 4 1/2in. Size of scale, 6 1/2in. x 3 1/2in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 200 c.p.s. to a depth of 30 per cent., modulated or unmodulated R.F. output continuous variable 100 millivolts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.

£4/19/6 or 34/- deposit and 3m'thly payments 25/- P. & P. 4/6 extra.

COMMERCIAL TELEVISION CONVERTER SUITABLE

ANY T.V. (except Philips) WITHIN 35 MILES OF I.T.A. TRANSMITTER. ALL CHANNELS NO ALTERATIONS TO SET. Complete with built-in power supply 230-250 v. A.C. mains. Crackle finish case 5 1/2in. long, 3 1/2in. wide, 4 1/2in. high, incorporating gain control and band switch. Illus. with cover removed.

£3.19.6 Plus P. & P. 2/6. Hire purchase available. 3 element folded dipole I.T.A. LOFT AERIAL 15/- P. & P. 2/- Coax cable 8d. yd



AC/DC MULTI-METER KIT

Comprising 2 1/2in. moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milli-amps. Voltage range AC/DC 0-10, 0-100 and 0-500. Milli-amps 0-10, 0-100. Ohms 0-1,000 and 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting) two toggle switches, resistors and meter rectifier. In grey hammer-finish case.

19/6 Plus P. & P. 1/6.

Point to point wiring diagram 1/- free with kit.

4 VALVE ALL-DRY SUPERHET PORTABLE KIT

Incorporating Ferrite rod aerial Medium and long waves. In grey leatherette. Size 9in. x 7in. x 6in. Valve line-up: 1T4, IR5, IS3 3V4. Complete kit of parts (less batteries).

£5.19.6 Plus Post & Packing 3/6



COMPLETELY BUILT PORTABLE AMPLIFIER

approx. size 6 1/2in. x 2 1/2in., incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls 39/6 Plus and double wound mains transformer 230-250 v. 3/6 P. & P. 3/6 5 T.M. SPEAKER & O.P. TRANSFORMER, if purchased with the above, 18/6. Plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER

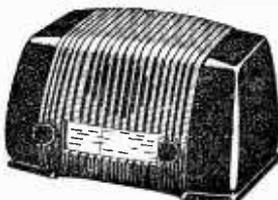
Model 458 (suitable for use with above amplifier). A.C. mains, 200-250 v., turnover crystal head. Brand new, fully guaranteed. £8.19.6 Plus or 25/- deposit, plus P. & P. 5/-, and 7 monthly payments of £1-5-0.

T.R.F. KIT in PLASTIC CABINET

3 valve plus metal rectifier. A.C. mains 200-250 v. Medium and Long waves. In pastel blue or brown. Valve line-up: 2 VR65s and VT52. Size 15 1/2in. long by 9in. high by 7in. deep

£3.19.6 P. & P. 7/6.

Point to point wiring diagram 1/6. Free with kit.



RADIO & T.V. COMPONENTS (Acton) LTD.

23 HIGH STREET, ACTON, LONDON, W.3

GOODS NOT DISPATCHED OUTSIDE U.K.

REPANCO HIGH GAIN COILS

Dual Range Crystal Set Coil, Type DRX1 ... 2/6
Dual Range Coil with Reaction, Type DRR2 ... 4/-
Matched Pair Dual Range T.R.F. Coils, Type DRM3 ... pair 8/-
Pair Dual Range Superhet Coils, Type SH4 pair 8/-

Miniature Iron Dust Cored Coils, Type "R" :-

Range	Aerial	H.F.	Osc.	
800-2,000m.	RA1	RHF1	RO1	
190-550m.	RA2	RHF2	RO2	
70-230m.	RA3	RHF3	RO3	each 3/3
15-50m.	RA4	RHF4	RO4	

Ferrite Rod Aerial, Dual Range Type FRI ... 12/6

Miniature I.F. Transformers, Type MSE (465 Kc/s) ... pair 12/6

Standard I.F. Transformers, Type TCG (465 Kc/s) ... pair 13/6

Three Waveband Superhet Coil Pack, Type LMS ... 26/-

F.M. Coil Set ... 29/6

(All components boxed complete with circuits.)

Send S.A.E. for complete list of Repanco components.

Making your own radio set as featured on B.B.C. Children's Television. All components for this receiver in Stock. Send S.A.E. for complete price list.

RADIO EXPERIMENTAL PRODUCTS LTD.

33 MUCH PARK ST., COVENTRY.

Tel. 62572.

*radio upkeep
and repairs*

By Alfred T. Witts, A.M.I.E.E., etc., 8th Edition. This practical handbook explains in an easy-to-follow style how to locate faults, how to remedy them and how to keep modern radio receiver apparatus in the best possible working condition. It forms a most valuable book for radio service engineers and mechanics, and for all who require a practical book of "do's and don'ts." 15/- net. "This little book is a god-send..."—Engineer.

PITMAN

Parker St., Kingsway, London, WC2

TOP QUALITY FULLY GUARANTEED VALVES BELOW MANUFACTURERS' PRICES

EXPRESS SERVICE !!!
C.O.D. ORDERS RECEIVED BY 3.30 P.M. EITHER BY LETTER, PHONE OR WIRE, DESPATCHED THE SAME AFTERNOON. ALL ORDERS RECEIVED BY FIRST POST DESPATCHED SAME DAY

FOR ONLY 6d. EXTRA PER ORDER WE WILL INSURE YOUR VALVES AGAINST DAMAGE IN TRANSIT. ALL UNSURED PARCELS AT CUSTOMER'S RISK.

OZ4	6/-	6AQ5	7/6	6K8G	8/-	10P13	17/6	30P4	15/-	CK505	6/6	EC70	12/6	EY51	PABC80	UAF42	10/6
IA3	3/-	6AT6	8/6	6K8GT	9/6	11E3	15/-	30P12	13/6	CK506	6/6	ECC31	15/-	(Large)	12/6	UB41	12/7
IA5	6/-	6AU6	10/6		11/-	12A6	6/6	30P16	10/6	CK523	6/6	ECC32	10/6	EZ35	6/6	UBC41	8/5
IA7	15/-	6BA6	6/6	6L6G	9/6	12AH7	8/-	31	7/6	CV63	10/6	ECC33	8/6	EZ40	8/6	UBF80	9/6
ID6	10/6	6B7	10/6	6L7M	8/-	12AH8	10/6	33A/158M		CV85	12/6	ECC35	8/6	EZ41	10/6	UBF89	10/6
IH5	11/-	6B8G	4/6	6L18	13/-	12AT6	10/6			CV271	10/6	ECC40	15/-	EZ80	8/6	UCB85	10/6
IL4	6/6	6B8M	5/-	6N7	8/-	12AT7	8/6	35/51	12/6	CV429	30/-	ECC81	8/6	EZ81	10/6	UCH42	19/-
ILD5	5/-	6BA6	7/6	6Q7G	8/6	12AU7	7/6	35A5	11/-	DI	3/-	ECC82	7/6	EZ30	19/6	UCHS1	11/6
ILN5	5/-	6BE6	7/6	6Q7GT	9/-	12AX7	9/-	135L6GT	10/6	D42	10/6	ECC83	9/-	GZ32	12/6	UCH82	13/6
INS	11/-	6B16	8/-	6R7G	8/6	12BA6	9/-	35W4	8/6	D63	5/-	ECC84	10/-	GZ34	14/-	UCL81	11/6
IRS	8/6	6BR7	11/6	6SA7GT	8/6	12BE5	10/-	35Z3	10/6	D77	6/6	ECC85	9/6	H30	5/-	UF41	9/-
IS5	8/-	6BW5	8/6	6SG7GT	7/6	12E1	30/-	35Z4GT	8/6	DAC32	11/-	ECC91	5/6	H63	12/6	UF80	10/6
IT4	7/-	6BW7	9/-	6SH7	6/-	12J5GT	4/6	35Z5GT	9/-	DAF91	8/-	ECCF80	12/6	HABC80		UF85	10/6
IU5	7/-	6BX5	8/6	6S7	8/-	12J7GT	10/6	41MTL	8/6	DAF96	10/-	ECCF85	9/6	HK90	10/6	UF99	10/6
2A3	12/6	6C4	7/-	6SK7GT	6/-	12K7GT	7/6	50C5	12/6	DF33	11/-	ECH42	10/-	HL23	10/6	UL41	10/6
2A7	10/6	6C5	6/6	6SL7GT	8/-	12K8GT	6/6	50L6GT	9/6	DF91	10/-	ECH481	8/-	HL41	12/6	UL46	15/6
2C26	4/-	6C6	6/6	6SN7GT	7/6	14/-	61B1	15/-	DF96	10/-	ECH81	8/-	HL1	12/6	UL84	11/6	
2DI13C	7/6	6C8	12/6	6S7	7/6	12Q7GT	7/6	61SPT	15/-	DH53	8/6	ECL80	10/-	HL33DD		UY41	8/6
2X2	4/6	6C9	12/6	6U4GT	14/-	12S47	8/6	72	4/6	DH75	8/6	ECL82	13/6			UY85	10/6
3A4	7/-	6C10	12/6	6USG	7/6	12S7	7/6	77	8/6	DH77	8/6	ECL83	13/6			Y1507	5/6
3A5	12/6	6CH5	7/6	6U7	8/6	12S7G	7/6	78	8/6	EF36	6/-	ECL84	13/6			Y1507	5/6
3B7	6/6	6D6	6/6	6V6G	7/-	12SH7	5/6	80	9/-	EF37A	9/-	ECL85	13/6			Y1507	5/6
3D6	5/-	6E5	12/6	6V6GT	8/-	12S7	8/-	93V	15/-	EF39	6/-	ECL86	13/6			Y1507	5/6
3Q4	9/-	6F1	15/-	6X4	7/-	12SK7	8/-	85A2	15/-	EF40	15/-	ECL87	13/6			Y1507	5/6
3QS5T	9/6	6F6G	7/-	6XS7	6/6	12SQ7	8/6	150B2	15/-	EF41	9/6	ECL88	13/6			Y1507	5/6
3S4	8/-	6F6GT	8/-	6Z4/84	12/6	12SR7	8/6	807	15/-	EF42	12/6	ECL89	13/6			Y1507	5/6
3V4	9/-	6F8	12/6	6Z5	12/6	12Y4	10/6	866A	13/6	EF43	12/6	ECL90	13/6			Y1507	5/6
5U4	8/6	6F12	9/-	6J30/12	12/6	14R7	10/6	956	3/-	EF44	10/6	ECL91	13/6			Y1507	5/6
5V4	12/6	6F13	12/6	7A7	12/6	14S7	14/-	1203	7/6	EF45	10/6	ECL92	13/6			Y1507	5/6
5X4	10/-	6F16	9/6	7B7	8/-	19AQ5	11/-	4033L	12/6	EF46	10/6	ECL93	13/6			Y1507	5/6
5Y3G	8/-	6F17	12/6	7C5	8/-	19H1	10/-	5763	12/6	EF47	10/6	ECL94	13/6			Y1507	5/6
5Y3GT	8/6	6F32	10/6	7C5	8/-	20D1	16/-	7193	5/6	EF48	10/6	ECL95	13/6			Y1507	5/6
5Y4	10/6	6F33	7/8	7H7	8/-	20L1	13/6	7475	7/6	EF49	10/6	ECL96	13/6			Y1507	5/6
5Z3	12/6	6C5	6/6	7Q7	9/-	25L6GT	10/-	9002	5/6	EF50	10/6	ECL97	13/6			Y1507	5/6
5Z4G	10/6	6H6GT/G	7/6	7S7	9/6	25Y5	10/6	9003	5/6	EF51	10/6	ECL98	13/6			Y1507	5/6
6A8	10/-		3/-	7V7	8/6	25Y5G	9/6	9006	6/-	EF52	10/6	ECL99	13/6			Y1507	5/6
6AB7	8/-	6H6M	3/6	7Y4	8/6	25Z4G	9/6	AC6PEN	7/6	EF53	10/6	ECL100	13/6			Y1507	5/6
6AB3	10/6	6I5G	5/-	8D2	3/6	25Z5	10/6	AC/HL		EB41	8/6	ECL101	13/6			Y1507	5/6
6AC7	6/6	6I5GTG	5/6	8D3	9/-	25Z6G	9/6	DDD	15/-	EB91	6/6	ECL102	13/6			Y1507	5/6
6AG5	6/6	6I5GTM	6/-	9D2	4/-	28D7	7/-	AC/P4	8/-	EB33	7/6	ECL103	13/6			Y1507	5/6
6AG7	12/6	6I6	5/6	10C1	15/-	30	7/6	AP4	7/6	EB41	8/6	ECL104	13/6			Y1507	5/6
6AJ8	8/-	6I7G	6/-	10F1	15/-	30C1	12/6	ATP4	4/-	EBF83	9/6	ECL105	13/6			Y1507	5/6
6AK5	5/-	6I7GT	10/6	10F9	11/6	30F5	12/6	AZ31	12/6	EBF89	9/6	ECL106	13/6			Y1507	5/6
6AL5	6/6	6K7G	5/-	10F18	12/6	30FL1	12/6	B329	7/6	EC52	5/6	ECL107	13/6			Y1507	5/6
6AM6	9/-	6K7GT	6/-	10LD3	8/6	30L1	12/6	BL63	7/6	EC54	6/-	ECL108	13/6			Y1507	5/6

TERMS OF BUSINESS :—CASH WITH ORDER OR C.O.D. ONLY. ORDERS VALUE £3 OR MORE SENT POST/PACKING FREE. ORDERS BELOW £3 PLEASE ADD 6d. PER VALVE C.O.D. ORDERS :—MINIMUM FEE, INCLUDING POST AND PACKING, 3/-. WE ARE OPEN FOR PERSONAL SHOPPERS. MON.-FRI. 8.30-5.30. SATS. 8.30-1 p.m.

ALL VALVES NEW, BOXED, TAX PAID, AND SUBJECT TO MAKERS' GUARANTEE. FIRST GRADE GOODS ONLY, NO SECONDS OR REJECTS. GOODS ARE ONLY SOLD SUBJECT TO OUR TERMS OF BUSINESS, OBTAINABLE FREE ON REQUEST. CATALOGUE OF OVER 1,000 DIFFERENT VALVES 3d.

We specialise in VALVES—of every kind and description—serving the industry for years. More than 2,000 different types in stock for IMMEDIATE DELIVERY—including hard-to-get and discontinued numbers. All valves exhaustively tested in our fully equipped laboratories, and re-tested at time of despatch. FULL NINETY DAY GUARANTEE. All valves individually boxed.

BENTLEY ACOUSTIC CORPORATION LTD.

THE VALVE SPECIALISTS
38 CHALCOT ROAD, LONDON, N.W.1
PRimrose 9090
PLEASE ENQUIRE FOR ANY VALVE NOT LISTED. 3d. STAMP. PLEASE.



Stern's "fidelity" TAPE RECORDER

IT HAS EVERYTHING—EXCEPT A HIGH PRICE

TESTED AND APPROVED AT THE TRUVOX LABORATORIES

IT INCORPORATES: The NEW TRUVOX Mk. IV TAPE DECK together with the "fidelity" MODEL HF/TR2 TAPE AMPLIFIER (both illustrated on this page), and a Rola 10in. x 6in. P.M. SPEAKER.

PRICE... including CRYSTAL MIKE and 1,200ft. reel of PLASTIC TAPE.

£49.10.0.

(OR £3 EXTRA WITH REV. COUNTER.)

(Plus £1/10- carriage and insurance, of which 1/- is refunded on return of Packing case.)

● BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THIS MODEL—TRULY "HI-FI" RECORDINGS ARE OBTAINABLE and it is comparable to much higher priced Recorders.

Alternatively send S.A.E. for ILLUSTRATED LEAFLET.

CREDIT SALE: Deposit £12/8- and 9m'thly payments of £4/10/8.
HIRE PURCHASE: Deposit £24/15/- and 12 monthly payments of £2/5/11.

ADVANCE NEWS!!

Our "fidelity Junior" Tape Recorder will be available mid-January. It incorporates the TRUVOX MK III Deck and the correctly matched HF/TR1 A Tape Amplifier.

Price is only 39 gns. complete with ACOS crystal mike and 1200ft. of Plastic Tape. **39 Gns.**

The "fidelity" TAPE AMPLIFIER Model HF/TR2 WITH POWER SUPPLY UNIT

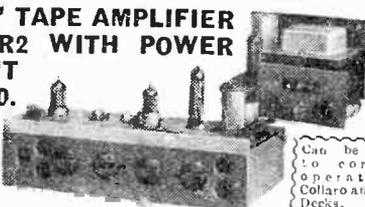
PRICE **£16.0.0.**

(Carr. and ins. 6/-)

H.P. TERMS: Deposit £3 and 13 months of £1.

CREDIT TERMS: Deposit £4 and 9 monthly payments of £1/0/4.

When ordering, please advise make of deck in use. Send S.A.E. for full details.



(Can be supplied to correctly operate with Collaro and Truvox Decks.)

HOME CONSTRUCTORS

We can supply a COMPLETE KIT OF PARTS to build this TAPE AMPLIFIER for £12 (plus 5/- carr. and ins.). The Assembly Manual, Practical Diagrams, etc., are available for 2/6. WE MAKE SPECIAL PRICES TO PURCHASERS OF TAPE EQUIPMENT (i.e., buyers of Deck and Amplifier together, etc., etc.). SEND YOUR ENQUIRY TO US... H.P. and CREDIT SALE TERMS ARE AVAILABLE.

The NEW TRUVOX MkIV TAPE DECK

ONE OF THE BEST DECKS ON THE MARKET.

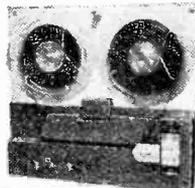
PRICE **£27.6.0.** (Plus 10/- carr. and ins.)

CREDIT TERMS: Deposit £6/17- and 9 monthly payments of £2/10-.

H.P. TERMS: Deposit £13/13- and 12 monthly payments of £1/5/4.

WE ALSO HAVE A FEW DECKS WITH REV. COUNTERS. Price £30/9-.

Send S.A.E. for details.



A TAPE PRE-AMPLIFIER and ERASE UNIT



STERN'S MODEL HF/TR1.—A completely assembled

Pre-amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox or Collaro Decks and incorporates Recording Level Indicator and Monitoring facilities. Please send S.A.E. with any enquiry.

PRICE **£11.10.0.** (Plus 5/- carr. and ins.)
SPECIAL PRICE REDUCTION WHEN PURCHASED WITH TAPE DECK.

WE HAVE THE FULL RANGE OF DULCIS CHASSIS IN STOCK

THE MODEL H.4, is illustrated but all Chassis and Tuners are similar—send S.A.E. for leaflets. H.P. and CREDIT SALE TERMS are available. Send S.A.E. for details.

RADIOGRAM CHASSIS These two Chassis are really well designed and reproduce most excellent quality on both Radio and gram.

MODEL H.3. A 3 Waveband AM/FM CHASSIS **£20.17.0.**
MODEL H.4. A 4 Waveband AM/FM CHASSIS **£24.6.6.**
MODEL H.4.T. A 4 Waveband AM/FM TUNER with self-contained POWER SUPPLY **£20.17.0.**

RECORD PLAYERS

at Greatly Reduced Prices

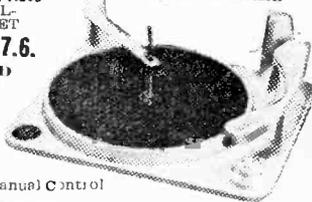
Send S.A.E. for ILLUSTRATED LEAFLET

"CASH ONLY" **£8.7.6.** (plus 5/- carr. & ins.)

THE NEW 4-SPEED B.S.R. MONARCH

- A "MIXER" Auto-changer complete with High Fidelity Crystal "Turn-over" head.
- Incorporates the Manual Control position.

THE VERY LATEST MODELS OFFERED

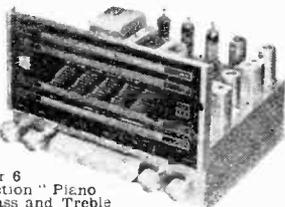


MODERNIZE YOUR OLD RADIOGRAM

The NEW ARMSTRONG PB. 409 A.M./F.M. Radiogram Chassis

"A chassis for those who want the highest quality." ● A 9-valve line up employing the latest MULLARD preferred-type valves. ● Provides complete coverage of the V.H.F./F.M. Transmissions plus the Short, Medium and Long Wavebands. ● Has Push-Pull Output with Negative Feedback for 6 watts peak Output. ● Quick Action "Piano Key" Selectors and separate Bass and Treble Controls. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9 1/2in. x 8in. high. Dial size 11 1/2in. x 5 1/2in.

PRICE **£29.8.0.** Credit £7.7.0 and 9 monthly payments of £2.14.0. (Plus 6/- carr. & ins.) H.P. £14.14.0 and 12 monthly payments of £1.7.3. SEND S.A.E. FOR ILLUSTRATED LEAFLET.

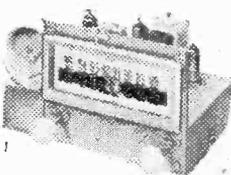


STERN'S "F.M." TUNING UNIT

A 5-valve Tuner incorporating the latest Mullard Permeability Tuning Heart and a "Magic Eye" Tuning Indicator.

PRICE ASSEMBLED **£14.10.0.**

READY FOR USE: (Plus 7/6 carriage and insurance.) TERMS: (a) Hire Purchase: Deposit £7.5.0 and 9 monthly payments of 18/4. (b) Credit: Deposit £3.12.6 and 9 monthly payments of £1.6.7.



HOME CONSTRUCTORS—You can build this unit for **£10.0.0.** Full Assembly Instructions are available for 1/6.

STERN RADIO LIMITED

COMPLETE KITS of PARTS for the "Hi-Fi" ENTHUSIAST

STERN'S REMOTE CONTROL UNIT

Designed in particular for use with the MULLARD 5-10 Main Amplifier. Ideally suited for simple domestic installation as an alternative to the more elaborate Pre-amplifier (shown and described opposite). Tone Control facilities are really excellent and in conjunction with the "5-10" Main Amplifier reproduction is of very high quality. Perfectly suitable for use with all the popular Record Players (B.S.R., Collaro, Garrard) and the modern Radio Tuner Units. Front Panel contains: (a) Coloured Indicator, (b) Separate BASS and TREBLE CONTROLS, (c) 3 position selector Switch, (d) Volume control. Input on back for Radio and Gram, and Gram equalising is incorporated. FULL DATA is contained in the 5-10 MAIN AMPLIFIER MANUAL at 16.



The MULLARD "5-10" MAIN AMPLIFIER

Probably the most popular certainly needs no recommendation from us. Our kit is complete to MULLARD'S specification including the latest ULTRA LINEAR OUTPUT TRANSFORMER and the recommended Mullard Valve line-up. **PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) £9.10.0** or alternatively we supply - FULLY ASSEMBLED and TESTED for £11.10.0 (Plus 5/- carr. & ins.) The ASSEMBLY MANUAL, containing FULL SPECIFICATION is available for 1/6. We also offer the "5-10" incorporating the latest PARTRIDGE ULTRA LINEAR OUTPUT TRANSFORMER for £16.0.0 an extra



STERN'S "fidelity" PRE-AMPLIFIER TONE CONTROL UNIT

"A design for the Music Lover"

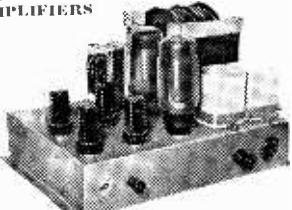
This unit can be used with any Main Amplifier. Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK-UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL, (b) STEPCUT FILTER, (c) Continuously variable BASS and TREBLE CONTROLS, a variable OUTPUT CONTROL which enables its use with any type of Amplifier, and Jack Sockets on Front Panel for TAPE RECORD and TAPE PLAYBACK. Used with the "5-10" the reproduction is comparable to that normally associated only with the very expensive commercially made High Fidelity Amplifiers. **PRICE OF COMPLETE KIT OF PARTS £6.6.0** WE ALSO OFFER IT ASSEMBLED READY FOR USE, £8 (plus 5/- carr. & ins.). The ASSEMBLY MANUAL, contains full specification and is available for 1/6.



BRITAIN'S FINEST "Hi-Fi" AMPLIFIER

THE GENUINE WILLIAMSON

STILL SETS THE STANDARD FOR ALL AMPLIFIERS



Many versions of the Williamson have been offered to the public at various low prices, but the "only Williamson" is the Amplifier built to the designer's specification and employing only the very high grade components, i.e., PARTRIDGE TRANSFORMERS, CHOKES, etc., that he specifies. It is only in doing this that the exceptionally high standard that has made this Amplifier so famous, particularly in America, is obtained. WE HAVE DONE THIS! and we offer these KITS OF PARTS including Partridge and other high grade components as follows:

(a) To build the MAIN AMPLIFIER ONLY (Illustrated above), **£14.10.0**

(b) To build the TWIN POWER SUPPLY UNIT ONLY (insufficient space to illustrate this), **£13.10.0**

(c) COMPLETE KIT to build both above, **£27.0.0** We will also supply both COMPLETELY ASSEMBLED and will be pleased to quote. Credit and H.P. Terms are available. The complete SPECIFICATION and general ASSEMBLY INSTRUCTIONS are available for 3/6.

Our "fidelity" PRE-AMPLIFIER (Illustrated and described above) or alternatively the R.C.A. Pre-amplifier at £16.5.0 is recommended for use with the Williamson.

CALLERS ONLY

We have in stock various designs for HOME CONSTRUCTORS including: F.M. Tuners, A.M./F.M. Tuners, Midset Battery Portable, Mains Units, etc., etc.

(Dept. P.W.)

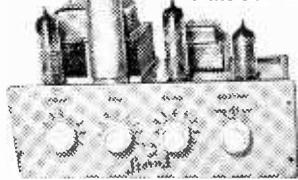
109 & 115 FLEET ST., LONDON, E.C.4.

Telephone: FLEet 5812 3 4.

SPECIAL PRICE REDUCTIONS... WE OFFER YOU...

- Prices are subject to £1.6.0, extra if PARTRIDGE TRANSFORMER is preferred.
- (a) The COMPLETE KIT OF PARTS to build both the MULLARD 5-10 and the REMOTE CONTROL UNIT for..... **£11.11.0**
 - (b) The COMPLETE KIT OF PARTS to build both the MULLARD 5-10 and the Fidelity PRE-AMPLIFIER TONE CONTROL UNIT for..... **£15.15.0**
 - ALTERNATIVELY WE WILL SUPPLY ASSEMBLED and FULLY TESTED, as follows—
 - (a) The MULLARD 5-10 and the REMOTE CONTROL UNIT for..... **£14.0.0**
 - CREDIT SALE TERMS, £3.10.0 Deposit and 9 monthly payments of £15.5. H.P. TERMS, £7 Deposit and 9 monthly payments of 17/9.
 - (b) The MULLARD 5-10 and the "Fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT for..... **£18.18.0**
 - CREDIT SALE TERMS, £4.15.0 Deposit and 9 monthly payments of £14.7. H.P. TERMS, £9.0.0 Deposit and 12 monthly payments of 17/6.
- WHEN ORDERING PLEASE INCLUDE 1/6 to cover cost of Carriage and Insurance.

THE MULLARD "3-3" QUALITY AMPLIFIER



A small compact Amplifier capable of HIGH QUALITY REPRODUCTION on both RADIO and GRAM.

PRICE FOR COMPLETE KIT OF PARTS, £6.19.6 (plus 6/6 carr. & ins.) Alternatively supplied ASSEMBLED and READY FOR USE **£8.12.6** (plus 6/6 carr. & ins.). The Complete SPECIFICATION and ASSEMBLY DIAGRAMS are available for 1/6.

Developed from the very popular 3 valve 3 watt Amplifier designed in the MULLARD LABORATORIES. We strictly adhere to the specification list; in addition we have added switched equalising for L.I.V. and 75 Records and a position for Radio Inputs, plus additional power to feed a Radio Tuning Unit. Extremely simple to assemble and ideally suitable to incorporate with an F.M. Tuner or Record Player in a small installation.

STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER



Has power supply for Radio Tuning Unit

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) £7.10.0 SUPPLIED ASSEMBLED and READY FOR USE **£9.10.0** Proved one of the most popular models yet offered to the HOME CONSTRUCTOR. Provides excellent reproduction up to 8 watts, employing 8V6s in push-pull, incorporating negative feedback. Provides for use of both 3 and 15 ohm speakers.

SPECIAL CASH ONLY OFFER !!

This very attractive PORTABLE AMPLIFIER CASE together with a good quality GRAM AMPLIFIER and a matched 3 1/2" P.M. SPEAKER, ALL FOR **£8.7.6** ONLY (plus 7/6 carr. & ins.).



The Amplifier consists of a 2 Stage design incorporating the modern B.V.A. valves types ECC83, EL81 plus E200 Rectifier and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger, and is attractively finished in Maroon and Grey colour Resine.

WE ALSO SUPPLY SEPARATELY—

- (a) The 2-Stage (plus Rectifier) AMPLIFIER..... **£4.2.6**
- (b) The PORTABLE CARRYING CASE..... **£3.17.6**
- (c) 3 1/2" P.M. SPEAKER..... **16/9**

Carriage and insurance, an extra. We also have a smaller PORTABLE CASE ideal for Record Players. PRICE ONLY **£3.3.0** (plus 3/- carr. & ins.).

SEE THESE FINE BARGAINS AT *The Walk-around Shop*

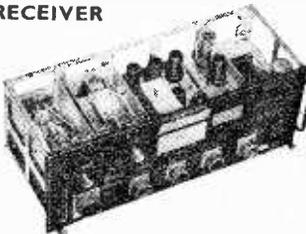
TRANSMITTER/RECEIVER AN/APN.1

Frequency Approx 400-470 Mc/s.

TRANSMITTER. Containing two 955 (VT121) Acorn valves and Moving Coil Transducer

RECEIVER. Containing two 9304 Acorn valves.

A.F. AMPLIFIER. Containing two 125H7 and one 125J7 valves. The above chassis are housed in a Black crackle case which contains three Relays Resistors, Potentiometers, and the following valves : 3-125H7's, 1-125J7, 1-VR150/30, and 2-12H6's making a total of 14 valves in all. Brand New, Priced, 30/-, plus 7/6 carriage.



RECEIVER UNIT Ex 1143A

10.72 Mc/s I.F.s. Frequency 100-120 Mc/s, suitable for conversion to 2 metres and Wrotham. Owing to a large purchase we can offer these units fully valved, with circuit diagram, at 25/- each, plus 3/- post/packing. Valve line-up : (4) EF50, (1) EL32, (2) EF39, (1) EBC33, (1) EA50.

Crystal Microphone Inserts. Suitable for connection directly into pick-up sockets of Radio or Gramophone Amplifier. No transformer required. Very sensitive. Guaranteed. 4/6 each, post paid.

ANTENNA RELAY UNIT

U.S. manufacture, containing change-over relay, 2 1/2 in. panel mounting meter (measuring aerial current) with separate thermo-couple, vacuum condenser 50 pF. 7.5 K.V. Meter movement 2mA basic contained in metal case 3 1/2 x 4 1/2 x 3 1/2 in. with ceramic stand off terminals. 12/6 post paid.

No. 19 SET TRANSMITTER/RECEIVER

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, 870 P/A. This unit incorporates a TX/RX 229 to 241 Mc/s with a local range of one mile. Valve line up :—CV.6, 2-6K7's and 6V6. Also intercom. set two valve AF amplifier 6K7 and 6V6. As New condition and of American manufacture. Fully Valved, £3/5/-, plus 10/- packing and carriage.

38 SET TRANSMITTER/RECEIVER

7.4 to 9 Mc/s. This Walkie Talkie is offered complete with throat microphone, headphones and collapsible aerial. Fully valved with 4 VP23 and 1 ATP4. Including leads and canvas carrying bag. Brand New 65/-, plus 5/- p. & p.

SIGNAL GENERATOR AND WAVEMETER

Type W.1649. Frequency of signal generator : 140 to 240 Mc/s. Accuracy ± 0.5 Mc/s. Frequency of Heterodyne Wavemeter : 155 to 255 Mc/s. Accuracy ± 0.2 Mc/s. Containing VR135 and 4-VR91. 5 meg. crystal. Retractable aerial. Power requirements : 6.3 volts and 120 volts. Unit housed in copper lined wooden case. Size : 15 1/2 in. x 13 in. x 14 1/2 in. In good condition. £2.10.0, plus 10/- packing and carriage.

ELECTRIC TIME SWITCHES

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. in diameter. Price 12/6 post paid.

PROOPS Bros. Ltd. Dept. P, 52 Tottenham Court Road, London, W.1. LAngham 0141. Hours 9-6 p.m. Thursday to 1 p.m. Open all day Saturday.

data for AUDIOPHILES

EF86 ECC83

EL34 GZ34

EL84 EZ81

Audiophiles all over the world are demanding Mullard audio valves for their high quality sound equipment. And who can blame them when they know that the Mullard World Series of Audio Valves is the finest in the world. Fill in the coupon below for free data on Mullard World Series Audio Valves.

* *Audiophile - Enthusiast for high quality sound reproduction who is satisfied with nothing but the best.*

This popular book is available now from most dealers, price 3 6d. It contains designs and full constructional details of the new Mullard EL34 High Quality 20 Watt Amplifier, a Mullard Band II F.M. Tuner, pre-amplifiers for the Mullard EL34 Amplifier and for the popular Mullard 5 Valve 10 Watt Amplifier, together with other useful technical information.



Mullard
WORLD SERIES
AUDIO VALVES



Mullard Ltd., Publicity Division, Mullard House, Torrington Place, London, W.C.1.

COUPON

To Mullard Ltd., Publicity Division
Please send me, free of charge, leaflets on the Mullard World Series of Audio Valves, and details of "High Quality Sound Reproduction".

NAME

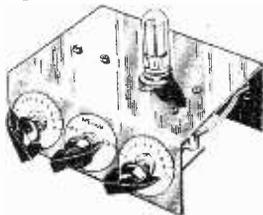
ADDRESS

HOME RADIO OF MITCHAM

187 LONDON ROAD, MITCHAM, SURREY.

MIT 3282

Exciting Gift for Any Boy or Girl



R.E.P. 1 valve all-dry battery set, gives excellent results. Complete kit of parts, including valve, only 33/6. Combined H.T. and L.T. battery, 8/3. Head-phones, 14/-. Full constructional details and price list, price 9d.

Loudspeakers for Transistor Sets

Now in stock, the new WB Stentorian mini-speakers. Ideal for personal sets. S.175. Diameter 1 1/2 in., depth 1 in., 3 ohms, 26/9. S.2X3. Elliptical 2 1/2 in. x 1 1/2 in. Depth 1 1/2 in., 3 ohms, 32/-. Full range of REPANCO transistor components in stock, also kits for THREE DEE and TRANSEVEN. details on request.

W.B. STENTORIAN HF1012



The most popular Hi-Fi speaker on the market to-day. Top quality at realistic cost. 10 in. diecast unit with 12,000 gauss magnet. Response 30 to 14,000 cps. 10 watts handling. Universal speech coil for 3, 7 and 15 ohms.

PRICE £4-19-9 (Plus 2/- post)

We also carry a comprehensive range of WHARFEDALE and GOODMANS Hi-Fi speakers and tweeters, and cross-overs. The amazing LORENZ LPH65 tweeter brings life and realism to your reproduction. Only 39/6 with instructions. Easily connected to your existing speaker through 2 mfd. condenser, 3/-.

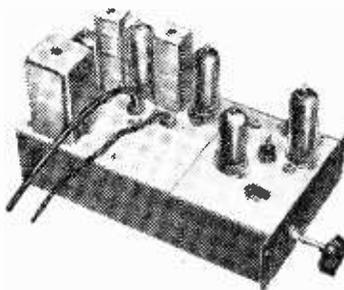
THIS MONTH'S BARGAINS

New ELAC miniature output transformers for mains pentode, 4/-, plus 9d. post.
Single screened microphone cable. Black P.V.C. covered, 6d. yard, plus 1/- post.
S.130P voltage stabilizers. New in boxes, 3/- each, plus 9d. post.
New Franklin multiratio output transformers, individually boxed, 5/-, plus 1/- post.
7 in. x 4 in. elliptical speakers, 3 ohms ELAC, 15/-, plus 2/- post.
1,200 ft. P.V.C. recording tape. New and boxed. 20/-, plus 1/4 post.

GREAT NEWS FOR ALL CONSTRUCTORS

The "Universal" chassis comprises pairs of drilled aluminium channel sections which enable the user to construct a large variety of chassis, vision strips, screened boxes, etc. Send S.A.E. for descriptive leaflet giving sizes, prices and full details. **DO NOT MISS THIS!**

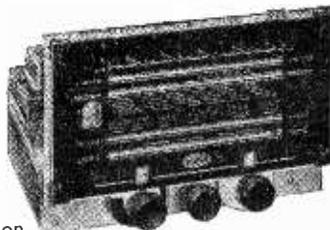
A new JASON F.M. TUNER—THE MERCURY



AM/FM Tuner chassis with own power supply. Designed for highest quality reproduction. Built to highest technical standards. Full Specification on request. PRICE £20-17-0. We also carry the other DULCI tuner, receiver and amplifier chassis and the ARMSTRONG PB409 and AF105. Call for demonstration.

F.M. at its simplest and best. The programme you want at the turn of a switch. Automatic frequency control prevents drifting and the Foster-Seeley discriminator gives top quality. Enjoy crystal clear Hi-Fi reception at all times. Full data and price list 2/-. All parts available separately. Complete kit £10-0-0.

DULCI MODEL H4T



THE HIWAYMAN ALL-DRY PORTABLE



A well-trying portable, using high efficiency ferrite rod aerial. 2 waveband. 4 valves. Build it during the dark evenings ready for the spring. Full constructional data and price list 1/6. Total building cost £7-10-0.

W.B. STENTORIAN CABINETS



A full range of beautifully-finished cabinets for housing record players, tuners, and amplifiers. PRICES FROM 12 gns. Bass reflex and corner speaker cabinets from 9 gns. Send 3d. stamp for illustrated leaflet, including the new "Prelude" contemporary models. These cabinets are packed flat in cartons and can be quickly and easily assembled using only

a screwdriver. Despatch by return to anywhere in U.K., carriage charge 5/-.

We are stockists for : EDDYSTONE receivers and components, PANDA transmitters, including the CUB and EXPLORER. Also the PANDA G4ZU MINIBEAM.

R.S.C. BATTERY CHARGING EQUIPMENT

ASSEMBLED CHARGERS
 5v. 1 amp. 19/9
 5v. or 12 v. 1 amp. 27/9
 6v. 2 amps. 28/9
 6v. or 12 v. 2 amps. 38/9
 5v. or 12 v. 4 amps. 59/9
 Above ready for use. Carr. 3/6. With mains and output leads.

SELENIUM RECTIFIERS
F.W. BRIDGE TYPES
 612 v. 1 a. 411 L.T. Types H.A.V. 19/9
 612 v. 2 a. 89 2-6 v. 1 a. 111 22/9
 612 v. 3 a. 119 6-12 v. 1 a. H.W. 2/2 22/9
 612 v. 4 a. 149 H.T. Types H.A.V. 22/9
 612 v. 6 a. 19/9 150 v. 50 mA. 3/9
 612 v. 10 a. 25/9 250 v. 50 mA. 5/9
 612 v. 15 a. 35/9 250 v. 80 mA. 7/8
 250 v. 250 mA. 11/6

BATTERY CHARGER KITS
 Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse holders, Grommets, panels and circuit. Carr. 2/9 extra.
 6 v. or 12 v. 1 amp. 22/9
 6 v. or 12 v. 2 amps. 25/9
 6 v. or 12 v. 4 amps. 31/8
 6 v. or 12 v. 4 amps. 53/9

BATTERY CHARGER KIT
 Consisting of F.W. Bridge Rectifier, 612 v. 5 a. Mains Trans., 0-9-15 v. 6 a. output and Ammeter, 49/9. Post 3/-

ASSEMBLED CHARGER
 6 v. or 12 v. 2 amps.
 Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused. Only Carr. 3/9. **47/9**

All for A.C. Mains 200-250 v., 50 c/c.s. Guaranteed 12 months.



Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finish. Fused and ready for use with mains and output leads. Carr. 3/9. **75/-**

R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

Interleaved and Impregnated. Primaries 200-250 v. 50 c/c.s. Screened.
TOP SHROUDED DROP THROUGH
 250-0-250 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a. 16/9
 350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a. 19/9
 200-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 22/9
 300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 22/9
 350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 22/9
 350-0-350 v. 100 mA. 6.3 v. 4 v. 4 a. C.T. 0-4-5 v. 3 a. 23/9
 350-0-350 v. 50 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9

FULLY SHROUDED UPRIGHT
 250-0-250 v. 90 mA. 6.3 v. 2 a. 5 v. 2 a. Midjet type 21-3-in. 17/6
 250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9
 250-0-250 v. 100 mA. 6.3 v. 6 a. 5 v. 3 a. For R1355 conversion 31/-
 300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9
 350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. 23/9
 300-0-300 v. 130 mA. 6.3 v. 4 a. 6.3 v. 1 a. For Mullard 510 Amplifier 35/9
 350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. 33/9
 350-0-350 v. 150 mA. 6.3 v. 2 a. 6.3 v. 2 a. 5 v. 3 a. 35/9
 425-0-425 v. 200 mA. 6.3 v. 4 a. C.T. 6.3 v. 4 a. C.T. 5 v. 3 a. Suitable Williamson Amplifier, etc. 49/9

FLAT-LEAF TRANSFORMERS
 All with 200-250 v. 50 c/c.s. primaries 6.3 v. 15 a. 5/9, 6.3 v. 2 a. 7/6, 0-4-6.3 v. 2 a. 7/6 12 v. 1 a. 7/11, 6.3 v. 3 a. 8/11, 6.3 v. 6 a. 17/8, 12 v. 3 a. or 21 v. 1.5 a. 17/6.

JUNCTION TRANSFORMERS. Red Spot Audio Type only 7/6 each. R.F. Type 17/6.
VOLUME CONTROLS with long (1/2 in. diam.) spindle all values less switch, 2/9; with S.P. switch, 3/9; with D.P. switch, 4/9.

I.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v. A.C. Output 120 v. 40 mA. Fully smoothed and rectified supply, to charge 2v. accumulator. Price with louvred metal case and circuit, 29/8, or ready for use, 8/9 extra.

ELIMINATOR TRANSFORMERS
 Primaries 200-250 v. 50 c/c.s.
 50 v. 15 mA. 4/9-4/5, 500 mA. 15/9

CHARGER TRANSFORMERS
 All with 200-230-250 v. 50 c/c.s. Primaries:
 0-9-15 v. 11 a. 11/9; 0-9-15 v. 3 a. 16/9;
 0-3-5-9-17 v. 3 a. 17/9; 0-9-15 v. 5 a. 19/9;
 0-9-15 v. 6 a. 23/9.

SMOOTHING CHOKES
 250 mA, 5 H 100 ohms 12/9
 150 mA, 7-10 H 250 ohms 11/9
 100 mA, 100 H 200 ohms 8/9
 80 mA, 10 H 350 ohms 5/9
 60 mA, 10 H 400 ohms 4/11

OUTPUT TRANSFORMERS
 Midjet Battery Pentode 6E1 for 354, etc. 3/9
 Small Pentode, 5,000Ω to 3Ω 3/9
 Small Pentode 7/8,000Ω to 3Ω 3/9
 Standard Pentode 5,000Ω to 3Ω 4/9
 Standard Pentode 7/8,000Ω to 3Ω 4/9
 10,000 Ω to 3Ω 4/9
 Push-Pull 10-12 watts 6V6 to 3U or 15U 15/9
 Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15U 16/9
 Push-Pull EL84 to 3 or 15U 16/9
 Push-Pull 15-18 watts, 6L6, KT66 22/9
 Push-Pull 20 watts, sectionally wound 6L6, KT66, etc. to 3 or 15U 47/9

MAINS TRANSFORMERS
 Manufacturers' surplus. Primaries 200-250 v. 50 c/c.s. 250-0-250 v. 70 mA. 6.3 v. 2.5 a. v. 50 c/c.s. 250-0-250 v. 89. 0-6-0-375 v. 150 mA. 6.3 v. 4 a. C.T. 6.3 v. 1 a. Fully shrouded, 22/9. Postage 2/9 on either type.

SPECIAL OFFERS: Electrolytics, 32-32-2 mfd. 50 v. D. Dubilier small can, 2/9 ea. 150 mfd. 450 v. 8/9. Small .0005 mfd. 2-gang, 4/9 ea. Westinghouse Rectifiers 250 v. 250 mA. 7/9. CO-AXIAL CABLE, 75 ohm. 1/2 in. 8d. yd. Twin-Screened Feeder 110 yd.

EX-GOVT. SMOOTHING CHOKES
 360 mA. 21 H 200 ohms 19/9
 230 mA. 5 H 50 ohms 12/9
 150 mA. 10 H 100 ohms 11/9
 150 mA. 6-10 H 150 ohms Trop. 8/9
 120 mA. 12 H 100 ohms 9/9
 100 mA. 5 H 100 ohms 3/11
 80 mA. 10 H 150 ohms 3/11

EX-GOVT. E.H.T. SMOOTHING CONDENSERS. 102 mfd. 5,000 v. Cans. 2/9. 1 mfd. 2,500 v. Bakelite Tubulars, 3/3.

THE SKYFOUR T.R.F. RECEIVER.
 A design of a 3-valve Long and Medium wave 250-250 v. A.C. Mains receiver with selenium rectifier. It consists of a variable Mu high-gain H.F. stage followed by a low distortion audio band detector. Power pentode output is used. Valve line-up being 6X7, 6X4, 6X2. Selectivity and quality are well up to standard and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions and parts lists, 1/9. This receiver can be built for a maximum of £4 19/6, including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2 in.

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMERS. 0-0-100-200-220-240 v. to 5-0-75-115-135 v. or REVERSE. 80-100 watts. Only 11/9, plus 2/9 post. 10-0-100-200-220-240 v. to 0-0-110-122-136-148 v. or REVERSE. 200 watts, 35/9, plus 7/6 carr. Both 50 c.p.s.

EX-GOVT. MAINS TRANSFORMER. Primary 0-110-120-200-210-220-230-240-250 v. 50 c.p.s. Secs. 275-0-275 v. 100 mA. 6.3 v. 7 a. 9 v. 3 a. Govt. rating 18 v. Following with 230-250 v. primaries, 400-0-400 v. 200 mA, 5 v. 3 a. 5 v. 2 a. 19/9; 230-0-230 v. 100 mA, 12.6 v. 1.5 a. 5 v. 2 a. 11/9; 12.6 v. 3 a. 5 v. 3 a. 9/9. Postage 2/9 on any type.

EX-GOVT. CASES. Size 14-10-8-in. high. Well ventilated. Black crackle finished, undrilled cover. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE. OR COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 postage. Size 8 1/2 x 13 1/2 x 6 1/2 ins. with undrilled well ventilated cover, finished in stoved grey enamel. Suitable for charger or instrument case, 7/9, plus 2/9 post.

EX-GOVT. VALVES (NEW)

1T4	7/9	6V6G	7/9	E891	4/9
1S5	7/9	6X4	6/9	EF91	8/9
354	8/9	6X5GT	8/9	EF36	4/9
5Y3G	8/9	6L6G	11/9	EL32	3/9
5U4G	8/9	807	2/9	ET4	5/9
5Z4G	9/9	12A6	2/9	KT44	8/9
6KT7	5/9	15D2	4/9	EZ90	6/9
6S7GT	6/9	35Z4GT	9/9	EL84	10/6
6SL6GT	8/9	MH4	4/9	FW4 500	9/9
6SN7GT	8/9	ECC83	4/9	FW4 500	9/9
6AT6	7/9	ECC91	4/9	SP61	2/9
6J6	4/9	EP80	7/9	35Z4	8/9

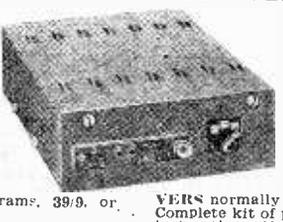
ELECTROLYTICS (current production) NOT EX-GOVT.

Tubular Types		Can Types	
8μF 450 v.	1/9	16 mfd. 350 v.	1 11
8 mfd. 500 v.	2/8	16 mfd. 500 v.	2/9
16μF 350 v.	2/3	16μF 450 v.	2/9
16μF 500 v.	2/9	32μF 350 v.	2 11
32μF 500 v.	3/9	32 mfd. 450 v.	4/9
32μF 350 v.	3/9	100 mfd. 450 v.	4/9
25μF 25 v.	1/3	8-8μF 450 v.	2/9
50μF 12 v.	1/3	8-16μF 450 v.	3 11
50 mfd. 25 v.	1/3	16-16μF 450 v.	4 11
50μF 50 v.	1/9	32-32μF 350 v.	4/9
100 mfd. 12 v. 1/9		32-32μF 450 v.	5/9
100 mfd. 25 v. 2/9		100-100 mfd. 350v. 4/9	
1,500 mfd. 6 v. 1/6		64-120 mfd. 350v. 7/9	
3,000 mfd. 6 v. 3/9		100-200 mfd.	
6,000 mfd. 6 v. 3/9		275 v.	6/9

Many others in stock.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 8 1/2 x 4 1/2 in. approx. Completely replaces hottricks supplying 1.1 v. and 90 v. where A.C. mains 200-250 v. 50 c/c.s. is available. Suitable for all battery portable receivers requiring 1.1 v. and 90 v. This includes latest low consumption types. Complete kit with diagrams, 39/9, or ready to use, 46/9.



Type BM2. Size 8 x 5 1/2 x 2 1/2 in. Supplies 120 v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 at 1 amp. and 2 v. 0.4 at 1 amp. Fully smoothed. The fully smoothed. The replacing both I.T. batteries and I.T. v. accumulators. When connected to A.C. mains supply 200-250 v. 50 c/c.s. **SUITABLE FOR ALL BATTERY RECEIVERS normally using 2 v. accumulator.** Complete kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

MINIATURE MOTORS. 21 28 v. D.C. or A.C. made by Hoyer Ltd., Canada. Size only 2 1/2 x 1 in. Spindle 1 1/2 in. long, 1/16 in. diam. Brand New. 9/9.

HEADPHONES. Brand new. Low resistance, 7.9 pr. High Resistance, 15/9 pr.

EX-GOVT. 50 WATT SPEECH AMPLIFIERS. For normal 200-250 v. A.C. mains. Complete with hand 'mike' with good length of lead and all valves. Ready for use in wood transit cases. Only 9/9 ea., carr. 15/-

TANNOY RE-ENTRANT 8 WATT SPEAKERS. For use with above, 27/6 ea.

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet. 8 in. 2-3 ohms, 35/9. Very limited number.



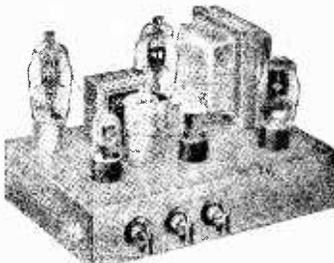
EX-GOVT. METAL BLOCK (PAPER) CONDENSERS.
 4 mfd. 350 v. 2/9; 4 mfd. 1,000 v. 4/9; 8 mfd. 500 v. 4/9; 10 mfd. 500 v. 3/9;

R.S.C. A8 ULTRA LINEAR 12 WATT AMPLIFIER

High-Fidelity Push-Pull Amplifier with "Built-in" Tone Control. Pre-amp stages, High sensitivity. Includes 3 valves (637 outputs). High quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut" Frequency response 3 db., 30-30,000 c.s. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs.

