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OCTOBER 1964

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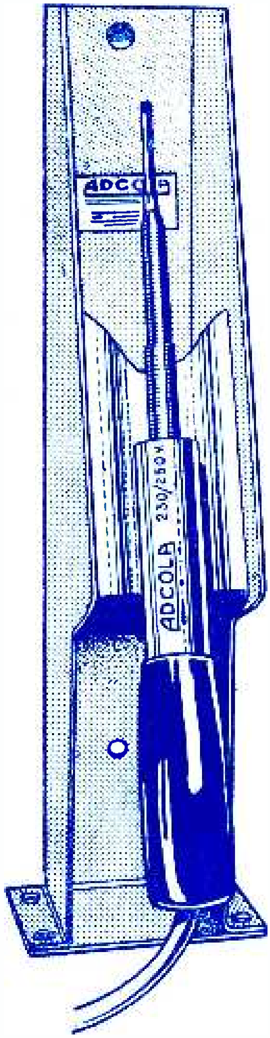

DESIGNED FOR THE AMATEUR'S RADIO STATION

ILLUSTRATED
List No. 70 $\frac{1}{8}$" BIT IN PROTECTIVE SHIELD
List No. 68

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'SUPER SIX'

TRANSISTOR RADIO KIT

NOW ONLY £4.17.6 **(post 5/-)**

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- All new parts.
- 6 transistors and diode.
- 350mW output.
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- Nicely styled wooden cabinet, 11 x 7½ x 3¼in.
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- 9v. battery required. VT9 or P.P.9 (3/9 with kit).

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Packet of 3 coded RF transistors (equivalent of OC44/5) 7/6 post paid. Trade supplied.
Set of 6 transistors and diode with circuit diagram. Neatly packed in foam-lined box; useful for presentation. 15/- post pd.

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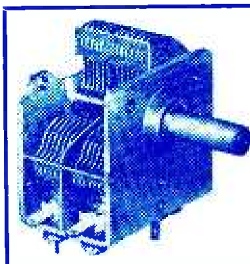
Precision built radio components are an important contribution to the radio and communications industry. Be sure of the best and buy Jackson Precision Built Components.



"00" Twin Capacitor

The JB type "00" is designed for use in transistor portables. Aerial section 208 pF, oscillator section 176 pF. Air-spaced, robust, light and compact: $1\frac{3}{8}$ x $1\frac{17}{32}$ x $1\frac{1}{32}$in. deep. Also available with slow-motion drive, trimmers and oscillator section tracked for 465 kc/s I.F. in M.W. band.

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LASKY'S RADIO Offer the Finest Value and HOME CONSTRUCTORS

We consider our construction parcels to be the finest value on the home constructor market. If on receipt you feel not competent to build the set, you may return it as received within 7 days, when the sum paid will be refunded less postage.

THE SKYROVER & SKYROVER De Luxe

★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THESE WELL-KNOWN SETS

A simple additional circuit provides coverage of the 1100/1950 M. band (including 1500 M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction data **Only 10/- extra** Post Free
This conversion is suitable for both models that have already been constructed.

The SKYROVER

Controls: Waveband Selector, Volume Control with on/off Switch, Tuning Control. In plastic cabinet, size 10 x 6½ x 3¼ in. with metal trim and carrying handle.
Can now be built for **£8.19.6** P. & P. 5/-.
H.P. Terms: 20/- deposit and 11 mnths. at 16/6.

GENERAL SPECIFICATION:
7 transistor plus 2 diode superhet, 6 waveband portable receiver. Operating from four 1.5 v. torch batteries. The SKYROVER and SKYROVER DE LUXE cover the full Medium Waveband and Short Waveband 31-94 M. and also 4 separate switched band-spread ranges. 13M. 16M, 19M and 25M, with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow stage by stage instructions.
SPECIFICATION:
Superhet 470 Kc/s. All Mullard Transistors and Diode. Uses 4-U2 batteries. 5in. Ceramic Magnet P.M. Speaker Easy to read Dial Scale. Band Spread Tuning. 500 MW Output. Telescopic Aerial & Ferrite Rod Aerial.
WAVEBAND COVERAGE: 180-576M; 31-94M and Band Spread on 13, 16, 19 and 25 metre Bands.

The SKYROVER DE LUXE

Tone Control Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet size 11½ x 6½ x 3in. covered with a washable material with plastic trim and carrying handle. Also car aerial socket fitted.
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Data for each receiver 2/6 extra. Refunded if you purchase the parcel. Four U2 batteries 3/4 extra.
All Components Available Separately.

The "Sixteen" Multirange METER KIT

This outstanding meter was featured by *Practical Wireless* in the Jan. '64 issue. Lasky's are now able to offer the complete kit of parts as specified by the designer.
RANGE SPECIFICATION: D.C. volts: 0-2.5-25-50-250-500 at 20,000 Ω/V. A.C. volts: 0-25-50-250-500 at 1,000 Ω/V. D.C. current: 0-50µA, 0-2.5-50-250 mA. Resistance: 0-2,000Ω, 0-200kΩ, 0-20MΩ. Basic movement: 40µA f.s.d. moving coil. With universal shunt full scale deflection current is 50µA. Size/finish: Black plastic case, 3¾ x 5¼ x 1½in. Controls: 12 position range switch; separate slide switch for A.C. volts—D.C. ohms; ohms zero adjustment pot, meter; meter zero. External connections: Two 4mm. sockets for test lead plugs. Power requirements: One 15V. and one 1.5V. batteries. Complete with all parts and full construction details.
Data and circuit available separately 2/6 refunded if all parts bought. Pair of Batteries, 2/5 extra.

LASKY'S PRICE £5.19.6 P. & P. 5/- **H.P. Terms: 21/- deposit and 5 months at 21/-**

NEW SUPER MINIATURE POCKET RADIOS

THE SINCLAIR MICRO-6

Self-contained pocket radio Size only 1⅘ x 1³⁄₁₀ x ½in.
A marvel of modern miniaturisation—truly amazing performance Without a doubt the most advanced transistor circuit ever offered to home constructors—yet may be built in an evening. Complete with earphone and detailed construction data. **Can be built for only 59/6**
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Micro alloy transistorised and printed circuit. All components available separately
Easy to assemble. **CAN BE BUILT FOR 49/6**

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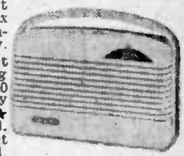
New, unused and individually boxed fitted with lightweight pick-up with ACOS G.P. 73/2 stereo cartridge. Cabinet space required 13½ x 12½ x 4½in. A 9in. metal turntable is fitted. For use on 200/250 volt A.C. Mains, with Auto-stop. The stereo cartridge will play all types of Mono Records, 78's, L.P.s etc., but if desired a G.P. 67 LP/78 Mono cartridge will be supplied in lieu of the G.P.73 at no difference in cost.

LASKY'S PRICE 79/6 P. & P. 3/6 extra.

The "REALISTIC" Seven



★ 7-transistor Superhet. ★ 350 milliwatt output into 4in. high flux speaker. ★ All components mounted on a single printed circuit board, size 5¼ x 5½in. in one complete assembly. ★ Plastic cabinet with carrying handle, size 7 x 10 x 3½in., Blue/Grey or all Grey. ★ Easy to read dial. ★ External socket for car aerial. ★ I.F. frequency 470 Kc/s. ★ Ferrite rod internal aerial. Operates from PP9 or similar battery. ★ Full comprehensive data supplied with each receiver. ★ All coils and I.F.'s etc. fully wound ready for immediate assembly.
An Outstanding Receiver. **LASKY'S PRICE** for the complete parcel including Transistors, Cabinet, Speaker, etc., and Full Construction Data. Can be built for **£5.19.6**
P. & P. 4/6
PP9 Batt. 3/9. Data and instructions separately 2/6. Refunded if you purchase the parcel.

REALISTIC Seven DE LUXE

With the same specification as standard model—PLUS a superior wood cabinet in contemporary styling. ALSO a full vision circular dial.
FOR ONLY **£1** EXTRA
P. & P. as std. model

RECORD PLAYERS

45 r.p.m. 6 volt Batt. operated. Complete with pick-up fitted crystal cartridge. Size only 7½in. x 6in. Fitted auto. stop and start. New and perfect.

45 r.p.m. Model 49/6 P. & P. 2/6
2 speed model for 33 and 45 r.p.m. (as illustrated). 69/6 P. & P. 2/6

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Rating 1.22 v. 3.5 AH at 10 hour rate. 1001 uses for model makers, miniature electronic equipment, portable radios and tape recs., trans receivers, photo flash etc. Hermetically sealed. Size 3¼ x 1½ x 1½in. Listed at 35/- each.
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Powerfully amplifies the incoming call. The pick-up is suction fixed to 'phone. Battery-operated at negligible cost. Fitted with on/off switch and vol. control. Size: 4½ x 3 x 1½in. Complete with PP3 battery. **LASKY'S PRICE 69/6**, P. & P. 2/6.

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CGM5 Crystal-high imp. Size only 1¼ x ¾ x ¼in. Clips to finger board—no screws. Complete with cable.
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Service in Great Britain to both & HI-FI ENTHUSIASTS

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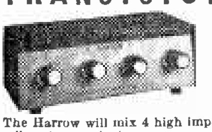
TAPE RECORDERS · RECORD PLAYERS · AMPLIFIERS ETC.
COMPLETE MONO/STEREO SYSTEMS TO YOUR SPEC.

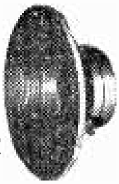
TRANSISTORISED MICRO-PHONE MIXER



The Harrow will mix 4 high impedance channels: mikes, tape rec's, tuners, grams, etc. 9 v. battery operated. Neatly styled, size only 6 x 2½ x 2¼in. Standard jack sockets. Complete with PP3 batt., full circuit diagram and operating instructions.

Model TM4 Mono 59/6 P. & P. 2/6
Model SM5 Stereo 72/6 P. & P. 2/6

SPEAKERS SPECIAL OFFER



12in. FANE HEAVY DUTY DUAL CONE HI-FI SPEAKER
Type 122/17A—listed at 12 gns. Power handling 25 watts—15 ohms imp. Flux density 17,000 gauss. Special Anisotropic magnet. Limited stock.

LASKY'S PRICE £6.19.6 P. & P. 5/-

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Power handling 10 watts—15 ohms impedance.
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Gives variable volume control of Woofer and Tweeter. Strong metal construction. Size 4 x 2½ x 1¼in. Screw tag connections.
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THE NEW STUDIO RANGE OF CELESTION HI-FI SPEAKERS NOW IN STOCK

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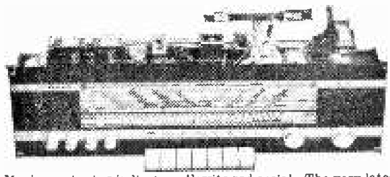
5¾in. Long play, 1,200ft., Acetate base....	12 6
5¾in. Standard play, 850ft., P.V.C. base..	11 6
7in. Standard play, 1,200ft., Mylar base..	12 6
7in. Long play, 1,800ft., Mylar base......	19 6
7in. Double play, 2,400ft., Mylar base....	25 0
7in. Long play, 1,800ft., Acetate base....	15 0
3in. Message tape, 150ft................	3 6
3in. Message tape, 225ft................	4 11
3in. Message tape, 300ft................	7 6
3in. Triple play, 450ft., Mylar base........	12 6
4in. Triple play, 900ft., Mylar base........	22 6
5in. Triple play, 1,800ft. Mylar base........	42 6
5¾in. Triple play, 2,400ft., Mylar base....	55 0
7in. Triple play, 3,600ft., Mylar base......	75 0

P. & P. 1/- extra per reel; 4 reels and over Post Free

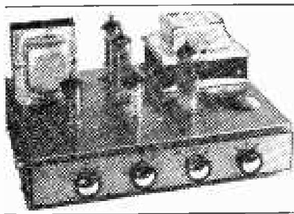
THE NEW "KUBA" CONTINENTAL AM/FM STEREO RADIOGRAM CHASSIS



Long, medium and short waveband coverage plus VHF/FM. Piano key wavechange. Separate flywheel tuning on AM and FM. Bass, treble and balance controls. Magic-eye tuning indicator. Ferrite rod aerial. The very latest printed circuitry. Provision for multiplex adaptor. 5 valves—line-up: ECC85, ECH801, ECC83, ELL80, EAF801. Full vision tuning scale size 21 x 6in. Overall dimensions: 21 x 6½ x 8in. Made to the very highest standards.

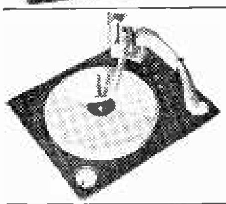
LASKY'S PRICE 29½ GNS. Carriage & Insurance 12/6 extra.

THE BH-14 HI-FI MONO 14 WATT AMPLIFIER KIT



High quality 14 watt output power amplifier with bass, treble and separate volume controls on each input. Inputs: 1—5 m/v; 2—40 m/v. Output impedance 3 or 15 ohms. 5 valves—line-up: 2 x EL84, 1 x EF86, ECC83 and EZ81. Frequency response 15 c/s—20 Kc/s. Ideal for the discerning hi-fi enthusiast or for guitar amplifier. Gold hammer finish with distinctive Perspex front panel. Complete kit of parts with detailed construction data.
LASKY'S PRICE 9 GNS. P. & P. 7/6. Instruction book avail. sep.; 1/6.
AVAILABLE READY BUILT AND TESTED. LASKY'S PRICE 11 GNS. P. & P. 7/6.

AUTOCHANGER SCOOP!!!



LASKY'S CAN NOW OFFER B.S.R. AUTOCHANGERS AT LOWEST EVER PRICES

All brand new and fully guaranteed—complete with cartridge and stylus.

UA14..	£3.19.6
UA16 4 speed, mains	£4.19.6
UA14 4 speed, 9 v. battery operated........	£5.19.6
UA20 4 speed	£5.19.6

Add 5/- P. & P. on each.

IT'S FABULOUS!! THE TRANSISTOGRAM

A portable battery operated fully transistorised Record Player for the music of your choice—any time and place! Made by famous British manufacturer, fully guaranteed. Size only 6½ x 12 x 10½in.. weight 10 lbs. Operates on 6 U2 torch batteries. 4 speeds—16²/₃, 33¹/₃, 45 and 78 r.p.m. Goldring Sygnet record player unit with lightweight pick-up fitted with CM-60 turnover ceramic cartridge. Output 500 mw to 5in. ceramic magnet loudspeaker, fitted into lid for maximum sound distribution. Cabinet constructed of wood, covered in two tone (pale blue-grey) leathercloth. Fitted carrying handle and strong lid catches. High quality amplifier with tone and volume controls gives excellent reproduction at all speeds. Plays 7, 10 and 12in. records. Today's value 12 Gns.

LASKY'S PRICE £6.19.6 Carriage & Insurance 7/6
New, boxed and guaranteed—exc. batts

CRYSTAL PICK-UP CARTRIDGES *LOWEST EVER PRICES!*

All Complete with Styli L.P. and Standard (and Stereo where shown) fully guaranteed. Standard Fitting will fit most P.U. Arms and Heads. Postage 1/- each extra.

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Ronette Stereo type 105 and 106 Diamond LP/Stereo and sapphire Std.	35 0
STEREO	
Acostereo 73/1, 2 sapphires	25 0
MONO	
Garrard Magnetic T.O.M.2	15 0
Acos GP.59	14 0
Acos GP.65/3	15 0
Acos GP.65/1	17 0
Acos GP.67/1	14 0

AND EVEN LOWER PRICES!

Mono C.T.1	4 11
Collaro Type C, 2 sapphires, stereo	15 0
Collet S.C.1. Diamond LP/Stereo	17 6
Sonotone 8T, stereo	19 11
Sonotone 2TA, mono	15 0

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BOTH OPEN ALL DAY SAT. Early Closing Thurs. Mail Orders to Dept. P.W., Edgware Rd.

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Open all day Thursday. Early closing Sat

LASKY'S FOR SPEEDY MAIL ORDER SERVICE

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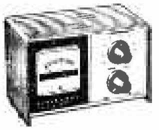
TM-59 'er 'S' METER



Signal strength meter using VTVM principles. Calibrated in S units. Sensitivity and zero adjustments. For any superhet receiver with AVC. Requires 150/200V. and 6 or 12V. Complete with valve and full instructions. 82/6. P.P. 2/6.

MAINS ISOLATION TRANS.

230V. to 230V. 50W. 16/6, P.P. 3/-; 100W. 29/6, P.P. 3/6; 1,000W. £5. Carr. 10/-.

MINIATURE LEAD ACID ACCUMULATORS

Brand new. 2V. 1.5A. 4 x 1 x 1½in., 5/6. P.P. 1/3. 12V. 0/75.A 4 x 3 x 1½in. 15/6. P.P. 1/6.

MARCONI TF144G/4 STANDARD SIGNAL GENERATORS

First release of this late mark. 85Kc/s to 2Mc/s +1%. Output variable from 1µV to 1 volt. Internal sine wave modulation 400c/s up to 75% depth. Operation 200/250 volt A.C. Offered in really excellent condition, like new, fully tested and guaranteed. £25. Carr. 30/-.

HEAVY DUTY POWER SUPPLIES

Input 200/250 volt A.C. Three H.T. outputs 2 x 400V. 175mA and 350V. 225mA. All fully smoothed. 2 x 6.3V. 5 amp, 6.3V. 4 amp, 12V. 0.5 amp. Supplied in perfect condition. £5.10.0. Carr. 20/-.

PRECISION PORTABLE VOLTMETERS

Polished wood case. 8in. scale with knife edge pointer. A.C. and D.C. volts; 0-160 volts, 59/6; 0-160-320 volts, £5.19.6. P.P. 3/6.

TWIN MOTOR BARGAIN

200/250V. A.C. Twin concentric spindles. Either motor reversible. 14000 r.p.m. Brand new. 12/6. P.P. 2/6.

VARIAC TRANSFORMER

24 amp. Pri. 230V. Sec. 185/250V. £12.10.0. Carr. 10/-.

MAINS MOTORS 220/240V

90 watts, 5,000 r.p.m. 4½ x 3in. ¼in. spindle 22/6. P.P. 2/-.

GEARED SLIDER RHEOSTAT

1.2 ohms 12 amp. 15/6. P.P. 3/6.

R.C.A. HEADSETS

Low imp. Fitted with std. jack plug. 15/6. P.P. 1/6.

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Std. type with handset and bell. No dial. Unused. 25/-. P.P. 3/6.

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12V. D.C. input. Output 310/360V. D.C. 30mA. New boxed. 10/-. P.P. 2/-.

COLLARO MAGNAVOX. STUDIO TAPE TRANSCRIPTOR

Brand new. 3 speeds. 1⅞", 3¾", 7½" i.p.s. 3 motors, digital counter. Complete with instructions. 2 Track. £10.10.0; 4 Track. £13.10.0. Carr. Paid.

HEADSET & BOOM MICROPHONE

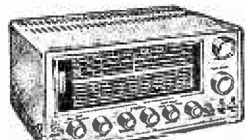
American type, low impedance, padded. 49/6. P.P. 2/6.

BEST BUY!

Send 1/- P.O. for full catalogue and lists.
Open 9 a.m. to 6 p.m. Every day, Monday to Saturday. Trade supplied.

PRICE SLASHED!

LAFAYETTE COMMUNICATION RECEIVERS



Superlative range of Modern Communication Receivers incorporating many special features at prices to suit every pocket

MODEL HE-40 4 Bands, 550Kc/s to 30Mc/s.	£19.19.0	Carr. 15/-
MODEL HE-30 9 Valves 4 Bands, 550Kc/s to 30Mc/s	£35. 0.0	Carr. 15/-
MODEL HE-80 15 Valves, 5 Bands, 550Kc/s-30Mc/s and 142-148Mc/s.	£52.10.0	Carr. 15/-

Each receiver supplied brand new and fully guaranteed complete with manual. All models for operation on 220/240 Volt A.C. S.A.E. for illustrated leaflet. Generous part exchange allowances.

TE-20A R.F. SIGNAL GENERATOR

A precision signal generator of extremely high accuracy and quality. Six ranges from 120Kc/s to 130Mc/s on fundamentals with calibrated harmonics from 120-390 Mc/s. 400 cps. INT. MOD. OR EXT. MOD. OUTPUTS MOD. RF UNMOD RF. or 400 c/s audio. RF. output in excess of 100 mv. Large clear 5 inch dial. Handsome grey metal case with handle. Size 7¼ x 10¼ x 4½in. Complete with leads Operation 220/240 volts A.C. Supplied brand new and guaranteed £12.19.6. Carr. 5/-.

MAINS RECORD PLAYERS & AUTOCHANGERS

ALL GUARANTEED WITH ARM AND CARTRIDGE

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GARRARD AUTOSLIM CHANGER	£6. 9.6
GARRARD AT6 CHANGER MONO	£10. 9.6
GARRARD AT6 CHANGER STEREO	£10.19.6
GARRARD 4 H/F MONO	£14.19.6
GARRARD 4 H/F STEREO	£15.15.0
GARRARD TYPE A CHANGER	£17.15.0
GARRARD 301 STROBO. NO ARM	£19.10.0
B.S.R. GU7 SINGLE PLAYER	£4. 7.6
B.S.R. UA16 CHANGER	£6.12.6
B.S.R. UA15 NEW SLIMLINE CHANGER	£6.19.6

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Brand New—Fully Guaranteed. Lowest ever prices. Supplied with leads, batteries and instructions.

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0/10/50/250/1000V. A.C. and D.C.
0/1/100/500 mA D.C.
0/100K Ω
39/6. P.P. 1/6.

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20,000 o.p.v.
0/.6/6/30/120/600/1,200/3,000/6,000V. DC
0/6/30/120/600/1,200V. AC
0/60µA/6/60/600mA
6/6K/600K/6 Meg/60 Meg Ω
5pF—.2mFd
£5.19.6. P.P. 2/6.

MODEL NH-400
10,000 o.p.v.
0/.3/3/30/120/300/600/1,200V. DC.
0/12/60/120/300/1,200V. AC
0/120 Ω A/30/300mA DC

0/2K/200K/2 Meg Ω
100pF—.2mFd
79/6. PP. 2/6.

MODEL AR-620
20,000 o.p.v.
0/10/50/250/500/1,000V. AC and DC
0/500µA/10/250mA
0/10K/100K/1 Meg Ω
250pF—.02mFd
0-500 Henrys
92/6. P.P. 2/6.

MODEL NH-201
30,000 o.p.v.
0/.25/1/10/50/250/500/1,000V. DC
0/10/50/250/500V. AC
0/50µA/10/250mA
0/5K/500K/5 Meg Ω
99/6. P.P. 2/6.

MODEL ITI-2
20,000 o.p.v.
0/5/25/250/500/2,500V. DC
0/10/50/500/1,000V. AC
0/50µA/25/250mA DC
0/60K/6 Meg Ω
.01—.3mFd.
82/6. P.P. 2/6.

MODEL 250J
2,000 o.p.v.
0/10/50/500/2,500V. DC
0/10/50/500/2,500V. AC
0/2 Meg Ω
0/250mA
—20 to +36db
49/6. P.P. 2/6.

TWO-WAY RADIOS

New improved "LAFAYETTE" Models.
Type 1. 3 transistor. Range up to 1 mile. £8.17.6 per pair.
Type 2. 9 transistor. Range up to 5 miles. £21 per pair.
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LAFAYETTE BRAND RECORDING TAPE

First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.

3in.	200ft. L.P. mylar	4/-
3¼in.	600ft. T.P. mylar	10/-
5in.	600ft. std. plastic	8/6
5in.	900ft. L.P. acetate	10/-
5in.	1200ft. D.P. mylar	15/-
5¾in.	1200ft. L.P. acetate	12/6
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7in.	1200ft. std. mylar	12/6
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7in.	1800ft. L.P. mylar	20/-
7in.	2400ft. D.P. mylar	25/-

Postage 2/-. Over £3 post paid.

BRAND NEW R.C.A. AR88D RECEIVERS

Unboxed £65; Boxed with spare valves, copper aerial, headset, and manual, £85. Carr. 30/-.

VARIABLE VOLTAGE TRANSFORMERS

Pri. 230V. Sec. 0-260V. 1 amp. £4.10.0; 2½ amp. £5.17.6; 5 amp. £9; 8 amp. £14.10.0; 10 amp. £16.10.0; 12 amp. £18.15.0; 20 amp. £32.10.0. All fully shrouded.

CHAMOIS PADDED MOVING COIL HEADPHONES

Canadian noise excluding type. Complete with M/C microphone. New, boxed. 25/-. P. & P. 2/6.

Brand New Double Beam CRT's

Cossor 89D. 59/6. P.P. 4/6.
Dumont K1051P1. 59/6. P.P. 4/6.

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400 P.I.V. (SCR)	4 7 amp	7/6
200 P.I.V.	6 amp	5/6
1,000 P.I.V.	650mA	7/6
800 P.I.V.	500mA	5/6
200 P.I.V.	200mA	3/-
400 P.I.V.	500mA	3/6
150 P.I.V.	165mA	1/-
70 P.I.V.	1 amp	3/6
95 P.I.V.	3 amp	5/6

Post extra.

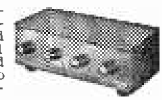
MINIATURE HIGH SPEED COUNTERS

4 Digit available. 6V, 24V, or 50V. ALL 7/6 ea. P. & P. 9d.

NEW LOW IMPEDANCE HEADSET

Latest Ministry Type. Rubber moulded. Fitted with Std. Jack Plug. Brand New, boxed. 17/6. P. & P. 1/6.

4-CHANNEL TRANSISTORISED MICROPHONE MIXER



Add musical highlights and additional sound effects to your recordings. The MM-4 permits mixing of four signals such as microphone, records, tuner, etc. into single output. Input and output take standard plugs. Fully transistorised and self contained in handsome case. PRICE 55/-, P. & P. 2/6.

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MARTIN RECORDAKITS

HALF TRACK	Price	Dep.	&	Mthly. pmts. of
TAPE AMPLIFIER FOR STUDIO DECK with ready wired printed circuit, control and input panels, mains and output transformers, knobs, plans, screws etc. EF86, ECC83, EZ80, EM85 and 2 EL84. 3 watts output. Magic eye. Radio and Mic. inputs, ext. speaker socket, tone and monitor controls. Can be used as an amplifier	£11.11.0	47/-	8	25/6
COLLARO STUDIO DECK. Very latest model, 3 speeds, 3 motors, 7-inch spools	£10.19.6	44/-	8	24/6
CASE for above with 8 x 5in. speaker, two tone grey	£5. 5.0			
COMPLETE KIT with tape and microphone	£29.19.6	120/-	12	44/-
QUARTER TRACK				
TAPE AMPLIFIER FOR STUDIO DECK as described above but Quarter track	£12.12.0	52/-	8	27/6
COLLARO STUDIO DECK fitted with Marriott "X" heads	£13.19.6	56/-	12	20/6
CASE with speaker, two tone grey	£5. 5.0			
COMPLETE KIT with tape and microphone	£33.19.6	136/-	12	49/10
TAPE PRE-AMPLIFIERS				
HALF TRACK for STUDIO deck, 400m/Volts output	£8. 8.0	34/-	6	25/8
QUARTER TRACK as above	£9. 9.0	39/-	6	28/4

MARTIN AUDIOKITS

	Price	Dep.	&	Mthly. pmts. of
The new Martin All Transistor TEN WATT AMPLIFIER kits represent excellent value for money. Each unit is complete, requiring only to be connected to the next. We show only the popular units here. Others are available. Newest leaflet upon request.		—	—	—
UNIT 1—FIVE INPUT SELECTOR. Size 3¼ x 3in. Mag. P.U., Crystal P.U. Radio, Mic. Tape head 18 volts. Must be used with Unit 4	£2. 7.6	—	—	—
UNIT 4—PRE-AMPLIFIER AND CONTROL. 6¼ x 2½in. Volume on/off. Bass and Treble controls. 18 Volts. Must be used with Unit 1	£3. 2.6	—	—	—
UNIT 7—MAIN AMPLIFIER. 10 watts. 6 Transistor transformerless PUSH PULL output. Mounted on heat sink, 15 ohms output 40 volts	£6.12.6	—	—	—
UNIT 8—POWER SUPPLY. 18 and 40 volts. Heavy duty transformer, rectifier and smoothing	£2.15.0			
CONTROL PANEL for Units 1 and 4	10.6	—	—	—
ALL FOUR ABOVE UNITS WITH PANEL. 15 ohms output	£15. 8.0	62/-	12	22/6
UNIT 5—MAIN AMPLIFIER as Unit 7, 3 ohms output. 24 volts	£5.12.6	—	—	—
UNIT 6—POWER SUPPLY as Unit 8, for use with Unit 5	£2.12.6			
ALL FOUR UNITS 1, 4, 5 and 6 WITH PANEL (3 ohms)	£14. 5.0	57/-	12	20/10

STEREO VERSIONS NOW AVAILABLE
LEAFLET ON REQUEST

GRAMOPHONE UNITS, MOTORS, PICK-UPS

Decca DERAM Arm and Plug-in Shell	£5. 5.0	—	—	—
Decca DERAM Transcription Cartridge	£4.14.6	—	—	—
Decca DERAM Auto cartridge	£3.13.6	—	—	—
GARRARD SRP10 with Mono cartridge. Single player	£5.9.11	—	—	—
B.S.R. UA14 with TC8 mono cartridge, 4 speed Auto-changer	£6.19.6	28/-	6	22/-
GARRARD AUTOSLIM, Mono cartridge, 4 speed changer	£7.17.0	33/-	6	24/-
GARRARD AT6 Autoslim de Luxe. Mono cartridge	£11. 9.0	47/-	8	25/3
GARRARD 4H/F with Mono cartridge	£17. 0.0	68/-	12	24/11
GARRARD LAB. "A" Transcription Auto changer, Mono cartridge	£19.14.9	79/-	12	28/11
GARRARD 301 STROBE	£22. 0.0	88/-	12	32/3
PHILIPS AG 1016 Stereo cartridge, will change 7 in. records, with adaptor 10/- extra	£12.12.0	50/6	12	18/6
GOLDRING GL58, with arm but less cartridge	£17. 1.0	69/-	12	24/11
GOLDRING GL70, with arm, less cartridge	£27. 9.4	111/4	12	40/1
GOLDRING "88" Transcription. No arm	£18.18.5	76/5	12	27/8

ARMSTRONG - NEW TUNER AMPLIFIERS

MONO				
224 F.M. only Self powered tuner	£22.10.0	90/-	12	33/-
223 A.M./F.M. Self powered tuner	£28.15.0	115/-	12	42/2
227M A.M./F.M. RADIO CHASSIS 10 watts	£36.15.0	147/-	12	53/10
STEREO				
227 A.M./F.M. RADIO CHASSIS. Stereo Gram. 10 watts each channel	£52.15.0	211/-	12	77/4
226 A.M./F.M. RADIO CHASSIS Stereo Gram. 10 watts each channel. Filter. Mag. P.U. etc.	£61. 0.0	260/-	12	88/-
SHELF MOUNTING TEAK CASE AVAILABLE FOR ALL THESE UNITS All models	£3.15.0	—	—	—

SEND FOR NEW LEAFLET GIVING FULL DETAILS

OTHER TUNERS

TRIPLETONE F.M. TUNER less power	£13.19.6	56/-	12	20/6
TRIPLETONE F.M. TUNER with power	£15.14.6	63/-	12	23/1

STEREO AMPLIFIERS—VARIOUS

ARMSTRONG 222 Intergrated 10W per channel	£27.10.0	110/-	12	40/4
DULCI GA505. Intergrated 5W per channel	£18.18.0	76/-	12	27/8
ROGERS CADET Mk2 with P.A. 4 ELC86 valves	£26.15.0	107/-	12	39/2
LEAK STEREO 20 P.A. and MAIN amplifier. Complete.	£55. 9.0	229/-	12	80/8
QUAD 22 Control Unit. Pre-amp only	£25. 0.0	100/-	12	36/8

MONO AMPLIFIERS

LINEAR L45/A. 3 Valve 3 watts	£6. 6.0			
LINEAR DIATONIC. 12 watts, suitable Mic. or Guitar	£13. 2.6	52/6	12	19/3
LINEAR CONCHORD. 30 watts, ideal Guitar amp. with cover	£19. 2.0	78/-	12	27/10
DULCI GA5. Integrated amp. 5 watts, ECL86 valve	£13. 2.6	52/6	12	19/3
DULCI DPA15. 15 watt with 2 valve pre-amp	£26. 5.0	105/-	12	38/6
TRIPLETONE. Hi Fi Major with pre-amp., suitable Microphone or Guitar	£15.18.9	64/9	12	23/3
LEAK TL12 10 watt Main amp. only	£18.18.0	76/-	12	27/8
LEAK VARISLOPE MONO pre-amplifier	£15.15.0	63/-	12	23/1
QUAD 15 watt MAIN amplifier only	£22.10.0	90/-	12	33/-
QUAD Pre-amplifier MONO	£19.10.0	78/-	12	28/7

JASON F.M. AND TV SOUND TUNER KITS

FMT1, complete with 4 EF91 valves	£7. 4.6	29/-	6	22/8
FMT2, less power, complete with 4 EF80 valves	£9 4.6	37/-	6	28/-
FMT2, with power, complete with 4 EF80 valves and 1 EZ80	£11. 4.6	45/-	8	25/-
FMT3, less power FRINGE, complete with all valves	£10.19.0	45/-	8	24/3
FMT3 FRINGE with power, all valves	£12.19.0	53/-	12	18/10
JTV/2 Switched F.M. and T.V. sound. Self powered all valves	£15.12.6	62/6	12	22/11
MERCURY II, as JTV/2, but less power. All valves	£11. 0.0	44/-	8	24/6
Instruction book included in all kits. Available separately. 2/6 switched 3/6.				
JTV/2 READY BUILT STATE CHANNELS	£22. 5.0	89/-	12	32/7
MONITOR READY BUILT as Mercury II	£16.15.6	67/6	12	24/6

LOUDSPEAKERS

GOODMANS AXIETTE 8 inch	£5. 5.7	—	—	—
GOODMANS AXIOM 10 inch	£6.5.11	—	—	—
GOODMANS 5K/20/XL Tweeter and X/over	£7. 7.0	—	—	—
GOODMANS XO5000 Cross-over	£2.0.11	—	—	—
XO950	£5.10.11	—	—	—
FANE 12 inch unit 20 watts	£5. 5.0	—	—	—
W.B. HF 1012. 10in. unit 3.75. 7.5 and 15 ohms	£4.12.0	—	—	—
WHARFEDALE SUPER 3 Tweeter	£5.16.8	—	—	—
WHARFEDALE SUPER 5 Tweeter	£5.19.7	—	—	—
WHARFEDALE SUPER 8 RS/DD	£6.14.2	—	—	—
WHARFEDALE SUPER 10 RS/DD. Full range	£10.18.0	44/-	8	24/3
GOODMANS AUDIOM 51. 15 watt Bass unit	£9. 2.8	36/8	6	27/8
WHARFEDALE W12/EG. 12in. 15 watt Lead Guitar	£10.10.0	42/-	8	23/6
GOODMANS 201. Full range 12in. unit. 15 watt	£10.17.6	43/6	8	24/3
WHARFEDALE RS/12/DD. Full range unit	£11.10.0	46/-	8	25/6
GOODMANS 301. Full range. 12in. 20 watts	£15. 4.6	61/-	12	22/4
WHARFEDALE W15/EG. 15in. 15 watt. Bass Guitar	£17.10.0	70/-	12	25/8
GOODMANS AUDIOM 91. 18in. 50 watt. Bass Guitar	£29.15.0	119/-	12	43/7

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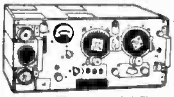
MORE BARGAINS OPPOSITE

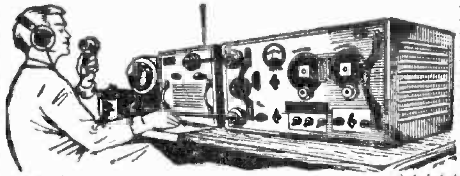
SONA

Mains Powered No. 19 Short Wave Receiver



This well known "A" set receiver covers 2 to 8 Mc/s in two overlapping bands, with optional CW/MCW/RT reception, and incorporates a built-in power-pack for A.C. mains operation. Valve line-up: 6K7 (RF amp), 6K8 (frequency changer), two 6K7 (I.F. amps), 6B8 (detector, AVC, and phone output), 6K8 (B.F.O.) This set features slow-motion tuning with two alternative tuning locks. All receivers tested before despatch. Price £5.19.6. P. & P. 10/-. Suitable phones 15/-. P. & P. 2/6.

No. 19 TRANSMITTER RECEIVER



New stocks just arrived. Equipment comprises 3 separate units built into one chassis and separate power pack.

Specification: "A" Set Transmitter/Receiver Frequency coverage 2-4.5 mc/s and 4.5-8 mc/s. (150-37 metres).

For R.T., C.W., or M.C.W. Range on R.T. 15 miles. C.W. 50 miles. Superhet R.X. I.F. 465 kc/s. B.F.O. etc.

R.X. valve line-up: 6K7, R.F.: 6K8 mixer. 2 6K7 I.F.: 6B8 det. A.F. phone output.

T.X.: 6K8, mixer, B.F.O., EF50 buffer, EB34 ADC, and output stage, which has to be decommissioned to conform with GPO requirements.

Transmitter/Receiver 229-241 mc/s. Local use up to 1 mile. Valve line-up CV5, 6K7 and 6V6.

Intercom set 2 valve A.F. amplifier for vehicle crew inter-communication. Valve line-up 6K7 and 6V6.

A 2½in. meter is built in reading L.T. and H.T. voltages, drive etc.

POWER UNIT. 12 volt DC input. Output 275 volts 110 m/a. and 500 volts 50 m/a. Equipment is of American or Canadian manufacture and is supplied in good condition.

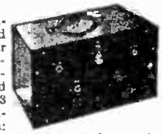
PRICE complete with Power Pack **£4.10.0**
Carriage 17/6.
19 set only **£3.10.0**
Carriage 10/-.
Power Unit only **£1**
Carriage 10/-.
Two 19 sets complete with Power Packs **£8.10.0**
Carriage 30/-.

Accessories

Handbook	3/6	P. & P. 6d.
Connectors 6 pin	7/6	P. & P. 2/6
Control Boxes, Single, new	7/6	P. & P. 2/6
Whip Aerials 8ft. 6in.	7/6	P. & P. 2/6
5ft.	4/6	P. & P. 2/6
Headphones less mike insert	5/-	P. & P. 2/6

Variometers for 19 sets, less front panel but electrically sound, 7/6 each. P. & P. 3/6.

CRYSTAL CALIBRATOR TEST SET No. 7 Mk. I



New in Paxolin cabinet with circuit and instructions on rear panel. Calibrates transmitters and receivers, 3 choices of calibration points: 10, 100, 1,000 kc/s apart, harmonics up to 20 Mc/s. Operates from 2v. accumulator and 120v. dry battery. Price £2.15.0. P. & P. 7/6.

