Wireless World

RADIO AND ELECTRONICS

DEC. 1949

2/-

Vol. LV. No. 12

IN THIS ISSUE: NEW NOISE-REDUCING CIRCUIT

Fine Limits of Accuracy

AVO REGD. TRADE MARK

VALVE CHARACTERISTIC METER

A comprehensive instrument built into one compact and convenient case, which will test any standard receiving or small power transmitting valve on any of its normal characteristics under conditions corresponding to any desired set of D.C. electrode voltages. A patented method enables A.C. voltages of suitable magnitude to be used throughout the Tester, thus eliminating the costly regulation problems associated with D.C. testing methods.

A specially developed polarised relay protects the instrument against misuse or incorrect adjustment. This relay also affords a high measure of protection to the valve under test. Successive settings of the Main Selector Switch enable the following to be determined :—

Complete Valve Characteristics including Ia/Vg, Ia/Va, Is/Vg, Is/Va. Amplification Factor, Anode, A.C. Resistance, 4 ranges of Mutual Conductance covering mA/V figures up to 25 mA/V at bias values up to —100V., together with "Good/Bad" comparison test on coloured scale against rated figures.

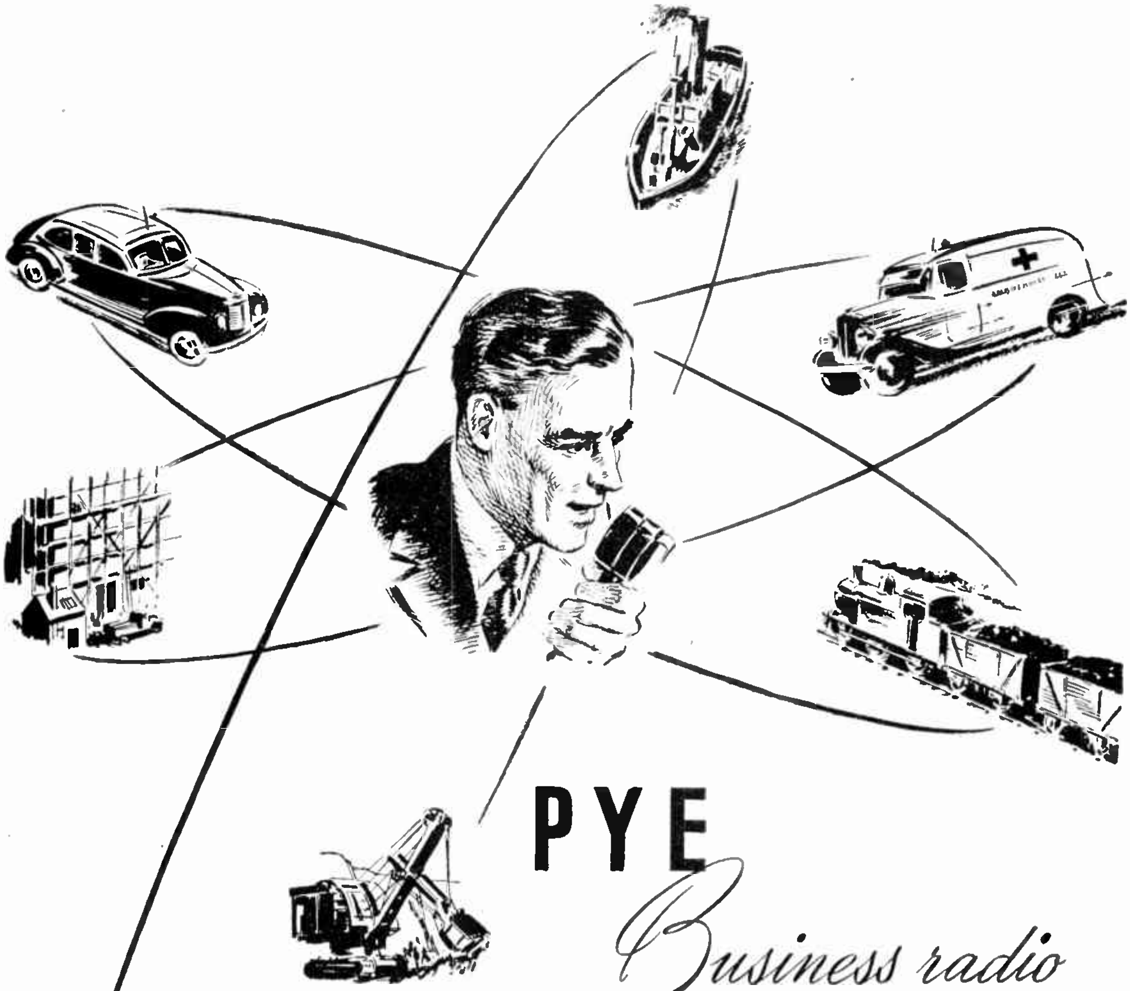
"Gas" test for indicating presence and magnitude of grid current, inter-electrode insulation hot and cold directly indicated in megohms, separate cathode-to-heater insulation with valve hot. Tests Rectifying and Signal Diode Valves under reservoir load conditions, and covers all the heater voltages up to 126 volts.

The AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD.

WINDER HOUSE, DOUGLAS STREET, LONDON, S.W.1. *Phone : VICtoria* 3404-9

'Avo' Precision Electrical Testing Instruments

V.O.3



PYE
Business radio

- *Contracting Engineers*
- *Haulage Contractors*
- *Fire Services*
- *Doctors*
- *Ambulance Services*
- *News Editors*
- *Veterinary Surgeons*
- *Building Contractors*
- *Port and Harbour Authorities*
- *Private Hire Companies*
- *Airports*
- *Surveyors*
- *Railways*
- *Agricultural Engineers*

Pye Ltd. announce a complete new range of "fixed" and mobile V.H.F. Radio-Telephone equipment for the Business Radio band 156-184 Mc/s, and for essential services in the 60-130 Mc/s band.
Combining the high performance made possible by modern V.H.F. Radio techniques with reliability and simplicity of operation, this new Pye equipment will meet the exacting needs of Government and Industry at home and overseas.

Further details will be sent on request.

PYE
Telecommunications
CAMBRIDGE ENGLAND

PYE LIMITED · TELECOMMUNICATIONS DIVISION · CAMBRIDGE · ENGLAND

45/-

Right for Every pocket

TRUVOX

12" C.P.M.

Truvox speakers can be obtained from all good dealers. Full technical data and price lists of the complete Truvox range will be gladly forwarded upon request.

Frequency range 60-8,000 c.p.s. bass resonance 65 c.p.s.; flux density 10,000 gauss; power handling capacity 10 watt (peak). Voice coil D.C. Resistance 2·6 ohms. The specification speaks for itself. The TRUVOX 12 inch C.P.M. speaker Model BX11, marks something of an economic revolution in the high quality reproduction of sound.

TRUVOX ENGINEERING CO. LTD., EXHIBITION GROUNDS, WEMBLEY, MIDDX.

"JUNO" and "OCO" floor polishing machines are also manufactured by TRUVOX—send for details.

designed . . . .

with your specific needs in mind

The Cossor general purpose Oscillograph is designed and built by electronic engineers who are themselves familiar with the every-day problems which technicians have to face. The instrument consists of a Double Beam Tube operated at 2kV., a Time Base, Y Deflection Amplifiers and Internal Power Supplies. The 90mm. screen is flat, and traces are presented over the full area. Signals are normally fed through the Amplifiers, and the calibrated Y-Shift controls provide a measurement of the applied voltages. The Time Base operates repetitively, or by external trigger (for single stroke operation), or at trigger pulse repetition frequency for continuous scanning. A calibrated X-Shift Control is provided for the measurement of Time.