For STANDARD or LONG-PLAYING RECORDS. For MUSICAL INSTRUMENTS such as STRING BASS, GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 20 mA. and 6.3 v. 1.5 a. For supply of a RADIO FEEDBACK KIT. Size Cutout: 2-5/16" For A.C. mains 200-250 v. 50 c.c.s. Output for 8 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unassembled Carriage 10. If required louvred metal cover with 2

£7-15-0



carrying handles can be supplied for 18.9. Additional input socket with associate Vol. control so that two different inputs such as Gram and "Mike" or Tape and Radio can be mixed. can be provided for 13. extra. Guaranteed 12 months. TERMS as assembled two input model: DEPOSIT 25.6 and nine monthly payments 23.4. HIGH-FIDELITY MICROPHONES and SPEAKERS in stock. Keep cash prices or I.L.T. terms if supplied with amplifier.

R.S.C. 4.5 WATT A5 HIGH-GAIN AMPLIFIER

A highly-sensitive 4-valve quality amplifier for the home, small club, etc. only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads. In addition to all other types of pick-ups and practically all "mikes". Separate Bass and Treble Controls are provided. These give full long-playing tone equalisation. Hum level is negligible being 71 db. down. 15 db. of negative feedback is used. I.T. of 300 v. 25 mA. and I.T. of 6.3 v. 1.5 a. Feeder Unit, or Tape Deck pre-amplifier. For A.C. mains input of 200-250 v. 50 c.c.s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue Hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15. or assembled ready for use 25. extra, plus 3/6 carr. or Deposit 22.6 and 5 monthly payments of 20.6 for assembled unit.



R.S.C. TA1 HIGH QUALITY TAPE DECK AMPLIFIER. For Tape Decks with High or Low Impedance. Ready for use. ONLY 11 GNS. For A.C. Mains 200-250 v. 50 c.c.s. Carr. 7.6. Positive compensated identification for recording level by Magi Eye. Recording facilities for 15, 7 1/2 or 3 1/2 in. per sec. Automatic equalisation at the turn of a knob. Linear Frequency response of 3 db. 50-11,000 c.s. Negative feedback equalisation. Minimum microphony and hum. High output with completely effective erasure and distortionless reproduction. Sensitivity is 15 millivolts so that any kind of crystal microphone is suitable. Only 2 millivolts input required from Recording head. Provision is made for feeding a P.A. amplifier. Illustrated leaflet 6d. Special price can be quoted for Amplifier and a Deck. When ordering please state make of Deck to be used.

Terms: C.W.O. or C.O.D. NO C.O.D. under £1. Post 1/6 extra under £2. 2/6 extra under £5. All goods supplied subject to terms and guarantee as detailed in current catalogue. Open 9 to 5.30; Sat. until 1 p.m. Catalogue 6d. Trade list 5d. S.A.E. with all enquiries

R.S.C. 30 WATT ULTRA LINEAR HIGH-FIDELITY AMPLIFIER A10

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response - 3 db. 30-30,000 c.s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used. EF86, EF88, EC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE. The unit is designed for CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS, etc. For standard or long playing records. OUTPUT SOCKET PROVIDES I.T. and H.T. for a RADIO FEEDER UNIT. An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" can be mixed. Amplifier operates on 200-250 v. 50 c.c.s. A.C. Mains and has outputs for 8 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 18.9. The Carr. 10/- amplifier can be supplied, factory built with 12 months guarantee, for £12.15/6. TERMS: DEPOSIT 35.9 and 9 monthly payments of 28.11.

10 GNS.

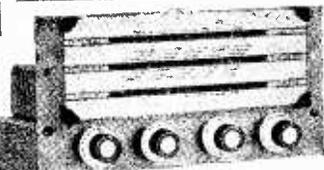
R.C.A. 20 WATT RE-ENTRANT SPEAKERS. 15 ohms or 600 ohms matching. For outdoor work. Only 8 GNS. O.E.M. SPEAKERS. All 2-3 ohms, suitable for use with LG3, L45, A5, or A7 amplifiers. 5in. Goodmans, 17.9. 7 x 4in. Elliptical Elm., 18.9. 6in. Goodmans, 17.9. 8 in. Rola, 19.9. 10in. Goodmans, 27.9. 10 x 6in. Elliptical Goodmans, 27.9. 12in. Plessey, 29.3. 10in. W.B. Stenorian, 28 or 15 ohms type HF1012 10 watts. High-fidelity type. Recommended for use with our A8 Amplifier. £4.10. 12in. Plessey 3 ohms 10 watts. (12,000 lines), 59.6.

PLESSEY DUAL CONCENTRIC 12in. 15 ohm HIGH FIDELITY SPEAKER with built-in tweeter, completely separate elliptical speaker with choke, condensers, etc.), providing extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rated 10 watts. Price complete, only £5/17/6.

M.E. SPEAKERS 2-3 ohms, 8in. R.A. Field, 600 ohms 11.9.

R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 230-250 v. 50 c.c.s. Mains input. Appearance and Specification, with exception of output wattage, as A5. Complete kit with Diagrams. 25 15/- Assembled 22.6 extra. Carr. 3.6.



AM/FM RADIOGRAM CHASSIS HIGH QUALITY 6.3 WATT PUSH-PULL OUTPUT

For 200-250 v. Mains. Long wave, Medium, I.M. and Gram. Complete with 8 B.V.A. valves. Guaranteed 12 months. Only 22 GNS. Or Deposit £2.12. and 9 monthly payments of £2.12.-

COLLARO RC54 3-SPEED AUTOCLEANERS with Studio Pick-up. Brand new. For 110 v. 50 c.c.s. A.C. mains. Price with 110 v. to 200-250 v. Auto Trans. only 7 Gns. Carr. 5.6.

COLLARO RC 457 4-SPEED AUTOCLEANERS with high fidelity Studio Pick-up. Latest model. Brand new. For 200-250 v. 50 c.c.s. A.C. mains. Our price £29.16. Carr. 5.6. Credit Terms. Deposit 3 gns. and 6 monthly payments of 21.6.

COLLARO JUNIOR 4 SPEED SINGLE PLAYER, with separate pick-up, as fitted to RC457. For 200-250 v. A.C. mains. £4.12.6.

LAG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.c.s. A.C. mains. Overall size 4 1/4 x 4 1/4 in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 49.9.

PORTABLE CABINETS. Exceptionally attractive appearance. Take any amplifier and/or 4 speed auto-change or single player. 5/6. Carr. 4.6.

SUPERHETERODYNE Design of a high quality Radio Tuner Unit, specially suitable for use with any of our Amplifiers. Delayed A.V.C. employed. The Controls are Tuning, W.Ch. and Vol. Only 250 v. 15 mA. H.T. and I.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-7/16 in. high. Simple alignment procedure. Point-to-point wiring diagrams, instruction and priced parts list with illustration. 2.6. Total building cost, £4.15.-. For descriptive leaflet send S.A.E.

LINEAR L45 MINIATURE 4.5 WATT QUALITY AMPLIFIER. Suitable for use with Collaro, B.S.H. or any other record-playing unit, and most microphones. Negative feedback 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c.c.s. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5/16 in. high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only 25 19.6. Send S.A.E. for illustrated leaflet. Credit Terms. Deposit 22.6 and 5 monthly payments of 22.6.

LINEAR DIATONIC 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-250 v. 50 c.c.s. A.C. mains. Valve line-up EC83B, EC83B, EL84, EL84, EZ81 miniature Mullard. The unit has self-contained Pre-amplifier, Tone Control stages, independent "Mike" and Gram input sockets are provided. Size is only 9-7/16 in. Output Matches for 3 and 15 ohm speakers. Only 12 GNS. 5 or Deposit 26.9 plus 10 c.c.s. and 8 monthly payments of 26.9. Send S.A.E. for leaflet.

RADIO SUPPLY CO. 32, THE CALLS, LEEDS, 2



Either side—LP or standard—of an Acos 65 turnover cartridge is a strong side.

And the whole 65 Series makes strictly a first-division team. Type 65-1 plays

with finesse and style on hi-fi form right up to 12 kc/s (yet he is no weakling*).

Type 65-3 gives a powerful kick* (but a pretty performance, as well). All have

× 500 styli in slip-in fittings, and they play in league with practically every well-known

make of gramophone. Forward fellows, these Acos 65.

* Outputs : Type 65-1, 0.15 V ; Type 65-3, 1.0 V, at 1 cm/sec velocity, 1,000 c/s

acos ARE DOING THINGS IN STYLI

COSMOCORD LTD WALTHAM CROSS HERTS · TEL: WALTHAM CROSS 5206 (London subscribers please dial WA 4 5206)

PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXIII, No. 613, JANUARY 1958
COMMENTS OF THE MONTH

EDITOR : F. J. CAMM

25th YEAR
OF ISSUE

BY THE EDITOR

“What Shall We Do With The BBC?”

THE Publicity Department of Transport House recently issued a statement to the Press under the above heading, which is presumably to be interpreted as “what we shall do with the BBC”! Mr. Anthony Wedgwood Benn, M.P., thinks that radio and television services should be run by four public corporations, and if this new set-up is to succeed every one of these four corporations must receive a share of the licence fee.

He further suggests that these four public corporations should be (1) the BBC, which will broadcast two basic national programmes in sound only, rather like the Home Service and the Third Programme; plus all overseas broadcasting as at present. (2) The “Independent Broadcasting Authority” (IBA), which would take over the Light Programme as a second competitive national programme. “It would also be responsible for a technical co-operation with the regions,” he says. (3) BBC television would be hived off as the “British Television Corporation” (BTC). “This would broadcast one or more national programmes. . . .” (4) The existing Independent Television Authority would be strengthened and given the right to produce its own programmes. Mr. Benn further suggests that school broadcasting ought certainly to be borne on the Ministry of Education vote and that overseas broadcasting should be paid for by the Foreign Office. Thus, we should have the BBC, ITV, IBA, BTC. The BBC is certainly not short of critics and one would have thought that it could have rectified those things in need of improvement within its own organisation, without the aid of members of parliament whose minds should be occupied with more important subjects, and there are plenty of them! The internecine conflict and sniping which would go on if four bodies controlled broadcasting and television can easily be imagined. One can, of course, see the political drift of Benn’s remarks. We think that sound and vision programmes should be independent of any political influence whatsoever. Only chaos can follow if each party had its own ideas as to how these services should be run. There would be no stability about the programmes, for each party would repeal its predecessor’s efforts. Mr. Benn is one of those political schemer-dreamers whose ideas are nearly always wide of the beam.

“PRACTICAL HOME MONEY MAKER”

OUR new companion monthly magazine, *Practical Home Money Maker*, was an immediate success and a very large print order for the first issue was rapidly absorbed by the public. It is evident from correspondence that a journal to co-ordinate the spare-time activities of the nation and of the industry which supports them was needed. The journal appeals to women as well as to men, to young as well as to old. In fact, to all those who have time on their hands which they wish to employ and enjoy profitably. It costs 1s. 3d. every month.—F. J. C.

Our next issue, dated February, will be published on January 7th.

Editorial and Advertisement Offices :
PRACTICAL WIRELESS

George Newnes, Ltd., Tower House,
Southampton Street, Strand, W.C.2.

(C) George Newnes Ltd., 1958.

Phone : Temple Bar 4363.
Telegrams : Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

SUBSCRIPTION RATES

including postage for one year

Inland - - - 19s. per annum.
Abroad - - 17s. 6d. per annum.
Canada - - - 16s. per annum.

CONTENTS :

	Page
Editorial	761
Round the World of Wireless	762
Beginners Superhet	764
Square Wave Generator	767
On Your Wavelength	773
Observe the Satellite	774
Mullard Observatory	777
Microphone Amplifier	781
Choke and Transformer	
Winding	783
A C.R.L. Bridge	785
Beginner's Constructional	
Course	790
Transistors in Practice	797
Transmitting Topics	802
Open to Discussion	809
Trade News	813
Programme Pointers	817

The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them in a stamped and addressed envelope if enclosed. All correspondence intended for the Editor should be addressed: The Editor PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Copyright in all drawings, photographs and articles published in PRACTICAL WIRELESS is specifically reserved throughout the country's signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden. PRACTICAL WIRELESS incorporates "Amateur Wireless."

Round the World of Wireless



Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of September, 1957, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include licences issued to blind persons without payment.

Region	Total
London Postal	1,129,016
Home Counties	1,142,275
Midland	860,937
North Eastern	1,129,324
North Western	831,362
South Western	716,729
Wales and Border Counties	452,965
Total England and Wales	6,262,608
Scotland	816,714
Northern Ireland	189,934
Grand Total	7,269,256

B.I.C.C. Unit Radio Masts in the Far North

THE Norwegian Telegraph Service Radio Station at Isfjord, on the coast of West Spitzbergen, Svalbard, is the most northerly coast service station in the world. It is well within the Arctic Circle, having a latitude of 78° 3' 45" North.

Four B.I.C.C. unit radio masts, each 120ft. high, support the station's aerial. These galvanised steel masts, designed and supplied by British Insulated Callender's Construction Co. Ltd., and fabricated by their associated company, Painter Bros. Ltd., are of triangular formation with tubular corner members and welded rod bracings. Built to an extremely economical design, these masts are much in demand wherever inexpensive, light, transportable, easily erected aerial structures are required, and are at present in use in more than 25 different countries.

Ideal Home Exhibition

THE Daily Mail Ideal Home Exhibition of 1958 will be held at Olympia from March 4 to March 29.

The Exhibition was founded in 1908, so next March is its Golden Jubilee.

By "QUESTOR"

Radio Show, 1958

THE Radio Industry Council announces that the 25th National Radio and Television Exhibition will be held at Earls Court, London, from Wednesday, August 27th, to Saturday, September 6th, with a pre-view on Tuesday, August 26th.

New British Standard

A NEW standard on improved testing techniques and a re-grouping of "types" are the main features in this revision of the standard for ebonite which was first published 15 years ago.

B.S. 234 deals with ebonite in the form of sheets, rods, tubes and mouldings suitable for electrical purposes and composed substantially of good quality natural rubber and sulphur, with or without the addition of suitable compounding ingredients.

The more significant alterations to the 1942 edition are that the ebonite is now classified in three types, grouped according to their chemical loading.

TV and Radio Sales

RETAIL sales of radio receivers, radiograms and television receivers all showed substantial increases during the first nine months of the year, as

compared with the same period last year, according to the monthly retail survey published recently by the British Radio Equipment Manufacturers' Association.

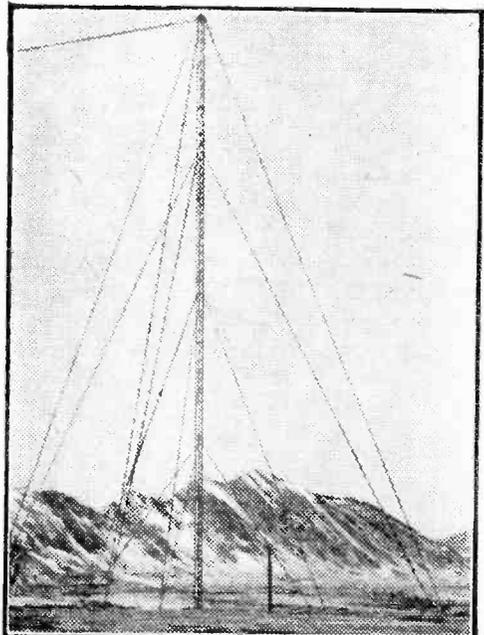
Television receiver sales were greater by 10 per cent., radiogram sales by 30 per cent. and radio receiver sales by 22 per cent.

The sales of radiograms, 21,000, were 24 per cent. above those of both the previous month and of September, 1956. In the third quarter the sales were 19 per cent. higher than those in the third quarter of 1956.

For radio receivers, the sales in September at 105,000 were four per cent. below those of August, but 22 per cent. above those of September, 1956. In the third quarter sales were 27 per cent. above those in the same quarter of 1956.

The Radio Trades Examination Board

THE Radio Trades Examination Board has been



One of the B.I.C.C. masts referred to in the first column.

granted a licence by the London County Council for the operation of an Appointments Service.

This service, which will be free to employers and employees, will be limited to holders of the Board's Radio or Television Servicing Certificate.

Over 2,500 candidates have now passed the Board's examinations and employers in industry and trade have shown interest in wishing to interview these candidates.

Further information regarding the Appointments Service may be obtained from: The Secretary, The Radio Trades Examination Board, 9, Bedford Square, London, W.C.1.

Less Electricity in the Air

ACCORDING to a director of the Magnetic Observatory on Manhay, at the University of Liege, in Belgium, the air one meter above the ground has been found to have a potential of 15 volts, whereas in the past it had a potential of 100 volts relative to ground. This points to an increase in ionization which could lead to a new kind of radio blackout. It could also result in a reduction of the discharges during a thunderstorm and lightning terrors would tend to disappear. There is some doubt as to whether this change is natural or the result of the injection of radioactive material into the atmosphere.

£75,000 Export Order

THE Selectogram, which made its debut at the Radio Show, is the new way of keeping gramophone records.

It enables one to find any one of a hundred gramophone records in seconds and to keep them all in good condition permanently. An American buyer passing through London on his way back to the U.S.A. saw a sample, and as a result placed an order worth £75,000.

British Transmitters for Khartoum

AN important order for high-frequency radio telecommunications equipment to a value of nearly £50,000 has been awarded to Marconi's by the Sudan Posts and Telegraphs Department for the Khartoum

Communications Centre. The new installations, when completed, will represent a major step forward in the modernisation of Sudan's communications system, providing a greatly expanded and extended service.

With the new Marconi transmitters, direct communication will be possible with the capital cities of Europe and many important centres in Africa and Asia.

The order includes three 3½kW H.F. Transmitters Type HS31 with their associated drive, keying and monitoring equipments, and a 30kW linear amplifier. Special switch-gear will permit the amplifier to be used with any of the transmitters. Six receivers will be supplied, two for independent-sideband operation, two for single-sideband operation and two double-diversity telegraph receivers, one of which will be adapted for frequency shift Diplex signals.

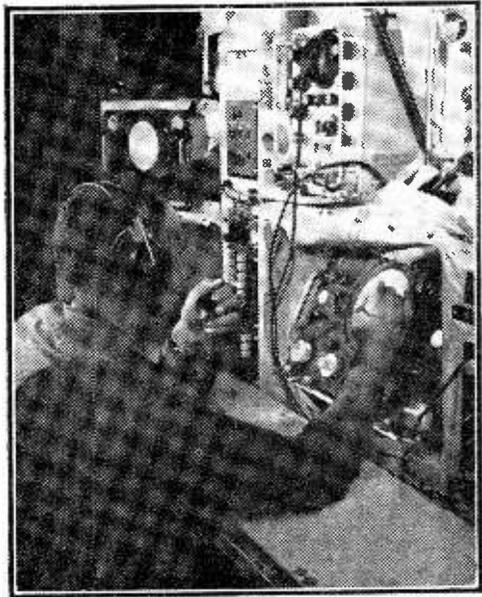
B.I.R.E. Meetings

THE following institution meetings will take place during December, 1957:—

London: At the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1. Wednesday, December 18th, at 6.30 p.m. Recent Developments in Electronic Instrument Design—a paper by E. Garthwaite, M.B.E., and A. G. Wray, M.A., A.M.Brit.I.R.E.

North Eastern Section: At the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle-upon-Tyne, Wednesday, December 11th, at 6 p.m. Stereophonic Sound and Tape Recorders—a paper by D. H. McBean.

North Western Section: At the Reynolds Hall, College of Technology, Sackville Street, Manchester 1, Thursday, December 12th, at 6.30 p.m. Process Heating—a paper by M.O.C Horgan, O.B.E., T.D., M.Sc.



Here is the heart of the radar plane's electronic warning and control system. Sitting at a master radar scope, the Combat Information Officer co-ordinates search work of radar observers and directs the over-all operation. With his equipment and backed up by a well-schooled crew of assistants he keeps track second by second of unidentified or "enemy" crafts' movements and directs the flow of reports on their manoeuvres to defending ships, planes and ground stations.

Toy Sputnik

A TOY Sputnik, or "baby moon," has been made by a Hungarian factory and will be on sale in time for Christmas.

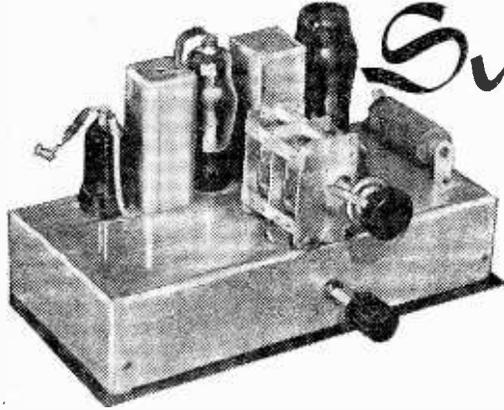
BBC Scottish V.H.F. Station

THE BBC's new Very High Frequency sound broadcasting station which is shortly to be opened at Kirk o'Shotts will radiate the Scottish Home Service on 94.3 Mc/s, the Light Programme on 89.9 Mc/s, and the Third Programme and Network Three on 92.1 Mc/s, each with an effective radiated power of 120 kW. The transmissions will be horizontally polarised, and therefore receiving aerials must be fixed horizontally.

Beginner's 200-1600m. Superhet

A SIMPLE THREE-VALVE SET FOR A.C. MAINS OPERATION ONLY.

By F. G. Rayer



A RECEIVER of the type described here has the great advantage that no aligning difficulties arise, because the aerial circuit is aperiodic. Only the oscillator is tuned, the usual padder being omitted so that a coverage of about 1,965 to 650 kc/s is obtained with the .0005 μ F variable condenser. This allows reception on a continuously-tuned band of 150 to 185 kc/s, or about 200 to 1,600 metres, so that no separate long-wave band is required for the 1500 metre Light Programme transmitter. Further to simplify the circuit, a type of detector is employed which will easily operate the loudspeaker direct, thereby avoiding any separate A.F. stage, and associated components and wiring. This arrangement gives results approaching those obtained from a diode detector followed by an A.F. output stage, but is simpler. Further components are eliminated by the absence of A.V.C., and by using a common

dropper for screen grids and oscillator anode.

The circuit, shown in Fig. 1, is thus much less complicated than that of the usual superhet. It has a very good degree of adjacent-channel selectivity, interference of this nature which is troublesome on T.R.F. circuits being absent. The 25K potentiometer provides volume control and on/off switching, so that there are only two controls in all. It is important to note that the output valve bias resistor is much higher in value than would be the case for normal A.F. amplification. If other output valves are used, this must be remembered. The anode bypass condenser in this stage is also essential, though its value is not critical.

Oscillator Coil

A standard medium-wave oscillator coil with separate windings is satisfactory, or it may be wound as shown in Fig. 2. A $\frac{1}{2}$ in. dia. former, with dust-iron core, is required, and both windings are in the same direction, and of 34 s.w.g. D.S.C. wire. Each winding is in a compact pile,

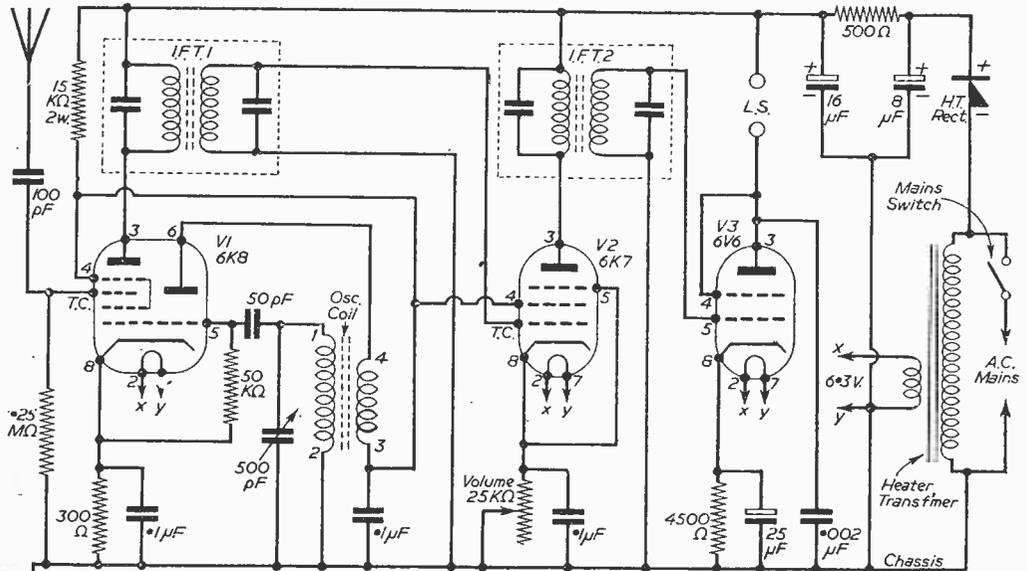


Fig. 1.—The circuit of the receiver described in this article.

single $\frac{1}{16}$ in. hole under each transformer will suffice. Other transformers may have projecting tags, and a clearance hole for each tag will then be necessary. With the first transformer, the primary goes to 6K8 anode and H.T. positive. The secondary is taken to 6K7 grid cap and chassis, the latter tag or lead normally being marked as the A.V.C. connection. The second transformer similarly has its primary wired to 6K7 anode and H.T. positive. The secondary is usually marked for diode and diode-load connections. If so, the "diode" lead is taken to the 6V6 grid, and the "diode-load" lead to chassis.

If a small smoothing choke is to hand, this can replace the 500 ohm resistor. As the valves consume only 1.05 amp., sufficient current is available to operate a 6.3v. dial or indicator bulb wired in parallel with the heaters.

To reduce chances of shocks if the chassis is touched it is worth while taking the "Neutral" main to the chassis, and to use a non-reversible plug. The receiver should also be totally enclosed in an insulated cabinet with control spindles, bushes, and knob set-screws out of reach. With suitably shaped knobs it will only be necessary to see that the set-screws are short, or to insert a little insulating compound into the set-screw holes after tightening.

Adjustments

These are very simple, but will nevertheless considerably influence results. A station should

either direction. If such is the case, all the trimmers (or cores) should be adjusted until this is no longer necessary.

The set can be lined up with equal success at any intermediate frequency within the limits tunable by the transformers. It is not necessary to employ any particular frequency. Due to the manner in which the F.C. stage operates, any station higher or lower in frequency than the oscillator frequency, to the extent of the I.F. selected, will be received. If a local station on the second channel chances to interfere with some

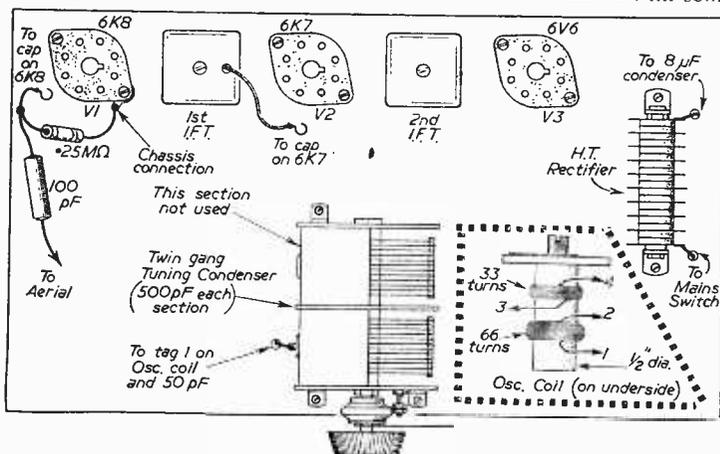


Fig. 3.—Top of chassis layout and inset (Fig. 2) the oscillator coil.

other transmitter, this can be corrected by re-aligning the I.F. transformers at a slightly different frequency.

In some circumstances modulation hum may be troublesome. If so, it can usually be reduced by wiring a $.05\mu\text{F}$ 750v. condenser from rectifier negative to chassis. If some modulation hum remains, the aerial lead in Fig. 1 can be taken to a dual-wave H.F. choke returned to the chassis, and a further aerial-isolating condenser of $.0001\mu\text{F}$ to $.001\mu\text{F}$ added for the aerial. The need for this depends upon local conditions, and especially upon any stray mains leakage to the aerial or lead-in.

COMPONENT LIST

- Two 465 kc/s I.F. transformers.
- $.0005\mu\text{F}$ tuning condenser with reduction drive and knob.
- 300 ohm, 4,500 ohm, 50 K, and $.25$ megohm $\frac{1}{2}$ -watt resistors.
- 500 ohm 1-watt resistor. 15 K. 2-watt resistor.
- 50 pF and 100 pF mica condensers. $.002\mu\text{F}$ condenser.
- Three $.1\mu\text{F}$ condensers.
- $25\mu\text{F}$ 25 v. bias condenser.
- $8\mu\text{F}$ plus $16\mu\text{F}$ 350 v. smoothing condensers.
- 25 K. potentiometer with switch. Knob.
- 6.3 v. $1\frac{1}{2}$ amp. heater transformer.
- 250 v. 60 mA metal rectifier.
- M.W. oscillator coil.
- 6K8, 6K7 and 6V6 valves.
- Three octal valholders.
- Chassis about 10in. x 5 $\frac{1}{2}$ in.

be tuned in, the volume control being set to a low level. The I.F. transformer trimmers or cores are then adjusted for maximum signal strength. It is essential that an insulated blade, such as can be made from a piece of ebonite rod, be used for this adjustment. No trimmer (or core) should be at the limit of its adjustment in

JOIN THE PRACTICAL GROUP

Edited by F. J. CAMM

- PRACTICAL HOME MONEY MAKER 1/3
- PRACTICAL WIRELESS 1/3
- PRACTICAL TELEVISION 1/3
- PRACTICAL HOUSEHOLDER 1/3
- PRACTICAL MECHANICS 1/3
- PRACTICAL MOTORIST & MOTOR CYCLIST 1/3

They are all published monthly

A Transistor Square Wave Generator

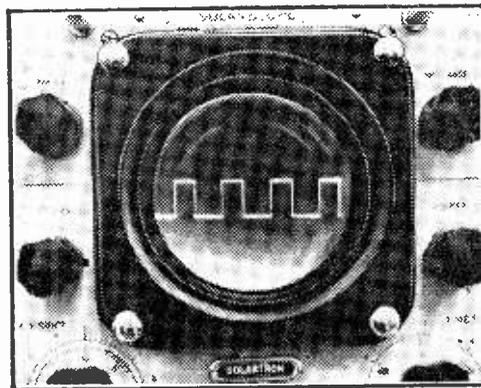
CHECK YOUR AMPLIFIER WITH THIS HANDY UNIT

By R. E. Bebbington, Grad. Brit.I.R.E.

THE harmonic composition of square waves renders them ideally suitable for the rapid checking of amplifier response (the operative word being "rapid") since the overall frequency characteristics can be displayed by a single trace on an oscilloscope. If a square wave is injected into an amplifier having linear frequency response and negligible phase shift a square wave will be displayed if the output is "scoped." Any departure from the "ideal" will result in a distorted square wave. Without delving into the mathematics of Fourier's analysis of square waves it would be as well to see how they are built up in order to help in the interpretation of these distorted wave-forms.

Square Waves

Briefly recapping, a square wave consists of a fundamental sine wave with the addition of odd harmonics, theoretically to infinity. This is never realised in practice but the frequency spectrum of



The actual waveform from the unit described here.

the generator to be described gives an excellent square wave. A sine wave of the chosen fundamental frequency is shown in Fig. 2 (a), whilst Fig. 2 (b) shows the effect of adding to this the third harmonic. Note the steeper sides and the dip in the horizontal portions. When the fifth and seventh harmonics are added as in Fig 2 (c) the rising and falling edges sharpen up considerably and the horizontals tend to flatten out. Thus the effect of various frequency components on the final waveshape provides a useful basis for the analysis of amplifier or network characteristics. A few typical waveforms are illustrated in Fig. 3. The resulting pattern when a square wave is applied to an amplifier or network having linear frequency response and negligible phase distortion is, as might be expected, a square wave. In Fig. 3 (b) the significance of the rounded leading edges is poor high frequency response, and the waveform at (c) shows an even further deterioration of H.F. Low frequency deficiencies are characterised by the concave horizontal portions as at Fig. 2 (d), whilst a preponderance of fundamental would result in convex horizontals. Phase distortion at low frequencies is indicated by the sloping horizontals (Fig. 2 (e)). This slope is very significant in that it provides a most sensitive measurement of phase distortion, a phase error of only 2 per cent, at the fundamental frequency giving a slope of one in ten. The "ringing" on the horizontals at (f) is due to excessive high frequencies.

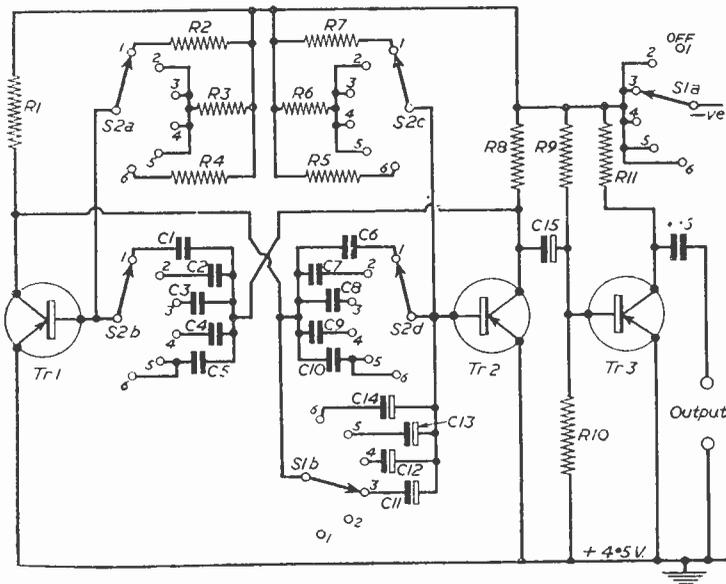


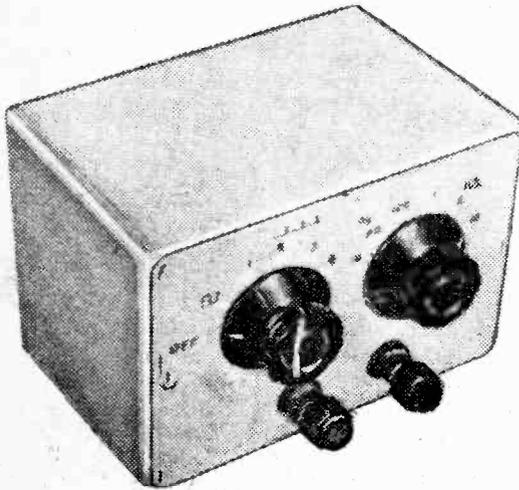
Fig. 1.—Theoretical circuit of the generator.

Test Procedure

Connect the generator to the input of the amplifier or network under observation using short low capacity leads to prevent high frequency attenuation. Similarly connect an oscilloscope to the output.

For low frequency checking a low fundamental frequency

is injected and a sloping top will indicate time-delay or phase errors at the low frequencies.



capacity networks between generator and "scope," making notes of the results. Once the principles of square wave testing have been thoroughly mastered a mere glance at the C.R.O. will suffice,

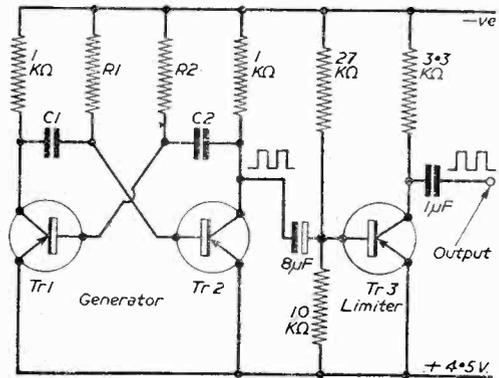


Fig. 5.—Basic arrangement.

for every picture tells a story. That is, of course, if one understands the language.

Excess or deficient fundamental will be apparent by a convex or a concave top.

High frequency response is best checked by choosing an input of fundamental frequency about the middle of the frequency range under investigation. Remember that the H.F. response affects the leading and trailing edges. Not all the defects have been listed since the reader can learn a great deal by inserting various resistance-

The Square Wave Generator

The generator to be described was designed to give square-wave spot frequencies at 10 c/s, 50 c/s, 100 c/s, 1 kc/s, 5 kc/s and 10 kc/s, at 4½ volts amplitude. An additional facility is a

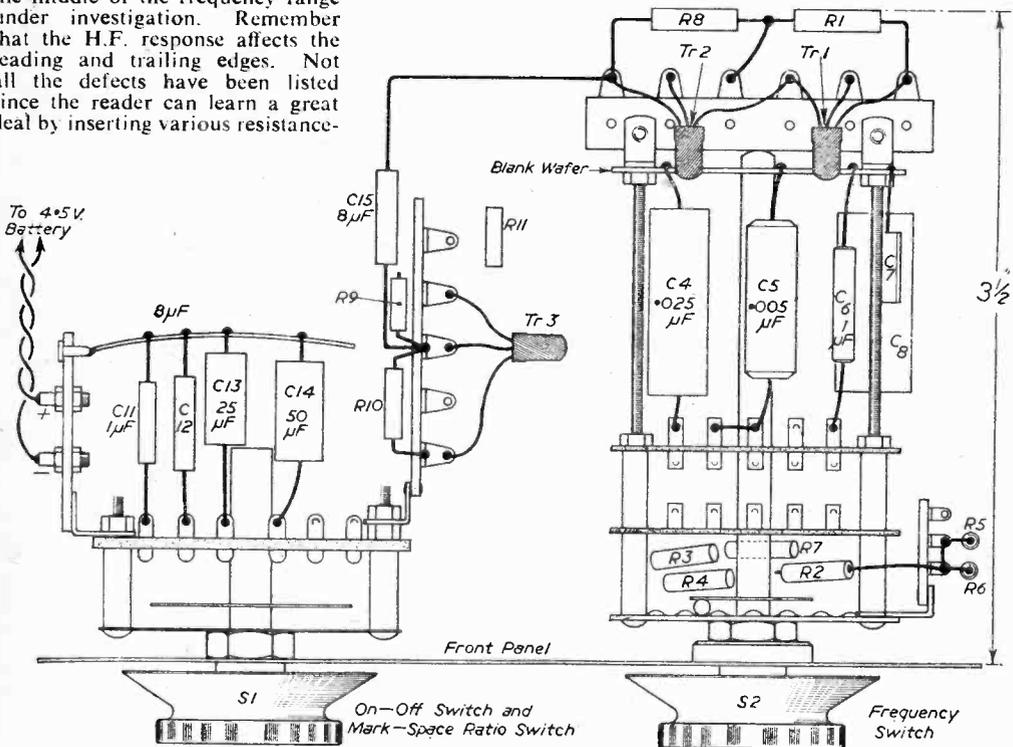


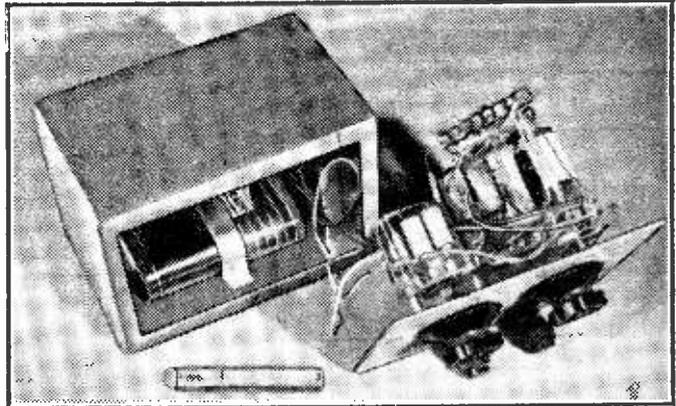
Fig. 6.—Actual wiring details of the unit.

variable mark-space ratio switch converting the output into sharp pulses, useful as marker pips, if desired. The circuit is similar to its valve counterpart and consists of two OC71's in a multivibrator circuit followed by a further OC71 employed as a limiter to sharpen up the verticals. The current gain of the transistors is not very important but for ease of adjustment the two employed in the multivibrator should have similar characteristics. In point of fact those used by the writer were production spread rejects having current gains of 40, 40 and 20, the latter value being used for the limiter stage. These values of gain were obtained on a Transistor test set as described in the October issue of PRACTICAL WIRELESS by my colleague, Mr. B. E. Wilkinson.

Whilst on the subject of testing transistors I must pass on a novel method of labelling them in terms of current gain. It consists of threading $\frac{1}{16}$ in. lengths of small diameter coloured plastic sleeving on to the base lead-in wire, the colours conforming to the resistance colour code. For example, a transistor having a current gain of 35 would have an orange, and then a green sleeve slipped on to the base connection. Furthermore, the sleeving performs a dual role in that it serves to insulate the emitter, collector and base wires from one another.

To understand the operation of the circuit more clearly Fig. 5 shows the basic generator with the switching omitted. If we consider initially that Tr1 is fully conducting, then in the "bottomed" condition almost the whole of the battery voltage

is across its collector load. As C1 charges, the base of Tr2 goes negative until it conducts. Tr1 is now cut-off due to C2 discharging through R2 but as Tr2 conducts C2 charges and the base of Tr1 goes negative until it again conducts. This cyclic switching depends upon the time constant of R1 C1 and R2 C2, the frequency of operation being approximately equal to .77 divided by CR. Although the spot frequencies given are useful



The completed unit and its case. The small piece of rule in front is 3in. long.

for most purposes there must be other applications that call for other frequencies. By applying the formula readers may readily determine values of C and R to suit their own requirements.

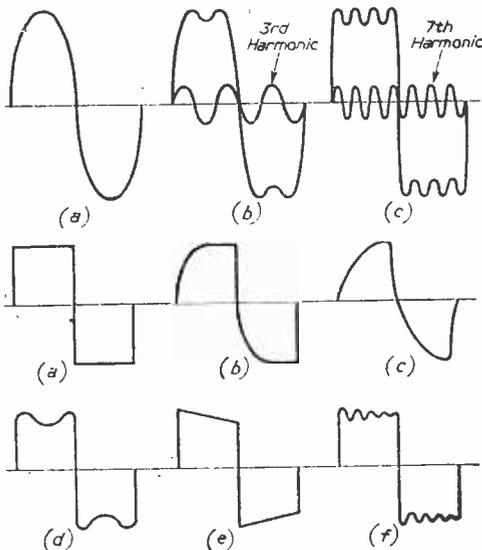
For example, if a spot frequency of, say, 400 c/s is required then:—

$$\text{Since } f = \frac{.77}{CR}$$

$$\text{then } CR = \frac{.77}{f}$$

$$\therefore CR = \frac{.77}{400}$$

If we conveniently keep R constant, and 27K



Figs. 2 and 3.—The production of a square wave.

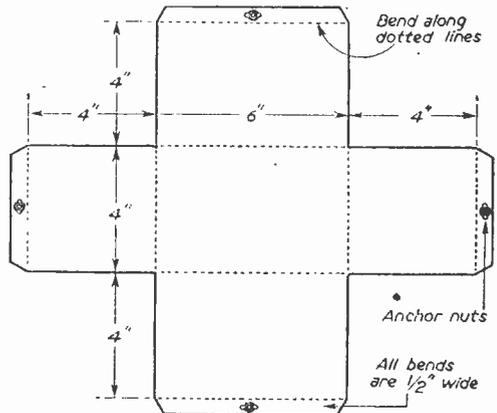


Fig. 4.— Details of the case or cabinet for the unit.

ohms seems an optimum value around this frequency, we have:—

$$C \times 27,000 = \frac{.77}{400}$$

$$\text{therefore } C = \frac{.77}{400 \times 27,000}$$

$$= \frac{.77 \times 10^6}{4 \times 27 \times 10^5 \mu\text{F}}$$

$$C = .071 \mu\text{F}$$

Since the formula is only an approximation there is no point in pursuing the value of C any further than .07 μF .

The output from the collector of Tr2 is a

is used as the on/off switch connecting the battery negative to the common negative line in all positions except number one which is the "off" position. The other side of the wafer (S1b) is used for the mark space ratio facility. The "mover" contact is connected to Tr1 collector and positions 3, 4, 5 and 6 are connected through their various capacitors to a common line connected to Tr2 base. Switch contacts 1 and 2 are spare since 1 is the "off" position and 2 is the "square wave" position. No difficulty need be experienced in construction if the theoretical diagram is followed closely and the lay-out sketch used as a guide to the disposition of components.

Readers will no doubt have their own ideas on

LIST OF COMPONENTS

R1—1 K	R8—1 K	C4, C9—.025 μF	Tr1—OC71
R2—30 K	R9—27 K	C5, C10—.005 μF	Tr2—OC71
R3—27 K	R10—10 K	C11—1 μF	Tr3—OC71
R4—15 K	R11—3.3 K	C12, C15—8 μF	S1—2 pole-6 way
R5—15 K		C13—25 μF	S2—4 pole-6 way
R6—27 K	C1, C6—1 μF	C14—50 μF	Battery 4.5 volts Ever Ready D888
R7—30 K	C2, C7—.5 μF	C16—1 μF	
	C3, C8—.25 μF		

reasonable square wave except that the trailing edges tend to fall exponentially. The limiter stage, however, is most effective in cleaning this up and the resultant waveform is exceptionally good throughout the entire frequency range.

Construction

As can be seen from the illustrations the circuit is constructed around the two rotary switches used for on/off, mark-space and frequency selection. The latter consists of two wafers to accommodate the four-pole, six-way action necessary for selecting the appropriate resistors and capacitors. The resistors R2—R7 are grouped around the first wafer of S2 and a short tag strip serves to anchor these to the common 4.5v. negative line. This is clearly visible in the bottom right hand corner of the layout showing principal components. Care should be taken when wiring these components to make sure that the same value of resistor is being simultaneously switched on S2a and S2c since as these lie on opposite sides of the wafer this can lead to some confusion. The same warning applies when wiring the capacitors as it is most disconcerting to discover that when S2b is switched to C1, S2d is connected to C10 instead of C6. The capacitors are wired from their appropriate contact on the second wafer to a blank wafer on the end of the side strut about 2in. from the former. If 1/16in. diameter holes are drilled around the periphery of the blank opposite the capacitors, the wire ends can be inserted and bent over to form soldering lugs. The two generator transistors are mounted on a six-way tag strip behind the blank wafer and affixed to the side-strut ends. The collector load resistors R1 and R8 are also mounted on this strip as shown in the lay-out.

The other rotary switch carries a five-way tag strip on which is mounted the limiter transistor and associated components. One side of the wafer

housing the generator but the case shown, measuring 6in. \times 4in. \times 4in., makes a very compact unit. It is made from a sheet of 18 s.w.g. aluminium as shown in the sketch. The dotted lines indicate the right-angle bends. All these are made in the same direction, the four outer flanges being bent first. The edges were finally welded and rounded off with a file. However, if welding facilities are not available, angle pieces may be inserted along the four butted edges and riveted inside the box. The front panel measures 3 $\frac{3}{4}$ in. \times 5 $\frac{1}{2}$ in. and holds the two switches and output terminals. It is affixed to the box by four 4 B.A. countersunk screws.

The case and front panel were finally given a grey crackle finish, producing a professional appearance that the excellent results, surpassed only by the more costly generators, demand.

PRACTICAL TELEVISION DEC. ISSUE NOW ON SALE PRICE 1s. 3d.

The main feature in the current issue of our companion paper, PRACTICAL TELEVISION, which is now on sale, is a constructional article on the making of a small unit with which picture tubes may be both tested and rejuvenated. It is invaluable to the serviceman or keen experimenter.

Further notes will be found in this issue on the construction of our latest switched TV/F.M. receiver, as well as the improved Band III converter.

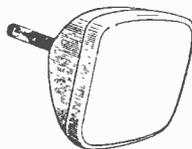
Making Simple Sound TV Receivers is another constructional feature, whilst the usual series will be found on Scanning and Sync., Flywheel Sync. and A.G.C., Problems Solved, Teletext and Simplified Servicing.

TELEVISION TUBES

RECTANGULAR

T.V. TUBES

17" £7.10.0



12 MONTHS'

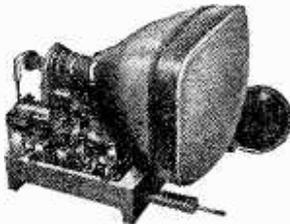
GUARANTEE

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 14in., 15in., 16in. round T.V. Tubes, £5. 3 months' guarantee. Convert your 9in., 10in., 12in. to these larger sizes. Details on how to do-it-yourself in our FREE catalogue. 12in. T.V. TUBES, £6. 3 months' guarantee. 15/6 ins., carr., on all tubes.

17" T.V. CHASSIS

Latest improved circuits. Higher E.H.T. (brilliant picture). Improved sensitivity (for greater range). Chassis easily adapted to any cabinet. 17in. rectangular tube on adapted chassis. All channels. 12 MONTHS' GUARANTEE on tube. 3 months' guarantee on valves and chassis. Less valves.

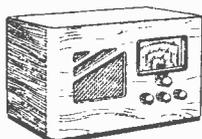


£19.19.6

Valve line up (5 valves): 6SN7G, 6V6, EY51, 2 6D2s. Others: 6L18, EL38, 7 6F1s. TURRET TUNER. 50/- extra. Chassis size 11in. x 14in. x 11in. With 5 valves. £21.19.6. With all valves, £25.19.6. Ins., carr., 25/- (incl. tube). State B.B.C. channels (and I.T.A. if turret tuner required).

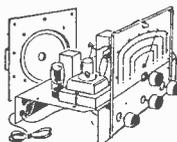
14" T.V. CHASSIS, TUBE AND SPEAKER £13.19.6

As above with round type tube. Less valves. 3 months' guarantee. With 5 valves, £15.19.6. With all valves, £19.19.6. Ins., carr., 25/- (incl. tube). Turret Tuner. 50/- extra.



HOME RADIO 79/6

5 valve (octal), superhet, 3 waveband receiver, A.C./D.C. Universal mains can be adapted for gram. P.U. In wooden cabinet. 18in. x 11in. x 8in. Ins., carr., 7/6.



SUPER CHASSIS 99/6

5-valve superhet chassis including an 8in. speaker. 4 control knobs (Tone, Volume, Tuning, W.C. switch); 4 waveband, with position for gram. P.U. and for extension speaker. A.C./D.C. P. & P. 5/6.

ELECTRIC CONVECTOR HEATER 99/6

Cleaner, cheaper, safer than paraffin. A.C./D.C. Switched for 1 or 2 k/watts. Illuminated grille. Ins., carr., 19/6.



ELECTRIC FIRES 17/6

Hammered finish. A.C./D.C. 200-250 volt. 1 k.watt. Post, 3/6.

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

BEAUTIFUL EXTENSION SPEAKERS 29/9



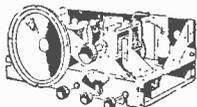
Complete fitted with 8in. P.M. Speaker "W.B." or "Goodmans" of the highest quality. Standard matching to any receiver (2.5 ohms). Flex and switch included. Unrepeatable at this price. Money refunded if not completely satisfied. Ins., carr., 3/6.

8in. P.M. SPEAKERS 8/9. Let the lady of the house listen to that Radio or T.V. programme. Complete with O.P. trans., 10/- P. & P. 2/8.

P.M. SPEAKERS 12/9. Elac. or Goodmans. High quality. 2.5 ohms. Complete with O.P. trans., 14/- P. & P. 2/9.