V.H.F. SIGNAL GENERATOR 1-130-A

A fine instrument with crystal/M.O. coverage 100 to 150 mc/s. Slow motion tuning, with simple easily read scale. Stepped output and adjustable amplitude. Requires only a single plug in crystal, and power supply. Dimensions: 8" x 6" x 20", in sturdy black crackle finish carrying case. Price 75/-. P. & P. 5/-.

TRANSMITTER RECEIVER NO. 46

Compactly built to be carried by one man. This has a range of app. 10 miles and being crystal controlled tuning is avoided and operation is as accurate as a telephone Frequency 3.6-9.1 Mc/s. Complete stations comprising receiver transmitter, rod aerial, 1 set of headphones and microphone in canvas carrying bag, but less the plug-in crystal coil units (these are easily obtainable). Price per station **£4.10.0** P. & P. 10/- each. Two stations for **£9.10.0** Post free.

R.A.F. SHORT WAVE RECEIVER

35 to 40 Mc/s. Power supplies 12 volts and 250 volts D.C., in excellent condition with exceptionally fine slow-motion tuning and clean component layout. Price £2.19.6. P. & P. 6/-.

STABILISED POWER UNIT

A valuable unit comprising mains transformer, neon stabiliser, etc. 50 c/s mains voltage, 110 or 80 volts standard input. Stabilised output 130 volts D.C. and 6.3 volts A.C. optional A.C. output 190-0-190 volts. An ideal stabilised supply for the constructor for use in transmitters model control, Hi-Fi equipment and test equipment. Price 49/6. P. & P. 3/6. With polished sturdy wooden cabinet and mains lead. Price 59/6. P. & P. 5/-.

No. 19 SET INSTRUCTION HANDBOOK 3/6 each P. & P. 6d.

1155 INSTRUCTION HANDBOOK 3/6 each P. & P. 6d.

H.R.O. INSTRUCTION HANDBOOK 3/6 each P. & P. 6d.

4 CHANNEL TRANSISTORISED SOUND MIXER

Add musical highlights plus additional sound effects to your tape-recorder. This instrument permits mixing of 4 signals such as microphone, record player, radio tuner etc., into single output. Fully transistorised and self contained in handsome cabinet. Price 55/-. P. & P. 2/6. Standard jack plugs to fit same, 2/6 each. P. & P. 6d. 2 for 4/6. P. & P. 9d. Chrome shielded 3/6 each. P. & P. 9d. 2 for 6/6. Post free.

9v. BATTERY CHARGER AND A.C. ELIMINATOR MODEL LA. 6P.

A "must" for every transistor set owner! Save those batteries by running your transistor set direct from AC mains this summer. Reactivate all your old PP3 batteries. Unit contains neon indicator and standard battery connections with nearly 2 yards of mains leads and plug. Also snap cord for connection to set.

NOW ONLY **19/6** P. & P. 2/6.

TRANSISTOR SALE

Mullard OC71 (P. & P. 3d.)	2/11
Mullard OA90 (P. & P. 3d.)	1/11
Ediswan XD202 Germanium diodes (P. & P. 3d.)	1/11
Mullard OA79 (P. & P. 3d.)	1/11
Transistor holder 3-pin (P. & P. 3d.)	11d. each

MICRO ALLOY TRANSISTORS

Mat 100	7/9
Mat 101	8/6
Mat 120	7/9
Mat 121	8/6
VHF Transistor ADT 140	15/-

Above MAT's postage paid.

Ferrite Slab Aerials suitable for transistor sets 3/-. P. & P. 6d.

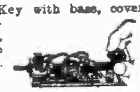
RESISTOR COLOUR CODE INDICATOR

Enables you to determine value of resistor at a glance. A must for the constructor. Price 1/6. P. & P. 3d.

LEAD ACID ACCUMULATORS (Unspillable)

2 volts at 16 A.H. Brand New. Size 4 x 7 x 2in. 4/11 each. 3 for 12/6. P. & P. 3/- per cell.

MORSE KEYS



Morse key assembly. Key with base, cover and terminals. Complete with lead. 6/11. P. & P. 2/-. 2 Morse Keys for 12/6 post-free.

HIGH IMPEDANCE PERSONAL LISTENING EARPIECE

Suitable for all types of crystal sets and transistor sets. Complete with plug. Price **4/11** P. & P. 6d.

NEW WALK ROUND STORE OPEN IN LAMBERTS ARCADE, LOWER BRIGGATE, LEEDS 1. NEXT TO HALFORDS CYCLE SHOP. OPEN ALL DAY SATURDAY. 48 HOUR DESPATCH SERVICE. ALL MAIL ORDERS TO OUR BRIGGATE HOUSE ADDRESS.

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SONA ELECTRONIC CO. (Dept. PW10), BRIGGATE HSE, 13 ALBION PL, LEEDS

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HULL 51 Savile Street (Half-day Thursday)

LEICESTER 32 High Street (Half-day Thursday)

LEEDS 5-7 County (Mecca) Arcade (No half-day closing)

LIVERPOOL 73 Dale Street (No half-day closing)

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MANCHESTER 8-10 Brown St. (Market Street) (No half-day)

MIDDLESBROUGH 106 Newport Rd. (Half-day Wednesday)

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EX. GOV. 2V. ACCUMULATORS

16 A.H. Size 7 x 4 x 2 ins. Brand new, 4/9 each. Three for 12/6, carr. 5/-.

JASON FMTI

V.H.F./F.M. Radio Tuner design. Total cost of parts including valves, Tuning dial, Escutcheon, etc., £6.19.6.

LINEAR L45 MINIATURE 4-5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit and most microphones. Negative feed-back 12 dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves EZ80, ECC83, EL84. Size only 7 x 5 x 5½ in. high. Guaranteed 12 months. Only 6 gns. Send S.A.E. for leaflet. Terms: Deposit 24/9 and 5 monthly payments of 24/9.

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 30-20,000 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, EF86, ECC83, 807, 807, GZ34. 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** L.T. and H.T. for **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/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required perforated cover with carrying handles can be supplied for 19/9.

11 Gns. Carr. 10/-

The amplifier can be supplied, factory built with EL34 output valves and 12 months' guarantee, for 14 gns. Send S.A.E. for leaflet.

TERMS: DEPOSIT 33/9 and 9 monthly payments of 33/9.

Suitable microphones and speakers available at competitive prices.

FANE HEAVY DUTY HI-FI SPEAKERS

12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.

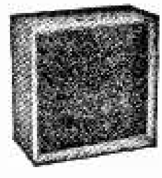
122/10 20watt, 5 gns. 122/10A 20watt, 6 gns.
122/12 20watt, 7 gns. 122/12A 20watt, 8 gns.
122/14 22watt, 9 gns. 122/14A 22watt, 10 gns.
122/17 25watt, £11.17.6 122/17A 25watt, £12.17.6

15in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.

152/12 20watt, 12 gns. 152/12A 20watt, 13 gns.
152/14 27watt, 14 gns. 152/14A 27watt, 15 gns.
152/17 35watt, 16 gns. 152/17A 35watt, 17 gns.

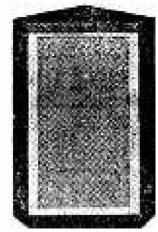
"A" indicates dual cone type, 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

12in. 10 WATT HIGH QUALITY LOUDSPEAKER.



In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6. Carr. 5/-. Terms: Deposit 11/3 and 9 monthly payments of 11/3. **12in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS.** Size 18 x 18 x 10in. Finish as above. Terms: Deposit 17/9 and 9 monthly payments of 17/9. Only £7.19.6. Carr. 8/6. For larger types see page 499.

R.S.C. CORNER CONSOLE CABINETS



Polished walnut veneer finish. Pleasing design.

JUNIOR MODEL. Size 20 x 11 x 8in. for 8 x 5in. or 10 x 6in. speakers, £2.9.9.

STANDARD MODEL Size 27 x 18 x 12in. for 8 or 10in. speakers, £4.11.9.

SENIOR MODEL. Size 30 x 20 x 15in. for 12in. Speaker. Suitable Speaker systems below. Only 7 gns.

AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; crossover unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating £4.19.9. Carr. 5/-. Or Senior 15 watt, £6.19.9. Carr. 7/6.

R.S.C. BASS REFLEX CABINETS. JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only £3.19.6.

STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. For vertical or horizontal use, £5.19.6. Set of legs with brass ferrules, 19/6.

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 record equalisation. Hum level is negligible being 71 dB down. 15 dB of Negative feedback is used. H.T. of 300 v. 25 mA and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohms 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 £4.15.0, or assembled ready for use 25/- extra. Plus 3/6 carr., or deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

THE SKYFOUR T.R.F. RECEIVER. A design for a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list 1/9, maximum building costs £4.19.6. inc. attractive walnut veneered wood cabinet 12 x 6½ x 5½in.

TWEETERS. R.A. 3 ohm. 25/9; 15 ohm. 25/9

R.A. 12in. DUAL CONE 3 ohm 8 watt Speakers. Ideal for Stereo. Only 39/9 ea.

P.M. SPEAKERS. 10in. W.B. "Stentorian" 3 or 15 ohms type HF 1012 10 watts, hi-fidelity type. Recommended for use with our All Amplifier, £4.12.6. 12in. R.A. 3 ohms 10 watts (12,000 lines), 59/9.

ARMSTRONG, DULCI, LINEAR, ROGERS, LEAK and JASON EQUIPMENT, GOODMANS, W.B. AND FANE SPEAKERS. GARRARD AND GOLDRING T/TABLES CASH or H.P.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

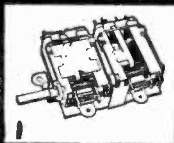
R.S.C. BATTERY TO MAINS Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 and 90 v.** This includes low consumption types. Complete kit with diagrams, 39/9, or ready to use, 46/6.

Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v. 90 v. and 60 v. 40 mA and 2 v. 0.4 a. to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators when connected to A.C.** mains supply 200/500 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulators. Complete kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V./C. Controls are Tuning, W/Ch. and Vol. Only 250 v. 15 mA H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations, 2/6. Total building cost £5.5.0. S.A.E. for leaflet.

MULTI-METER, CABY M1. Sensitivity 2,000 ohms per volt. A.C. and D.C., 54/-. **A.10.** Basic Meter sensitivity 155 microamps A.C. and D.C. ranges £4.11.6. **B.40.** Sensitivity up to 10,000 ohms per volt A.C. and D.C., £6.2.6. TMK500 30,000 ohms per volt, with overload buzzer, £8.19.6.

Just a few of our BARGAINS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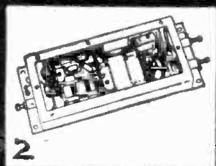
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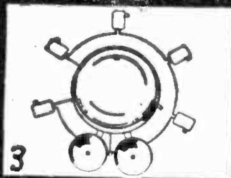
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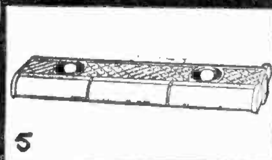
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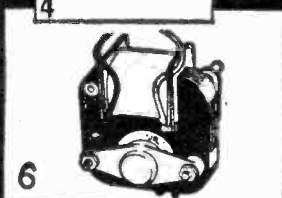
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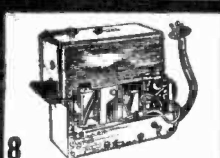
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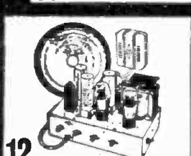
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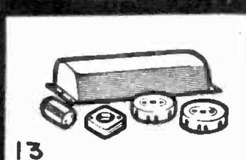
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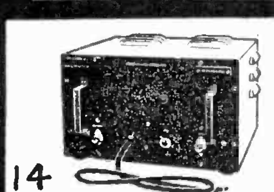
FREE OFFER
ELECTRIC SOLDERING IRON with the **POCKET MULTI-METER**
See item No. 7 for further details


14

1. **CYLDON A.M. F.M. PERMEABILITY TUNER FOR ALL TRANSISTOR OPERATION.** Size 2¾ x 2¼in. approx. By famous manufacturer. A.M. I.F. 470 Kc/s. F.M.-I.F. 10.7 Mc/s. A.M. coverage from 1620 Kc/s-525 Kc/s. F.M. coverage 108 Mc/s-88 Mc/s Circuit diagrams 2/6. FREE with Tuner, 1st, 2nd, 3rd A.M. I.F.'s. 1st, 2nd, 3rd and 4th F.M. I.F.'s. V.H.F. Osc. choke, A.M. I.F. trap, A.F. 114 and A.F. 115, All the above are the R.F. end of an A.M./F.M. receiver car radio, etc. The above six items, £2,10.0.
2. **TRANSISTOR INVERTOR.** 50 v. D.C. Input. Output 240 v. A.C. 40 watts incorporating transformers, choke, condensors and 2 Get573. In solid 16 gauge aluminium case size 15 x 6 x 2¼in., by famous manufacturer, 19/6, plus 6/- P. & P.
3. **RINGO BURGLAR ALARM SYSTEM.** A.C. mains, 200/240 volt. Fire salvage slightly tarnished. List price 7 gns. Our price, complete with double gong bell five micro switches and full instructions, **49/6.** P. & P. 4/-.
4. **SIGNAL GENERATORS.** Cash £7.5.0. P. & P. 6/6. Coverage 100 Kc/s to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x 6½ x 5¼in. Three miniature valves and Metal Rectifier. A.C. mains 200/250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 multivolts. C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy 2 per cent.
5. **FLUORESCENT LIGHT FITTING.** Twin 40 watt 200/250 v. less tubes 59/6. P. & P. 6/-.
6. **A.C. MAINS MOTOR.** Can be used for a variety of purposes, silent running, satisfactory in every way. 230/250 v. A.C., **9/6.** P. & P. 2/-
7. **POCKET MULTI-METER.** Size 3⅞ x 2¼ x 1⅜in. Meter size 2¼ x 1⅜in. Sensitivity 1,000 O.P.V. on both A.C. and D.C. A.C. and D.C. volts 0-15, 0-150, 0-1000. D.C. current 0-150 mA. Resistance 0-100K Ω. Complete with test prods, battery and full instructions, 35/-. P. & P. 2/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value 15/- to every purchaser of the Pocket Multi-Meter.
8. **CHANNEL TUNER I.F.** 16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—PCF80 and PCC84 (in series). Cover BBC and ITA ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, 10/-. P. & P. 3/-.
9. The **MOTORISTS' REV. COUNTER.** Kit of parts comprising 270 degree 3in. moving coil movement. Manufacturer's present price of this movement would be at least £7. Complete with full instructions and circuit diagram. Scale calibrated up to 8,000 r.p.m. Can be used with any 4 or 6 cylinder car. 29/6, plus 3/6 P. & P.
10. **B.S.R. MONARCH UA14 WITH FULL-FI HEAD.** 4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position: colour brown. Dimensions: 12½ x 10⅞in. Space required above baseboard 4⅞in., below baseboard 2⅞in. Fitted with Full-Fi turnover crystal head, £5.19.6. P. & P. 6/6.
11. **50 MICRO-AMP METER** movement by world famous manufacturer. Size 3 x 2¾in., **50/-** post free.
12. **8-watt PUSH-PULL 5 VALVE AMPLIFIER plus METAL RECTIFIER.** A.C. mains 200-250v. Size 10½ x 6¼ x 2¼in. 5 valves. For use with all makes and types of pick-up and mike. Negative feed back. Two input, mike and gram, and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 kc/s. 2 dB down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Note level 40 dB down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with Std. or L.P. records, musical instruments such as guitars, etc. Suitable for small halls. **£3.19.6.** P. & P. 7/-. **Crystal mike to suit, 15/-.** P. & P. 2/-. **8in. P.M. Speaker** to suit, **12/6.** P. & P. 2/-.
13. **FLUORESCENT LIGHT KIT.** 40 watt fluorescent lighting kit comprising Siemens choke. 2 bi-pin holders, starter holder and starter, **11/6.** P. & P. 3/-. Twin 20 choke instant start, complete with 4 bi-pin 200/250 v. holders, **11/6.** P. & P. 4/-. Twin 40 choke instant start with 4 bi-pin 200/250 v. holders, **17/6.** P. & P. 4/-.
14. **FIXED FREQUENCY SIGNAL GENERATOR.** Crystal control in metal case, size 10 x 6 x 6in. Incorporating two FC13 valves, mains transformer, metal rectifier, choke, indicator, lamp, crystal and numerous components. Modulated and unmodulated output socket. Originally used for I.T.V. frequencies. Brand new. **39/6,** plus 6/- P. & P. A.C. mains 200-250 volts.

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

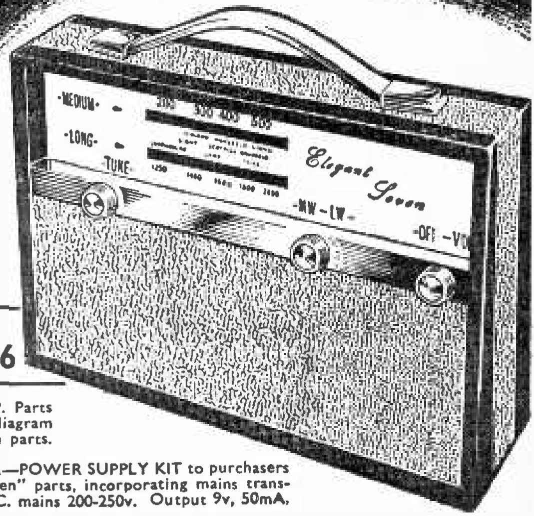
21b High Street, Acton, London, W.3.

All enquiries S.A.E. Goods not despatched outside U.K.

Shop Hours 9 a.m.—6 p.m. Early closing Wednesday.

SPECIAL OFFER! FROM R. & T.V. LTD.

Elegant Seven



COMBINED PORTABLE & CAR RADIO

The Radio with the STAR features

4½" SPEAKER

- ★ 7-transistor superhet. Output 350mW.
- ★ Two-tone grey wooden cabinet, fitted handle with silver coloured fittings. Size 12¼ x 8½ x 3½in.
- ★ Horizontal tuning scale, size 11¼ x 2⅝in. in silver with black lettering.
- ★ All stations clearly marked.
- ★ Ferrite-rod internal aerial.
- ★ I.F. 470 Kc/s.
- ★ Operated from PP9 battery.
- ★ Full comprehensive instructions and point-to-point wiring diagrams.
- ★ Printed circuit board, back printed with all component values.
- ★ Fully tunable over medium and long waveband.
- ★ Car aerial socket.
- ★ Full after-sale service.

ONLY £4.19.6

Plus 5/6 P. & P. Parts list & circuit diagram 2/6. FREE with parts.

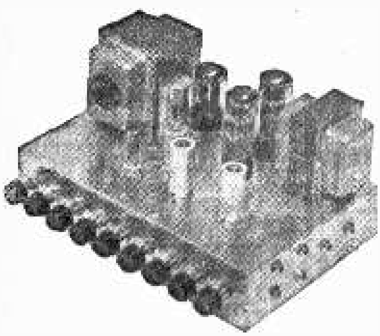
SPECIAL OFFER—POWER SUPPLY KIT to purchasers of "Elegant Seven" parts, incorporating mains transformer etc. A.C. mains 200-250v. Output 9v, 50mA, 7/6.

Goods not despatched outside U.K. All enquiries S.A.E. Terms C.W.O.

RADIO & TV COMPONENTS (ACTON) LTD 21C High St., Acton, London W3

Open 9 a.m.—6 p.m. including Sats. Early closing Wed.

GUITAR AMPLIFIERS WITH TREMOLO



Five jack socket inputs, four with separate mixing volume controls, and one input "straight through". All inputs are of very high sensitivity, only 10 millivolts input is required for full output, making them suitable for all types of guitars and microphones. Separate Bass and Treble controls, giving a wide range of lift and cut. Separate master gain control. Tremolo speed and depth controls. Jack socket for remote tremolo switching. Outputs for 3 and 15 ohms speakers. Valves used in the 30 watt and 50 watt amplifier ECC83, ECC83, EL34, EL34, GZ34. In the 15 watt amplifier ECC83, ECC83, EL84, EL84, EZ81. An extra valve ECC83 is used in the tremolo circuit. The chassis is complete with baseplate and is solidly made of 18 gauge steel, finished silver grey hammer. Size 12 x 8 x 6¼ inches high.

PRICES—

50 watt with tremolo	£21.10.0
50 watt less tremolo	£20.10.0
30 watt with tremolo	£15.10.0
30 watt less tremolo	£14.10.0
15 watt with tremolo	£12.10.0
15 watt less tremolo	£11.10.0

Add carriage 10/- any amplifier. Send for free descriptive leaflet.

STROUD AUDIO

PAGANHILL LANE, STROUD, GLOS. Stroud 783

BARGAINS FROM BROADWAY ELECTRONICS

12in. **ALTHAM SPEAKER** with built-in tweeter. 3 ohm or 15 ohm 7,000 Gauss Magnet. Only **29/6**, postage 3/6.

L.S.H.75 ELECTROSTATIC TWEETER—2/6 with diagram.

HAYDON CABINET (17 x 15 x 8in.) designed to take a 12in. Heavy Duty Speaker. 50/-, postage 7/6.

ATTRACTIVE TWO-TONED CABINET, 11 x 6 x 5in., room for small amplifier, fitted with ex T.V. 5in. speaker. Only **19/6, post 2/6.**

The Famous **B.M.3 XTAL MICROPHONE** with neck lanyard, **32/6** table stand for above, 9/6 extra. Xtal Insert, 7/3.

GUITAR PICK-UP, complete with clip and screened lead. **15/-.**

3-WAY PUSH-BUTTON UNITS. Each button operates a 4-pole, 2-way switch. 4/6.

BARGAINS IN TRANSISTORS. Mullard RF Packs, OC44, two OC45, 12/6; AF Packs, OC81D, two OC81, 12/6; OC44, 3/6; OC45, 3/-; OC71, 2/6; OC72, 3/-; OA81 diode, 2/3; AF115, 6/6; AF117, 6/6; ORP12 Light Cell, 7/6; OC29, 12/6; OC35, 12/6.

TRANSISTOR ELECTROLYTICS. 1, 2, 4, 5, 6, 10, 16, 32, 50 100mFd —all at 15 volts. 1/3 each.

McMICHAEL TELESCOPIC TV AERIAL, 23in. extends to 45in. Fitted with co-ax plug will suit any set. Only 7/6.

CARTRIDGES. Acos 67-1G Low Output, 67-2G Medium Output GP59-5 High Output, Garrard GC2 or GC8, all with mounting brackets, 15/-. Ronette Stereo with mounting bracket, 25/-.

EARPIECES with cord and 3.5 mm. plug. 8 ohm magnetic, 3/-; 250 ohm, 4/-; 180 ohm magnetic with clip, 6/6; Xtal, 4/-.

3.5 mm. plugs with nice long shank, complete with jack, 3/-.
3.5 mm. plugs with nice long shank, complete with jack, screened 4/-.

TOGGLE SWITCHES. Single pole with on-off plate. 2/6.

NEON PANEL LIGHTS. 240c A.C. Arcolectric. 2/6.

TERMS: C.W.O. OR C.O.D.

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92 MITCHAM ROAD, TOOTING, S.W.17

Phone: BALham 3984

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Electronics Centres throughout Great Britain

CHASSIS BARGAIN

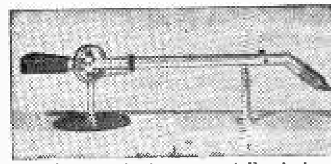
A 6 valve Superhet Radiogram Chassis of outstanding quality covering MW 200/550 Metres. LW 1200-2000 Metres. VHF 87-100 Mc/s.

Incorporating internal Ferrite Rod Aerial and the famous Gorler Tuning Heart for VHF Pick-up input suitable for most modern Record Players. Power output 4 watts, valve line up EZ80, EABC80, EF86, ECH71, EL84, ECC85. Volume On/Off and Tone Control, attractive black Tuning Dial size 15 x 6in. with gold lettering and contrasting cream and gold knobs. A.C. 200/250 v. Size 15 x 7¼ x 6¼in.

PRICE **16 Gns.** P. & P. 5/-. Or £3.9.0 deposit (plus P. & P.) and monthly payments of 32/8.

OUTSTANDING PRICE REDUCTION

THE B. & O. ST/M PICKUP COMPLETE WITH SP 11 STEREODYNE MAGNETIC CARTRIDGE



A Transcription Pickup of outstanding quality employing a specially designed counter balanced and unique weight adjustment.
Specifications: Length 10¼in. from tip of Cartridge. Height 2¼in.
Stereo/Mono Cartridge.
Frequency Response: +2.5dB from 30 c.p.s. to 15 Kc/s.
Output Voltage: 7mV per channel at 5 cm/sec. at 1000 c.p.s.
Separation: 20dB minimum.
DC Resistance: 1250 ohms.
Inductance: 200mHs.
Recommended Tracking Force: 2 to 4 grams.
Compliance: 5 x 10÷6 cm/dyne in all directions.
Stylus: Diamond, radius of curvature: 7th.
Recommended Load: 47000 ohms.

PRICE **9½ Gns.** Plus 3/6 P. & P.

THE HE-30 4-BAND COMMUNICATION RECEIVER

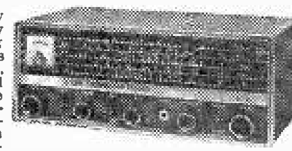
One of the finest general coverage bandspread Receivers available at this price. Covering 550Kc/s—1600Kc/s, 4.8Mc/s—14.5Mc/s, 1.6Mc/s—4.8Mc/s, 10.5Mc/s—30Mc/s. Illuminated slide rule dial, calibrated every 5Kc/s on 80 and 40 metres. Edgewise S-meter, 0-100 logging scale, coverage from 9.55—30Mc/s. 8 valve plus Rectifier superhet circuits. RF stage with an Aerial Trimmer. 2 IF Stages. B.F.O. control Q-multiplier. Controls: Function Switch, Audio Gain, Selectivity (Q-multiplier) Frequency (BFO), Band Selector, IF Gain Trimmer. AVC-MVC Switch. Anl Switch. Main Tuning. Bandspread Tuning and Head phone Jack. Selectivity—60dB at 10Kc/s. 0.8Kc/s at 6dB (with Q-multiplier) IF-455Kc/s. External PM Speaker reqd., 4 or 8 ohms impedance. Output 1.5 watts, 8 modern Miniature B7G Base Valves and 5Y3 Rectifier. Size 15 x 10 x 7½in. Grey crackle finish. 220/240 volt A.C. mains. 50/60 cycle operation. Full instructions and circuit diagram supplied. Send S.A.E. for leaflet.

PRICE **40 Gns.** Carriage Paid

THE HE-30 COMMUNICATION RECEIVER (KT320). now available in sub-assembled form. All I.F. Transformers and coils are factory aligned and therefore only require peaking when receiver is assembled. Full easy-to-follow instructions supplied.

32 Gns. Post Paid

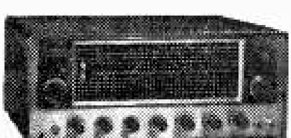
THE HE-40 4-BAND COMMUNICATION RECEIVER



Completely built and ready to go. High sensitivity Superhet receiver covering 550Kc/s—1,600 Kc/s, 1.6 Mc/s—4.4Mc/s, 4.4Mc/s—11Mc/s, 11Mc/s—30Mc/s. Electrical Bandspread tuning. Slide rule type tuning dial. Internal ferrite rod aerial for medium waveband reception and 1 59in. 10 section chromium plated telescopic whip aerial for the short wavebands. Sockets for optional outdoor aerial, internal high flux monitor loudspeaker. Latest modern miniature B7G base valves. Headphone socket (may also be used for external loudspeaker). ANL, BFO, built-in "S" meter. 220/240 /volt A.C. mains. 50/60 cycle operation. Handsomely styled cabinet with grey crackle finish and handsome front panel, with chrome and satin chrome fittings. Measures 13¼in. x 8½in. x 5½in. (high) and weighs only 11¼lb. A comprehensive instruction manual is supplied. An ideal receiver for the radio amateur and short wave listeners of all ages. Send S.A.E. for leaflet.

PRICE **£24.15.0** Carriage Paid

THE NEW HE-80 COMMUNICATION RECEIVER



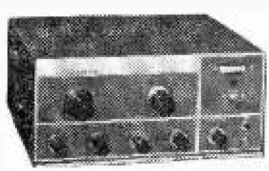
The HE-80 has outstanding sensitivity 0-100 logging scale for instant re-set, built-in "S" meter special recording Jack, remote Control Socket allowing simultaneous control with transmitter. 100Kc crystal oscillator circuit providing accurate harmonic signals of either 4 or 8 ohms impedance. Two headphone sockets one high, one low.

TECHNICAL SPECIFICATIONS.

Frequency Coverage: Band 1 540—1605Kc/s; Band 2 1.6—4.8Kc/s; Band 3 4.8—14.5Mc/s; Band 4 10.5—30Mc/s; Band 5 144—146Mc/s. **Band Spread (Ham Band directly read):** 80 Metre Band; 40 Metre Band; 20 Metre Band; 15 Metre Band; 10 Metre Band. **Sensitivity:** 1 microvolt for 10dB signal to noise ratio. **Selectivity:** Normal 10Kc at —75dB, 1.25 at—6dB. With Q-Multi: variable to 700 c.p.s. at 6dB. **Operation:** AM, SSB, CW and FM. AM diode detector. SSB/CW product detector (BFO). FM gated beam detector. **Power Source:** 240 volts 50/60 Cycles A.C. **Power Consumption:** 60 watts. **Audio Output:** 1.5 watts, 8 or 500 ohms impedance. **Auxiliary Circuit:** Electrical Bandspread. Q-Multiplier, ANL, AVC-MVC, BFO. 100Kc crystal calibrator. **Valve Line-up:** 4—6AQ8, 6BL8, 3—BA6, 2—6BE6, 6AL5, 6AQ5, OA2, 6CA4. **Dimensions:** 17in. wide, 6½in. high, 10in. deep.

PRICE **59 Gns.** Carriage Paid

"STARFLITE" TRANSMITTER



Designed to meet the needs of most amateurs the Starflite has single-knob bandswitching, front panel switch to select any of five crystal positions with provision for an external VFO. Controlled carrier modulator permits almost 100% of the CW input to be used on AM peaks. Grid-block keying provides chirp-free operation. A full wave silicon diode power supply effects extremely low output ripple for cleaner CW transmission, electron-coupled Pierce Oscillator, capacitance bridge neutralisation of the final and a three-stage lowpass filter. An illuminated edgewise D'Arsonval panel meter. Pi-network output provides the correct impedance match between the plate circuit and any 50-72 ohm co-axial feeder. Easy to follow point-to-point instructions supplied with each set of components. When constructed the Unit is housed in a heavy gauge steel Cabinet finished in grey crackle.

SPECIFICATIONS: Power input—20 watts peak; Operation: C.W., AM Phone—crystals or VFO Control; Band coverage: 80-10 metres; Coupling: Pi-network; Valve Line-up: 6146, (2) 6CL6, 12AX7, 6DE7, Low Pass Filter. Size 13½in. wide x 12in. deep (inc. knobs) x 6½in. high (inc. rubber feet). Weight 28lb. Power requirements, 200/240 v. 50/60 c.p.s. 225 watts.

MAY BE BUILT FOR **35 Gns.** Carriage & Insurance 15/-

SEE FOLLOWING PAGES FOR ADDRESSES AND OTHER ITEMS

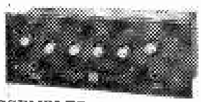
STERN-CLYNE

Electronics Centres throughout Great Britain

MULLARD 2-VALVE PRE-AMLIFIER TONE CONTROL UNIT

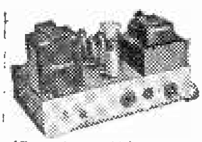
Employing two EF86 valves and designed to operate with the Mullard AMPLIFIERS but also perfectly suitable for other makes with input up to 250 mV.
★ Equalisation for the latest R.I.A.A. characteristics. ★ Inputs for Crystal Pickups and variable reluctance magnetic types. ★ Input (a) Direct from High imp. Tape Head. (b) From a Tape Amplifier or Pre-Amplifier. ★ Sensitive Microphone Channel. ★ Wide range BASS and TREBLE Controls.
KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£9.10.0** (Carr. & Ins. 5/-).
Instruction book and detailed price list (free with kits) available separately at 2/- Post Free.

MULLARD 3-VALVE PRE-AMLIFIER TONE CONTROL UNIT



Designed mainly for Mullard Range of Amplifiers, also suitable for any Amplifiers requiring input up to 250mV. incorporates 5 input Channels, including for Tape and Magnetic Pickups. Separate Bass and Treble controls. High pass filter 20 to 160 c/s. low pass filter 5-9 Kc/s. Totally enclosed in case Size 11½ x 4½ x 4½.
KIT OF PARTS **£10.0.0** (Carr. & Ins. 5/-). ASSEMBLED & TESTED **£13.13.0**
Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

MULLARD "5-10" MAIN AMPLIFIER

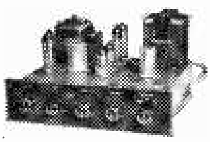


For use with MULLARD 2 or 3 valve pre-amplifiers with which an undistorted power output of up to 10 watts is obtained SPECIFIED COMPONENTS and MULLARD VALVES including PARTRIDGE MAINS TRANSFORMER and choice of PARMEKO or PARTRIDGE Output Transformer.
COMPLETE KIT (Parmeko Output Trans.) **£10.0.0**
ASSEMBLED AND TESTED **£13.13.0**
(Carr. & Ins. 6/6).
ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0. extra.
Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

COMBINED PRICE REDUCTION

MULLARD 5-10 Main amplifier and 2 valve Pre-Amp. Kit £15.15.0. C. & I. 8/6. Built and tested. £21.10.0. C. & I. 8/6.
MULLARD 5-10 Main Amplifier and 3 valve Pre-Amp. Kit £19.10.0. C. & I. 8/6. Built and tested. £25.10.0. C. & I. 8/6. With Partridge Transformer £1.6.0 extra.

THE MULLARD 5-10RC AMPLIFIER

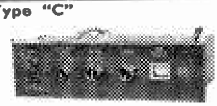


The popular complete "5-10" incorporating Passive Control Unit providing up to 10 watts high quality reproduction with input of 600mV. Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMEKO or PARTRIDGE Output Transformers. Surplus power available for Tuner.
COMPLETE KIT **£12.0.0**
ASSEMBLED and TESTED **£16.0.0** (Carr. & Ins. 7/6). With PARTRIDGE OUTPUT TRANS. £1.6.0 ex.
Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

THE MULLARD 3-3RC

A HIGH QUALITY AMPLIFIER DEVELOPED FROM THE VERY POPULAR 3-WATT MULLARD "3-3" DESIGN.
KIT OF PARTS **£8.8.0**
ASSEMBLED AND TESTED **£11.10.0** (Carr. & Ins. 6/6).
Complete to the MULLARD specification including PAMEKO OUTPUT TRANSFORMER. Switched inputs for 78 and L.P. records plus a Radio position. Extra power to drive a Radio Tuning Unit is also available. Please state L.S. impedance.
Instruction book and detailed price list (free with kit) available separately at 3/- Post Free.

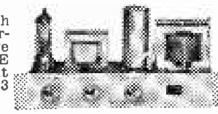
TAPE PRE-AMPLIFIER MULLARD Type "C"



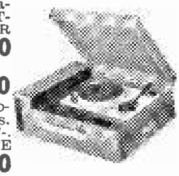
Suitable for most ½ track, Mono Tape Decks. Incorporates Ferrox-cube Push-Pull Oscillator. Treble Inductor and 3-sp. Equalisation. Includes separate Power Unit.
KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.10.0**
Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

SEE PRECEDING PAGE FOR OTHER STERN-CLYNE PRODUCTS

THE "MONO-GRAM"



A small Amplifier of genuine high quality performance. Incorporates MULLARD ECL86 Valve separate BASS and TREBLE controls. PARTRIDGE output Transformer producing up to 3 watts undistorted output.
KIT OF PARTS **£4.10.0** (Carr. & Ins. 3/6). ASSEMBLED **£6.0.0**
Instruction book and detailed price list (free with kit) available separately at 2/6 Post Free.

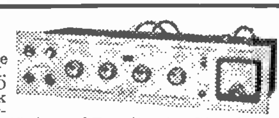


Perfectly suited for Portable Installations for which purposes we offer PORTABLE CASE (£3.10.0). the AMPLIFIER (Kit £4.10.0) and 8" x 5" SPEAKER (£1.0.0). All for **£9.0.0**
Alternatively with ASSEMBLED AMPLIFIER **£10.0.0** (Carr. & Ins. 5/-).
The Case quoted above will accommodate some 4-speed Single Record Units. A larger model is available for extra 10/-.
With this Equipment a COMPLETE PORTABLE RECORD PLAYER can be built for **£14.0.0**

MODEL CR3/S TAPE RECORDER

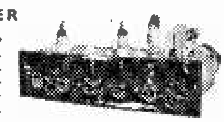
MODEL CR3/S incorporates the HF/TR3 Mk. II Tape Amplifier (described below) and the Collaro "Studio" Twin-Track 3-speed Deck operating at 1⅞in., 3¾in. and 7½in. speeds. Complete with microphones and 1,200ft. tape.
KIT OF PARTS **£33.0.0**
ASSEMBLED AND TESTED **£43.0.0**
(Carr. & Ins. 15/- extra).

STEREO TAPE PRE-AMPLIFIER



MODEL STP-1. For use with current TRUVOX. BRENELL or COLLARO "STUDIO" ½ and ¼ track Stereo Decks. Incorporates Ferrox-cube Oscillator, 4-speed Equalisation Signal Lever Meter and separate Gain Control. Includes separate Power Unit.
KIT OF PARTS **£22.0.0** Carr. & (Ins. 8/6) ASSEMBLED **£28.0.0**
Instruction book and detailed price list (free with kit) available separately at 5/- Post Free.

MULLARD TAPE AMPLIFIER MODEL HF/TR3/MK. II



Based on Mullard's Type "A" design and suitable for most ½ track Mono Tape Decks. Incorporates Ferrox-cube Treble inductor. Gilson Output Transformer, and 3-speed Equalisation. Includes separate Power Unit, using PARTRIDGE Mains Transformer.
KIT OF PARTS **£13.13.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.0.0**
Instruction book and detailed price list (free with kit) available separately at 3/- Post Free.

COMBINATION TAPE UNITS

All our Tape Units can be supplied specially matched to any Tape Deck such as Collaro, Brenell Mk.5 Series II. also the Wearite. Specimen prices as below.

	Kit	Assembled
STP-1 Pre-amp with Collaro Studio Tape Deck......	£36. 0.0	£42. 0.0
Assembled with track switch fitted, £44.2.0		
STP-1 with Brenell Mk. 5 Series II with Track Switch fitted	£68. 4.0	
STP-1 with Brenell Mk. 5 Series II, ¼ Track Deck....		£74.15.0
Type "C" Pre-amp with Collaro Studio Tape Deck....	£24.10.0	£30. 0.0
Assembled with deck wired and matched, £32.2.0		
Type "C" Pre-amp with Brenell Mk. 5 Series II Deck	£46.11.0	£53. 1.0
Assembled with deck wired and matched, £55.3.0		
HF/TR3 with Collaro Studio Tape Deck..........	£24. 3.0	£29.10.0
Assembled with deck wired and matched, £31.12.0		
HF/TR3 with Brenell Mk. 5 Series II Deck..........	£46. 4.0	£51.11.0
Assembled with deck wired and matched, £53.13.0.		