Model 1428
CAMERA

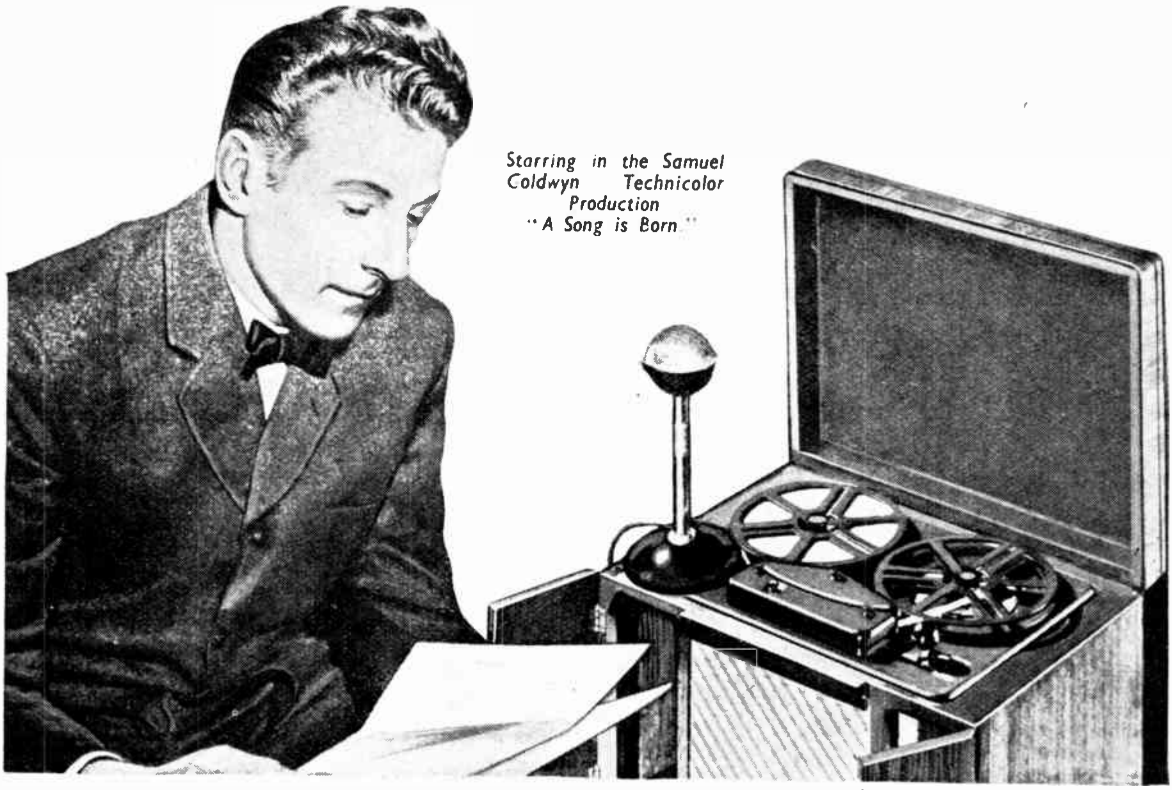
Specially developed for use with Cossor Oscillographs, it provides the simplest means of recording stationary or non-recurrent waveforms and slow transients by the moving film method on standard perforated 35 mm. film or paper. Of robust construction, it has provision for power drive by the Cossor Three-Speed Motor Attachment, Model 1429.

COSSOR
Double Beam
OSCILLOGRAPH

Further details obtainable on application to :—

A. C. COSSOR LTD., INSTRUMENT DIVISION, HIGHBURY, LONDON, N.5

CI 11



Starring in the Samuel Goldwyn Technicolor Production "A Song is Born"

USING HIS

Soundmirror
MAGNETIC TAPE RECORDER

Made in England. Protected by British & Foreign Patents and Patents Pending.

Full details from the Manufacturers, or Demonstrations by Appointment.

THERMIONIC PRODUCTS LTD.
MORRIS HOUSE, JERMYN STREET, HAYMARKET, LONDON, S.W.1
Telephone: WHItehall 6422 (5 lines)

With this one compact and reasonably priced Instrument you are completely equipped for all Sound Recording and Reproducing.

The Soundmirror is a high-fidelity Instrument which records and reproduces on reels of inexpensive magnetic tape Speech, Music, and every other sound audible to the human ear. Each reel gives a half-hour's uninterrupted playing. Short recordings can be cut and joined together. Playback is immediate. Recordings are permanent or if desired, can be automatically erased as new items are recorded.

The Soundmirror is simple to operate—Single finger-tip control for Play, Record, Fast Re-wind or Fast Forward requirements.

Built-in jacks enable the Soundmirror to be used in conjunction with radio or public address equipment.