POPULAR RADIO OR R/GRAM CHASSIS 39/6

3 w/and. and gram. S'het. 5 valve International Octal. Ideal table gram., but still giving high quality output. 4 knob control. 8in. P.M. Speaker. 7/9 extra, set of knobs, 2/- Chassis size 12in. x 6in. x 9in. Less valves. Ins., carr., 4/6.

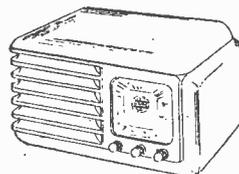


DENCO RADIOGRAM CHASSIS 97/6

3 and 4 waveband turret tuned. Superhet. A.C./D.C. chassis, with 6in. or 8in. speaker. Size: 8in. x 10in. x 12in. Valve line-up: CCH35, EF39, EBC33, CL33 and CY31. (CIC dropper). Ins., carr., 7/6.

MIDGET RADIO 99/6

5 valve, CCH35, EF39, EBC33, CL33, 35Z4 or metal rec., 3 control knobs. Switched for gram. In attractive brown plastic cabinet. 15in. x 7in. x 9in. Ins., carr., 4/6.



T.V. CONSTRUCTOR CHASSIS

SOUND & VISION STRIP 25/6. Tested, working, complete less valves. I.F.s 16-19.5 mc/s. P. & P. 2/6. Drawing 2-6 or FREE with order.

POWER PACK & AMPLIFIER 29/6. 7-9 kV. R.F. E.H.T. unit included. Amplifier stage 6V6 with O.P. trans. 3 ohms matching. Smoothed H.T. 350 volt at 250 mA. 6.3 v. at 5 amp. 22 v. at 3 amp. 6.3 v. at 4 amp. and 4 volt centre tapped. Less valves. Drawing FREE with order or 2/6. Ins., carr., 5/6.

TIMEBASE 15/6. Tested, Incl. focus unit, line trans. scann. coil, etc. Less valves. P. & P. 3/6.

MIDGET EVER READY BATTERYMAX 1/9

"B" type battery. 2 1/2 v. No. B155. Ideal for Midget or Personal Radio, Hearing Air, or Photography Flash. Size 1in. x 2in. 1 for 1/9. Post 3d. 6 for 7/- Post 6d. 12 for 12/- Post 9d.



TERMS AVAILABLE (Over £4)

Liverpool St.—Manor Park Stn.—10 minutes. Send for our FREE 1958 catalogue. Open all day Saturday.

DUKE & CO. (Dept. 4), 621/3 Romford Road, Manor Park, E.12. Tel.: ILford 6001-3

BENDIX RECEIVER R.A.10.

A 4 waveband superhet covering 150 kc/s-10 mc/s. Valves 6SK7 1st R.F., 6K8 mixer, 6SK7 1st and 2nd I.F., 6R7 2nd Det., 6C5 B.F.O., 6K6 output. Size 6½ x 15½ in. Easily converted to mains operation as described on page 453 of the September "Practical Wireless." £5.10.0, carr. 7/6.

VIBRATOR PACKS. 12 v. input, 300 v. output at 150 mA. As a bridge rectifier will handle 450 v. RMS at 120 mA. Pack consists of 12 v. vibrator, 4 metal rectifiers, chokes and smoothing condensers. Only 30/-, carr. 5/-. Also 6 v. input, 230 v. output at 100 mA., complete 4-pin vibrator, OZ4 rectifier. Fully smoothed, 25/6 each, p.p. 2/6.

COMMAND RECEIVERS. 1.5-3 mc/s, fully valved. Brand new, only 65/-, p.p. 3/6.

SPECIAL "HAM" OFFER. TEST SET 102. Consists of impregnated mains transformer 200-250 v. 50 cycles, 12 v. 2 amps., 6 v. 3 amps., output 280 v. at 80 mA. S.T.C. metal rectifier 10 mA. 1-DET19, 1-615. Bulgin plugs, sockets and pilot lights. Mains leads. Circuit is a multi-vibrator locked mains type, with a cathode follower. Can be modified for: Audio Amplifier, Audio Oscillator, V.F.O., External Synchronizer, Stabilised Power Unit, Modulator, etc. Brand new, including circuit only, 40/-, carr. 5/-.

No. 38 TRANSMITTER/RECEIVER WALKIE TALKIE. Range approx. 5 miles. Covering 7.4-9 mc/s. Absolutely complete, with junction box, headphones, microphones, webbing, haversack. Brand New, only 60/-, carr. 7/6.

R.F. UNITS.—R.F.25, 40-50 mc/s, 8/6 each. R.F.26, 50-65 mc/s, 25/- each. All valved. Postage 3/6 on each.

RCF AMPLIFIER UNIT. 12 v. input. Vibrator Pack 250 v. out. OZ4 Microphone Transformer into a 6K6GT output valve with negative feedback. Size 8 x 5½ x 8½ in. Brand new. 35/- each. P. & P. 3/-.

INDICATOR UNIT SLC NO. 5. Ideal for conversion into an Oscilloscope using a 139A or ARC10 tube. Unit consists of 2 VR65, 1 VR66, various resistors, condensers and pots. Size 11 in. x 6 in. x 3 in. Brand new, complete with modification circuit, 20/-, p.p. 4/-.

YOU CAN'T BEAT THIS VALUE!! RT-7/APN-1 ALTIMETER TRANCEIVER. Brand new, complete with 14 valves: 3-12S17, 4-12SH7, 2-12H6, 1-VR150, 2-9004, 2-955. Famous Wobbulator Unit, Dynamotor. Relays 3,500 ohms and 6,500 ohms. A.F. amplifier. Receiver section covers 400-450 Mc/s. Transmitter sweeps 418 to 462 Mc/s. With manual. Only 35/-, carr. 10/-.

HIGH RESISTANCE HEADPHONES.—Type No. 2, 4,000 ohms, brand new, 11/- each, n.p. 2/-.

R109 RECEIVERS. 8 valves. 5 APR12, 3 AR8 covering 1.8-8.5 mc/s on two frequency bands. Contains 6 v. Vibrator Pack and built-in 3½ in. Goodmans speaker, operates from 6 v. battery, consumption 1½ amps. Housed in metal case 13 x 12 x 11 in. Designed for Mobile or Ground station. Operates with any normal aerial. Complete and tested, including circuit. Very good condition. Only 80/-, carr. 7/6.

PYE 45 MC/S I.F. STRIPS. Complete with seven valves: 6-EF50, 1-VR92, 6 tunable I.F. transformers. Only 30/-, post paid.

WHEATSTONE BRIDGE. Consisting of four stud switches: 0-10 ohms, 0-100 ohms, 0-Inf. Galvometer centre zero F.S.D. 2.5 mA. Ranges easily extended. Housed in oak cabinet 16 x 7½ x 6 in. Complete with instructions. 40/-, p.p. 4/-.

MUIRHEAD VERNIER DRIVES. Scaled 0-180 deg. Ratio 25 to 1, 3 in. dia. 10/6, p.p. 1/6.

COMMUNICATION RECEIVER R1155. This magnificent receiver covers 5 ranges: 75-200 Kc/s, 200-500 Kc/s, 600-1,500 Kc/s, 3-7.5 Mc/s, 7.5-18.5 Mc/s. Fully tested before despatch. Complete with simple modification details for mains use. £8.10.0, carr. 10/-.

AMERICAN ROTARY CONVERTER.—With detachable cooling fan 12 v. input, 250 v. output at 90 mA. Completely suppressed, 19/-, p.p. 4/-.

Kelda Radio Ltd.

(Dept. "P") 32A, Coptic Street, London, W.C.1. Phone: MUSeum 9607.

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-8"

Push-Pull Portable Superhet

Can be built for £11/10/-.

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.

TEN STAR FEATURES

- ★ 8 Specially Selected Transistors
- ★ 250 Milliwatts Output Push-Pull
- ★ Medium and Long Waves
- ★ Internal Ferrite Rod Aerial
- ★ 7 x 4 Elliptical Speaker
- ★ Drilled Plastic Chassis 8½ x 2½ in.
- ★ Point to Point wiring and practical layout
- ★ Economical. Powered by 71 v. battery
- ★ Highly sensitive
- ★ Attractive lightweight contemporary case

N.B. Pair of Matched OC72's or equiv. Supplied at additional cost of 40/-.

Call and hear demonstration model.

We can supply all these items including Cabinet for £11/10/- All parts sold separately.

Send for circuit diagrams, assembly data, illustrations and instructions, and full shopping list. 3d. in stamps.

"EAVESDROPPER"

THREE TRANSISTOR POCKET RADIO
(No Aerial or Earth required)

Variable Tuning. Total cost, as specified including Transistors, Transformers, Coils, Condensers and Battery, etc., with circuit and plastic case. 77/6 POST FREE. With single phone, 82/6. With Acos Mike, 90/- With Min. Hearing Aid, 90/-.

MINI-TWO

TWO-TRANSISTOR MINIATURE POCKET RADIO

The smallest Transistor set offered on the market. Variable Tuning, Drilled Chassis. Plastic Case size 3 in. x 2 in. x 1 in. 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

Variable Tuning

We can supply all components including 2 Transistors, Diode, Resistors, Condensers and Miniature Hearing Aid and Plastic Case size 4½ x 2½ x 1½ in. and 1½ v. Battery FOR 52/6. All items sold separately.

R.F.25, 12/6. R.F.26, 25/-
Brand new with valves, carr. 2/6.

6 v. VIBRATOR PACKS
Output 120 v. 40 mA., 12/6.
Brand new.

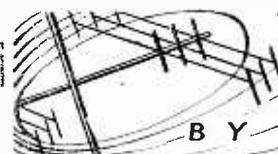
373 MINIATURE I.F. STRIP 9.72 Mc/s

The ideal F.M. conversion unit as described in P.W. April/May, 1957. Complete with 6 valves, two EB91's, two EP92's and one EB91, I.F.T.'s, etc., in absolutely new condition. With circuit 12/6 (less valves). 42/6 (with valves). Postage & Packing 2/6 (either type).

SEND STAMPS FOR NEW 1958 28-PAGE CATALOGUE
OPEN MONDAY to SAT, 9-5. THURS. 1 o'clock.

HENRY'S RADIO LTD.

5 HARROW ROAD, EDGWARE ROAD, LONDON, W.2
TEL.: PADDINGTON 1008-9



'On Your Wavelength'

BY THERMION

Credits

ONE reader, Mr. Donald S. Wallace, of Forest Gate, bemoans the long list of credits which are given at the end of every item broadcast by the BBC, which at the same time omits important information. In this respect, the BBC seems to be aping the cinema, where a long list of credits is run off at high speed, either at the end or the beginning of the film. These credits are quite meaningless, although they may flatter the vanity of some of the halfwits responsible either for the production of the film or for acting in it. Fortunately, they are run off at such a rate that one scarcely has time to read them, never mind remembering. The American tendency is to give credit to everyone associated with the film, however unimportant their task. But for the name of the leads I doubt if any member of the public ever remembers any of the names, few of which seem to be English and require to be sneezed rather than pronounced. Even the office boy may be referred to at the end as the director of communications. As the names of the leads have already been broadcast in the newspapers and by trailers, there really is no need for a list of credits at the end at all. The BBC could usefully include the titles of the incidental music used in plays and documentaries. The title and composer would be sufficient. The BBC is altogether too rapid in its method of flashing the cast over the screen at the end of a programme. In any case, it wastes programme time, and I really do not think that the public cares two hoots who produced the programme. Now that the listening audience is rapidly turning to viewing, I suggest that credit time be devoted to an increase in news summary time. The BBC news summary is always very sketchy, a point which no doubt pleases the newspapers!

The 1958 Radio Show

THE 25th National Radio and Television Exhibition is to be held at Earls Court from Wednesday, August 27th, to Saturday, September 6th, 1958, with a preview on August 26th. The R.I.C. having decided on the date, I think that they should settle down at once to improving the amenities of the exhibition in directions which I have criticised before. One of the most important of these amenities is the catering, which annually gives rise to serious complaints, particularly of poor quality and over-charging. The catering is undertaken by outside catering contractors and sponsors of exhibitions take no interest in feeding the public that they attract to their exhibitions. It is my view that they have a moral responsibility to do so. It is easy for those who have season tickets to have their meals outside, since they do not have to pay for readmission. The public, however, is trapped in

the exhibition and must pay the extortionate charges for food and drink or go without. For many the Radio Show is an annual event where wives and families are taken out for the evening. A good meal at a reasonable price is part of the evening's entertainment. In spite of the very poor service and the poor quality of the food, the prices charged exceed those of a high-class west-end restaurant. Those who like to enliven the evening with a modicum of alcoholic inspiration will find that they pay 2s. 8d. for a whisky, the measure of which does not seem to conform to any imperial standard, and 2s. for a bottle of light ale. Wishy washy tea is retailed at 5d., and seems to be made according to the formula, 1lb. of tea to a hundred gallons of water. In some of the catering rooms conditions are anything but hygienic. I maintain, therefore, that the R.I.C. should take this matter in hand themselves. These high prices may prevent a lot of people from visiting the exhibition—or invite them to take a packet of sandwiches. Earls Court has never quite captured the atmosphere of Olympia. Perhaps one day the exhibition will return there.

BBC Worries

THE admission of the BBC that where people have a choice of television programmes, more and more are watching I.T.V. programmes, has another aspect. The BBC and the I.T.V. are both competing for the TV public. The TV public is expanding and this means, as the figures prove, that the listening public is declining. It logically follows that the majority of those who refrain from listening are changing over to I.T.V. and not to BBC television programmes. The BBC is thus losing on both counts, and it needs therefore not only to improve its TV, but also its sound service. There is plenty of room for it and I'll wager that if there were to be an alternative sound programme on commercial lines, similar proportions would exist between the two services, which as far as television is concerned is 28 per cent. BBC, 72 per cent. I.T.V. Whilst the BBC had no competition in TV, its programmes were considered excellent. When you have a yardstick such as a competitor with which to compare them the story is different. As far as I can see, that position will remain, because it cannot be denied that each is working to different standards. The BBC is more idealistic than the commercial people. The BBC programmes in general are good. The ideal behind them is sound, even if the execution is bad in some cases. I strongly feel that the BBC should depart from party games and it should cease from aping America.

Observe the Satellites-1

HOW TO PICK UP AND TRACK THE
ARTIFICIAL MOONS

By O. J. Russell, B.Sc.(Hons.), G3BHJ

THOUSANDS of amateurs the world over hastily tuned to 20 Mc/s as soon as the dramatic news of the artificial satellite burst upon an unsuspecting public.

It would appear that a considerable number of satellites operating upon the 20.005 and 40.002 Mc/s frequencies will be launched. As we all know, the original emission consisted of 0.3 second pulses, each frequency pulse alternating with the other. Presumably a simple multivibrator circuit provided the keying impulses, with a possibility that transistors were employed partly or wholly in the transmitter circuitry. The good signal strength of the transmissions indicates that a "reasonable" power was available, although this need not have exceeded a fraction of a watt, owing to the "line of sight" propagation conditions that exist. Thus the "optical path" range of a satellite at 500 miles altitude is some 1,500 miles, although ionospheric effects could provide an extension of this range in some cases, while in other cases ionospheric absorption or reflection could reduce the observable range by reflecting the waves back into space instead of letting them penetrate. However, the observable range of a satellite even under conditions of a highly

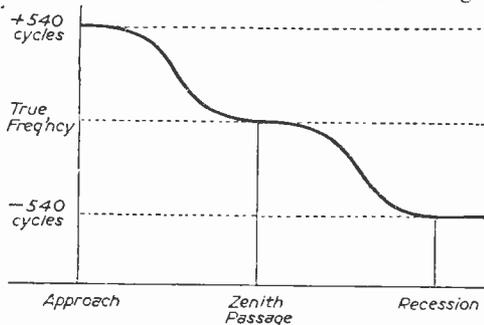


Fig. 1.—Observed frequency variation of satellite. Initially the frequency of 20 Mc/s will be observed 540 cycles high in the initial approach stages for a velocity of 18,000 miles an hour. The final frequency shift when receding will be the same amount low. For any given satellite speed, the maximum observable frequency shifts will be proportional to satellite velocity. For other frequencies of transmission, the frequency shift will be proportional to the transmission frequency. Thus for the 40 Mc/s frequency, the frequency shifts will be twice the above figures. The American satellite frequency of 108 Mc/s will provide over 5 kc/s shift for the above conditions.



Canadian amateur radio operator Cecil Ludlow picked up the radio signal of the Russian satellite on the 20-metre band as it passed over Toronto and recorded it on his tape recorder as pictured here. He was able to make a very good quality recording of the signal.

reflecting ionosphere is likely to be several hundred miles about the zenith point. The 40 Mc/s frequency would be almost unaffected by the ionosphere under average conditions. Note that paradoxically the "range" of audibility of a satellite is greatest when normal DX conditions are bad, as this implies that the ionosphere is of poor reflective intensity, so that the satellite radiations will penetrate even at glancing angles. Under conditions of extreme ionisation—as evinced by abnormal propagation in the 50 Mc/s band—even the 40 Mc/s emissions might be absorbed or reflected to an extent that would cut down the distance to which the signals would be heard from the satellite.

Merely listening to the satellite signals serves very little purpose, although a careful note of the times of initial audibility, maximum signal strength and final disappearance of the signal on any one transit are of value. A careful note of fading, echo or skip effects on the two frequencies, plus a record of the different behaviour of the two frequencies, will be even more valuable. In fact, observations of this sort may give valuable evidence of ionospheric conditions that could not be obtained by any other methods, as for the first time we are able to observe what happens to a signal coming through the ionosphere from outside! A tape recorder for recording the signals is, of course, an almost indispensable item, as details

may become apparent upon a replay that were unnoticed at the actual time the recording was made. Furthermore, do not switch off the instant the satellite signals have "finally" faded into inaudibility, a little extra time might reveal some extraordinary anomalous ionospheric echo or exceptional skip-distance effect. If newspaper accounts are to be relied upon, the satellite signals have been heard at a range of some 6,250 miles, clearly due to ionospheric effects. Moreover, even at the 18,000 miles per hour velocity of the satellites, this distance represents audibility some twenty minutes after the satellite has passed overhead. Thus, with all factors taken into account, the satellite signals might be heard some twenty minutes earlier than expected, and remain audible some twenty minutes after they should have disappeared. This means that the satellite signals could very well be audible for over an hour all told, and under exceptional conditions heard over the major portion—or even the whole—of an orbital passage. Thus even straight "listening" offers a whole host of fascinating possibilities.

Making Observations

It should be noticed that from straight "listening" we have gradually shifted the emphasis over

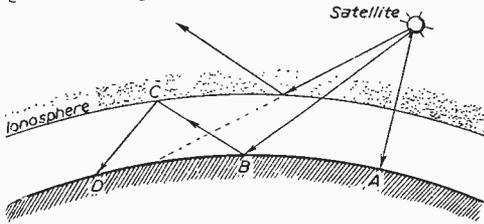


Fig. 2.—Possible modes of reception of the satellite signals. The observer at A hears the satellite by direct path through the ionosphere, as also does the observer at B. The waves reflected from Earth at B are again reflected back to Earth to an observer at D from a point C in the ionosphere. Between the points D and B a "silent zone" may exist due to the ionosphere reflecting the satellite signals into space instead of transmitting them through to Earth.

to "observing." There are many valuable observations that may be made in the peace and quiet of the shack, particularly if a tape recorder is available. The most fascinating observation that may be simply made with no additional apparatus at all is that of the relative speed of the satellite.

By employing the well-known Doppler principle a very good estimate of the velocity of the satellite relative to the observer may be made. The Doppler principle is known to us in the familiar phenomenon of the sudden drop in pitch of a train whistle as the train passes at speed, or nowadays the change in pitch as a jet plane sweeps overhead. Briefly, as a sound wave or radio wave emitting source approaches us, the frequency appears higher than it is, similarly a receding source appears of slightly lower frequency than it really is. Naturally, this effect depends upon the ratio between the velocity of

the object and the velocity of propagation of the waves it emits. Thus with sound waves crawling at a mere 1,000 feet per second, slight pitch changes are easily observable even with trains, while with light waves and radio waves propagated at 186,000 miles per second a very fast moving source is necessary to produce much frequency shift. However, the use of single sideband communication systems on fast jet aircraft has already run into carrier reinsertion troubles due to Doppler shifts becoming noticeable at the higher frequencies and higher speeds both being used by modern aircraft!

Briefly, a velocity of 1,000 miles an hour relative to the observer for a frequency of 20 Mc/s produces an apparent frequency shift of 29.87 cycles. This is near enough to 30 cycles for a good degree of accuracy. Thus we may postulate a shift of $1\frac{1}{2}$ cycles per megacycle in frequency for each 1,000 miles an hour of velocity. One can easily see that modern jet planes using single sideband will call for quite a sizeable amount of retuning at present day speeds. Note that a radio source approaching the receiver will be apparently slightly increased in frequency, and a receding source will be received at a slightly lower frequency than the true frequency. In reception of a C.W. transmitter in a satellite, as the signal is first heard, it will be at frequency higher than the true frequency by an amount depending upon the velocity of approach. Thus a satellite coming directly towards the receiving point at an orbital velocity of 18,000 miles an hour will be received as a frequency 18×29.87 cycles higher than the true frequency. To half per cent. accuracy this is 540 cycles. As the satellite is at first distant from the receiving point, there will be little shift in frequency. As the satellite approaches the frequency will drop, at first slowly, and then faster. Instantaneously, as the satellite passes overhead, the change in frequency will slow down, remain fractionally steady and then commence to drop faster in note again, finally settling to a steady note now 540 cycles lower than the true frequency until it passes outside optical range. Fig. 1 illustrates this graphically. The duration of the initial and final periods during which the observed frequency is steady will depend largely on propagation conditions. At a conservative one thousand miles radius of audibility, however, the signal would be heard over a total of 2,000 miles of path, which at 18,000 miles an hour would

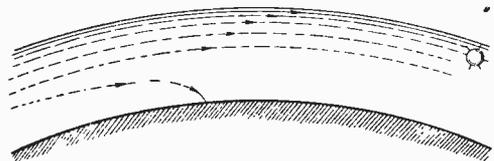


Fig. 3.—The orbit of a satellite close to Earth becomes slowly smaller due to the effect of residual air drag losses. At the same time, however, the orbital speed of the satellite actually increases, contrary to popular ideas, thus increasing the effect of air drag. This process rapidly augments until finally the satellite crashes catastrophically, probably being partly vaporised by air drag in the process.

represent an audibility of 1/9th of an hour, or just over six minutes. As audibility from times ranging from a few minutes up to over twenty minutes has been reported, it is clear that propagation conditions have a large effect, and the time the signal is heard, plus any possible skip effects, should be noted. Thus the satellite might easily traverse a skip zone, and be heard weakly (after first fading out) by ionospheric reflections.

Measuring the Velocity

Thus the amateur may now ponder the most expeditious means of making accurate frequency

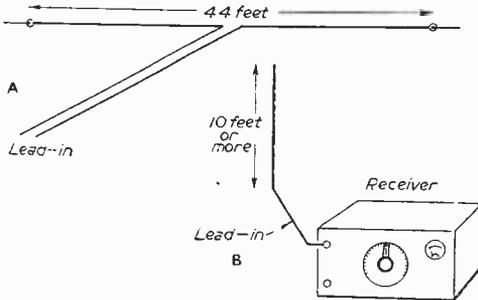


Fig. 4.—Two simple aerial systems. A gives the dimensions of a dipole for 20 Mc/s use. The vertical aerial at B will be found useful for "extreme range" detection of the satellite. For the 40 Mc/s transmissions, a conventional Band I television aerial may be used. Detuning a turret tuned domestic receiver might enable the signals to be heard on the sound channel of a TV receiver.

measurements to obtain his own measurement of the velocity of the satellite.

The amateur wishing to make a velocity measurement is thus faced with measuring a small shift in frequency, amounting in all to just over a kilocycle at 20 Mc/s, twice this value if the 40 Mc/s frequency is observed, while for the American 108 Mc/s satellite frequency, a shift of over five kilocycles will be observed. The USA satellites, with stable receivers, offer the chance of really good speed determinations. However, the vast majority of amateurs and S.W.L.s are able to receive at 20 Mc/s, whereas they are not at the moment equipped for the higher frequencies. Thus we have the problem of measuring just over a kilocycle difference in frequency accurately. The lucky possessors of tape recorders may record the beat note observed on the satellite signal, and "measure at leisure." Here a stable calibrated audio oscillator may be used to observe the recorded beat frequency by the method of beats. Provided the oscillator is really accurately calibrated—as by a cathode ray method against standard frequencies—it is possible to determine the frequencies accurately. A good tape recorder should be quite reliable. However, any measurement better than ten cycles will give accuracies better than one per cent. A simple method is to provide the received B.F.O. with a calibrated vernier. To do this a small variable of only a pF or so should be used. Such a condenser may

be improvised by removing vanes and increasing the spacing if necessary from a small V.H.F., receiving type capacitor. Use a straight line capacity type having semi-circular moving vanes to provide a linear variation of B.F.O. frequency with angular rotation. Most B.F.O. oscillators in communication receivers are of the E.C.O. or similar type, and to fit such a condenser all that is necessary is to run a lead to the grid of the B.F.O. tube, and earth the other side of the vernier condenser. If desired, the condenser may be shunted directly across the B.F.O. tuned circuit. A sweep that gives a comfortable variation of well over the desired range should be selected. With such a calibrated control, the B.F.O. may be set to zero beat at the moment the satellite is first heard, and continuously adjusted to maintain zero beat until the note has settled down to its final value on passing out of radio range. This difference in initial and final settings gives the two frequency values needed for calculating the satellite speed.

Estimating Height

Further details and methods of estimating height of the satellites are left for a further article, as it is clear that the unexpected arrival of a real live satellite caught most of us unprepared. Also the average amateur and S.W.L. had little interest in preparing elaborate 108 Mc/s gear in this country, as it was not expected that the American satellites would be observable from England. However, such is the present "satellite race" that it is possible that there may be more opportunities than expected for interesting observations on both the American and the Russian frequencies. In any case the 20 Mc/s transmissions enable any keen amateur and S.W.L. to participate without elaborate equipment or special receivers. It is now possible that American satellites may also operate on 20 Mc/s to enable all amateurs to receive them. Unfortunately, the early impression was that elaborate installations would be necessary to observe the satellites, particularly as only weak signals were envisaged. Now it would seem that much more than listening to a "bleep" is possible for almost any amateur, even if the precision possible at V.H.F. is reduced at the lower frequencies now being used. It is perhaps unfortunate that while the American frequencies were widely publicised well in advance, the Russian frequencies were only revealed a short time before the satellite was launched.

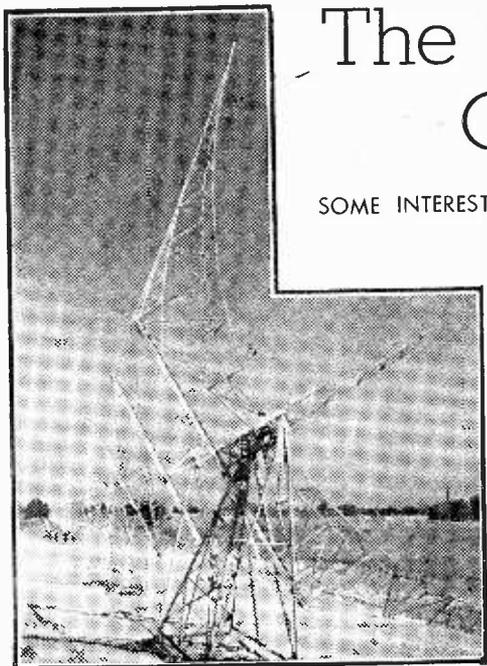
(To be continued)

Books Received

- THE BOYS' BOOK OF RADIO, TELEVISION AND RADAR.** 143 pages, 78 illustrations. Published by Burke Publishing Co. Ltd., Price 9s. 6d. net.
- ALFRED HITCHCOCK PRESENTS.** 25 stories, 372 pages. Published by Max Reinhardt Ltd. Price 18s. net.
- FUN WITH RADIO,** by Gilbert Davey. 64 pages, 34 illustrations. Published by Edmund Ward Ltd. Price 10s. 6d. net.

The Mullard Radio Observatory

SOME INTERESTING DETAILS OF THE LATEST ADDITION TO THE UNIVERSITY OF CAMBRIDGE



The fixed aerial of the radio star interferometer during construction. The end tower is complete. Length of the aerial is 1,450 feet and the distance across a parabola 65 feet.

THE release of the Russian Earth Satellite brought into prominence in this country the new Mullard Radio Laboratory at Cambridge. This was, in fact, the first British station to pick up both the first and second satellites, and in some respects it has proved of more use than the much publicised giant Radio Telescope at Jodrell Bank. No doubt many readers will be interested in this Mullard project and the following notes and accompanying illustrations have been supplied to us by Mullard.

The observatory was opened by Sir Edward Appleton on July 25th. This Observatory has been provided, through the far-sighted generosity of Mullard Ltd., who are to provide, over a period of ten years, the sum of £100,000, and with the help of the Department of Scientific and Industrial Research, to provide facilities for an extension of the work which Mr. M. Ryle has been carrying out in the Cavendish Laboratory at Cambridge since the war. This work has been concerned with the investigation of the radio waves reaching the earth from outer space, a subject which is now given the name of Radio Astronomy.

To obtain the greatest amount of information from the radio waves from outer space two requirements must be satisfied. First, the radiations must be received with the greatest possible strength; that requires the largest possible aerial for their reception. Second, the aerial must be of a kind which will provide an accurate measure

of the angle of arrival of the waves. The power to make this measurement is called the "resolving power" and a great resolving power requires a large aerial. The obvious way to make observations in Radio Astronomy is thus to construct the largest possible aerial. Comparatively small aerials of this kind are in existence in Holland, Germany and the U.S.A.

The "Interferometer"

Although the construction of the largest possible aerials would seem to be the best way of getting the strongest reception and the greatest resolving power, for some purposes they have insufficient resolving power. For many investigations a different type of aerial known as an "interferometer" is to be preferred. Its method of working can be understood as follows. The "resolving power" of an aerial depends on the interaction or "interference" of the radio waves received at its edges, and the farther apart these edges are, the greater is the resolving power. Suppose therefore that an aerial is made as large as possible, so that because of its large *area* it collects a large power and because of the large *distance* between its edges it has great resolving power. Now suppose it to be split into two halves which are then moved apart some considerable distance. Then the total area of the aerial is unaltered so that the total power received is the same as before; but if the waves received in the two halves are properly combined they will, by their "interference" effect, provide a resolving power which is increased proportionally to the distance between them. In this way it is possible to increase the resolving power far beyond what is practicable with a single large aerial, and at the same time to keep the collecting power the same.

An interferometer aerial of great resolving power was constructed at the Cavendish Laboratory, Cambridge, in 1948, to make a survey of the distribution of "radio stars" over the sky. The measured positions of the two strongest radio stars were sufficiently accurate to lead to the discovery, with the great 200in. optical telescope at Mt. Palomar, U.S.A., that one of the radio stars was, in fact, two galaxies in collision. This astronomical object is so far away that it has taken light 200 million years to travel from it to the earth.

2,000 Radio Stars

In 1952 a new and much larger radio telescope of the interferometer type was built, with the

aid of a grant from the Department of Scientific and Industrial Research. The total collecting area of this is equal to the collecting area of the large single aerial constructed at Manchester, and its resolving power is that appropriate to the distance, 1,900ft., between its two halves. About 2,000 radio stars have been detected with this instrument, but only about ten of these can be identified with visual objects. The nature and distribution of the remainder present a problem of the greatest interest to astronomers and cosmologists.

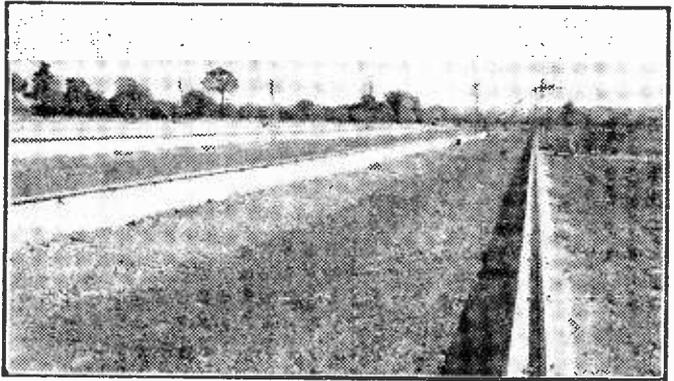
The Cambridge workers consider that their observations point to the conclusion that at very great distances the "radio stars" are closer together. If their conclusion is correct it would seem to favour a theory in which the Universe is supposed to be expanding from an initial highly condensed state, and to conflict with one in which there was supposed to be continuous creation of matter. Workers in Australia have criticised these results, and have stated that, with a different type of radio telescope, they have not been able to repeat the Cambridge observations. The matter is so important for cosmological theories that every effort is being made to extend and improve the observations so that it can be decided without doubt which view is correct.

Plans were made in Cambridge to extend the observations by constructing an even larger "interferometer" in which both the collecting power and the resolving power would be increased. This was too large to be put on the same site as the existing interferometer and it was necessary to plan in terms of a new "Radio Astronomy

Observatory" covering an area large enough to contain both this and other large aeri-als. It was realised that the renting of this site and the construction of the aeri-als was too costly for the University to undertake, and astronomers everywhere were delighted to hear that the Mullard Valve Company had found it possible to finance a large portion of the scheme, and the D.S.I.R. would finance the remainder. The site for the new "Mullard Radio Astronomy Observatory" is at Lord's Bridge, about five miles from Cambridge. A small Observatory building contains the associated complex electronic equipment which makes the records and which, in fact, recorded signals from the second Russian satellite automatically during the early hours of the morning. The equipment is run and the records are analysed by a small team of about 15 research workers under Mr. Ryle, who has inspired all this work. These workers have to be fully familiar with the latest techniques in the use of aeri-als and electronic devices of considerable complexity, and it is hoped that the Observatory will prove to be not only a place where astronomical results of the greatest importance will be obtained, but also a training ground for experts in modern radio techniques.

Interferometer Details

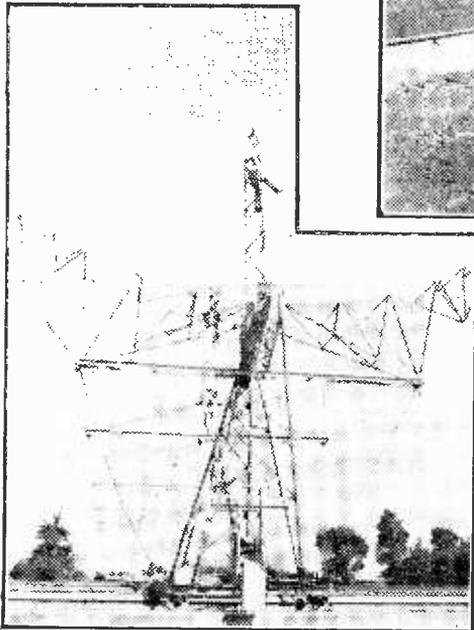
The radio-star interferometer, which is designed for a wave-length of 1.7 m., comprises a fixed



The moving aerial and railway tracks of the radio star interferometer during construction. The steel-work is complete and part of the dipole assembly in place. Length of the railway tracks is 1,000 feet and the length of the aerial (i.e., the width across the railway track) is 190 feet. Distance across a parabola is 65 ft.

east-west aerial 1,450ft. long and 65ft. wide; the moving aerial is 190ft. long in the east-west direction and 65ft. wide, and moves along north-south railway lines which are 1,000ft. in length. Both aeri-als are cylindrical paraboles made as in the earlier Cambridge interferometer by stretching wires across parabolic tubular steel frames which can rotate about an east-west axis.

The resulting envelope pattern will have a width to half intensity of approximately 25×35 min. of arc, and this will contain an interference pattern in right ascension having a lobe separation of about 8 min. of arc.



PREMIER RADIO COMPANY

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

OPEN TILL 6 P.M. SATURDAYS (Dept. P.W.1) 207, EDGWARE ROAD, LONDON, W.2

Telephone : AMBASSADOR 4033 PADDINGTON 3271-2



The "Petite" PORTABLE

A completely new design with the all star feature from the firm with 45 years of experience in the supply of designs for the home constructor.

MAY BE BUILT FOR

£7.7.0

Plus p. & p. 3/-.

Batteries Extra. H.T. 10/- (type B126) or equivalent. L.T. 1/6 (type AD35) or equivalent.

★ Size only 8in. x 8in. x 4 1/2in. ★ Instruction Book 1/6
MAINS UNIT NOW AVAILABLE FOR ONLY 37/6 plus 2/- p.d.

THE NEW MERCURY SWITCHED F.M. TUNER

by Jason

Completeset of parts available with built and tested front end.

Price **£9.19.6** plus 2/6 pkg. & carr.

Power Pack requirements 35 ma.

The NEW De - Luxe TAPE RECORDER TR3

for

£6.5.0

Deposit and 8 monthly payments of £5.17.11.

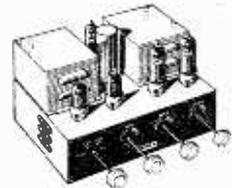
or

Cash 45 gns. Plus 2/- post and packing.



TRADE ENQUIRIES WELCOMED.

Case finished in Red and Cream with gilt styling and fittings. Size 18in. x 15in. x 9in. for A.C. Mains 200/250 v. 50 cycles.



BUILD THE 1-VALVE BATTERY RECEIVER

As shown on B.B.C. T.V. This receiver contains a DAF36 valve and a pair of 4,000 ohm headphones, and is powered by a combined 671 and 11 volt battery. Price complete with headphones but less battery 45/- Send for free diagram.

THE STAAR "GALAXY"

4-speed mixture Auto-changer. Finger-tip stop, start and speed change control. Size 10 1/2in. x 12 1/2in. A.C. mains 110-250 v. Price **£9.15.0**, plus 4/6 pkg. & carr. Credit Terms **£1.5.0** & 6 monthly payments of **£1.5.9**.

2-Volt 16Ah bakelite-cased ACCUMULATOR by Oldham, Dagenite, Exide. New and unused, unspillable. 7 1/2 x 4 x 2. Price 6/6, plus 1/6 p. & p.

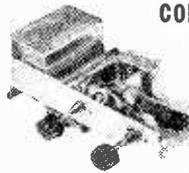
THE TELETRON "COMPANION" 3 TRANSISTOR POCKET RECEIVER

This receiver **89/6** complete. Postage and packing 1/6.

New F.M. TUNER for the Home Constructor

A new design using the latest circuit techniques. Includes 4 valves plus magic eye tuning indicator, permeability tuning and an integral power supply. Two controls only, a gear driven slow motion tuning control and an output volume control with on/off switch. Suitable for fringe area reception. All components may be purchased for **£8.15.0** plus packing & postage 3/6. OR Less Mains Transformer & Rectifier **£7.12.6** plus packing & postage 3/-. Power requirements H.T. 230 v. 50 mA. L.T. 6.3 v. 1.5 A. Dial size 4 1/2" by 1 1/2". Overall size 11 1/2" long, 5 1/2" deep, 4 1/2" high. Send 1/6 for Booklet.

COMPACT GRAM AMPLIFIER



Complete ready to connect to any type of Pick-up and Speaker (3 ohms). A.C. Mains 200/250 v. Volume and tone control fitted with knobs. Overall size 7in. long x 3in. wide x 2in. high.

Suitable speaker 7 x 4in. elliptical 21/10.

Plus packing and postage 2/6.

£2.19.6

8 WATT AMPLIFIER

This design includes 5 miniature valves of the latest types, an ultralinear output transformer suitable for Speakers of 3 and 15 ohms and a very attractive perspex front panel with gold lettering, complete set of parts.

Postage & packing **£8.8.0** 5/- extra.

or **£10.19.6** built and tested. Send 1/6 for Booklet.

WRITE FOR DETAILS OF PREMIER TAPE RECORDER KIT FOR ONLY £39.15.0.

4-WATT AMPLIFIER

MAY BE **£4.10.0** Plus 2/6 Pkg. BUILT FOR & Carr.

Instruction Book 1/- post free.

A steel case is now available, complete with engraved panel, for 15/6 extra. The amplifier may be supplied complete for **£5.5.0** plus pkg. and post 3/6, or fitted in case at **£6** plus pkg. and post 3/6.

2-BAND T.R.F. RECEIVER

MAY BE **£5.15.0** Plus 3 - Pk. BUILT FOR & Post.

3-Band Superhet Receiver may be built for **£7.19.6** plus pkg. & carr. 3/-. These two receivers use the latest type circuitry and are fitted into attractive cabinets 12in. x 6in. x 5in. in either walnut or ivory bakelite or wood. Individual instruction books 1/- each. Post free.

B.S.R. T.U.8 3-speed Record Player **£3.19.6** plus 2/6 post and packing. P.U. complete with arm, 36/-.

THE LATEST COLLARO 4-SPEED SINGLE PLAYER UNIT COMPLETE WITH PICK-UP AND TURNOVER CARTRIDGE **£4.14.6**, PLUS 2/6 PKG. & CARR.

Why not make the best ! MULLARD AMPLIFIER KIT

Now supplied with ultralinear output transformer.

All the components for Model 510, plus pre-amplifier, on one chassis (total six valves), chassis gold hammer finished. May be purchased for **£12.12.0** plus pkg. and post 7/6. This version complete and tested **£15.15.0**. Or pre-amplifier and tone control in a separate unit **£14.14.0**, plus pks. and post 7/6.

Mitcham 6201

R S T

"All Valves Brand New"

211, STREATHAM ROAD, MITCHAM, SURREY

EXPRESS MAIL ORDER SERVICE! 24 HOURS

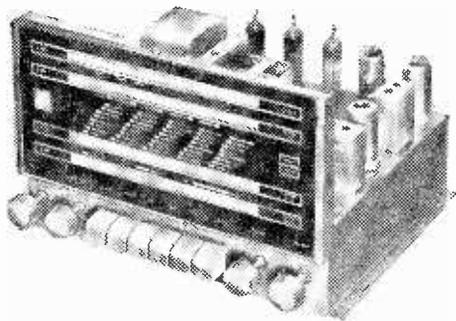
OZ4	5 9	6BW6	8 6	6U5	8 6	12Q7GT	10 1	25Z56T10	10 1	D4F91	9 1	ECC40	17 6	EL37	21 1	1W4,500	10 1	MU14	10 1	TP23	18 1	UT85	10 1	
LA5	6 8	6BW7	9 6	6V6G	10 1	12	12	35W4	7 6	D4F96	9 6	ECU81	8 6	EL38	23 6	10	N18	11 6	TP23	12 6	UP89	10 1		
JA7	12 6	6BX6	8 6	6V6GT	7 6	12SA7	8 6	50C5	10 6	DF33	9 9	ECU82	9 1	EL41	10 1	KRC32	10 1	N37	18 3	UL16	11 1	UL41	9 6	
1D6	10 6	6C4	7 6	6X4	7 6	12SJ7	8 6	50C6G	12 6	DF91	8 6	ECU83	9 1	EL42	10 1	KF35	10 6	N78	11 6	UL24	27 6	UL44	23 6	
1H5	9 6	6C5GT	8 6	6X5GT	8 6	12SK7	8 6	10 1	10 1	DF92	8 6	ECU84	10 1	EL41	17 6	KL32	10 6	N142	9 6	UL25	13 6	UL46	21 1	
1X5	9 6	6C8	16 6	6X6GT	12 6	12SN7	15 6	50LGT	DF93	8 9	ECU85	10 6	EL41	9 1	KLL32	14 6	N153	11 3	UL26	13 6	UL54	9 1		
1K5	9 6	6C9G	27 1	7B7	8 6	12SQ7	9 9 1	10 1	10 1	DF97	9 6	ECU91	7 6	EL45	10 6	KLL32	14 6	N154	11 3	UL30	9 1	UL56	18 6	
1S5	9 1	6C16	7 6	7C5	8 6	14S7	14 6	75 10	10 1	DH63	10 6	ECF80	12 6	EL40	8 6	KL35	10 6	N229	8 1	UL50	8 6	UL77	16 6	
1T4	8 1	6E5GT	10 1	7C6	8 6	18B6G	17 7 6	10 1	10 1	DH76	7 6	ECF82	12 6	EL91	8 6	KT2	7 6	PCC84	9 1	UL52	8 6	UL78	23 6	
2D13C	8 1	6F1	19 6	7H7	8 6	1	21 1	80 9 6	9 6	DH77	7 6	ECF81	21 1	PM80	10 1	KT32	9 6	PCC80	12 6	UL56	8 6	UL79	7 6	
2X4	4 6	6F6	10 1	7S7	12 6	30D1	13 3	807 8 6	8 6	DH97	10 6	ECF82	9 6	EM81	11 6	KT33C	12 6	PCC82	11 6	UL78	8 1	UL785	8 1	
3Q4	10 6	6F12	8 6	7Y4	7 6	20F2	21 1	AC4, PEN	15 1	DH97	10 6	ECF81	9 6	EM85	15 1	12 6	12 6	PCL82	12 6	UL42	8 6	UP2B	19 1	
3Q5	9 6	6F13	18 6	8D3	8 6	20L1	19 6	15 1	15 1	DK91	9 1	ECF83	12 6	KY81	10 1	KT35	13 6	PCL83	12 6	UL45	8 6	VP4B	21 1	
3K4	8 1	6F14	23 6	10C1	18 1	20P1	23 6	AC3/PEN	15 1	DK92	11 9	ECF80	10 1	BY84	13 1	KT36	23 6	PCL83	18 6	UL147	9 9	W17	8 6	
3V4	8 6	6F15	16 6	10C2	18 6	20P3	21 1	15 1	15 1	DK96	9 6	ECF82	13 6	BY91	9 1	KT44	12 6	PCL88	23 6	UL153	9 6	W76	8 6	
5D4	5 6	6J3GT	10 1	10F1	22 6	20F5	21 1	AC6, PEN	15 1	DL92	8 1	EP9	21 1	EZ35	8 6	KT55	15 6	PY80	8 3	UL191	18 6	W77	9 6	
5V4	12 1	6J4GT	10 1	10F3	21 1	25L6GT	9 1	15 1	15 1	DL94	8 1	EP22	16 1	EZ40	8 1	KT68	10 1	PY82	8 6	UL251	17 6	W81M	18 6	
5Y3GT	8 1	6K7GT	10 1	10F9	12 6	25V5	10 6	AC/TP	29 6	DL96	8 9	EP36	6 6	EZ41	10 6	KT68	10 1	PY82	8 6	UL281	18 6	W142	9 1	
5Z4	10 1	6K8GT	12 3	10LD11	15 2 4	9 1	AZ1	15 6	EAS0	2 1	EP37	9 6	EZ80	8 1	KT66	16 6	PY83	8 6	UL282	20 1	W719	8 6		
6A8	10 1	6K25	18 6	14 9	25Z5	10 1	AZ31	15 6	EABCS0	EP37A	10 3	EZ81	8 1	KTW61	9 1	PZ36	17 6	UL301	21 1	W727	8 6			
6A7	13 6	6L9	7 6	10P13	23 6	25Z9	9 6	B38	15 6	1	9 6	EP39	7 6	EZ90	7 6	KTW62	8 1	QP21	8 6	UL403	9 6	X18	11 9	
6AR8	9 6	6L8	12 6	10P11	18 6	30 1	8 6	B65	8 6	EAC91	10 1	EP40	15 1	PC3	14 6	KTW63	9 1	QP22	13 1	UL404	9 6	X61	12 6	
6AJ8	9 6	6L19	21 1	12L6	6 6	32 9 1	8 6	B329	9 1	EAF42	10 1	EP41	9 6	PC13	14 6	KTZ41	9 1	QP20	17 6	UL801	27 6	X65	15 1	
6AK8	9 6	6L1	17 6	12A18	10 1	30C1	12 6	B339	9 1	EB41	10 6	EP42	12 1	CZ30	10 1	KTZ63	10 1	R10	22 1	ULBCS0	X66	15 1		
6AL5	5 6	6N7GT	8 1	12AT6	8 9	50F5	12 6	CB11	23 6	EB91	5 6	EP80	8 1	GZ32	11 6	L63	6 6	R19	10 1	10 1	X78	19 1		
6AM5	8 6	6P25	18 6	12AT7	8 9	30F11	12 6	CB131	23 6	EB41	9 3	EP85	7 6	GZ34	11 6	LX309	12 6	S106	12 3	ULAF2	10 1	X79	11 9	
6AM6	9 1	6P28	23 6	12AV7	9 1	30L1	11 1	CB35	21 1	EBF89	9 6	EP86	12 6	H30	4 9	LZ319	12 6	SP4	15 1	ULB41	8 6	Y61	9 6	
6AN5	9 1	6Q7GT	10 6	12AX7	9 1	30P4	23 6	CL33	18 6	EBF89	9 6	EP89	10 1	H63	10 1	MH4	8 6	SP11	3 1	ULBF90	9 6	Y63	9 6	
6AQ5	7 6	6A7GT	8 6	12BA6	8 9	30P12	12 6	CY1	15 6	EBL21	21 1	EP91	8 6	HBC90	8 1	MH4	8 6	SP42	8 6	ULC85	10 1	Z21	10 6	
6AT6	8 3	6B6GT	9 1	12BR6	9 3	30P16	12 6	CY31	15 6	EBL31	21 1	EP92	9 1	H12	11 6	MH4	12 6	SP61	3 1	ULC82	10 1	Z63	10 6	
6B8	4 1	6SH7	8 6	12L5GT	7 6	30P11	20 1	D41	8 6	EC91	8 9	EP93	6 6	H12	9 6	MH4	12 6	T41	21 1	ULC81	10 6	Z77	10 6	
6LA6	8 6	6J7	8 6	12L7GT	10 1	35Z3	10 6	D42	8 6	EC91	12 6	EP95	13 1	HL35DD	12 6	TDD4	18 6	1	1	ULC81	10 6	Z89	20 6	
6BE6	8 3	6K7	8 6	12K7GT	9 1	35L6GT	D63	6 1	EC92	16 1	EL31	12 6	11 6	ML4	12 6	TDD13C	18 6	1	1	ULC83	21 1	Z152	8 6	
6BGG	21 1	6NL7GT	7 6	10 1	10 1	177	5 9	EC93	8 6	EL32	5 8	HY90	7 6	MKT4	5 or	18 6	1	1	1	ULF41	9 1	Z719	8 6	
6BJ6	7 6	6N7GT	8 6	12K8GT	35Z3	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	Z729	12 6
6BR7	12 1	6U4GT	11 6	12 3	35Z4GT	8 6	PAC32	9 9	ECU35	8 6	EL35	15 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	10 1	ZD133	8 6

OBSOLETE VALVES A SPECIALITY ANY TYPES NOT LISTED SUPPLIED ON REQUEST
TERMS OF BUSINESS C.W.O. OR C.O.D. ALL VALVES GUARANTEED

Modernise Your Radiogram

with an **ARMSTRONG** chassis

The effect of substituting a good quality Receiver/Amplifier for your ordinary commercial unit will astonish and delight you. Only in this way can the full benefits of the improved modern recordings and the superb quality of the VHF/FM transmissions be obtained. Armstrong have been making replacement chassis for nearly 25 years and have concentrated exclusively on the requirements of those who want the best. This is your guarantee of first-class performance and reliability.



MODEL PB 499 (illustrated) 28 Gns.