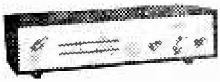
Carr. & Ins. 15/- on above units. Send S.A.E. for comprehensive price list.

SEND FOR CURRENT PRICE LIST OF ALL LEADING RECORDING TAPES AND ACCESSORIES

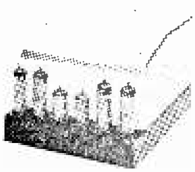
STERN-CLYNE

Electronics Centres throughout Great Britain

THE TUDOR STEREO HI-FI SYSTEM



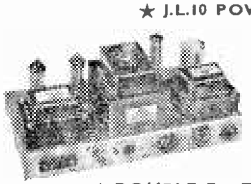
Comprising a Self Powered AM/FM Tuner. Stereo Pre-amplifier. 12 watt per channel Stereo Power Amplifier. The Tuner and Pre-amplifier are housed in matching black crackle finish metal cabinets for shelf mounting, with silver metal dials and matching knobs. Specifications: **Tuner:** Outstanding quality providing full VHF/FM long and medium waveband coverage, frequency range FM 87.5-108.5 Mc/s. AM/MW 522-1630 Kc/s. LW 145-270 Kc/s. 100 mV output mains supply 105/240 A.C. Valve line-up: ECC85, ECH81, EBF89, EB91, EM84, ECC83. Multiplex outlet provided. **Pre-amplifier**—Designed for use with Tudor Stereo Power Amplifier with inputs for most types of Pickups, direct play from Tape-Heads and ample sensitivity for either Crystal or Moving Coil Microphone. Distortion 0.1%, tape outputs 100 mV from 90 K ohm source inputs—Microphone 5 mV. Tape 5.3 mV. R.I.A.A. 4.3 mV flat 250 mV. Tuner 100 mV. Valve line-up: 2—EF86. 4—ECC83. **Power Amplifier.**—14 watts per channel, sensitivity 1 volt r.m.s. for 14 watts output, frequency response ±0.5dB 20 c/s. —20Kc/s. Speaker impedance 4, 8, or 16 ohms, surplus power available for Tape Pre-Amp. mains supply 105/240 v. A.C. Valve line-up: 2—ECC83, 4—EL84, 1—GZ34.



AM/FM TUNER AVAILABLE AT 24 GNS. P. & P. 7/6.
STEREO PRE-AMPLIFIER AND POWER AMPLIFIER TOGETHER AT 24 GNS. P. & P. 10/-.

DUE TO PRODUCTION STREAMLINING WE ARE PLEASED TO ANNOUNCE REDUCTIONS IN PRICE!

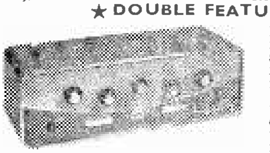
★ J.L.10 POWER AMPLIFIER



Incorporates the latest triode-pentode ECL86 valves in push-pull, PARTRIDGE ultra linear output transformer. PARTRIDGE mains transformer and smoothing choke. 10 watts power output, surplus power available for tuner. Output impedance 3—7.5—15 ohms.

KIT OF PARTS **£10.0.0** C. & I. 7/6
READY BUILT **£13.13.0**

★ DOUBLE FEATURE PRE-AMPLIFIER

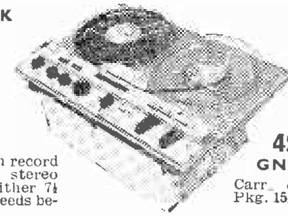


Inputs for microphone, crystal or magnetic pickups, tuner unit, and in addition offers full facilities for tape recording and high fidelity replay. This unique feature means that should you wish to include tape in your hi-fi system at a later date all that is required is a suitable tape deck. Push-button switching for 3 tape speeds equalised. Tape erase Bias Oscillator circuit incorporating ferrox-cube transformer. Function switch, separate base, treble and volume controls, level control and latest EM87 magic eye level indicator. The pre-amplifier is totally enclosed in a silver hammer finish steel case, and an attractive perspex front panel completes the presentation.

KIT OF PARTS **£13.13.0** READY BUILT **£19.19.0** C. & I. 5/-
PRICES: If both above units are purchased together;
KIT OF PARTS **£23.13.0** READY BUILT **£32.0.0** C. & I. 10/-

SEND STAMP FOR COPY OF OUR INTERESTING LITTLE BOOKLET **"What is High Fidelity?"**

STEREO TAPE-DECK WITH BUILT-IN PRE-AMPLIFIER

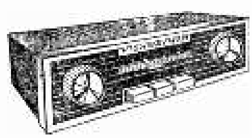


A professional addition to your Hi-Fi Stereo System consisting of two basic units, the Tape Deck and Pre-amplifier, which employs 4 Transistors and 4 Valves. The Unit with record and playback ¼ track stereo or ¼ track mono at either 7½ i.p.s. or 3¾ i.p.s. both speeds being fully equalised.

42 GNS Carr. & Pkg. 15/-

Features: Track System: ¼ track 2 channel stereo or monaural record and playback. Independent single channel recording on either channel while playback on other channel. Head Type: ¼ track 2 channel inline stereo and associated erase heads. Low loss laminated pole pieces. Level indicators: 2 Meters, 1 per channel. Digital Counter: 3 digit tape position indicator. Automatic Stop: When tape runs out or breaks. Inputs: Microphone 1mV (50K. ohms impedance) Gram/Tuner 50mV (high impedance). Output: (cathode follower). Monitor Sockets: 2 x 5 K. ohms impedance. Audio Output: 500mV. Oscillator: Push-pull 80 Kc/s. S/N Ratio:—45dB or better at 7½in. tape speed Separation: 45dB or more between stereo channels. Frequency Response: 40 to 15,000 cycles per sec. at 7½ i.p.s., 40 to 9,000 cycles per sec. at 3¾ i.p.s. Single Motor: 4 pole heavy duty induction type. Power Supply: 240v. A.C. 50 cycles. Size 6½ x 10½ x 15in. Tape Size: Up to 7in. Line up: 4—2SB173 Transistors, 2—12AT7, 1—1AU7, 1—12BH7 Valves.

THE 'HIGHWAYMAN'



OUR QUALITY CAR RADIO TO BUILD YOURSELF AT A NEW LOW PRICE

Look at these features:

★ Attractive styling. ★ Push-pull output. ★ Three latest Mullard transistors plus valves types EBF83 and ECH83. ★ No Buzz, high output and sensitivity. ★ Printed circuit (latest type), 7 x 4in. high flux p.m. speaker and baffle. ★ Medium and Long Waves. ★ Push button for fingertip control. ★ Extremely low battery consumption (less than ½-amp). ★ Easy to fit any make car (Positive earth only). ★ 12-volt operation ★ Compact size, measures only 7 x 7 x 2in. deep. ★ Easy assembly, supplied with dial and drive already mounted.

Special inclusive price of ONLY **£7.19.6** Plus 5/- P. & P.

All parts available separately. Individually priced parts list and comprehensive instruction booklet 2/6 post free. (Deducted from cost if complete parcel purchased later).

Optional extras, 3 section chromium plated weatherproof telescopic aerials type 1 17"/41", 19/6; type 2, 2"/43", 29/6. both plus P. & P. 2/6 if purchased separately.

ACOS MONAURAL STETHOSCOPE HEADSETS

Suitable for Tape Recorders, or monitoring tape recorders 100 ohm impedance magnetic. Complete with lead. (Originally 21/-). OUR PRICE **12/6** P. & P. 1/6

NEWS FLASH!!

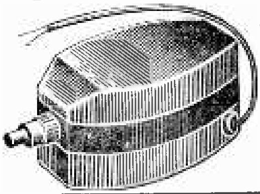
YET ANOTHER NEW ELECTRONICS CENTRE
OPENING SHORTLY AT
125, THE MOOR, SHEFFIELD

WEST END:	18 Tottenham Court Road, W.1.	MUSeum 5929/0095	Half-day Sat
(Premier Radio)	23 Tottenham Court Road, W.1.	MUSeum 3451/2	Half-day Thurs
(Premier Radio)	309 Edgware Road, W.2.	PADdington 6963	Half-day Thurs
CITY:	109 Fleet Street, E.C.4.	FLEet St. 5812/3	Half-day Sat
NORTH LONDON:	162 Holloway Road, N.7.	NORth 7941	Half-day Thurs
SOUTH LONDON:	9 Camberwell Church Street, S.E.5.	RODney 2875	Half-day Thurs
CROYDON:	12 Suffolk House, George Street.	MUNicipal 3250	Half-day Wed
BRISTOL:	26 Merchant Street, Bristol 1.	Bristol 20261	Half-day Wed
LIVERPOOL:	52 Lord Street, Liverpool.	Royal 7450	
MANCHESTER:	20/22 Withy Grove, Manchester 4.	BLAckfriars 5379	Open 6 days a week

Mail Orders and enquiries to Dept. P.W. 3/5 Eden Grove, Holloway, London, N 7.

THE "INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER 200/250 v. A.C.

35/-



Leaflet S.A.E.

PLASTIC RECORDING TAPE

		Spare Plastic Reels
Double Play	7in. reel, 2,400ft. 42/-	
	5in. reel, 1,200ft. 25/-	
Long Play	7in. reel, 1,800ft. 22/6	3in. 1/6
	5¾in. reel, 1,200ft. 17/6	4in. 2/-
	5in. reel, 900ft. 15/6	5in. 2/-
Standard	7in. reel, 1,200ft. 17/6	5¾in. 2/-
	5in. reel, 600ft. 11/6	7in. 2/6

"EASISPLICE" Tape Splicer 5/-. Leader tape 4/6: Splicing tape 3/-.

CRYSTAL SET BOOKLET 1/-.
CRYSTAL DIODE G.E.C. 2/-. GEX34, 3/-. OA81, 3/-.
HIGH RES. PHONES, 4,000 ohms, 15/-. 2,000 ohms, 12/6. MOVING COIL PHONES, 100 ohms, 10/-.
SWITCH CLEANER. Fluid squirt spout, 4/6 tin.

"6+1" TRANSISTOR RADIO
First class components to make a 6 transistor 2 waveband superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, *with car aerial coil*, printed circuit, 8½in. x 2¾in., but EXCLUDING Speaker and cabinet. **£4.5.0**
Speakers, 35 ohms, 6 x 4in., 21/-. 5in., 17/6: 3½in., 15/6.

BULGIN PLUGS AND SOCKETS. Non-reversible P74, 2-pin, 4/3; P73, 3-pin, 4/6; P194, 6-pin, 6/6.
JACKS. English open circuits, 2/6. Closed circuit, 4/3. Grundig type, 3-pin, 1/3. Grundig lead jack, 3/6.
JACK PLUGS. English, 3/-; Screened, 4/-; Grundig 3-pin, 3/6. Phono Plugs, 1/-; Sockets, 6d.
ALADDIN FORMERS and cores, ¼in., 8d.; ⅜in., 10d. 0.3in. Formers, 5937 or 8 cans TV1 or 2, ½in. sq. x 2½in., or ⅝in. sq. x 1¼in., 2/- with cores.
SLOW MOTION DRIVES. 6:1, 4/3. 36:1, 10/6.
SOLON IRON. 25W, 200V or 230V, 24/-.
ANTEX SUB-MIN IRON. 15w. 200 or 250v., 32/6.
BENCH STAND for above, 12/6. Spares in stock.
Paxolin Panels. 10 x 8 x $\frac{1}{16}$ in., 2/-.
Miniature Contact Cooled Rectifiers, 250V, 60mA, 7/6; 250V, 85mA, 9/6. **Selenium Rect.,** 300V, 85mA, 5/-. K3/25, 600V, 5mA, 5/-. RM4, RM5, 14A100, 14A116, 10/- each. FC31, 20/-. **TV etc. Silicon Sub-Min. Rectifiers,** 250V 450mA, 10/-; 250V 150mA, 5/6.

465 kc/s. SIGNAL GENERATORS
Price 10/6, ready made with valve 1S5. **POCKET SIZE** 2¾x4¾x1in. One resistor to change, full instructions supplied. Battery 8/6 extra. Details Free.

Coils Wearite "P" Type, 4/- each.
Osmor Midget "Q" type, adj. dust core, from 4/- each. All ranges. List S.A.E.
Repanco DRR2. L. and Med. T.R.F. with reaction, 4/6. Med. wave D.R., 3/6.
Ferrite Aerials, M., 8/9: M. and L., 12/6.
Osmor Ferrite Rod Aerials. L. and M. for transistor circuits, 10/- each.
Ferrite Rods, 8 x ⅜in., 6 x ¼in., 6 x $\frac{5}{16}$ in., 3/-.
H.F. Chokes, 2/6. **Osmor QC1,** 6/9.
T.R.F. Coils, A/HF, 7/- pair: HAX 3/6.
Screwdriver, 5in., 6d. **Test Prods,** 2/9 ea.
Neoside Trimming Tool, 1/9.
Neon Mains Tester Screwdriver, 5/-.
Multicore Solder, 4d. yd. **Dispenser,** 2/6.

Blank Aluminium Chassis, 18 s.w.g. 4 sides, riveted corners, lattice fixing holes, 2½in. sides, 7 x 4in., 4/9; 9 x 7in. 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6.
Aluminium Panels, 18 s.w.g., 12 x 12in., 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3; 8 x 6in., 2/-; 6 x 4in., 1/6.

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For 2 Track Collaro £11.11.0
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Collaro Studio 2 Track £10.15.0
BSR TD2 2 Track Tape Deck £7.5.0
Collaro Record/Erase Heads, ¼ track 35/- pair

MAINS DROPPERS. Midget adjustable sliders 0.3A, 1,000 ohms, 6/-, 0.2A, 1,200 ohms, 6/-; 0.15A, 1,500 ohms, 6/-; 0.1A, 2,000 ohms, 6/-.
LINE CORD. 3-way 100 ohm ft., 1/- ft.
MIKE TRANSFORMERS. 50-1, 3/9.
P.V.C. Covered Wire, single or stranded, 2d. yd. **Sleeving,** 1 or 2 mm., 2d.; 4 mm., 3d.; 6 mm., 5d. yd.

B.T.H. TAPE MOTORS. 115 v. A.C., 12/6 ea. or pair for 230 v., (in series) 12/6.

SPEAKER-FRET. Gold Maroon or Green Cloth 17 x 25in., 5/-; 25 x 35in., 10/-. **Tygan,** various colours 52in. wide from 10/-ft.; 26in. wide from 5/-ft. Samples 1/-. Expanded Metal, Gold, 12 x 12in., 6/-. Panel mounting fuse holder, 2/-. Fuses 1¼in. 60mA-5A, 6d. Insulated side cutters, 3/6. Bib Strippers, 3/6.

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NEW MULLARD TRANSISTORS
OC71 6/-, OC72 7/6, OC81D 7/6, OC81 7/6, OC44 8/-, OC45 8/-, OC171 10/6, AF117, 9/6.
Sub Miniature Condensers, 0.1 mFd, 30v., 1/3, 1, 2, 4, 5, 8, 16, 25, 30, 50, 100 mFd. 15 volt, 2/6 ea. Transistor Holders, 1/3.

SINCLAIR "SLIMLINE" RADIO
Med. wave kit, 2 transistors, 2 diodes, earphone, ferrite aerial. Cabinet 3 x 1¾ x ¾in., 49/6. No aerial required!

Transistor 4 Channel Mixer with 4 separate input/output controls 59/6.

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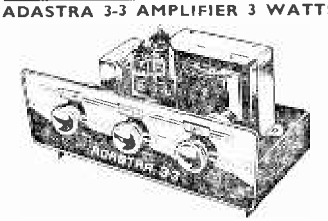
PM9 Mains Unit 9 volt for Transistor Radios. Same size as P.P.9 (200/250V.)
Miniature PP3 model 19/6

ADASTRA 3-3 AMPLIFIER 3 WATTS



A.C. 200-250V. Valves ECL86 and EZ80. 3 ohms output. Controls: bass, treble and volume. Separate front panel with de luxe finish. Quality mains transformer. Enamelled chassis 6in. x 5in. x 3in. Price £4.19.6. Details S.A.E.
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Complete with ACOS LP-78 Turnover Head. 20/-

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£5.15.0 (less cabinet) Post 5/-.
With 2-stage Amplifier; 3 watt; 2 valves, UCL82, UY85. High-flux 5in speaker; 4-speed E.M.I. Turntable, 16, 33, 45, 78 r.p.m.; Crystal Pick-up for LP/STD. Records, 7in., 10in., 12in.; Cut out Mounting Boards 12½ x 9½in.

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Size 1¾in. sq. Precision jewelled bearings, 2% accuracy, silvered dials, black numerals and fine pointers, zero adjustment screw on front of meter.

1 mA	27/6	50µA	39/6
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300V	27/6	"S" Meter	35/-

MOVING COIL MULTIMETER TK 20a 0-1000 v. A.C./D.C., ohms 0-100k, etc., 49/6. 0-150 ma. pocket size with 2 in. scale.

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ACOS 39-1 DE LUXE STICK MIKE 35/-
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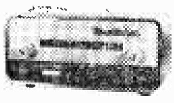
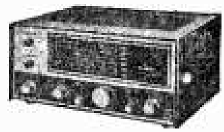




AMATEUR BANDS RECEIVER. Model RA-1. Covers all Amateur Bands from 160 to 10m. Special features incl. half lattice crystal filter, 8 valves, signal strength "S" tuning meter, tuned R.F. amplifier stage Kit **£39.6.6** Assembled **£52.10.0**

5W HI-FI MONO AMPLIFIER. Model MA-5. A low-priced well designed amplifier. Printed circuit construction makes it easy to build. Kit **£10.19.6.** Assembled **£15.10.0**

"COTSWOLD" HI-FI SPEAKER SYSTEMS. MFS or Standard. Range 30-20,000 c/s. Kit **£23.4.0.** Assembled **£30.15.0**

MONO CONTROL UNIT. Model UMC-1. Ideal for use with MA-12 or similar amplifier. Kit **£8.12.6.** Assembled **£13.12.6**

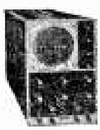
HI-FI EQUIPMENT CABINETS. Large range, in kit form or assembled and finished, incl. record housing range, available to meet various needs. Details on request. from **£7.7.0** to **£37.16.0**

6W DE LUXE AMPLIFIER. Model S-33H. An inexpensive Stereo-Mono amplifier, with high sensitivity Suitable for Decca Deram Cartridge. Kit **£15.17.6.** Assembled **£21.7.6**

6 TRANSISTOR PORTABLE. Model UXR-1. Prealigned I.F. transformers. Printed circuit, 7 x 4in. high flux speaker. Real hide case. Very easy to build. ... ... Kit **£12.11.0**

SHORTWAVE TRANSISTOR PORTABLE. Model RSW-1. Two short bands, trawler and medium wave ... Kit **£19.17.6**

HI-FI A.M./F.M. TUNER. Covers F.M. 88-108 Mc/s. A.M. 16-50, 200-550, 900-2,000m. Tuning heart (**£4.13.6** inc. P.T.) and I.F. Amp. **£21.16.6.** Printed circuit board. Total ... ... Kit **£26.10.0**



5in. OSCILLOSCOPE. Model IO-12U. Wide band amplifiers essential for T.V. servicing, F.M. alignment etc. T/B covers 10 c/s-500 kc/s in 5 ranges. Kit **£32.12.6.** Assembled **£41.10.0.** The ideal low-priced 'scope.

"OXFORD" DE-LUXE TWO WAVEBAND TRANSISTOR PORTABLE. Model UXR-2. The ideal domestic, car, or personal portable receiver. 10 Semi-conductors. Send for full details. **£14.18.0** Kit (inc. P.T.). Assembly can be arranged.

Assembled models also available: prices on request—Deferred terms available over £10. Free delivery U.K.

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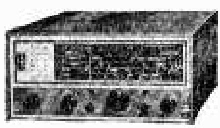
PA AMPLIFIER. Model PA-1. 50W output. For vocal and instrumental groups, guitars, etc. 4 inputs, 2 speakers, Tremolo. Send for full details. Kit **£54.15.0.** Legs optional extra 17/6 set. Assembled **£74.0.0.**

50W POWER AMPLIFIER. Model MA-50. Ideal for PA work etc. Kit **£19.18.0.** Assembled **£27.18.0.**



RG-1

COMMUNICATIONS TYPE RECEIVER Model RG-1. An excellent low cost receiver Freq cov.: 600 kc/s-1.5 Mc/s. 1.7 Mc/s-32 Mc/s. A two speed tuning drive. R.F "front end" supplied assembled, aligned and tested. Send for details Kit **£39.16.0.** Assembled **£53.0.0.**

2½in. PORTABLE SERVICE OSCILLOSCOPE. Model OS-1. An ideal light, compact 'scope for servicing and general work. Printed circuit construction. Kit **£21.18.0.** Assembled **£29.8.0**

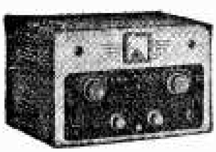
"MOHICAN" TRANSISTOR GEN-COVERAGE RECEIVER. Model GC-1U. An excellent portable for the short wave listener. ... ... Kit **£37.17.6.** Assembled **£45.17.6**

VALVE VOLTMETER. Model V-7A. Measures up to 1,500 v. (D.C. and r.m.s.) and 4,000 pk-to-pk. Res. 0.1Ω to 1,000 MΩ. Kit **£13.18.6.** Assembled **£19.18.6**

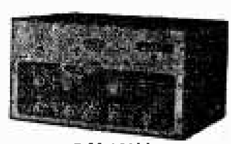
6W STEREO AMPLIFIER. Model S-33 3 w/chl Inputs for radio-tape-gram. Stereo/Mono, ganged controls. Sensitivity 200 mV Kit **£13.7.6.** Assembled **£18.18.0**

MULTIMETER. Model MM-1U. Ranges 0-1.5 v. to 1,500 v. A.C. and D.C. 0-150μA—15A D.C. 0.2Ω to 20MΩ 4½ in. 50μA meter. ... ... Kit **£12.18.0.** Assembled **£18.11.6**

R.F. SIGNAL GENERATOR. Model RF-1U. Up to 100 Mc/s fundamental, 200 Mc/s on harmonics. Up to 100 mV output all bands. ... ... Kit **£13.8.0.** Assembled **£19.18.0**



NEW MODEL!
TELEVISION ALIGNMENT GENERATOR. Model HFW-1. Accurate alignment of TV receivers achieved in minimum time at low cost. Covers 3.5 to 220 Mc/s fundamentals.
ONLY **£30.15.0.** Kit. **£44.10.0** Assembled



DX-100U

AMATEUR TRANSMITTER Model DX-40U. Self-contained. 80-10 m. Power input 75 w. CW., 60 w. peak C.C. phone. Output 40 w. to aerial. Prov. for VFO Kit **£33.19.0.** Assembled **£45.8.0.**

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Practical Wireless

Vol. XL No. 692 OCTOBER, 1964

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Contents

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 if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*

Good Response

TO trim, or not to trim? That is the question that must have been asked a million times in radio shack or workshop, or the corner of the kitchen table.

A lot of nonsense has been talked about the unforgiveable sin of "twiddling the trimmers". The imputation is that the average radio enthusiast is quite incapable of making tuning adjustments. Such critics need an answer.

It would be foolish to ignore the fact that in the course of every year, many receivers find their way to the professional's service bench, hopelessly out of alignment due to inexpert and haphazard trimmer and core twiddling. Or that many gloomy hours are spent annually by home constructors in futile attempts to peak and calibrate newly constructed sets.

However, those that suffer in this way are usually raw novices, those with no contact with other amateurs, or those who with iron resolve refuse to put themselves out to learn a few elementary facts.

The majority of amateurs are unquestionably more competent and intelligent, and even if they do not have access to the proper test instruments they are able, under certain circumstances, to make adjustments to tune circuits without dire consequences.

When a receiver is known to be aligned—when it has been working, but a fault has developed—there is no objection to an exploratory movement of iron-dust cores and trimmers, provided a few obvious basic rules are observed.

First, cores or trimmers should be moved *one at a time*. If no improvement is noted, they should be returned to the original position before proceeding to the next. Second, a visual indication of output is very much better than trusting to the ear; more delicate adjustment is possible.

Third, where a set is completely out of alignment, the correct sequence of adjustments should be followed—and the possibility of an alternative fault should be investigated before re-tuning. A receiver that is known to be out of alignment, such as a newly-built model, should be aligned "according to the book".

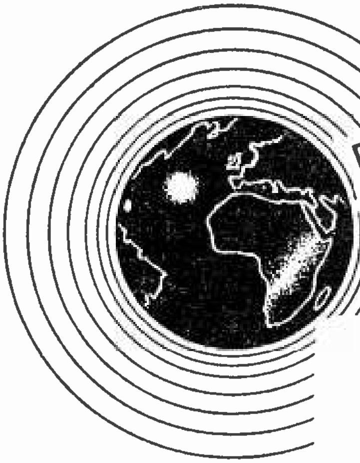
Now the critics must be well aware that most readers of magazines such as PRACTICAL WIRELESS are quite conversant with the above homespun rules. Why, then, their spleen?

It seems to be based on one main bad fault—the chewed-up slug or the trimmer with the cracked insulating washer. This is generally the result of using makeshift tools. Very seldom is it caused by the true enthusiast.

The only real restriction on trimming should be the necessity for test equipment when aligning those circuits that *must* be tuned to an exact response curve. A small movement of any one core of a TV or an f.m. receiver i.f. strip may seem to make little difference, but its effect on the overall response could be deceptively damaging.

We are sure that regular readers will know not only how but *when* to adjust a tuned circuit. And we hope that the trimming tools presented with this issue may prevent a few more slugs becoming chewed up or cracked!

Our next issue dated November will be published on October 7th



ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

Amateur Radio Contacts via the Moon

THE story of amateur radio reached another milestone recently, when radio amateurs in different countries achieved communication via the moon. Pairs of amateur stations have been using signal bounce off the moon to relay radio transmissions in the 2m and 70cm ham bands.

These experiments were undertaken with the new giant 300m radio telescope in Puerto Rico, soon after its completion. (This installation is from time to time being made available for such amateur experiments.) Several contacts have already been logged using this somewhat spectacular amateur set-up, the first being on 13th June, 1964, when KP4BPZ (Puerto Rico), using the giant telescope aimed at the moon as receiver antenna, received signals from a group of Swiss and German amateurs in Hedingen, near Zurich, and, some time later, signals beamed at the moon by the British station G3LTF (Peter Blair) running 80W into a parabolic aerial.

A further successful contact with Puerto Rico via the moon was established by the German station DJ3EN (Hinterzarten/Black Forest) on June 14th. On this occasion, DJ3EN ran 500W on the 2m band into a conventional ten-element Yagi aimed directly at the moon. By the time his signals had been received in Puerto Rico, they had travelled a distance of roughly half a million miles.

ELECTRONIC COMPONENTS CONFERENCE

A ONE-WEEK conference on components and materials used in electronic engineering will be held at the Institution of Electrical Engineres in London from 17th to 21st May next year, concurrent with the 1965 Radio and Electronic Component Show at Olympia.

Subjects to be discussed are recent developments in active and passive components, including integrated circuits, and in the materials of which they are made.

"Resistors", "dielectrics", "capacitors", "microwave ferrites", "electro-mechanical devices", "semi-conductor devices" are a few of the categories for which contributions have been invited for inclusion in the programme.

The conference is being organised jointly by the I.E.E. Electronics Division, the Institution of Electronics and Radio Engineers and the United Kingdom and Eire Section of the Institute of Electrical and Electronics Engineers.

450 Motorcycle Transceivers Ordered

FOLLOWING their successful introduction last year, an order for 450 Ultra 4A5 motorcycle transceiver sets for use by British Police Forces has been received by the Telecommunications Division of Ultra Electronics Limited from the Home Office.

The 4A5 set provides two-way communication on four channels with a standard spacing of 25kc/s. The single superhet receiver design is fully transistorised and uses a 10·7Mc/s i.f. crystal filter. The transmitter, now further transistorised, incorporates quick-heating valves to eliminate standby battery drain. It operates on 6 or 12V supplies.

Ultra have also received an initial order for 26 of their f.m. 4B6 Packsets for use by the Metropolitan Police.

Computer for Scottish University

A LARGE general purpose analogue computer, type 247, costing approximately £19,000, has been ordered by the University of Strathclyde, Glasgow, from the Solartron Electronic Group Ltd., of Farnborough, Hampshire.

This is the fourth 247 computer to be ordered this year, the others having already been installed at the University of Sheffield and two technical colleges. The Glasgow computer will be installed in the Electrical Engineering Department and will be used for the investigation of automatic control systems and general research.

MULLARD INTRODUCE CIRCUIT MODULES FOR TRANSISTOR SETS

A RECENT innovation from Mullard Ltd., which could have the probable effect of standardising more than ever before the design of transistor receivers, is a range of transistor circuit modules for a.m. radios being made available to manufacturers, having the obvious advantages of faster, easier production and greater freedom in cabinet styling.

With these devices a manufacturer will be able to build a receiver around two modules—one constituting the r.f./i.f. section, the other the complete audio amplifier — instead of assembling individual components.

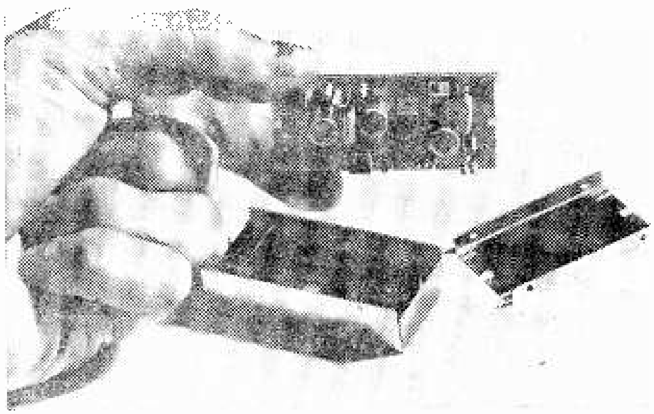
The r.f./i.f. module, type LP1156, is a fully-screened i.f. amplifier and mixer stage (see photograph on this page) covering the short, medium and long wavebands using external oscillator coils. (Other versions are available for medium and long wavebands only, using internal oscillator coils, but all versions measure the same: 2·44in. x 1·19in. x 0·64in.) The mixer stage uses an AF115 transistor and the two stages of i.f. amplification use AF117's, followed by a diode detector (OA90).

The whole module is designed to operate from a 7·6V supply line derived from the audio module.

This latter, type LP1153, is an a.f. amplifier giving an output of 500mW into a 10Ω loudspeaker. It is designed to operate from a 9V supply and it measures 2·01in. x 1·27in. x 1·08in.

The circuit uses an LFK4 transistor package and comprises a d.c.-coupled preamplifier stage and a complementary output stage. Overall d.c. feedback of 10dB is applied to stabilize the working condition and approximately 10dB of a.c. feedback reduces distortion and gain spreads.

To simplify manufacture further, the r.f./i.f. module comes pre-aligned, so reducing the alignment procedure of the complete receiver. In addition fault-finding by the set maker is virtually eliminated since both types of module are given stringent quality control tests during manufacture. Servicing is also simplified, the replacement of a module taking a few minutes only.



Mullard's new r.f./i.f. circuit module.

V.H.F. RELAY STATION IN FORFAR

THE BBC's new television and v.h.f. sound relay station for Forfar, which was brought into service earlier this year, is situated at Harecairn, near Monikie, Dundee. From here it serves an area including southern Angus, northern Fifeshire and small areas of eastern Perthshire and southern Kincardineshire, with transmissions of BBC-1 television and the three v.h.f. sound programmes.

The television transmissions are on channel 5 (vision 66·75Mc/s, sound 63·25Mc/s with vertical polarisation, with the Scottish Home Service on 92·7Mc/s, the Light Programme on 88·3Mc/s and the Third Programme/Network Three on 90·5Mc/s, all with horizontal polarisation.

New Radio Station in British Honduras

A NEW h.f. radio station is to built in British Honduras for Cable and Wireless Ltd., near the city of Belize. It will cost in the region of £100,000 to build and take about 18 months to complete.

The station will be built on a site at Pine Ridge and when finished will comprise two separate buildings, about 800 yards apart, for housing transmitters and receivers, the transmitters being remotely controlled from the receiver building.

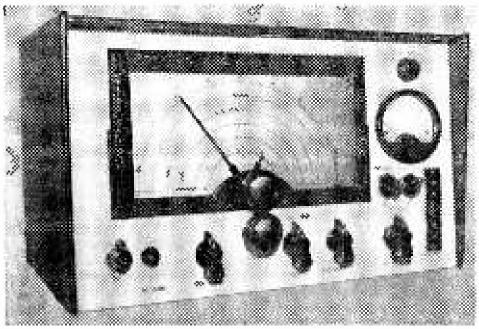
Belize is one of the youngest branches in the world-wide telecommunications network of Cable and Wireless Ltd., and its associated companies. Opened in April, 1962, it faced many difficulties as a result of the devastation caused by hurricane "Hattie", which struck Belize on October 31st, 1961.

A temporary wireless station set up in 1958 was destroyed and much of the equipment lost. An emergency station was set up while negotiations for the company to take over the external telecommunications of British Honduras continued with the Government.

The damage caused by flooding during hurricane "Hattie" emphasised the vulnerability of sites in the city of Belize and it was decided that the new station would be erected further inland on higher ground.

Four transmitters of 1kW each, and five receivers will be installed in the station. A link between the new station and the Central Telegraph Office in Cattouse Building, Belize, will be established by a mutli-channel v.h.f. link.

THE "TEN-FIVE"



A 10-transistor double-conversion communications receiver

• s-meter • • b.f.o. • • mains powered •

BY A. S. CARPENTER G8ABG

NOW that suitable ready-made coils are available it is possible to construct an excellent Short Wave transistorised receiver possessing a high degree of sensitivity.

The receiver to be described was built primarily to provide signals in the various Amateur bands; it requires no valves and may be run either from a standard 9V dry battery or from the domestic mains supply at 220-240V a.c.. The semi-conductor complement comprises ten transistors and five diodes, two of which are used for a.c. rectification purposes in the mains power supply section.

The receiver is not inexpensive to construct and a fair amount of work is also involved since the design is moderately complicated. Other requirements in the workshop are: A suitable signal generator, a soldering iron fitted with a pencil bit, time, patience—and a pair of strong tweezers!

Sections of the Receiver

The block diagram of Fig. 1 shows the various sections and it will be observed that the "double conversion" principle is employed, for as is well known this technique proves most beneficial on the higher frequency bands. A tuned r.f. stage is also included and this ensures high gain whilst also acting as a buffer stage against oscillator radiation, via the aerial system.

The primary coverage afforded by the tuned section is 1·67—31·5Mc/s (9·5—180 metres) with additional optional coverage of 0·175—1·545Mc/s (194—1700 metres.) These additional ranges are rarely likely to be needed here, however, since they are more easily and conveniently covered using a conventional portable domestic medium/long waveband transistor receiver.

Mechanical bandspreading is provided for the tuned sections via the familiar Jackson "Caliband" drive, this providing by means of its two pointers reduction ratios of 6 and 48 : 1. Although adequate bandspreading is achieved even on the highest frequency ranges a small panel fitted device—to be described later—is also included, this being most useful for minimising interference caused by an adjacent station.

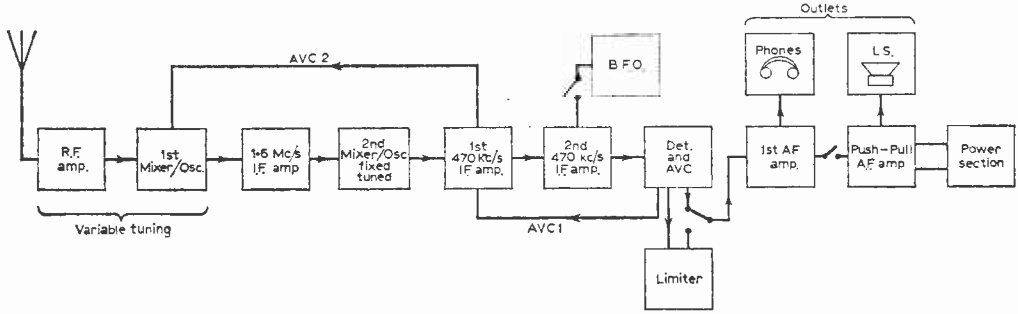


Fig. 1: Block diagram representation of the "Ten-Five" circuit.

It may be noted too that a beat frequency oscillator (b.f.o.) is also fitted together with a "pitch" control to vary the beat note. In addition, the b.f.o. may also usefully be employed in conjunction with the "Pitch" control to make single sideband (s.s.b.) transmissions intelligible.

A signal/tuning meter is fitted and operated by the receiver a.v.c system and because the a.v.c is made inoperative when the b.f.o. is in use the meter pointer reads full scale. In a permanent battery-powered construction it might then be beneficial to arrange for the meter to monitor the applied battery potential but this service was not needed in the prototype due to use of an a.c. mains power unit.

Outlets

Both phone and speaker outlets are provided on the front panel and may be selected as required by means of a switch. The phone outlet is high impedance whilst the "LS" outlet is low impedance and assumes use of an externally connected 3Ω unit. Some 500mW of audio is available under normal circumstances via the loudspeaker. The phones may be left connected or may be removed as required without in any way affecting the receiver.

Consumption

The total quiescent current drain from a 9V supply is 12mA when the speaker outlet is in use but falls to 5mA on phone because the output stages are switched out. Bringing in the b.f.o. adds 0·6mA (600μA) and may be considered negligible. Current consumption changes very little at any time when on phone but if the speaker is in use the demand varies with the signal strength and volume as is usual in push/pull systems of the type employed. The consumption can easily rise to 45mA or more on peaks so the mains transformer supply is obviously preferable on both regulation and replacement counts. The output stage could then be advantageously allowed a larger quiescent current drain. For general phone use, however, a battery is quite satisfactory and a reasonable life can be expected.

Bandchanging

The simple "plug-in" method is employed and because the converter section is fitted with an r.f. stage three coils have to be changed for each band. A total of three sets (nine coils) covers the ranges envisaged so the problem is not very serious.

Each coil is clearly colour coded and fits a standard noval 9-pin valve holder. "Padder" connections present no problem either, for on each coil this connection is brought out to a different pin so that if the holder is appropriately wired the correct padding capacitance is automatically connected for each oscillator coil. Details relating to this and to ranges covered, etc., are given below.