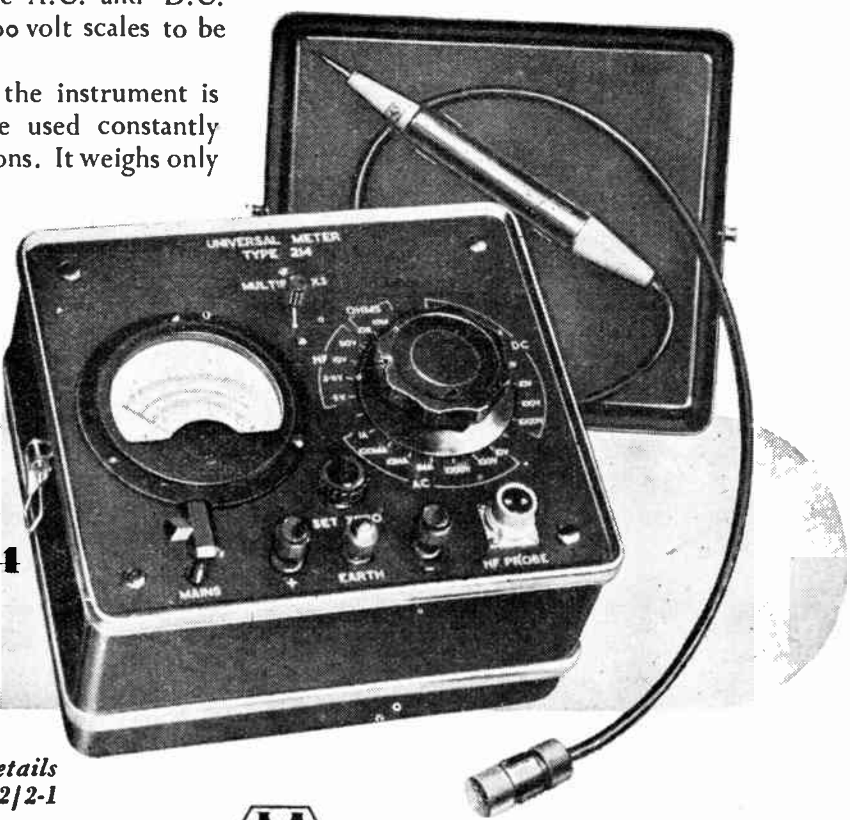
SALES AND SERVICE CENTRES: BIRMINGHAM · MANCHESTER · BRISTOL · LEEDS, etc.

An entirely new development . . .

THE METROVICK UNIVERSAL METER

This latest Metrovick product in the field of electronics gives the Electronic and Radio Engineer all he needs in a multi-range instrument for the measurement of current, resistance and voltage. In addition, provision for R.F. Voltages is made by the inclusion of a probe which employs a diode valve for rectification. All sections give indication on the same moving coil instrument, and a multiplier switch enables all the A.C. and D.C. ranges, except the 1000 volt scales to be trebled if required.

Though so compact, the instrument is robust enough to be used constantly under average conditions. It weighs only 17 lb., and is contained in an attractive steel case in cream or blue hard stoved enamel, fitted with leather carrying handle.