A high quality Radiogram Replacement Unit

- ★ 9 valves ★ 6 watts VHF ★ Quick action Piano Push-Pull output Key selectors ★ Separate Negative Feedback Bass and Treble controls
- ★ 4 wavebands including ★ Magic Eye.

MODEL AF 105 £37

AM and FM Tuners and High Fidelity Amplifier on one compact chassis

- ★ 10 valves ★ 10 watts ★ Independent wide range Push-Pull output ★ 20 dB Negative Feedback ★ 5 wavebands including VHF
- ★ Bass and Treble controls with visual indicators ★ Magic Eye.

Post this coupon or write for descriptive literature and details of Home Trial facilities, Credit terms and Guarantee to Armstrong Wireless and Television Co. Ltd., Warrlers Rd., Holloway, N.7. Tel: NOR 3213. BLOCK CAPITALS PLEASE.

NAME

ADDRESS

Demonstrations at our Holloway Showroom 9-6 Weekdays and Saturdays. PWJ

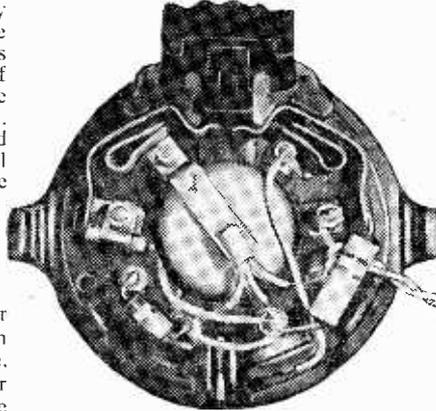
THERE are many ex-Government microphones available very reasonably priced. Probably the main reason for their cheapness and availability is their comparative lack of sensitivity. Most of these microphones were manufactured for use in fairly rough conditions, so that the robustness of the instruments is achieved at the cost of sensitivity. Three types are available, namely carbon, balanced armature and moving coil, though we shall concern ourselves with the latter type.

The sensitivity of a microphone can be increased by the use of a pre-amplifier which provides a larger signal for the main amplifier than would the microphone alone. Transistors are admirable for A.F. pre-amplifiers because of their compactness, small power supply and low current consumption. It is intended that the pre-amplifier be built inside the microphone itself. The type of microphone chosen for the purpose is of the moving coil variety and is fitted with a press switch. This latter feature is extremely useful, as it may be used to switch in the pre-amplifier battery supply.

The Circuit and Components

The components required are as follows: Moving coil microphone type No. 13.2.A.17605 (if this particular type is not obtainable there are many other ex-Government types which are admirable), one A.F. red spot transistor, 47 KΩ resistor, 4.7Ω resistor, 8μF condenser, one L.T. deaf aid battery (Mallory RM 625). The circuit, which is very simple, is shown in Fig. 1. Since the amplifier has only a single stage, we require a fair amount of current from it, with which to feed the first stage of the main amplifier. If we decide upon 2 milliamps and assume the load resistor to be 200 ohms (this will be the primary of the input

A TRANSISTOR MICROPHONE



AMPLIFIER

By B. E. Wilkinson

transformer to the main amplifier), then our voltage drop will be given by:

$$E = I \times R = \frac{2 \times 20}{100} = \frac{2}{5} = 0.4 \text{ volts}$$

The actual collector voltage then, is (1.5 - 0.4) = 1.1 volts, since the transistor is an OC71 equivalent. Study of the Ic/Vc characteristic for this type of transistor shows that a base current of 40 microamps is necessary. The bias resistor necessary to produce this is given by:

$$R = \frac{E}{I} = \frac{1.5}{40 \times 10^{-6}} = \frac{1.5 \times 10^6}{40} = 37.5 \times 10^3 \text{ ohms} = 37K\Omega$$

R is thus 37 KΩ, though higher values up to 50KΩ will not impair the efficiency of the amplifier. In the list of components 47KΩ is recommended, since this is a common value, easily obtained.

Constructional Data

The plastic case of the microphone is made up in three pieces. The front piece can be unscrewed, while to take off the back piece it is necessary to remove three screws. The centre piece now looks like Fig. 2. Eight terminal bolts (6 BA) are visible and are numbered, for convenience, in an anti-clockwise direction from 1 to 8. Terminals 2 and 7 and 1 and 8 form the two-pole switch operated by the black plastic plunger. Terminal 1

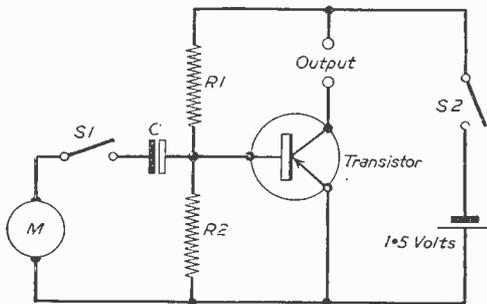


Fig. 1.—The circuit diagram of the amplifier.

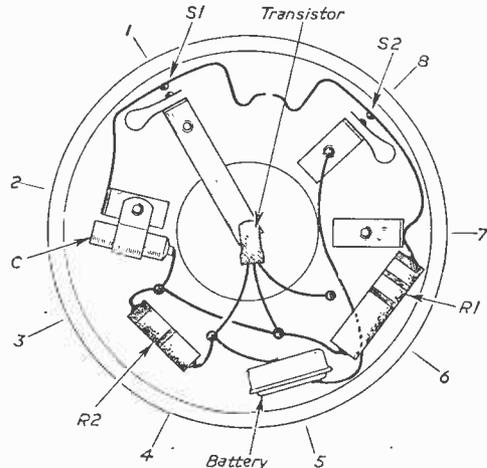


Fig. 2.—General layout; the radial numbers indicate the terminals.

also connects to one side of the microphone insert. The other connection to the microphone is taken from terminal 4. The small lead joining terminals 6 and 8 should be removed. The leaf spring from terminal 8 to the microphone insert is too long, and $\frac{1}{4}$ in. should be removed from the free end with a pair of tin snips.

Initially, the transistor should be connected up. The leads should be trimmed until the base (centre lead) measures $\frac{1}{4}$ in. to $\frac{1}{2}$ in. The emitter and collector leads should be left slightly longer. For neatness, and to prevent the possibility of short circuiting, short sleeves can be put over the leads. The transistor leads are soldered in, emitter, base and collector to terminals 4, 5 and 6 respectively. The transistor should just rest on the spring leaf. R1, the bias resistor (47K Ω), is connected between terminals 5 and 7, the switch part of 7 being used. R2 is connected between terminals 3 and 4 and a lead taken from 3 to either 5 or the positive side of C. In the illustration this resistor is shown as being $\frac{1}{4}$ watt, but this is not necessary. The particular one was chosen only on account of its small size. The 8 μ F electrolytic condenser is connected between terminals 2 and 5 (base connection). The two output leads come from terminals 6 and 7.

Finally, the installation of the battery. The RM 625 is a deaf aid L.T. battery (1.5 volts) and measures just over $\frac{1}{2}$ in. in diameter and is just less than $\frac{1}{4}$ in. thick. The positive pole is marked, so that no confusion should arise over this point. The battery will press comfortably in the recess just below terminal 5. The positive pole towards the transistor. Before it is installed, however, connection must be made to it. Two leads are soldered, one to the positive and the other to the negative pole. The soldering should be done quickly, since the battery should not be heated unduly. It is recommended that each pole be slightly trimmed first to ensure a good, quick, clean connection. The battery installed, the positive lead is taken to terminal 4, while the negative goes to terminal 8.

The circuit is now complete.

One point, however, must be carefully noted. Never switch on until a load is connected across

the output leads. If this occurs, excessive base current may flow, ruining the transistor.

At this point, difficulty may be experienced in fitting the back of the microphone case in position. This is due to the battery and R (if this should be $\frac{1}{2}$ watt resistor). With a small file, or a sharp knife, the offending pieces in the back can be modified easily, and the case will then fit together. The front of the case may now be screwed up tight and the microphone is complete.

It will be readily appreciated by those who have had much experience of microphones that the quality of reproduction is very greatly affected by the characteristics of the case in which the instrument is fitted. Most Government microphones are primarily designed to work fairly close to the source of sound and to exclude background noise. For this reason most are fitted with a projector or mouthpiece through which the sound must pass to reach the diaphragm. The projection has the effect of distorting the sound to a certain extent, so that the result is not unlike sound heard over a telephone. Fortunately this can be overcome by removing the projection. The front of the microphone should be removed, and the projection sawn off with a hacksaw. The plastic is fairly tough, but care should be taken not to grip it too tightly in the vice. The hole left in this part of the case is now about 1 in. in diameter. If it is found that this aperture still distorts the sound, one should increase its diameter until it is about $\frac{1}{2}$ in. short of the diameter of the microphone insert. A grille or mesh can be fitted over the aperture if desired. The instrument complete, it can now be tested. The two output leads should be taken to the primary of the matching transformer of the main amplifier. Pressing the microphone switch, switches on the preamplifier. If there is a loudspeaker at the output of the main amplifier, then the sound input, at the microphone may be checked directly against the output from the speaker. One final point—releasing the microphone switch switches off the preamplifier. If occasions are met with when it is inconvenient to hold the switch continuously, a strong elastic band around the microphone will keep it closed.

Brooms and Bombers

ALTHOUGH the connection between brooms and bombers would at first sight appear to be slight, a recent investigation by Post Office engineers shows how the manufacture of the humble household broom nearly swept special aircraft from the skies.

Bombers and other aircraft of the Royal Air Force use radio telephone channels to keep in touch with their control centres on the ground, and these channels were being jammed by radio noise on the same wavelength.

Aircraft flying over Devon, Wales, Northern Ireland and the Home Counties were affected and the Air Ministry asked the Post Office Interference service if they could help to discover the source of the noise. As the radio noise could not be detected on radio receivers used on the ground,

special recording apparatus was fitted in one of the aircraft which then flew over some of the affected area and brought back a record of the noise. From these recordings the Post Office engineers were able to deduce the nature of the apparatus likely to produce the interference. Widespread checks were made of hospitals, factories and other organisations likely to use radio-type apparatus which would, perhaps fortuitously, generate and transmit the radio frequency which was causing the trouble.

The cause was ultimately traced to a factory in Sussex where electronic apparatus was used for drying wooden billets used for making ordinary domestic broomheads. Co-operation by the factory director and the manufacturers of the equipment, the R.A.F. and the Post Office enabled modifications to the equipment which successfully cleared the trouble.

Choke and Transformer Winding Methods

DETAILS OF SOME OF THE MORE IMPORTANT POINTS TO BE CONSIDERED WHEN WINDING YOUR OWN COMPONENTS By "Waveguide"

TRANSFORMERS and chokes are not quite so difficult to wind as some beginners imagine. At first sight the winding of, say, a thousand turns, seems to involve a great deal of work, but usually several turns can be wound in a second and several thousand in an hour. It is also possible to use a geared winder, but it is then more difficult to guide the wire by hand, and the machine would require to be made semi-automatic.

The winder can, however, be very satisfactory while taking a simple form, but a turns counter of some kind is almost essential. This is preferably geared to the shaft so that it can add turns wound or subtract if some should have to be unwound. A zero reset is unnecessary. A horizontal bar may be added to steady the hand when guiding the wire.

Choice of Wire

Enamelled wire is not the best for home-made transformers. Paper interleaving has to be added and the winding will then take up more space than when double silk covered wire is used. On gauges as thick as 16 s.w.g., enamel is liable to crack at bends. On the other hand, E. & S.S. (enamelled and single silk covered) or E. & S.C. wire is adequately protected and will not corrode. Double cotton covered wire usually takes up too much space, but is probably

frame. Holes at the corners can be used for fastening tags or tag strips.

Except in very large transformers it is safe to use D.S.C. wire without interleaving, providing that the bobbin is evenly filled. With fine wire it is not necessary to wind the turns exactly side by side, but with thicker gauges this is desirable, and a piece of interleaving should be inserted whenever the winding is becoming uneven. The more rounded the former, the easier it is to wind the turns closely side by side. The thicker heater windings of a mains transformer must, of course, be on the outside where sharp bends are unnecessary.

Ideally, a transformer core would be circular in cross-section, and a square centre-limb approaches this more nearly than an oblong, but in some circumstances it may be necessary to use a deeper stack of laminations to reduce the number of turns or to increase the power-handling capacity.

On the completion of a winding it can be covered with empire cloth or ordinary insulating tape. When space is limited, one layer will often be sufficient, but only if no interstices are left.

Wax-dipping

Impregnation of the transformer is worth while to avoid corrosion and to improve the insulation resistance. The application of varnishes during the

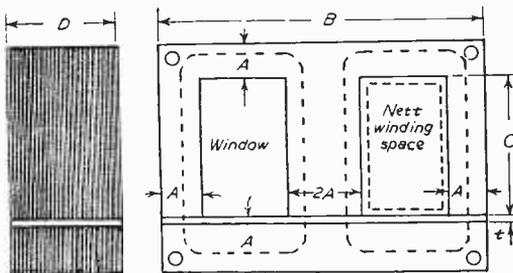


Fig. 1.—Laminations of the E & I type, especially suitable for a choke. The length of magnetic path, l , is that of either dotted line. Effective gap = $2t$. Volume = $2AD(B+2C)$.

the best choice for heater windings of thick wire.

The transformer bobbin can be constructed of pieces cut with a fret saw from 1/16in. insulating material. The construction shown in Fig. 2 involves six pieces. Once these have been put together and some adhesive strip wrapped round the former, the projections will prevent it from coming apart, and so eliminate this source of trouble. A series of holes should be drilled where the leads are to emerge. If there is any doubt as to the positions, the holes can be elongated by using a tension file in a hacksaw

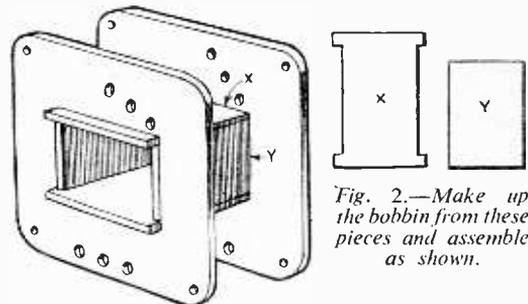


Fig. 2.—Make up the bobbin from these pieces and assemble as shown.

winding is inconvenient, and special varnish is necessary. Shellac in methylated spirit cannot give a high insulation resistance since it is difficult to drive out all the spirit even by prolonged baking. Some oil varnishes also refuse to oxidise or polymerise and remain sticky. This in some cases actually causes corrosion.

Wax-dipping is a much better method, assuming that the transformer in use will not heat enough for the wax to melt and run out. The process consists of heating a quantity of paraffin wax until the wax can travel up a strip of paper dipped into it (but not any hotter than necessary). The transformer, complete with laminations, can then be lowered into this. Air in the windings expands and emerges in bubbles.

When the wax cools, the remaining air contracts and wax infiltrates into the windings. The transformer is removed before the wax begins to congeal. The laminations are also protected from corrosion and vibration is prevented even when the clamping arrangements are not perfect, which is often the case when the laminations are without holes for securing bolts. (Some loudspeaker transformers give quite an audible output with the speaker disconnected.)

Enamelled wire stands up sufficiently well to wax-dipping, but it must not later be unwound and used again, since the enamel may show a tendency to flake away.

Designs

The turns per volt of the windings in a mains transformer is obtained by dividing 7 by the core area in square inches (i.e., by the cross section of the centre limb). The power-handling capacity in watts is taken as 31 times this area squared. Larger outputs can be drawn but at lower efficiency. Some allowance may have to be made for the resistive voltage drops in the windings, but the exact number of turns in a heater winding is probably best adjusted by experiment, when supplying the required current. An accurate moving-iron voltmeter may be used for the purpose. Normally one finds that the output from one secondary winding is only slightly affected by the current drawn from another winding.

Leakage inductance is the part of the inductance of a winding which is not coupled into another winding. It has little effect at mains frequency, but in a loudspeaker transformer it may cause a large drop in the amount of power transferred at the higher frequencies. For this reason output transformers for an extended frequency response have the secondary sandwiched between primary sections, and a double bobbin with balanced windings is best for a push-pull output stage. The mutual cancellation of the D.C. ampere-turns due to the two valves preserves a high primary inductance which is necessary to maintain the primary input at low frequencies.

The voice-coil resistance, taken at some nominal figure rather larger than the D.C. value, is stepped up by the square of the transformer turns ratio to give the anode load recommended for the valve. The application of a substantial amount of negative feedback reduces the effect of mismatching.

When a single output valve is employed, the loudspeaker transformer has to be gapped like a choke. In making a smoothing choke the volume, V , of the iron in the laminations (c. in.), and the average length, l inches, of either of the two magnetic circuits should be calculated. Then the following inductance can be obtained:

$$L = 0.05 \frac{V}{l^2} \text{ henrys,}$$

where I is the direct current in amperes.

To accomplish this, the number of turns should be:

$$N = 96 \frac{l}{I}$$

and it will be necessary to adjust the gap carefully. To do this the choke should be inserted in circuit with the load connected, but without the output smoothing condenser. An indicator such as a vacuum tube voltmeter is connected across the load, and the thickness of the gapping material is adjusted until the ripple voltage across the load is at a minimum. The inductance will then be the maximum obtainable

with that amount of direct current flowing. With a smaller direct current the inductance would be higher. Accurate adjustment of the gapping can produce a considerable increase in inductance. For example, with a current of 240 mA. through a choke it was found possible to raise the inductance from about $1\frac{1}{2}$ henrys (with zero gap) to $2\frac{1}{2}$ henrys with the optimum gap. E & I laminations have the advantage that the three gaps are in line, but V and T laminations can be utilised when necessary.

Accommodating the Windings

Leads taken out from a transformer should consist, in the case of thin wire, of at least four strands. The strands are bared at the end, twisted with, and soldered to the wire of the coil. A piece of insulation tape is placed below and another piece pressed over the junction, which should not have any sharp projections, such as spikes of solder.

It is simpler to abandon the double-windings and heater windings which a full-wave valve rectifier requires, by using metal rectifiers instead. In fact, quite a small secondary will suffice with a voltage-doubler, but the wire should be thicker than the primary in order to secure a low resistance and good regulation.

For a transformer of round about 30 watts (core area 1 sq. in.) the primary may be of 32 to 30 s.w.g., according to the room available. A secondary supplying a voltage-doubler rectifier could then be of, say, 26 s.w.g. This gauge would also serve in a heater winding to supply a single 0.3 amp. valve. Larger currents, up to at least 6 amperes, can be obtained from a single 16 s.w.g. winding.

The net winding space will be less than the "window" of the laminations by at least $1/16$ in. all round, and inter-winding insulation must also be allowed for. The wire table enables the turns per layer, and depth of each winding to be calculated, but in practice the latter may be somewhat exceeded owing to the springiness of the wire. Mean turns can be roughly estimated by placing a piece of wire loosely about the former and measuring its length. The two columns on the right then enable the resistance and weight of each winding to be assessed.

S.W.G.	mA.*	Turns / Inch (Close Wound)		Ohms per 1000'	Oz. per 1000'
		D.C.C.	E. & S.C.		
16	3,200	13.2	13.4	0.210	16.5
18	1,800	17.0	17.3	0.374	9.29
20	1,000	21.3	21.8	0.664	5.23
22	620	25.6	26.4	1.10	3.16
D.S.C. E. & S.S.					
24	380	40.0	39.0	1.78	1.95
26	250	48.8	47.5	2.66	1.30
28	170	57.8	55.3	3.93	0.883
30	120	67.1	67.1	5.59	0.621
32	92	75.2	76.2	7.39	0.470
34	66	85.5	88	10.2	0.341
36	45	99	102	14.9	0.233
38	28	118	126	23.9	0.145
40	18	137	147	37.4	0.0929
42	13	161	166	53.7	0.0647
44	8	185	200	84.2	0.0413
46	4.5	217	242	150	0.0232

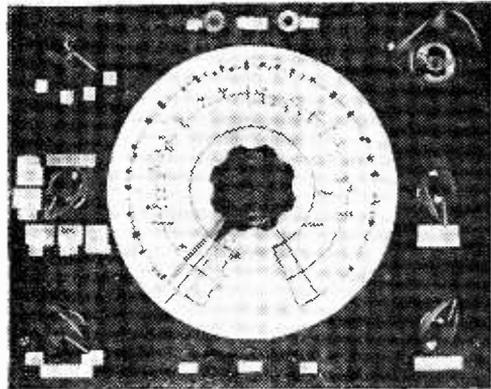
* At 1,000 amp./sq. in. (This current density is occasionally doubled.)

A C.R.L. Bridge

MEASURE CAPACITANCE, RESISTANCE AND INDUCTANCE WITH THIS HANDY TEST SET

By J. Hillman

THIS is a conventional bridge completely self-contained, enabling measurements of resistance, capacitance and inductance to be made. It employs an amplified null indicator, thus enabling a better balance point to be obtained, and has a choice of two oscillator frequencies, namely 50 cycles and 1,000 cycles. On the resistance range, from 0.1 ohm up to 100 megohms can be measured, whilst on the capacitance range, from 3pF to 100 μ F can be measured. On the inductance range, from 10 m. henries to 100 henries can be measured. Provision is also made for matching resistors or capacitors. A power factor control is fitted and gives an indication of the quality of both capacitors and inductors. The accuracy of the instrument depends on the accuracy of the standards used and, if possible, only 1 per cent. components should be employed and they should be stable. The null indicator can be used separately by connecting leads to X1 and chassis, with S2 in the M position, and so can be used as an output meter when aligning sets and also can be used to check A.V.C. The



View of the panel.

1,000 cycle oscillator can also be used separately by connecting leads to X2 and M1, with S2 in the M position, and thus can be used to give an audible note for testing amplifiers and loudspeakers. Its output is approximately 8 volts.

Construction

Mark out as Fig. 4 and bend up the half-inch edges at right angles. Now mark out chassis, as Fig. 3, and bend in alphabetical order, A bend first, then B and so on to K. Secure H and I to J with 6 B.A. bolts and nuts and then proceed to mark out front panel as Fig. 2. Drill and cut out holes as shown and then bolt up the front panel to the chassis, when it should appear as Fig. 5. Now mark out the chassis as Fig. 14 and drill and cut out holes as shown, then mark out and cut out cover as Fig. 7, then bend to form shape as Fig. 9, securing with 6 B.A. bolts and nuts. Now place cover in position over chassis and front panel and mark position of two holes only, drill these 3/32in. and secure cover with self-tapping screws. 6 B.A. Then proceed to drill rest of holes and fit screws as each hole is drilled. This method ensures a good fit and avoids errors in marking out and drilling. Now make bottom panel as Fig. 6 and fit in same way to bottom of chassis. Before proceeding further it is a good plan to paint the outside of the instrument and if a black crackle finish is needed then the procedure is as follows. Use "Panl" crackle paint, sold in tins at 3s. a tin, and apply like ordinary paint, but only do one side at a time. Having applied the paint to one side suspend that side horizontally over a small paraffin lamp so that there is a slight tract of smoke from the lamp. Leave for an hour or so, when the

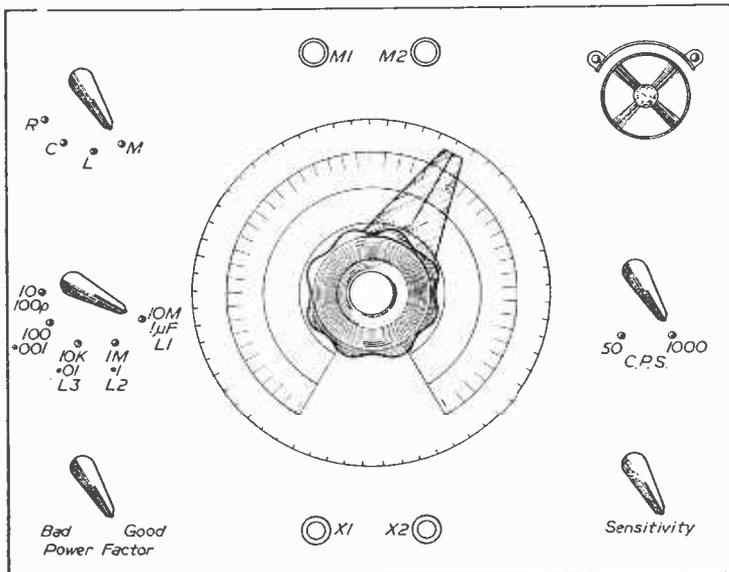


Fig. 1.—Details of the panel shown in the illustration above.

wide and 2in. long, then get the centre point of the wire and double it back on itself to form a Bifilar winding when wound on the Paxolin. The reason for using a thin piece of Paxolin and a Bifilar winding is to counteract the inductive effect of the winding as otherwise its resistance would not be stable but would vary according to the frequency of current passing through it. Precision resistors can be obtained fairly easily and capacitors in the lower values. but some difficulty may be experienced in getting some higher values. Up to 5,000pF capacity the price is 2s. each, but above this value the

with the least losses. Similarly for the 1μF use a selected block paper component. It will be noted that no reservoir condenser is fitted to the smoothing circuit, and the reason is to keep the H.T. voltage down and to avoid having to

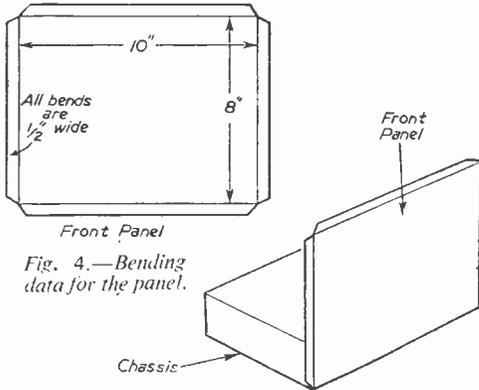


Fig. 4.—Bending data for the panel.

Fig. 5.—General assembly data.

price rises rapidly; however, for 0.01 use two 5,000pF in parallel. With the 0.1 a mica one can be expensive and the next best thing is to select a good paper one, preferably oil filled. If you have several to choose from then leave this range until the 0.01 range has been calibrated and use it to select the most accurate one and the one

use too high a voltage dropper. With 150 volts at junction R1, R2 the oscillator will give roughly 1,000 cycles. The frequency is not critical and need not be stable, as it does not affect the accuracy of the bridge, for whatever frequency is used it passes through both the standard and the unknown and although their reactance varies according to frequency their ratio remains the same and it is in the measurement of the ratio that the bridge is calibrated. The reason for having two test frequencies is that on some ranges a better null point can be obtained with 50 c.p.s., whilst on others the reverse is the case. With inductors it is much more difficult to get accurate standards and as most of the data for ordinary service work is merely concerned with whether a choke or coil is the required value no great accuracy is required. For the first two

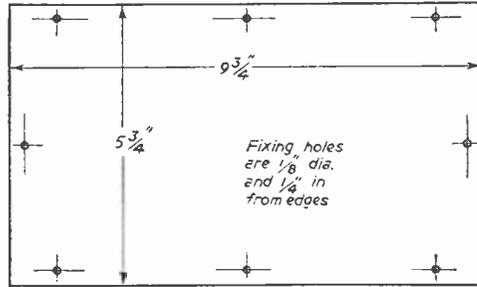
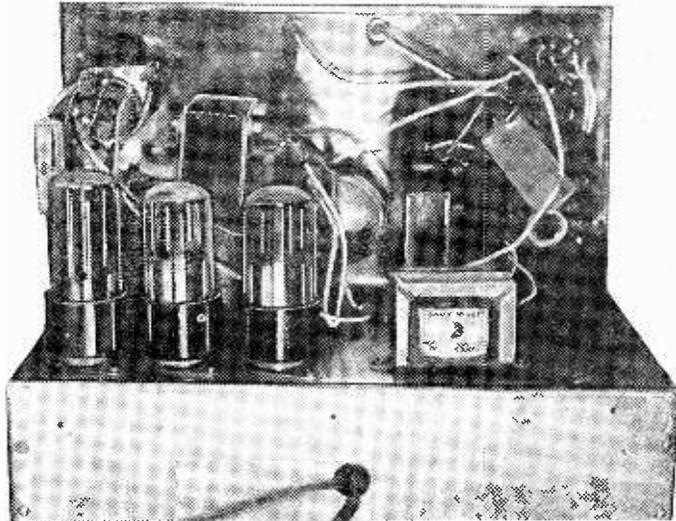


Fig. 6.—"Lid" for the bottom of chassis.

IST

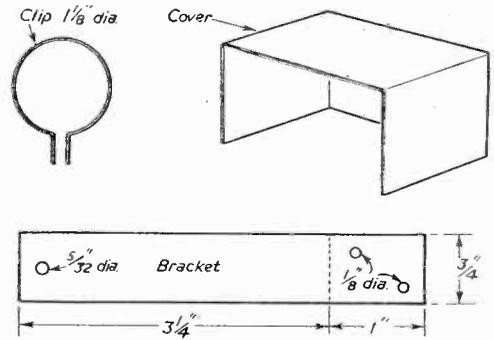
- 1 midget output transformer
- 4 insulated sockets
- 4 Int. octal valveholders
- 1 mains transformer
- 2 1 amp. fuses
- 1 Twin fuseholder
- 1 3 pole, 5-way switch S3
- 1 3 pole, 4-way " S2
- 1 2 pole, 2-way " S1
- 1 DPST toggle switch S4
- 5 small pointer knobs
- 1 large round knob
- 2 wander plugs
- 2 crocodile clips
- Aluminium, 7.33 flex, 23.36 flex, 20 s.w.g. TC, as required.
- 4 and 6 B.A. nuts and bolts, self-tap
- 6 B.A. screws, as required.
- 2 6SN7gt valves, V1, V2
- 1 EM34 valve V3
- 1 5Y3GT valve V4
- 1 mains lead
- 1 tin black crackle paint



A rear view of this test set.

ranges covering the L.F. chokes a small output transformer is used as a standard, and with this it is quite easy to distinguish between a 5- and 10-henry choke as the distance between their calibration marks is about one and a half inches. The third range has a 1K resistor as a standard, and with this on the 1,000 cycle input the lowest reading on the scale is 2,000 micro-henries. Readings below this figure are not possible because the reactance of the inductor is far less than its D.C. resistance, and you would be measuring resistance rather than inductance. Take, for example, a 2,000 micro-henry coil. Its D.C. resistance is about 40 ohms, whilst its reactance at 1,000 cycles is only 13.8 ohms, whilst at 50 cycles it is only 0.69 ohm. With, say, a 10-henry choke, its D.C. resistance may be 250 ohms, but its reactance at 50 cycles would be 3,141.6 ohms, whilst at 1,000 cycles it would be 62,832 ohms, and therefore its D.C. resistance is only a small fraction of its A.C. one. The D.C. resistance of

the coil depends on the number of turns of wire and also on the diameter of the wire, so that



Figs. 8 and 9.—Details of the condenser clip and cover for the set.

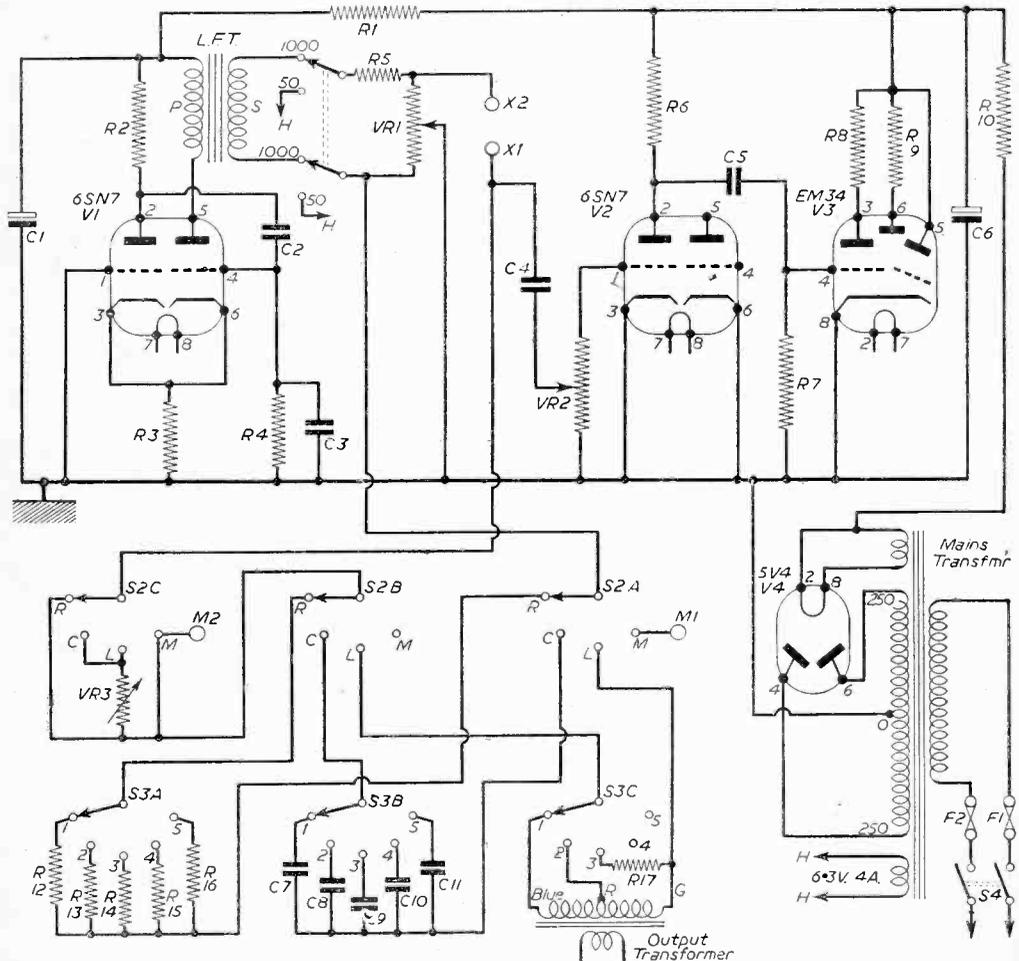


Fig. 10.—Theoretical circuit of the test set. A list of parts will be found on the previous page.

although two coils may have the same inductance, but wound with different gauge wire, their resistance to D.C. would be different. On A.C. the D.C. resistance remains the same, with the addition of the reactance, and unless this D.C.

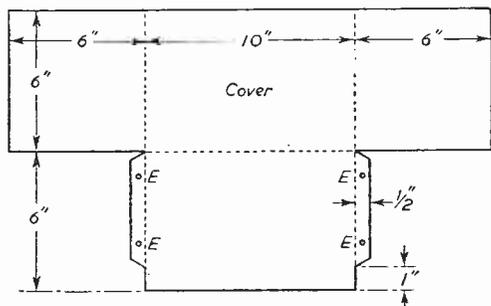
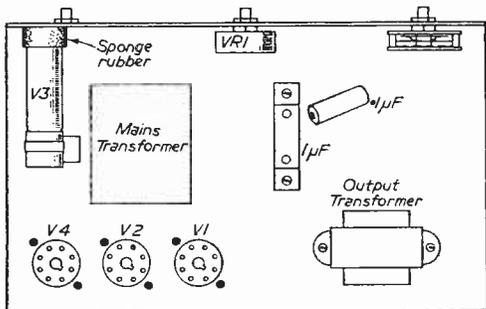
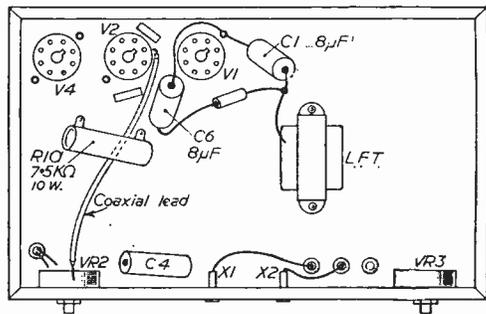


Fig. 7.—Details of the cover.

resistance is only a small part of the total, the true inductance cannot be found. One point to note in calibrating on range 3L is that two different readings will be obtained with the two test frequencies, but as a null point will only be obtained with the 1,000 cycles frequency, use this for test and calibration. Separate scales are used for the three inductance ranges, each individually calibrated. For wiring up the components use 7/33 PVC coloured wire except for the standards, and for this use 20 s.w.g. T.C. Make up two test leads from single 23/36 flex about three inches long and having at one end a wander plug and at the other a crocodile clip.



Figs. 11 and 12.—Top and underside of chassis layout.

Calibration

Start with resistor range first, place S2 to R. S1 to 50 c.p.s. S3 to 10K range. Ideally the best method is to use precision resistors in 20 steps to get the scale accurate at all points, but it is most unlikely that these will be available. In my case I only had three precision resistors, 50K, 5K

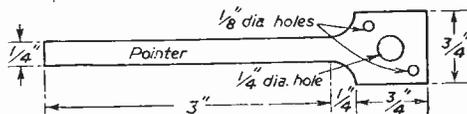
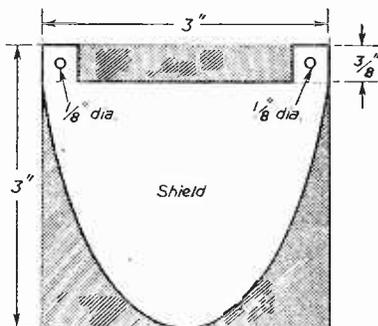


Fig. 13.—Pointer details.

and 1K. Using the 10K range, connect up the 5K resistor to X1 and X2, switch on the bridge and advance VR2 until shadow on EM34 commences to close, then move VR1 until shadow opens again, advance VR2 to close shadow then re-adjust VR1 to open shadow. Continue this, until a definite point is reached on the scale of VR1, at which the shadow closes either side of it, mark this point on the scale 0.5 for use when the range is multiplied by the reading. Thus 10K by 0.5 the answer is 5K. Do the same with 50K, the mark in this case being 5, whilst for 1K the mark will be 0.1. We now have



three marks on the scale and by connecting the 5K and 1K in series we get a fourth mark 0.6. Now mark off the centre of the scale and mark this 1. Now divide the distance between 5 and 1 in half and mark this point 2. Now use a number of 10 per cent. resistors and by taking the average of the markings mark off the points in between. The scale will not be uniform, but will be cramped slightly at each end. The only points that need be marked are from 1 to 10, and from 1 to 0.1. The spaces between these marks can be divided up
(Continued on page 801)

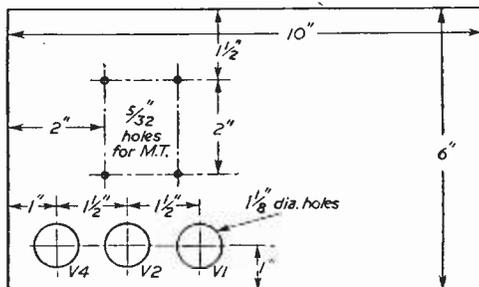
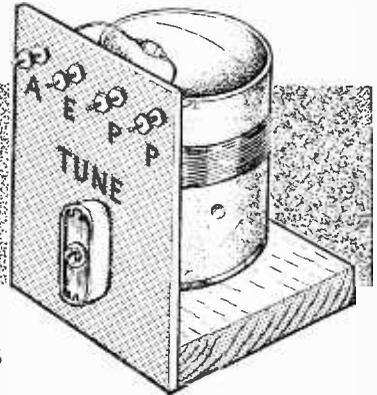


Fig. 14.—Chassis drilling details.

A BEGINNER'S CONSTRUCTIONAL COURSE



AS DISTINCT FROM A THEORETICAL COURSE, THIS SERIES STARTED WITH A SIMPLE CRYSTAL SET, IN THE OCTOBER ISSUE, WHICH HAS GRADUALLY BEEN MODIFIED IN STAGES, AND IS NOW COMPLETED AS A CRYSTAL AND TWO TRANSISTOR LOUDSPEAKER SET

By E. V. King

(Concluded from page 688, December issue)

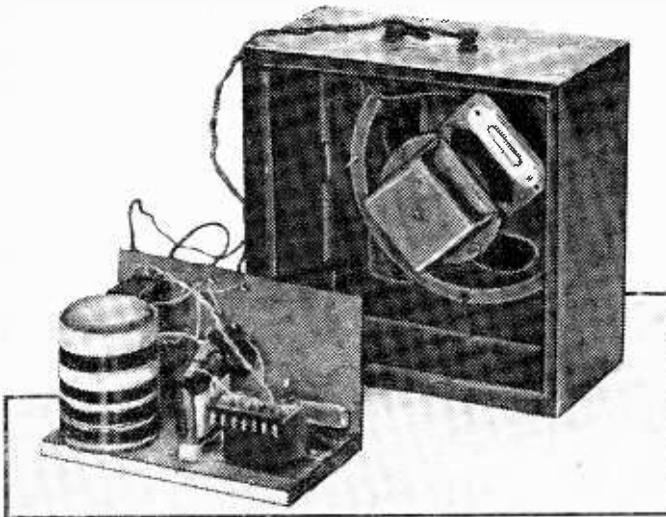
THE original set will now have been modified to include variable selectivity, a volume control and one transistor, and it is hoped that the beginner will have carried out the experiments suggested. These may be carried out again with advantage when the transistor has been fitted as more volume will be available. If you have not made the receiver you could do so now, and remember that the transistor stages can be fitted to any crystal set provided you put the crystal the right way round (trial and error will do). Never carry out a modification until the previous one is working well; this is advice essential to the beginner and not to be laughed at by the expert. A complete circuit diagram is given in Figs. 28 and 29.

How to Get Loudspeaker Volume from the Crystal Set

A further transistor may now be added to bring the volume up to loudspeaker strength. Naturally you cannot expect the loudness to be suitable for a rowdy party or large hall, but for the den or bedroom it is very suitable indeed. The circuit has been especially kept simple and is dead easy to get working, but with experience the experimenter could fit push-pull output and get added volume.

The tuning arrangements and diode are left intact. The T2 battery is not required, the transistor and 220K resistor are temporarily removed. An ordinary multi-ratio transformer is then fitted (see Fig. 29). A battery clip is made (Figs. 30b and 27) from cocoa-tin material, which may be cut with scissors. Two busbars of the same material (Figs. 30a and 27) are made and fixed to the wooden base with tacks or screws. Four brass drawing pins are pushed into the base as shown in Fig. 27, they act as very convenient tags for fixing the transistors, but these are actually left in the spares box until everything else is wired up.

It is usual, and good policy, to fit speaker and aerial terminals remotely from each other, but the writer found no ill effects on leaving the original phone terminals for the speaker. However, you may either move them to the other end of the panel or take the speaker leads direct from the transformer (Fig. 29).



The finished set connected to the loudspeaker.

(Continued on page 793)

RETURN-OF-POST SERVICE

MULLARD TAPE AMPLIFIER TYPE "C"

THE MULLARD TAPE AMPLIFIER TYPE C is a new version of the Type B Amplifier. It comprises a recording amplifier and a play-back Pre-Amplifier, and is intended to use an existing amplifier for play-back. It uses a Ferroxcube Inductor in the treble boost circuit and has a switch for the speed equalising circuits in place of the plug-in unit on the Type B Amplifier. The circuit gives details for use with Brenell, Collaro, Truvox and Lane Tape Decks.

INSTRUCTION MANUAL is available from us free of charge. Please send 4d. in stamps to cover cost of postage.

RESISTORS.—LAB Kit, 33'.

CONDENSERS.—Our Kit, 32'.

INDUCTOR.—Mullard LA1 Pot Core, 20'-. Reel of 33 swg wire to wind coil, 2'.

OSCILLATOR COILS.—Brenell, 8'-. Truvox, 6'-. Lane, 10'.

VALVES.—EF86 Mullard, 24 4. Alternative, 15'-. EM81 Mullard, 18' 1. EL34 Mullard, 16'-. Alternative, 12'-. Diode Mullard OA71, 6'.

SWITCHES.—Specialist Switches. Set of two, 26'.

TAG BOARDS.—Bulzin C12). 1 3. C125. 2 3.

CHASSIS.—Dence. Fully drilled and including screens and cover plate. 32 5.

PLUGS AND SOCKETS.—Belling Lee. L7348. 1'-. L9018. 1 3. L734P Plugs. 1 3. Elcom. P04 Chassis Plug. 3 6. S04T Flex Plug. 5 3. Isamic Jack Sockets. P71. 3/4. P72. 3 10. Bulgin P38 Jack Plugs. 3'.

VALVE HOLDERS.—McMurdo. BM9U, 10d. XM9 UC1. 17. XM9 UG1. 2 3.

KNOBBS.—Bulzin K370. 1/6. **CERAMIC INSULATORS.** 1'-. **ESCUTCHEON FOR EM81.** 2 6. **SUNDRIES KIT.**—Nuts. Bolts. Wire, etc. 7/6.

COMPLETE KIT containing all components, valves and sundries kit.

KIT A.—With alternative valves. £14.0.0.

SKIT B.—With Mullard valves. £15.15.0.

POWER PACK KIT. £4.0.0. Items available separately. Send for list.

CREDIT TERMS.—Kit A. Deposit £2.1.6 and seven monthly payments of £1.17.6. Kit B. Deposit £2.7.0 and seven monthly payments of £2.2.0.

GRAMOPHONE EQUIPMENT

RECORD PLAYERS

GARRARD 4SP.—The latest Garrard four-speed player unit. Fitted with Garrard GC2 Crystal Pick-up, £8.1.8. Credit Terms. Deposit £1.4.3 and seven monthly payments of £1.2.6.

COLLARO 4/564.—Four-speed unit fitted with the well-known Studio Pick-up "O" or "P." £37.0. Credit Terms. Deposit £1.8.6 and seven monthly payments of £1.5.6. Special Offer of the same unit fitted with "T" (High output) Pick-up only. £7.19.6. Credit Terms. Deposit £1.5.6 and seven monthly payments of £1.2.0.

BSR TU9.—Four-speed motor with separate Pick-up fitted with BSR TC8 cartridge. £4.15.0. Credit Terms. Deposit £1.5.0 and three monthly payments of £1.6.8.

COLLARO JUNIOR.—Four-speed motor with separate pick-up. The Pick-up is an ACOS model and is fitted with the HGP39 Cartridge. £4.13.6. Credit Terms. Deposit £1.3.6 and three monthly payments of £1.6.8.

GARRARD TA MK II.—Four-speed. Very well made player fitted with Garrard GC2 cartridge. £9.15.8. Credit Terms. Deposit £1.10.2 and seven monthly payments of £1.6.6.

RECORD CHANGERS

We have several types available—some at special prices. Please send for latest list.

LATEST AVO TEST METERS

AVO METER MODEL 8 MARK II

The latest version of this finest of all test meters is now available from stock. 50 microamp movement (20,000 ohms per volt). Eight DC Voltage, Seven DC Current, Seven AC Voltage, Four AC Current and three ohms ranges. Fully detailed literature available free. Price £23.10.0. Credit Terms. Deposit £3.9.0 and seven monthly payments of £3.3.0. Leather carrying case, £3.0.0.

AVO MULTIMINOR

A new and very attractive pocket size instrument at a modest price. Movement is 100 microamps (10,000 ohms per volt). Six DC Voltage, Five AC Voltage, Five DC Current and two ohms ranges. Descriptive leaflet available free upon request. Price £9.10.0. Credit Terms. Deposit £1.8.0 and seven monthly payments of £1.6.0. Leather carrying case, 32/3.

HI-FI AMPLIFIERS

LEAK TL12 POWER AMPLIFIER.—14 watts output. Distortion 1% at 12 watts. Frequency response is within 5 dB to 20,000 cycles. Output impedance enables any speaker from 3 to 20 ohms to be used. The Varislope and Point One Pre-Amplifiers are both suitable for use with the TL12. Price £18.18.0.

LEAK VARI-SLOPE III PRE-AMPLIFIER.—The latest Leak Pre-Amplifier. Inputs for Pick-ups, Tuner, Tape or Microphone. Rumble filter. Recording characteristic correction. Separate bass and treble controls. Price £15.15.0.

LEAK POINT ONE PRE-AMPLIFIER.—This unit has input selector switch for the various recording characteristics, tuner and tape inputs. Separate controls for volume, treble and bass. £10.10.0. Fully detailed literature is available on all the above.

CREDIT TERMS ON LEAK TL12 AND VARI-SLOPE.—Cash Price £34.18.0. Deposit £5.4.6 and seven monthly payments of £4.12.6.

CREDIT TERMS ON LEAK TL12 AND POINT ONE.—Cash Price £23.8.0. Deposit £4.8.6 and seven monthly payments of £3.18.6.

QUAD MARK II AMPLIFIER AND CONTROL UNIT.—15 watts output. Distortion at 12 watts output is less than 1%. Frequency response is within 2 dB 20 to 20,000 cycles. Output impedance is 7 and 15 ohms. The control unit has a wide range of inputs for Pick-up, Radio, Microphone and Tape. Fully detailed booklet available upon request. Price £42.0.0. Credit Terms. Deposit £6.8.0 and seven monthly payments of £5.12.0.

MULLARD AND GEC AMPLIFIER KITS.—We stock all the items needed for both these kits. Fully detailed lists available.

NEW JASON "MERCURY" FM SWITCHED TUNER KIT

This fine new switched tuner provides all three BBC programmes at the turn of a switch. The front end unit is supplied ready wired and tested. See our advertisement in December PRACTICAL WIRELESS or send for full details. Instruction Book 2/3 post free.

COMPLETE KIT, £9.19.0 POST FREE.

CREDIT TERMS. Deposit £1.10.6 and seven monthly payments of £1.7.0.

TERMS OF BUSINESS.—Cash with order or C.O.D. Postage extra under £3. We charge C.O.D. orders as follows. Up to £3, postage and C.O.D. fee, minimum 2/5. Over £3 and under £5, C.O.D. fee only 1/6. Over £5 no charge.

WATTS RADIO (MAIL ORDER) LTD.

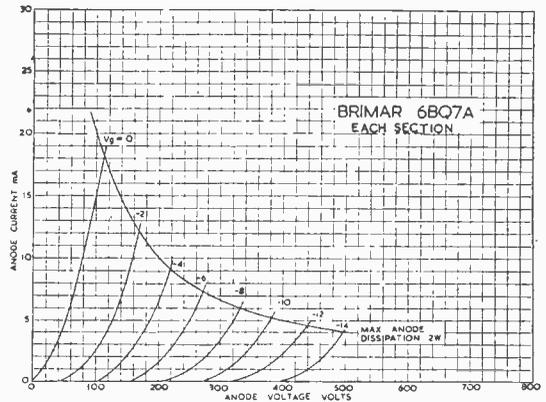
54 CHURCH STREET, WEYBRIDGE, SURREY

Telephone: Weybridge 4556

PLEASE NOTE. POSTAL BUSINESS ONLY FROM THIS ADDRESS.

BRIMAR 6BQ7A

The Brimar 6BQ7A is a double triode consisting of two independent high slope sections with similar characteristics. The valve is particularly useful as a cascode R.F. amplifier for television receivers and also as a combined oscillator and mixer for frequency modulation receivers. It can, of course, be used wherever high slope triodes are required, and features low interaction between the sections as an internal screen is provided which is brought out to a separate base pin.



TYPICAL CHARACTERISTICS

Heater voltage.....	6.3 volts
Heater current.....	0.4 amp
Anode voltage.....	150 volts
Cathode bias resistor.....	220 ohms
Anode current.....	9 mA
Mutual conductance.....	6.4 mA/V
Amplification factor.....	39
Anode resistance.....	6,100 ohms
Grid cut-off voltage ($V_{g1} - 10\mu A$).....	-10 volts approx.

Write to the Publicity Department for a data sheet.

Standard Telephones and Cables Limited FOOTSCRAY SIDCUP KENT Footscray 3333

FOUR-SIDED BLANK CHASSIS

Made in our own works from Commercial Quality half-hard Aluminium of 18 s.w.f. thickness (approx. 1/16") these chassis will carry components of considerable weight and normally require no corner strengthening.