TABLE 1

Blue and Yellow Coils T1—T2					White coils T3				
Maker's range No.	Ls μH	Coverage Mc/s	Coverage Metres	"Q"	Lo	C9	pin	Cto	Copi
1	2350	0·175–0·525	570–1700	60	156	50	6	35	20
2	271	0·515–1·545	194–580	100	66	110	2	20	10
3	27·2	1·67–5·30	57–180	60	13·6	340	3	11	10
4	2·9	5–15·0	20–60	90	2·22	960	4	4·5	—
5	0·65	10·5–31·5	9·5–28	110	2·35	2000	6	1·5	—*

Aerial Coils—Blue, T1. Interstage Coils—Yellow, T2. Oscillator Coils—White, T3.

Ls —Nominal inductive value of tuned winding. (Approximately 15% variation obtainable via dust core).

'Q' —Approximate 'Q' value of tuned winding—mid scale tuning point.

Lo —Nominal inductive value of oscillator tuned winding.

Cq —Padder capacitance value required.

Cto —Oscillator pF trimmer capacitance extra to 39pF assumed circuit capacitance.

Copi —Additional fixed capacitance recommended across tuned winding as appropriate using plug-in band changing method. *Note:* panel fitted TC4 accomplishes this.

*Harmonic mixing used on this range, the second harmonic being automatically present at alignment.

Note that Table 1 shows all coils available although only ranges 3-5 are likely to be required here.

CIRCUIT DESCRIPTION

Converter and 1st 1·6 Mc/s I.F. Amplifier

The converter, intermediate frequency stages, a.v.c., demodulating and limiting sections are shown in Fig. 2. (a) and (b).

The first two transistors, Tr1, Tr2 (AF115) are the active elements of the converter, Tr1 being the r.f. amplifier feeding Tr2 as mixer oscillator. Signals from the aerial are here converted to the 1st intermediate frequency, viz., 1·6Mc/s and since no direct pick-up at this frequency is required a simple wavetrap is inserted in series with the aerial.

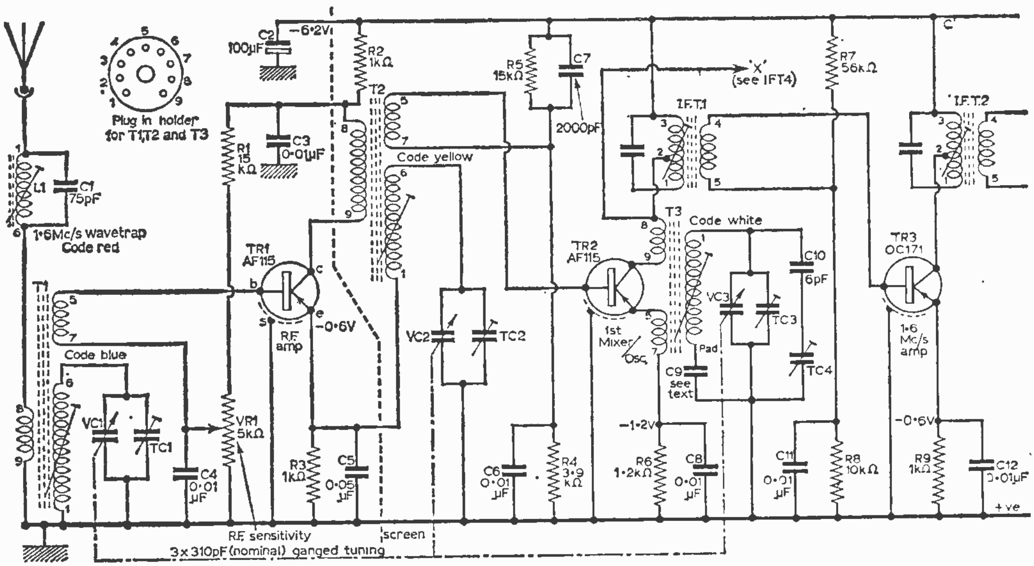


Fig. 2 (a): The r.f. amplifier, first frequency changes and 1·6 mc/s i.f. stages of the circuit.

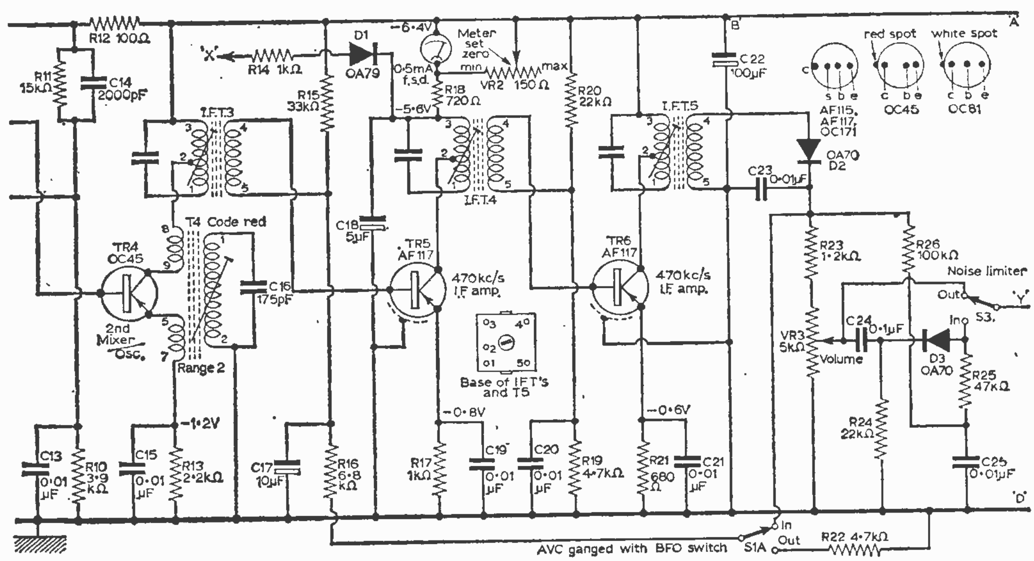


Fig. 2 (b): The second frequency changes, 470 kc/s i.f. amplifier and detector.

The coil (L1) used here is a range 2 (Denco) *valve* type, the quoted inductance value of which is 129μH for the main winding. This is roughly resonated at 1·6Mc/s by C1, fine adjustments being made using the variable core. A single winding high "Q", 1·6Mc/s filter coil could be used as an alternative.

The sensitivity of the r.f. stage is controllable to some extent by means of VR1 which is brought out to the panel. The control normally needs to be retarded when s.s.b. transmissions are being received but it has also been noted that the gain—as indicated by the signal meter—does not necessarily increase when VR1 is turned fully up. Sometimes the reverse is the case depending on the band in use and might be due to the transistor characteristics.

Coils T1, T2 and T3 are the plug-in types already referred to, each being tuned by a section of the 3-gang capacitor VC1/2/3 fitted with trimmers. The tuned sections of each transformer are coupled to the appropriate circuit by mutual inductance.

Signals at 1·6Mc/s appearing at Tr2 collector are next applied via a transformer to the base of Tr3 (OC171) for further amplification at this frequency, so increasing the need for the aerial trap.

Converter Trimming

Although variable r.f. trimmers, panel mounted, are feasible to compensate for errors due to band-changing, the first oscillator is controlled by means of TC4, labelled (Osc. Trim). In use it is assumed that the first stage is damped by the aerial so that it remains either to trim the interstage circuit to fit the oscillator or vice versa, the oscillator adjustment being preferred here since it helps compensate for C_{to} and C_{-opi}, Table I.

In practice TC4 is initially set to about half capacity and the tuning mechanism operated in the usual way to resolve a signal. Should this seem "pruned" away. C10 may also be made to limit maximum circuit capacitance as required.

Second Converter and 470kc/s I.F. Amplifier

When the 1·6Mc/s signals from Tr3 are applied to Tr4 a second frequency conversion takes place. The second i.f. amplifier operates at 470kc/s and because T4 can be fixed tuned the oscillator may operate at a frequency lower than that of the signal, i.e., at 1·13kc/s. The coil (code red—range 2) *must* be screened, using the can provided; it has a tuned winding, quoted inductance value of 129μH and so requires a capacitor of approximately 170pF across it, although in practice accurate setting is accomplished with its core. This second converter could be operated at 2·07Mc/s if preferred, but use of a different coil would be advisable to allow adequate shunt capacitance to be added whilst Tr4 would need to be an OC44.

The 470kc/s i.f. amplifier is conventional except that transistors from the Mullard "AF" range are used instead of the more usual OC45 types which would necessitate additional items in the form of neutralising components. All the i.f. transformers

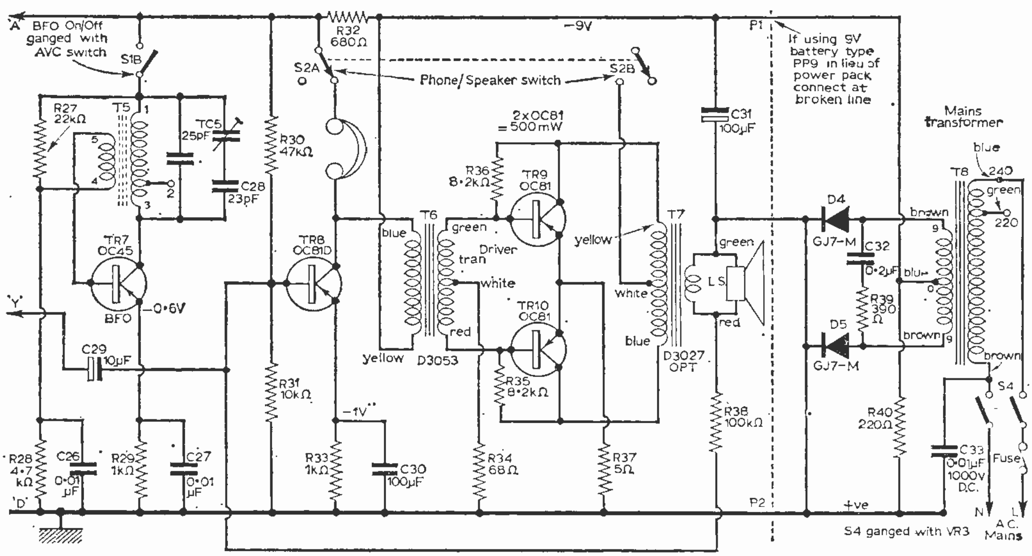


Fig. 2 (c): The b.f.o. and audio sections, plus the power supplies.

weak, the pointer mechanism is moved a fraction to one side of the transmission and TC4 experimentally adjusted. It is quickly evident which way the main pointer must go by watching the signal meter. TC4 is also useful for picking out a single transmission from a clutter, for losing adjacent c.w., etc., quality being unimportant. Sometimes a "returning" station is very slightly off frequency and TC4 is then particularly useful, for the main dial needs no alteration, both stations being heard in turn merely by moving TC4 to and fro. A large value capacitor must *not* be used for TC4 and the total number of vanes should be four, others being are single tuned and selectivity is quite good. The circled figures associated with all coils and i.f. transformers refer to their basing connections for which a key is provided (Fig. 2).

The signal meter in the collector circuit of Tr5 reads in reverse but this is not important. (It could, however, be mounted upside down to give a left to right needle movement but would require a new scale.)

As the bias varies at the base of Tr5 due to demodulator action, a large rectified signal tends to cut off the collector current thereby causing the meter pointer to fall back. The meter records

COMPONENTS LIST

Resistors:

R1	15kΩ	R21	680Ω
R2	1kΩ	R22	4·7kΩ
R3	1kΩ	R23	1·2kΩ
R4	3·9kΩ	R24	22kΩ
R5	15kΩ	R25	47kΩ
R6	1·2kΩ	R26	100kΩ
R7	56kΩ	R27	22kΩ
R8	10kΩ	R28	4·7kΩ
R9	1kΩ	R29	1kΩ
R10	3·9kΩ	R30	47kΩ
R11	15kΩ	R31	10kΩ
R12	100Ω	R32	680Ω
R13	2·2kΩ	R33	1kΩ
R14	1kΩ	R34	68Ω
R15	33kΩ	R35	8·2kΩ 5%
R16	6·8kΩ	R36	8·2kΩ 5%
R17	1kΩ	R37	5Ω
R18	720Ω	R38	100kΩ
R19	4·7kΩ	R39	390Ω
R20	22kΩ	R40	220Ω

All ± 10% $\frac{1}{2}$W miniature carbon, unless otherwise stated.

Potentiometers:

- VR1 5kΩ
- VR2 150Ω
- VR3 5kΩ with double-pole on/off switch (S4).

Coils and Transformers:

- IFT1 I.F. transformer. Denco IFT16
- IFT2 I.F. transformer. Denco IFT16
- IFT3 I.F. transformer. Denco IFT13
- IFT4 I.F. transformer. Denco IFT13
- IFT5 I.F. transformer. Denco IFT14
- T1 See Table 1; plug-in transistor coil. Denco (blue)
- T2 See Table 1; plug-in transistor coil. Denco (yellow)
- T3 See Table 1; plug-in transistor coil. Denco (white)
- T4 Miniature valve-type coil. Denco range 2 (red)
- T5 B.F.O. transformer. Denco IFT14
- T6 Driver transformer. Ardente D3053 (with clamps)
- T7 Output transformer. Ardente D3027 (with clamps)
- T8 Mains isolating transformer. Norcol or Osmor MT9
- L1 Miniature valve-type coil. Denco range 2 (red)

Variable Capacitors:

- VC1, 2, 3 310pF (nominal) 3-gang tuning capacitor with feet and trimmers (TC1, 2, 3). Jackson "F".
- TC1, 2, 3 Trimmers on VC1, 2 and 3.
- TC4 See text. Jackson "Air Tune".
- TC5 25pF. Jackson "Air Tune".

Capacitors:

- C1 75pF mica
- C2 100μF electrolytic 12V
- C3 0·01μF ceramic or paper
- C4 0·01μF ceramic or paper
- C5 0·05μF paper
- C6 0·01μF ceramic or paper
- C7 2,000pF mica
- C8 0·01μF ceramic or paper
- C9 see Table 1
- C10 6pF see text
- C11 0·01μF ceramic or paper
- C12 0·01μF ceramic or paper
- C13 0·01μF ceramic or paper
- C14 2,000 pF mica
- C15 0·01μF ceramic or paper
- C16 175pF mica
- C17 10μF electrolytic 6V
- C18 5μF electrolytic 12V
- C19 0·01μF ceramic or paper
- C20 0·01μF ceramic or paper
- C21 0·01μF ceramic or paper
- C22 100μF electrolytic 12V
- C23 0·01μF ceramic or paper
- C24 0·1μF paper
- C25 0·01μF ceramic or paper
- C26 0·01μF ceramic or paper
- C27 0·01μF ceramic or paper
- C28 23pF see text
- C29 10μF electrolytic 6V
- C30 100μF electrolytic 6V
- C31 100μF electrolytic 12V
- C32 0·2μF paper
- C33 0·01μF paper 1,000V

Semiconductors:

Tr1	AF115	Tr5	AF117
Tr2	AF115	Tr6	AF117
Tr3	OC171	Tr7	OC45
Tr4	OC45	Tr8	OC81D
Tr9	OC81 } Matched pair		
Tr10	OC81 } Matched pair		
D1	OA79	D4	GJ7-M
D2	OA70	D5	GJ7-M
D3	OA70		

Switches:

- S1a, b 2-pole, 2-way
- S2a, b 2-pole, 2-way
- S3 Single-pole change-over toggle
- S4 Double-pole on/off switch on VR3

Miscellaneous:

Meter 500μA f.s.d. movement. $9\frac{1}{2}$in. x 6in. x $\frac{1}{16}$in. piece of paxolin. Nine tag strips. Lektrokit LK-2231. Aerial socket. 16 s.w.g. aluminium for flanges and screen. Two transistor mounting clips. Battery connectors. Phones/speaker outlet sockets. Jackson "Caliband" dial and drive assembly. 3 Noval low-loss valve-holders. Tags, wire, etc.

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all changes of signal strength and can thus be used usefully as a tuning indicator and alignment aid. A 500μA meter movement shunted by a preset variable resistor enables accurate f.s.d. setting as required, at the same time temporarily removing the a.v.c. bias, i.e., by rotating S1A to "Out". Small panel type meters are easily obtainable.

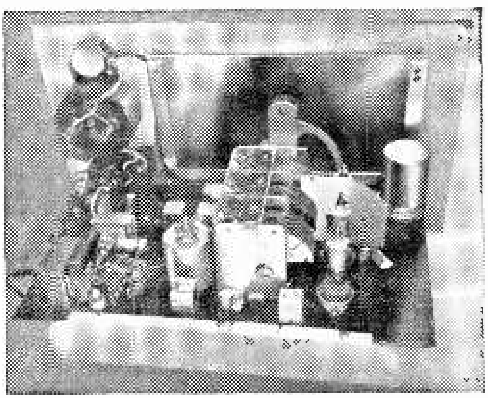
The A.V.C. System

Diode D1 in connection with Tr5 collector circuit is arranged to be non-conductive on small or moderately strong signals, the reverse bias applied being in fact 0·6V. When a very strong signal is tuned in, however, a proportionately greater bias is applied to Tr5 due to D2 which provides bias at all times, whereupon the potential at C18 changes sufficiently for D1 to conduct and thereby damp the first i.f. transformer to reduce gain still further. Simple undelayed a.v.c. thus initiates a delayed a.v.c. characteristic.

The B.F.O. and Audio Sections

The audio content of the demodulated signal appears across VR3 and is available as required via the slider, S3 determining whether the signals are extracted direct or via the simple series limiter circuit associated with D3. Carrier level maintains D3 in a conducting state but a sudden burst of noise results in cut-off so that the signal path is broken when the switch is set to "In". Distortion occurs particularly at high volume settings and there is heavy attenuation although the circuit proves useful when listening on 'phones.

The audio stages proper plus the b.f.o. are shown in Fig. 2(c). The b.f.o. calls for little comment since it is a conventional feedback-type



A rear view of the finished receiver.

oscillator operated close to the intermediate frequency, the precise value being controlled by panel-fitted TC5, labelled "Pitch". CW signals may then be conveniently heterodyned and in addition s.s.b. transmissions may be read. Sufficient b.f.o. injection results due to stray couplings: it may be noted that C28 is not required if a 15pF maximum capacity air-spaced variable trimmer is available for use at TC5.

The audio signal is fed via C29 to Tr8, this being a conventional audio driver transistor stage (OC81D) feeding the push/pull output pair. Tr9/10. Fitment of the phone outlet in the collector circuit of Tr8 has no adverse effect on performance for R32 is in series with the phones across the driver transformer when this function is in use. Signals of moderate phone strength are actually available at points "D" and "Y" but the amplification afforded by Tr8 is worth while using.

The output transistors bias arrangement calls for some comment. As is well known forward bias for a pair of output transistors worked in push/pull is frequently achieved by connecting the driver transformer secondary winding centre tap to a fixed potentiometer connected across the supply battery, etc. Here the lower member of such a potentiometer is R34 but the upper section (normally approximately 4·7kΩ) is not connected to the −9V line. Instead two resistors are used (R35/36) and connected between base and collector on each of the output pair. This arrangement not only simplifies phone/l.s. switching (Tr9/10 are completely disconnected at phone) but also introduces some degeneration due to a.c. feedback and this materially assists the overall performance in several ways, at the expense of a small amount of gain. A small portion of the output at T7 is also fed back degeneratively across the amplifier via R38 but apparent increased sensitivity results if the resistor is omitted. It may be noted that the driver and output transformers used in the prototype are Ardente, but there is no reason why equivalent types by other manufacturers should not be used.

Powering the Receiver

Power requirements were detailed earlier and although the prototype uses an internal mains unit this is by no means essential for the construction is such that a PP9 battery will stand neatly in the area here occupied by the mains components, rectifiers, etc. Expense may be minimised initially by using the battery and adding the mains items required later. In the main, however, battery powering is uneconomical for in common with all transistor receivers batteries have to be discarded when their potential has fallen by some 30% and many volts are thrown away.

As may be seen from the illustration the mains transformer, T8, is quite small physically and is only about one quarter the size of a conventional heater transformer! The primary winding is appropriately tapped and a single secondary supplies 9-0-9V which is rectified by a pair of sub-miniature GJ7M diodes. These require no heat sinks due to low current demands. The resultant d.c. potentials are fed to the positive and negative receiver rails, R40 being included to assist in some degree, voltage stabilisation in association with C31. An automatic "earth" results from fitting C33. No heating has occurred in the prototype even after allowing the receiver to run continuously for several hours. Constructors who do not wish to include this section should omit all items to the right of the broken line in Fig. 2(c) yet retaining "On/Off" facilities via the switches integral with the volume control. Care must be taken to check that polarity is correct.

continued next month

INEXPENSIVE INTERCOM SYSTEM

by P. D. de Lacey and A. T. Chattaway

THE intercom described here was designed to be built at low cost and to use, as far as possible, existing equipment. It provides a means of speech communication between house and workshop, and may also be used as a private telephone link between adjacent houses. It has the advantage that the sound is reproduced at sufficient volume to be heard throughout an average-sized room, leaving the user at the "slave station" free to continue his work while holding a conversation with his counterpart at the "master station".

Construction of the Master Station

The use of a loudspeaker as the microphone, whilst not giving an ideal frequency response, simplifies the construction to a great extent. Most enthusiasts will have at least one amplifier suitable for this purpose, the only features required being that (a) it will give a loud output using, as a microphone, a loudspeaker similar to that for which its output is matched, and (b) it has one terminal (earth or chassis) common to the input and output circuits (this avoids unnecessary complications in the switching arrangements). Most radiograms come into this category. The circuit of the master station is shown in Fig. 1.

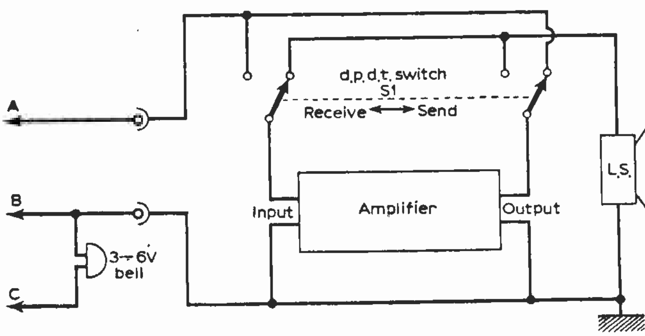


Fig. 1: Circuit of the master station.

Two sockets and a double-pole double-throw switch are screwed to the case of the amplifier. One of the sockets is connected to the earth or "common" lead of the amplifier, and the other to two diagonally opposed end terminals of the switch. The remaining two end terminals are connected to the side of the loudspeaker which is not earthed. The connection which formerly went to this terminal of the loudspeaker is now joined to one of the centre terminals of the switch, and the other centre terminal to the non-earthed side of the "gram-input" sockets. The switch should then look like Fig. 2.

Construction of the Slave Station

The slave station consists of a loudspeaker, as nearly as possible identical with that at the master station; a battery suitable for operating the bell (or buzzer) at the master station; and a push-button switch.

The circuit diagram is given in Fig 3. No constructional details are given since these will vary according to the cabinet used. The push-button S2 is to ring the bell at the master station, which should then call up the slave station.

Completion of the Intercom

The wires marked A, B and C in Fig. 1 are joined to the sockets marked A, B and C in Fig. 3 respectively. Suitable wire may be purchased for about 10s. per half-mile. A valuable saving can be made by using the earth connection of the mains power supply for the connection marked C. This cannot, of course, be done where the "two-pin" fixtures are in use. DO NOT USE THE MAINS EARTH FOR A OR B AS IT WILL INTRODUCE A LOUD HUM.

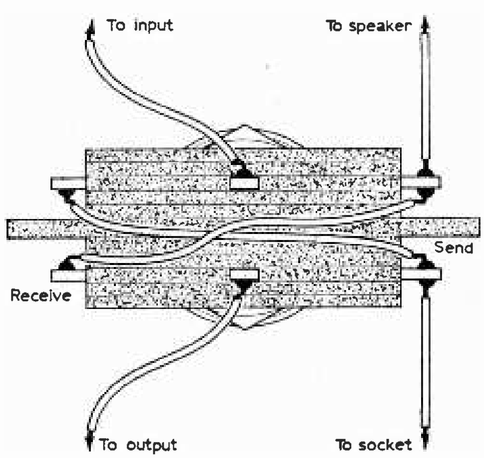


Fig. 2: Wiring of S1.

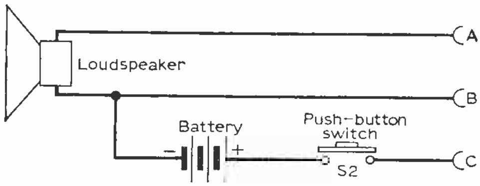


Fig. 3: Slave station circuit.

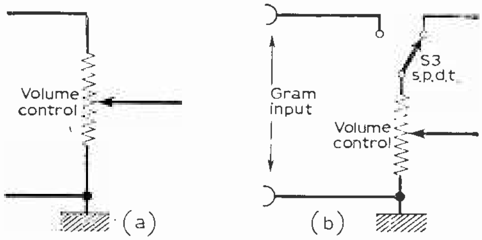


Fig. 4 (a) and (b): These show, respectively, the receiver volume control before and after the incorporation of a gram input socket and S3.

Transistorisation of the Unit

A valve amplifier needs to warm up before use and hurried calls may be delayed because of this. A transistor amplifier is therefore recommended. If a transistor radio is owned the chances are that it is not fitted with sockets for "gram input".

COMPONENTS LIST

R1	100kΩ R2 1MΩ R3 3kΩ
All	±20% ¼W miniature
C1	2μF electrolytic 12V
C2	2μF electrolytic 12V
Tr1	OC71
S1	D.P.D.T. switch
S2	Bell-push switch
S3	S.P.D.T. switch
S4	D.P.D.T. switch

These can be fitted very simply by connecting the sockets across the volume control (in most radios). A switch should be fitted to disconnect the radio while using the amplifier. Fig. 4 (a) shows the volume control before alteration and Fig. 4 (b) shows it afterwards.

If this gives insufficient volume, a pre-amplifier is needed. This will follow the circuit of Fig. 5. The transistor is a "red spot" or OC71.

The resistors in Fig. 5 may be ¼W, 20% tolerance types. The capacitors should have a voltage rating of at least 12V. The simplest method of construction is to solder the transistor, 100kΩ and 1MΩ resistors, and the capacitor direct to the sockets and the 3kΩ resistor and other capacitor direct to the switch.

Using the Intercom

After everything has been correctly connected up, the master station should be switched on, the "gram-radio" switch should be put in the "gram" position, the "send-receive" switch in the "send" position, and the volume control adjusted to about half its maximum value. The user should then make some suitable announcement and switch the "send-receive" switch to the "receive" position, when he should hear suitable comments from his

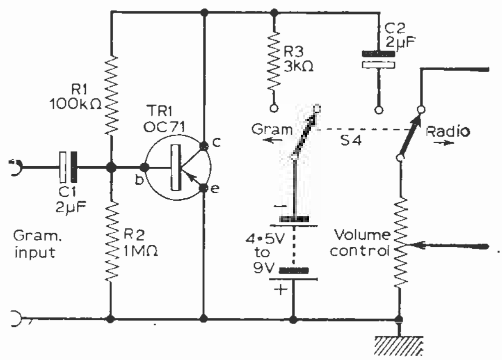


Fig. 5: Circuit of the preamplifier.

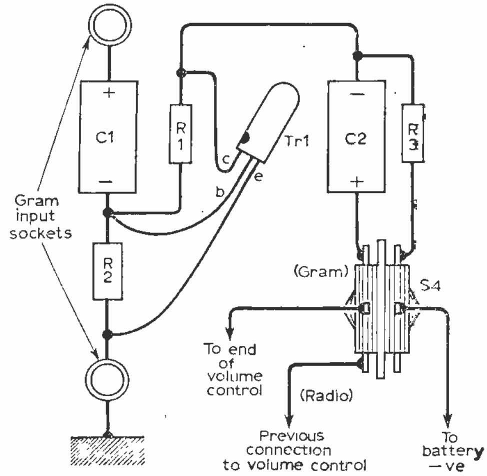
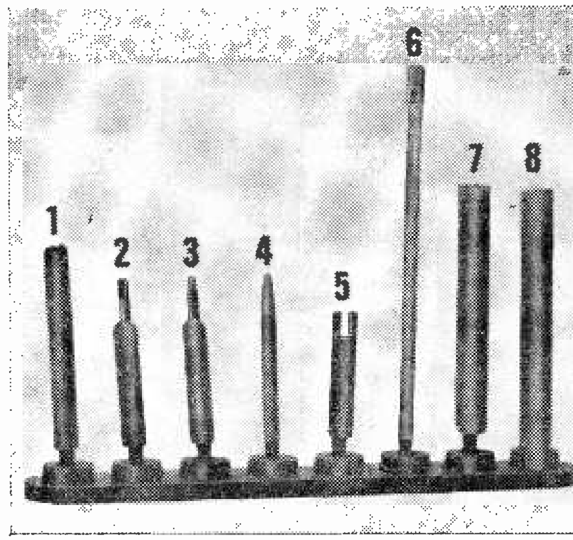


Fig. 6: Construction details of the preamplifier.

colleague at the slave station. The best position to mount the "send-receive" switch is on the left-hand side of the cabinet, as it can then be operated with the left hand, leaving the right hand free to take notes if necessary. The volume control, if it incorporates the "on-off" switch, should be marked to enable the most convenient position to be selected each time it is switched on. The user soon acquires the knack of switching over the "send-receive" switch to listen or speak.

The PRACTICAL WIRELESS TRIMMER and ALIGNMENT SET



TRIMMING tools are not only essential to anyone undertaking serious constructional work on receivers, but they are expendable. This is not to say they necessarily get broken, but like the canteen spoon they are liable to become elusive at the critical moment—usually because someone else has borrowed them.

Many readers, no doubt, already have a set of trimming tools, in particular those who obtained the set we presented with the April issue this year. Others make do with improvised trimming tools fashioned from plastic knitting needles or other suitable materials. We are certain, however, that all readers will welcome the new set of tools being presented with this issue—whether they already have trimming tools or not.

The new set is based on the first set but is designed in a different way. Thus the two sets may be, in some ways, complementary. One great improvement is the material from which the new tools are made: this is a new very tough plastic, admirably suited for such applications.

The photograph in the heading shows the tools assembled, and a description of their uses follows:

No. 1 has a wide "screwdriver" blade (though it should not be used as such!) and is used to adjust mica and ceramic trimmers, ferrite pot cores, and slotted hex-nut compression trimmers.

No. 2 has a fine, narrow blade for the adjustment of slotted cores widely used in transistor radio receivers. The slots are often carried right through the core and the correct method of adjustment is to insert the trimming tool as far as possible before turning, to reduce torsion. Since this is a very popular size, two of these are provided in this kit, No. 3 being a duplicate.

No. 4 has a blade suitable for the majority of iron dust cores employed in radio and television receivers (except transistor radios).

No. 5 has a slotted end which may be used for turning the flattened shank (usually brass) which is used to move a ferrite core in the coil of many radio sets and television turret tuners.

No. 6 is for adjusting tuning slugs with hexagon-shaped holes. This has a long shank so that it may be used with transformers fitted with two such slugs one above the other. The trimming tool is inserted through the upper slug without disturbing its setting, then inserted into the lower slug which can then be adjusted independently, the diameter of the shank is small enough for it to rotate in the hexagon bore of the upper slug.

Nos 7 and 8 are extension shanks. Each has a hole in the top for receiving the spigot of any of the other trimming tools. No. 7, in addition to the hole, also has a spigot, so that it may be inserted into the end of No. 8, thus exending even further the length of the composite tool.

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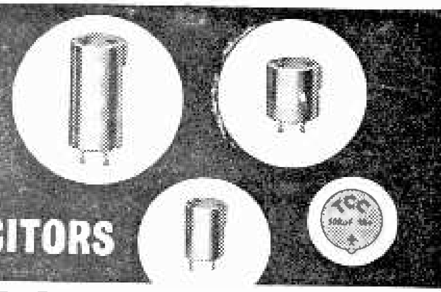

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12v 10amp Rectifier. 8½in. sq. plates **19/6**. Post 2/-.

Transistor ferrite rod aerial with medium and long wave coils with circuit. **7/6**.

Oscillator Coil and set of 3 I.F. transformers for transistor set with circuit. **12/6**.

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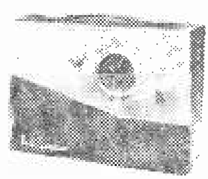
Zener diodes for voltage control and stabilisation. Complete with circuit diagram. **3/6** each.

UNIQUE OPPORTUNITY FOR CONSTRUCTORS

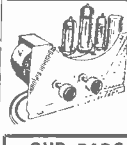
Good Companion



6 Transistor superhet with remarkable performance over medium and long wave. Opportunity occurs to make this very fine receiver, which uses mainly standard parts at a very low price. Constructors parcel comprising: 2 tone cabinet as illustrated printed circuit board, wave change switch, volume control with on/off switch, self adhesive scale pointer, 2 small knobs, 1 gold embellished tuner. Full constructional data, retail value of this parcel **69/6**. This month offered for **39/6** post and packing 5/6.

THIS MONTHS BARGAIN

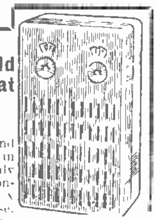
MAINS POWER PACK designed to operate transistor sets and amplifiers. Adjustable output 6v—9 to 12 volts for up to 500ma (class B working). Takes the place of any of the following batteries. PP1-PP4-P6-PP7-PP9 and others. Kit comprises: mains transformer-rectifier, smoothing and load resistor 5000 and 500 mfd condensers, zener diode and instructions. Real snip at only **14/6** plus 2/6 post.



Amplifier for Portable Player —

uses three valves, has push pull output for quality and power and mains transformer for safety. Real bargain at **29/6** plus 2/6 post (less valves).

OUR BARGAIN OF THE YEAR
Complete kit of parts to build transistor 2 wave receiver at only 39/6.
"CORONET" Mk. III



It fully covers the medium waveband and that part of the long waveband to bring in B.B.C. Light. The circuit includes a highly efficient slab aerial and Plessey tuning condenser. Overall size approximately 4" x 2½" x 1¼in. Supplied complete with carrying case.

Speaker Bargain

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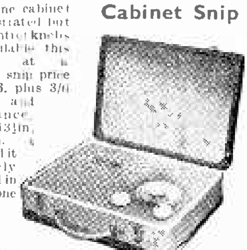
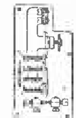
Cabinet Snip



This fine cabinet as illustrated but less control knobs is available this month at a special snip price of **12/6**, plus 3/6 post and insurance. Size is 13½in. x 9in. x 4in. and it is nicely covered in two tone I.C.I. fabric



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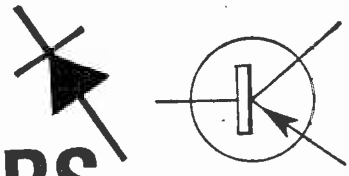
PART I

Understanding SEMICONDUCTORS



BY LESLIE MOORE

THE series aims to give the reader a basic knowledge in the use of semiconductors and the principle of operation of several different types of circuit. It also aims to give the amateur ability to design these basic circuits with a minimum knowledge of mathematics. A knowledge of Ohm's law and the basic operation of components such as inductors, capacitors, etc., will be taken for granted.

CONTENTS OF SERIES

The principle of operation of the crystal diode with a brief explanation of their atomic structure, the circuit symbol of the diode and an illustrated explanation of the junction diode as a half-wave rectifier.

Reasons for full-wave rectification, introduction to power supplies, rectification, smoothing, stabilisation. An explanation of the smoothing circuit will be given. The zener diode and its use as a stabiliser and the conversion of thermionic rectifiers to semiconductor rectifier circuits.

An explanation of the principle of operation of the transistor, its use as an amplifier and an explanation of the derivation of a formula for current gain. The grounded emitter amplifier, input impedance, output impedance, impedance matching between stages. Frequency response of the amplifiers, negative feedback, the emitter follower. Summary of amplifier.

Oscillators—comparing the oscillator to an amplifier with feedback; the Wein bridge, phase-shift oscillators; an L.C. oscillator.

The free-running multivibrator with a brief explanation of the other multivibrators that exist ($\div 2$ ccts, etc.).

No circuits will be given as typical examples of working models. It will not be possible to include the whole of one subject in one article except that of the explanation of the principles of operations of single articles, e.g. introductory passage.

THE OPERATION OF THE CRYSTAL DIODE

Since the introduction of crystal diodes as an electronic device an amazing revolution has taken place. The semiconductor has now become a part of the modern way of life; to enable a greater understanding of their uses and applications this series of articles has been written.

A basic knowledge of atomic structure is necessary to enable the understanding of the operation of semi-conductors.

An atom, the smallest obtainable particle of an element, consists basically of a nucleus encompassed by orbiting particles known as electrons.

The nucleus contains several different sized particles the largest of which are the neutron, an electrically neutral particles, and the proton, which is of equal mass to the neutron but holds a positive electrical charge. The number of protons in the nucleus is equal to the number of orbiting electrons. Electrons orbit the nucleus in a set manner as can be seen in Fig. 1.

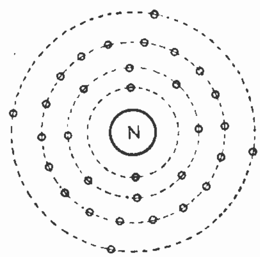


Fig. 1: The germanium atom.

The germanium atom has 32 orbiting electrons set in fixed paths known as shells. The first shell contains two electrons, the second eight, the third 18, the fourth four, but in other atoms is capable of holding as much as eight electrons.

Copper has only 29 orbiting electrons, hence it has only one electron in its outer shell. The nucleus has little influence over the single electron because of the comparatively large distance between the two; on the application of an external electrical force the single electron can be easily attracted away from the atom. This enables copper to be a good conductor of electricity, electricity being the flow of electrons.

Germanium, however, has four electrons in the outer shell, so that a greater attraction between the outer shell and the nucleus is established, making the attraction of electrons from the atom difficult. Because of this characteristic germanium is known as a semiconductor.

The atoms in a germanium crystal form themselves in such a manner so that each atom shares each one of the electrons in its outer shell, with another atom making it appear that each atom has a full outer shell of electrons. The formation is known as the crystal "lattice".

If small quantities of (a) arsenic and (b) gallium are added to germanium crystals the following will occur:

(a) Arsenic has five electrons in its outer shell and an arsenic atom will take place in the lattice as a germanium atom: this will leave a single atom to orbit the arsenic atom. As electrons hold a negative charge this material is known as "n" type.

(b) Gallium has three electrons in the outer shell and if a similar occurrence happens as before, neighbouring atoms in the lattice will share their electrons with the gallium atom but in return can only share three atoms with the germanium. Between two atoms, therefore, there will be a space, one electron missing, which is called a "hole". Because the electrons have a negative charge and the holes indicate a lack of negative charge the holes are said to have a positive charge; this material is called "p" type.

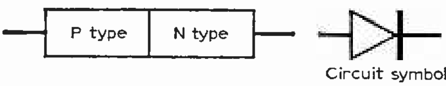


Fig. 2: Make-up of the semiconductor. The bar of the circuit symbol is equivalent to the cathode of the thermionic diode.

If an alternating voltage were to be applied to the diode the action previously described and as shown in Fig. 3 would occur.