TYPE 214

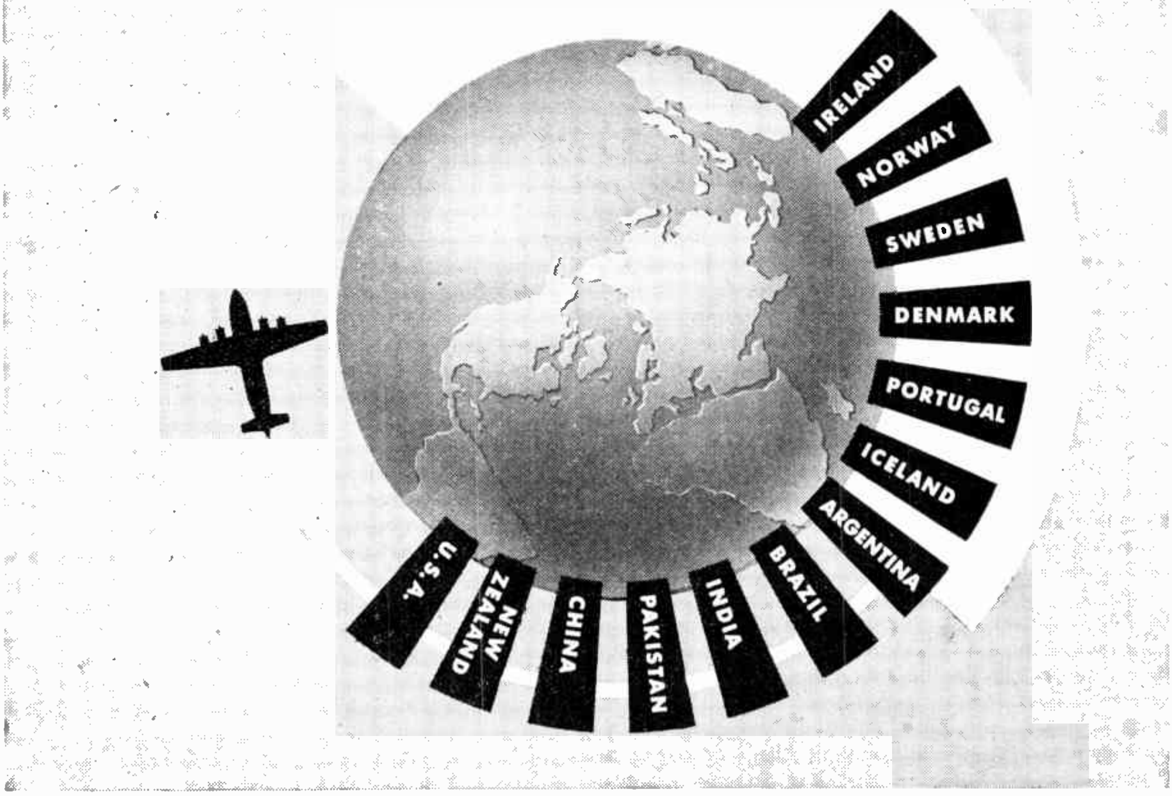
Send for further details contained in leaflet 652/2-1

METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

TRAFFORD PARK, MANCHESTER 17

R/E.901

in communications...



WILCOX SERVES THE GOVERNMENTS OF THE WORLD

Wherever airplanes fly—wherever lives depend on reliable communications—you'll find WILCOX radio transmitting and receiving equipment. From the Scandinavian countries to New Zealand...from Portugal to Pakistan, the governments of the world select WILCOX because of its *proven* performance under all extremes of climate, temperature, and humidity.

As with many governments, WILCOX is being used by the United States government in the basic communication systems for the Air Force, Signal Corps, and the Civil Aeronautics Authority.

The governments of the world have spanned the globe with WILCOX communications. From the Berlin Airlift to the Orient...WILCOX equipments carry the messages that help keep freedom a vital force in the turbulent affairs of the world.

WRITE TODAY... for complete information on all types of point-to-point, air-borne, ground station, or shore-to-ship communications equipment.

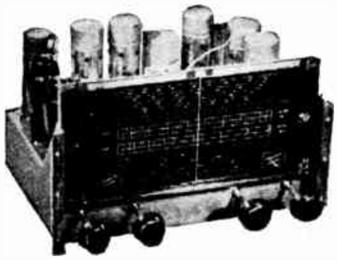
WILCOX ELECTRIC COMPANY

KANSAS CITY MISSOURI, U.S.A.

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

A NEW A.C. ALL-WAVE SUPERHET RECEIVER



7 Valves (plus metal Rectifiers) for 200/250 volts; 40/60 cycle A.C. mains. 4 wavebands, 13.6-52, 51-200, 200-550 and 900-2,100 metres. Pick-up input. Uses 6K7, 6K8, 6K7, 6B8, 6J7 and 2-6V6 in push-pull, giving an output of 10 watts. Specially designed OP Transformer to match 6V6's to 3 and 15 ohm Speakers. Negative feedback is applied over 3 stages giving a high fidelity output. Completely wired and tested, **£15/17/9.** Our Universal model is still available at **£15** built; or **£13/8/-** in kit form. All prices include Pur. Tax.

H.T. METAL RECTIFIERS.
230 v. 30 m/a., **2/6**; 260 v. 30 m/a., **3/-**; 300 v. 75 m/a., **4/-**; 250 v. 120 m/a., **5/-**.

L.T. METAL RECTIFIERS.
To charge. 2 v. Acc. at ½ a., **2/-**; 12 v. Acc. at 1 a., **6/-**; 24 v. Acc. at 6 a., **37/6**.