THOUSANDS OF SIZES TO CHOOSE FROM!

We can now supply on the SAME DAY as your order is received the exact size to the nearest half-inch and in depths of 1", 1 1/4", 1 1/2", 1 3/4", 2", 2 1/4", 2 1/2" and 3", that you require — AT NO EXTRA CHARGE. Maximum length 18". To arrive at the cost of any chassis, you need only add twice the depth to the length and the width, multiply the two and refer to the table below.

Sq. ins.	Price	Post	Sq. ins.	Price	Post	Sq. ins.	Price	Post
18	3/-	1/3	176	8/-	1/6	336	13/-	1/9
48	4/-	..	208	9/-	..	368	14/-	..
80	5/-	..	240	10/-	..	400	15/-	..
112	6/-	..	272	11/-	..	432	16/-	..
144	7/-	..	304	12/-	..	464	17/-	..

* Full particulars on request.

PANELS.—Cut to any size up to 3ft. x 3ft. at 4/6 per square foot. Postage should be added at the rate of 1 oz. for each 9 sq. ins. **H. L. SMITH & CO. LTD. (Metalwork Dept.)** 287-289, EDGWARE ROAD, LONDON, W.2. PAD 5891

“DIY”

Yes! YOU can DO IT YOURSELF with the aid of our RADIO HOME CONSTRUCTOR'S HANDBOOK. Thousands of enthusiasts already own this famous 66 p. book which gives full parts lists, and circuits of many modern receivers, tape recorder, 'scope, feeder units, communications set, crystal set, hi-fi amplifiers, etc. Also packed with data, building and servicing hints, facts and formulae, colour code, soldering hints, etc. Easy-as-A.B.C. FULL SIZE p-p. Construction sheets for our outfits are available FREE with orders so that even the beginner gets professional results first time! This claim is confirmed by hundreds of genuine testimonials received. Send 2/11 to-day for your copy!

NEVER BEFORE HAS THERE BEEN A BOOK SO VALUABLE TO THE RADIO NOVICE AND EXPERT ALIKE!

RODING LABORATORIES

Hurn Airport, Christchurch, Hants

VALVES—Guaranteed

EA50	2/- U22	8/- 6DE6	7/- 6U5	7/6
EB41	7/6 UUG	10/- 6BH6	5/- 6U7	5/-
ECC33	8/6 VR65	3/6 6BW6	6/6 7D6	7/6
EF36	4/6 VR65A	3/6 6CSM	6/- 8D2	4/6
EF37	7/6 VR91	4/- 6D2	7/- 9D2	5/-
EF39	5/6 VT20	3/6 6F6	7/- 9D6	8/-
EF59	5/- VU111	2/6 6F13	11/6 10F1	11/6
EF80	8/6 W77	5/- 6J5	6/- 12BA6	7/6
EL32	5/- OZ4	5/- 6J6	6/- 12BE6	6/-
PG1	4/- Z152	8/6 6K7G	4/6 12J7	8/6
PCC84	11/- 1D5	8/6 6K7M	5/6 12K7	8/-
PY31	8/0 3D6	4/6 6F13	11/6 10F1	11/6
PY81	10/- 4D1	4/- 6SA7	8/- 18	7/6
SP41	4/- 6AK6	7/6 6SN7GT	35W4	7/6
SP61	6/- 6AL5	7/-	8/6 50C5	8/6
TA1	8/6 6AM6	8/- 6U5(UX)	50L8	8/6
TT11	3/6 6B3	6/-	7/6 78	7/6

Postage 8d. per valve, orders over £1 post free. (Also all components) TV Tubes, Perfect Condition (callers only) MW22/16, MW22/18, £4.0.0 each. Also all Transistor Components.

TELEKIT SUPPLY

104 High Street, Beckenham, Kent. Phone: BEC 3723

TRANSISTORS ARE OUR SPECIALITY

FULL TECHNICAL ADVICE SERVICE

- 7-Transistor Portable (Transeuen) Circuit, 1/6.
- 3-Transistor Radio (Three Dee) Circuit, 9d. (11d. post pd.).
- Complete kit only £3.17.6. (Speaker extra.)
- Transistors—Red Spot, 7/6. Red & Yellow Spot (R.F.), 21/-, Green/Yellow Spot, 10/-.
- Crystal Diodes, 1/3.
- Resistors, All Values 10%. 1-watt, 6d.
- "Hi-Fi" Enthusiasts Dept.:
- G.E.C. 912 PLUS Amplifier Book, 4/-.
- Mullard Amplifiers Book, 3/6.
- Repanco F.M. Tuner Circuit, 1/6.
- Full range of WB/Stentorian Hi-Fi Speakers.
- Full Component List, 6d. Post Paid (C.W.O.)

OAKFIELD RADIO,

OAKFIELD ROAD, STOCKPORT.

H.A.C. SHORT-WAVE EQUIPMENT

Noted for over 18 years for S.W. Receivers and Kits of Quality.

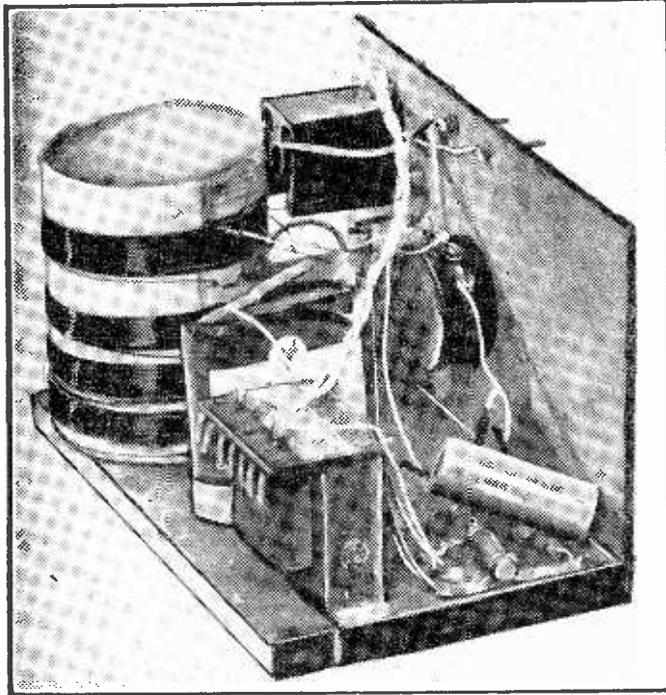
Improved designs with Denco coils: One-Valve Kit, Model "C" Price, 25/- Two " " " " " " " " 50/-

All kits complete with all components, accessories, and full instructions. Before ordering call and inspect a demonstration receiver or send stamped, addressed envelope for descriptive catalogue.

"H.A.C." SHORT-WAVE PRODUCTS (Dept. TH), 11, Old Bond Street, London, W.1.

A Suggested Plan for the Beginner to Follow
Refer to Figs. 27, 28 and 29. Note that in

and positive busbar. The long strip (minus) of the torch battery is then connected to the negative busbar.



Another view of the complete set.

Fig. 29 the front panel has been laid flat and some of the wires are shown longer than they really are.

Wire the earthy side of the volume control VR1 to the plus busbar. Wire the short tag (plus) of the battery (Ever Ready, flat torch, No. 1289) to S2, and the other side of S2 should already be earthed via C2. The other side of the volume control is connected to Drawing Pin 1. Solder R1 to pins 1 and 2, R3 between Pin 2 and the negative busbar. Solder R5 between pin 3

transformers is not very critical and you will do no harm by experiment on this part of the set.

- Torch battery, flat type, Ever-Ready 1289, 4½ volts.
- R3—2.2 k. ½ w. resistor.
- R4—25 k. ½ w.
- R5—10 k. ½ w.
- C3—Electrolytic condenser, 25 v. 25 µF.
- Tr2 Transistor OC71 or red spot.
- Speaker Transformer, Standard Multi-ratio (R.S.C.) (or special transistor output transformer).
- Parts required if the one transistor receiver has not been made
- Detergent Box, 24 turns 26 s.w.g. enam. copper wire and 3 x 40 turns of 32 s.w.g. enam. copper wire.
- C1 and C2—500 pF trimmers (R.S.C.).
- D1—Crystal diode.
- R1—220 k. ½ w. resistor.
- VR1—Volume control, 50 or 30 k.
- Tr1 transistor, OC71 or Red Spot.
- S1 and S2—Toggle switches.
- Four terminals.

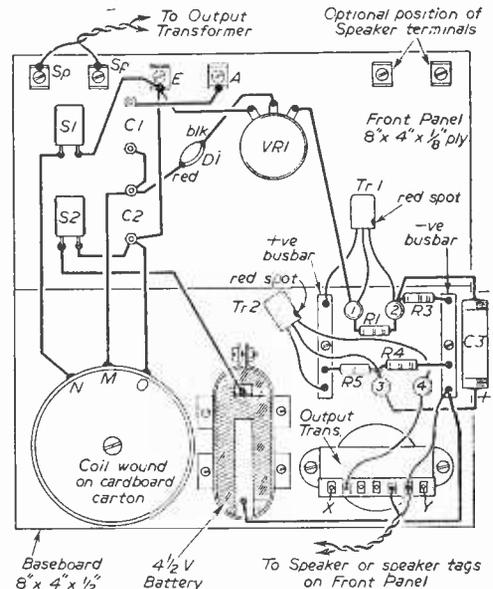


Fig. 29.—The practical wiring diagram.

How to Check the Wiring

When using transistors it is even more important than with mains receivers that you check the wiring carefully before switching on or connecting the transistors in circuit. A good method which the author uses is to copy out the circuit on a piece of paper in pencil and to ink it in bit by bit as it is checked. Everyone makes mistakes, but this method will find them!

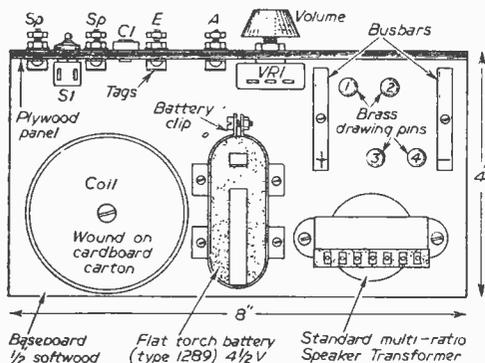
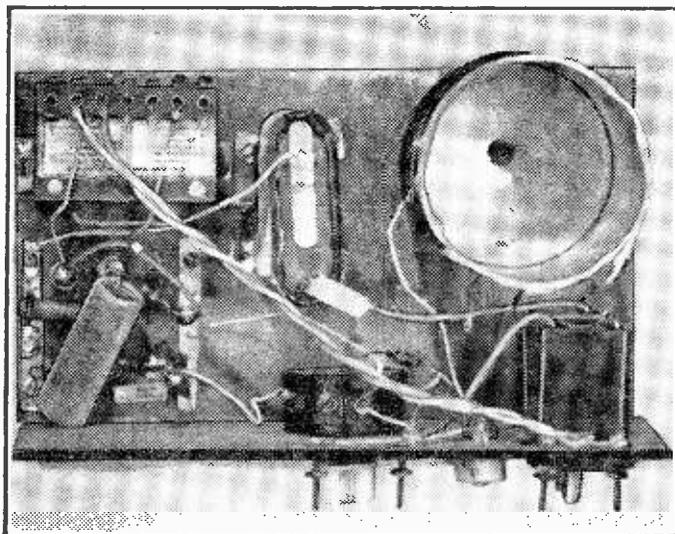


Fig. 27.—Top view of two transistor layout.

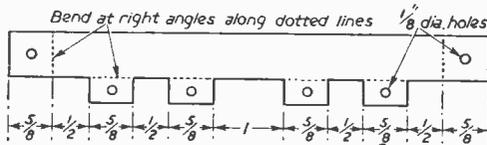
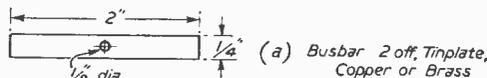
Fixing the Transistors

Wire in the OC71s or Red Spot transistors, remembering the safety precautions necessary with these delicate parts. Here is a suggested plan to follow. Switch off S2. Wire Tr. 1 with emitter (remote from red spot) to positive busbar, base to pin 1 and collector (red spot) to pin 2. Wire Tr. 2 with emitter to the positive busbar, base to pin 3 and collector to pin 4.

Never shorten the leads. solder in positions quickly. leave them suspended "in air." Make sure there are no shorting wires.



Plan view of the final stage of construction.



(b) Battery clip 1 off, Tinplate etc.

Fig. 30.—Details of the busbars and battery clip.

Testing the Receiver

Connect up in the usual way, tune with C2 and adjust C1 for best results with your aerial, (Continued on page 801)

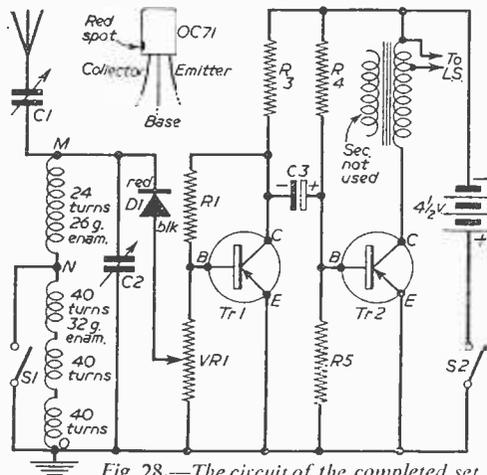


Fig. 28.—The circuit of the completed set.

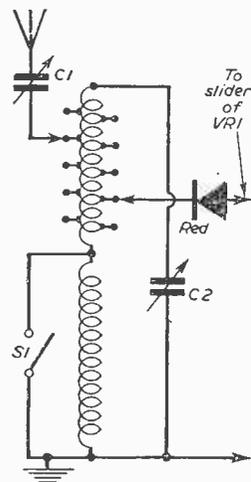


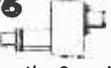
Fig. 31.—Circuit of an improved tuner.

'Q'-FIDELITY F.M.

Reliable F.M. Tuners of High Performance for Hi-Fi amplifiers or as add-on units for existing radios or radio-grams. Fulllest information supplied.

Model 1. The "Mini-Magic." Economy is the watchword of this clever unit which is achieved without sacrifice of performance or reliability. 5 gns. incl. P.T. Kit £4.10.0.

Model 2. Simple switch-tuning with automatic frequency control. A high-quality, stable and completely drift-free unit. Kit or separate components. Size 4½ x 4½ x 5½.

<p>High "Q" Coils 4/- EACH Iron dust cores. Clip in fixing. EXTREMELY SMALL AMAZING EFFICIENCY For Superhet T.R.F. or Transistor operation.</p> 	<p>All coils for Collaro Tape Transcripator pre-amp. BIAS OSC. Coil Type QT9 7/6</p> 	<p>STATION SEPARATOR HOME-LIGHT-THIRD-LUX ETC. 10/6 Not a guaranteed cure but—A positive answer to selectivity problem.</p> 	<p>STOP! T.V. Patterning 10/6 An easily fitted—Simple Remedy</p> 	<p>I.T.A. Converter To fit inside T.V. KIT complete 65/- £4 Very efficient. Can be built in an evening. State B.B.C. and I.T.A. channels.</p> 
---	--	--	---	---

OSMOR COILS FREE!
ARE BEST FOR
Selectivity & Performance



Send 1- (stamps) for fully descriptive literature including OSMOR DESIGNS—5-Valve S'Het, Mini-ature ditto, Battery and Battery/Mains Receiver, Mains T.R.F. S'Het and T.R.F. Feeders. Band 3 Converters, Wiring Diagrams, Chassis Templates, Coil & Coilpack information and price lists and information on circuits in "Wireless World," "Practical Wireless," "Radio Constructor." Full Circuits included. See also Classified Advt.s on page 818.
(Dept. PW 18) 418 BRIGHTON ROAD,
SOUTH CROYDON, SURREY
CROYDON 5148/9

TRANSISTORWISE

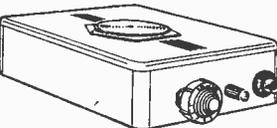
"RECO" ALL-WAVE ONE TRANSISTOR KIT
A low cost beginner's radio. Kit includes all parts, transistor, diode, and super sensitive Bell-Phone for private listening, neat plastic case and 1.5 v. battery for months of dependable listening. Only 29/6.



"RECO" TRANSISTOR 2 PORTABLE; receives home and continental stations. Ferrite rod aerial. Attractive plastic case, balanced armature output unit and all parts. 55/- inc. battery.



"RECO" PORTABLE TRANSISTOR 3
Uses high gain frame aeria mounted on metal chassis. Has variable gain control. 65/- buys all parts, case, and battery.



All parts sold separately. Wiring circuit parts price list, 1/- each. P.O. only.
Please note NEW address.

RADIO EXCHANGE CO.
(Dept. PW)
27 HARPER STREET, BEDFORD
(MAIL ORDER & TRADE ONLY)

G2AK This Month's Bargains

HI-FI EQUIPMENT

Amplifiers, speakers, pick-ups by			Available for immediate delivery.
Gramplan	Leak	Quad	
Rogers	R.C.A.	Spectone	
W.B.	Wharfedale, etc.		

D104 CRYSTAL HAND MIKES. List £6. Complete with 6 ft. cord and plug. Very limited quantity. ONLY £3/10/- each.

HEADPHONES. H.R. Type 4,000 ohms, very sensitive. Only 12/6 pr. Post 1/6. C.L.R. type (low res.) 8/6. Post 1/6.

100 kc/s CRYSTALS, by famous American makers in 3-pin based holder. New condition. Worth £3/10/0. ONLY 25/- post free.

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

AERIAL WIRE. Copper, 7-25 stranded: 140ft., 10/-, 70ft., 5/-; Hard Drawn 14g.: 140ft., 17/-; 70ft., 8/6. P. & P. 2/-.

RIBBED GLASS 3in. AERIAL INSULATORS, 1/6 ea., or 6 for 7/6, 12 or more post free. Small shell porcelain, 4½d. each or 4/- doz.

CONDENSERS. 8 µF 600 v. Trop. 750 v. normal condensers. NEW, ex W.D. stocks, 5/6. P. & P. 1/6.

ABSORPTION WAVEMETERS, 3 to 35 Mc/s in 3 switched bands. Complete with indicator bulb. 17/6 post free.
No C.O.D. on orders under £1.
Please Print Your Name and Address.

CHAS. H. YOUNG LTD.
Dept. 'P' 110, Dale End, Birmingham, 4. (CEN. 1635)

TRANSISTORS

in Practice

AN EXPERIMENTAL TRANSISTOR CHASSIS

By R. Hindle

(Continued from page 696, December issue)

As pointed out last month, due to manufacturing tolerances, the current gain can vary. For a collector current of $500 \mu\text{A}$, there could be a base current of the order of a thirtieth of that current, say $17 \mu\text{A}$. This current flows through R1 in addition to the current drawn by the potentiometer R1 and R2 in series across the battery. For good regulation it is necessary for the potentiometer current to be many times the base bias current. The smaller these resistors are made the greater will be the potentiometer current and the greater will be the stability of the circuit, but there is a lower limit set by the need for economy in battery current. Another point is that R2 is in parallel with the input of the transistor and so will rob it of signal if made too small. A reasonable proposition will be to make the potentiometer current ten times the base current for the lower limit quoted for current amplification (i.e., $17 \mu\text{A}$.) say $200 \mu\text{A}$. This is not likely to upset any battery used for power. Base current through R1 having thus been made negligible compared with the potentiometer current, there is no point in splitting hairs by introducing it into calculations and so the combined value of R1 in series with R2 is calculated by Ohms Law to drop 6 volts at $200 \mu\text{A}$, i.e., 30,000 ohms. The base has to be slightly more negative than the emitter to give the base bias in the correct direction, and the emitter is .9 volts negative with regard to the earth line ($500 \mu\text{A}$ through 1.8 K ohms). Actually the base to emitter voltage is .1, so the base to earth line potential must be 1 volt. R2 must therefore be a sixth of the total potentiometer resistance, i.e., 5 K Ω , and the other limb, R1, must be five sixths, or 25 K Ω —the nearest common values, 4.7 K Ω and 22 K Ω will actually be chosen. R2, at 4.7 K Ω , is large compared with the input resistance of the transistor (1 K Ω) and, though some signal current will be lost in this lower potentiometer resistor, R2, it will not be serious.

The voltage of the battery will drop with use below its nominal value and this will cause a drop in voltage across R3, R4 and T1 in equal proportions. Supposing that the battery is to be allowed to drop by about 25 per cent. before being replaced. There will then be $1\frac{1}{2}$ volts across T1, which will still be satisfactory for the small signal current condition. The emitter voltage will drop by a quarter but will still give adequate stabilisation and the base voltage will drop in like proportion to hold the base/emitter voltage at a reasonable level. The permissible output current

will also fall, but the following transistor will have suffered similarly, and as a consequence will be able to accept only a reduced input before distortion attains serious proportions. The stage will be able to accept only a smaller input signal before overloading, as the battery runs down because of the reduced current swing available at the collector, but in practice it will be the subsequent output stage that governs the limit in signal input to this amplifier, which will be able to load the output stage down to the level that the battery will be used.

On the other hand, supposing the circuit had to be worked on a higher voltage than that specified? The current conditions having been set up satisfactorily for the 6-volt supply, all that need be done is to mop up the excess voltage by increasing R1 and R3. A 9-volt supply, for instance, would require the extra 3 volts to be dropped at $200 \mu\text{A}$, by increasing R1, and at $500 \mu\text{A}$, by increasing R3; the resistors at the lower end of the circuit remain unchanged. Quite likely, however, if 9 volts were to be used it would be in conjunction with an output stage, and then some decoupling between that stage and those in this amplifier would be necessary. The extra 3 volts would then conveniently be dropped in the decoupling resistor.

Second Stage

The next stage is working under somewhat different conditions. It will be accepting a higher input signal by virtue of the amplification of the first stage and therefore, so that its output may be relatively undistorted, it will have to be set up for higher collector current. The larger output current swing that it is to give must still keep the collector current at all times above the leakage current level. A collector current of 3 mA. will allow this stage to deliver reasonable power to

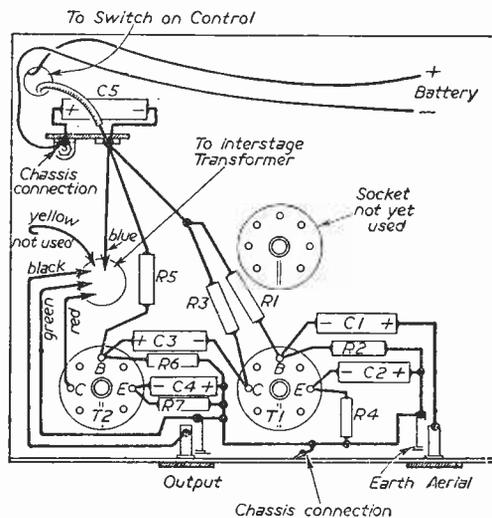


Fig. 17.—Wiring diagram of the circuit shown in Fig. 15 last month.

drive a pair of earphones and also will give adequate output to feed an output stage such as is likely to be needed by a speaker in a portable receiver, when this is built in due course.

The transformer that will be needed to feed the next stage eventually to be added is included in the design at the present stage. The primary resistance of this transformer must be low to avoid too great a drop in voltage. In fact, the specified transformer has a primary resistance of 200 ohms and so, at 3 mA., only .6 volt is lost here. R7 is the D.C. feedback resistor, but it will have to be less than R4 because of the current flowing—3 mA. through 1,800 ohms does not leave much out of 6 volts. The value chosen, 470 Ω , provides adequate feedback because the greater current drops across it a voltage of the required order for stabilisation. The voltage drop across this and the transformer primary leaves about 4 volts for the transistor itself, which is satisfactory for this higher order of signal at the second stage. The potentiometer current through R5, R6 also has to be increased to give satisfactory stabilisation. R6 must not be made too small, however, if excessive loss of signal current through it is to be avoided. The base has to be at the emitter voltage of 1.4 (3 mA. through 470 Ω) plus the required base to emitter voltage which, according to the curves, can be expected to be about 170 mV., indicating an overall voltage around 1.6. Taking a value of 4.7 K Ω for R6, which will not be unduly wasteful of signal current, the value of R5 is calculated by referring to the relative voltages to be dropped. As stated above, 1.6 volts is across R6, so 4.4 volts must be dropped in R5. If the same current were flowing through the two resistors the value of R5 would need to be:

$$\frac{4.4}{1.6} \times 4.7 \text{ K}\Omega = 12.9 \text{ K}\Omega$$

The next lower standard value, 12 K Ω , is chosen, and this compensates to some degree for the additional current flowing through the upper limb in the form of base current. The total resistance is thus 16.7 K Ω and 6 volts will drive a current of about 360 μ A., which is large compared with the base current of 50 μ A for the average OC71.

Capacitances

It remains to determine the sizes of the electrolytic by-pass and coupling capacitors. The reactance of 10 μ F at 100 cycles is around 160 ohms. This is reasonable by comparison with the resistances of the order of 1,000 Ω involved in this circuit and components of this size are used at positions C1 to 4. In a portable system there is little point in attempting to retain the lowest of audio frequencies as the speaker will not reproduce them. C4 is across a resistor of 470 ohms and consequently its value could be increased to, say, 50 μ F with advantage if the amplifier were to be used with higher output powers to feed into reproducing systems capable of delivering lower frequencies.

The battery resistance increases as it runs down and this resistance is common to all stages fed from it. C5 across the battery limits the coupling effect by its low reactance, about 30 ohms at 100 cycles.

Construction

The two parts of the chassis are fixed together

using the volume control with switch and the tuning capacitor. If the constructor at the present stage does not wish to provide these components a switch could be used in the volume control position and a nut and bolt used in the position indicated for the tuning control. The three miniature 7-pin valve holders can now be mounted, these being turned until the pins are in the positions indicated in Fig. 17 and then bolt holes marked and drilled. Now, so that no mistake can be made when the chassis is being wired and when subsequently being used, clearly mark the pins to be used, both above and below the chassis, indicating which connection of the transistor goes to each pin used. Take care that the marking above the chassis agrees with that below the chassis, remembering that when the chassis is turned over the pin that was to the right is now to the left, and that pin numbers, which are counted clockwise below the chassis are counted anti-clockwise above! Pin 2 is used for collector, pin 4 for base and pin 6 for emitter. The transformer can now be clamped to the chassis with leads projecting through the hole provided, and the two socket strips for aerial/earth and output mounted. The tag strip is screwed to the chassis to form an anchor for supply leads.

It will be noted that the aerial/earth sockets are used at the present stage for audio input signals—C1 will be disconnected from the aerial socket eventually, so do not make too good a mechanical joint before soldering at this point or the capacitor will be damaged when removing the connection. The output sockets are used as a convenience whilst the chassis is operated without a power output stage. The leads from one side of the secondary and the centre-tap are connected to these sockets, the other end of the secondary being left disconnected. Later, when a push-pull output stage is brought into use, these three secondary leads will go direct to it instead of passing to an output socket. None of them will then go to the earth line. The centre-tap is, of course, the point at which the base current is introduced to the push-pull stage.

A busbar of 18 gauge tinned copper wire between one socket of each of the socket strips forms a convenient anchor for the earth end of components and is put on first. This is connected to the chassis at one point only, actually to a soldering tag at one of the holding down bolts of the aerial/earth strip. All earths go to this busbar except the battery positive lead, which is conveniently taken to earth via the earth tag of the tag strip.

Wiring is very simple, as shown in Fig. 17 and will present no difficulties. The components are not necessarily held in the relative positions shown on this diagram, which has to be drawn in this open manner for the sake of clarity. In practice, the leads and components take the shortest path from point to point. It must be remembered that electrolytics have to be connected according to their polarity. C2, C4 and C5 are connected directly to a terminal of the battery and so the polarity is obvious. C3 is connected with positive to the base of T2 because this point is at a potential nearer to earth than the collector of T1. This is not always so in the case of transistor circuits, so it must not be taken as a golden

(Continued on page 801)

EASY AS "A.B.C."—CHEAP TO MAKE!

LOOK!



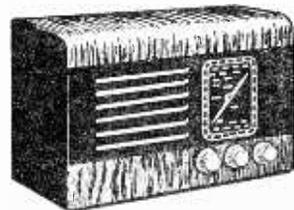
BUILD THIS POCKET RADIO FOR ONLY 37/6

AT LAST! In response to many requests we now present the **DOUBLE TRIODE "SKYPOCKET,"** a beautifully designed precision **POCKET RADIO.** No radio knowledge needed!—**EVERY SINGLE PART TESTED BEFORE DESPATCH!** Our simple, pictorial plans take you **step-by-step.** This set has a remarkable sensitivity due to painstaking design. Covers all medium waves 300 to 550 Metres. Size only 5 1/2 in. x 3 in. x 2 in. in Strong, Transparent case with panel, cover and ivorine dial. A really personal-phone, pocket-radio **WITH DETACHABLE ROD AERIAL.** Self-contained all-dry battery operation. Average building time 1 hour. **Total Building Cost—including Case, Double Triode Valve, etc., in fact, everything down to the last nut and bolt—ONLY 37/6,** with plans. Postage, etc., 2/- C.O.D. 1/6 extra. (Parts sold separately. Priced Parts List, etc., 1/6.) Demand is certain to be heavy—**so SEND TODAY!**



47/6

Build this exceptionally sensitive double triode radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6 1/2 in. x 5 in. x 2 1/2 in. Covers all Medium and Long waves—uses only one all-dry battery. H.T. consumption only 1 to 1.5 mA. Uses personal phone. Ideal for Bedroom, Garden, Holiday, etc. Many unsolicited testimonials. **Mr. Norton of Oxford writes: "Yesterday evening on the Medium waveband, I counted 32 separate stations: I am very pleased with the set, which is well worth the money. BUILD THE "SKYHOMER" NOW!"** Total building cost—everything down to last nut and bolt—**47/6** (Postage, etc., 2/-)—with full set of clear, easy-to-follow plans. (Parts sold separately. Priced Parts Lists, etc., 1/6.)



107/6

Total building cost including choice of beautiful walnut veneered cabinet or ivory or brown bakelite. This is the lowest possible price consistent with high quality. No radio knowledge whatever needed... can be built by anyone in 2-3 hours, using our very simple easy-to-follow diagrams. The terrific new circuit of the **"OCEAN-HOPPER"** covers all medium and long waves with optional negative feedback, has razor-edge selectivity, and exceptionally good tone. Price also includes ready drilled and punched chassis, set of simple easy-to-follow plans—in fact, everything! All parts sparkling brand new—no junk! Every single part tested before despatching. Uses standard octal-base valves: 6K7G high-frequency pentode feeding into 6J5C anode-bend detector triode, coupled to 6V6G powerful output beam-power tetrode, fed by robust rectifier. For A.C. Mains, 200-250 Volts (low running costs—approximately 18 Watts!). Size 12 in. x 6 in. x 5 in. Build this long range powerful **midset NOW.** All parts and set of plans, **£5.7.6.** (Post and packing 3/6.) Parts sold separately. Priced Parts List, 1/6.

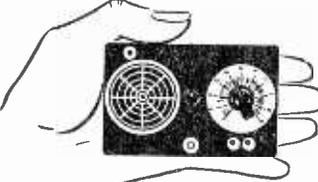
Build This **TRANSISTOR POCKET SET** For Only **49/6!**



FEW ONLY AT 92/6!

NEW in maker's sealed cartons!—limited quantity of the famous 3-speed record player units, exceptionally easy to fix, with lightweight pick-up incorporating "Acos" crystal turnover head and separate sapphire styl for Standard and Long-Playing. With full instructions and fixing plans. Unbeatable price **92/6,** plus 3/6 Post, Packing, etc. C.O.D. 2/- extra. **RUSH YOUR ORDER NOW—BEFORE IT'S TOO LATE!**

WE'VE DONE IT AGAIN!... our design department in response to a great many requests have designed this **"SKY-PINIE" Vest-Pocket TRANSISTOR RADIO** which gives a superb performance. It is highly sensitive. Size only 4 1/2 in. x 3 1/2 in. x 1/2 in., the weight under 628g.—yet it is a **TWO-STAGE** receiver covering all medium waves, working entirely off a tiny "pen-light" battery, which costs 6d.—fits inside the case—and lasts many months. Uses personal phone and has push-button **"LIMON"** On/Off Switch. Every part tested before despatch! **SPECIAL STEP-BY-STEP PLANS for ABSOLUTE BEGINNERS.** Total building cost including case, transistors, etc.—everything down to the last nut and bolt—**ONLY 49/6** with plans, Postage, etc., 2/- C.O.D., 1/6 extra. (Parts sold separately. Priced parts list, etc., 1/6.) As the building cost is absolutely "rockbottom" (it might increase later) **DEMAND WILL BE VERY HEAVY—RUSH YOUR ORDER TO-DAY!**



BUILD THIS TRANSISTOR SET FOR ONLY 35/-
VERY SPECIAL OFFER WHILE STOCK OF PARTS LASTS!—The **"Sky-Scout"** Pocket two-stage transistor set, size only 4 1/2 in. x 3 1/2 in. x 1/2 in. Covers all medium-waves and works entirely off tiny "pen-light" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 35/-, plus 2/- post and packing, including Case, Transistor, **STEP-BY-STEP PLANS for ABSOLUTE BEGINNERS,** nuts, bolts, etc. C.O.D. 1/6 extra. (Parts sold separately, priced parts list, etc., 1/6. **VERY SIMPLE TO BUILD.**



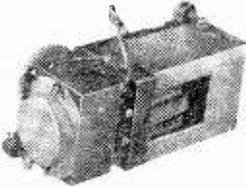
ONLY £8-12-6

BRAND NEW—NOT SURPLUS! In maker's sealed cartons. Latest **UA8 "Monarch"** 4-speed record-player complete with High-fidelity "turnover" head. Type HGP—1. Capacity of 10 Records, plays 12 in., 10 in. and 7 in. intermixed in any order. 78, 45, 33 and 16 r.p.m. For A.C. mains 100 to 250 volts. **Exclusive "madisk"** selector gives quickest and quietest change ever. With full instructions and fixing plans. **Limited Quantity at £8-12-6,** plus 4/6 Post, Packing, etc. **WHY PAY MORE! SEND NOW WHILE STOCKS LAST!**—modernise your radiogram and increase its value.

CONCORD ELECTRONICS Dept. PWQ
69 PRESTON STREET BRIGHTON

Orders receive prompt attention. Cheques accepted. Cash on delivery 1/6 extra. Please print name and address in block letters. Suppliers to Schools, Universities, Government and Research Establishments. Complete range of components and valves stocked. **CALLERS WELCOME. Shop Hours—9 a.m. to 6 p.m. (1 p.m. Thursday). Regret no C.O.D. abroad.**

LASKY'S RADIO



MINIATURE MOTORS

Will work on any voltage from 6 to 12 v. Complete with gearbox. Overall size 2 1/4 in. long x 1 1/4 in. x 1 in. Ideal for models, remote control, etc. Original cost over £2.

LASKY'S PRICE **12/6** Post 1/6.

4-SPEED SINGLE PLAYER BARGAIN

COLLARO "JUNIOR" 4-spd. motor and pick-up with HGP59 cartridge. **92/6** Post 5/-.
Motor only. **59/6**, Post 2/6.
Pick-up only. **33/6**, Post 2/6.

TRANSISTORS

Hermetically sealed and unaffected by temperature variations. Tested and guaranteed efficient.

R.F. P.N.P. Junction Type, suitable for medium and low freq. oscillators, freq. changers and I.F. amplifiers **21/-** (1.5 to 8 Mc's).

(Double spot—yellow and red.)
AUDIO P.N.P. Junction Type, suitable for high gain and low freq. amplifiers, and for output stages up to 250 milliwatts. **10/-**

(Double spot—yellow and green.) Post free.

Full operating data and circuit diagrams for receivers, oscillators, amplifiers, etc., supplied.

TRANSISTOR AMPLIFIER KIT

200 milliwatts. Output impedance 5 ohms. Operates from 6 v. battery. Miniature size: 3 1/4 in. x 3 1/4 in. height can be under 1 in. COMPLETE KIT including 4 Transistors, PRINTED CIRCUIT, full instructions. **79/6** Post 3/6. Full details on request.

TRANSISTOR S/HET TUNER

For construction on Printed Circuit. Uses 3 R.F. Transistors, 1 germanium diode, 3 I.F. transformers, Ferrite rod aerial. Operates from 6 v. battery and 1.5 v. cell. Size of Printed Circuit, 3 1/4 in. x 3 1/4 in.

CAN BE BUILT FOR **£5/12/9** Post 3/6.

Full details on request.

Demonstrations at both addresses.

LASKY'S (HARROW ROAD) LTD.

42, TOTTENHAM COURT ROAD, W.1.

Telephone: MUSEUM 2605.

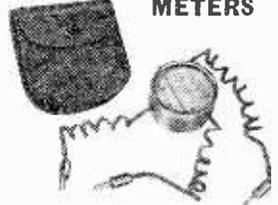
370, HARROW ROAD, PADDINGTON, W.9.

LAD 4075 and CUN 1979.

Open all day SATURDAY. Half day Thursday.

PLEASE ADDRESS ALL MAIL ORDERS TO HARROW ROAD.

BARGAIN OFFER OF POCKET VOLT TEST METERS



Two ranges, D.C. 0-250 v. and 0.25 v. Complete with leads in canvas case. LASKY'S **12/6** Post & Pkr. 2/6. PRICE

In leather case, 1'6 extra.

COLLARO 4-SPEED MIXER AUTO-CHANGER

Latest model RC.456 incorporating auto and manual control enabling records to be played singly or automatically. Complete with Studio crystal p.u. and sapphire stylus. List £13/17/-.

LASKY'S PRICE **£8/19/6** Post 5/-.

FREE TO AMBITIOUS ENGINEERS!

This 148-page Book

Have you sent for your copy?



'ENGINEERING OPPORTUNITIES' is a highly informative guide to the best-paid Engineering posts. It tells you how you can quickly prepare at home on "NO PASS—NO FEE" terms for a recognised engineering qualification, outlines the widest range of modern Home-Study Courses in all branches of Engineering and explains the benefits of our Employment Dept. If you're earning less than £20 a week you cannot afford to miss reading this unique book. Send for your copy to-day—FREE.

--- FREE COUPON ---

Please send me your FREE 148-page "ENGINEERING OPPORTUNITIES"

NAME
ADDRESS

Subject or Exam. that interests me.....

British Institute of Engineering Technology
509 B, College House, 29-31, Wright's Lane,
Kensington, W.8.

WHICH IS YOUR PET SUBJECT?

Mechanical Eng.
Electrical Eng.
Civil Engineering
Radio Engineering
Automobile Eng.
Aeronautical Eng.
Production Eng.
Building, Plastics,
Draughtsmanship,
Television, etc.

GET SOME LETTERS AFTER YOUR NAME!

A.M.I.Mech.E.
A.M.I.C.E.
A.M.I.P.E.
A.M.I.M.I.
L.I.O.B.
A.F.R.Ae.S.
B.Sc.
A.M.Brit.I.R.E.
CITY & GUILDS
GEN. CERT.
OF EDUCATION
etc., etc.

BIET

EDDY'S (Nottm.) LTD.

(DEPT. P.W.)

172 ALFRETON ROAD, NOTTINGHAM

THIS MONTH'S SPECIAL OFFERS

RECORDING TAPE. 1,200ft. reels, 9/11 each. Post, etc., 1/- extra.

MIDGET BATTERY ELIMINATORS. To convert all low-consumption Portables for Mains Operation. Mains input 220/240 v. A.C. H.T. output 85 v. 10 mA. L.T. output 1.3 v. 125 mA. Size 3 7/8 in. x 2 5/8 in. Actually smaller than H.T. Battery alone! Amazing price of 55/- plus 2/6 extra post and packing.

GERMANIUM DIODES, 1/- each, 10/- dozen. Post extra, 3d.

5-INCH SPEAKERS, 16/11 each, 2/- extra post and packing. ALL NEW AND GUARANTEED.

Any parcel insured against damage in transit. 6d. extra.

SURPLUS, NEW & GUARANTEED

VALVES

All tested before despatch.

1A7G 12/6	6K7G 2/11	12AH7 7/6	EL84 9/-
1C5G 10/6	6L6G 7/11	12K7G 7/6	EZ80 8/-
1H5G 10/6	6Q7G 8/3	12Q7G 7/6	EZ81 9/6
1N5G 10/6	6Q7CT 9/11	12R8GT 7/6	GZ32 12/6
1R5 7/11	6V6GT 5/11		GZ34 13/6
1S5 7/-	6X4 6/6	DM70 7/11	MU14 8/11
1T4 7/-	6X5GT 7/6	EABC80 7/6	PCC84 8/-
3Q4 9/-	7Y4 7/11	EB91 6/6	PCL83 13/11
3Q5 9/6	10F1 14/11	ECC84 10/-	PY30 8/3
3S4 8/-	10F9 11/6	ECC85 9/6	PY81 8/6
3V4 8/-	14S7 13/6	ECH35 9/6	UF41 8/-
5Y3GT 7/6	25L6GT 9/-	DH76 7/6	UY85 8/11
5Z4G 9/6	35A5 11/3	ECL30 8/11	UL84 8/11
6AM6 6/11	35W4 7/6	EF31 5/-	UCH42 8/-
6BR3 3/11	35Z4G 7/11	EF41 9/-	UL41 9/11
6BA6 6/6	807 (B) 6/6	EF90 8/3	UZ5 13/6
6BJ6 7/-	954 1/6	EF98 12/6	UY41 7/6
6FL1 13/6	955 3/11	EF99 9/11	U76 7/6
6FL5 14/9	956 2/6	EL32 (4 pin) 3/11	W76 7/6
6J5GT 4/11	958 3/11		

No Lists. Trade Enquiries Invited.

rule for all time. C1, however, has its negative terminal connected to the base of T1 because it is assumed that the input signal has no D.C. component.

Using the Amplifier

This amplifier was tested using a pair of low resistance earphones across the output socket. Phones were also operated directly in the collector circuit of T2, without the transformer in circuit. High resistance phones would provide a better match to T2 when operated directly in the collector circuit but would drop a considerable proportion of the available voltage and would result in the transistor operating on a lower current condition than intended, giving a lower output, so that the benefit of better matching would not materialise. Low resistance phones are better, but if only high resistance instruments are available they can be used. Results are better with the transformer than without.

The amplifier, without any additional stage, has driven a loud speaker. It will be realised that the total power dissipated in the second stage is only $6 \times 3 = 18$ milliwatts, and not all this by any means is available as audio power, so normal

loudspeaker volume cannot be expected, but quite readable signals are available and it is more convenient to use this than a pair of headphones. No attempt is made to try to match speaker to transistor. Conditions have been set up for the complete design and this is just a makeshift method of trying out the first part. Actually, one of the surprising discoveries from these tests is the high sensitivity of modern speakers. The input signal used for the tests was from a simple audio test oscillator. Any source of audio, provided that it has no D.C. component, or so long as there is a blocking capacitor to prevent the D.C. from getting to the amplifier, can be used. In the case of a pickup a series resistor will be needed both to provide the proper load to the pickup and to ensure that the input current to the amplifier follows the voltage signal produced by the pickup. The series resistor should be that quoted as the correct load for the pickup, if it is the crystal variety.* A lantern type 6 volt battery was used for the tests.

We shall now proceed to develop this amplifier into a complete, but simple, receiver.

(To be continued)

A BEGINNER'S CONSTRUCTIONAL COURSE

(Continued from page 794)

and in your locality, remembering that each will affect the other to some extent. If you are fortunate enough to have a milliammeter you may connect it in one of the battery leads, when it should show about 2mA and not on any account more than 5mA. This drain on the battery is only 1/150th of the consumption of a torch bulb, so the life will be very long indeed.

Other Arrangements With This Circuit

Some readers may like to make this into a semi-portable unit for campers, cyclists, boy scouts, etc., for it is easy to stick a skewer into damp soil and hang some wire from a tree. The writer used an ordinary 8in. P.M. speaker, but for portable use he tried and got good results with an ordinary low resistance balanced armature type ear-piece mounted behind the front panel with a fabric-covered hole in front. Using this earpiece no output transformer was used, the phone being connected in place of the primary (between battery minus and the collector of the second transistor). The volume is quite good, but bass notes are lacking, as in any small speaker.

Having made up the unit you may like to box it into a permanent cabinet or to rebuild it into your own design, fitting variable condensers in place of trimmers, an internal speaker and terminals at the back of the cabinet.

Improving the Tuned Circuit

A further refinement which the author found not in the least necessary, is to rewind the medium-wave coil, making taps (small twists in the wire) every five turns. The lead from C1 then goes to one of the taps, the best one being found by trial and error. The red side of the diode may also be tapped in on one of the taps, again by trial and error. This will only affect the medium wave band (Fig. 31).

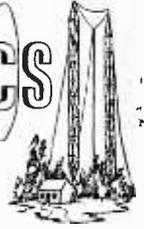
A C.R.L. BRIDGE

(Continued from page 789)

into five or ten parts, but not marked. Another method is to mark out the first three precision marks, then select ordinary resistors of these values and check them to select the ones that agree with the marks made, then put, say, the precision 1K and the selected 1K in series to give the 2K mark. The two 50K resistors will give the 100K mark if placed in series, and the 25K mark if put in parallel. The two 3K in series will give the 10K mark, and in parallel the 2.5K mark. Using a third resistor of 1K will give 3K in series, and by various combinations the whole scale can be calibrated. As a matter of interest, the minimum number of precision resistors required to give the whole 20 calibration points is as follows; eight resistors are required, namely 1K, 2K, 2K, 5K, 10K, 20K, 20K, 50K, by using various combinations in series the whole twenty points are covered. Having completed the resistor range, the next one to do is that for the capacitors. For this you can use capacitors if you like, but it is not necessary if you have calibrated the resistor range accurately, for by taking the reciprocal of the mark on the resistor range and marking it at the same point on the capacitor range the readings will be accurate for capacitors. For instance, take the 5 mark on the resistor range, this will be 0.2 on the capacitor range, similarly for 0.2 on the resistor range it will be 5 on the capacitor range. To change resistor value to capacitance value divide the number into one, thus 5 divided into 1 is 0.2 and 0.2 divided into 1 is 5. For the inductance range use various chokes and coils to get the calibration points. The most useful points on range L1 are 3, 5, 10, 20, 40 henries.

If the bridge is operated where direct light falls on the indicator it is best to make a shield for it, as Fig. 14, where the shaded parts are cut out and the aluminium bent round to form a shield.

TRANSMITTING TOPICS



METHODS OF USING THE CLAMP-VALVE

By O. J. Russell, B.Sc.(Hons.), G3BHJ

THE use of a clamp-valve circuit in "holding down" the P.A. stage has become almost universal. A typical circuit arrangement is shown in Fig. 1, where a triode-connected pentode is used as the "clamp-valve." In the absence of any R.F. grid drive, the clamp-stage runs without bias, and thus tends to draw a heavy current. The screen resistor of the P.A. stage has to pass the current drawn by the clamp-valve, so that a large voltage drop occurs, and the effective screen potential of the P.A. stage becomes very low. With the very low screen voltage caused by the current flow in the clamp-valve, the P.A. stage will only draw a small anode current, and this may be arranged so that the anode dissipation of the P.A. tube is not exceeded.

When R.F. drive is applied to the P.A. tube, the negative bias developed across the clamp-tube cuts off the clamp-valve, so that only screen current flows in the screen resistor, and the normal screen potential is developed for amplifier operation. Thus the value of the screen resistor used in the clamp-valve circuit is the normal value employed for Class C operation of the P.A. valve. A smooth control of C.W. power level may be obtained by a potentiometer arranged to adjust the bias applied to the clamp-tube, as shown in Fig. 2. By this means the C.W. operating level may be lowered by letting the clamp-valve conduct to an extent determined

by the setting of the potentiometer. As the clamp-valve conducts, the current passing through the screen resistor lowers the screen voltage and thus lowers the anode current and power level of the P.A. stage. This facility is often incorporated in transmitters to enable a quick adjustment of power output to be made.

However, we have been careful to refer to the C.W. level of output, as there are some sizeable snags. Firstly, if anode and screen modulation is employed, then if the clamp-stage is used to cut off the screen voltage to a lower figure, when the screen voltage rises under modulation, the clamp-valve will conduct more, and may clip the modulation waveform on the positive peaks. This results in a serious loss of modulation capability, and will also result in appreciable distortion due to the heavy clipping of the positive going peaks of screen voltage. Judging by some modulation circuits which have been suggested for amateur use, there may be some amateurs who have no objection to radiating splatter caused by distortion products. However, their fellow amateurs will certainly object. Moreover, the effective percentage of modulation is severely restricted and may be even more so if the operator turns down the audio level until splatter is not heard, under the mistaken belief that the splatter is caused by

(Continued on page 805)

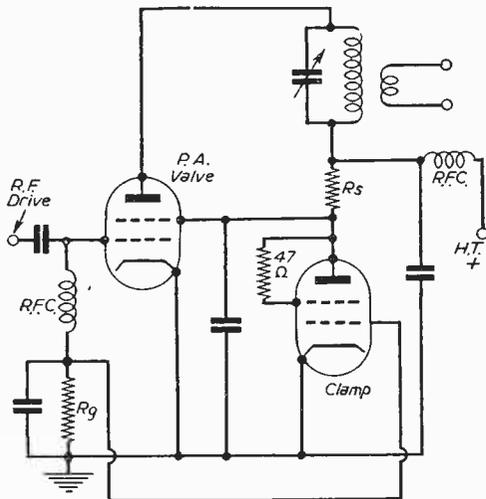


Fig. 1.—The simple clamp-valve circuit used to "hold down" a P.A. stage when excitation is removed, and no fixed bias source is used.

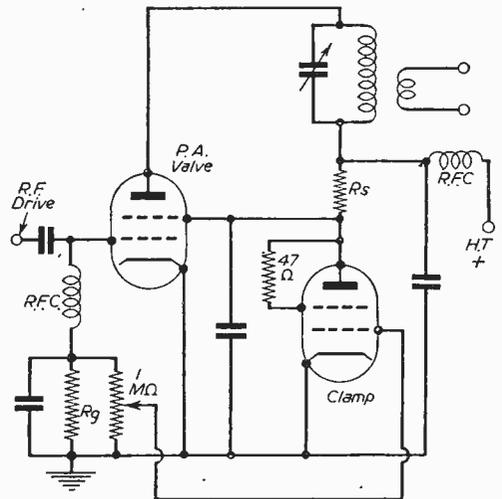


Fig. 2.—A potentiometer enables the clamp-stage setting to be adjusted on C.W. so that the P.A. stage runs at any desired power setting within the range determined by the circuit conditions.

SKILLED MEN!

HERE'S A NEW WAY
TO BETTER YOUR INCOME!

*Up to £25 tax-free bonus plus first rate
wages for two weeks of your time*

Are you in a skilled trade? Then you can probably add a tidy sum to your income by joining the Army Emergency Reserve. For one thing, you get pay and allowances at full Regular Army rates whilst in camp. And the more your skill's worth in civilian work, the higher your Army rank and pay. Better still, you also get £9-£25 bonus tax-free (£50 if you are an electronic specialist). For this you just spend 15 days a year at

a camp, working on your own speciality. And money's not the only profit you get from that. You get a grand refresher course, giving you a lot of new ideas, and putting you right in touch with the latest Army developments. And you get a welcome break from the usual routine, with sports, games and a great social life. For the place is full of people with the same interests as yourself. Don't miss this chance! Send off the coupon now to: H.Q., A.E.R., R.E.M.E., Broxhead House, Bordon, Hants.