It has been explained how a semiconductor diode could be used as a half-wave rectifier. The problem with this method is one of power consumption; the half-wave not seen in the output is returned back to the supply, so that half the current drawn from the supply is wasted. If the diode were to be connected as shown in Fig. 4, on the half-cycle which is not seen at the output, no current would be drawn from the supply.

The application of rectifying circuits in electronic circuitry is most prominent in power supply units.

For reasons of economy the vast majority of mains supplies in this country are alternating current (a.c.) rather than direct current (d.c.).

The majority of electronic equipment requires a direct current supply and to produce this an a.c. to d.c. power supply unit is used as shown in Fig. 5.

The rectifying circuit produces a pulsating direct voltage from an alternating voltage. A half-wave rectifier may be used for this purpose but the average output voltage is low compared with the peak voltage of the input. A more efficient but more expensive arrangement is the full-wave rectifier which is a combination of a number of semiconductor diodes. This is shown in Fig. 6.

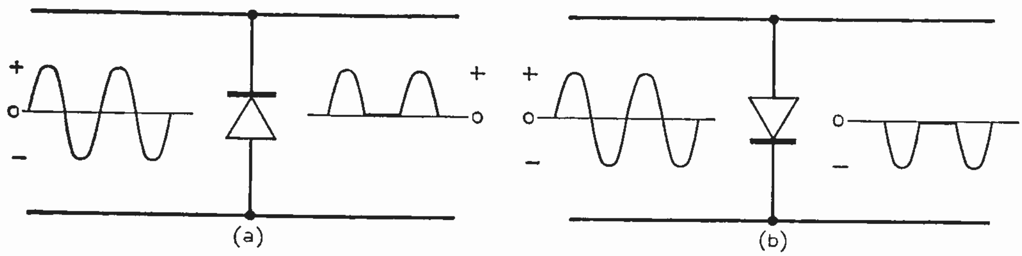


Fig. 3: The action of half-wave rectification: (a) obtaining a positive pulsating direct current; (b) a negative pulsating direct current.

When a junction is made by joining a "p" type crystal to an "n" type crystal the additional electrons in the "n" type begin to flow into the "p" type for a short period and form a barrier at the junction, preventing any further flow of electrons.

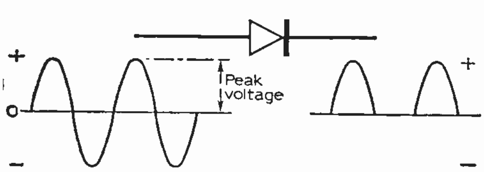


Fig. 4: Arrangement for drawing no current from the supply.

The junction barrier so formed is of such a manner to allow electron flow to take place when an external voltage source is applied to the junction, making the "p" type of positive potential with respect to the "n" type. When the voltage or "bias" is reversed the junction will not conduct.

(1) On the application of a positive half-cycle of alternating voltage it is seen that diode (a) will conduct current but diode (b) will not, so that the positive half-cycle will appear at point A.

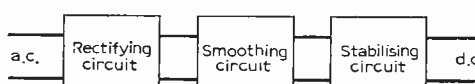


Fig. 5: Block diagram of a power supply.

(2) On the negative half-cycle the signals will be seen by diodes (c) and (d). Diode (d) will not conduct current under this condition but diode (c) is biased to enable it to conduct current. The negative half-cycle will therefore appear at point B.

If the output terminal B is held at a steady voltage, usually zero voltage or "earth", the second half-cycle will appear as a positive voltage at A with respect to B.

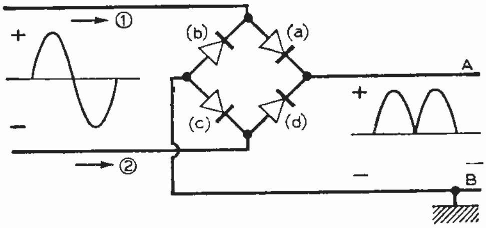


Fig. 6: The full-wave rectifier.

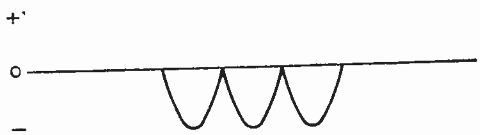


Fig. 7: The waveform obtained when terminal A is held at steady voltage instead of B.

If a "negative voltage" is required it is in order to hold terminal A at a steady voltage, instead of B, and the voltage at B will appear to be a pulsating negative direct voltage (see Fig. 7).

It is obvious that the full-wave rectifier produces an average voltage greater than that produced by the half-wave rectifier for the same input voltage.

Another advantage of the full-wave rectifier will become apparent when smoothing circuits are dealt with.

The basic component of a smoothing circuit is a capacitor as depicted in Fig. 8.

As the first input pulse is applied the capacitor draws current from the rectifier circuit and charges to the peak voltage. If a normal load (or a current drawing circuit) is placed across the capacitor, after the first pulse is applied, the capacitor will then supply current to the load.

Because current is being drawn from the capacitor the voltage across it will drop: the rate at which the voltage across the capacitor falls is much less than the rate at which the voltage from the rectifier falls. The voltage supplied to the load will begin to rise after the rising voltage of the second pulse from the rectifier coincides with the falling voltage across the capacitor.

The waveform due to the changing voltage difference across the capacitor is known as voltage ripple.

There are numerous types of smoothing circuits used, all of them employing the charging of one or several capacitors.

For very good smoothing a filter network, as shown in Fig. 9, is used.

The inductance or choke, L, opposes alternating voltages without dissipating excess power. The capacitor C' functions in a similar manner to capacitor C, reducing even more the voltage ripple.

A less expensive method is to replace the inductance by a resistor. The resistor opposes direct and alternating voltages equally. The effectiveness of smoothing in this case is less than the first.

The type of smoothing used for a circuit is entirely dependent on the degree of d.c. the circuit is required to produce.

The stabilising circuit involves more complex components and will be dealt with later in the series.

In many commercial radio receivers, etc., it would be uneconomical to stabilise the output from the smoothing circuit, so the stabilising circuit is omitted.

The resistor R is placed in the circuit (Fig. 10) to limit the peak rectifier current. If the peak current became excessive the semiconductor diodes would overheat and eventually break down.

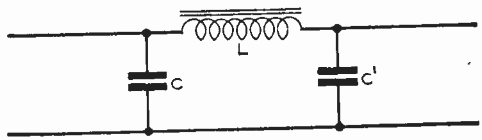


Fig. 9: A filter network.

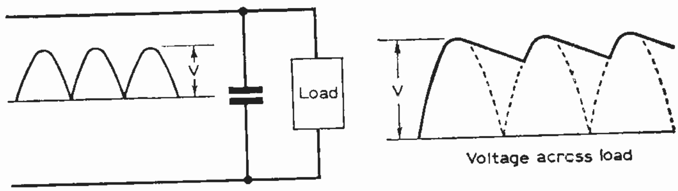


Fig. 8: The basic smoothing circuit and its action.

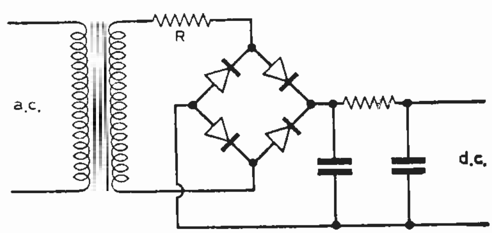


Fig. 10: A typical unstabilised power supply.

This resistor is also used to limit the effect of mains "surges" in the circuit. The mains voltage is by no means "stable" and can vary within values as much as 30V apart.

The voltage and current ratings on semiconductor diodes must be strictly adhered to; it is imperative that mains variations be taken into account when utilising this type of rectifier for a power supply unit.

Part 2 follows next month

BOOKS REVIEWED

EXPERIMENTAL RADIO ENGINEERING

By E. T. A. Rapson. Published by Sir Isaac Pitman & Sons Ltd.
214 pages, 8½ x 5½ in., boards. Price 14s.

THIS is a fifth edition of an old favourite which dates back to the war years. It will be remembered by many old hands and in its up-to-date edition will, no doubt, be welcomed by newer students of radio.

A new chapter has been added which is devoted entirely to transistors, measurement of parameters, etc.

This book is not intended for the general reader and has, obviously, been written with the technical student in mind.

The entire volume consists of a series of experiments in radio engineering which range from the characteristics of attenuators and filters to electro-acoustic tests.

This volume would, as the preface rightly points out, be suitable for a student attending a three year course in radio engineering at a technical college. Would-be students and prospective radio engineers are referred to Mr. Rapson for further details.

At the price, this is extremely good value. *—D.L.G.*

COMPUTER CIRCUIT PROJECTS

By Lee Boschen. 144 pages. Price 21s.

THERE are many men in the realms of electronics, be they professional or amateur, who are bonded by one common tie—they are practical people. While they no doubt enjoy the odd spate of technical literature they are never more happy than when there is a trusty soldering iron in one hand and a reel of "resin cored" in the other.

This group should find **Computer Circuit Projects** of great interest, since it caters for just such tastes. It takes the terrifying and grand name of "computer" and transforms it into 143 pages of practical and interesting circuitry. There are 14 such projects ranging from a single stroboscope to a Rally Computer. Some of these circuits are very similar to others already published. The "Logic Lock" and the "Automatic Signal Flasher" for instance. However, there are numerous ideas to suit all tastes.

It should not be thought that this book is merely a collection of circuit diagrams printed on a few pages. Each project has photographs of it together with other illustrations, and with each there is a discussion of circuit action. The circuitry as a whole is right up to date, some using transistors, some diodes or valves, and in some cases an alternative circuit transistor and/or valve is offered.

For those who are tired of t.r.f.'s and audio amplifiers and would like to build something different but not too difficult, then you are advised to visit your local bookshop with 21s.*—D.L.G.*

ABCs OF COMPUTERS

By Allan Lytel. 128 pages. Price 16s.

THE word computer conjures up many things in the mind. Huge grey steel monsters with staring, winking eyes, rows of meters pulsing, and memory mechanisms buzzing. To the average man and to many electronic enthusiasts the word often means huge consoles and thousands of diodes, transistors and/or valves, and quite unconventional and frightening circuitry. Rumour even has it that the grids are taken direct to h.t.+ and that transistors are connected the wrong way round —on purpose.

For those who profess to be impartial, and prefer to think for themselves, together with those readers who would like to know some basic facts about computers, it is suggested that an outlay of 16s. of the realm be made. This modest sum will enable the "enquiring" to obtain a tome of knowledge aptly titled **ABCs of Computers**, and as this title implies it is a book which supplies the basic facts on this fascinating subject. Its 128 pages are generously sprinkled with illustrations and the text is well written and concise.

In a book of this size it is obviously not possible to enter deeply into the subject and the would-be reader, therefore, need not fear that he will be dragged into heavy technical discussions. The chapters 4 and 5 on "Numbers for computers" and "Arithmetic Operations" are a pleasure to read. The binary system seems easy enough, once it is understood, but understanding it in the first place can prove very tricky. Some writers never seem to present this binary business very clearly and often gloss over it in a few words.

However, it would not be true to say this of Allan Lytel. It would have been even more useful had values been given to all circuit diagrams, even more so in this case since the novice would not have any idea of values in these types of circuits shown.

Also, perhaps, having educated the reader to a certain standard it would have been helpful to have provided a list of suggested books for further reading. However, for the person wishing to scratch the surface of this fascinating field—**ABCs of Computers**—is recommended.*—J.D.G.*

ABCs OF ELECTRICITY

Howard W. Sams Editorial Staff. 96 pages. Price 16s.
These three books, originally published in the USA by Howard W. Sams & Co. Inc., and now published and distributed in this country by W. Foulsham & Co. Ltd. Each book has a preface for British readers written by W. Oliver, G3XT. The common format is 8½ x 5in., stiff covers.

IN any technical field there is one segment of learning more vitally important than any other—the ground work. It is essential that the basic theory be fully understood, and although this may prove a long "slogging" effort it is well worth while in the long run.

ABCs of Electricity is obviously written for the raw beginner and offers five chapters—Electricity (batteries), Magnetism, A.C. Theory and

—continued on page 535

on the Short Waves

A MONTHLY COMMENTARY BY J. GUTTRIDGE

HAVING gleaned and logged all the information we can about a station's signal we come to the business of sending off a reception report, and if possible getting it confirmed by a QSL card.

An ordinary piece of notepaper can be used for the actual report but a much neater report can be made on quarto lined paper. Neatness and simplicity are important because (except at the bigger stations) it will probably be in a language of which the evaluating engineers only have a limited knowledge.

As a general rule all stations except those in South America will accept a report in English. With South America, unless you are dealing with a station which you know to have an English section, the report should be in the local language Spanish or Portuguese. A suitable translation is contained in "How to listen to the World".

The first thing a report should contain is your name and address. Great care (block capitals) should be taken to see that this is legible. If the station can't even read your address it is unlikely to persevere with the rest of the report!

To start off you should say something to the effect that recently you were very pleased to hear the station concerned and are enclosing a report on its signal, mentioning the reporting code you are using e.g. SINPO, SINFO, RSI. After this you should ask the station to verify the report, if it finds it to be correct, with its QSL card.

The final part of your letter should deal with your receiving equipment. Details stations are interested in are the type of your receiver (domestic or communications) and the sort of aerial you are using—dipole or end fed, indoor or outdoor.

You should then set out your report. It should take a similar form to your log with columns for date, time (stating the zone you are using, Greenwich Mean Time being the most common), frequency (stating whether kilocycles or megacycles), the report (SINPO) and remarks.

Two items go in the last column. The first of these is interference details. These should include the type (jammer, broadcast, c.w.) of the interfering station and its frequency. The second item consists of details of the programme heard. The purpose of giving these details is to prove absolutely to the station that you really heard it. Unfortunately there are some unscrupulous QSL collectors who invent reception reports in the hope of gaining QSL cards. Some stations will waive the programme details after you have proved yourself if you report regularly to them.

Ideally your report should cover at least half an hour's listening time though this need not all be at the same time. Stations that use more than one frequency for a transmission especially appreciate comparative reports on the frequencies used. You can end your report with such things as a programme schedule request. Record requests or questions for special programmes are best sent in a special letter.

Finally there comes the question of return postage. With large and government stations this is normally unnecessary. Smaller stations, however, often appreciate it. A full list of stations requiring return postage is given in the "World Radio and Television Handbook". Postage if sent should be in the form of an International Reply Coupon which you can obtain at your Post Office. Don't forget, incidentally, that your report will usually require more than a threepenny stamp.

DX NEWS

News has just arrived from Radio Japan of its plans for broadcasting the Olympic Games to the world. An unenviable task this, as the games are taking place at about the worst time possible as far as reception conditions go. Because of this two new 100kW transmitters are being linked together to give an output of 200kW.

From October 10th to 24th when the games are in progress there will be special programmes during Radio Japan's normal transmissions and the general service will be especially extended. Normal transmissions to Europe in English will be at 0800-0820 GMT on 11,780/15,135kc/s. English broadcasts in the General Service consisting of both live and recorded items are as follows: On 9,505/15,195/15,310kc/s — 0645-0700, 0745-0800, 0845-0900, 0945-1000 and 1045-1100; on 9,505/9,740/11,815kc/s—1245-1300, 1345-1400, 1445-1500, 1545-1600, 1645-1700, 1745-1800 and 1845-1900; on 11,815/11,940/15,195—2145-2200; on 11,940/15,105/15,425kc/s—2345-0000; on 15,105/15,195/15,310kc/s—0245-0300, 0345-0400.

On October 10th the opening ceremony will be broadcast live from 0450/0700 and on October 24 the closing ceremony will be broadcast live from 0800-0900. Programme schedules giving full details are available free of charge from Radio Japan, Tokyo, Japan.

Radio Australia has been coming through well in the late evening recently. Two transmissions recently logged around 2245 in London were an Indonesian programme on 11,760kc/s and an English programme to Southern Asia. This station's U.K. transmission in English is from 0630-0730 on 9,570/11,710kc/s but is not coming through too well at present.

A Middle Eastern station presenting quite a challenge is the Kuwait Broadcasting and Television service. It is sometimes audible after 1930 through heavy CW on 4967kc/s.

For more DX news see page 573

UTILITY POWER PACK

A Compact Power Supply for the Workbench

by V. E. HOLLEY

MANY constructors have need from time to time of a bench power supply which usually takes the form of a self-contained pack from which h.t. and l.t. voltages can be taken by leads to the equipment to be supplied. The unit here described is somewhat different, being designed so that it can be fitted in a few minutes to any chassis with only three connections to be made and may remain there permanently if desired.

The basis of the pack is a mains transformer of the three-way mounting type, on to which are fitted all the components of the circuit shown in Fig. 1. Outputs of 250V 80mA and heater voltages of 6·3, 5 and 4 are provided.

Apart from bench use, the pack is especially suitable for compact equipment. The transformer selected for the prototype measures 4in. x 3½in. x 2½in. and the addition of the rectifying and smoothing components increases the 2½in. measurement by less than a quarter of an inch. The total heating effect is noticeably less than that of a pack using a valve or metal rectifier and this is an important advantage in equipment where temperature rise must be limited.

Rectifiers and Fuses

Silicon rectifiers are used. These have a very low forward resistance, 15 to 25Ω being typical, so that the protection against overload afforded by the relatively high resistance of a vacuum valve or metal rectifier is absent. If a large current rating is selected, say 500mA, the rectifiers do not require any protection against the accidental short circuit that may occur on the bench, but the transformer winding does. Fuses F1 and F2 are therefore included in series with the rectifiers. This arrangement is to be preferred to the more usual single fuse in the h.t. secondary centre tap because it gives protection against breakdown of a rectifier.

It will be seen from Fig. 1 that if such a breakdown occurred and there were no fuse, a very large current would pass around the h.t. secondary winding which would quickly be destroyed. The fuse ratings must be selected not with reference to the load current but to the larger value of the surge current which passes into the capacitors C1 and C2 when power is first applied. This is not

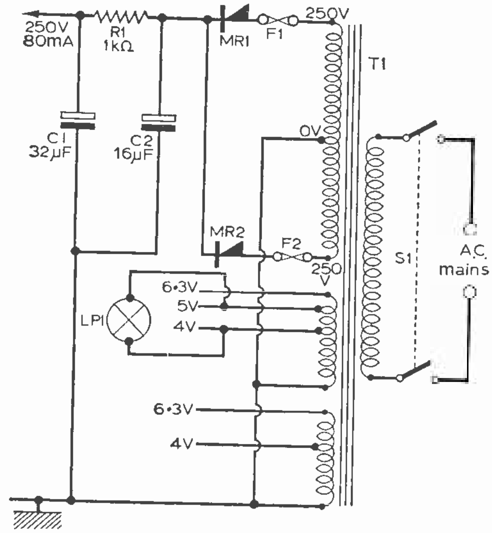
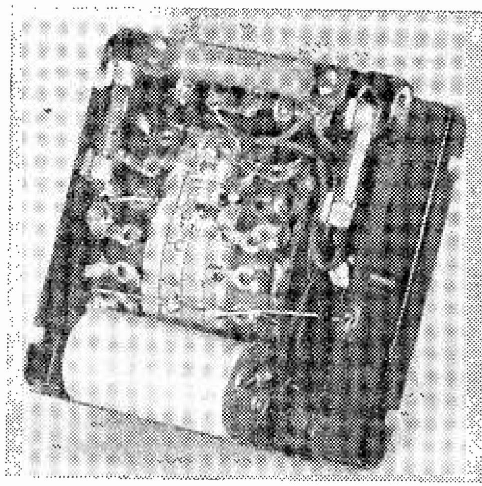


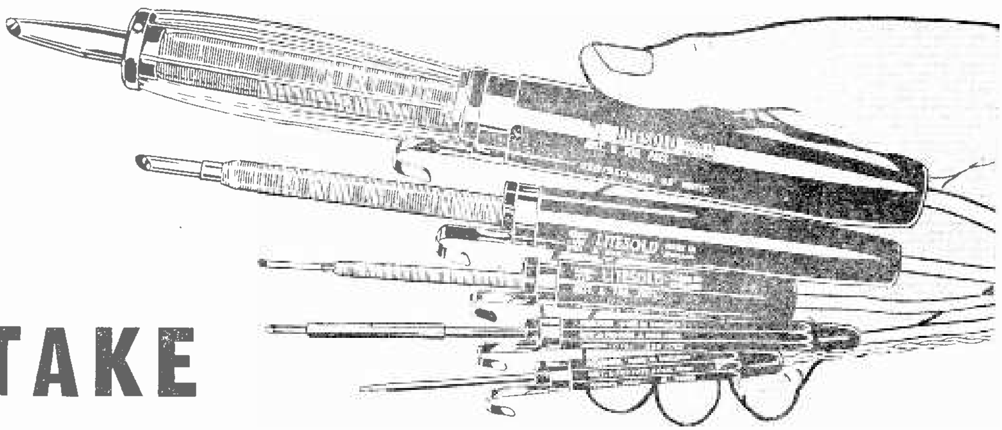
Fig. 1: The simple circuit for the power pack.



The finished power pack.

COMPONENTS LIST

T1	Mains transformer, 3-way mounting, 250-0-250V 80 mA. 6·3V 3 amps, tapped 4V, 6·3V 2 amps, tapped 5V and 4V
MR1, 2	Silicon rectifiers, BY100 or similar, 800V p.i.v., 500 mA
R1	Resistor—1kΩ, 10W
C1, C2	Capacitors—16 + 32μF electrolytic, 350V working in 1in. diameter can
F1, F2	Fuses rated at 150 mA each
	Fuseholders—two
LP1	Pilot lamp—2·5V 0·3A bulb
S1	Double pole on/off switch
	Length of tag strip
	Perspex for cover, self-tapping screws, wire and sleeving, etc.



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There are 30 other models, too. There ARE several other makes of soldering instruments. Big ones. Small ones. Good ones. We've seen them. We don't make the biggest ones. Or the most expensive ones. Or the most elaborate ones. We DO make the smallest ones. And the widest range. We make the best. Always have. May we send you details?

Brochure P.W.10 post free on request

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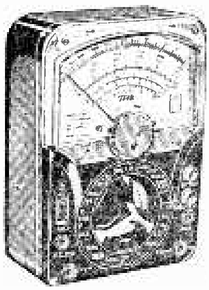
Telephone: CROydon 8589

TEST METERS



30,000 OHMS PER VOLT MODEL 500. Reads voltages up to 1,000 D.C. at 30,000 ohms per volt and A.C. at 15,000 o.p.v.: D.C. current to 12 amps. Resistance to 60 Megs.: Decibels from —20 to +56; Incorporates internal buzzer for audible warning of direct shorts and blocking condenser for A.F. output measurements. Size 3 9/16 × 6 5/8 × 2¼in. £8.19.6.

2,000 OHMS PER VOLT MODEL TP-10. Reads A.C. and D.C. volts up to 1,000, D.C. current to 500mA: Resistance to 1 Meg.: Capacitance to 1μF; Decibels from —20 to +36; Output jack for Audio measurements. Size: 3½ × 5 × 1¼in. **£3.19.6.**

20,000 OHMS PER VOLT MODEL TP-5S. Reads voltages up to 1 000 D.C. at 20,000 ohms per volt and A.C. at 10,000 o.p.v., D.C. current to 500mA. Resistance to 10 Megs.: Capacitance to 0.01μF. Decibels from —20 to +36. Size: 3½ × 5, 1¼in. **£5.19.6.**

PANEL METERS

25 microamps D.C. 2½in. Proj. circular **59/6.** 50 microamps D.C. 2½in. Flush circular. **59/6** 100 microamps. D.C. 2½in. Flush circular **39/6.** 40 amps. D.C. 2in. Proj. circular. **7/6.** 500 volts A.C. 2½in. Flush circular **25/-.**

DOUBLE BEAM OSCILLOSCOPE TUBES Another purchase of Type CV 1596 equivalent to Cossor 09D as used in Oscilloscopes by Cossor (339 series) and Hartley & Erskine (13 series) Listed £12. Brand new in Maker's crates (Carriage 5/-). **25/-**

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SUPER CRYSTAL STICK MIKE, complete with heavy desk stand neck cord, and screened lead. **ONLY 49/6** (post 2/6).

SPRAGUE CONDENSERS. Metal cased, wire end. New 0.1 mFd. 1,000 volt and 0.1 mFd. 500 volt 7/3 per dozen. Special quotes for quantities.

RESISTORS. 100 assorted values, our choice. **New 7/6.**

MOVING COIL STICK MIKE complete with heavy desk stand, and screened lead. **ONLY 59/6** (post 2/6).

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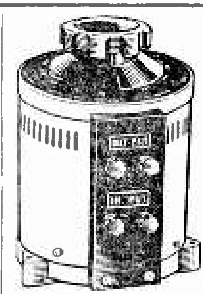
CRYSTAL DESK MIKE with screened lead and built-in stand. **ONLY 15/-** (post 1/6).

15 OHMS P.M. SPEAKERS. Special Heavy Duty 12in. **£5.5.0.** Wharfedale W12EG 12in. for Lead Guitars **£10.10.0.** Wharfedale W15EG 15 in. for Bass Guitars. **£17.10.0.** 12in. wedge type speaker cabinet **£9.17.6.** (Please add 5/- carr. all items.)

CONDENSERS. 100 assorted mica and silver mica. NEW 10/-.



VARIABLE VOLTAGE TRANSFORMERS. Fully shrouded. Input 230 v. A.C. 50/60 cycles. Output 0-260 v. 2.5 amps. type **£5.17.5.** 5 amps. type **£9** 10 amps. type **£16.10.0.** Brand new import fully guaranteed. Immediate delivery and service. Illustrated details on request.

20/- CONSTRUCTOR'S PARCEL Assorted colours wiring wire solder, resistors, condensers, volume controls, tag panel. ALL NEW (post 2/6).

LINEAR AMPLIFIERS. LG34. 4 watts, size 8½ × 4½ × 2¼in. high. £5.5.0. L45A 5 watts, size 7 × 7 × 5in. high. **£5.19.6.** Protective cover **12/9.** L5/55 5 watts stereophonic. size 10½ × 8 × 6in. high **£12.12.0.** cover with carrying handles **25/-.** "Diatonic" 10 watts Hi-Fi Ultra Linear Push-Pull, size 9 × 7 × 6½in. high. **£12.12.0.** Cover with carrying handles. **19/6.** L1/10 10 watts Hi-Fi Ultra Linear size 9 × 7 × 5in. high **£13.13.0.** Cover with carrying handles. **19/6.** "Conchord" 30 watts Hi-Fi Ultra Linear size 12¼ × 9 × 7¼in. high. **£13.16.9.** Cover with carrying handles. **25/-.** L50/50 watts Hi-Fi Ultra Linear. size 14 × 10 × 8in. high. **£23.2.0.** Cover with carrying handles. **32/6.** All amplifiers for normal A.C. mains, and ex stock. Details on request.

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"Tripletone" F.M. Tuner. size 11 × 6 × 3in. high. Coverage 86-104 Mc/s. **£13.19.6** (unpowered), or **£15.14.6** (self powered). Details on request.

HETERODYNE FREQUENCY METERS TYPE LM14. Frequency range 125-20 000 kc/s in 2 band. This is the United States Navy Model of the well-known BC221 Frequency Meter, but has many additional features which increase its usefulness. Voltage stabilisation circuits and Crystal control ensure extreme accuracy and in addition it is fitted with an Internal Modulation switch to allow use as a Signal Generator. Size only 8½ × 8 × 8½in. Full information on request.

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Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross easily measured but with the values of R, C1 and C2 shown, 150mA fuses are satisfactory.

It is important that the rectifiers should have adequate peak inverse voltage rating. Referring again to Fig. 1, when the right hand side of SR1 is 250V rms above earth, the peak voltage at this point will be 1·414 times as great, i.e., approximately 350V.

Capacitor C2 and the left hand side of SR2 will also be at this potential: but the right hand side of SR2 will at the same instant be 350V peak negative to earth so that the peak voltage across it in the non-conducting direction will be 700V. In practice, this theoretical figure may be increased somewhat by the effect of line surges, wave form distortion and such-like disturbances, so the rectifier peak inverse rating should not be less than 800V.

Construction

Fig. 2 shows the positions of the components and the connections to be made. The wiring should be no longer than necessary and if 20 s.w.g. tinned copper is used, it can be laid neatly in position and will stay there. The tag strip holding the smoothing resistor etc., must be soldered to the transformer frame, using a large iron, and the rectifiers tucked neatly beneath it as shown in the illustration.

Take care not to use the earthed tags for any of the connections. The outer metal bodies of the rectifiers are "live" so they must be firmly positioned clear of the transformer frame. The indicator lamp is considerably under-run and so is not likely to need replacement: it can therefore be soldered permanently into circuit without a lamp holder. The fuse holders are secured with impact adhesive.

Safety Precautions

In view of the exposed h.t. connections it is advisable, if the unit is for bench use, to fit some sort of cover over both sides of the transformer. This was done in the case of the prototype by bending two pieces of 1/16in. perspex to the required rectangular shape and securing them to the sides of the transformer frame with self-tapping screws.

The bending can be accomplished quite easily after clamping the perspex between two pieces of plywood along the line of bend and dipping the assembly in very hot water.

The cover should be about half an inch shorter than the height of the transformer so that an opening can be left at the bottom for through ventilation which the smoothing resistor at the top will promote by convection. The double pole on-off switch, S1, S2, is fitted to the cover on the

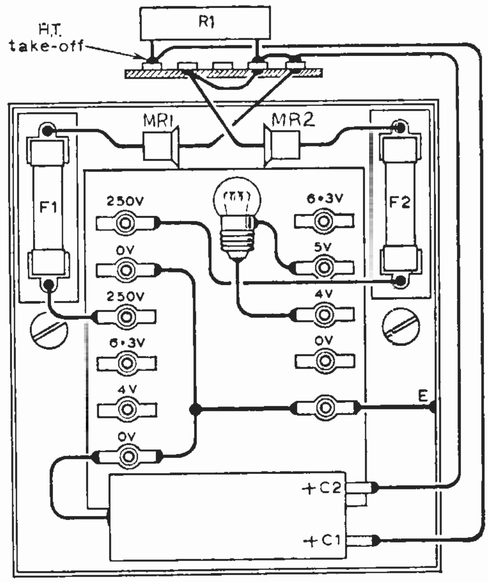


Fig. 2: Construction details of the unit.

mains input side of the transformer. If desired, an additional fuse can also be fitted here in the a.c. supply line as a protection against heater line short circuits etc.

A suitable rating, allowing for surge is 250 to 500mA.

BOOKS REVIEWED

—continued from page 530

Generators and Alternators. Although there is no question that this book offers a great number of basic facts there are one or two puzzling aspects of it.

In Figs. 1—13 and 1—14 the battery mysteriously reverses polarity and the voltages in Fig. 13 are given with respect to reference point D. The voltage then would be minus 6V and minus 5V and not just 6V or 5V as stated. In Fig. 1—17, page 24, we are told to note that 4 amps of current flow toward point A, but there is, in fact, no such reference point marked A in the Fig. 1—17 at all. In the photographs, Figs 2—4 and 2—6, the same battery is shown twice, and perhaps a different photograph would have been more educational. It would certainly prove more interesting.

A graph appears on page 62 and the vertical axis is marked in gausses, yet the word gauss does not appear to be included in the text at all. These points may appear small, but since the book is intended for beginners it is felt they should be mentioned.

Vector diagrams start to appear on page 73 and it is regrettable that no clear explanation of them appears, particularly as their importance is very great, as anyone who has studied a.c. theory will know.

The book is priced at 16s. and it is suggested that any reader contemplating purchasing it should be in a position to examine it first rather than send money "blindly" through the post. —*D.L.G.*

The "Spectreuphon"

SOME IDEAS FOR EXPERIMENTS WITH CHROMASONIC DISPLAYS

BY I. J. KAMPEL

DESCRIBING a unique device, which from an existing audio source, improves mono or stereo reproduction, *and* provides a visual conception of the music, by means of changing colours, to match the mood of the music.

There are many examples of how sound and colour can be subtly merged to produce an unparalleled emotional effect—producing not only extreme pleasure, but a pleasing relaxation of mind. This is offered as a supplement to all hi-fi and audio fans—so much more than the 'flat' sound from a single-speaker mono system, and much more pleasing than the simpler two-speaker stereophonic system.

The *Spectreuphon* provides a visual conception of the music to be provided from an existing audio source.

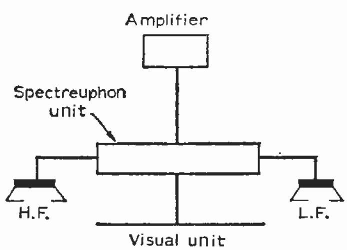


Fig. 1a (above): The basic layout of a mono system using the "Spectreuphon".

Fig. 1b (right): The arrangement for stereo.

Direct coupling to most modern radios, tape-recorders, record-players, is simply made through extension speaker sockets. It will be necessary, however, to fit a switch on the audio unit, if one does not exist, to cut out the internal speaker.

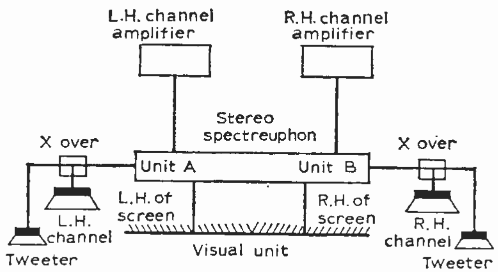
Before describing the unit in detail, a brief description of the effect would be in order.

Effect of Mono Spectreuphon

The author has previously described a unit for feeding two loudspeakers from an existing audio source (mono), giving an effect not unlike stereophonic sound to the unexperienced, average listener. No owner of a stereo set-up would mistake it for stereo, but if suitable speakers are used, he would be forced to admit there was a fair comparison. Some listeners to the system were in fact convinced that it was stereo, and found it just as satisfactory! (The original unit—the *Euphon*—appeared in the October, 1963, P.W.) The mono version of the *Spectreuphon* contains the original *Euphon* circuit. (Section 2, Fig. 2.)

The *Spectreuphon* should be listened to—and viewed—in a darkened room.

Let us suppose that the unit is connected to a record-player, and a record has just been put on. Until the record begins there will be complete darkness—then comes the music—and light. The coloured light thereafter faithfully follows the pitch, volume, beat, and general mood of the music. As the volume increases so the light becomes more intense; it follows visually if there is a distinct beat; if there is a predominance of treble, mid-range, or bass, so there is a predominance of one particular colour, and as the ranges merge together so do the colours, mixing, diffusing together, giving subtle intermediate shades and hues. If the record ends in a fade-out, so the light dies down to darkness with the sound.



Effect of Stereophonic Spectreuphon

Two inputs are required for this unit, these being taken from the sockets to which left-hand and right-hand channel speakers are usually connected. The audio to these speakers is then fed via the *Spectreuphon* unit. This is necessary, as the unit must have a volume level on it.

The left-hand audio channel then controls the left-hand side of the display unit—consider it as a screen for now—whilst the right-hand audio channel covers the other half. This means that beside the visual effects described in the mono version, the stereo version provides left and right emphasis according to speakers, and also a colour shift if there should be an audio movement shift.

The stereo *Spectreuphon* does not improve sound reproduction in itself. If, as later diagrams indicate, two crossover networks are employed, and a four-speaker system set up, then there will be a great improvement. Many stereo systems have, however, these networks built in, with twin woofer and tweeter.

Single Speaker Spectreuphon

If for one reason or another, only a single speaker may be employed, or a single speaker view, it consists simply of a number of lights.

There are three groups of lights, each group controlled by a different filter network and channel of the *Spectreuphon*. One set of bulbs responds to bass, one to treble, and the third to mid-range.

Fig. 2 is the complete mono *Spectreuphon*, which includes a two-channel audio network to feed two loudspeakers, to give an effect similar to stereophonic sound. This circuit diagram is divided

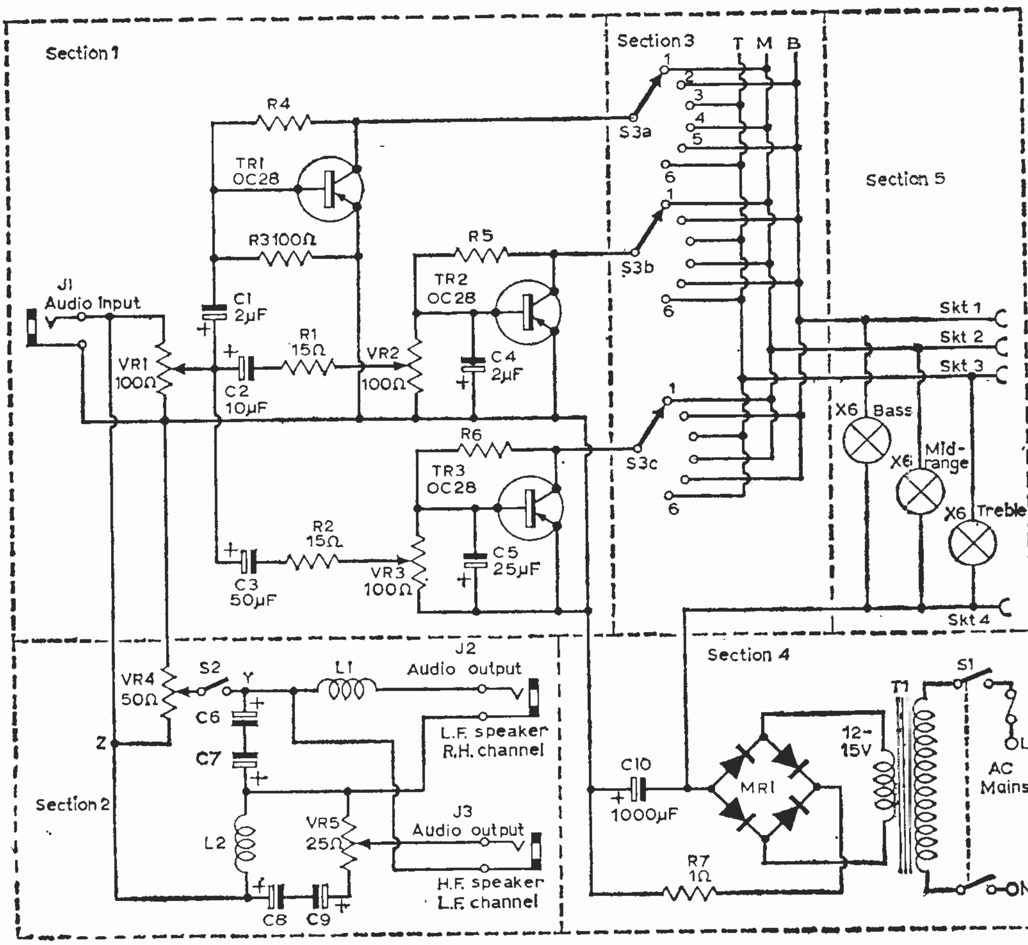


Fig. 2: The complete circuit of the mono "Spectreuphon".

unit, slight adaptions will have to be made to the circuit of the mono unit. Details of this will be given later. It is possible to use only the one existing speaker.