VACANCIES
FOR
ARMAMENT ARTIFICERS
RADIO · RADAR
AND
ELECTRICAL CONTROL

POST THIS OFF RIGHT AWAY

*Please send me—without obligation—the illustrated booklet
telling all about the Army Emergency Reserve.*

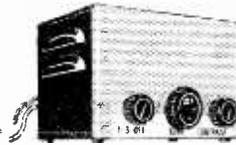
NAME

ADDRESS

TRADE

PW/AER

I.T.A. CONVERTER. All I.T.A. stations, wired ready for use, complete with power pack, fine tuner, etc., £4/7/6, as illus. Metal cabinet, stove enamel grey hammer finish. Walnut cab., £4/17/6. Lizard rexine, £4/12/6. Chassis (less cab.), 7/7/6. All with two ECC81. All plus 3/- p. & p. (C.O.D. 2/- extra). Clip on I.T.A. aerial to existing mast, or mount in loft. 3 element, 17/-; 5.E., 35/-; 8.E., 55/-; low loss co-axial, 8d. yd. Terms on complete converters one-third down and balance, plus 5/-, payable in 4 equal monthly instalments. Postage with first payment.



ELECTROLYTICS 25 mf. 25 v. tub. wires. 9d.; 12-12 mf. 275 v. tub. wires. 7/3; 32-32 mf. 350 v., 1 in. can. 3/-; 200 mf. 6 v. 2 in. can. 9d.; 16-24-8 inf. 350 v., 1 1/2 in. can. 3/-; 100-200 mf. 275 v. can. 7/6.

MAINS TRANSFORMER. 290-0-290 v. 60 m.a., 6.3 v. 2 1/2 A and 6.3 v. 4 A., 12/6 (p. & p. 3/-).

BATTERY ELIMINATOR. 90 v. 15 m.a. and 1.4 v. 125 m.a. for 4 low consumption valves; 5 1/2 in. x 3 1/2 in. x 2 in. for 200-250 v. input. 35/- (p. & p. 2/6).

Ex-W.D. PERISCOPIES, fixed, giving rise of 10 in. Price 4/6 (p. & p. 3/-).

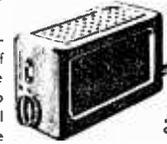
AUTOMATIC RECORD CHANGERS are in short supply. Collaro RC456 Studio turnover crystal pick-up. 4-speed mixer. A.C. mains 200-250 v., see illus. ALSO Collaro single player AC3/554. 3-speed, turn-over crystal pick-up with "T" head. £6/16/6 (3/6 p. & p.).



£8/16/6 (5 - p. & p.)

HIGHLY SUCCESSFUL 13-CHANNEL CONVERTER.

Designed and made by a world-famous organisation regardless of expense. Tunable over the whole of Band I and Band III to give one Band I and two Band III stations at the turn of the switch. Acts as Two-valve Pre-amplifier on Band I Valves PCC84 and PCF80. No drift. In Moulded Bakelite Cabinet. 8 1/2 in. x 4 1/2 in. x 6 in. high. With full operating instructions. Built-in Power Pack added by us. Separate gain controls for I.T.A. and B.B.C. (p. & p. 3/-, C.O.D. 2/-.)



£5-5-0

AB ABOVE LESS POWER PACK 72/6 (P. & P. 3/-)

CONVERTER available for Philips receivers to above specification complete with built-in power pack, at £5/5/- P. & p. 3/-.

CONVERTER in above moulded case, complete with power pack. Having 3 position switch, giving—OFF—ITA—BBC. Valves used PCF80 and PCC84. A 13-channel converter for the low price of £4.15 0. Tunes over the whole range of Band III.

ALL CONVERTERS FITTED WITH CO-AX PLUG.

I.T.A. AERIALS. 1 in. to 2 in. mast mounting 5 element, 35/-, carriage paid. 9 element, 55/-, carriage paid.

LOW LOSS CO-AXIAL CABLE, 8d. per yard.

ALL NEW GOODS POSTED ORDERS TO CAMBERLEY, PLEASE.

3 CHURCH RD., REDFIELD, BRISTOL AND 82B HIGH STREET, CAMBERLEY, SURREY

GLADSTONE RADIO

ALFRED PADGETT

40, MEADOW LANE, LEEDS, 11
TEL: CLECKHEATON 50

VALVE TESTERS.—Ex R.A.F. Type 4A, complete with case and meter. Not tested. £3 17/6, carriage 7/6.

BRAND NEW TX TYPE 240U.—Freq. 86, 3 mc., complete with 3 Det. 1 $\frac{1}{2}$ 2 CNT and 1 6G6 valves, 17.6, carr. 7/6.

Make a set of Fairy Lights. Brite 24 volt miniature, 4/6 per doz. Post 1/-.

BRAND NEW EF50 VALVES.—Fit on a strip with valveholders and jacking rings. 10/-, post 2/-.

CHOKE.—3 hy., 150 mill, 1 1/3, post 1/6.

6-WAY JONES PLUG AND SOCKET. 1/-, post 1/3.

MIXED B.A. NUTS AND BOLTS.—Half a pound for 1/6, post 1/6.

PAPER BLOCK CONDENSERS.—8 m., 500 v. working, 3/-, post 1/6.

NEW RED SPOT TRANSISTORS, 70. Diodes 10d. each. Not rejects. Post 3d.

OCTAL VALVEHOLDERS.—Removed from new sets. Amphical Type 2 6 per doz., post 9d. Int. or Mazda.

NEW T.U.B. PARTS.—Afike Delvex, Vernier Drives, 2/6. Switch and Knob, 1/- Handles, 9d. each. Coil former Pot., 6d. Post 1/- each extra.

VALVES, GUARANTEED GOOD.—5U4 6/0; 5Z1, 6/0; 6V6, 6/-; 6SN7, 5/-; 6P50, 2/0; 6J5, 2/0; 6L6, 3/6; 6C4, 2/0; 6D6, 3/-; 6C6, 3/-; 6B8, 2/-; 6H6, 6d.; 6K7, 2/-; 6K6, 3/-; 6V6S, 1/0; 6V6S, 1/-; 6V6S7, 1/-; 6SL13, 3/-; Pen 48, 2/0; VR150 30, 4/-; ARP12, 3/0; QP220, 1/0; V5110, 1/-; AC6 Pen, 2/0; VR102, 9d.; DLS10, 2/6; 2X2 1/0; VR31, 9d.; 12S7JM, 4/-; 12SG7M, 4/-; 12S7FM, 2/-; 12L6M, 1/3; 12CN, 4/-; 12AX7, 4/6. All valves 9d. post.

TRANSISTOR CIRCUITS

22s.

Postage 9d.

by R. P. TURNER

A practical work book showing electronic technicians, engineers and experimenters how to use various transistor circuits. Over 150 practical, usable circuits. This book will save the practical man hours of tedious and fruitless hit-or-miss experiments.

F.M. RADIO SERVICING HANDBOOK. By G. J. King. 25s. Postage 1/3.

FUN WITH RADIO. By G. Davey. 10s. 6d. Postage 9d.

THE A.R.R.L. ANTENNA BOOK. 18s. Postage 1/3

RAPID TV REPAIR. By G. W. Hearsh. 23s. Postage 9d.

A BEGINNER'S GUIDE TO RADIO. By F. J. Camm. 7s. 6d. Postage 6d.

RADIO/VALVE DATA. Compiled by "W.W." 5s. Postage 8d.

MULLARD MAINTENANCE MANUAL. 10s. 6d. Postage 1/-.

THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKISTS of British and American Technical Books. Complete catalogue 6d.

19-23 PRAED STREET, LONDON, W.2

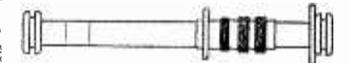
Phone: PADDington 4185
Open 5 days 9-6 p.m.

TELETRON TYPE FX. 25



Self-tuned. Dual-wave Ferrite Rod Aerial, 15/- each.

Designed for use in pocket Transistor receivers. Descriptive folder with circuit-component layout, and wiring instructions for a three-Transistor regenerative receiver. Price 6d. NO aerial, earth or tuning condenser required. Operates speaker from 3 Penlight cells. All parts, including cabinet and chassis, available from component stockists.



Miniature Transistor IFTs & Osc coil for 315 kc/s, 6'6 ca. FRM.2 Transistor Ferrite Rod Aerial, 10/- Available from component stockists. Stamp for complete lists and circuits.

THE TELETRON Co. Ltd.
266 Nightingale Rd., London N.9
HOW 2527

overmodulation. If the clamp-valve introduces serious clipping of positive peaks, then splatter will be introduced far below the 100 per cent modulation level. If the gain is turned down until splatter ceases, then the overall modulation level may be very low indeed. The fact should be noted that if the grid drive is at all low, then there is a danger of the clamp-tube not being cut off fully. If the clamp-valve is not cut off fully, then the P.A. screen volts will be lower than they should be, and output will fall off. Thus

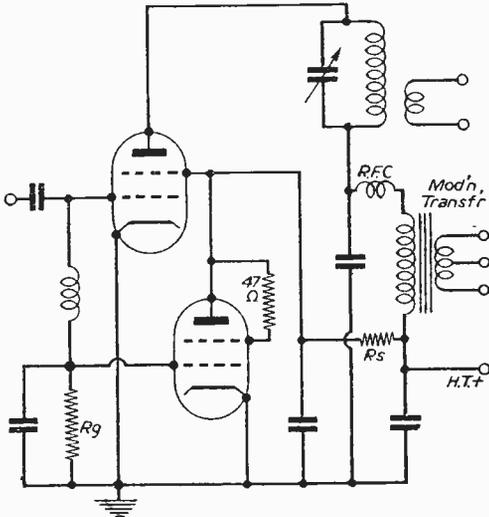


Fig. 3.—Returning the screen to the unmodulated supply prevents the clamp-valve clipping positive modulation peaks. However, this connection does not permit full modulation as the screen supply is unmodulated.

below a critical drive figure, a clamp-valve protected P.A. stage will be very sensitive to a fall in grid drive and output will drop off very quickly as grid drive falls too low. Clearly, for telephony working, plenty of grid drive is necessary to ensure that the clamp-stage remains cut off, even when the modulated H.T. line doubles its potential on modulation peaks.

The Valves

Unfortunately it would seem very clear that it is sometimes difficult to ensure that the clamp-stage will not start to conduct on positive modulation peaks. Various combinations of valves are employed for clamp service. Thus for the 807 valve, a 6L6 is often used to "hold down" one or a pair of 807s, while a 6Y6 is also excellent as a clamp-valve. In all cases there is the possibility of positive peak clipping occurring on the positive peaks of anode and screen modulation. In some cases a definite backwards flicker of the plate current meter needle may be observed on modulation, and the modulation may appear to lack punch, despite the fact that adequate audio is available. In some cases the use of a tube such as the 6Y6 for the clamp-valve has been resorted to for "phone use only,"

despite the fact that this does not give as good a cut off on standby as the 6L6. However, the shorter grid base of the 6Y6 is held to ensure that the 6Y6 valve is held in a cut-off state even on modulation peaks. With a 6V6 clamp-valve, however, a pair of 807s with 500 volts on the plate draw just about their maximum rated dissipation under "key-up" conditions. Thus the clamp-stage becomes merely a protection failure device that protects the P.A. stage from excessive dissipation should the drive fail. To save running the P.A. at full dissipation all the time during "standby" periods it is then necessary to switch the H.T. supply. Switching the H.T. supply is not a bad idea, of course, but if this is done then one might just as well omit the clamp-valve and arrange for a few volts of protective bias to be developed by a small cathode resistor, so that the P.A. valves will not burn out in the absence of drive.

As the troubles of the clamp-valve commence with the application of modulation, and as the clamp is otherwise a very convenient way of adjusting power level, the above expedients of "phone only" type clamp-valves that merely act as P.A. protectors, or the use of standby cathode bias are not too attractive. What is needed is a foolproof method of providing flexible clamping operation with full power level control that will work satisfactorily on anode and screen modulation. One such circuit arrangement that the author can confidently recommend is shown in Fig. 3. In order to prevent the clamp-valve anode voltage being affected by modulation peaks, with possible conduction on modulation peaks, the

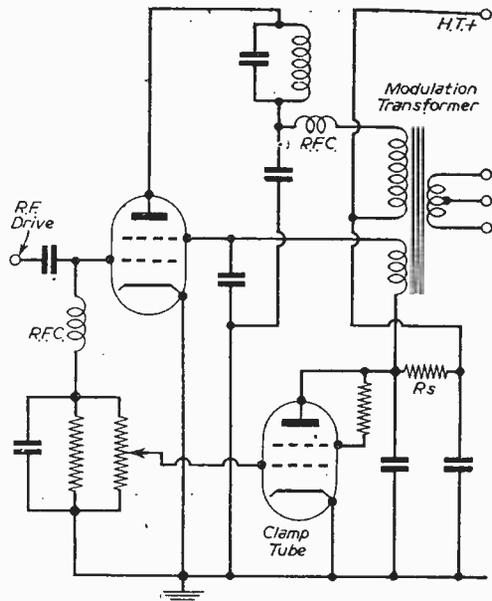


Fig. 4.—The screen may be modulated from an independent winding, thus enabling full clamp-valve control to be retained without any difficulties on modulation peaks.

P.A. screen supply is taken from the unmodulated supply line. Normally it would not be possible to obtain satisfactory full modulation by modulating the anode alone, although quite good speech may be obtained in this way.

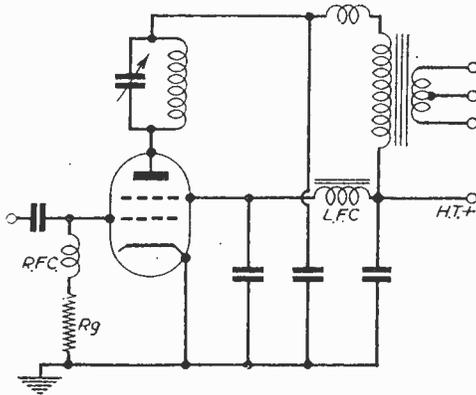


Fig. 5.—The self screen system of modulation enables the screen to develop its own modulation voltage when the anode is supplied with modulated H.T.

Satisfactory Circuits

Satisfactory "plate and screen" modulation is assured in the circuits of Figs. 4 and 6. In Fig. 4 a separate winding is used to modulate the screen. The use of a separate winding requires that the screen winding supplies the correct fraction of audio to the screen, and at one time

modulation transformers were made with separate screen windings provided. As may be expected, however, these windings were designed for a specific type of valve and were something of a compromise, as the fraction of audio voltage depended somewhat upon the operating condi-

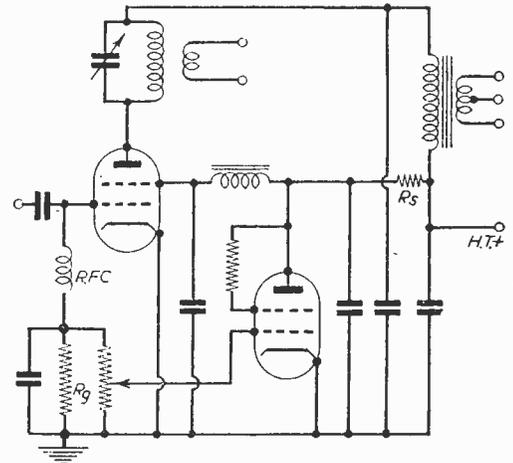


Fig. 6.—The self screen system applied to the clamp circuit.

tions of the P.A. stage. Generally the fraction would be calculated on the ratio of the screen voltage to the anode voltage.

(To be continued)

News from the Clubs

PONTEFRACT AREA TRANSMITTING GROUP

Hon. Sec. : W. Farrar (G3SP), 6, Hensworth Road, Aekworth, Pontefract, Yorkshire.

A CLUBROOM is now in use at the Queen's Hotel, Pontefract, and the call-sign G3FYQ has been re-issued. The club is already "on the air" and when completely fitted out should be active on all bands from 1.8 to 144 Mc's with telephony and telegraphy.

Meetings are held on the first, third and, where applicable, fifth Thursdays of each month from 8 p.m. Morse-code practice and talks and discussions form a part of all meetings. New members are very welcome.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec. : Geo. Western (G3FL), 118, Salisbury Avenue, Barton, Torquay.

THE meeting held at the Y.M.C.A., Torquay, in September, proved most interesting. The principal speaker being Mr. W. Jones (G3BBF), Newton Abbot, whose constructive talk for beginners was particularly appreciated by the many new members present.

ROCH VALLEY RADIO CLUB

Hon. Sec. : D. J. Power, 2, Clement Street, Rochdale, Lancs. A NEW club to be known as the "Roch Valley Radio Club" has been formed in Rochdale. Meetings will take place each Tuesday at 8 p.m. in the Windmill Hotel, Sudden, Rochdale. All those interested will be made welcome. For the present all enquiries to be made to D. J. Power, Esq., 2, Clement Street, Rochdale.

SPEN VALLEY AND DISTRICT RADIO AND TELEVISION SOCIETY

Hon. Sec. : Norman Pride, 100, Raikes Lane, Birstall, Nr. Leeds. IT is proposed to organise a Northern Mobile Rally on Sunday, April 27th, 1958, to be centred on the West Riding. Plans are in hand for a suitable location and offers of support should be sent to the Hon. Sec.

BURY RADIO SOCIETY

Hon. Sec. : Mr. L. Robinson, 56, Avondale Avenue, Bury, Lancs. THE Bury Radio Society will meet at 8 p.m. on Tuesday, December 10th, at the George Hotel, Kay Gardens, Bury, for the Annual General Meeting followed by a Junk Sale.

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec. : Mr. R. Purdy, 37, Bond Street, Brighton 1, Sussex. AT the recent Annual General Meeting, the following new Committee was elected:

Hon. Sec. : Mr. R. Purdy, 37, Bond Street, Brighton 1, Sussex.
Chairman : Mr. C. Fairchild, G3YY.
Treasurer : Mr. R. Langridge. Also Vice-Chairman and fifth member.

The Club will continue to meet on Tuesdays at the "Eagle Inn," Gloucester Road, Brighton, 8 p.m., where all visitors and prospective members will be most welcome.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec. : Mr. C. H. Bullivant, G3DIC, 25, St. Fillans Road, Catford, S.E.6.

THE tenth anniversary of the Society was celebrated with a Dinner, attended by members, their ladies and guests to a total of more than 50. The guests were welcomed by the Chairman of the Clifton Amateur Radio Society (Mr. J. Lambert, G3FNZ), accompanied by Mrs. Lambert, and during dinner the health of the guests was proposed by Mr. D. French, G3HSE. Dancing and musical entertainment after dinner was provided by Billy Mulvaney.

An "Open-Evening" is being held at the clubrooms on Friday, December 13th, during which entries in the annual constructional contest will be judged. A cordial invitation is extended to visitors on this evening to meet members of the Society at home.

The Christmas morning round-up of club members on Top Band will take place as usual this year.

Meetings are held every Friday at 7.30 p.m. at the clubrooms, 225, New Cross Road, London, S.E.14. Details of membership can be obtained from the Hon. Secretary.



FOR VALVES—
Guaranteed New and Boxed

024	5/6	6AK7	8/-	ATP4	3/6	6Y3	8/-
1A3	3/6	6AK7	8/-	CV73	5/6	6Y4	8/-
1A5GT	6/-	6AN7	7/6	DAF96	9/6	6Y5	8/-
1A7	12/6	6AQ7	9/3	DF96	9/6	6Y6	8/-
1B2	9/6	6T4GT	14/-	DH73M	9/-	6Y7	8/-
1H5GT	10/6	1H5G	8/6	DK96	9/6	6Y8	8/-
1L4	6/6	6U5	8/6	DL96	9/6	6Y9	8/-
1LDS	3/6	6U7A	8/6	DM70	8/6	6Y12	8/-
1N5	10/6	6V6GT	7/-	EACB80	10/-	6Y13	8/-
1R5	8/-	6V6GT	7/-	EAC81	10/-	6Y14	8/-
1R4	10/6	6X4	7/6	EAF42	10/6	6Y15	8/-
1R5	7/6	6X5G	7/-	EB41	9/-	6Y16	8/-
1T4	7/6	6X3GT	7/-	EB43	10/-	6Y17	8/-
2PA	15/-	6J0L2	12/6	EB90	10/6	6Y18	8/-
2X2	4/6	7B7	8/6	EB90	10/6	6Y19	8/-
3A4	7/-	7C5	8/6	EBF80	11/-	6Y20	8/-
3A6	5/-	7C9	8/6	EC84	9/6	6Y21	8/-
3Q4	9/-	7H7	9/-	EC84	12/6	6Y22	8/-
3Q5	9/6	7Q7	9/-	EC85	10/6	6Y23	8/-
3R1	8/-	7R7	9/6	EC91	6/-	6Y24	8/-
3V4	9/-	7Y4	8/6	ECF80	14/6	6Y25	8/-
4D1	3/-	7E	11/6	ECF82	15/-	6Y26	8/-
4TSA	10/6	7E	9/-	ECF83	15/-	6Y27	8/-
4Z	8/-	80	8/6	ECF85	10/6	6Y28	8/-
5R4GY	9/6	807	6/6	ECF86	10/6	6Y29	8/-
5U4G	8/-	812	2/6	ECF87	9/6	6Y30	8/-
5V3G	8/-	912	3/6	ECF88	9/6	6Y31	8/-
5V3GT	9/-	9001	5/6	ECF89	9/6	6Y32	8/-
5Z4G	10/-	9003	5/6	ECF92	8/6	6Y33	8/-
6A7	13/-	9004	5/6	ECF93	13/6	6Y34	8/-
6A8G	10/6	9006	5/6	ECF94	13/6	6Y35	8/-
6A7	6/6	954	2/-	ECF95	13/6	6Y36	8/-
6A85	5/6	955	4/6	ECF96	13/6	6Y37	8/-
6AK5	6/6	956	3/6	ECF97	13/6	6Y38	8/-
6AK7/6A47	7/6	10F1	12/6	ECF98	12/6	6Y39	8/-
6AL5	6/6	12A6	6/6	ECF99	8/6	6Y40	8/-
6AM6	9/-	12A8H	11/6	EL1	12/6	6Y41	8/-
6AQ5	7/6	12A7G	10/6	EL2	11/6	6Y42	8/-
6AT6	8/6	12A7	9/6	EL3	14/6	6Y43	8/-
6AU6	10/6	12A7	9/6	EL4	11/6	6Y44	8/-
6B4	5/-	12A7	8/6	EL5	11/6	6Y45	8/-
6B4G	4/-	12B4G	9/6	EL6	11/6	6Y46	8/-
6B4E	7/6	12B4G	10/6	EL7	11/6	6Y47	8/-
6B5G	8/-	12B4T	11/6	EM14	10/6	6Y48	8/-
6B5G	9/6	12C7	7/6	EM8	11/6	6Y49	8/-
6BR7	11/6	12H6	3/6	EV31	12/6	6Y50	8/-
6BR7	13/-	12J5	4/6	EV8	12/-	6Y51	8/-
6BW6	8/6	12J7	10/-	EV81	6/-	6Y52	8/-
6BW7	10/-	12K7	8/6	EZ80	10/-	6Y53	8/-
6C1	7/6	12K8	13/6	EZ80	10/-	6Y54	8/-
6C5GT	6/6	12Q7	9/6	EL148	2/-	6Y55	8/-
6C6	5/-	12R67	2/6	FC13	12/6	6Y56	8/-
6C8G	7/6	12R67	7/6	FW4/50m	10/-	6Y57	8/-
6D6	5/-	12R67	5/6	GZ32	12/6	6Y58	8/-
6E1	13/6	12R7	9/6	GZ32	12/6	6Y59	8/-
6F8G	7/6	12R7	8/6	H30	5/-	6Y60	8/-
6F9M	7/6	12R7	8/6	HL23D/19/6	10/-	6Y61	8/-
6F13	14/-	12R7	8/6	HL22	12/6	6Y62	8/-
6F33	5/6	12R7	7/6	HN308	13/6	6Y63	8/-
6F13	14/-	13VPA	9/-	HR210	9/-	6Y64	8/-
6G8G	4/6	1487	14/6	K40N	9/-	6Y65	8/-
6H6	2/6	15D2	7/6	KBC32	8/-	6Y66	8/-
6J5G	5/6	20D1	10/6	KF35	8/6	6Y67	8/-
6J3GT	5/6	20L1	13/6	KL32	13/6	6Y68	8/-
6J5M	6/6	20P1	13/6	KT24	4/6	6Y69	8/-
6J6	8/-	20P1	11/6	KT2	5/-	6Y70	8/-
6J74	6/-	25L6GT	10/-	KT30	10/-	6Y71	8/-
6K8GT	7/-	25Y30	9/6	KT66	15/-	6Y72	8/-
6K7GT	7/-	25Z4G	9/6	KT68	8/6	6Y73	8/-
6K7G	8/-	25Z5	10/-	KT68	8/6	6Y74	8/-
6K7M	6/6	25ZGT	9/6	KT24	6/-	6Y75	8/-
6K8G	9/6	30P5	12/6	LP220	5/-	6Y76	8/-
6K8GT	9/6	30P11	12/6	MH4	7/6	6Y77	8/-
6L6G	9/6	30P4	15/-	MH4	7/6	6Y78	8/-
6L7	7/6	33L94T	9/6	MKT4	13/6	6Y79	8/-
6L18	11/6	35W1	4/6	MSP4T	pin	6Y80	8/-
6N7	6/6	35Z4GT	8/6	N78	12/6	6Y81	8/-
6P25	13/6	35Z5	9/-	P61	3/6	6Y82	8/-
6Q7GT	8/-	41MXP	5/-	P213	3/1T	6Y83	8/-
6A47GT	8/-	50T5	11/6	PEN34	15/-	6Y84	8/-
6Q7GT	7/6	50LGT	9/6	PEN25	5/-	6Y85	8/-
6R7	6/6	142BT	8/6	PEN25	5/-	6Y86	8/-
6R7	8/6	210DT	5/6	PEN34	12/6	6Y87	8/-

THE "EKE" QUALITY 3 WATT
AMPLIFIER



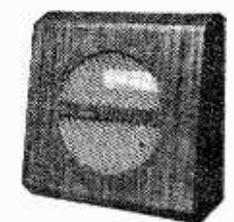
Three International Octal Valves 6B8GT, 6V6GT, 6X5GT. A.C. mains fully isolated, negative feed back (voltage and current) controls, volume and tone, input network for modern crystal. Really low hum level and even frequency response. Price 84/- plus 3/- Packing and Post.

HEADPHONES—MICROPHONES

EX-GOVERNMENT HEADPHONES AND MICROPHONES



CLR Low resistance type 120 ohms, 7/6 pair.
Throat Microphones, American surplus. Complete with strap, lead and plug type T300, 3/- set.
High Resistance Phones, 4,000 ohms, 13/6 pair.
High Resistance DLR Phones, 16/- pair.



LOUDSPEAKER CABINETS

This attractive walnut finished cabinet is available for 8 1/2 in. or 5 in. speaker units. Metal speaker feet, complete with back and rubber feet.
6 1/2 in. type. Measures 8 1/2 in. x 5 1/2 in. x 4 1/2 in. at base. Price 17/6 each.
5 in. type. Measures 10 1/2 in. x 10 1/2 in. x 5 in. at base. Price 21/6.
5 in. type. Very similar design. Price 16/6 each.
Postage—any type 2/- each.

WB "STENTORIAN" HIGH FIDELITY SPEAKER UNIT

Model H.F. 1012
10 in. Die-cast unit, incorporating 12,000 gauss magnet. Handling capacity 10 watts. Frequency response 30 c.p.s. 14,000 c.p.s. base resonance, 35 c.p.s. 24.15.9.

RECORD PLAYER UNIT



B.S.R. MONARCH
Four speed automatic record change unit. Plays 7 in., 4 in., and 12 in. records automatically with "MAGNIFONK" Selector Turn-over Pick-up. Unit Plate 12 1/2 in. x 10 1/2 in., £8.15.0.
Carriage on above unit, 4/6.



COLLARO Model 3/544

Three speed single player. Automatic stop, fitted with "Studio T" pick-up. Cream Finish. £6.19.6.
Carriage on above unit, 4/6.

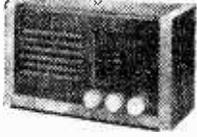


COLLARO

Four speed automatic record change unit. A fully mixing automatic changer with many advanced features. Unit plate 12 in. x 13 1/2 in., £9.15.0. Carriage on above unit, 4/6.

BUILDING A "SECOND" SET

THIS IS THE CABINET TO GIVE YOUR RECEIVER THE COMMERCIAL LOOK. WALNUT FINISHED CABINET—Size: 11 1/2 in. x 7 in. x 5 in. Supplied with Chassis (cut out ready), Dial, Back Plate, Drive Cord, Dial Drum, Pointer. Price 27/6 complete—Post 3/-.

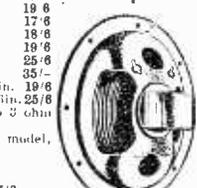


LOUDSPEAKER UNITS

Make	Type	Size	Price each
Elac	Square	3 1/2 in.	19/6
Lecturna, Plessey	Round	5 in.	17/6
Goodmans, Plessey	Round	6 1/2 in.	18/6
Goodmans, R. & A.	Round	8 in.	19/6
Plessey, R. & A., Elac	Round	10 in.	25/6
Plessey	Round	12 in.	35/-
Rola	Elliptical	6 in. x 4 in.	19/6
Elac	Elliptical	10 in. x 6 in.	25/6

All the above are PM units with 2 to 3 ohm speech coils.
KT2 12 in. Heavy Duty 20 watts model, 15 in. 5 ohms.
Speech Coil, £5.5.0.
5 in. Mains Energised Speaker, £1.
6 in. Mains Energised Speaker, 17/6.
8 in. Mains Energised Speaker, £11.0.
All have field coils of approx. 600 ohms.

SPECIAL OFFER
Just a few 8 in. units by Goodmans and Lecturna fitted with standard output transformer, £11.6 each.



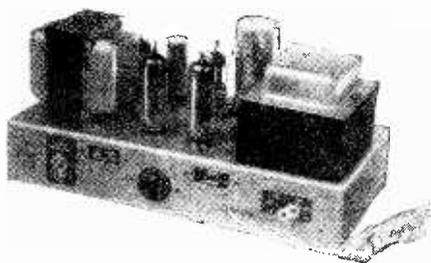
ALPHA
RADIO SUPPLY CO.

103 LEEDS TERRACE
WINTON STREET
LEEDS 7

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/- unless otherwise stated. Minimum C.O.D. fee and postage 3/-. All single valves postage 6d. Personal Shoppers Monday-Friday 9 a.m. to 5 p.m. Saturday 10 a.m. to 1 p.m.

YOU DON'T NEED to pay the earth for a high degree of fidelity, that's for certain. Just because rather than work down to a price and consequently lose quality, DULCI have streamlined production and inspection to such a fine art that their claim of 'the finest quality at reasonable cost' is no idle boast but really means what it says. Superb circuit design and the use of only the best components available leave little to be desired and guarantee trouble-free reproduction of the highest high fidelity. Just listen.

HIGH FIDELITY



DPA 10 Power Amplifier (Illustrated)
10-14 watts. Built strictly for Ultra Linear High Fidelity with choice of control unit or pre-amplifier. A superb laboratory-designed amplifier, modern styled and of precision quality for domestic use or in assembly halls holding up to 500 people. Incorporates every facility for the reproduction of high quality sound from radio, records, tapes or microphone. *DPA 10 only £12.12.0. DPA 10 with Control Unit £15.15.0. DPA 10 with Pre-amplifier*

Price £19.19.0.

- LOW OUTLAY

GA4 High Fidelity Amplifier
4 watt 4-valve circuit with a frequency response of 40-18,000 c.p.s. \pm 2db. Neat Control Panel, size 6" x 4", on fly leads for individual mounting. Input selector switch matching to Radio L.P. and 78 r.p.m. records. Separate bass and treble controls, giving wide range of cut and lift. Volume Control. Rotatable Transformer for hum cancellation.

Price £9.9.0.

distinctly



quality products

THE DULCI COMPANY LTD. 97-99 VILLIERS RD. LONDON N.W.2
WILlesden 6678/9

REPANCO HIGH GAIN TRANSISTOR COMPONENTS

STANDARD RANGE

Ferrite Slab Aerial Type FS2. Designed for Long and Medium Wave reception with transistor portable superhet receivers. Slab size 5 1/2 in. x 2 in. x 5/32 in. Complete with fixing brackets, 13/6.
Combined Oscillator and 1st I.F. transformer Type OT1. 13/16 in. sq. x 1 1/2 in. I.F. Frequency 315 kc/s., 11/6.
2nd I.F. Transformer (315 Kc/s.), Type TT2. 5/-.
3rd I.F. Transformer (315 Kc/s.), Type TT3. 5/-.
I.F. Transformers enclosed in iron dust pots with slug tuning.
Push Pull Interstage Transformer Type TT4. Ratio 1 : 1 C.T. Stack size 1 1/2 in. x 1 1/16 in. x 7/16 in., 8/6.
Push Pull Output Transformer, Type TT5. Ratio 15 : 1 C.T. (Size as TT4.) Matched to 3 ohm speaker, 8/-.

MINIATURE RANGE.—For pocket receivers.

Ferrite Slab Aerial Type FS3. Medium Wave only. With fixing grommets. Size 3 in. x 2 in. x 5/32 in., 7/6.
Oscillator Coil Type XO8. Medium Wave only. Overall size 3 in. dia. x 1 in. Enclosed in Ferrite pots, 5/-.
I.F. Transformer Type XT6. Suitable for 1st and 2nd I.F. 455 Kc/s. Size 1 in. sq. x 1 1/16 in., 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 2 in. x 2 in. x 13/32 in., 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.

Send S.A.E. for complete list of Repanco Quality Components.

Mail Order and Trade :
**RADIO EXPERIMENTAL
PRODUCTS, LTD.,**
33, Much Park St.,
COVENTRY
Tel. : 62572

Wholesale Enquiries and Export :
REPANCO, LTD.,
O'Brien's Buildings,
203-269, Foleshill Rd.,
COVENTRY
Tel. : 40594

SOUTHERN RADIO'S WIRELESS BARGAINS

TRANSRECEIVERS. Type "38" (Walkie Talkie) complete with 5 valves, etc. New condition, untested by us but serviceable. No guarantee. £12.6 each.

ATTACHMENTS for Type "38" Transreceivers. ALL BRAND NEW. Headphones, 15/6; Throat Microphones, 4/6; Junction Boxes, 2/6; Aerials No. 1, 2/6; No. 2, 5/-; Webbing, 4/-; Haversacks, 5/-; Valves—A.R.P.12, 4/6; A.T.P.A. 3/6. Set of FIVE VALVES, 19/- the set.

TRANSRECEIVERS. Type "18" Mark 'II. Two Units (Receiver & Sender). Six Valves, Microammeter, etc., in Metal Carrying Case. Untested, without guarantee but COMPLETE. £2.18.6.

ATTACHMENTS for "18" Transreceivers. ALL BRAND NEW. Phones, 15/6; Microphones, 12/6; Aerials, 5/- Set of SIX VALVES, 30/-.

RECEIVERS RI09. S.W. Receiver in Case. 8 valves. Speaker and 6-v. Vibrator Pack. Untested. No guarantee but COMPLETE, £2.18.6.

RESISTANCES. 100 Assorted useful values. New wire end, 12/6
CONDENSERS. 100 Assorted. Mica, Tubular, etc., 15/-.

BOMBSIGHT COMPUTERS. Ex-R.A.F. NEW. Hundreds of Components, Gears, etc. Ideal for Experimenters, £3.

LUFBRO HOLE CUTTERS. Adjustable 1/2 in. to 3/2 in. For Metal, Plastic, etc., 7/-.

QUARTZ CRYSTALS. Types F.T.241 and F.T.243. 2-pin, 1/2 in. Spacing. Frequencies between 5,675 kcs. and 8,650 kcs. (F.T.243.) 20 Mc/s and 38.8 Mc/s (F.T.241, 54th Harmonic), 4/- each. ALL BRAND NEW. TWELVE ASSORTED CRYSTALS, 45/-.

Holders for both types, 1/- each. Customers ordering 12 crystals can be supplied with lists of frequencies available for their choice.

MORSE TAPPERS. Standard type, 3/6; Extra Heavy on Base, 5/6; Midget, 2/9.

TRANSPARENT MAP CASES. Plastic, 14 in. x 10 1/2 in. Ideal for Maps, Display, etc., 5/6.
DINGHY AERIALS. Ex-U.S.A. Reflector Type, 4/6.

STAR IDENTIFIERS. Type I A-N covers both Hemispheres, 5/6.
CONTACTOR TIME SWITCHES. 2 Impulses per sec., in case, 11/6.

Postage or Carriage extra. Full List of RADIO BOOKS, 3d.

SOUTHERN RADIO SUPPLY LTD.

11 LITTLE NEWPORT ST., LONDON, W.6.2. GERard 6653

Open to Discussion



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

Amateur Communications Receiver

SIR,—You may be interested to hear that since constructing the communications receiver given in your issues of June, July and August, I have logged amateur stations in 26 countries. Apart from almost all the European Continent, good reception has been obtained from such places as Peru, Brazil, the Virgin Islands and a large number of W stations in America. I live in a flat where aerial facilities are severely limited, the above countries being obtained on a short length of wire hanging over the curtain rail!

As this is the first receiver I have ever constructed, I feel the results speak well for the clarity of description and the hobby has gained a firm addict. The only main changes I have made in the original circuit are the insertion of a tone control and a further audio stage using a 6SJ7. I find the latter very considerably improves the speaker volume.

I feel sure I am not the only one who would like to see circuit details for adding a noise limiter and an "S" meter. A short description of the theory and calibration of the latter would be appreciated.—J. ACTON, M.Sc., A.R.I.C. (W.14).

An Amateur's Results

SIR.—I have recently completed a radio-gram with an almost identical circuit to that on page 46 of March PRACTICAL WIRELESS; but using ex-Government equivalents of some valves, a phase splitter and two VT52 valves in push-pull output, with a 12in. speaker. Separate coils and switch used for 3-wave range, in lieu of coil pack.

Results *incredibly* good and reproduction better than anything else I have heard; with which many friends agree.

The set was built in a cabinet I made, with side cupboards for records.—A. J. SWEENEY (Gloucester).

Results from Indonesia

SIR.—I would like to know from your readers about the reception from our radio stations here. When I was in Europe last I failed to receive any Indonesian station. I would be glad to supply any information you may need about our stations here.—MR. CHIA FOEN FOE, Djalan Merdeka, No. 348 Palembang, Sumatra, Indonesia.

Identifying Stations

SIR.—As an occasional but fervent S.W.L. I find it difficult to locate or identify particular stations on my commercial receiver. The distance of the pointer behind the dial causes parallax and the flywheel tuning precludes fitting a calibrated knob. Fixing a length of plastic transparent ruler is not much better. Perhaps some of your readers have solved this problem? My set deserves better, having brought in Australia at lunch-time on an indoor copper rod, on the ground floor! In anticipation of your readers' remarks.—
DESMOND O'BRIEN (Dublin).

Wavebands of P.C.R. Set

SIR.—I shall be grateful if any reader can advise me what are the wave-bands of the P.C.R. Communications Receiver (a war-time model). I understand two versions were made, one of which has two short-wave bands and a medium-wave band.—W. E. RIGG (P.O. Box 36, Luanshya, Northern Rhodesia).

A Peculiar Fault

SIR.—I have just been reading the letter from E. Yeates (Bromsgrove) in "Open to Discussion" in the December, 1957, issue of PRACTICAL WIRELESS. He writes to say there was a time-lag of five to six seconds between two receivers both taking the same programme but on different frequencies on A.F.N. Germany.

The solution is simple. During the Second World War the Germans had all programmes recorded and put out about 10 seconds later than the actual transmission. This was in case someone gate-crashed the transmission and made uncomplimentary remarks about the Third Reich or its rulers.

The control engineer was able during that time-lag to switch off the transmission before it was transmitted.

As Mr. Yeates was in B.A.O.R. about 10 years ago it is probable that A.F.N. just took over the German transmitting stations as they stood.

Of course, one station would be transmitting the actual occurrence and the other a recorded occurrence 10 seconds later, hence the time-lag.—W. C. GREEN (G3QG), Luton.

Command Receiver Circuit

SIR.—I should like to give a corrected circuit diagram of the I.F. section of the Command Receiver BC455 (ref. "P.W." 11/57, p.606), which

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

is different from that published. The one published is that of the QS-er. BC453, which has an 85 Kc/s I.F.; and therefore much narrower band circuits.

The circuit is copied from the official U.S.A.A.F. publication, it is not a modification, and I have checked it against my own BC455 receiver. The I.F. is 2,830 Kc/s. and it will be noted that tuned anode couplings are used, choke capacity coupled to the following grid circuits. These chokes are mounted inside the I.F. cans, and these I.F.T.s have single tuned coils only.

Therefore the circuit shown by you on page 606 of PRACTICAL WIRELESS as that of the BC455 is *not* correct. Your correspondent has confused the issue and supplied that of the BC453, which is quite a different job. I know all these Command receivers very well, and I have all the official manuals on the whole series to refer to.—F. W. HATTEMORE (Penarth).

Music and Movement

DEAR THERMION.—I work as a teacher of English in a secondary modern school and, during the winter months, I help with a youth club which teachers and boys attend voluntarily one evening per week to follow leisure-time activities. Having been interested in radio communication for many years I run a small section where boys can learn the elementary principles of wireless and apply them in practice. I cannot agree that the value of set construction is as negligible as your correspondent maintains.

It is very true, as he says, that a new interest may be aroused in mathematics: it is most rewarding to a teacher when a boy, through the translation of a theoretical diagram to a practical, everyday piece of equipment, comes to realise that elementary algebra is a precise, concise and purposeful language. I would say that when this occurs, as it does, then the teacher has taught to some purpose.

Again, one does not limit the children to the building of one small set. They can be led through the stages of crystal to super-het, from

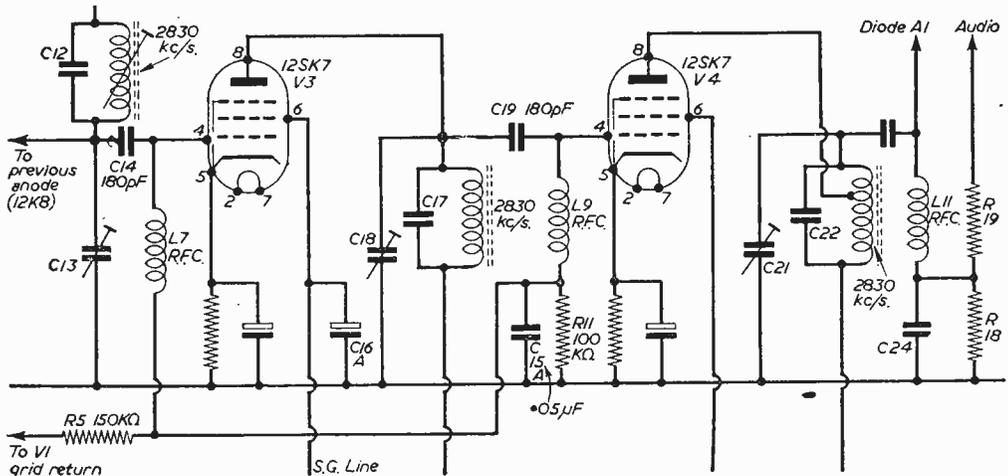
simple valve amplifiers to more complicated push-pull circuits: they can be presented with the problems that confronted the pioneers in radio and amplifier design and will perhaps appreciate the way in which these problems were overcome by the power of human endeavour. I rather fancy that there is something of educational value here.

Children can be trained to think diagnostically by means of the elementary principles of radio servicing: they love to trace a fault which has been introduced deliberately into a piece of equipment. They can be brought to appreciate the meaning of the words "consecutive" and "consequent," and will learn, let us hope, not to use such a syllogism as you quoted in your October article.

Some pupils, through having some knowledge about the control of current, might become interested in stage lighting. If there are any they will certainly discover another stimulating experience as back-stage workers in school theatricals. They will be able to work with their colleagues, the actors, and will learn the value of co-operation in a worthwhile enterprise.

Although I do not regard my room as a vocational training centre I find that many boys have found jobs in the radio trade. Surely a valuable by-product? Finally, there is the obvious benefit of teaching children to value their leisure time and to use it profitably.

These things can develop from the building of "one small radio," but, of course, it is no use for the teacher to keep his eye close to that one small piece of apparatus only. He will become short sighted. Not that I am recommending set construction for all. The same benefits can accrue from a multitude of leisure-time activities and from all the usual subjects of the school curriculum. Success is attendant upon the interest the teacher has in his subject, academic or practical, upon the depth of his knowledge and upon his ability to cultivate an infectious enthusiasm in himself for what he is trying to teach.—P. L. UGLOW (N. Devon).



The corrected circuit of the Command Receiver according to reader Hattemore. See letter above.

C.R.T. ISOLATION TRANSFORMER

Type A. Low leakage windings. Ratio 1:1.20 giving a 25% boost on secondary.

Type B. Mains input 220/240 volts. Multi Output 2, 4, 6, 8, 10 and 13 volts.

Type C. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type D. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type E. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type F. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type G. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type H. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type I. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type J. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type K. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type L. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type M. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type N. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type O. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type P. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type Q. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type R. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type S. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type T. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type U. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type V. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type W. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type X. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type Y. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type Z. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AA. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AB. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AC. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AD. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AE. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AF. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AG. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AH. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AI. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AJ. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AK. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AL. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AM. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AN. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AO. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AP. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AQ. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AR. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AS. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AT. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AU. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AV. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AW. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AX. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AY. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type AZ. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BA. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BB. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BC. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BD. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BE. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BF. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BG. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BH. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BI. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BJ. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BK. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BL. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BM. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BN. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BO. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BP. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BQ. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BR. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BS. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BT. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BU. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BV. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BW. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BX. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BY. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type BZ. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CA. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CB. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CC. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CD. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CE. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

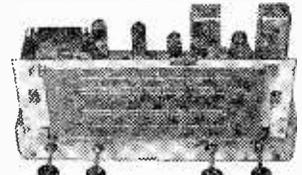
Type CF. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CG. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CH. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CI. Low capacity wound transformer for use with 2 volt Tubes with falling emission.

Type CJ. Low capacity wound transformer for use with 2 volt Tubes with falling emission.



1557 RADIOGRAM CHASSIS

THREE WAVEBANDS. FIVE VALVES. S.W. 16 m.-50 m. LATENT MULLARD M.W. 200 m.-550 m. ECH42, EP41, EP41, L.W. 800 m.-2,000 m. EL41, EZ40.

12 month guarantee. A.C. 200/250 v. 4-way Switch; short-Medium-Long-Gram. A.V.C. and Negative Feedback

12 watt. Chassis 13 1/2 x 7 1/2 x 2 1/2 in. Class Bial 10 x 4 in., horizontal or vertical or available.

2 Pilot Lamps, Four Knobs, Walnut or Ivory. Aligned and calibrated. Chassis isolated from mains.

10 gns. Carr. & Ins. 4/6. TERMS: Deposit £5.5.0 and six monthly payments of £1.

MATCHED SPEAKERS FOR ABOVE CHASSIS. 8in. 17/6; 10in. 25/-; 12in. 30/-.

RECOMMENDED FOR ABOVE CHASSIS

★ COLLARO ★ HIGH-FIDELITY AUTO-CHANGER 1957 Model R1456

7in., 10in., 12in. 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 six monthly payments of £1.

Space required 14in. x 12 1/2in. 5in. above and 3in. below. Cut Out board, 6/-.

GARRARD 4-SPEED RECORD CHANGERS RC120/4H 1957 MODELS Brand new and fully guaranteed 12 months.

AUDIO RECORDER

Designed to play 16, 33, 45, 78 r.p.m. Records. 7in., 10in., 12in. Lightweight X.M. Pick-up, turner head, 10 separate sapphires for Standard and L.P., each plays 2,000 records

Voltage 200/250 A.C. OUR PRICE £10.15.0 each. Post Free.

TERMS: Deposit £8 and 6 monthly payments of £1. Space required 14in. x 12 1/2in. 5in. above and 3in. below. Cut Out board, 6/-.

AMPLIFIER-RECORD PLAYER CABINETS. Cabinet size 18 1/2 x 13 1/2 x Ht. 8 1/2 in., with motor board 14 x 12 1/2 in. £23.3.6 post 3/-.

ALUMINIUM CHASSIS. 18 s.w.g. un drilled. With 4 sides, riveted corners and latrice fixing holes. 2 1/2 in. sides, 7 x 4 in., 4 1/2 x 9 x 6 in., 5 1/2 x 11 in., 6 1/2 x 13 x 6 in., 8 1/2 x 14 x 11 in., 10 1/2 x 15 x 14 in., 12 1/2 x 18 x 16 x 3 in., 16 1/2.

TRANSISTORS. Audio, 10/-, R.F. 2/6 M/s, 21/-. Mullard OC71, 20/-.

SUPERHERT COIL PACK. 27/6. Miniature size 2 1/2 in. x 2 1/2 in. HIGH "Q" Dust cored Coils. Short, Medium, Long, Gram Switching. Single hole fixing with connection diagram and circuit. 465 Kcs 1 P.P.

COLLARO. 4-speed Motor and Turntable with selecting switch for 16, 33, 45, 78 r.p.m. records. 200/250 v. A.C. 50 cps. Also HIGH FIDELITY Lightweight Pick-up. Accu Xtal turner head, separate Sapphire stylus or L.P. and Standard records. SPECIAL OFFER, THE TWO: £24.12.6, post 2/6. Cut Out Board, 13 x 12 1/2 in., 6/-.

SUITABLE AMPLIFIER-PLAYER CABINET. Really cut out for above, 45/-.

CERAMIC MIKE INSERT by Acos, pushbutton engineer. Size only 1 1/2 x 3 1/2 in. Bargain Price 8/6. No transformer required.

CHAMPION VHF (FM) TUNER,

88-96 mc/s.

5 Multid valves and superb tuning heart. Maroon and cream receiver styled cabinet 12 x 6 x 6 in. Features: This is a self-powered 200/250 v. A.C. VHF (FM) Adaptor with operating and servicing data and a screened lead for connection to pick-up sockets of any radio, radio-gram, or amplifier.

Brand new with 12 months' guarantee. List price, 16 gns. Our price, 10 gns., carr. 4/6.

Volume Controls 80 ohm CABLE COAX

Long spindles. Guaranteed 1 year. Midget 10,000 ohms to 2 Meg. No Sw. S.P.S.W. D.P.S.W. 3/-, 4/-, 4/9 Air Space.

Linear or Log Tracks. Semi-air spaced Poly-tene insulated. Jln. dia. Stranded core. 9d. yd. Losses out 30%. Fringe Quality 1/6 yd.

COAX PLUGS ... 1/- DOUBLE SOCKET 1/3 SOCKETS ... 4/6 BALANCED TWIN FEEDER 7/6. 6d. 80 or 300 ohms. DITTO SCREENED per yd. 1/-, 80 ohms only. WIRE-WOUND POTS. 3 WATT. Pre-Net Min. T.V. Type. All values 25 ohms to 30 K, 3/-, ca. 50 K, 4/-, 400 ohm 50 K to 2 in., 3/-.