The Spectreuphon Circuit (Mono)

Fig. 1a is a block diagram of the basic principle and lay-out of the mono system. Actual visual units will be described later, but whatever type is used, basically, and from the electronic point of into five sections so that reference to this circuit is simpler.

Section 1 is the three-channel filter network which separates treble, mid-range, and base, and so controls a group of lights on each of these channels. An increase in one range, and the consequent additional transistor bias, increases the collector current, and consequently the lights brilliance, being connected directly in the collector line.

Section 2 is the two-channel audio network, which feeds J2 a low frequency output, and J3 a high frequency output, so the speaker connected to J2 produces mainly bass, and the speaker to J3 mainly treble. Coil and cap. details are to be found in **Table 1.**

Section 3 is simply a switching unit on the three outputs of Section 1. Each of these outputs feeds a different set of lights, **of a different colour.** Hence, the six-way, three-pole switch, allows any combination of colours and channels to be obtained, so giving a greater variety.

Section 4 is simply the smoothed power supply. There is little to say about this, as any suitable full-wave bridge rectifier and transformer are satisfactory.

TABLE 1

C	L	Speaker Impedance	C	L
6–9	1–2	3Ω	30—32 µF electrolytic	3Ω 0·135 mH
		15Ω	5—8 µF electrolytic	15Ω 0·675 mH
X	Y	3Ω	30µF paper	3Ω 0·135 mH
		15Ω	6µF paper	15Ω 0·675 mH

Suitable makes	L1—L2		as below
X & Y		Hunts W54/1—WP44 (30µF) W49/1—B551 (6µF)	Denco divider network coils

Section 5 indicates the form the lights will take. Only one of six bulbs on each channel is indicated. It will be seen that they all have a common negative—the only contact with the negative side of the rectifier—except the smoothing capacitor.

Controls

VR1, VR2, VR3, are sensitivity controls, and require some patience to set for best performance from the visual unit.

VR4, is an audio volume control. The volume control on the existing audio unit is turned up until a suitable level is obtained in the lights unit. VR4 is then used to turn down audio to a comfortable level.

VR5, is a balance control, and with this it is possible to shift the treble-base emphasis, according to individual requirements.

Details of Construction

It will be seen from the circuit diagram (Fig. 2) that resistors R4, R5, and R6, have no value indicated on them. The reason for this is that they tend to vary according to particular transistors. To find the right value resistor, the method indicated in Fig. 3 should be employed. Here a variable resistor and a set resistor are connected, in series, collector to base. The six bulbs should be in circuit for this test, on each channel. Set this system up on each of the three transistors. For this test, the audio part of the circuit need not be operational, but it will probably be found that the level required to operate the unit will be too high for listening to, and hence the speaker on the audio unit will have to be cut out.

Firstly, in daylight, adjust each of the three 3K potentiometers until the filaments of the bulbs on each of these channels have just gone out. When this has been carried out on all channels, start the audio unit up. The lights should then light up and fluctuate in brilliance. Adjustment of VR1, VR2 and VR3 may be necessary, but if the lights are working as described, it is pointless at this stage, to try and adjust them for optimum treble—mid-range—bass performance.

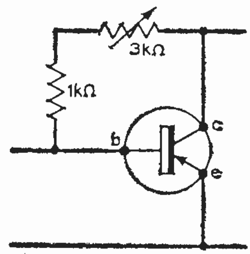


Fig. 3: Determining the values for R4, R5 and R6, see text.

In Fig. 3 the 1k resistor is in series with the potentiometer as a safety measure, and should not be omitted. If it is, a collector-base short could occur, causing permanent damage to the transistor. When the correct level has been found, the resistance then across the collector-base of each transistor should be measured, and replaced by a resistor of the same value. If space will permit, leave the potentiometers in circuit. These potentiometers should be mounted inside the unit,

COMPONENTS LIST

Number required: Mono	Stereo		
			Euphon Circuit (Sect. 2 Fig. 2)
2	—	L1, L2	See Table 1
4	—	C6-C9	See Table 1
1	—	VR5	25 Ω wirewound pot.
			LIGHTS FILTER NETWORK Etc. (Sect. 1)
3	4	J1-J3, Jx	Jack plugs and sockets
3	6	VR1-VR3 (x2)	100 Ω wirewound pots
1	—	VR4	50 Ω wirewound pot
—	1		Twin-ganged 50 ohm wirewound pot
2	4	R1, R2 (x2)	15 Ω ½ watt res.
1	2	R3 (x2)	100 Ω 1 watt res.
2	4	C1, C4 (x2)	2 µF elec. 25V
1	2	C2 (x2)	10 µF elec. 25V
1	2	C3 (x2)	50 µF elec. 25V
1	2	C5 (x2)	25 µF elec. 25V
4	7		Wander plugs and sockets
18	24		6·3V 150 mA bulbs
2	2	S1, S2	D.P. S.T. toggle switches
1	—	S3	6W. 3P. rotary switch (mono) 6W. 6P. rotary switch (stereo) or as required
3	6	Tr1-Tr3 (x2)	OC28
			Test Requirements
3	6		1kΩ res.
3	6		3kΩ wirewound pots
			POWER SUPPLY (Sect. 4 Fig. 2)
One 3A	One 4A	T1	Transformer: primary to suit; secondary 15V
1	1	C10	1000 µF elec. cap. 25V
1	1	R7	1 Ω 1 watt res.
1	1		Full-wave rectifier 3A/4A
1	1		3A/4A Fuse

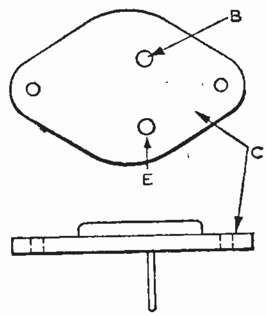


Fig. 4: Connections to an OC28 transistor.

so that they are only disturbed when required. The response of the lights is far more sensitive if adjusted as described.

Fig. 5 indicates the mounting of the power transistor.

Oversize holes are drilled in the chassis to ensure that the connections do not short to chassis. The transistor rests on a lead heat-sink, and underneath this is a mica washer to insulate the collector from the chassis.

Should it be found that the lights will not dim, then a higher value potentiometer or resistor should be fitted in place of the original.

Sk1, Sk2, Sk3, are the positive contacts of the three sets of bulbs. Six bulbs, in parallel, are connected to each of these sockets, their common negative on all sets, going to Sk4.

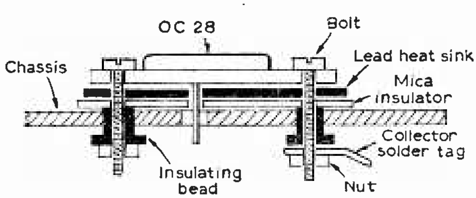


Fig. 5: Mounting details of the power transistor.

When ready for the final test of audio and visual unit, each of these sets of bulbs will be a different colour.

The Spectreuphon Without Additional Speaker Cabinet

If it is required to have the visual unit with original sound (mono), and it is found on test that the volume is not too high when turned up high enough to operate the *Spectreuphon* light-control unit, then you have no problem. Forget Section 2 and just plug in to extension speaker sockets for light control. If, however, as expected, it is too high, then the audio level has to be brought down by another control.

In Fig. 6, a two-way, two-pole switch is inserted between the speaker and output transformer. In one position there is a straight path through and in the other position, the path is through to socket. JA.

A lead is then taken from this, preferably screened, to JB or JI on Fig. 2.

The 50Ω potentiometer is then used to turn the volume down to a suitable level, and the signal is fed back to the original unit, and speaker, via JC on the *Spectreuphon* unit, and JD on the audio source.

If this is the method that is to be employed, because of reasons of expense or space, sound could be improved by the addition of a small tweeter in the record-player or what-have-you, in which the speaker is contained.

The circuit of Fig. 7, the usual crossover network, should then be employed. The coil and capacitor values given in this table are also suitable for the *Euphon* circuit.

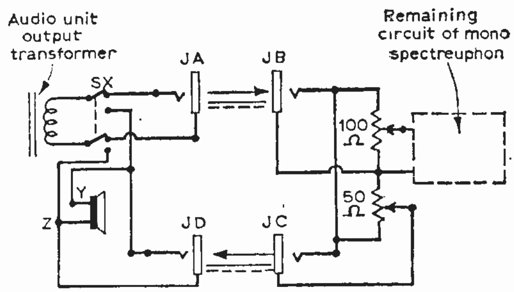


Fig. 6: Incorporating a two-way, two-pole switch between the speaker and output transformer.

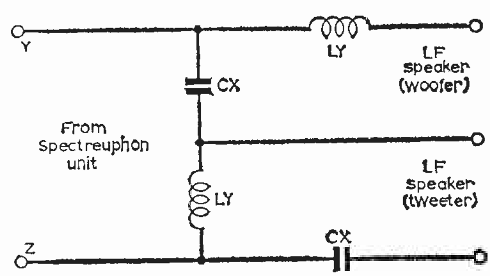
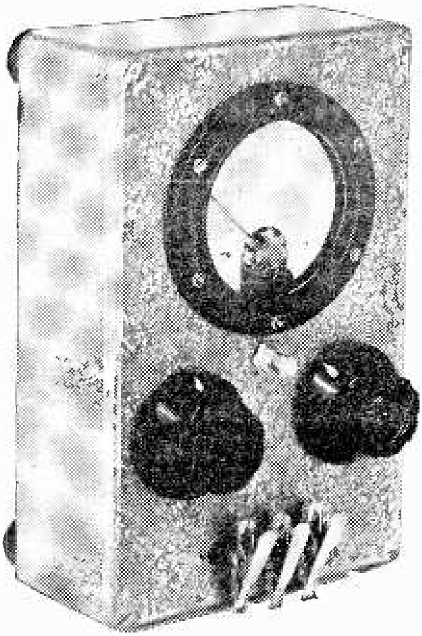


Fig. 7: A crossover network for the "Spectreuphon".

Unless the audio source is of the standard known to-day as hi-fi, the addition of this network is pointless. This also applies to some extent in the audio circuit of the *Spectreuphon*. If there is not any response below say 10kc/s, or a cut-off before it reaches the higher frequencies, little will be gained by the use of this unit.

If there is room for a single cabinet, a large woofer and small tweeter mounted together in the same cabinet, if large enough, will produce far superior audio to that previously experienced with a single—perhaps small—speaker, in a cabinet which did not allow the required resonance. The cross-over network of Fig. 7 should be used for this, connected across YZ on the original circuit (Fig. 2).

TO BE CONTINUED



A SIMPLE transis

THIS transistor tester was developed to facilitate rapid transistor testing in the workshop. The main purpose of this tester is to make what are primarily "go"—"no-go" tests, by measuring the transistor collector leakage current and current amplification factor in the common emitter configuration, i.e. Ico and ß. Experience has shown that a tester of this type is all that is required to tell whether a transistor is working or not or to measure or compare "Beta" for matching transistors etc. Furthermore testers of this type are generally used in preference to the more accurate and comprehensive transistor parameter test sets.

The basic tester is suitable for testing only low power receiving type transistors.

SPECIFICATION

Collector Leakage Current (Ico)	0-1mA
Current Amplification Factor (ß)	0-100 } two 0-250 } ranges
Transistor Type	pnp or npn

CIRCUIT AND THEORY

The circuit of the tester is shown in Fig. 1. A $4\frac{1}{2}$V dry battery is used as the power source, one of quite small capacity being suitable since the maximum drain is 10mA and that only for the few seconds required to take a reading.

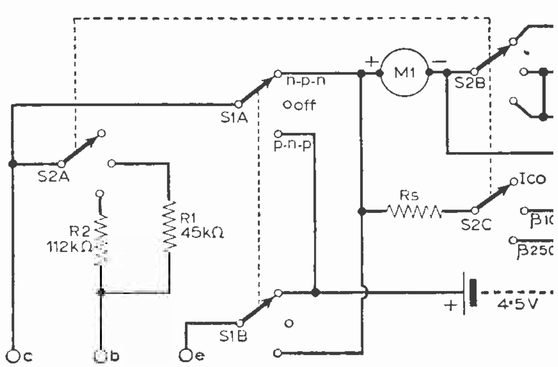
Switch S1 selects the supply polarity required for either npn or pnp transistors with a central "off" position, whilst switch S2 is used to measure either Ico or "Beta." When switched to Ico the base circuit of the transistor is left open circuit and a 4·5kΩ resistor is connected in series with the meter to prevent it being damaged if a transistor having a short circuit between collector and emitter is tested. When the tester is switched to read Ico a check on battery voltage may be made by shorting the collector and emitter terminals, the meter should then read full scale or thereabouts, since the meter is connected as a voltmeter reading 4·5V full scale. It may, incidentally also be used as a continuity tester or ohmmeter! There are two positions of S2 for measuring "Beta," the first giving a full scale

COMPONENTS LIST

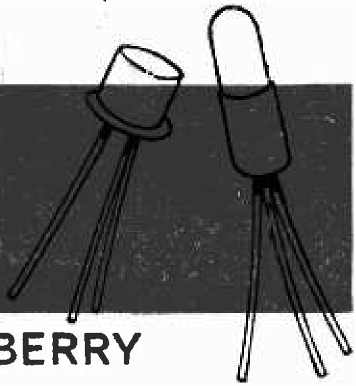
Resistors:
- R1 45kΩ (33kΩ + 12kΩ) $\frac{1}{4}$W h.s.
- R2 112kΩ (100kΩ + 12kΩ) $\frac{1}{4}$W h.s.
- R3 4·5kΩ (3·3kΩ + 1·2kΩ) $\frac{1}{4}$W
- R4 390Ω

Switches:
- S1 2-pole 3-way rotary (or 4-pole 3-way, see text).
- S2 3-pole 3-way rotary
- S3 Bell-push type: push to make

Miscellaneous:
- M1 1mA moving coil meter
- $4\frac{1}{2}$V battery. Case. Knobs, terminals, crocodile clips, etc.



tor tester



By K. BERRY

reading of 100 and the second of 250. The measurement of "Beta" is effected by injecting a known current into the base of the transistor and measuring the resultant collector current. Thus when the meter is switched to the "Beta" range giving a full scale reading of 100, a current of

$$\frac{4\cdot5}{45{,}000} \times 1{,}000\text{mA} = 0\cdot1\text{mA}$$

is injected into the base of the transistor. Now

$$\text{“ Beta ”} = \frac{\Delta I_c}{\Delta I_b}$$

hence, assuming a linear characteristic,

$$\text{“ Beta ”} = \frac{I_c}{I_b} \text{ (approx.).}$$

If I_{co} is small compared with the collector current, I_c, this is a reasonable approximation. So if the meter reads 3mA "Beta" $= \frac{3}{0\cdot1} = 30$.

With the meter having a full-scale deflection of 10mA the reading of 3mA so obtained will correspond to a "Beta" of 30, which is the correct result.

When S2 is switched to read "Beta" a 390Ω resistor is connected in series with the meter to protect it from damage should a transistor having an internal short circuit be connected to the tester. This resistor may be removed by pressing a push button, S3, which then shorts the 390Ω resistor, though in practice the value of "Beta" indicated varies very little whether the resistor is in or out of circuit.

In the circuit shown, the meter reads the collector current plus the base current, but since the latter is so small it makes very little difference to the indicated value of "Beta." This slight error can be overcome by moving the meter circuit from its present position to one where it is in the collector circuit. The only drawback is that S1 then becomes a four pole switch since the meter must be reversed as well as the battery when changing from pnp to npn transistors. The modified circuit is given in Fig. 2.

CONSTRUCTION AND COMPONENTS

The prototype tester made by the author is illustrated in Fig. 3 and was made as small as

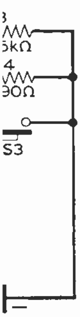
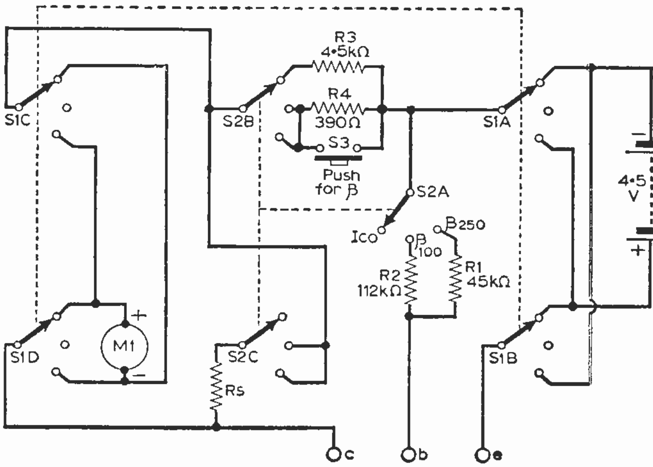


Fig. 1 (left): The basic circuit of the transistor tester.

Fig. 2 (right): The circuit modified to incorporate a 4-pole switch in the S1 position to give the instrument a slightly better degree of accuracy.



possible. It is housed in a small proprietary die-cast box measuring 7¼in. x 2⅛in. x 4⅜in. (Eddystone Cat. No. 845). Small rubber feet are fitted to the underside of the instrument to prevent it scratching polished surfaces.

The meter used originally was a 2½in. diameter moving coil meter with a resistance of 180Ω, but any 1mA meter will suffice. It will be seen that in the components list the value of Rs, the meter shunt, is not given. This is because the value of this resistor will depend on the resistance of the meter used. Its value may be calculated from the

expression: $Rs = \text{meter resistance} \times \frac{10}{90}\Omega$.

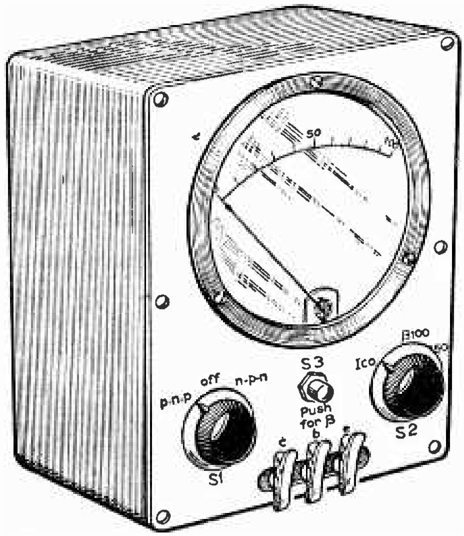


Fig. 3: A view of the finished instrument showing the front panel layout of controls, etc.

Hence in the original transistor tester, which used a meter with a resistance of 180Ω, the shunt

Rs has a value of $180 \times \frac{10}{90} = 20\Omega$.

The type of components used is unimportant, though it is suggested that the resistors controlling the base current 100kΩ + 12kΩ and 33kΩ + 12kΩ should be 1/4W high stability types. Fig. 4 shows the internal layout of components and the wiring.

TEST CONNECTORS

The connections to the transistor under test are brought out to the front panel via sockets which take "wander" plugs such as are used for the older type of h.t. battery. To facilitate connecting a transistor to the tester, the standard "wander" plugs have been modified by cutting off their heads and soldering "crocodile" clips to them as shown in Fig. 5. The plug portion of the plug/crocodile clip assembly is then inserted in the tester socket.

USING THE TESTER

Having assembled and wired the tester it may now be given an initial test before being used. This may be done by switching to npn and Ico when once again the meter should read full scale. When this has been done a "known good" transistor should be tested as follows: First connect the transistor to the tester. Next select npn or pnp as required by S1. Then set S2 to Ico and note meter reading. Finally switch S2 to "Beta" 100 range and note reading. If reading is greater than 100 switch to "Beta" 250.

It should be appreciated that when testing a transistor on this tester there is no thermal stabilisation and in consequence measurements of "Beta" should be made quickly, otherwise the junction will rise in temperature, with the result that Ico will increase and thermal runaway might occur. ■

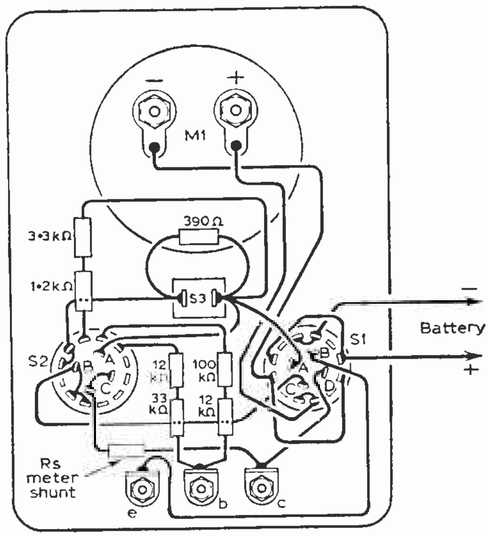


Fig. 4: The wiring inside the case. This diagram shows the wiring for the circuit of Fig. 2, i.e. with 4-pole switch.

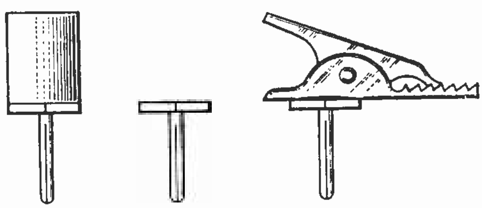
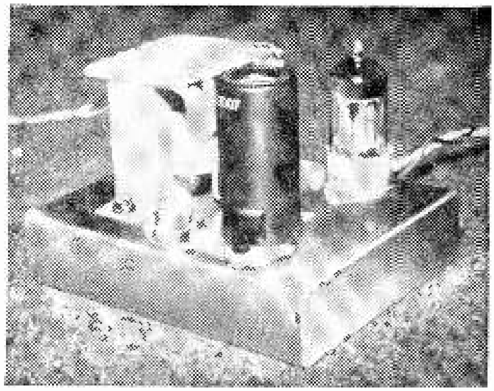


Fig. 5: The modified wander plug/crocodile cilp transistor connector.

Miniature POWER Amplifier

by J. Harrison



THIS small power amplifier was developed while converting a mono radiogram to stereo, but since making the unit many other uses have been found. among them as a centre channel amplifier for experiments in 3 channel stereo, as the output stage of a domestic radio and as a monitor during tests on equipment when using an oscilloscope. No doubt the constructor will find plenty of other uses for this compact cool-running amplifier.

For constructors who are tired of the usual single-ended small amplifier designs (usually employing a valve of the ECL80, ECL82, ECL86 variety). this circuit makes an interesting and rewarding project, easily assembled in a few hours.

The two valves used are almost sure to be found in the spares-box and are 12AX7 (amplifier and phase-splitter) and 12AU7 (push-pull output). These can be bought for around 6s. 0d. each.

The advantages of push-pull operation are well known and 90% of all amplifiers with a hi-fi tag to them have push-pull output. The main advantage for an inexpensive amplifier is the fact that there is no d.c. flux in the output transformer and no signal currents flow around the power supply, which contributes greatly towards amplifier stability.

In a practical amplifier. due to slight unbalance of valve currents and signals, perfect cancellation is not achieved but even so there is a great improvement compared to single-ended working. The only disadvantage is, more signal drive is required because the signal is halved between the two output valves.

The Circuit

One half of the first valve is used as a voltage amplifier directly coupled to the other half used as a phase-splitter. The anode load of the first stage is large (470kΩ) and working into the high-impedance of the phase-splitter produces a greater than usual stage-gain.

Provision has been made in the circuit for a negative feed-back loop (if required) from the output transformer secondary to the cathode of V1A.

The amplifier should be tried out at first without any feedback, tested and if satisfactory then it should be incorporated. The amount of n.f.b. will depend upon how much gain the constructor can afford to lose, however, even without any n.f.b. sound is clean and well-damped.

Construction

Construction is quite simple and there is plenty of room on a 4½in. x 4in. x 1in. chassis. The layout shown in the diagrams is definitely the best for

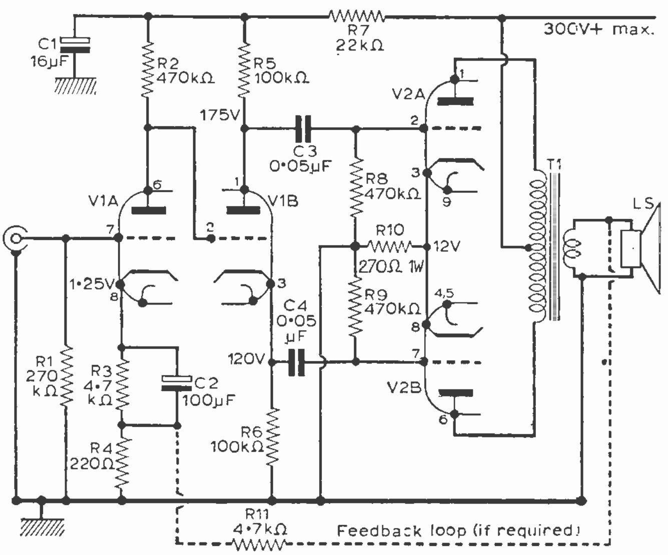


Fig. 1: The simple two-valve circuit.

short leads and constructors are recommended to follow it.

Most of the components are mounted on a small tag-board which has ten pairs of tags. These have been numbered for reference 1 to 20 in the wiring diagram. Some of the tags are linked together and wiring these first before mounting any components will make the job much easier.

There are three components not on the tag board:

(1) Input grid resistor R1 between pin 7 on V1A and earth solder tag.

(2) Output valves bias resistor R10 from the commoned cathodes of V2 to the centre

—continued on page 566

COMPONENTS LIST

Resistors:

R1	270kΩ	R7	22kΩ
R2	470kΩ	R8	470kΩ
R3	4·7kΩ	R9	470kΩ
R4	220Ω	R10	270Ω 1W
R5	100kΩ 1% h.s.	R11	4·7kΩ
R6	100kΩ 1% h.s.		

All ±5% ½W, unless otherwise stated.

Capacitors:

C1 16μF electrolytic 350V
C2 100μF electrolytic 6V
C3 0·05μF 350V
C4 0·05μF 300V

Valves:

V1 12AX7 (ECC83, CV4004)
V2 12AU7 (ECC82, CV4003)

Miscellaneous:

T1 Output transformer, to match 10kΩ anode load (see text).

Two B9A valveholders. 10-way tag strip. Coaxial socket.

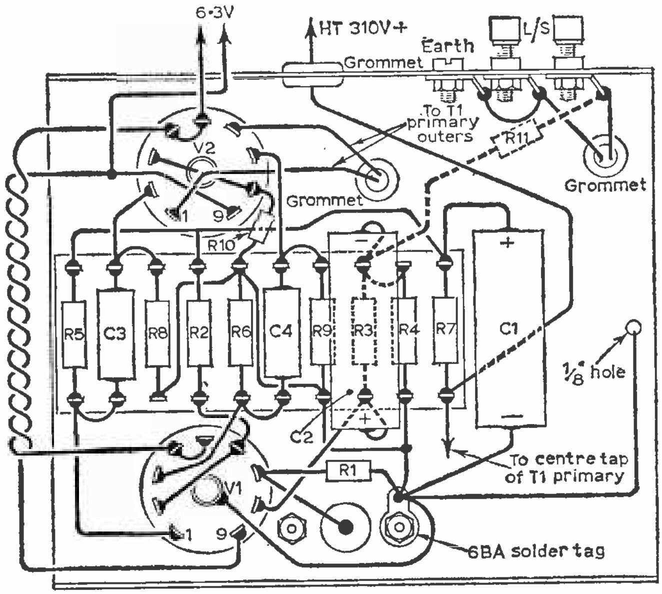
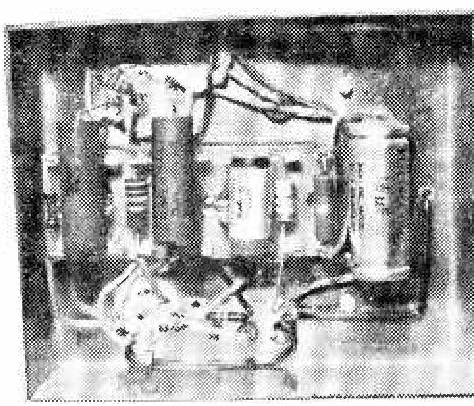


Fig. 2: The main wiring diagram; below is an underchassis view of the finished amplifier.



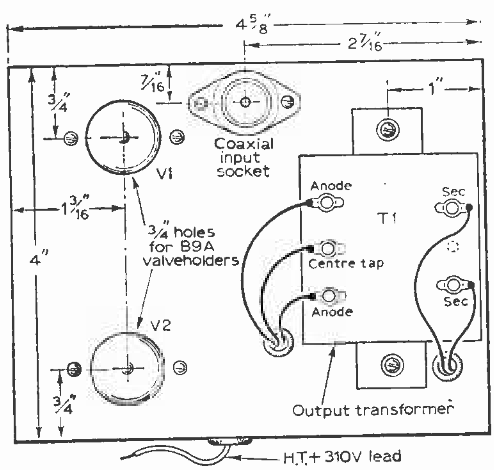


Fig. 3: Above-chassis layout and dimensions.

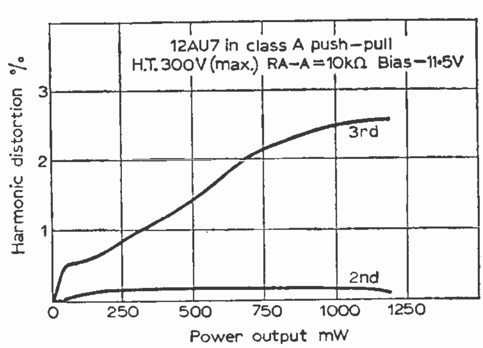


Fig. 4: Harmonic distortion plotted against output for the 12AU7 operated in Class A push-pull.

A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 2 Show-Biz

SOME like circuses, others prefer bread. The organisers of the Radio Show contrive to offer us both.

Some of the other exhibitions around town look with envy on the Earls Court Dichotomy. But radio and television are a natural gift to the show-biz-minded organiser. After all free samples of synthetic butter, or a static, unreal room, or even a bevy of this year's winners of the nursemaid stakes can hardly compete with the Fair of the Air.

Behind it all there is a pretty formidable feat of dovetailed planning. And not a little skull-duggery.

It is the aim of many exhibitors to unveil a last-minute surprise. "*You want a better set—we have it . . . at last*", they seem to say. This leads to a frenzied rushing around on preview and opening days of the gentlemen of the Press. Dashing the free gin from their lips, they converge on the suspected harbour of secrets and attempt to lift the veils—or at least those ugly dust covers that so many exhibitions affect. (Haven't they heard of polythene?)

Hard on their heels come the rival representatives. They try to look unconcerned as they teeter on tiptoe, wondering whether that box behind the stand is going to turn out a trend-setter TV or merely contains the managing director's packaged chicken and champagne lunch.

Frenzied rushing around

Up in the Organiser's Office the headache grows yet more intense. Piles of statistics have to be sorted, analysed and sent to the corners of the world. The bloke with the late-entry surprise may find he has defeated himself by missing the Press boys' deadline. Or he may lose his impact entirely with the kind of oracle who sits in the Press Office and writes his report to the readers of Little Midmarsh from the wealth of exhibition handouts.

On the stands all is glitter and smiles. Bright new models look better than they ever will again. Silver and gold plated dissections revolve on their stands. Arty-crafty scenes vie with the blatantly humorous displays, while here and there, as if in defiance, some bold maker stacks his exhibits like a row of cheeses. One expects the immaculately dressed vendor to bark: "*Roll up, roll up. Every one a winner*".

The annoying thing to some hardened visitors is the lack of information available on their favourite hobby-horse subjects. The deferential gent at the front of the stand is not quite sure. He will have to ask Mr. Mumblegum. This elusive character is hidden behind a phalanx of broad backs, within the drapes and hardboard, like a Rugby forward changing his tattered shorts.

In the meantime there is much else to see. The special attraction, for example, of the XYZ demonstration. We consult the guide, the official map, which even a child could understand. We are stupidly adult. We end up wandering in widening circles between towering walls of brick. When we finally reach the Dem. Room a forbidding clockface, its hands leering toward some impossible, future appointment, confronts us.

For the moment we must be satisfied with the information in the leaflets so lavishly displayed

Changing his shorts.

on every other stand save where we forage. Little boys with capacious satchels have long since skimmed the cream.

But there is still plenty to see. The designers of both the technical innards and the fashion-conscious cabinets and cases (for some modern sets can hardly be described as having cabinets) are at pains to cry their originality. Which makes it all the more surprising when we see the same styling on so many stands. Are we to believe that design has reached a saturation point of near-perfection? (Stand up that man who gave a hollow laugh!)

In our bemused wandering around this Aladdin's Cave of wonders we are likely to lose sight of the great amount of background work. The miles of specially laid cable, the carpentry, the decoration, the problem of assembling people and products under one roof at any given period.

Think of that next time you curse the unexpected hump on the floor of the main aisle, the confusing layout of stands that always seems to lead you past the same eye-catching display, the queues for lukewarm tea, the foot-wearying iron stairs, the heat, the draughts, the impassable crowd around the rostrum.

Whether your taste is for bread or circuses, remember we must have both.

AN INDUCTANCE/CAPACITANCE TESTER

by H. Webster

A simple but versatile two terminal oscillator which enables inductance and capacitance measurements to be carried out with good accuracy is described. In addition, gang capacitor sections and inductances, whether screened or unscreened, can be matched to a high degree of accuracy. Further suggestions are given for the construction of a signal generator which is a novel departure from the usual type of instrument.

A problem which is frequently encountered by the constructor is the measurement of inductance. In particular, one is often faced with the task of matching inductances to fairly close tolerances. Even when two coils are wound as physically similar as possible, the inductances of the respective coils may well vary by as much as 2%. In most cases the error will generally exceed this figure.

As a simple example consider an inductance of 100μH in parallel with a capacitance of 200pF. The resonance frequency of the combination is 1125 Kc/s. Replacement of the 100μH inductance with one of 99μH results in the new resonance frequency of 1131 Kc/s. Since the miss match between the two inductances is a mere 1%, the 6kc/s error is somewhat astonishing. Nevertheless, a simple calculation will convince the experimenter of the truth of this statement.

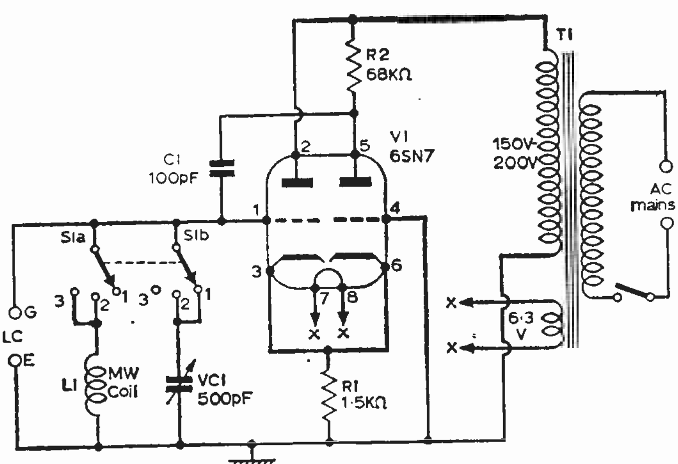


Fig. 1: The basic circuit of the instrument.

Two such coils used in the radio frequency stages of a receiver would give extremely bad alignment. Since hand wound coils are less reproducible than machine wound coils, these errors are frequently much greater than in the foregoing example.

For some time past the author has employed a simple unit which can be used to match inductances to a high degree of accuracy. In addition, the inductances of coils can be measured, capacitances determined and tuning capacitor sections equalised. Slight modification of the oscillator is necessary if inductance and capacitance measurements are contemplated. The modified circuit diagram is given in Fig. 1.

Principle of operation

Inductance measurement.

A simplified block diagram of the basic circuit for the measurement of inductance is given in Fig. 2.

The mode of operation is as follows. L, the unknown inductance, is placed in parallel with a standard capacitance C. The resonance frequency of the combination LC is determined by means of a calibrated receiver. A knowledge of this frequency enables one to determine the inductance utilising the formula

$$L = \frac{25{,}330}{C\,f^2}$$

where L is expressed in microhenries, C in microfarads and f in kilocycles/second. Since several

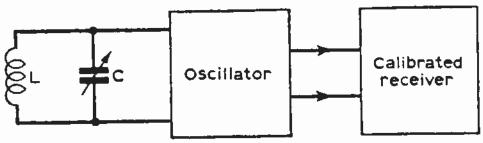


Fig. 2: The basic arrangement for making inductance measurements.

factors have been excluded, this method is only suitable for approximate measurements.

In the block diagram, the tacit assumption has been made that the capacitance C is the only capacitance in circuit. Since circuit wiring and valve electrode capacitances are present these so called stray capacitances must be taken into account.

Consider the following argument:

Let L = inductance μH.
C_S = stray capacitance μF.
C_1 = maximum capacitance of C μF.
C_2 = minimum capacitance of C μF.
F_1 = resonance frequency of combination L, C_1 C_S kc/s.
F_2 = resonance frequency of combination. L, C_2 C_S kc/s.

When C_1 is in circuit, total capacitance $= C_1 + C_S$.

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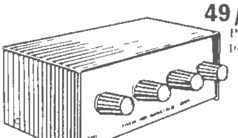

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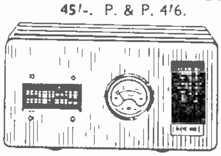

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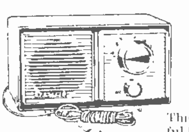

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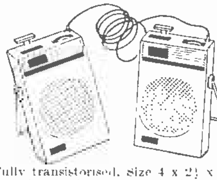

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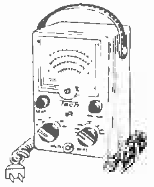

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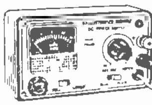

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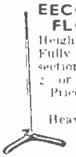

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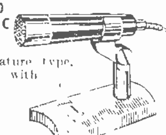

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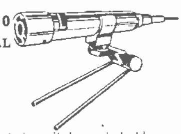

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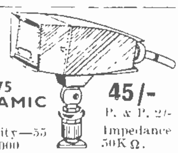

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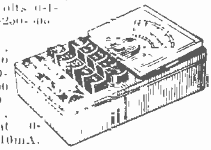

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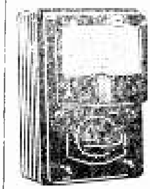

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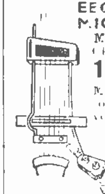

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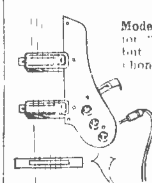

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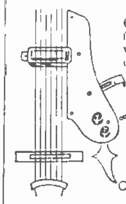

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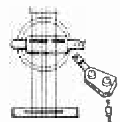

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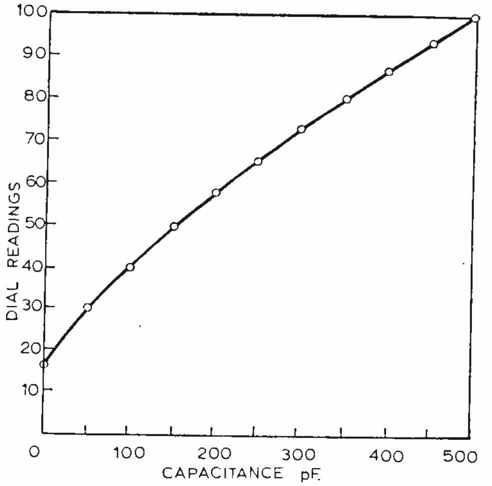

Fig. 3: Specimen graph of dial readings plotted against capacitance. The apparent zero capacitance at a dial reading of 16 occurs because of the arbitrary choice of 500pF as maximum capacity.