WIRE-WOUND 4 WATT. Pot. 2 1/2 in. Spindle. Values, 100 ohms to 50 K, 5/6; 100 K, 6/6. CERAMIC CONDS. 500 v., 3 pf. to .01 mid., 10d. SILVER MIC CAP CONDENSERS. 10% 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. Close tolerance (± 1 pf.) 1.5 pf. to 47 pf., 1/6. (Ditto, 1%, 30 pf. to 475 pf., 1/9; 1,000 pf. to 3,000 pf., 2/-).

MEAS 6d. Tubular 500 v. .001 to .01 mid., 50d.; .05, .1, .2, 1.5, 5, 50, 500 v., 1/9; 1,500 v., 9d.; 1,000 v., 1/3; 1 mid., 2,000 volts, 3/6. CERAMIC CONDS. 500 v., 3 pf. to .01 mid., 10d. SILVER MIC CAP CONDENSERS. 10% 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. Close tolerance (± 1 pf.) 1.5 pf. to 47 pf., 1/6. (Ditto, 1%, 30 pf. to 475 pf., 1/9; 1,000 pf. to 3,000 pf., 2/-).

IF. TRANSFORMERS 7/6 pair 465 Kcs Slug Tuning Miniature Can. 2 1/2 in. x 1 1/2 in. High Q and good bandwidth By Eye Radio. Data sheet supplied.

Wearite M800 IF 465 Kcs 12/6 per pair.

NEW ELECTROLYTICS. FAMOUS MAKES TUBULAR TUBULAR CAN TYPES

1 350 v. 2 100 25 v. 2 1/2 x 1 1/2 x 1 1/2 5/6 2 450 v. 2 3/8 x 8/500 v. 4 6/16 x 16/500 v. 6/8 2 450 v. 2 1/2 x 16/500 v. 25 x 20 450 v. 5/6 8 450 v. 2 3/8 6/- 32 x 32/500 v. 4/6 8 500 v. 2 3/8 32 x 32/500 v. 4/6 16 450 v. 2 1/2 4 1/8 34 30 x 30/500 v. 7/- 16 500 v. 4/1 16 450 v. 3/6 60 x 100 250 v. 11/6 32 450 v. 5/1 32 250 v. 4/1 100 x 200 275 v. 11/6 25 25 v. 1 1/4 250 v. 5/1 12/6 50 250 v. 1 1/4 250 v. 3/- 1,000 x 1,000 6/6 20 500 v. 2 1/2 16 450 v. 2 1/2 8/6

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGES. K3/25 2 v. 8/-; K3/30 3.2 kv., 7/-; K3/45 3.6 kv., 7/6; K3/50 4 kv., 8/-; K3 100 8 kv., 14/6. 50 cps. voltage, 30% of above.

MAINS TYPE CONTACT COOLED 250 v. 50 mA., 8/6; 250 v. 75 mA., 9/6.

COILS Various. B.T. type, 3/- each. Osborn Midget "Q" type adj. dnd. ret. from 4/-.

TELETRON L & Med. T.R.F., with reaction, 3/6. FERITE ROD AERIALS. M.W. 8/9; M. & L. 12/6. T.R.P. COILS A HF. 7/- pair. E.P. CHOKES, 2/6. FERITE ROD SH. 3/6 in. dia., 2/6.

JASON P.M. TUNER COIL SET. 26/-, H.P. coil, aerial coil, oscillator coil, two I.F. transformers 10 7/8 in. x 1 1/2 in. Detector transformer and heater choke. Circuit book using four 6AM6, 2/-, J.B. Chassis and Dial, 19/6. Complete Jason F.M. Kit, 25.18.6. With Jason superior calibrated dial, 26.15.0.

FULL WAVE BRIDGE SELENIUM RECTIFIERS. 2, 6 or 12 v. 1 1/2 amp., 8/9; 2 1/2, 11/3; 4 1/2, 17/6. CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 5 or 12 v., 11 amp., 15/6; 2 amp., 17/6; 4 amp., 25/6.

VALVE and T.V. TUBE EQUIPMENT. 5/- TOGGLE SWITCHES. S.P. 2/-, D.P. 3/6, D.P. 1/4 - WAVECHANG SWITCHES.

5 p. 4-way 2 wafers long spindle ... 6/6 2 p. 2-way 3 p. 2-way 4 p. 2-way ... 2/6 2 p. 4-way 2 p. 2-way 4 p. 2-way long spindle 3/6 3 p. 4-way, 1 p. 12-way, long spindle ... 3/6 VALVEHOLDERS. Pax. Int. Oct., 4d. EF50, EA50, 6d. B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7, and 9 pin. 3/-, B02, B03, B04, 9d. B7G with can, 1/6. VCR97, 2/6, B88 with can, 2/6. CERAMIC EF50, B7G, 80A, Int. Oct., 1/6. B7G with can, 1/9. BLACK CRACKLE PAINT, air drying, 3/- tin.

Table with 4 columns: Part Number, Description, Price, and Status. Includes items like 145 8/6 6K8, 146 8/6 6K8, 147 8/6 6K8, etc.

Table with 4 columns: Part Number, Description, Price, and Status. Includes items like 148 8/6 6K8, 149 8/6 6K8, 150 8/6 6K8, etc.

Table with 4 columns: Part Number, Description, Price, and Status. Includes items like 151 8/6 6K8, 152 8/6 6K8, 153 8/6 6K8, etc.

A MERRY CHRISTMAS TO ALL READERS OF PRACTICAL WIRELESS Please post Christmas orders by Wednesday 17th December.

RADIO COMPONENT SPECIALISTS 337 WHITEHORSE RD., WEST CROYDON

Shop closed 25th, 26th, 27th December. OPEN ALL DAY - (Wed. 1 p.m.) Catalogue 6d. Tel. THO 1665. Buses 133 or 63 pass door. 48-hour postal service. P.&P. 1/-, over £2 post free. (Export Extra.) C.O.D. Service 1/6

Let I.C.S. Train YOU!

● **COURSES ON :—**

**RADIO and TELEVISION
SERVICING · ELECTRONICS**

● **EXAMINATION COURSES FOR :—**

P.M.G.'s CERTIFICATE (Marine Radio Operators)

C. & G. RADIO AMATEURS' EXAM.
(Amateurs' Transmitting Licence)

C. & G. RADIO SERVICING CERTIFICATE (RTEB)

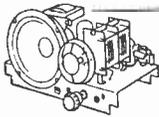
BRITISH INSTITUTION OF RADIO ENGRS., etc.

Whether you plan to have your own business, to become an electronics engineer or to take up a career in industry, an I.C.S. Course will help you to succeed. You learn at home in your own time, under expert tuition. Moderate fees include all books.

● **LEARN-AS-YOU-BUILD
Practical Radio Course**

A basic course in radio, electronic and electrical theory backed by thorough practical training. You build a T.R.F. and a 5-valve superhet radio receiver, signal generator and multi-tester.

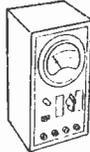
Other Learn-as-you-Build radio courses are available



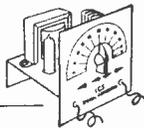
5-VALVE SUPERHET RECEIVER

MULTI-TESTER

(sensitivity
1,000 ohms per volt)



RF/AF SIGNAL GENERATOR



● **POST THIS COUPON TODAY** for FREE book on careers in Radio, etc., and full details of I.C.S. Courses.

**INTERNATIONAL CORRESPONDENCE
SCHOOLS**

Dept. 170H, International Buildings, Kingsway, London, W.C.2.

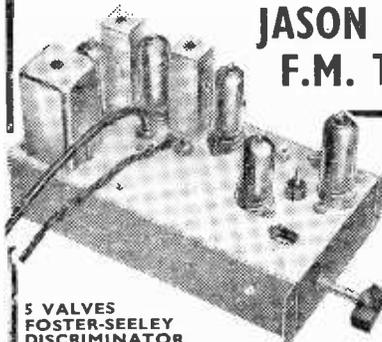
Name..... Age.....
(Block Letters please)

Address.....

Occupation..... 1.58

**INTERNATIONAL
CORRESPONDENCE SCHOOLS**

BUILD THIS AUTHENTIC JASON SWITCHED F.M. TUNER



**JASON
MERCURY**

**5 VALVES
FOSTER-SEELEY
DISCRIMINATOR**

When built, this new Jason F.M. Tuner provides choice of the three B.B.C. programmes at the turn of a switch, with a fourth position for "OFF". It is a stable unit, free from drift and of high quality. The Switch Tuned Front End is supplied wired, tested and aligned, complete with 2 valves and station-indicating plate. Chassis ready and punched. In conformity with all Jason F.M. Units, this model is completely stable and offers the highest possible standards of reproduction.

**CONSTRUCTOR'S
SWITCH-TUNED
KIT** including assembled Front End with two valves and all parts as specified and up- **£9.0.0**

**SWITCH-TUNED
FRONT END** with two valves, complete. **£6.5.0**
(incl. £1 15' 0" P.T.A.C.)

Data Publication Book of the Tuner (Post Paid) **2/-**

JASON POWER PACK KIT £2.1.9

FROM LEADING STOCKISTS, or in cases of difficulty:

THE JASON MOTOR & ELECTRONIC CO. Phone: **SPE 7050**
328, Cricklewood Lane, London, N.W.2.

NEW SHOP IN LEEDS, I

All Spares for Radio and TVs. Plenty of Valves in Stock. Show this advertisement for Free Valve Testing this Month on Latest Mullard Electronic Tester. Large Stock of Reduced Aerials and Convertors in Stock.

TV SPARES
41, CALL LANE, LEEDS, I

TESTOSCOPE MAINS TESTER



For high and low voltage testing
Standard Model
range 100/250 volts A.C. or
D.C. Dual Model : range 1.30 and
100/250 volts A.C. or D.C.

Write for interesting leaflet 29F.

Rumbaken
MAKINGISTS

BOOKLET—"Hints on Electrical Testing," post free 1.-

News from the Trade

R.S.C. 30-WATT AMPLIFIER

THERE are often occasions when something more powerful than the usual 20-watt amplifier is needed, and the majority of amplifiers of this rating on the market are quite expensive. We recently had the opportunity of trying out a unit made by the Radio Supply Co., of Leeds, which is not only rated at an output of 30 watts, but employs the now popular ultra linear feature and in addition costs only £12 19s. 6d. Employing two EF86 input stages and an ECC83 phase splitter, with two 807s in the output stage, good quality components and well-rated resistors are used throughout, and there are two inputs of the coaxial type with separate volume controls—one labelled High Gain and the other Low Gain. In addition, a comprehensive tone control is fitted prior to the phase splitter, and this provided both bass and top cut and lift. The output transformer, which is made by the company, might look rather small for an amplifier of this type, but it certainly does its work. The amplifier is rated at 30-20,000 c.p.s., with hum and noise 70 db down. An output socket is provided for feeding a pre-amplifier or similar unit, and if desired a louvred cover may be obtained to fit over the complete unit. The chassis in the model tested was finished in a light blue, and there was a cover plate fitted below to provide complete screening and avoidance of stray pick up.

We tested the unit both with pick-ups and microphones and finally on an electronic organ. It gave surprising results from these, dealing very

well with the pedal 32 cycle note, and with the bass boost at maximum, the output stages handled the output without distress. On the top notes of the organ with the flageolet stop in action the result was clean cut, and passing the two tones through the amplifier resulted in both coming through cleanly with little intermodulation distortion. At maximum volume from the organ, with pedals and both manuals in action, the amplifier was as good as many very much higher-priced units we have tried.

If desired, the amplifier may be obtained in kit form for home assembly for 10 gns.—Radio Supply Co. (Leeds) Ltd., 32, The Calls, Leeds 2.

TECHNICAL CERAMICS MARKET NEW CERAMIC PICK-UP

A NEW Sonotone ceramic pick-up cartridge, to be known as the type 2T, will shortly be introduced to the commercial market by Technical Ceramics.

Designed for long playing and standard 78 r.p.m. records, the new 2T will eventually replace the company's existing type 9980 cartridge. Employing a barium titanate element as the transducer material, the new pick-up cartridge, of rugged construction, is suitable for use in any part of the world, as it is unaffected by conditions of high temperature and humidity.

Change of stylus is accomplished by rotating the dual tip of the cantilever arm to bring the appropriate tip into use, while the complete stylus assembly may be easily replaced by the user. The frequency response of this new medium compliance cartridge is a close match to the B.S.1928 characteristic without any equalisation; moreover, it provides the necessary

degree of output to avoid any difficulties due to hum pick-up.—Technical Ceramics Ltd., Towcester, Northants.

NEW RANGE OF DIRECTLY HEATED SUBMINIATURE VALVES

HIVAC, LIMITED, are marketing an augmented range of directly heated subminiature valves, many of which are exact equivalents of American types used in portable radio communication equipment.

The range includes the XFY14, Output Pentode (U.S. equivalent 5672); the XFR1 R.F. Amplifier Pentode (U.S. equivalent 1AD4); the XFR3 R.F. Oscillator Triode (U.S. equivalent 5676); and the XR4 R.F. Power Amplifier (U.S. equivalent 6397). All the valves, with the exception of the XR4, are 38.1 mm. long, 10.1 mm. wide and 7.6 mm. in thickness. The filament voltages are 1.25. The XR4 is 40.64 mm. long and has a diameter of 10.16 mm. The R.F. amplifier pentodes have metallised screening.—Hivac, Ltd., Stonefield Way, Victoria Road, South Ruislip, Middx.



The R.S.C. A.10 Ultra Linear 30w amplifier.

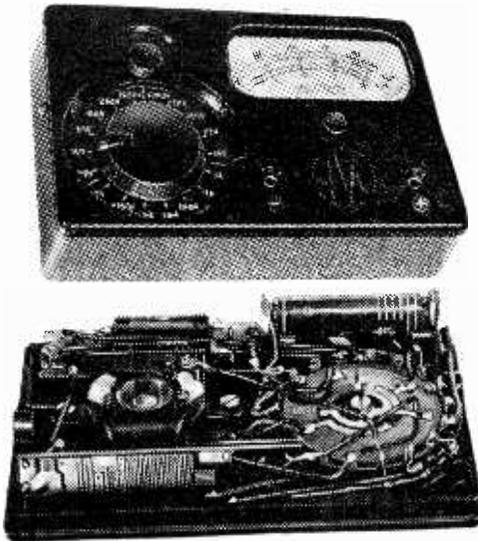
A NEW EARTH CLAMP

IN response to the increased demand for a safer, simpler and more durable earth clamp, Cable Covers have developed the CCL Universal Earth Clamp—world patents pending.

The completed assembly provides a clamp of streamlined design and efficient in appearance as well as in performance. The clamp is supplied with 6in. of cadmium-plated copper strip and is suitable for all pipe diameters in the B.S.S. 951 range. Stocking of various sizes is, therefore, eliminated, and prices are more competitive. A fully descriptive leaflet showing the simple method of fixing and other useful data is available on request.—Cable Covers Ltd., St. Stephen's House, Westminster, London, S.W.1.

THE NEW MULTIMINOR

TO meet growing competition in world markets "AVO" have produced a new pocket size instrument, the Multiminor. Two models are available: (a) the Multiminor Model 1, for use in temperate climates, and (b) the Multiminor Model 2, for use under adverse climatic conditions. The Multiminor is the first meter of its type, and is being mass produced in London.



Two views of the interesting new AVO meter—the Multiminor.

All components which could be moulded have been made on precision moulding presses, using a recently developed moulding powder, which endows the finished product with a very high factor of electrical insulation, even when working under conditions of extreme humidity. Moreover, this new material resists the growth of fungus, an enemy of instruments used under humid conditions, and a very common cause of failure. The indicating movement has been neatly constructed in a dust-proof casing, and all wiring is termite proof.

One of the weakest components in inexpensive multi-range meters is the selector switch. In this instrument the switch is quite unique in design, a

series of 18 fixed, silver plated contacts being rigidly held in a ring of high-grade moulding material, and wiped by a double-contact rotor arm.

The most outstanding feature of the instrument is the employment of printed resistors, produced from a special metallic alloy. It is the first time that such resistors have been made and used on any mass-produced apparatus. In one instance it has been possible to combine a printed resistor with an auxiliary switch-plate as an integral part of the selector switch mechanism, another printed resistor forming the universal meter shunt.

Ranges

Range selection is by means of a rotary switch, there being only two connection sockets for all measurements. The instrument has 19 ranges

Table of Ranges

D.C. Voltage	A.C. Voltage	D.C. Current
Sensitivity (10,000 Ω/V) First indication 2 mV.	Sensitivity (1,000 Ω/V) First indication 200 mV.	First indication 2 μA .
*0-100 mV. 0-2.5 V. 0-10 V. 0-25 V. 0-100 V. 0-250 V. 0-1,000 V.	0-10 V. 0-25 V. 0-10 V. 0-250 V. 0-1,000 V.	0-100 μA 0-1 mA. 0-10 mA. 0-100 mA. 0-1 A.

* The 100 μA range corresponds to 100 mV.

Sensitivity

All D.C. voltage ranges have a sensitivity of 10,000 Ω/V .

A.C. voltage ranges have a sensitivity of 1,000 Ω/V .

Accuracy

D.C.—3 per cent. of full scale.

A.C.—4 per cent. of full scale.

(Instruments can be supplied to a higher degree of accuracy for a small charge.)

Approximate weight: 1 lb. (0.45 kg.).

Overall size: 5 $\frac{1}{2}$ in. x 3 $\frac{1}{2}$ in. x 1 $\frac{1}{2}$ in. (14.3 cm. x 9.2 cm. x 3.5 cm.).

The instrument is attractively presented in a coloured box, which can be used for display purposes, and working instructions are provided in 6 languages. A handsome ever ready leather case can also be supplied for the protection of the instrument.—Price £9-10-0.—AVO. Ltd., 92-96, Vauxhall Bridge Road, London, S.W.1.

STANDARD PRICE FOR PRINTED CIRCUITRY

IN the past the cost of manufacturing a printed circuit has usually been quoted only after detailed study of the type of circuit and quantity required.

Now, however, Printed Circuits Limited announce that they are prepared to undertake the quantity production of almost any form of printed circuit at a fixed cost of 1d. per square inch. This figure, based on lengthy experience of the process, includes such factors as raw materials, all the necessary processing, but excluding the cost of special tools.—Printed Circuits Ltd., Stirling Corner, Barnet By-Pass, Borehamwood, Herts.

Wanted!

QUALIFIED MEN AND WOMEN

Industry & Commerce offer their best posts to those with the necessary qualifications—such posts that will bring personal satisfaction, happiness, good money and security. As part of a modern industrial organisation, we have skilled knowledge of what is required in industry to-day 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. Make your own choice and write to us to-day for further information. There is no obligation of any kind.



OUR BACKGROUND!

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

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

EMI

INSTITUTES

PERSONAL & INDIVIDUAL TRAINING IN—

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

NEW! Courses with PRACTICAL EQUIPMENT

in RADIO · TELEVISION · MECHANICS
CHEMISTRY · ELECTRICITY
DRAUGHTSMANSHIP · PHOTOGRAPHY etc., etc.



COURSES FROM 15/- PER MONTH!

POST THIS TODAY

FREE

E.M.I. INSTITUTES, Dept. 32K, London, W.4

NAME _____ AGE _____
(if under 21)

ADDRESS _____

Subject(s) with/without equipment _____

JAN. 58 _____ We shall not worry you with personal visits

BLOCK CAPS PLEASE

IC 92



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

Best Buy at Britain's

EXPRESS ELECTRONICS

ROSEDENE LABORATORIES
KINGSWOOD WAY, SELSDON, SURREY

MINIATURE 373 I.F. STRIPS.—For F.M. tuner described in April and May P.W. Complete with 3 of EF91, 2 of EF92 and EB91. A fresh release enables us to offer these once again. BRAND NEW. with circuit. 42/6. OR less valves 19 6. Post either, 2/6.

AVOMETERS.—36 range Universal meter, for A.C. and D.C. volts, A.C. and D.C. current and Ohms. Large easy-to-read 5 in. mirror scale. B.S.I. standard. Complete with batteries and guaranteed in first-class working order. £8 19 6. P. & P., 4/-.

MULLARD GM4140 1.C. & R. BRIDGES.—0.1 Ohm to 10 Megohms in 4 ranges; 10 p.p.f. to 10 m.f. in 3 ranges. For 50 c.s. A.C. mains. In perfect working order. £7 10 - P. & P., 3/6.

F.M.I. AUTOMATIC MONITOR 4FD231.—Soak tests up to 3 receivers or amplifiers simultaneously and SILENTLY. Fault warning buzzer, lamp indicators. A.C. mains operation. BRAND NEW, boxed, complete with 8 valves, all connecting leads, and instruction manual. Fraction of original price. £4 19/6, carr. 7/6.

RECORD INSULATION TESTERS.—0 to 50 Megohms. Generator output 500 v. In perfect working order, complete with leather carrying case. £9 19/6. OR less case, £8 10 -

SPEAKERS.—3 Ohms, 6 1/2 in. diam. in grey wrinkled steel cabinet. 9 x 9 x 5 in. Complete with volume control, and transformer for 600 Ohms line. Brand new. 27 6. P. & P., 3/6.

VIBRATOR PACK.—Input 6 v. D.C. Output approx. 100 v. at 30 m.Amps. D.C. Fully smoothed and R.F. filtered. Size 6 1/2 x 5 x 2 in. Fitted with Mallory 629C vibrator. BRAND NEW. 12/6.

VIBRATOR PACK.—Input 6 v. D.C. Output 200 v. D.C. 100 m.Amps Fully smoothed and R.F. filtered. Size 9 x 6 x 6 1/2 in. Complete with 0Z4 and vibrator. Brand new. 25/-

MAINS ISOLATING TRANSFORMERS (Vortexlon).—For testing A.C./D.C. sets in safety. 230 v. input, output 230 v. 100 watts, 22 6. P. & P., 2/6.

MAINS TRANSFORMERS.—Input 200-250 v. A.C. Outputs 275-0-275 v. 100 m.Amps; 6.3 v. 7 Amps; 5 v. 3 Amps. (Govt. rating.) 4 x 4 1/2 x 4 in. high. Upright intk. Brand new. 25 - P. & P., 2/6.

R.C.A. OUTPUT TRANSFORMERS.—Pri. push-pull 6L6s. Secs. 600 Ohms, tapped at 15, 7.5 and 5 Ohms. Teritary winding for NFB. Handles 20 Watts. Potted. Circuit of R.C.A. amplifier supplied FREE. Brand new. 27/6.

AVOMINOR LEATHER CASES.—Brand new, with strap, 7 6.

POCKET VOLTMETERS.—0-25 and 0-250 v. D.C. 2 1/2 in. diameter. Complete with leads and rexine case. Brand new. Tested. 12/6.

VALVES NEW, TESTED AND GUARANTEED

IAC6	8/6	6BR7	10/6	12AU7	7/6	ECC35	7/6	N18	7/6
IC1	7/6	6BW6	7/6	12AX7	8/-	ECC81	8/6	N19	7/6
IC2	8/6	6BW7	8/-	12K7GT	8/-	ECC82	6/9	PCC84	9/-
IC3	9/-	6CH6	7/-	12K8GT	10/6	ECC83	8/6	PCF80	10/6
IF1	8/6	6C10	9/-	12Q7GT	8/-	ECC84	10/6	PCF82	10/6
IF3	7/6	6D1	1/6	25L6GT	8/6	ECCF80	10/6	PL81	11/6
IFD1	8/6	6D2	6/9	35L6GT	8/6	ECCF82	0/6	PL82	9/-
IFD9	7/6	6F12	6/-	35W4	8/6	ECH42	10/-	PY81	8/-
IP1	9/-	6F15	9/-	35Z4GT	8/-	ECH81	8/-	PZ30	17/6
IP10	7/6	6J5G	5/6	5763	10/6	ECL80	8/6	U52	8/6
IP11	7/6	6K7G	5/6	D77	6/9	EF37A	9/-	U76	8/6
IR5	7/6	6K8GT	9/6	DAF91	7/6	EF39	5/-	U78	7/-
IT4	7/6	6L6G	10/6	DF91	7/6	EF41	9/-	UBC41	8/6
IS5	7/6	6Q7GT	9/-	DF96	8/6	EF80	8/6	UBC42	8/6
IU5	7/-	6SA7	8/-	DH76	8/-	EF91	6/-	UF41	8/6
3Q4	7/6	6SL7GT	7/6	DH77	7/6	EF92	5/6	UL41	8/6
354	7/6	6SN7GT	8/-	DH142	8/6	EL37	19/6	UY41	7/6
3V4	7/6	6V6GT	7/6	DH150	10/-	EL38	20/-	V76	8/-
5U4G	8/6	6V6GT	7/6	DK91	7/6	EL41	10/-	V77	5/6
5Y4G	7/-	6X4	7/-	DK92	8/6	EY51	9/6	W142	8/6
5Z4G	9/6	6X5GT	6/6	DK96	9/-	EZ35	6/6	X17	7/6
6AL5	6/9	757	8/6	EAS0	1/6	EZ40	8/-	X18	8/6
6AM6	6/-	8D3	6/-	EABC80	8/6	EZ80	8/-	X142	8/6
6AT6	7/6	12AH8	10/6	EB91	6/9	KT33C	9/-	X150	10/-
6BA6	7/6	12AT6	8/6	EBCA1	10/-	KT66	11/-	Z77	6/-
6BE6	8/-	12AT7	8/6	EBF80	9/6	N17	7/6	ZD17	7/6

PLEASE ADD POSTAGE OR CARRIAGE ON ALL ITEMS
CHARLES BRITAIN (RADIO) LTD.
11 Upper Saint Martin's Lane, London, W.C.2
TEMPle Bar 0545

Shop hours 9-6 p.m. (9-1 p.m. Thursday). Open All Day Saturday.

MATCHED PAIRS
EL84 23 -, 6V6G and GT 17/-, 6BW6 18/- per pair.

SETS OF VALVES

DK91, DF91, DAF91, DL92 or DL94.....	27/6
IR5, IT4, IS5, 354 or 3V4.....	27/6
6K8, 6K7, 6Q7, 6V6, 5Z4G.....	35/-
12K8, 12K7, 12Q7, 35L6, 35Z4.....	35/-

Postage and packing, 6d. Over £1 post free. C.O.D. 2/6.

FOR THE BEST VALUE in TAPE RECORDERS

... we recommend the



55 GNS.

or 55/- deposit

NO INTEREST TERMS

4 watts output—3 hours playing time—3 speeds. Completely automatic operation. All other makes of Tape Recorders in stock.

Wrt. to details to:—

E & G THE RADIO CENTRE
33, Tottenham Court Rd., London, W.1
Telephone: MUSEum 6667

COPPER WIRE

ENAMELLED, TINNED, LITZ.
COTTON AND SILK COVERED.
RESISTANCE WIRES,
1 oz., 2 oz. & 4 oz. REELS.
All gauges available.
B.A. SCREWS, NUTS, WASHERS,
soldering tags, eyelets and rivets,
EBONITE AND BAKELITE PANELS,
TUFGNOL ROD, PAXOLIN TYPE COIL
FORMERS AND TUBES.
ALL DIAMETERS.
Latest Radio Publications.
SEND STAMP FOR LISTS.

SPECIAL OFFER G.E.C., B.T.H. & WESTINGHOUSE GERMANIUM CRYSTAL DIODES

1/- each. Postage 3d.

Diagrams and three Crystal Set Circuits
Free with each diode.
A large purchase of these fully
GUARANTEED diodes from the
manufacturers enables us to make this
attractive offer.

CRYSTAL SET INCORPORATING THE SILICON CRYSTAL VALVE

Adjustable Iron Cored Coil.
RECEPTION GUARANTEED
Polished wood cabinet, 15/-, post 1/6
A REAL CRYSTAL SET, NOT A TOY
POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

CHASSIS

UNDRILLED
ALUMINIUM CHASSIS

4 sides, welded corners. ea.

7in. x 4in. x 1 1/2in. deep ...	4/3
9in. x 6in. x 1 1/2in. deep ...	5/6
11in. x 7in. x 1 1/2in. deep ...	6/6
10in. x 8in. x 2 1/2in. deep ...	7/-
16 1/2in. x 8 1/2in. x 2 1/2in. deep ...	9/-

2 sides only.

7in. x 4in. x 2in. deep ...	3/-
9in. x 6in. x 2in. deep ...	4/-
10in. x 8in. x 2 1/2in. deep ...	4/9
16 1/2in. x 8 1/2in. x 2 1/2in. deep ...	6/9

Screw-up type hole punches.

7in. Dia. ...	6/-
1in. Dia. ...	7/-
1 1/2in. Dia. ...	8/-
1 1/2in. Dia. ...	9/6

Prices are subject to postage being charged extra.

Send sketch of your requirements for prices by return to:—

Oliver & Randall
LIMITED
53 Perry Hill, London
S.E.6

Programme Pointers



Third Programme

"A ROSE by any other name would smell as sweet." "Third Programme," "Network Three." What has been achieved by all the retiming, regrouping and re-arranging of programmes to which, I suppose, we have now all become accustomed? To me, personally, as a humble listener, nothing, other than annoyance and frustration at finding most of my favourite items moved around ten minutes earlier here, half an hour later there, and occasionally to a different day, compelling me to forgo it altogether. What they have done to the internal economy of the BBC I wouldn't know.

It all seems very unnecessary to me, but then, I always was a peculiar sort of chap who liked his eggs and bacon not only served regularly, but at an unchanging hour. The only thing which would have made all these changes compelling would have been an inability to switch from one programme to another on the same set; had we had to own a separate set for every wavelength it would have to have been done years ago. However, it is done now; let us hope they will leave us in peace this time. If they switch the "Critics" about many more times my digestion will be impaired through the too-often changing of my meal times, forcing me to lodge a complaint with the Ministry of Health. I wouldn't like to say offhand how many timings they and the repeat have had.

As to the network three, which was heralded as a sort of highbrow home, or lowbrow third—a *mezzo voce*, in fact, in which either one's brain could relax without becoming too idle, or it could be aroused without being called upon for too great energy, according to the direction from which you approached it. So far, it shows nothing to warrant its creation. It is very like the woman's page in the papers; the only thing they do is to deprive men of one page of reading; women nowadays taking part in most walks of life and therefore finding a whole issue to be suitable material.

The Rattigan Festival

The Rattigan Festival has brought six first-class plays on the air, namely, *The Browning Version*, *French Without Tears*, *The Deep Blue Sea*, *The Winslow Boy*, *Adventure Story* and *While the Sun Shines*. Mr. Rattigan is one of our most versatile as well as accomplished playwrights. His work covers a wide range of character and emotion. Whilst that indispensable ingredient of all good theatrical work, entertainment value, is seldom absent.

The performances varied in quality. Perhaps the best known of the six plays is *The Winslow Boy*, and it was the least satisfactory of the

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

festival. The great scene of the interview between young Ronnie Winslow and the overpowering lawyer Sir Robert Morton—which, on the stage, was one of the most dramatic *coups-de-théâtre* of recent years, fell singularly flat. On the other hand, Sir John Gielgud, as the master in the beautiful *The Browning Version*, was perfect.

The Deep Blue Sea was excellently produced and acted, but *French Without Tears* lost some of its Criterion vivacity and sparkle. *Adventure Story*—a deep dip into history—interested rather more than it entertained, but *While the Sun Shines* tripped along as merrily as could be wished.

Altogether a most enjoyable and rewarding experience.

Tony Shryane's and E. J. Mason's word game doesn't seem quite so funny as when it first started under John Arlott's umpireship. The parodies of famous quotations are getting easy to anticipate, whilst the Norden-Muir cracks, always bearing the same stamp, wear just a little thin.

The first of a new monthly series called "Workshop" promises to be most interesting. Purporting to be a magazine about "Britain at Work," and very fluently presented by Kenneth Harris, it contains four diverse features: cotton, elections in the Electrical Trades Union, the North Somerset coalfields and the self-portrait of a shop steward.

We learned such facts as that Lancashire cotton is the only unprotected cotton in the world, and that through lack of modern equipment it works shorter hours than any other. We were told that almost all the executive posts in the E.T.U. were filled by Communists. And that in the North Somerset coalfields there had not only been no stoppages for ten years, but that they were the first to employ foreign labour.

Symphony Orchestra

Rudolf Schwarz seems firmly in Sir Malcolm Sargent's saddle as conductor of the Symphony Orchestra. It is axiomatic that no chief directs anything but a body of tip-top musicians, each a virtuoso in his own department, and all conversant with every note of his score. So far so good; half a conductor's battle may be said to have been fought and won for him. But his main task has still to be faced: to blend ninety or a hundred diverse units into a perfect whole, slaves to his will, and able to obey his interpretative commands in every bar and every note.

RECEIVERS & COMPONENTS

MIDDLESBROUGH. Largest stocks on N.-East coast. Radio TV components, FM Kits, Gram. Cabinets, Tape Decks, Leak Amplifiers, Valves, etc. Callers only. **PALMERS, 106**, Newport Road. (Phone: 3096.)

MAKING YOUR OWN? Telescopes, Enlargers, Projectors, or in fact anything using lenses. Then get our booklets "How to use Ex-Gov. Lenses & Prisms," price 2/6 ea. Comprehensive lists of optical, radio and scientific equipment free for s.a.e. **H. W. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.**

TELEVISIONS NEEDING ATTENTION. 9in-10in. models, £4 10/- each, 12in. models, £6 6/- each, 15in. models and Philips Projection models £11/10/- each; immediate despatch; carriage paid. **BARKERS, 925**, Brockley Road, S.E.4. (TID 6752.)

NEW SHOP IN LEEDS. We are stocking Spares for Radios and T.V.'s. New and Surplus Valves. Bring this ad. for free valve testing this month. We have plenty of reduced Aerials and Convertors in stock for callers only. **T.V. SPARES, 41, Call Lane, Leeds, 1.**

FOR SALE, White Ibbotson Projection T.V. Set, suitable for use in staff recreation room. Can be inspected at City Hospital, Chester. Offers to: **SECRETARY, Chester and District Hospital Management Committee, 5, King's Buildings, Chester.**

SPECIAL TAPE OFFER at Great Saving! 1,200ft. of Plastic Recording Tape on 7in. reels, listed 35/-, our price, 22/6, p. and p. 1/6; also 850ft. (long play) Plastic Tape on 5in. reels, listed 22/-, our price 19/6, p. and p. 1/6. **PHOTO OPTIX (LONDON) LTD., 73, Praed St., London, W.2. (PAD 2891.)**

POWER IN PACKETS.—Batteries as usual... but, now for an exceptional bargain you cannot afford to miss. Brand new ex-Navy Oscilloscopes, 230v mains, using '97 tube, etc., only small mod. required, repeat, small mod. required; no extras, no cutting, hacking, or filing. The 'Scope, fitted within a grey cabinet, with lift up and slide back front cover, is complete with power pack, etc. 100 only, so hurry, hurry, hurry. Send data required; also further Bargain Cabinet, price £5 plus 15/- carriage. On receipt of enquiry we will provisionally reserve a unit for you for 10 days pending instructions, no obligation. Remember, 100 only. **DIGGINS, 129-131, Radnor St., Manchester, 15.**

ANNAKIN

Wireless Set No. 19 Mk. 2. With 15 valves. Covers 37-150 metres. As New. £31.50. **Reef, R109.** Approx. 85-155 metres. With speaker, vib. pack, etc. Less valves, vibrator. New. 43/6. **Loudhailer Speakers.** Cap. 8 watts. 74 ohm. Transformer for 180 ohm in. New. 25/6. Two for 50/-. **Power Unit 25A.** 200-250 v. In. 250 v. 125 ma. 6.3 v. 8a. Out. Fused. Double smoothed. Heavy solid job. With 5Z4, but less meter. New, boxed. £3.10.0. **Carbon Mike.** Switch, plug, cord. New, boxed. 4/6. **Tuning Head G4.** Cal. 31-40. New, boxed. 4/6. **Corundum Terminal Seals** (soldered feed-thrus). Tag ends. Box of 100 for only 5/-. **Mike Cable.** Same screened. 24 vds. 7/6. **Audio Oscillator Transformers.** New, boxed. 1/6. **Thermal Delay Relays.** Vacuum type. 4 v. New, boxed. 5/3. Above Post or Carriage FREE. Mainland only. S.A.E. Lists or Enquiries **25 ASHFIELD PLACE, OLEY, YORKS**

RATES: 5/6 per line or part thereof, average five words, to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., Strand, London, W.C.2.

TELEVISIONS, 9in. models, £7/10/-, 12in. models, £13/10/-, 12in. 5-channel models, £19/10/- each; all working, carriage paid. Send for list. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR 5497.)

BARGAIN-TEST INSTRUMENTS.—I have available: Cossor 339A Double Beam Oscilloscope, £18. Taylor 45A Valve Tester, complete with up-to-date adaptors, £9/10/-. Metrix Model 430 Multi Meter, 20,000 o.p.v., brand new, £18/10/-. Triplet AM/FM Signal Generator, Model 9433 (110v. A.C.), 100 Kc/s-120 Mc/s in 10 ranges, £240 Mc/s on harmonic. £20. Tequipment Model W.G.4 T.V. Pattern Generator, £20. G.E.C. Frequency Meter, 0-45 Kc/s in 4 ranges, rack mounting, £6/10/-. Taylor Model 190A Audio Oscillator, 20 c/s-20 Kc/s—£10. Funke Field Strength Meter with antennae, 45-230 Mc/s with meter calibrated 0-500 uv. battery operated. £12/10/-. Taylor Model 260A T.V. Wobbulator, combined with Oscilloscope, 10 Mc/s-70 Mc/s on fundamentals, £19/10/-. Webster Portable Tape Recorder, £22. All instruments are in good or excellent condition with manuals and accessories. Apply, **E. STRAUSS, 5, Gloucester Avenue, Slough, Bucks.**

EX-R.A.F. G.E.C. Airfield Amplifier Equipment, incorporating five 175W individual Amplifiers with priority relay Panel, individual Power Packs, Distribution and Test Panels, complete with valves, and offered on a fully tested basis. £150 ex-works. **GEORGE COHEN'S, Wood Lane, London, W.12. (Tel SHE 2070.)**

"OSMOR NEWS," Components lists for "P.W." "Consul Car Radio," "P.W." "The Chorister" and "R. Constructor," "Beginners S. Wave 1 Valve" on request. **OSMOR, 418, Brighton Rd., S. Croydon. (CRO 5148.)**

NEW and used Valves and Components at low prices; all guaranteed; s.a.e. list. Service Sheets, s.a.e. enquiries. **J. PALMER (PW), 32, Neasden Lane, London, N.W.10.**

UNREPEATABLE OFFER.—12in., 5 Channel T.V., £15; 14in., £22, good working order. **C. EDWARDS, 1070, Harrow Rd., London, N.W.10. (Phone: LADBROKE 1734.)**

TAPESPONDING. Exchange tape recorded messages home/overseas. Details **EWART, 87, Terrace, Torquay.**

GUARANTEED TELEVISION. 12in. 5-Channel models, first-class picture. £26 each, carriage paid. **THE GRAMOPHONE SHOP, 19-21, Brockley Rise, London, S.E.23.**

LOUDSPEAKERS repaired promptly. **MODEL LOUDSPEAKER SERVICE, Bullingdon Rd., Oxford.**

HI-FI TEST TAPE. Check your recorder with the B.R. Test Tape Frequency response check, 50-10,000 cycles; transit and quality test 600ft. reel recorded at 7 1/2 or 3 1/2 in. per sec.; 20/-, post free. **BISPHAM RADIO LTD., 153, Rd Bank Rd., Blackpool.**

T.V. TUBES, 30', with cathode heater shorts; 15', with burn; carr. extra. Ideal for testing; good picture: all types and sizes. Please enquire. **DUKE & CO., 623, Romford Rd., Manor Park, E.12. (GRA 6677.)**

V.H.F. RECEIVERS, 1124, easily converted to T.V. Sound, etc., 6 valves, plus host of useful parts, 17 6 each, plus 3/6 carriage; U.H.F. Coils, dust tuned and fitted air trimmers, 7 different coils for only 5/-; Speaker O.P. Transformers, two together with circuit, match any output, 4/9 pair; G50 Wavemeter, complete with 19 M/c crystal, less valves, 180-230 Mc/s, unused, £3; carriage paid; 250 v. A.C. Voltmeter, brand new and boxed, 25/-; 3-0-3, 30-0-30, D.C. Voltmeters, 12/6 each. Please add postage; s.a.e. for list. **H. JAMES, 175, Brettenham Rd., Walthamstow, E.17.**

FREE Language Course and no interest charges with all makes of Tape Recorders. Ask us about our new high quality—low cost "Adda-tape"—can be connected to amplifier making a real Hi-Fi Recorder or plugs into radio. Leaflets and prices on request. Special offer: 1,200ft. plastic Recording Tape, listed 35/-, only 22/6, post free! **E. C. KINGSLLEY & CO. (G), 132, Tottenham Court Road, London, W.1. (EUSTON 6500.)**

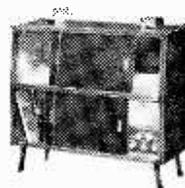
LOOK! All post paid.—"Stirling" Converters, Channels 2 and 10, £6/6/-. "Cydon" Internal Tuners, state TV model, £7/7/-. All best components available. Speakers, Auto-changers, Tape Decks, Amplifiers, etc. Please state your wants. **RADIO SHOP, Empire Cinema, Wakefield Rd., Normanton, Yorkshire.**

FOR SALE

NEON INDICATOR LAMPS, AM10E6, striking voltage 70/90, 10/- per dozen. Exposure Meter Photo-cells, 40 x 22mm., 7/6 each. **G. R. PRODUCTIONS, 29, Runnymede Avenue, Bristol, 4.**

CABINETS

for
**EQUIPMENT,
SPEAKERS,
PYE BLACK
BOX &
RECORDS.**



Write for Catalogue

A. L. STAMFORD (Dept. P29), 20, College Parade, Salisbury Road, London, N.W.6

TAN IN 24 HOURS.—Super-tonic Sunray Lamps, Ultra-violet Infra-red combined; automatic exposure; controlled emission; all mains. Listed £7/10/-, our price, 80/-. S.A.E. illustrated brochure. Dept. 100, **SCIENTIFIC PRODUCTS, Cleveleys, Lancs.**

VALVE CARTONS.—Miniatures, 10/6; "GTs," £12/-; "Gs," 14/- per 100 plus 2/- p. and p. Lists free. **RHS, 155, Swan Arcade, Bradford, 1.**

CAR CIGARETTE LIGHTERS, 6 or 12 volt., 8/6, post free. WHITSAM ELECTRICAL PRODUCTS, 18, Woodrow Close, Greenford, Middlesex.

WANTED

WANTED. Transmitters BC191, Receivers EC312; Power Supply Units BD77; Transmitter/Receivers, types 1934, 1935 and 1936; Receivers, type 100; Teletype Equipment. R. GILFILLAN & CO. LTD., 7, High St., Worthing, Sussex. (Tel.: Worthing 30181.)

VALVES WANTED. EY51, EY86, PCF80, PCC84, PC183, U25, 10F1, 10C1, 10C2, 10P14, 5Z4G. Prompt cash, brand new only. R.H.S., 155, Swan Arcade, Bradford, 1.

WANTED VALVES

All types for prompt cash. Must be new. State quantity.

WILLIAM CARVIS LTD.
103, North Street, Leeds, 7.

GLASGOW. Cameras bought for cash or taken part exchange for Tape Recorders, Players, or Amplifiers. VICTOR MORRIS, 406, Argyle St., Glasgow, C.2.

ALL TYPES of Valves required for cash. State quantity and condition. **RADIO FACILITIES LTD.,** 38, Chalcot Road, N.W.1. (PRImrose 9090.)

WANTED FOR CASH! Tape Recorders, Tape, Hi Fi Equipment, etc. Best prices from E. C. KINGSLEY & CO (G), 132, Tottenham Court Road, London, W.1. (EUSTON 6500.)

ELECTRICAL

ASBESTOS RESISTANCE WIRE, 10, 30, 40, 65, 220 ohm. Per yard, 1/3, p.p. SEMPLE, The Mount, Heswall, Cheshire.

SERVICE SHEETS

SERVICE MANUALS/SHEETS, Tel./Radio for hire, sale and wanted. Mixed Manuals and Sheets, 12 for 10/-; s.a.e. enquiries. W. J. GILBERT (P.W.), 24, Fritville Gdns., London, W.12.

THE "WAVEMASTER" TRANSISTOR PORTABLE

All components available, as advertised. Circuit assembly data at 1/6.

TRANSISTOR PUSH-PULL AMPLIFIER Complete kit of parts (less speaker and battery), 90/-.
Circuit and assembly data of this high-efficiency amplifier, 1/6.

Transistor transformers for the Mullard 20 M.W. Circuit, Miniature Interstage at 8/-; Output at 7/8. Sub-miniature interstage at 12/6; Output at 12/-.
Surplus transistors, Junction type, P-N-P tested, guaranteed. Audio 10" R.F. to 8 Mc/s 2/-.

Sub-miniature electrolytics, 6 v. working, 8 mfd., 16 mfd., 25 mfd., 4/- each.
T.R.F. coils M/L wave, boxed with circuit, 7/6.

Coil Pack, S.M.L., with gram. position, boxed, with circuit, 27/6.
Box spanner kit in case 0, 2, 4, 6 and 8 B.A., at 15/-.

Contact rectifiers, 125 v. 85 m.A., 4/9; 250 v. 50 m.A., 7/6; 250 v. 85 m.A., 10/6.

AERIALS

Band III dipole, 7/6; Combined outdoor, 33/9; F.M. Dipole, 10/6.
Resistors all types pref. values, 20%. 1 w., 3d.; 1 w. 5d.; 1 w. 6d.

Postage on all Orders.
Comprehensive List of Components. Stamp, please.

Trade and Mail Order

OSMARD LTD.

14 Hillside Rd., Tottenham, London, N.15

EDUCATIONAL

11 +

EXAMINATION

Write for FREE 20-page GUIDE and Test, stating age of child, to: THE REGISTRAR (Dept. M8), Mercer's Correspondence College, 69, Wimpole St., London, W.1.

LEARN IT AS YOU DO IT—we provide practical equipment combined with instruction in Radio, Television, Electricity, Mechanics, Chemistry, Photography, etc. Write for full details to: E.M.I. INSTITUTES, Dept. PW47, London, W.4.

THERE IS a national shortage of Mercantile Radio Officers. Why not make Communications your career? You can be assured of a sea-going appointment after qualifying at The School of Marine Radio and Radar (A.S.T.), Hamble, Southampton. For details, apply Commandant, quoting A.12.

FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby Enthusiast for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other Professional Examinations. Train with the college operated by Britain's largest Electronics organisation. Moderate fees. Write to: E.M.I. INSTITUTES, Dept. FW20, London, W.4.

WIRELESS.—Day and Evening Class instruction for P.M.G. Certificate of Proficiency and Amateur Wireless Licence. Morse instruction only if required, also postal courses. Apply BST, LTD., 179, Clapham Rd., London, S.W.9.

CITY AND GUILDS (Electrical, etc.) on "no pass—no fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook free and post free. B.I.E.T. (Dept. 242A), 29, Wright's Lane, London, W.8.

WIRELESS. See the world as a Radio Officer in the Merchant Navy; short training period; low fees; scholarships, etc. available. Boarding and Day students. Stamp for prospectus. **WIRELESS COLLEGE,** Colwyn Bay.

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc. on "no pass—no fee" terms; over 95% successes. For details of exams and courses in all branches of engineering, building, etc., write for 144-page handbook, free. B.I.E.T. (Dept. 242B), 29, Wright's Lane, London, W.8.

ASTRAL RADIO PRODUCTS

'HOME RADIO,' 32-page illustrated booklet. Simple wiring instructions for Crystal Set, 1, 2, 3 Valvers, 2 post 3d. **TRIF COILS.** Specified for 'Bed-side Push-button 4', 'All Dry 3 Band, 3' Push-button 4', etc., 6/6 pr., post ed. Push-button Unit with modification data 7/-.
DUAL WAVE HF Coil, Specified for 'Summer All Dry Portable', 'Modern 1 Valver', 'Modern 2 Valver', 'A.C. Double Triode 1', etc., 4/3, post 3d.
JFT's Miniature, 1'x1 1/2'x2 1/2' in cans. Extra Rich Q. Special offer, 9/- pr., post 6d.
K COILS. 'A.C. B'pass', 3/3 each, post 6d.
FRAME AERIALS. M.W., 5/-, post 4d.
COIL PACKS. L/M/S, 36/-, post 1/-.
Crystal Set Coils. L. & M.W., 2/6, post 3d.
82 Centurion Road, Brighton

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 Rd., London, N.8.

T/V and RADIO.—A.M.Brit.I.R.E., City and Guilds, R.T.E.B. Cert., etc., on "no pass—no fee" terms. Over 95% successes. Details of exams, and home training courses in all branches of radio and T/V, write for 144-page handbook free. B.I.E.T. (Dept. 242G), 29, Wright's Lane, London, W.8.

SITUATIONS VACANT

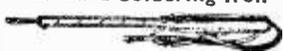
THERE IS a national shortage of Mercantile Radio Officers. Why not make Communications your career? You can be assured of a sea-going appointment after qualifying at The School of Marine Radio and Radar (A.S.T.), Hamble, Southampton. For details, apply Commandant, quoting A.12.

ROYAL AIRCRAFT ESTABLISHMENT, Bedford, requires Electronic Mechanics to serve as Research and Development Craftsmen Special on the repair and maintenance of aircraft or airfield Radio/Radar installations. Applicants should be familiar with modern V.H.F., U.H.F., and Micro Wave techniques. Appropriate service experience would be an advantage. Houses will be made available for successful married applicants coming from outside the district. Starting rate 182/4, plus 38/- merit lead for 44-hour, 5-day week. Rates are re-assessed within three months and any increase awarded is backdated to date of entry. Two weeks (88 hours) paid annual leave; paid sick leave scheme. Applications giving full particulars of apprenticeship, training (including Forces Service) and experience to: PERSONNEL OFFICER (P.W.), Royal Aircraft Establishment, Bedford.

~~*~*~*~*~*~*~*~*

The "TYANA"

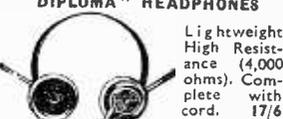
Standard Soldering Iron



- Adjustable Bit.
- Weight approx. 4 oz.
- Heating Time 3 min.
- 40 Watt economy Consumption.
- Standard Voltage Ranges, 14/9

Replacement Elements and Bits always available.

'DIPLOMA' HEADPHONES



Ideal for CRYSTAL SETS and also for use with TAPE RECORDERS.

KENROY LIMITED
152/297 UPPER ST., ISLINGTON, LONDON, N.1.

Telephone: Canonbury 4905-4663

~~*~*~*~*~*~*~*~*

RADIO & TELEVISION COMPONENTS

of guaranteed performance, reliability, endurance and long life.

MAINS TRANSFORMERS. Primary shielded 195/250 v. Sec. H.T. 250-0-250 100 mA. L.T. (1) 6.3 v. 3.7 amps. L.T. (2) 6.3 v. 0.95 amps. with mounted tag panel and double fuse-holder, prov. for switch and motor conn., 27/6 each, post 3/-. Primary shielded 105/250 v. Sec. H.T. 250-0-250, 60 Ma. L.T. (1) 6.3 v. 1.78 amps.; L.T. (2) 6.3 v. 0.95 amps., mounted tag panel for switch and motor, 22/6 each, post 3/-. Primary shielded 200/250 v. Sec. H.T. 125 volts, 30 Ma. L.T. 6.3 v. 1.5 amps., 10/- each, post 2/-.