When C_2 is in circuit, total capacitance $= C_2 + C_S$.

$$\therefore \text{ since } LC = \frac{K}{f^2} \text{ where } K = 25{,}330$$

$$\text{then } L(C_1 + C_S) = \frac{K}{f_1^2}$$

$$\text{and } L(C_2 + C_S) = \frac{K}{f_2^2}$$

Subtracting

$$L(C_1 + C_S) - L(C_2 + C_S) = \frac{K}{f_1^2} - \frac{K}{f_2^2}$$

$$\text{or } LC_1 + LC_S - LC_2 - LC_S = \frac{K(f_2^2 - f_1^2)}{f_1^2 f_2^2}$$

$$\text{or } L(C_1 - C_2) = \frac{K(f_2 + f_1)(f_2 - f_1)}{f_1^2 f_2^2}$$

transposing

$$L = \frac{K(f_2 + f_1)(f_2 - f_1)}{f_1^2 f_2^2 (C_1 - C_2)}$$

Hence, if the resonance frequencies, f_1 and f_2, are found and $C_1 - C_2$ is known, then L can be calculated. Two points arising from this expression are worthy of note. First, the stray capacitance term C_S is automatically cancelled out in the derivation. Secondly, the expression contains in the denominator the factor $C_1 - C_2$. Since this is merely the difference, ΔC, between two quantities, the absolute value of C, the variable capacitor, is not required. What is required, however, is an accurate knowledge of ΔC.

Practical considerations

An accurate calibration of the variable capacitor is absolutely essential if reliable results are to be obtained. A method for the determination of ΔC will now be given.

With the switch in position 2 the standard medium wave coil is brought into circuit. The variable capacitor is turned to maximum capacity. In the author's instrument this capacitor had a nominal value of 500pF and was fitted with a dial calibrated from 0-100.

A table, divided into two columns, is drawn up. One column represents capacitance, the other column dial readings. The capacitance column is divided in 50pF intervals, starting with 500pF, corresponding to a dial reading of 100.

The modulated r.f. signal emitted by the oscillator is picked up on the calibrated receiver which is tuned to the medium wave band and placed a suitable distance from the oscillator. A knowledge of the frequency of the emitted signal is not necessary for calibration of the capacitor.

The receiver setting is left undisturbed and a close tolerance ($\pm 1\%$) capacitor of 50pF capacitance placed across the LC terminals. The variable capacitor is retuned until the signal is again picked up on the receiver. Since the inductance is constant, the reading of the variable capacitor must have decreased by 50pF. The dial reading must therefore correspond to 450pF. With the dial setting of the variable condenser unchanged the 50pF standard is removed and the signal again picked up on the receiver. The 50pF standard is replaced across LC and the variable capacitor retuned as before. In this way a series of capacitance points, each differing by 50pF can be obtained. The variable capacitor dial readings are then plotted against the appropriate capacitance readings on a sheet of graph paper as shown in Fig. 3. Reference to the graph will then enable the constructor to determine the capacitance difference between any two points on the dial.

The factors affecting the accuracy of the foregoing calibration will be apparent: First, the calibration is based on the accuracy of the fixed standard capacitor, and secondly, it is necessary to decide whether two signals are of equal magnitude. For all practical purposes a $\pm 1\%$ silver mica capacitor is adequate for calibration purposes. The second source of error can be largely eliminated by fitting the receiver with an output meter. Alternatively, if a.v.c. is fitted, a 0-10 v. d.c. meter may be connected across the bias resistor of one of the controlled valves.

Applications of instrument
Inductance measurements

The experimenter is often required to wind a coil to a given inductance value. In general the required number of turns can be obtained either by calculation, using some type of empirical formula, or by graphical methods. After winding the coil with the appropriate number of turns it is frequently found that inductance is quite different from the nominal value.

Now let us suppose that a coil of inductance 170μH is required for medium wave band coverage. Reference to tables or formulae will indicate that approximately 98 turns of 34 s.w.g. enamelled wire close wound on a 1 in. diameter former will give this value of inductance. Starting at the grid end of the coil, wind on 5 turns and space this section from the remaining 93 turns by approximately $\frac{1}{8}$ in. Switch the oscillator to position 1 and connect the coil across the LC terminals. Set the variable capacitor to 400pF and tune in the resulting signal on the receiver. Note the frequency f_1. Reset the capacitor to 300pF and again note the new frequency f_2. The values obtained in this way are substituted in the formula and the inductance calculated. Adjustment of the inductance can be made either by spacing of the 5 turn section or by removal of turns.

As an example of an experiment by the author, a coil of nominal inductance 170μH, was required. It was found that with 400pF in circuit the resonance frequency was 600kc/s. With 300pF in circuit the resonance frequency was 680kc/s. Substitution in the formula gives

$$L = \frac{25330 \times (680+600) \times (680-600)}{680^2 \times 600^2 \times \cdot 0001}$$
$$= 156\mu H$$

Although the arithmetic is simple, the working out is a little heavy and the use of logarithms is recommended. In the above case the inductance was increased by bringing the 5 turn section into closer proximity with the main coil.

A serious source of error in the preceding experiment can arise in reading the frequency on the receiver dial. Unless the receiver calibration can be relied upon a better procedure is as follows. Tune the receiver to a station of known frequency at the l.f. end of the medium wave band. Adjust the oscillator variable capacitor until zero beat is obtained. With the aid of the graph note the capacitance corresponding to the dial reading. Retune the receiver to a station of known frequency near the h.f. end of the band. Adjust the variable capacitor for zero beat, again noting the capacitance reading. The inductance is calculated as in the preceding example.

When other inductance values are required a rough calculation will give the approximate frequency coverage and the receiver can be switched to the appropriate band.

Inductance matching

Although the foregoing experiments are of interest, particularly where an exact knowledge of the inductance of a coil is required, in practice, the constructor is more interested in the matching of coils rather than in the determination of absolute values. It will now be shown how exact matching of two or more coils is possible.

Let us assume that two coils L1 and L2, require matching. Insert L1 across the LC terminals and place the switch in position 1. Adjust the variable capacitor to any convenient value and the note the frequency f_2 of the resulting signal on the calibrated receiver. Remove L1 and insert L2 and again note the frequency f_1 of the signal. If f_1 and f_2 coincide the coils are perfectly matched. However, the author assures readers that this is extremely unlikely! In the more likely event of f_1 and f_2 being different, note whether f_2 is greater or less than f_1. If f_2 is greater than f_1 then L2 is *less* than L1 and conversely, if f_2 is less than f_1 then L2 is *greater* than L1. Since it is more practicable to remove turns from a coil, inductance matching is carried out on the higher of the two inductances. The following procedure is adopted.

With the lower of the two inductances determine the frequency with the calibrated receiver. Without disturbance of the generator or receiver settings, remove the inductance and insert the inductance of higher value. The coil is then adjusted, either by placing or removal of turns until the emitted signal coincides with the receiver setting. The coils are then matched.

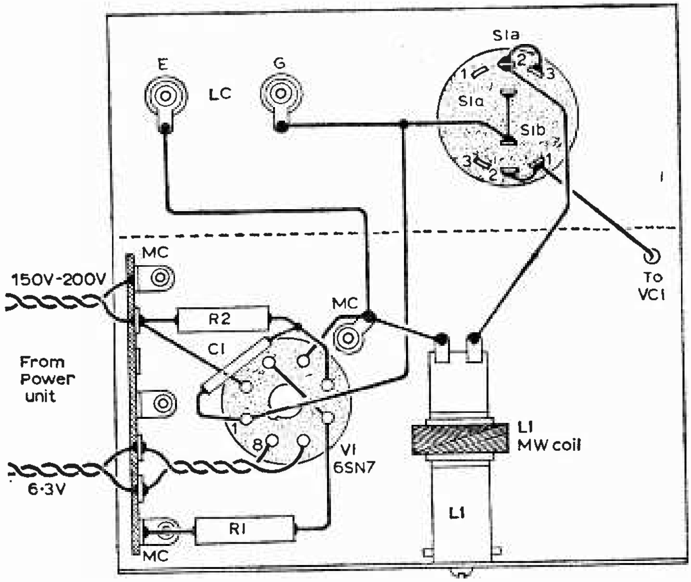

Fig. 4: The underchassis wiring diagram.

If greater accuracy is required the coils can be matched by zero beating against a station of known frequency. With practice, a high degree of accuracy can be achieved.

It is important to note that after each adjustment of the coil, the hand or any other earthed object should not be in close proximity with the coil. Since it is inevitable that the panel is near to the coil, each determination is carried out at exactly the same distance from the panel.

Gang capacitor matching

It is not generally realised that gang capacitor sections are rarely equal. In many cases the errors involved may be as great as 2%. For exact ganging of circuits not only must the inductances be matched and stray capacitances balanced out but also the gang capacitor should have equal capacitance in each section at every setting of the gang capacitor. Too often this source of error is overlooked when poor receiver alignment is obtained, Provision is generally

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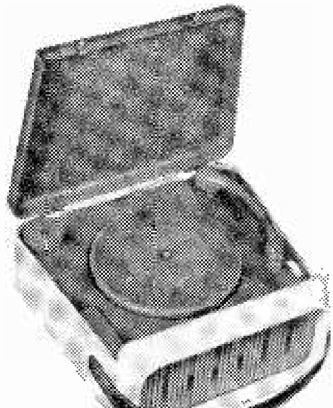

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3½	7000	35	8/6
3½	9500	50	10/6
4	7000	25	11/6
4	6000	35	10/6
4	7000	35	11/-
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5	6000	5	8/-
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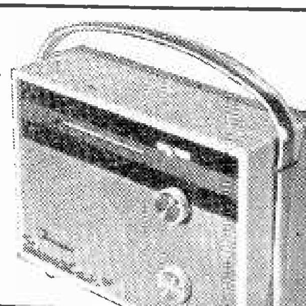

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made for the adjustment of gang capacitor inequalities by the provision of split end vanes in each section. Using the oscillator, excellent matching of gang capacitor sections can be achieved in the following manner.

For the purpose of illustration the matching of a twin gang capacitor will be described. With the oscillator switch in position 3 the medium wave coil is brought into circuit and the variable capacitor switched out of circuit. Connect one section of the gang capacitor across the LC terminals of the oscillator. Turn the gang capacitor from maximum capacity to minimum capacity until the first segment of the split end vane is completely in mesh with the stator plates. Tune the receiver to the h.f. end of the medium wave band until the oscillator signal is heard. Remove the clip from the stator tag of the first section and replace on the second section tag. The end segment is then gently bent out from the vertical and away from the other rotor vanes until the radiated signal coincides with the receiver setting.

Naturally the choice of section for adjustment depends on which section has the higher capacitance value. The higher the capacitance, the lower the frequency, conversely the lower the capacitance, the higher the frequency. The adjustment is always carried out on the section with the higher capacitance.

When equality has been obtained the process is repeated with the remaining segments until a perfect match is obtained at all settings of the gang capacitor.

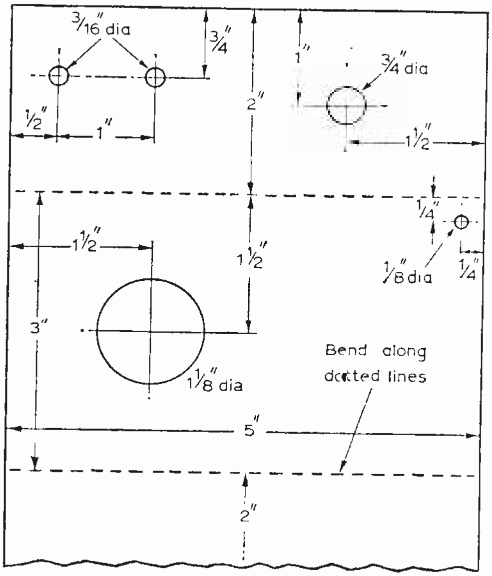


Fig. 5 (left): Principal chassis dimensions.

Capacitance measurement

Capacitors in the range 10-500pF can be measured with reasonable accuracy by means of the oscillator. The accuracy of measurement is limited only by the errors involved in the calibration of the oscillator variable capacitor. The principle of the method is similar to that employed in the calibration method.

With the variable capacitor set to maximum capacity (500pF) the resultant frequency is observed on the receiver. The unknown condenser is placed across the LC terminals and the variable capacitor tuned until the signal is again heard. The capacitance reading of the oscillator dial is noted. For example, if the setting of C without the unknown capacitance is 500pF and 450pF with the unknown capacitance in circuit, then the value of the unknown capacitance is 500—450=50pF. This method is unsuitable for capacitances greater than 500 pF since the greatest measurable capacitance can never be greater than the capacitance swing of the variable capacitor.

Constructional details

The oscillator is constructed on a 5in. × 3in. × 2in. chassis, the relevant dimensions being given in Fig. 5. Wiring of the instrument is not critical and most of the components will probably be to hand. The variable capacitor is the most critical item and it is strongly recommended that a good specimen manufactured by a reputable firm is used. Since the current consumed by the oscillator is negligible a small midget transformer will suffice for the power requirements. In the author's instrument the transformer is separate from the oscillator but there is no reason why other constructors should not make the transformer an integral part of the unit. A slightly larger chassis will of course be necessary if this is envisaged.

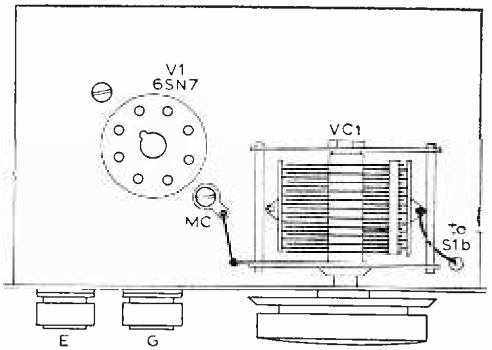


Fig. 6: An above-chassis view.

The connections of the unknown inductance or capacitance to the LC terminals are of considerable importance. These connections should be constructed from thick copper wire so that the leads are self supporting. The two leads terminate in crocodile clips which can be firmly attached to the component under test. When testing gang capacitor sections it is important that the frame of the capacitor is connected to the terminal marked E. Similarly, if screened coils are being tested the screen and earthy end of the coil should be firmly earthed to the same terminal.

The oscillator switch performs three functions. Position 1 is used for inductance testing and matching, position 2 for capacitance testing and position 3 for gang capacitor matching.

When testing or matching inductances it is essential to ensure that the two coils are tested in the same position relative to the instrument panel. To avoid undesirable screening effects it is recommended that the test leads are not less than 3 in. in length.

The author has found that the instrument is greatly superior to the grid dip oscillator for the measurement of inductance and capacitance. If desired, the basic circuit could be embodied in a complete signal generator with the additional facilities of inductance and capacitance testing being incorporated. A suggested circuit for the experimenter who desires to elaborate on the test unit is given in Fig. 9.

Appendix

For the sake of completeness and as a convenient reference for constructors the following data is included.

Several expressions are available for the calculation of the number of turns required for a given inductance The author has used two well known formulae which have proved satisfactory in practice. The first formula is applicable to single layer coils.

$$N = LR\left[1 + \sqrt{\frac{9}{aLR^2}}\right]$$

Where N is the required number of turns
L is the inductance in microhenries
a is the radius in inches
and $R = \dfrac{20}{nd^2}$ where
n is the number of turns per inch
d is the diameter in inches

The second formula is applicable to pile wound coils. See Fig. 8.

$$L = \frac{0{\cdot}2 \times a^2 \times N^2}{3a + 9b + 10c}$$

where a is the mean diameter
b is the winding length
c is the depth of winding
N is the number of turns
all dimensions being expressed in inches

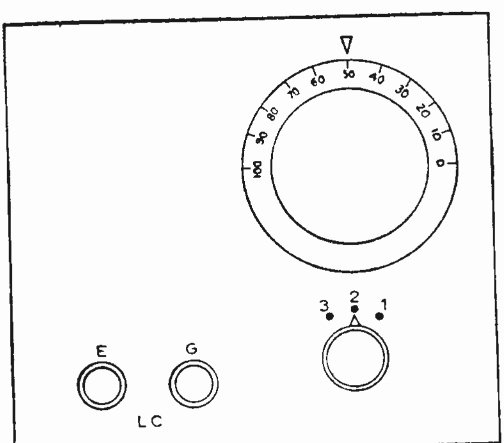


Fig. 7: Front panel layout of controls.

Applications to coil winding

The frequency coverage of a given coil and variable capacitor is given by the expression

$\dfrac{f_2}{f_1} = \sqrt{\dfrac{C_1}{C_2}}$ where C_1 is the maximum capacity of the variable capacitor and C_2 the minimum capacity. In practice, stray capacitances have to be taken into account. These extraneous capacitances have a bearing on the frequency coverage of the given combination of C and L. Now let us suppose that it is desired to cover the medium wave band with a given coil and a variable capacitor of 500pF nominal capacity. Average values for the maximum and minimum capacitances of such a capacitor are 500 and 15pF respectively. To these values must be added stray capacitances, which in general may be as high as 15pF. The capacitance coverage is now 515—30pF. The total minimum capacitance is now brought up to some predetermined value by the use of a trimmer capacitor. Let this excess capacitance be 20pF. The capacitance coverage is now 535—50pF. We can now calculate the frequency coverage using the previous expression. If we assume the lowest frequency we wish to cover is say 560kc/s then

$$\text{Since } \frac{f_2}{f_1} = \sqrt{\frac{535}{50}} = 3{\cdot}27$$

then $f_2 = 560 \times 3{\cdot}27 = 1753$kc/s.

The inductance of the required coil may be calculated utilising the expression

$$L = \frac{25{,}330}{Cf^2}$$

Substitution of the previous values of C and F gives

$$L = \frac{25{,}330}{{\cdot}000535 \times 560^2} = 165\mu H$$

The required coil may now be wound to this inductance value using the first inductance formula. Let the diameter of the former be 1 in. and assume that the given enamelled wire occupies a winding length of 100 turns per inch. e.g. 34 s.w.g.

$$\text{Since } R = \frac{20}{nd^2} \text{ then } R = \frac{20}{100 \times 1^2} = 0{\cdot}2$$

$$\therefore N = 165 \times 0{\cdot}2\left[1 + \sqrt{1 + \frac{9}{0{\cdot}5 \times 165 \times {\cdot}04}}\right] = 97$$

Hence the coil can be wound with 97 turns of 34 s.w.g. wire, close spaced and occupying a length of approximately 1 in.

An example of inductance calculation utilising the second formula will now be given. Assume that a coil of 2000μH inductance is required to be wound on a 1 inch former and using 34 s.w.g. wire. Any arbitrary value of b may be chosen. Let this value be $\frac{1}{8}$ inch. The number of turns of wire occupying this length is approximately 12. It is now necessary to try several trial solutions. Assume that 100 turns are required. The number of layers is therefore

$$\frac{100}{12} = 8 \text{ ca.}$$

The depth therefore is $\frac{8}{100}$ in. = C.

Substituting these values in the formula gives

$$L=\frac{0{\cdot}2\times 1{\cdot}08^2\times 100^2}{3{\cdot}24+1{\cdot}11+0{\cdot}8}=454\mu H$$

thus giving one trial solution. The process is repeated for other values of N. A rough plot of N against

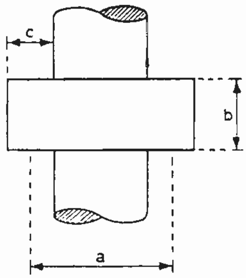


Fig. 8: Critical coil dimensions in inductance calculations.

COMPONENTS LIST

R1	1·5kΩ 1W R2 68kΩ 1W
C1	100pF silver mica
VC1	500pF variable
L1	Medium wave coil
S1a, b	2-pole 3-way switch
V1	6SN7
T1	Mains transformer: miniature type
	Octal valveholder, terminals, aluminium chassis, panel, etc.

COMPONENTS LIST

S1a, b	Altered to two-bank switch: single-pole 7-way each bank
L1	0·45μH
L2	2μH
L3	19μH
L4	1,500μH
L5	165μH

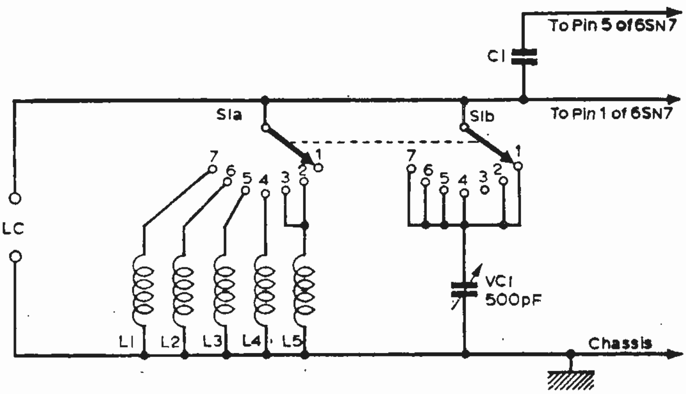


Fig. 9: Input circuit for combined signal generator and inductance/capacitance tester. S1: pos.1 inductance match and test; 2 capacitance test and 560-1600 kc/s; 3 gang capacitor match; 4 180-600 kc/s; 5 1·6-5 Mc/s; 6 5-15 Mc/s; 7 10-30 Mc/s.

inductance is made, when the required number of turns for the given inductance may be read off from the curve.

Another and possibly less tedious method of computation may be carried out with this formula

$$\text{Since } L=\frac{0{\cdot}2\,a^2N^2}{3a+9b+10c}$$

Transposition gives

$$N^2=\frac{L\,(3a+9b+10c)}{0{\cdot}2a^2}$$

The preceding 2000μH inductance may now be calculated as follows.

Two arbitrary valves are assigned to b and c. For the purpose of calculation let b = ⅛ inch and C = ⅛ inch, then since L = 2000 and a = 1⅛

$$\text{Then } N^2=\frac{2000\,(3\tfrac{1}{8}+1\tfrac{1}{8}+1\tfrac{1}{4})}{0{\cdot}2\times 1\tfrac{1}{8}\times 1\tfrac{1}{8}}=49{,}400$$

$\therefore N=222$

The required gauge of wire is now calculated. Let n be the number of turns per inch.

Then the number of turns in length b = bn.

and the number of turns in depth c = cn

$\therefore$ Total number of turns = bn × cn = bc

and this value is equal to N

$\therefore$ Since N = 222

then $bcn^2=222$ and since b = c = ⅛ in.

$$\text{then } n=\sqrt{\frac{222}{\frac{1}{8}\times\frac{1}{8}}}=120$$

From wire tables it is found that the nearest gauge which has a winding length of 120 turns per inch is 38 s.w.g. enamelled wire.

The required data is therefore 222 turns of 38 s.w.g. enamelled wire, pile wound to a length of ⅛ in. and a depth of ⅛ in.

The required number of turns for the inductances given in the suggested circuit of Fig. 9 can be calculated by means of these formulae. These calculations are left as an exercise for the experimenter. ■

TRADE NEWS • TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS • TRADE NEWS

Wide Range Sine-Square Generator and a New Valve Voltmeter

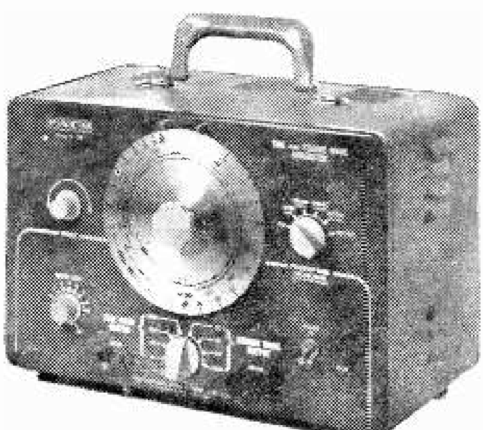
THE Paco G.34 is a combined sine-square wave generator covering a frequency range of from 7c/s to 750kc/s for sine and 7c/s to 300kc/s for square waves. Distortion is claimed to be less than 0·3% from 20c/s and frequency response is flat within ½db from 120c/s to 120kc/s and 1db to 750kc/s. Sine wave output is 0-10V across 600Ω. Square wave output 20V p.p. no load, with a rise time of less than 0·15μS.

The output level is controlled by an attenuator, with three 20db steps, also a control for fine adjustment. The Paco G.34 is priced at £40 7s. complete, or may be purchased in kit form at £38 5s.

Also from Paco comes a new valve voltmeter, the V.70. This instrument has 7 d.c. ranges from 0—1500V, 7 a.c. ranges from 0—1500V r.m.s. and 0—4000V peak-to-peak, an ohmeter range of 0—1000MΩ and a decibel range of −6db to +66db.

The V.70 comes complete with a detachable 3-way probe, but the AV.1 high frequency crystal probe and the AV.2 high voltage probe are also available for use with the valve voltmeter permitting direct readings of voltages up to 60kV.

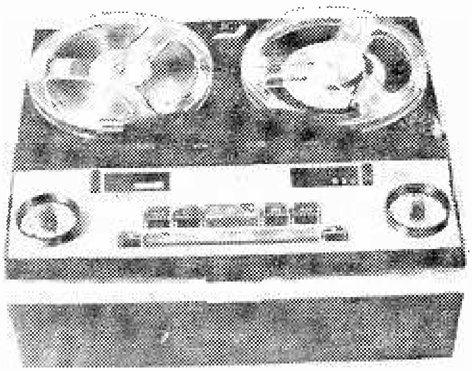
The Paco V.70 is priced at £22 12s. and may be purchased in kit form for £20 8s. *K.L.B. Electric Limited, 335 Whitehorse Road, Croydon, Surrey.*



This is the Paco G.34 sine-square wave generator.

Sony Agreement

THE Radio and Electrical Division of St Aldate Warehouse Ltd. (a Debenham Import & Distribution Company) have signed an agreement with the Sony Corporation of Japan, for exclusive distribution rights in the U.K. of Sony Products. The products included in the agency agreement are radios, tape recorders, and all future Sony products to be introduced into the United Kingdom markets.



The Sabafon TK230-S tape recorder.

New Equipment from SABA

NEW from SABA Electronics Ltd., is a range of audio equipment. Featured among this is a stereo/mono four track, two speed tape recorder, the Sabafon TK 230-S. This machine incorporates two amplifiers with matched transistor input stages, a built-in mixer unit with inputs for two sound stages, two push-pull output stages providing 5W per channel for stereo and 10W for mono, and a built-in tape cleaner. There are input sockets provided for gram, radio, pedal switch, slide synchroniser, time switch, stereo microphone, external loudspeakers and high impedance headphones. Weight is approximately 30lbs. and the price is 95 guineas. *SABA Electronics Ltd., Eden Grove, Holloway, London, N.7.*

Lighting Control Switch

A NEW lighting control switch has been introduced by Regentone, which enables room lighting to be adjusted easily to any level.

Called the "Varilite", the new control replaces the conventional wall switch and uses a new kind of rectifier which enables it to control up to 300W of lighting without generating wasteful heat and without taking up too much space.

The "Varilite" uses no power itself, therefore reducing electricity bills—since payment is only made for the light selected—and prolonging the life of the bulb.

The "Varilite" costs 6½ guineas, fits any standard wall switch box and can be installed in a few minutes with the aid of a screwdriver. *Regentone Radio and Television Ltd., Footscray, Kent.*

New Portable from Ever-Ready

NEW from Ever-Ready is the "Sky Queen". It is one of a new range of Ever Ready transistor radio receivers. The Sky Queen is a 7 transistor superhet covering medium and long wavebands, and having an output power of 500mW. There is provision for car aerial and ear-

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Sockets for all above types 1/3 each, universal (½in. or ¾in.) 2/-.

Miniature twin crystals in glass envelope wire ended, 5/- each.

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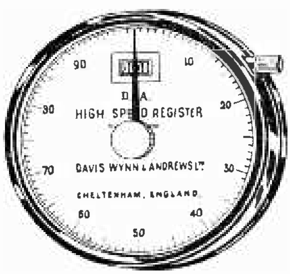
BY DAVIS, WYNN and ANDREWS

4in. dial and pointer registers up to 100 and 4-digit counter, both manually re-settable. The drive to the counter is by an inverse escapement so that there is no loading of the pointer mechanism when digits are changed, and adjustable pawls are unnecessary.

Coil resistance 100 ohms for nominal 50 volt operation, but the device works reliably from 20 volts at rates up to 10 impulses/sec. In circuit with a thyratron or neostron counting rates up to 100 impulses/sec are possible provided pulse width is restricted to keep mean current to 100 mA.

Highly suitable as readout element for Geiger counters and similar devices where the pointer movement would give a clear impression of change in rate of count.

Brand new in individually sealed boxes **£4.7.6**



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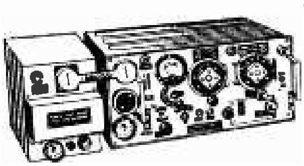
TYPE 19



with power pack for 12V. input covers 2–8Mc/s and 240 Mc/s. V.H.F.I.F. used 465 kc/s. C.W. or speech. Untested, in good condition, fully valved.

£4.17.6 plus £1 p. & p.

Combined Mike-headset 17/6, p. & p. 2/6.
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BRAND NEW WITH MAKER'S GUARANTEE

Plate size 7¼ x 7¼ x 7¼in.

		£ s d	carr
12 V.D.C.	12 amps	1 12 6	3/6
12 „	18 „	1 19 6	3/6
12 „	36 „	3 19 6	7/6
12 „	54 „	5 17 6	7/6
24 „	18 „	3 19 6	7/6
24 „	36 „	5 19 6	7/6
24 „	54 „	11 15 0	7/6
36 „	18 „	5 17 6	7/6
36 „	36 „	11 15 0	7/6

Plate size 4¼ x 4¼in.

		£ s d	carr
12 V.D.C.	8 amps	19 6	2/6
24 „	8 „	1 19 6	3/6
36 „	8 „	2 19 6	3/6

18V max. input

D.C. out 1 amp	3/6 plus 1/-
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2 amps D.C.	1 5 6	3/6
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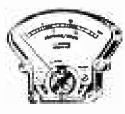
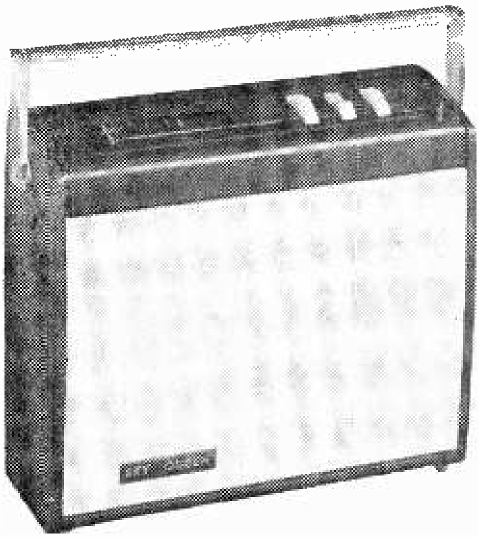


FOR CALLERS ONLY

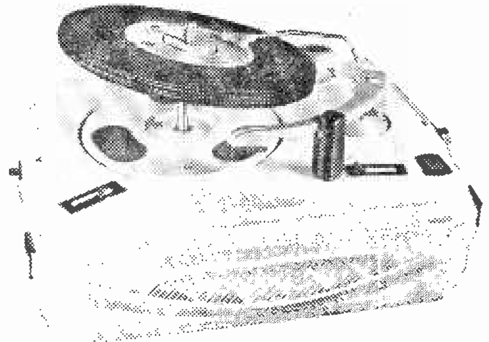
We have a large and varied quantity of odd types of valves, many brand new all at 1/- each, callers only. Come in and sort 'em out! Many other interesting items for personal callers.

piece or tape recorder connection.

The set is powered by an Ever Ready PP9 battery giving some 190-200 hours playing time, and the price, including purchase tax, is fixed at 15 guineas. *Ever Ready Co., (Great Britain) Ltd., Hercules Place, Holloway, London, N.7.*



Ever Ready's new "Sky Queen" portable.



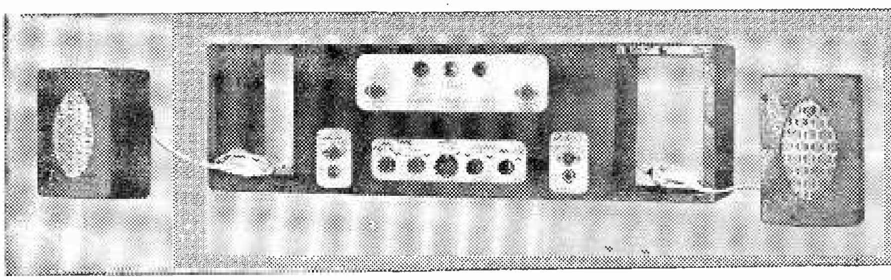
This battery-operated record player is made by W. H. Sanders (Electronics) Ltd.

Battery Autochange Player

BULK production has begun of a transistorised battery-powered record player, for 7in. 45 r.p.m. records, designed and manufactured by W. H. Sanders (Electronics) Ltd.

This automatic portable record player has been designed as a "take-anywhere" gramophone, its construction being exceptionally robust and featuring built-in transit protection for the pick-up and needle. Retail selling price is expected to be less than £15. *W. H. Saunders (Electronics) Ltd., Gunnels Wood Road, Stevenage, Hertfordshire.*

THE "MULTIPHONIC"



A 13-STAGE STEREO AMPLIFIER

BY MARTIN L. MICHAELIS

CONTINUED FROM PAGE 421 OF THE SEPTEMBER ISSUE

PROVIDED that the points outlined last month regarding h.t. voltage for the output stages are observed, almost any reasonable arrangement with available components may be used as h.t. supply if the exact specified items are not to hand.

If a transformer with a centre-tapped full-wave h.t. winding 250-0-250V (do not use a higher voltage one) is used operate one rectifier MR1, MR2 off each 250V end. The value of R20 will almost certainly need to be raised somewhat under such circumstances. If valves type ECC88 are available in place of PCC88 all heaters may be run in parallel off a single 6·3V winding, so that only one such winding (rating about 3A) is then needed. However, such valves are rarer than PCC88s. If a single heater winding used in this way has no tap earth one side and operate D1 and D2 off the other end.

The resulting increased bias voltage may be applied to V4 without further modification but C11 on each amplifier must now be shunted with a 5V Zener diode (cathode to chassis). If a 4V tap is present earth the "0" end and operate D1, D2 off the 4V tap. Naturally, when using ECC88s R41-R44 are not required.

Circuit Details of Input/Output Matrix

V4 and V5, on the one hand, and V3 on the other hand constitute two separate units, either or both of which may be omitted if not required. V3, with its function of splitting a monaural input into two channels, is the more important. It is hardly sensible to omit it if one is likely to operate with monaural signals in addition to pure stereo.

The output matrix section V4, V5 may be omitted if one never contemplates using outputs other than the two main speakers, and when the latter are substantial enough to give good bass reproduction themselves, not requiring the use of a common middle position bass amplifier and speaker operated off P4 when feeding a large audience in a large room with large baseline stereo signals.

The circuit arrangement of V3 is known as "anode-splitter". Both grids of the double triode are fed in parallel from the monaural input via separate grid-stoppers to prevent parasitic oscillation. The anode circuits are separate, giving two identical but electrically separate outputs.

The unbypassed cathode resistors both reduce gain (largely unwanted in this stage) and neutralise any would-be cross-talk between stereo signal channels due to this stage. R22/VR1/VR2 form an output voltage divider, coupling into the respective main amplifier channels; C14 is the normal h.t. voltage blocking capacitor.

This very high impedance voltage divider serves the purposes of further removal of unwanted gain of V3, thus not unnecessarily raising the hum and noise level, and it also prevents loading of the stereo input through the anode circuits of V3. R21 serves no electrical purpose, being merely a convenient anchorage point in the layout specified.

This sort of measure is a useful trick to remember: if a string of required components in series requires anchorage at a junction a very high value resistor or very low value capacitor can be used as a dummy tie-point to chassis or some other convenient anchorage. One must merely be certain that the electrical side effects are in all cases truly negligible.

V4 operates simultaneously as a pair of independent cathode-followers for the stereo output at P3 and as an additive anode amplifier developing a combined monaural signal across R34 from the stereo input to the two grids.

The monaural anode signal is passed on to V5 as output cathode-follower. R35 and R37 as voltage divider set an operating point of sufficient standing anode current for V5 as the d.c. voltage across R37 is repeated by d.c. cathode-follower action across R38. Such a method of positive grid bias on an h.t. bleeder is not usable for V4 because it would pass d.c. into the track of VR3, making operation of that control scratchy.

The use of extra blocking capacitors would produce unnecessary bass loss and phase shift, detrimental to stereo reproduction with a central common bass speaker. Thus cathode bias is used here as an alternative.

Speakers

The cabinet design used in the prototype for the complete unit aims at giving a complete self-contained installation for "personal" stereo listening in a small room. Two small oval speakers of about 3 x 5in. are specified and housed in niches at each end of the amplifier cabinet, giving a baseline of about 2ft. This gives a reasonable stereo impression when the unit is standing on the table in front of the listener about a yard from his head.

A more intense effect is obtained when the speaker units are removed from the niches and placed as far apart as the listener recedes from them. The room area in which stereo effect obtains is thereby also greatly increased, enabling larger audiences to be served.

However, with the small speakers specified the tone is likely to be very shrill and thin when they are moved apart, with a rather empty "middle". This defect may be combated either by using in addition, placed centrally, a third amplifier and large bass speaker, operated off P4, or simply by using an identical pair of much larger speakers in good cabinets.

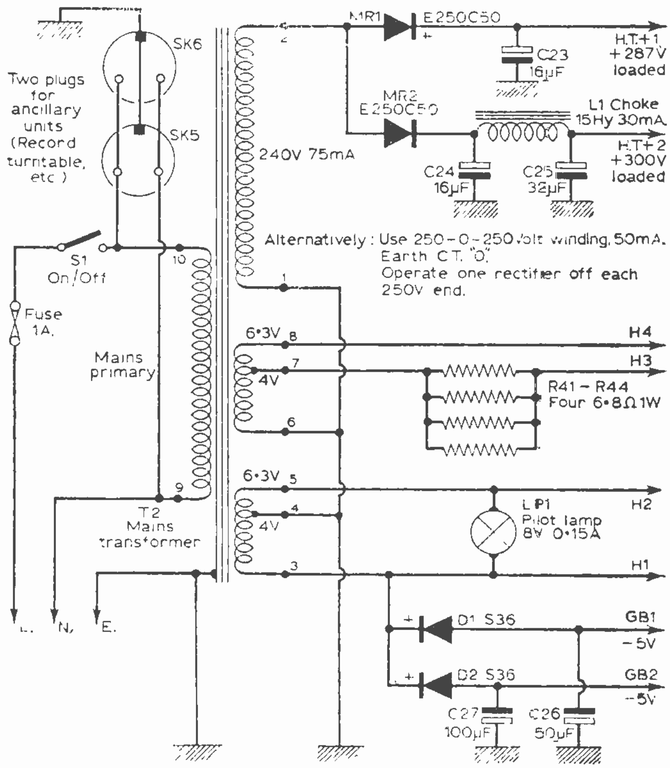
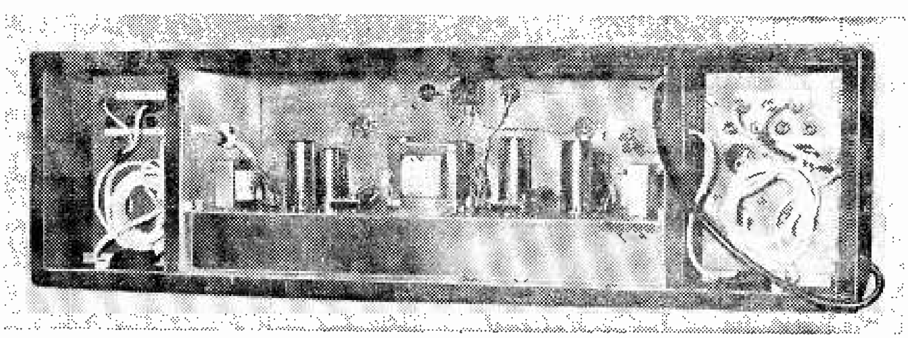


Fig. 4: The amplifier power supply



The "Multiphonic" viewed from the rear.

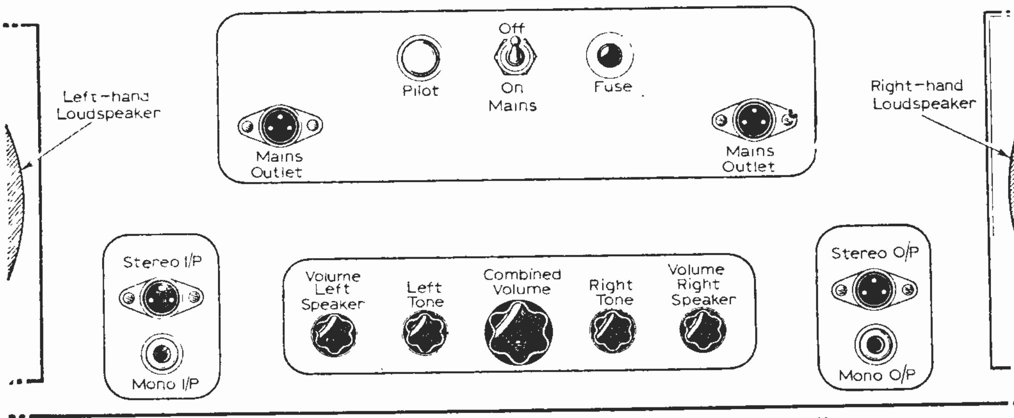


Fig. 5: Control layout on the front panel of the completed "Multiphonic".

Performance is very good indeed if a pair of 10in. speakers with 15Ω speech coils are mounted in bass reflex corner cabinets, stood in adjacent corners of the room and operated directly off the two amplifier channels.

A general rule for stereo listening is that the lines from the ideally positioned listener to the respective speakers should be approximately at right-angles. Frequencies below about 200c/s do not contribute greatly to the stereo effect as the human ear is not able to distinguish direction of origin very clearly at low frequencies.

Thus a common central speaker, obtaining bass from both channels, may be used. It is even possible to use passive cross-over networks for three speakers from the two amplifier outputs for this type of arrangement.

However, the use of two-channel speakers alone, both having adequate bass response, is generally preferable because—even though bass stereo contribution is negligible—the phasing is always purer in such an arrangement, thus definitely improving performance.

If a central bass speaker is used it is essential that a top-cut filter is used, preventing frequencies above at the most 500c/s reaching this speaker in audible amount. Otherwise the stereo effect is greatly weakened. ■

Miniature Power Amplifier

—continued from page 544

spigot on valve-holder No. 2.

(3) Decoupling capacitor C1 from tag No. 20 to earth.

Use rubber grommets in the holes in the chassis where wires pass through to prevent the plastic insulation being cut by sharp edges. Wiring should follow normal audio practice, twisted leads for heaters and single earth connection to chassis. When wiring-up do not forget the centre spigot on the valve-holders, which must be earthed, plus one side of the output transformer secondary.

Power Supplies

Almost any power unit will be able to supply the modest power necessary, smoothed h.t. of approximately 280/290V. at 20mA and 6·3V a.c. at 0·6A. An h.t. supply of 300V must not be exceeded.

Components

Resistors of 1/2 watt rating are adequate. Only two close-tolerance resistors are needed and these are the phase-splitter anode and cathode loads, where signal balance depends upon equality of the resistors. 1% tolerance must be used here.

Resistors for the rest of the circuit are preferably high stability of 5% tolerance, these are only slightly more costly than normal 10% carbon types and are well worth the slight extra cost.

Do not use a midget-sized o.p. transformer, otherwise low-frequency power output will be severely limited. A 3/4in. stack of laminations is the minimum for reasonable fidelity. The correct anode to anode load is 10kΩ and the turns ratio of the transformer for different loud speaker impedances is as follows:

Speaker Z	Ratio
3Ω	60 to 1
8Ω	35 : 1
15Ω	25 : 1

Testing

When connected to a suitable power supply and correctly matched to the loudspeaker, feed in a signal from tape-recorder or radio tuner and if satisfactory a test of voltages in the circuit can be made.

Voltages indicated are for no-signal conditions and should be within 5% of the indicated values. If voltages across the cathode bias resistors are low this indicates low emission of the valve(s). ■

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Garrard Autoslim, Mono .... **£6.0.0** P.P. 4/6

Single Players

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● **SCOOP! B.S.R. U.A.14 Autochangers.** T.C.8 Mono P.U. Brand new and boxed. Wired for stereo. Note **OUR** price **£5.7.6.** P.P. 5/-. Latest model.

● **SCOOP! Garrard Autoslim.** Mono P.U. Brand new and boxed. Wired for stereo. Latest model. Note **OUR** price **£6.0.0** only. P.P. 5/-.

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● **SCOOP! Tape Recorder Amplifiers.** Suitable for B.S.R. or Collaro Decks. Price: **£6.10.0** for B.S.R. Deck: **£6.12.0** for Collaro Deck. P.P. 6/-. Mk.III. Fully built, high gain, low noise, printed circuit. Attractive grey and gold front panel 13 x 1½in. Overall height 5½in. Front to back measurement 5½in. The amplifier is supplied complete with the switch wafer fully wired for B.S.R. deck. For Collaro deck, a completely wired separate switch with spindle is supplied. Magic Eye DM70 fitted.

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ECL82	6/-	PL33	7/-	UAF42	5/-	6P28	8/-	30FL1	7/-
EF85	4/6	PL36	6/6	UBC41	5/-	7B6	6/-	6/30L2	7/-
EF91	2/3	PL81	5/6	UCC84	7/6	7C5	6/-	R19	6/6
EL33	5/-	PL82	4/-	ECF80	7/6	7S7	10/-	50CD6	16/-
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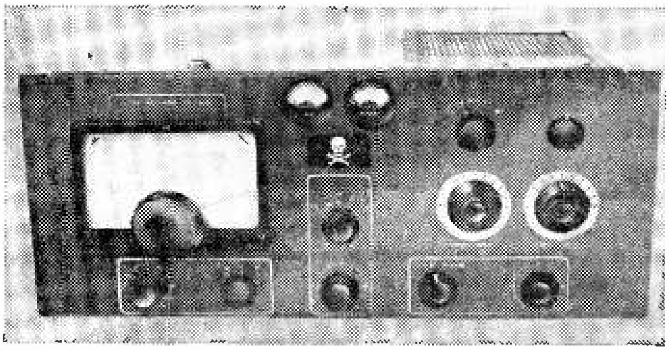


The BUCCANEER

MULTI-BAND TRANSMITTER

By J. E. Alban G3JEA

CONTINUED FROM PAGE 438 OF THE SEPTEMBER ISSUE

THE transmitter is assembled on a standard 16in. x 9in. x 2½in. deep chassis, and the valve base holes cut as shown in Fig. 4. If the Labgear unit is used, a drilling template is supplied by the makers and this should be positioned as indicated. The v.f.o. box is approximately 3in. high, 2½in. wide and 4in. deep, but should this not be readily available a small chassis could be used and a side cover fitted, access being made through the left hand side should repair be necessary. Alternatively, an Eddystone die-cast box can be used. The p.a. compartment is made rather on the large side to allow for ample ventilation.

All wiring should be carried out in 20s.w.g. tinned copper, covered with suitable insulated sleeving. Heater leads, h.t. leads other than those carrying r.f. must be screened. In each case the metal screening must be exposed and wherever leads cross one another or run parallel for more than 3 or 4in., they should be bound together with a few turns of tinned copper wire and soldered and bonded to the chassis. The modulator section clamper wiring, and bias supplies should also be screened and decoupled with disc ceramic conden-

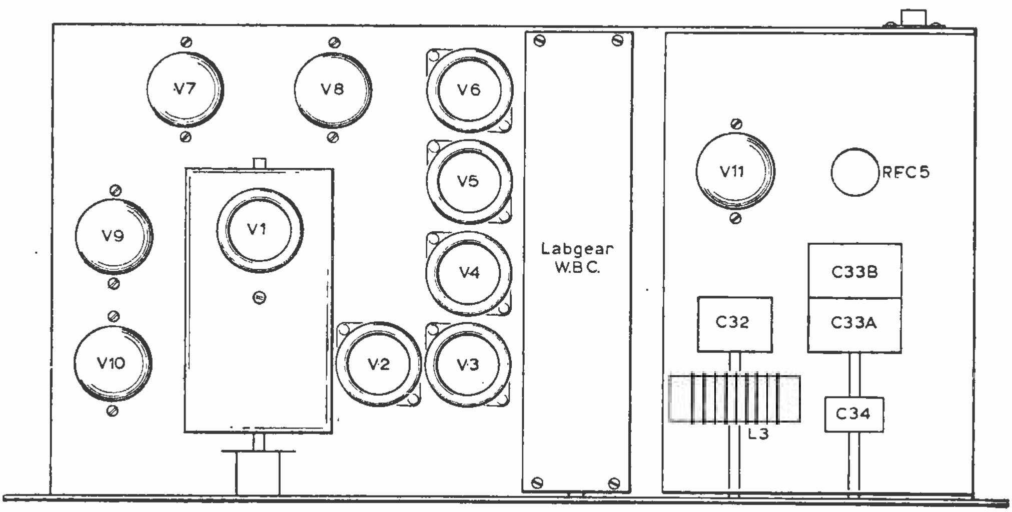


Fig. 4: Above-chassis layout of the major components.

MATERIALS FOR CHASSIS, PANEL, ETC.

Rack panel, 19 x 10in., black crackle finish
Chassis, 16 x 9 x 2½in.
Chassis bottom cover, 16 x 9in.
Box for v.f.o., 4 x 3 x 2½in.
V.F.O. box side cover, 4 x 3in.
All the above materials may be obtained from H. L. Smith & Co. Ltd. as standard ready-made items.
Two p.a. box side covers, 8¾ x 5¾in. with ½in. flange.
P.A. box rear and front panels, 6½ x 5¾in.
P.A. box top cover, 8¾ x 6½in. expanded aluminium.
32 x ½in. angle aluminium for top cover.

sers where indicated

When mounting the v.f.o. box on the chassis, care should be taken to see that the feed-through capacitors should be well clear of the holes drilled through the chassis, avoiding any possibility of short circuits or ineffectiveness of the condensers. Before any wiring is attempted, all holes indicated should be drilled in the front, rear, and top of the chassis. To avoid confusion, a Belling type of co-axial socket is used for the microphone, an Igranic socket for the key and ordinary banana-plug type of sockets for the station change-over relay connections. A Bulgin 5-way socket is used for the h.t. and l.t. connection to the power supply, there being ample spacing across the pins to wire in the r.f. decoupling chokes and condensers.

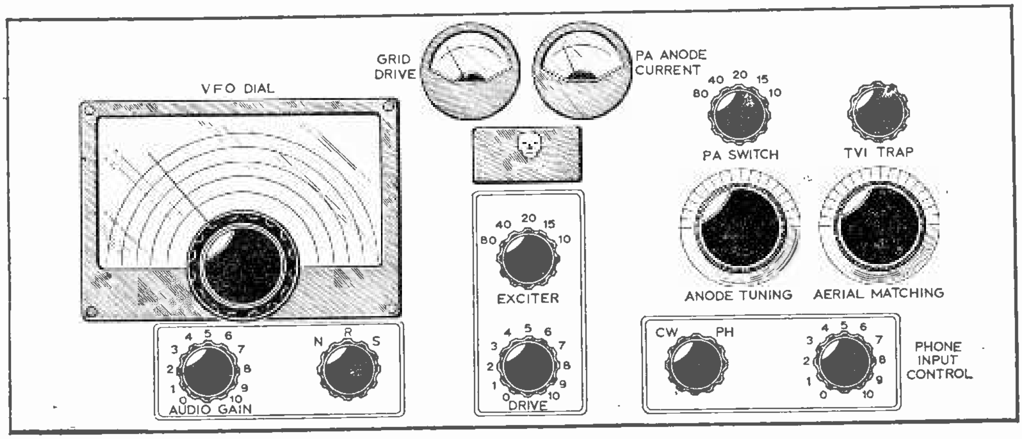
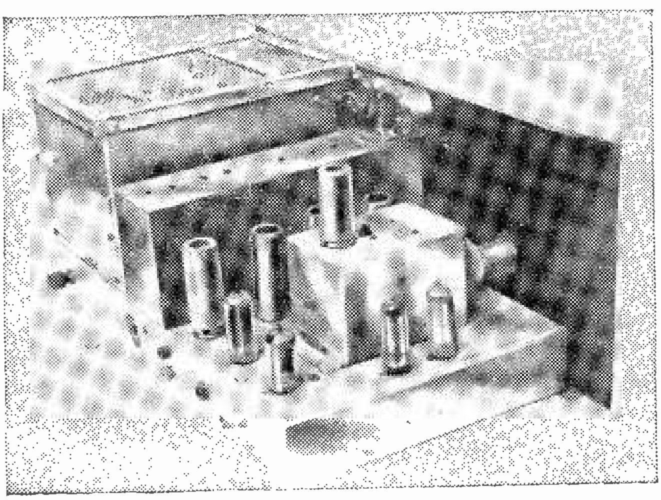


Fig. 5: Design for the front panel of the "Buccaneer".



The completed chassis of the "Buccaneer".

When assembling the p.a. stage, a small circular screen 3in. high and 2½in. diameter should be affixed to the chassis with the valve-holder screws. In the writer's case, this is a small aluminium can, obtained for the asking from the local chemist's shop, and used for the bulk packaging of tablets. The metal frames of the variable capacitors in the pi-network and that of the harmonic trap should be bonded together with copper braid or 16s.w.g. copper wire, and earthed to the chassis, as close to the cathode connection of the 807 as possible. Likewise, the 807 heater choke and decoupling capacitors should be soldered directly to the valve socket by the shortest lead possible.

Tuning Up Procedure

The v.f.o. should first be set to cover the bands as required. By using the bandset condenser and

the dust core of the inductance, some degree of variation is obtained in the bandspread coverage of the 15pF capacitor, TC1.

When satisfied with the coverage, the exciter bandswitch should be set to 3·5Mc/s and the main h.t. rail switched off. The drive control should be set at two-thirds open and key depressed. Some drive may be immediately apparent on the p.a.

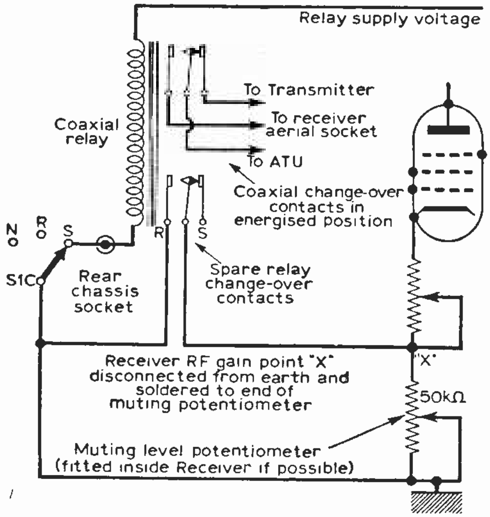


Fig. 6: The receiver muting and antenna change-over switching circuit.

grid current meter, but whether or not current is indicated, the first trimmer on the multiplier, that is, the one immediately behind the panel, should be peaked up for maximum drive. These adjustments to the wide band multiplier unit should only be made with reference to the manufacturers' details supplied with the unit. Reduce the level of the drive control by stages should the meter be overloaded. The v.f.o. should be set at 3·5Mc/s for this adjustment. When satisfied that the first trimmer is peaked at maximum, the v.f.o. should be tuned to the h.f. end of the band and the trimming procedure repeated, this time using the other trimmer. Now, should the drive fall off badly to one end or the other, further trimming should be carried out. The final adjustment should be carried out on the v.f.o. output capacitor TC2, situated at the rear of the v.f.o. box. As the latter is brought into resonance, it will be observed that the strength of the v.f.o. signal in the station receiver will decrease, allowing the oscillator to be left running all the time without hampering reception.

The other bands are then set up in turn, using the trimmers for 7Mc/s and 14Mc/s, etc., until all bands have been adjusted and drive is fairly linear across them. Final peaking adjustments can be carried out on these bonds with the Philips trimmers underneath the chassis. It is only necessary to obtain around 4mA with the drive control at maximum, to get more than sufficient power to drive the 807 to full input. In practice it is found that 1·5mA is ample when running at 90W input on phone and c.w. For phone operation the t.x. is adjusted in the c.w. position first, then the switch turned to the other mode, also, the input level control should be adjusted to give approximately 12mA standing anode current in the p.a. Using the mike gain control and speaking normally it should be adjusted until the anode current peaks reach the same level as when the key is pressed in the c.w. mode. The key is bypassed with a switch, so that it can be left in circuit if so desired.

The relay-control switching, shown in **Fig. 6**, is self-explanatory. Care should be taken to obtain a relay with reasonably wide spacing for the antenna change-over. Send-receive switching is a joy to use with just the one control to change over the antenna, mute the receiver, allow monitoring, and keep a snappy QSO going without the use of too many hands. ■

Amateur Band DX

by G3JDG

Top Band has been particularly disappointing. At one session only two stations were audible: G3SCP (RST599) and G3SVV (459) both calling CQ.

Eighty Metres has been rather "quiet" although some DX has appeared. Mostly Europeans in evidence, SM, DJ, OK, etc., and, of course, the usual G sideband net up the h.f. end discussing everything from rhombics to rhinoceros.

Forty Metres proves by far the noisiest band of the bunch and at times almost bedlam. The l.f. segment has been a hive (literally) of activity, but phone stations seem to be harder to find these days. For those who can stick at it the stations are there in amongst the noise, the commercials, and the many strange squeaks and whistles peculiar to the 7-7·1Mc/s portion of the short-wave bands.

Twenty Metres is by far the best DX band at the moment in spite of its annoying habit of fading out for a time. On July 28th 13 countries were heard in 14 minutes from 21·27 to 21·41 hrs. All Europe was in full swing: UT5, YO, F2, I1, OE, DJ, LZ, OH, UB5, UAI, DM, average report was 579. In the h.f. sector the "W's" were roaring in averaging 5 and 7 to 8 and easily readable in spite of the QRM and slight QSB. All these on an odd piece of wire for an aerial and no matching ATU.

Fifteen Metres rather dead and neglected. Rumours of exotic DX breaking through may well be true but they were not audible to your scribe. Anyone else hear anything on this band??

Ten Metres—Reputed to be dead as the proverbial Dodo—sunspot cycle at its lowest—waste of time—"Lucky if you hear a "G". Friends you have been misled! Sunday morning 26.7.64 from 1030 to 1400hrs—OK, UA3, OK1, SP8, DJ8, DL7, G3, LA8, DM3/P, OZ5, EI, HB9 and GM. ALL ON AM PHONE. Clearly there's life in the band and no doubt SWL reports would be appreciated.

CLUB NEWS

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, 3GEH, 188 Gunnersbury Avenue, London, W.3.

At the September meeting of this society, to be held on the 22nd, G3IGM will be giving a talk entitled "Application of Theory to Practice".

BRADFORD RADIO SOCIETY
Hon. Sec.: E. G. Barker, G3OTO, 63 Woodcot Avenue, Baildon, Nr. Shipley, Yorkshire.

Members of this society who attended the August meeting on the 18th, heard a lecture on "Civil Defence".

The first meeting in September was on the 1st and was an informal evening.

CHESHUNT AND DISTRICT RADIO CLUB
J. V. Beavan, G3GBL, 41 Albury Ride, Cheshunt, Hertfordshire.

This society meets on the first Friday of each month at the Civil Defence Centre, Turners Hill, Cheshunt. The meetings begin at 7.30 p.m. when visitors and prospective members will be welcomed.

On August 7th the Club met to hear a tape recorded lecture on test gear and other subjects.

This Saturday—5th September—Club members will be operating a demonstration station in the playing field at Goffs Lane, Cheshunt, under the call-sign GB3CRC. Visitors to the site will be welcomed by the members and all communications will be by telephony to create more interest for the less technical amongst them. The station will be on the air from 11.30 a.m. to dusk on 160 and 80 m.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, Field House, 19 Kingsley Road, Gt. Boughton, Chester, Cheshire.

After the activity of Net Night held at the beginning of August, members settled down to open discussion on the 11th. An open night on the 18th once again provided the opportunity for quite a ragchew amongst members.

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: J. Rose, G3OGE, 63 Broomfield Road, Beckenham, Kent.

Recent additions and alterations to the Club's aerial array have made it possible to increase activity on 144 Mc/s. and 70 cm.

On August 16th, members took part in the second 3.5 Mc/s. d.f. contest.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

This Society's mobile rally which is held annually at Rykneld School, went off successfully on August 16th after preparations had been finalised a few days before at a meeting on the 12th.

GUILDFORD AND DISTRICT RADIO SOCIETY
Hon. Sec.: D. H. Mead, G3OXI, 41 Egley Road, Woking, Surrey.

Chobham Common was the venue for a group of members of this Society working portable gear on August 21st. At the meeting on the 28th, members discussed plans for the demonstration station they are manning at this year's Guildford Town Show, being held the following weekend.

NORFOLK AMATEUR RADIO CLUB
Hon. Sec.: A. W. Preece, G3TCO, School of Biological Sciences, Wilberforce Road, Norwich, NOR 77H.

Since its inception in January this year, membership of this society has risen to nearly 40 with Club activities likewise increasing. Recently a regular series of lectures has begun, to be followed by R.A.E. classes and morse practice sessions.

New members will of course be welcomed at any of the meetings held each Monday, beginning at 8 p.m.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

Members of this Society provided two demonstration stations during August, one being at the Halifax Agricultural Show held on the 8th, and the other at Crossleys Carpets Gala held on the 15th.

On the 16th of the month, a group of members paid a visit to the radio telescope station at Jodrell Bank, Cheshire.

August ended with a ragchew night on the 19th, with no more club activities until September 2nd, when Northern Heights A.R.S. played host to members of the Manchester Radio Society at a Pea and Pie Supper

READING AMATEUR RADIO CLUB
Hon. Sec.: R. G. Nash, G3EJA. "Peacehaven," 9 Holybrook Road, Reading, Berkshire.

The Club met on August 29th to hear several members describe various pieces of ancillary equipment made by them for use with typical transmitter rigs.

WEST KENT AMATEUR RADIO SOCIETY
Hon. Sec.: H. F. Richards, 17 Reynolds Lane, Tunbridge Wells, Kent.

The main event of this Society during August proved to be a very enjoyable one for all who attended. It was held on August 30th and was in fact, a picnic at Sussex's Sheffield Park.

COURSES OF INSTRUCTION

BIRKENHEAD TECHNICAL COLLEGE

It is expected that an R.A.E. course will be run at this college on Thursday evenings. Enquiries for membership can be made either to the college or to A Seed, 31 Withert Avenue, Bebington, Wirral, Cheshire.

BRENTFORD EVENING INSTITUTE

Several courses of interest to the radio enthusiast are being run by this Institute this autumn, including R.A.E. and morse. Enrolment for any of the classes may be made between 14th to 17th September at the Brentford Evening Institute, Clifden Road, Brentford, Middlesex.

CENTRAL EVENING INSTITUTE

R.A.E. classes are being held at the Lea Mason Centre of the Central Evening Institute in Birmingham, starting on 14th September. Enrolment week commences 7th September.

EAST HAM TECHNICAL COLLEGE

An R.A.E. course will begin at the East Ham Technical College, High Street South, London, E.6, on 21st September. Candidates should enroll on the 14th, 15th or 16th September.

NORTHSIDE SCHOOL

On 21st September, an R.A.E. course begins at Northside School, Percy Road, Finchley, London, N.12. Morse instruction will also be given later in the course. Enrolment for the course can be made between 14th and 17th September,

WEMBLEY EVENING INSTITUTE

At the Copland School of this Institute in Wembley High Road, R.A.E. classes will be held from 21st September. Enrolments will be accepted between 14th and 17th September.

WESLEY EVENING INSTITUTE

A radio and television course will begin at this Institute on 21st September. Enrolment can be made at the Institute in Wesley Road, London, N.W.10, between 14th and 18th September

AUDIO OSCILLATOR DESIGN

We wish to point out that the article "Audio Oscillator Design", which appeared in the August 1964 issue of PRACTICAL WIRELESS, was based on a chapter of the Mullard Reference Manual of Transistor Circuits, published by Mullard Limited.

LETTERS TO THE EDITOR

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 the cover.

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

AMERICAN LITERATURE

SIR,—Recent issues of your journal have, more often than not, included a page of book reviews, and this, in my opinion, well reflects the state of the book market which is currently being flooded by technical publications both from home and abroad.

Many of the imported books come from the U.S.A. and while any additions to the amount of technical literature available is to be welcomed, much of the value of these books might be lost by an unwary reader in this country who does not allow for the very real language differences to be encountered in works of American origin. When reading books from the U.S.A. dealing with radio and electronics, I find it necessary to accustom myself to substitute automatically "earth" for "ground", "anode" for "plate", etc., for to stop, think and translate every unfamiliar term as it occurred in the text would be disastrous for any reader trying to absorb the contents.

There is then, I suggest, a strong case for making available information to explain and clarify these differences, a sort of English/American dictionary. It is probably true that English versions of technical works originally written in French, German or Russian suffer less from these difficulties than American books, as translators of foreign language books are aware of English expressions and take this into account, whereas books which come from the United States are left "raw" because officially both countries use the same language.

If it were just a matter of substituting one word for another, there would be little to worry about; however, very often the whole approach to a piece of theory differs in the U.S.A. and even circuit diagrams and symbols have a peculiar and confusing appearance to the British reader.—JAMES GOODWIN (Scarborough, Yorkshire).

PAST ISSUES OF P. W.

SIR,—With reference to your "Sell or Loan" column, I have available every copy of PRACTICAL WIRELESS from 1950 to 1962, also every copy of *Practical Television* from No. 1 to 1962, and I am willing to give any of these issues, free of charge, to anyone who cares to write, enclosing postage sufficient to cover any issues they require. This is a genuine offer now that I find I am forced to dispose of these magazines as they take up more space than I can afford.—J. F. HITCHCOCK (86 Reigate Avenue, Sutton, Surrey).

TRANSISTOR PREAMP

SIR,—Regarding the Transistor Preamp on page 358 of the August issue of PRACTICAL WIRELESS. When used with the power supply unit for a valve amplifier (Fig. 3) the output should be taken from C4 and the negative line. This will avoid having a potential difference between the preamp output and valve amplifier input circuits. The input circuits should be isolated by a 25μF 25V electrolytic in series with the +ve lead to the volume control and input sockets (negative to VR1 and sockets). This will prevent d.c. from reaching the tuners and gram p.u. if they are earthed to the amplifier chassis.

I would also like to correspond with any radio enthusiasts of my own age (13).—ALAN CAMPBELL (30 Barnsdale Road, St. Ninians, Stirling, Scotland).

POCKET SIGNAL INJECTOR

SIR,—It would be interesting to know the variety of containers used by your readers to make the Pocket Signal Injector and also the Signal Tracer when they found that the specified pencil torches were in short supply. I see that in your August issue Mr. Raymond Cruise used a film cassette tin. Myself I turned to the little clear plastic boxes in which "Desogen" throat tablets are packed. They measure 3in. x $1\frac{1}{2}$in. x $\frac{1}{2}$in., will contain a U16 1·5V battery, but with difficulty, or Mallory cells very easily, and have the advantage that they do not need insulating for a.c./d.c. work. They enabled me to make neat jobs of both the Injector and the Tracer with which I am very satisfied. The printing on the boxes can be removed with metal polish and elbow grease!

Making the probe from 2B.A. threaded rod with a hand drill is by no means child's play. Unless the rod is supported very little filing effect is obtained from a file held on the rod and the file cannot be controlled and prevented from slipping all over the place. I found that I had to nail a thick block of soft wood to my bench and fix the hand drill in the vice so that the 2B.A. rod in the chuck lay flat on this block. Then I drove a good-sized staple into the block so that I could put the point of my file into it and utilise it to get pressure on the rod. Even then I found the file tended to be dragged into the staple so that it jammed and lateral movement of it was impossible. This meant another nail in the block for a file stop to prevent the jamming. Another nail near where the rod entered the chuck jaws acted as a lateral stop and completed this Heath Robinson rig. After all this I had no difficulty in finishing two nicely tapered probes. I hope other readers will find this tip helpful for both of these neat and extremely useful instruments.—R. S. WELFORD (Sunbury-on-Thames, Surrey).

SHAKE-PROOF WASHERS

SIR,—No one these days seems to know what the shake-proof washers on such things as potentiometers and air-spaced condensers are for.

They are supplied to prevent the whole component from turning when heavy-handed people twist the knob; *not* to prevent the screw from turning. Therefore the washer should be fitted to the spindle of the component *before* it is fitted to its chassis.

It is true that some of these types of components are fitted with positioning lugs, in which case the washer should be placed on the *same* side of the chassis as the locknut.—A. MARTIN (London, S.W.19).

THE IMPORTANCE OF THE RAE

SIR,—While I am in favour of commercial broadcasting and think the BBC monopoly ought to be broken, I think the comments of W. Jenkins and A. Sidi, on Thermion's *Caroline* views should be put into proportion.

I would like to say that *Caroline's* operation outside Territorial Waters is merely a protest to the Postmaster General for his refusal to issue commercial broadcasting licences, and is not an advocate for the issue of licences to unqualified operators such as we would have in a "Citizen Band". The RAE is not an electronic wizard's examination. It merely tests one's knowledge of basic radio theory, and most important, the necessary knowledge to deal with any interference which may result from the operation of one's station.

If Mr. Jenkins or Mr. Sidi cannot be bothered to learn these few basic facts, then I suggest they try some other hobby. I can just imagine the answer they would give to their irate TVI-prone neighbours, to say nothing of the model enthusiast from down the street who has just lost a beautiful radio controlled plane. I should imagine it would be something to this effect, "Sorry mate, I don't know a thing about radio, I just operate it for fun".—A. MAYNARD, B.R.S. 26128 (Bognor Regis, Sussex).

(We endorse Mr. Maynard's remarks concerning the R.A.E.. The amateur transmitting licence is not a barrier to the real enthusiast. Readers interested in obtaining their "ticket" will find something of interest in the next issue—EDITOR.)

Sir—I would be grateful if any reader could sell or loan me . . .

. . . following issues of P.W.: Dec. 1961, Jan., Feb., Mar., Apl., May 1962, and Jan. 1963. I will pay full price for all copies in good condition.—J. J. BOWYER, 2 Chichester Street, Chester.

. . . the circuit and booklet of Marconi Communications Receiver CR100.—WAH KHAI LIANG, Department of Radio, Radio Malasia, Penang, Malasia.

. . . the March 1964 issue of P.W.—J. G. TANGNEY, 18 Green Park, Wilton Lawn, Cork, Irish Republic.

. . . the circuit and servicing data for the Defiant AF7.—R. W. SHEPPARD, 97 Hermitage Woods Crescent, St. John's, Woking, Surrey.

. . . circuit diagram and any other information regarding the PCR3 receiver.—B. GIBSON (ZS2PG), 69 First Avenue, Newton Park, Port Elizabeth, S. Africa.

. . . details or handbook on the Lavoie Laboratory Micro Wave Frequency Meter Model 105SM Serial 2876, covering 375 to 725Mc/s.—F. B. BLAKE, 2 Fair View, School Lane, Seer Green, Beaconsfield, Buckinghamshire.

. . . circuit or manual on the Super Skyrider Hallicrafter SX 16, also the data for the D.B.20 Preselector.—R McLACHLAN, 66 Haigh St., Halifax, Yorkshire.

. . . circuit diagram and manual for Hallicrafter receiver SX 28, and a circuit of about 60W c.w./phone v.f.o. transmitter with a suitable s.s.b. adaptor for the same. I shall arrange payment through a friend in U.K.—S. L. ANAND, 3066/5A Street No. 10, Ranjit Nagar, New Delhi -12, India.

. . . test instructions for Hansen Multimeter, Model T.S.—J. DUNNETT, 7 Lorne House, Kinlochleven, Argyll.

. . . the handbook, circuit or any other data on the R1132A communications receiver.—F. H. LADD, 4 Wellington Close, Melbourne Park, Chelmsford, Essex.

. . . the manual of the R.107 set ZA 3050.—B. CATCHPOLE, 45 Balmoral Drive, Borehamwood, Hertfordshire.

. . . circuit and any information on the receiver of Ex-Government Rx/Tx Model 3/11 (also known as B11).—A. PARKIN, 9 Dawsons Rough, Shawbury, Shropshire.

. . . circuit or any information as to the connections of the 12 pole outlet socket of the 38 a.f.v. transceiver.—D. K. COOPER, c/o R.E.C. & Co., Lefkara, Cyprus.

. . . list of valves or the circuit diagram for Philips Receiver, Type BX 516 A/10.—C. K. OCRAN, P.O. Box 205 Takoradi, Ghana.

. . . the February 1963 issue of PRACTICAL WIRELESS—S. SAETHERN, Roberg, Tonsberg, Norway.

. . . any aerial details or the circuit for Communications Receiver P.C.R.3.—A. GARGETT, 30 Dryden Road, West Cliff Est., Scunthorpe.

. . . any information on the Roding Transportable Tape Recorder.—H. WILSON, 59 Gatehope Drive, South Ockendon, Essex.

. . . circuit and any other details of a Crosley Prestotune set.—J. SMART-OKUOKA, 7 St. George's Road, Coventry.

. . . the August 1962 issue of PRACTICAL WIRELESS.—J. B. WHITE, 1 Lansdown Place West, Bath, Somerset.

. . . issues of PRACTICAL WIRELESS dealing with modifications to the R109 A receiver.—T. R. SMITH, 50b Aldershot Road, Guildford, Surrey.

. . . circuit diagram and component values for the Ekco Car Radio CR61/A.—P. HEARNE, 1 Derwent Close, Gossops Green, Crawley, Sussex.

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MESSRS. Henry's Radio have recently published a new 1964 edition of their comprehensive catalogue. It comprises 86 pages and is fully illustrated, covering a very wide range of electronic components.

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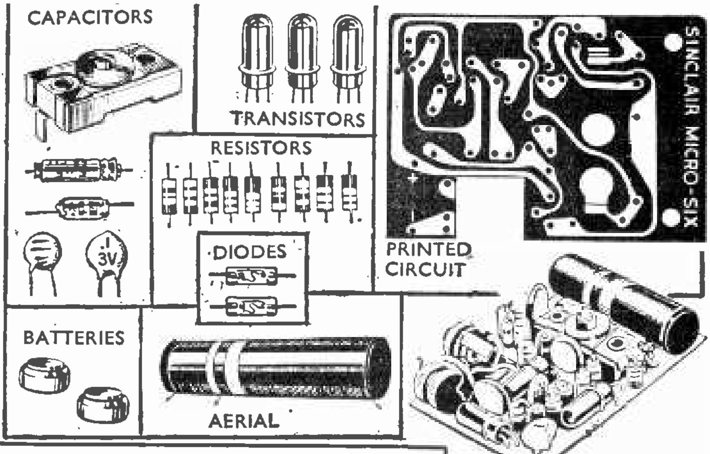
uses the smallest components ever

We show here some of the components. We didn't have room for case, dial, earpiece and some of the capacitors, drawn to actual size. They include the smallest ever to be made available to domestic set constructors, being of the kind used in space and computor electronics, so they have to be reliable. The tuning system has ingenious vernier control for easy station separation. 8 page fully illustrated instruction manual and all parts including case, vernier dial and earpiece, come to **59/6**



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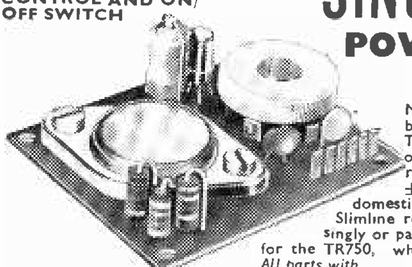

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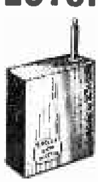

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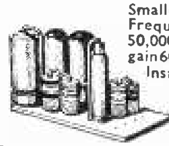

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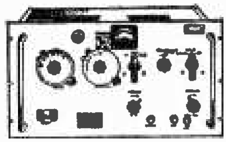

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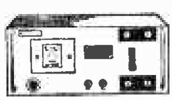

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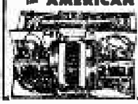

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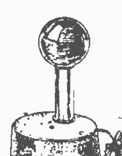

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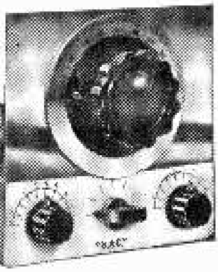

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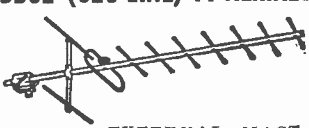

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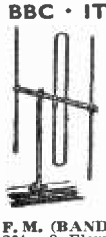

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Practical Wireless BLUEPRINT SERVICE

ALL of these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for those marked thus (*).

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, London W.C.2.

DOUBLE-SIDED BLUEPRINTS

Each blueprint in this series contains details of two separate instruments or items of equipment.

The Strand Amplifier ... ... / The PW Signal Generator	*	5/-
The Savoy VHF Tuner ... ... / The Mayfair Pre-amplifier	*	5/-
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SOME EARLIER DESIGNS

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6
BBC Special One-valver	AW387	2/6
A One-valver for America	AW429	2/6
Short-Wave World Beater	AW436	3/6
Standard Four Valve S.W.	WM383	3/6
Enthusiast's Power Amplifier ..	WM387	3/6
Standard Four Valve	WM391	3/6
Listener's 5-Watt Amplifier	WM392	3/6

QUERY COUPON

This coupon is available until 7th October, 1964, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, OCTOBER, 1964.

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