I.F. TRANSFORMERS. Dust iron cored. Double silk Litz wire wound. 470 kc/s, both coils 925 uH. Size 2 1/2" x 1 1/2" x 1 1/2" per pair, post 1/6.

PENTODE OUTPUT TRANSFORMERS for E.L.84 or like valve, 3/5 ohms speech coil, 5/- each, post 1/-; for 1N309 or like valve, 3/5 ohms speech coil, 6/- each, post 1/-.

V.H.F. F.M. TWIN GANG TUNING CONDENSERS. 180°, through angle of rotation, 9.79 pl. ball-bearing drive end, size 2 1/2" x 1 1/2" x 1 1/2", 5/6 each, post 1/-.

V.H.F. A.M.-F.M. TWIN GANG TUNING CONDENSERS. 0 to 523 pf. through 180°, angle of rotation for section A and C and 0 to 10 pf. through section B and D, ball-bearing drive end, size 3 1/2" x 3 1/2" x 1 1/2" with mounting brackets, 9/6, post 1/-.

WESTINGHOUSE RECTIFIERS. Type LW11/U493 mains input 240 v., Output D.C. 270 v. 300 Ma., 19/6 each, post 1/-; Type 14B/979, U465 mains input 100 v., Output D.C. 110 v. 70 Ma., 9/- each, post 1/-; Type 16HT/U452, suitable to pass forward current of about 8 Ma., 3/6 each, post 6d.

L.T. SMOOTHING CHOKES. 5 henries, 65 Ma. 190 ohms, D.C. resistance, 4/- each, post 6d.

POTENTIOMETERS. 2 Meg. Log Law with D.P. Switch, 1 1/2" D spindle, 4/6 each, 1 Meg. Linear Law less switch, 1 1/2" D spindle, 2/9 each, 5 Meg. Log Law less switch, 1 spindle, 2/9 each, 25 K. Linear Law less switch, pre-set, 2/9 each.

ELLIPTICAL SPEAKERS. Size 7" x 4 1/2", 50hms at 1,000 cycles, 8,000 Gauss flux density. Base resonance 100-130, 17/6 each, post 2/-.

METALLISED PAPER CONDENSERS. .01 uF, .0015 uF, .0025 uF 400 v., .0003 uF, .0005 uF, 600 v., 1/- each.

Cash with order or C.O.D. Carriage paid all orders £5 and over. All components are guaranteed new clean stocks. Not Ex-Government. Send S.A.E. for complete lists of all Components and Kits.

THE ELECTRONIC COMPONENTS CO.,
102, Grays Inn Rd., London, W.C.1. Tel.: TERMINUS 0229/8.

MAKE SOUND JOINTS SIMPLY BY USING Multicore

ERSIN MULTICORE

Contains 5 cores of extra-active, non-corrosive Ersin Flux. Prevents oxidation and cleans surface oxides.

SIZE 1 CARTON

5/-

HANDYMAN'S CARTON

Suitable for 200 average joints. 6d.



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

ARAX MULTICORE

FOR METAL FABRICATION

(Not wire-to-tag joints)

Contains 2 cores of Arax flux. Flux residue is easily removed with water.

SIZE B CARTON

5/-



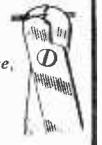
HOME CONSTRUCTORS 2/6 PACK

In addition to the well-known Home Constructors Pack (containing 19ft. of 18 s.w.g. 60/40 alloy) a similar pack is now available containing 40ft. of 22 s.w.g. 60/40 alloy especially suitable for printed circuits



BIB WIRE STRIPPER AND CUTTER

Strips insulation without nicking wire, cuts wire cleanly, splits extruded flex 3/6 each



MULTICORE SOLDERS LTD.,
MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. (BOXMOOR 36398)

WIRING ACCESSORIES

Return of Post Service. Lowest possible prices consistent with high quality. Money back guarantee.

PVC Cable Flat Twin Twin with E. 3 Core

1.044	£2.8.1.	£3. 2. 0	£3. 9. 3
3.029	£3.4.8	£3.14. 4	£4.13. 0
3.036	£4.7.6	£4.17. 6	£6. 6. 7
7.029	£5.9.3	£6.16.11	£3. 2.11

TRS CABLE

1.044	£2.13.5	£3. 6. 8	£3.13. 4
£.029	£3. 9.3	£4. 3. 1	£5. 3. 5
3.036	£4.11.4	£5. 6. 1	£6.15. 0
7.029	£5.11.6	£6.18.10	£8. 4. 0

Prices per 100 yds. All sizes stocked. Supplied in 25, 50, 75 or 100 yd. lengths. 7.029 and above cut to length—no cutting charge. Full range of accessories available. Send for complete lists.

F. HUNT & CO.
STEPCOBE HILL, EXETER
Phone : Exeter 56337

A really small RADIO RECEIVER

This radio receiver, although small enough to fit inside a matchbox, gives loud, clear reception of the BBC Home, Light and Third Programmes on the medium waveband, about 180-350 metres. No catwhiskers, valves or batteries are required, and the receiver works off a short indoor aerial in most districts. Easily assembled in half an hour. No cutting, drilling, or soldering. Complete Kit of Parts and Illustrated Instructions.

PRICE **7/-** POSTAGE AND PACKING 6d. EXTRA
This offer applies only to Gt. Britain and Northern Ireland.

RADIO COMPONENT SERVICE,
No. 1, SUMMER'S ROAD
BRISTOL, 2

FM and HI-FI Components

DENCO F.M. TUNER circuits	1s. 6d.
RADIO CONST'R. F.M. "	2s. 0d.
MULLARD AMPLIFIERS "	3s. 6d.
G.E.C. 912 PLUS AMPLIFIER "	4s. 6d.
G.E.C. F.M. PLUS TUNER "	2s. 6d.

Separate price lists available on request to
J. T. FILMER 82, DARTFORD RD., DARTFORD, KENT.
Tel. Dartford 4057.

1-Finger Pianists.

Build your own electronic keyboard and play everything! Send for free leaflet. Guitar, cello, lute and trumpet are all easy. Write now...

C & S, 10 Duke St., Darlington, Co. Durham

Your money can **EARN**

4 3/4% INTEREST 4 3/4% WITH INCOME TAX PAID BY THE SOCIETY

8 1/4%

EQUAL TO 8% WHEN TAX IS PAID AT THE STANDARD RATE.

Investments from £1 to £5,000 accepted; interest paid half yearly. Withdrawals at any time on demand. It is easy to open an account by post and you can pay in at your local bank.

Write for Brochure to-day.

MANCUNIAN
BUILDING SOCIETY
Chief Office:
14 ST. PETER'S SQ., MANCHESTER 2
Tel. CENTRAL 8765 (10 lines)
Incorporated under the Building Societies Act 1944.

Forrest

Transistor Transformers for Quality Equipment

H. W. FORREST (Transformers) Ltd.
349, Haslucks Green Road, Shirley, Solihull, Warwicks. Tel.: SHIRLEY 2483.

VALVES • SAME DAY SERVICE

All Guaranteed New and Boxed

1.4v. midget. 1R5, 1S5, 1T4, 3S4, DAF91, DF91, DK91, DL92, DK92. DL94; ANY 4 for 27/6.

1AT7T	12/6	60TGT	9/6	D1	3/-	EF50		PCL83	9/6	
1CSGT	15/6	6SNTGT	7/6	D7	6/-	SYL	6/6	PEN46	6/6	
1HSGT	11/-	6U4GT	11/-	DAC32	11/-	EF55	9/6	PL38	22/-	
1NSGT	11/-	6V6G	7/-	DAF96	8/6	EF90	8/6	PL81	13/6	
1R5	8/-	6V6GT	7/6	DF33	11/-	EF85	7/6	PL82	9/-	
1S5	7/6	6X4	6/6	DF96	8/6	EF98	11/6	PL83	10/6	
1T4	7/6	6X5GT	6/6	DH76	7/6	EF93	9/6	PY30	8/-	
3Q4	8/-	7B7	8/-	DH77	8/-	EF91	6/-	PY81	8/-	
3Q6GT	9/6	7C5	8/-	DK32	12/6	EF92	5/6	PY82	7/-	
3S4	7/6	7C6	8/-	DK92	8/-	EL32	5/6	PY83	9/6	
3V4	8/-	7H7	8/-	DK96	9/6	EL38	22/-	PZ30	18/-	
5U4G	8/-	7S7	7/6	DL33	9/6	EL41	9/-	SP41	3/6	
5V4G	11/9	7Y4	8/-	DL35	15/6	EL42	10/6	SP61	3/6	
5Y3GT	7/6	12AH8	9/-	DL96	8/6	EL94	9/-	TH41	17/6	
5Z4G	9/6	12AT7	8/-	EABC80	7/6	EM34	10/-	U25	13/6	
6AB8	7/6	12AU7	7/6	EAF42	10/6	EM80	10/-	U26	12/6	
6AK5	4/6	12AX7	8/-	EB91	6/-	EY51	10/6	U50	7/6	
6AL5	6/-	12BA6	7/6	EB33	7/6	EX86	12/6	U76	7/6	
6AM3	5/-	12J7GT	10/6	EB41	9/6	EZ40	7/6	U78	7/-	
6AM6	6/-	12K7GT	7/6	EBP80	8/6	EZ41	9/6	UABC80	9/6	
6AQ5	7/6	12KR8GT	14/-	EBP89	9/-	EZ80	7/6	UAF42	10/6	
6AT8	8/-	12Q7GT	7/6	ECC81	8/-	EZ81	9/6	UBC41	8/6	
6B46	7/6	12Z3	7/6	ECC82	7/6	FW4500		UBF60	9/-	
6BE6	7/6	25L6GT	9/-	ECC83	3/-		13/6	UCH42	8/-	
6BJ6	7/-	25Z4G	9/6	ECC84	10/6	GZ32	11/6	UF41	8/-	
6BR7	8/6	25Z6GT	9/6	ECC85	9/6	KT33C	8/6	UF89	10/-	
6BW6	7/6	35L6GT	9/6	ECP80	10/6	KT44	8/6	UL41	8/6	
6BY7	9/6	35Z3	9/6	ECP82	11/-	KT61	8/6	UL84	9/6	
6CH8	7/6	35Z4GT	7/6	ECH21	14/6	KTW61	6/-	UY21	15/6	
6F1	15/-	35Z5GT	9/-	ECH35	9/6	MH4	6/-	UY41	7/6	
6FG6	6/6	43	13/6	ECH42	8/6	MU14	8/6	UY85	7/-	
6F12	6/-	50L6GT	8/6	ECH81	8/-	N18	8/-	VP41	7/-	
6F13	13/-	80	8/6	ECL80	8/6	N78	11/6	VP1321	24/-	
6J6	5/6	8C/TP	8/6	ECC84	8/6	ACC84	9/-	W76	7/6	
6K7G	4/6	AZ31	11/6	EF39	6/-	PCF83	9/6	W77	5/6	
6K7GT	6/-	B36	20/-	EF41	9/6	PCF82	10/-	Y63	6/-	
6K9G	7/6	CL33	16/9	EF42	10/6	PCL82	10/-	Y63	6/-	
6L18	12/6								277	6/-

Any Parcel Insured Against Damage In Transit 6d. extra.

READERS RADIO

24, COLBERG PLACE, STAMFORD HILL, LONDON, N.16 STA. 4587

TECHNICAL TRADING CO.

AVO VALVE TESTERS. standard model. in case. tested. 29. B.S.R. L.P. SIG. GEN'S. Type L050A. 0-600 c/s. 0-16,000 c/s. Tested. £12/10/- GARRARD A.C.D.C. AUTOCHANGERS. Type R.C. 30W. boxed. £12/10/- 13 CTR. CONVERTORS. all instructions. all colls. £3/15/-

*CALLERS ONLY.—Quantity ET4336 RCA. 1 kW. TX. 230 v. mains operation 1-20 mc/s. from £20.

TRANSISTORS! RED SPOT. Regret Increase Due to Extreme Shortage. ... **8/6**
TRANSISTORS! WHITE SPOT (Up to 2.5 Mc/s) ... **14/-**
 GUARANTEED

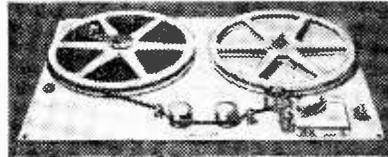
GERMANIUM XTAL DIODES. 9d., 8/- doz. 12 v. 4 a. Bridge Rects., 9/6. 230 v. MAINS TRANS. 6.3 v. 5 a. 5 v. 3 a. 525-0-525 v. 150 ma., 29/- 10 H. 150 m.a. Chokes to match. 9/- VCR97's. 12/6.

SAE FREE LIST, 400 AMAZING SNIPS

Including: 5Z4G 9/- 6SN7GT 5/9 6V6G 6/- EF50 2/6 31n. speakers 9/6. Midget ceramics 5/- doz., 10in. Cabinet speakers 29/-, Throat Mikes 2/6, 1 M. Pots. D.P. Sw. 3/1n. sp. 3/6. Postage 1/- in £1 (1/9 in £1 Speakers/Trans.) Min. 6d. No C.O.D. 10,000 OTHER BARGAINS TO CALLERS AT:—

350/352 FRATTON ROAD, PORTSMOUTH

“ASPDEN” TAPE RECORDER KITS



TAPE DECKS, 2-speed, (twin track, easy to assemble kits with finest motor, Ferroxcube heads and full instructions.

MODEL 582 for 5in. spools, kit £8.5.0.

MODEL 782 for 7in. spools, kit £9.5.0.

Either model assembled and tested, 30/- extra.

AMPLIFIER kit, 2½ watt. record/replay, 2 recording positions, neon indicator, etc., £5.18.0. Power pack kit for above, £2.18.6 (both without valves). Carr. and packing extra.

YOU CAN BUILD A QUALITY TAPE RECORDER

M.G. from Baghdad writes:—

“...really nice to have this amazing tape deck.”

D. B., Malaya, writes:—

“The recorder is now working as well as a commercial model and I am very pleased with it.”

This tape deck and amplifier is being used in the Antarctic by an Expedition member.

Send stamp for full particulars to:—

W. S. ASPDEN Stanley Works, Back Clevedon Rd., BLACKPOOL, Lancs.

TELEVISION TUBES

RECLAIMED GUARANTEED:

12"—£6 14"—£5 17"—£7.10.0

FULLY GUARANTEED HIGH QUALITY REBUILT:

12"—£9 14"—£11.10.0 15"—£12 17"—£13.10.0

CARRIAGE AND INSURANCE 15/6 EACH TUBE

MAIL ORDER ONLY

PRIME ELECTRICS

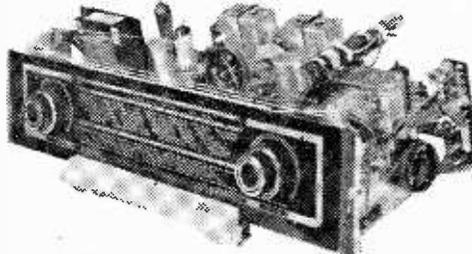
36 QUEENSDALE ROAD, W.11.

TELEVISION

The advance of Radio Technique will offer unlimited opportunities of high pay and secure posts for those Radio Engineers who have had the foresight to become technically qualified. How you can do this quickly and easily in your spare time is fully explained in our unique handbook. Full details are given of A.M.Brit.I.R.E., City & Guilds Exams., and particulars of up-to-date courses in Wireless Engineering, Radio Servicing, Short Wave, Television, Mathematics, etc., etc. We guarantee “NO PASS—NO FEE.” Prepare for to-morrow's opportunities and future competition by sending for this very informative 144-page guide NOW—FREE and without obligation.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY (Dept. 242), COLLEGE HOUSE, 29-31, WRIGHT'S LANE, KENSINGTON, W.8

IMPERIAL AM/FM CHASSIS



6 valve plus Rectifier, variable Ferrite AF, separate treble and bass controls, 7 push buttons, Duplex fly wheel tuning on all bands. Complete with 3 speakers, FM Dipole and magic eye escutcheon, ready to use.

£25 Tax paid. 10/- carriage.

M.C.V. 3 Farringdon Road, E.C.1

CHA 4131

TRANSISTOR SUPPLIES

TRANSISTORS. L.F. 7/6; R.F. 13/6; Mullard OC71, 24/-; OC72, 30/-; Matched pairs OC72, £3. Diodes, 1/6; Mullard, 5/-; Brimar 7/6. MORCO TRANSISTOR and Diode Coil for transistor and diode circuits. 3-. TRANSISTOR TRANSFORMERS. Interstage, 8/6; Driver Push-Pull, 8/6; Push-Pull output, 8/6. ELECTROLYTICS for transistor circuits, 3/F 2-; 15/F 2-; 50 /F 1/6. TELETRON COMPANION PARTS, 87-. All items at Manufacturers Prices. FERRITE ROD ASSEMBLY. Long, medium wave and coupling coil for MORCO CIRCUIT, 13/6. LOUD-SPEAKER, sensitive P.M. 5in., 13/6; output transformer for same, 5-. Single EARPIECE, moving coil—used as MINIATURE SPEAKER, 5-; Transformer to Match, 2/6; Volume Control 5 K, 2/3; 10 K, with switch, D.P., 5/6; Resistances 8/6; H.R. (4000 ohms), 17/6. Headphone Adaptor, high, low, 2/6. Double Sockets, 4d.; plugs for same 3d. TRANSFORMERS, MULLARD CIRCUIT, 20-; Bargain Lines—Blair (6d) Sockets (as miniature speakers), 5-; Trimmers 100, 250, 750 H., 1/9; Var Condenser, air, .0003, 3-; films, speakers with output trans., 16/6; Sub-Miniature Transistor Transformers, 8/6. Terms: C.W.O., postage extra. Excess refunded. Send 6d. stamps for transistor circuits and list.

MORCO EXPERIMENTAL SUPPLIES
(Props.: Moores (Sheffield), Ltd.)
8 & 10, GRANVILLE ST., SHEFFIELD, 2
Tel.: 27461

Brimar Valve and T.V. Tube Manual No. 7, 6/-, postage 8d.
Transistor Circuits for the Constructor, No. 2, 3/3, postage 4d.
Wireless World Diary 1958, 4/8, postage 4d.
High Fidelity Loud-speaker enclosures by Babani, 5/-, postage 6d.
Radio Upkeep and Repairs by Witts, New Edition, 15/-, postage 1-.
Television Explained by Miller, 12/6, new edition, postage 1-.
Mercury Jason Switched F.M. Tuner, 2-, postage 4d.

Send S.A.E. for Lists.

UNIVERSAL BOOK CO.
12 Little Newport Street, London, W.C.2
(adjoining Lisle Street)

Solder with
LITE SOLDER
"PERMATIP"
AND
"PERMABIT"
INSTRUMENTS
FOR
GREATER
SOLDERING
EFFICIENCY

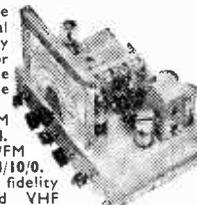


The soldering bit which maintains its face indefinitely without attention. 25 models available for mains or low voltage supply. Bit sizes 3/32 to 3/8 inch. Full details in booklet S.P.10 from sole manufacturers—

LIGHT SOLDERING DEVELOPMENTS LTD.,
106, GEORGE STREET, CROYDON, SURREY. Tel. CR0ydon 8589.

Fidelia HAND BUILT

Fidelia genuine hand built real high fidelity equipment for those people who desire the finest.



Major AM/FM De-Luxe AM/FM 11 valves, £34/10/0. Imperial, high fidelity amplifier and VHF tuner, £34. Full details willingly but 6d. in stamps is appreciated.

ELECTRO ACOUSTIC DEVELOPMENTS
2, Amhurst Road, Telcombe Cliffs, Sussex.

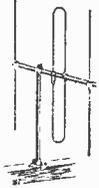
SPARKS' DATA SHEETS presents
THE "331"
A.C. SHORT WAVE
4-VALVE T.R.F. RX.

"Cathode-coupled" Regeneration ensures amazing Sensitivity and Selectivity plus 100% Stability. 10 to 220 M. Switched Coils. Separate Power Pack. Data Sheet (27" x 22") showing every detail in simplified form. Plus full Instructions, etc. 3/8 Post Free.

THE "SEAFARER"
Battery Two-valver offering New Interests and Thrills on Trawler, Ship-to-Shore, Aeronautical and 89/160 m. Amateur Bands Plus normal Med. and Long-waves. A Great little Set. Data Sheet, etc., etc., 3/3. All Components and Chassis available.

L. ORMOND SPARKS (P), VALLEY ROAD, CORFE CASTLE, DORSET

B.B.C.-I.T.V.-F.M.-AERIALS



Band I (B.B.C.). Telescopic loft, 19/6; External S' Dipole, 28/3.
Band III (I.T.V.). 3-element loft array, 24-; 5-element 32/6. External wall mounting, 3-element, 33/9; 5-element, 41/3.
Combined (B.B.C.-I.T.V.). Loft 1-3 element, 41/3; 1-5 element, 48/9. External wall mounting 1-3 element, 50/3; 1-5 element, 63/9. Room aerial, 12/9.
Band II (F.M.). Loft S Dipole 12/6; loft "H." 28/-; External S Dipole, 28/2. Postage and Packing all types, 2/6.
Co-axial, 8d. yd.; Co-axial plugs 1/3. State channel when ordering. S.A.E. for Price List. Trade enquiries invited.

KVA ELECTRONICS
189, Kent House Rd., Beckenham, Kent
SYD 2488

TRANSFORMERS

REWOUND OR BUILT TO SPECIFICATION
2 Years' Guarantee. Quick Service.
C.T.R. Isolating Transformers in Stock
Nottingham Transformer Service
179, WOLLATON ST., NOTTINGHAM
TEL. 41992

GRAM-PAK AMPLIFIERS

Complete £3.19.6 P. & P. 2/6
This midget 4-watt amplifier fits neatly into any record player leaving ample room for speaker. Suitable with any speaker and all modern crystal 3-speed pick-ups. Dimensions 7" x 2 1/2" x 1 1/2". Pressed steel plated chassis. Perfect, distortionless quality guaranteed. For 200-250 v. A.C.

ACCESSORIES:
ACOS crystal turnover pickup, £1.14.6.
7" x 4" elliptical speakers, 19s. 6d.
BSR 3-speed player unit with above pickup, £4. 12s. 6d.

THE COMPLETE OUTFIT READY FOR YOUR CABINET £9.10.0. post free.
6d. stamp brings details by return.

ELECTRO-ACOUSTIC LABS.
TAIN - ROSS-SHIRE - SCOTLAND

High sensitivity Miniature moving coil LOUDSPEAKER

As used in the Ferdio Pocket Transistor Radio. Diameter 2 1/2 in. Depth 1 3/16 in. Impedance 3 ohms. Price, including tax, post and packing, 27/6. Cash with order.

For this and other miniature components apply:
Specialised Electrical Components,
9-11, Monmouth Street, London, W.C.2.



PULLIN SERIES 100 HIGH RESISTANCE TEST METER
A.C./D.C.
10,000 ohms/volt 21 RANGES
100 microamps to 1000 v.
Complete in die-cast case with test leads, clips & prods.
FULLY GUARANTEED

CASH PRICE or Deposit £2-10-0 & nine further monthly payments of £1-4-6.
£12-7-6

Illustrated brochure free on request
FRITH RADIOCRAFT LTD
69-71 CHURCH GATE LEICESTER
& 24 HIGH ST NEWPORT PAGNELL Bucks

THE WAVEMASTER
TRANSISTOR PORTABLE
AN
OLYMPIC WINNER

PICK OF THE WORLD STATIONS AT YOUR FINGER TIPS.
LONG AND MEDIUM WAVEBANDS.

QUALITY PUSH-PULL OUTPUT.

A RECEIVER YOU WILL BE PROUD TO OWN.

COMPREHENSIVE ASSEMBLY DATA AND COMPONENTS LISTS, 1/6.

SPECIAL COMPONENTS KIT FROM USUAL STOCKISTS, PRICE 75/-.

OLYMPIC RADIO COMPONENTS
224 HORNSEY RD., HOLLOWAY, N.7

AT LAST, A REALLY PORTABLE
POCKET LOUDSPEAKER SET

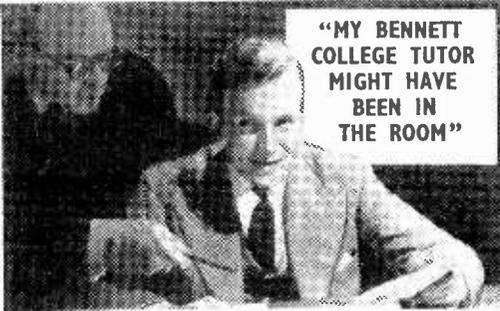
The famous Teletron "Companion" is a receiver of unique design and extreme portability. Contained in a neat plastic case, measuring 4 1/2 x 3 x 1 1/2 inches approximately, it gives loudspeaker reception on long and medium wavebands, and requires no aerial or earth. Using three transistors, the total power supply is obtained from three tiny 1 1/2 volt penlight cells. Complete Kit of Parts, 89/6, postage 1/6 extra. Or send four 1d. stamps for Illustrated Folder and Circuit Diagram. This offer applies only to Great Britain and Northern Ireland.

CENTRAL RADIO SALES
CENTRAL CHAMBERS, 11 SMALL ST.
BRISTOL, 1

COVENTRY RADIO
Component Specialists since 1925

We have now trebled the size of our premises in order to supply a larger range of Components, Amplifiers and Hi-Fi Equipment.

Send your enquiries to:
189-191 Dunstable Road, Luton, Beds.
New Telephone No. : LUTON 7388-9



"MY BENNETT COLLEGE TUTOR MIGHT HAVE BEEN IN THE ROOM"

PERSONAL POSTAL TUITION

WHAT CAREER DO YOU WANT?

- | | |
|--------------------|---------------------|
| Architecture | Surveying |
| Building | Telecommunications |
| Carpentry | Television |
| Commercial Art | |
| Diesel Engines | Book-keeping |
| Draughtsmanship | English |
| Electrical Eng. | Geography |
| Electric Wiring | Journalism |
| Forestry | Languages |
| Locomotive Eng. | Mathematics |
| Machine Design | Modern Business |
| Mechanical Eng. | Methods |
| Motor Engineering | Police Subjects |
| Plumbing | Salesmanship |
| Quantity Surveying | Shorthand |
| Radio Engineering | Short Story Writing |
| Sanitary Science | and many others |

OR WHY NOT OBTAIN A QUALIFICATION?

- | | | |
|---|----------------|------------|
| A.M.I.C.E. | A.M.I. Mun. E. | A.C.I.S. |
| A.M.I. Mech. E. | A.M.S.E. | A.C.C.S. |
| A.R.I.B.A. | A.A.C.C.A. | A.R.I.C.S. |
| A.M.I. Struct. E. | A.C.W.A. | A.S.J. |
| GEN. CERT. OF EDUCATION & R.S.A. Exams. | | |

Every Bennett College student enjoys this friendly, intimate coaching right through his Course. A few of the Courses are listed opposite. Tell us your subject. We will send you The Bennett College Prospectus and the famous FREE book "Train your mind to SUCCESS." This will show you how you can advance to a better, finer future by Personal Postal Tuition. Fill in and post the coupon today.

BENNETT COLLEGE
Dept. A, 104 PT) SHEFFIELD

Please send me the Prospectus on and my free copy of "Train your mind to SUCCESS."

NAME
ADDRESS
TOWN
AGE (if under 21)
Please write in BLOCK letters

Post this coupon NOW!

COLLINS TCS TRANSMITTERS. Special offer of these famous American Transmitters. Frequency Range 1.5-12.0 Mc/s in 3 bands. Employs 7 valves, 2 of 1625 in P.A. Stage, 1625 buffer and 1625 modulator stage, 3 of 12A6 in Oscillator stage. Radio Telephone or Radio Telegraph. Provision for VFO or Crystal Control. 4 Crystal positions. Has Plate and Aerial Current meters. IN BRAND NEW CONDITION. ONLY £12.10.0 (carriage, etc., 15/-).

WIRELESS SET NO. 19 Mk. II.—The famous Army Tank Transmitter-Receiver. Incorporates "A" Set (TX/RX covering 2.0-9.0 Mc/s, i.e., 37.5-150 metres), "B" Set (VHF TX/RX covering 230-240 Mc/s, i.e., 1.2-1.3 metres) and Intercommunication Amplifier. Complete with 15 valves as follows: 6 of 6K7G, 2 of 6K8G, 2 of 6V6G, and 1 ea. 6BB6, 6H6, E114E EF50, 807, and booklet giving circuits, notes, etc. Size 17 1/2 in. x 8 1/2 in. x 12 1/2 in. Magnificently made by famous American firms. IN BRAND NEW CONDITION. ONLY 65/- (carriage, etc., 10/-). **12 VOLT POWER UNIT** for the above available, 25/- (carriage, etc., 5/-).

MARCONI SIGNAL GENERATORS TF-390G. Frequency coverage 16-150 Mc/s, BRAND NEW IN MAKER'S ORIGINAL TRANSIT CASES, with instruction manual. For normal A.C. mains operation. A unique opportunity to acquire Laboratory Equipment at a fraction of original cost. ONLY £27/10/-.

MARCONI BAND III CRYSTAL CALIBRATORS. Frequency range 170-240 Mc/s. Incorporates 5 Mc/s crystal for better than .001 per cent. accuracy. Directly calibrated dial, internal A.C. mains pack. Complete with spare set of valves and instruction manual in maker's transit cases. BRAND NEW. ONLY £4/19/6.

POWER UNIT TYPE 3. Primary 200.250 v. 50 cycles. Outputs of 250 v. 100 mA. and 6.3 v. 4 amps. Fitted with H.T. current meter and voltmeter. For normal rack mounting and has grey front panel size 19in. x 7in. ONLY 70/- (carriage, etc., 7/6).

6 v. VIBRATOR PACKS. Output approx. 130 v. at 30 mA., fully filtered and smoothed. Complete. ONLY 12/6.

RI155 SUPER SLOW-MOTION TUNING ASSEMBLY. As used on all late model 1155s. Easily fitted to "A" sets, etc. ONLY 12/6.

EHT TRANSFORMERS. 5.5 kV. (Rect.) with 2 v. 1 a., 79/6. 7 kV. (Rect.) with 2 v. 1 a., 89/6. 2.5 kV. (Rect.) with 2.0-2 v. 1.1 a., 2.0-2 v. 2 a. (for VCR97 tube, etc.), 42/6 (postage 2/- per trans.).

L.T. HEAVY DUTY TRANSFORMERS. Ex-Admiralty, with 230 v. 50 cycles primary. Secondaries 5, 10, 15, 20, 25, 30 volts at 5 amps. ONLY 29/6. (Postage 2/9).

INSULATION TESTERS (MEGGERS). Read up to 20 megs at 500 volts pressure. Overhauled and in perfect order. ONLY £8.10.0.

A.C./D.C. BLOWERS, 220/250 volts 300 watts. Complete with filter pads, branch for dividing outlet, flexible hoses, etc. BRAND NEW. ONLY £4.19.6.

POCKET VOLTMETERS.—Read 0-15 volts and 0-300 volts A.C. or D.C. BRAND NEW and UNUSED. ONLY 18/6.

CRYSTALS. British Standard 2-pin 500 kc/s, 15/-; Miniature 200 kc/s and 465 kc/s, 10/- each.

RCA RIBBON MICROPHONE. Table type, mounted on black finished stand, 7 1/2 in. high, with press switch. BRAND NEW. ONLY 59/6.

ROLA 6 1/2 in. P.M. SPEAKER. Mounted in grey crackled metal cabinet 9in. x 9in. x 4 1/2 in., with volume-control. Ideal for use with receiver, or as extension. BRAND NEW. ONLY 27/6. (Post 2/6.)

12 VOLTS 1 AMP. BATTERY CHARGER. Very robust, ex-Admiralty, in grey crackled metal case size 6in. x 6in. x 4 1/2 in. BRAND NEW. ONLY 35/- (Post 2/6.)

MAINS ISOLATING TRANSFORMER. Manufactured by Vortexion. Fully shrouded. Will provide true 1 : 1 ratio from nominal 230 v. Primary. Rated at 100 watts. BRAND NEW. ONLY 22/6. (Post 2/6.)

HARRIS ELECTRONICS
(LONDON) LTD.

Formerly U.E.I. Corporation.

138, Gray's Inn Road, London, W.C.1 (Phone : TERminus 7937)

Please include carriage costs on ALL items.
(Open until 1 p.m. Saturdays. We are 2 mins. from High Halborn (Chancery Lane Station) and 5 mins. by bus from King's Cross.)

LYONS RADIO LTD.

Dept. M.P., 3 GOLDHAWK ROAD,
SHEPHERDS BUSH, LONDON, W.12

Telephone: SHEpherds Bush 1729

POWER OUTPUT METERS. Calibrated in Watts and Db. Range 5mW. to 5W. Input impedance variable from 25 ohms to 20 K ohms. Fitted with moving coil meter 4 1/2 ins. dia. 400 micro-amps f.s.d. These are the Windsor Model 150A. ex Gov. No. 3, Mk. 2. In good condition and working order. PRICE 26s. post 4/6.

WEE MEGGERS. 100 v. ex-Gov. by Evereadys in new condition and working order. PRICE 85s. post 3/6.

APN.1 UNITS. Radio altimeter which in effect are transmitter receivers and an A.P. amplifier section. The three basic sections are assembled on separate sub-chassis which make it easy to dismantle and use separately, if desired. Operational frequency is 67.42 cm. (445 Mcs.). Can be quickly converted for use in the 70 cm. band or for model control. The A.P. amplifier as a mike pre-amp, intercom, etc. Fitted with 14 valves (4-12SH7, 3-12SJ7, 2-12H6, 2-9004, 2-465, 1-VR150'30), relays, transformer stacks of other components and a Dynamotor. 24.27 v. D.C. input and 285 v. at 75 mA. D.C. output. These units offer plenty of scope for interesting experiment or just as a source of useful components represent top value at the BARGAIN PRICE only 29/6, or less dynamotor 25s. carriage.

METER BARGAINS. Moving coil types "A" Centre zero 50 0.50 milliamps, 2 1/2 ins. dia. PRICE 7/6. post 1/- "B" 0.500 microamps, 2 1/2 ins. dia. PRICE 17/6. post 1/3. Selected resistors to enable this meter to be used as a D.C. voltmeter for the following ranges: 1 v., 25 v., 250 v., 500 v., can be supplied for 5/6 each.

W. B. SUPPLIES 22 SWAN STREET MANCHESTER 4

TERMS.—Cash with order. Orders under 20/- add 9d. postage. Over 20/- add 1/3.

CONTROL BOXES. With 2 dimmers 24 volts, and on off switch, 2/9. Ferrite Coil with 2 Philips 6X4s, 9d. Exp. metal speaker frnt (old 12 in. x 12 in., 4/6; 6 in. x 12 in., 6/9).

SOLID DIELECTRIC variable condensers. .001 mfd. to .0005 mfd., .0005 mfd., 3 1/2 each. A. F. M. air-spaced variables. Twin .0005 mfd. plus twin 27pF, 12/6. Twin 10 pF variable, 2/6. Midget Xaxley switches, 3 pole 2-way, 1/8. High Resistance headphones (not ex. W.D.), 16 1/2. Can Condensers, 8 mfd. 500 v., 1/3. Mainsbridge Condensers, 8 mfd. 45 v., 2/6.

SCOPE TUBES. CV1526 size 2 1/2 in. with cover, 18/6, plus 2/- postage. VCR 139A 2 1/2 in. tube, 4 volt filament, 3 kV. Anode, 17/6, postage 2/-

4 WHY CHOKES for cross-over networks. 3/6. Balanced Armature earpieces for transistor speakers, 5/-, 50k. Dubilier pots with 1 1/2 in. spindle, 1/6.

AMPLIFIERS FOR RECORD CHANGERS. 3 watts output, 2 valves, brand new in makers' sealed cartons, a real bargain at 70/-, plus 2/6 postage. G.P.O. TYPE RELAYS. 500Ω 1-make 1-break, 270Ω 270Ω 4-make, 250Ω 2M2B, 250Ω 2M1B, 200Ω 3M2B, 500Ω 2M1B, 3/6 each.

G.P.O. type telephone switches with centre off position, 2/-, Westinghouse meters, 0-9 amps., R.F., 7/6.

TRANSMITTER RECEIVER chassis type PPN-2 with 2 volt vibrator pack, less valves, 20/-.

F.V. CIRCUITS & SERVICE DATA book covering Ferranti T1215, T1415, G.E.C. H2147, C, 6144, C, 4541 C, Pvc FV1, FV1C. Regentone T16 Mark 2, L. B. H. BIG 12, L. B. & H. "The whole lot, 3/10, post paid. Book on "How to Make Acrylics for B.B.C., I.T.V. and V.H.F.", 2/10 post paid. Telephone 3-D components in stock.

FIRST-CLASS RADIO COURSES . . .

GET A CERTIFICATE!

QUALIFY AT HOME—IN SPARE TIME

After brief, intensely interesting study—undertaken at home in your spare time—YOU can secure your professional qualification. Prepare for YOUR share in the post-war boom in Radio. Let us show you how!

FREE GUIDE

The New Free Guide contains 132 pages of information of the greatest importance to those seeking such success-compelling qualifications as A.M.Brit.I.R.E., City and Guilds Final Radio, P.M.G. Radio Amateurs, Exams., Gen. Cert. of Educ., London B.Sc. (Eng.), A.M.I.P.E., A.M.I.Mech.E., Draughtsmanship (all branches), etc., together with particulars of our remarkable Guarantee of SUCCESS OR NO FEE

Write now for your copy of this invaluable publication. It may well prove to be the turning point in your career.

FOUNDED 1885—OVER

150,000 SUCCESSSES

NATIONAL INSTITUTE OF
ENGINEERING
(Dept. 461), 148, HOLBORN,
LONDON, E.C.1.

BENSON'S ETTER BARGAINS

METERS: 4 x 4 x 2 1/2". Read D.C. 1.5 & 3 v., 60 mA & 5 k. ohms. Bakelite case, new, 12/6. Formers, 1", twin dust-cases, can 2 x 1", dia., 9d. **RELAYS.** Co-axial, "P.G." 12 v. 10/-; set 3 plugs 1.6. (p.p. 2/6). RK78, 2.4" 13 mcs. with 5 valves, 100 kcs. Xtal. Good cond., 35/- (p.p. 3/6). **TEST SETS:** 74A with 9 valves, VCR 139a, 220 240 v. power pack; fair condition, 50/- (carr. 8/6). BC1066 VHF Receiver, valves 21957, 111DRGT, new, 15/- (post 3/6). **CAR RADIO** (Command Receiver, Medium wave), circuit and modification data, 1/6. **COMMAND RECEIVERS,** brand new, with 6 valves, RC454, 5-6 mcs., 45/-; Med. wave, 0.52-1.5 mcs., 97/6, used 82/6 (post 3/6). **Vibrapacks,** 5 v. D.C. to 250 v., 80 mA., smoothed, cased, 22/6 (post 3/6). **INDICATOR UNITS,** new, with VC897, 3 V301, 2 x CV18, 2 VR74, 24 - (carr. 5/-). **Response:** ZS8381, 160/180 mcs. New, with valves, 15 - (carr. 7/6). **VIBRATORS,** Malloy G6200 12 v. 4 pin, 7/6. **BRAND NEW R.F. 20, 27, 25/-** (post 2/-); RP29, 10/6. RP26, 27, good cond., 20/- **DYNAMOTORS** (post 3/6); 12 v. to 250 v., 65 mA. and 6.2 v., 2.5 A., 11/6; 2 v. to 250 v., 40 mA., 12/6. **METAL RECTIFIERS:** 240 v., 100 mA., 4/-; 240 v., 20 mA., 3/6. 1,000 v., 20 mA., 7/6. 120 v., 2 a., Bridge, 30 - R1155 S.M. **Tuning DRIVES** - N.P. type, brand new, 10/6. **CHOKES** - 10, 15, 20, 120 mA., Screened, 7/6. 5 H. 200 mA., 4/6. **TRANSFORMERS:** 230 v. to 6 v., 7 times (total 15 A.), outputs, 25 - Small, upright, (a) 110 250 v. Input; outputs 325 v., 20 mA. and 6.2 v., 1 A., 2/6; (b) inputs 6.5 v. at 1 A., and 3 a., 8/6. Input 200 250 v. Outputs, 12 v., 3 a. and 6 v., 3 a., 12/6; 300-0-300 v., 200 mA. and 4 v., twice, 17/6. **VHF AMPLIFIER,** valves 21957, 111R36, with 50 c. power unit, 40 - (p.p. 3/6). I.F. multi-choke: 11 45 mA., 60 H. 10 mA., 35 H. 20 mA., 12/6 (post 2/6). **LIST AND ENQUIRIES:** S.A.F., please! Terms, C.V.O. Postage extra. Immediate despatch.

Calls and post: W. A. BENSON (P.W.)
136 Rathbone Road, Liverpool 15. SEP 485G.
Calls: SUPERADIO (W'chapel) LTD.,
118 Whitechapel, Liverpool 2. ROF 1136.

GUARANTEED CAPACITORS

Hi-K Disc. : 500 v. d.c. wkg., 470 pF, .001 μ F, .002 μ F, .003 μ F, .005 μ F, 9d. each. Tubular : 500 v. d.c. wkg., 1, 1.5, 2, 3 pF, 1/- each; 5, 7.5, 10, 15, 20, 25, 30, 40, 47, 50, 60, 75, 100 pF, 10/d. each; 150, 200, 250, 300, 350, 400, 500 pF, 1/2 each. Hi-K midget tubular 500 v. d.c. wkg., 500 pF, .001 μ F, .002 μ F, .003 μ F, 10/d. each; .005 μ F, .01 μ F, 1/- each.

Close Tolerance Silver mica. Plus or Minus 1 pF : 1.5, 2, 2.2, 3.9, 4.7, 5, 5.6, 8.2, 10, 15, 20, 25, 30, 40 pF, 11d. each. 1% : 47, 50, 56, 60, 68, 75, 80, 100 pF, 1/- each.

Minimum postage 9d. on orders under £3. Please note we do not supply overseas except to H.M. Forces.

SOUTHERN RADIO & ELECTRICAL SUPPLIES

SORAD WORKS
REDLYNCH, SALISBURY

TEST GEAR GOING CHEAP!

ITEMS FROM 3/6

Don't wait - Send stamp for lists - NOW

RADIO MAIL (Dept. S)
Raleigh Mews, Raleigh St., Nottingham

RECORD PLAYERS



COLLARO AC.3.554. Three-speed, single player for A.C. mains 200/250 v., cream finish, complete with turnover crystal pick-up. "T" type head. Strictly limited quantity at 48.10/6, plus 5/6 carr. **CRYSTAL PICK-UPS** fitted Acos H107 cartridge. Ultra lightweight. Our price 37/6, plus 2/6 carr. **3-SPEED RECORD PLAYERS,** fitted with Acos turnover H109 pick-ups with twin sapphire styl, resin case with lid, fitted clasps and handle. Worth 10 gu. Our price 47.15/6, plus 5/6 carr. **4-SPEED GRAM MOTORS,** complete with crystal Pick-up. Our price 99/6, plus 5/6 carriage. **REXINE COVERED CABINETS,** single player size, suitable most non-auto units, including transcription motors. (Motor board uncut.) Our price 48/6, plus 5/6 carriage. **PORTABLE RECORD PLAYER CABINETS** to house Monarch, Collaro or Garrard 120 Changers, with space for Amplifier and Speaker. Resine finish in attractive colours, fitted clasps and handles. Our price 23.5/0, plus 5/6 carriage.

Send stamp for complete bargain lists.

RONALD WILSON & CO.

(DEPT. P.W.), 12 BRIDGE STREET, WORCESTER

RADIO AND TELEVISION COMPONENTS

All parts in stock for:
Viewmaster, Soundmaster, Telesking, etc.
Easy Terms available.
2hd. stamp (only) for Catalogue.

JAMES H. MARTIN & CO.
FINSTHWAY, NEWBY BRIDGE,
CLYDEBURY, LANCs.

Practical Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS

No. of
Blueprint

CRYSTAL SETS

- 2/- each
1937 Crystal Receiver ... PW71*
The "Junior" Crystal
Set ... PW94*
2/6 each
Dual-Wave "Crystal
Diode" ... PW95*

STRAIGHT SETS

Battery Operated

- One-valve : 2/6 each
The "Pyramid" One-
valver (HF Pen) ... PW93*
The Modern One-
valver ... PW96*
Two-valve : 2/6 each
The Signet Two (D &
LF) ... PW76*

- 3/6 each
Modern Two-valver (two
band receiver) ... PW98*

- Three-valve : 2/6 each
Summit Three (HF Pen,
D Pen) ... PW37*

- The "Rapid" Straight
3 (D, 2 LF (RC &
Trans)) ... PW82*

- F. J. Camm's "Sprite"
Three (HF, Pen, D,
Tet) ... PW87*

- 3/6 each
The All-dry Three ... PW97*

- Four-valve : 2/6 each
Fury Four Super (SG,
SG, D, Pen) ... PW34C*

Mains Operated

- Two-valve : 2/6 each
Selectone A.C. Radio-
gram Two (D, Pow) ... PW19*

- Three-valve : 4/- each
A.C. Band-Pass 3 ... PW99*

- Four-valve : 2/6 each
A.C. Fury Four (SG, SG,
D, Pen) ... PW20*

- A.C. Hall-Mark (HF
Pen, D, Push Pull) ... PW45*

SUPERHETS

- Battery Sets : 2/6 each
F. J. Camm's 2-valve
Superhet ... PW52*

- Mains Operated : 4/- each
"Coronet" A.C.4 ... PW100*
AC/DC "Coronet" Four ... PW101*

No. of
Blueprint

SHORT-WAVE SETS

Battery Operated

- One-valve : 2/6 each
Simple S.W. One-valver ... PW88*

- Two-valve : 2/6 each
Midget Short-wave Two
(D, Pen) ... PW38A*

- Three-valve : 2/6 each
Experimenter's Short-
wave Three (SG, D,
Pow) ... PW30A*

- The Perfect 3 (D, 2 LF
(RC and Trans)) ... PW63*

- The Band-spread S.W.
Three (HF, Pen, D,
(Pen), Pen) ... PW68*

PORTABLES

- 2/-
The "Mini-Four" All-
dry (4-valve superhet) ... *

MISCELLANEOUS

- 2/6 each
S.W. Converter-Adapter
(1 valve) ... PW48A*

- The P.W. 3-speed Auto-
gram ... (2 sheets), 8/-*

- The P.W. Monophonic
Electronic Organ (2 sheets), 8/-

TELEVISION

- The "Argus" (6in. C.R. Tube), 3/-*

- The "Super-Visor" (3 sheets), 8/-*

- The "Simplex" ... 3/6*

- The P.T. Band III Converter 1/6*

All the following blueprints, as well as the PRACTICAL WIRELESS numbers below are pre-war designs kept in circulation for those amateurs who wish to utilise old components which they may have in their spares box. The minority of the components for these receivers are no longer stocked by retailers.

AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

- One-valve : 2/6
B.B.C. Special One-
valver ... AW387*

Mains Operated

- Two-valve : 2/6 each
Consoelectric Two (D,
Pen), A.C. ... AW403

SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No of
Blueprint

SHORT-WAVE SETS

Battery Operated

- One-valve : 2/6 each
S.W. One-valver for
American ... AW429*

- Two-valve : 2/6 each
Ultra-short Battery Two
(SG, det Pen) ... WM402*

- Four-valve : 3/6 each
A.W. Short Wave World-
beater (HF Pen, D, RC,
Trans) ... AW436*

- Standard Four-valver
Short-waver (SG, D,
LF, P) ... WM383*

Mains Operated

- Four-valve : 3/6
Standard Four-valve A.C.
Short-waver (SG, D,
RC, Trans) ... WM391*

MISCELLANEOUS

- Enthusiast's Power Am-
plifier (10 Watts) (3/6) WM387*

- Listener's 5-watt A.C.
Amplifier (3/6) ... WM392*

- De Luxe Concert A.C.
Electrogram (2/6) ... WM403*

QUERY COUPON

This coupon is available until Jan. 6th, 1958, and must accompany all queries sent in accord with the notice on our "Open to Discussion" page. PRACTICAL WIRELESS, JAN. 1958.

THE "WEYRAD" SIGNAL GENERATOR

AN INSTRUMENT OF HIGH ACCURACY AT LOW COST

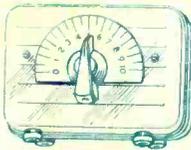


- Coverage 100 Kc/s-70 Mc/s (on fundamentals).
- Accuracy better than $\pm 2\%$ on all ranges.
- Large, clearly calibrated scale.
- Modulated or C.W. output.
- 500 c/s A.F. source.
- S.G.M.I.—A.C. mains operation. Double wound, varnish-impregnated transformer, tapped 210/225/250 volts.
- S.G.B.I.—All dry battery operated.
- All components are by well-known manufacturers ensuring maximum reliability.
- Both types in quantity production.
- Illustrated leaflet available, price 2d.

WEYMOUTH RADIO MANUFACTURING CO., LTD.
CRESCENT STREET, WEYMOUTH, DORSET

YOU can build any of these at Low Cost!

A MINI TRANSISTOR RADIO



IDEAL XMAS PRESENT

A two-stage highly sensitive circuit uses a new super high gain transistor coil and mini tuning condenser. Gives remarkable performance. With step-by-step instructions. Beginners can't go wrong. Get your order in while prices are low. Send 2/- for wiring diagram and component price list.

Total building costs
37/6

includes Plastic case, mini ear-piece, Batteries etc. All parts sold separately.

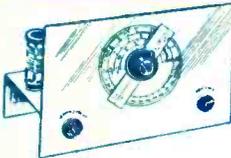
Ideal for:

- Late night listening.
- Children's nursery, etc.

1v. WORLD WIDE SHORT-WAVE RADIO

EXPLORE THE WORLD ON SHORT WAVES!

Can be built for from our list of components which can all be purchased separately, covers 10-100 metres and is capable of receiving speech and music from all over the world. Price includes the famous 954 acorn valve and one coil covering 40-100 metres. Provision is made to increase to two or three valves and all components are colour coded. Send 2/- for point to point wiring diagram, layout and price list.



30/-

Post and packing: Under 10/- add 9d.: under 40/- add 1/6: over POST FREE.

TRANSISTOR POCKET RADIO



The ideal low cost transistor pocket radio for the beginner. The Two-Stage circuit utilises the new R.C.S. VARILoopstick transistor coil. A specially designed miniature .0005 tuning condenser permits the receiver to be in a case which fits in the palm of your hand. Works for months off small battery costing 7d. Can be built in 30 minutes. PRICE **30/-**

All components are sold separately, including plan to parts for 2/-.

full construction data, including plan to parts for 2/-.

PERSONAL PORTABLE RADIO

THE SET FOR PERSONAL LISTENING

This little set was designed to give you a real personal portable radio that you can listen to anywhere without disturbing others. Use it on camping trips, in bed, in your office. Supplied with detachable rod aerial, it covers all the medium waves 200-500 metres. Average building time one hour. PRICE **30/-**

Send 2/- for specification, point to point circuit and parts price list.



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