E.H.T. RECTIFIERS.
J.50 400 v. at 2 m/a., **3/6** each, or **18/-** for six.

BATTERY CHARGERS.
Input 100/250 v. A.C. Output 15 volts at 16 amps. Continuously variable metered output. Usual price £24. Our price **£10/10/-** each plus 10/- carriage.

BATTERY CHARGER KITS.
All incorporate Metal Rectifiers, Transformers are suitable for 200-250 v. A.C. 50 cycles.

Cat. No.		Price.
2002.	Charges 6-volt Accumulator at 1 amp. Resistance supplied to charge 2 v. Accumulator	£1/2/6
2003.	Charges 12-volt Accumulator 1 amp	£1/7/6
2004.	Output 15 v. 4 a. Variable Resistance and Meter	£3/15/-
2005.	Output 15 v. 6 a. Variable Resistance and Meter	£5/-/-
2007.	Output 30 v. 5 a. Variable Resistance and Meter	£6/-/-
2009.	Output 24 v. 3 a. Variable Resistance and Meter	£4/5/-

COLLARO AUTOMATIC RECORD CHANGERS.
Type RC500 Rim-drive. Plays nine 10in. or 12in. records. A.C. 100/250 v., with High Fidelity Magnetic Pick-up, **£10/15/-**. With Crystal Pick-up, **£11/8/4.**

COLLARO GRAMOPHONE UNITS.
High grade Rim-drive Motors, complete with Pick-up and Automatic Stop-Start. A.C. 100/250. With Magnetic Pick-up, **£5/3/2.** With Crystal Pick-up, **£5/17/7.**

CONRAD GRAMOPHONE MOTORS.
A reliable Rim-drive Motor for A.C. 100/250 v. operation, **£2/17/6.**

ALUMINIUM CHASSIS.
16 S.W.G. Substantially made of bright aluminium with four sides.

	Price.
7in. × 3½in. × 2in.	3/3
9½in. × 4½in. × 2in.	4/-
10in. × 8in. × 2½in.	5/6
12in. × 9in. × 2½in.	6/8
14in. × 9in. × 2½in.	6/11
16in. × 8in. × 2½in.	7/3
20in. × 8in. × 2½in.	7/11
22in. × 10in. × 2½in.	10/-
10in. × 9in. × 3in.	6/3
12in. × 10in. × 3in	6/10
14in. × 10in. × 3in.	7/11
16in. × 10in. × 3in.	8/6
20in. × 10in. × 3in.	10/-

MINE DETECTOR PANELS, include three 1T4 valves. 12-1 Midget Trans., three ceramic valveholders, 18 condensers and resistors, etc., **20/-**. Without valves, **5/-**

ELECTRON MULTIPLIER PHOTO CELL TUBES.
Type 931A. Brand new. Guaranteed, **30/-**.

CRYSTAL DIODES. Type CV102, **3/6** each.

MOVING COIL EARPIECES.
Comprise a 1½in. Moving Coil Loudspeaker fitted with noise excluding rubber caps. Make excellent Mikes, Phones or Speakers, **2/-** each, **18/-** doz.

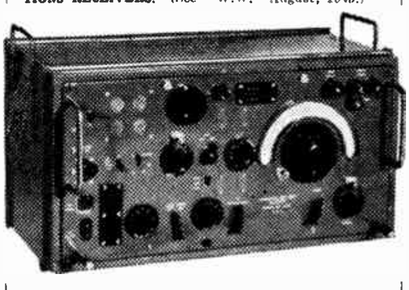
GOVERNMENT SURPLUS MAINS TRANSFORMERS.
All are for use on 230 volt 50 cycle Mains.

Type		
42	500-0-500 v. 170 mA. 4 v. 4 a.	25/-
44	10 v. 5 a., 10 v. 5 a., 10 v. 5 a.	35/-
53	250-0-250 v. 60 mA., 5 v. 2 a., 6.3 v. 2-3 a.	15/-
54	275-0-275 v. 60 mA., 5 v. 2 a., 6.3 v. 2-3 a.	15/-
55	250-0-250 v. 100 mA., 5 v. 2 a., 6.3 v. 3-5 a.	17/6

SUPER MOVING COIL MIKE AND STAND. We have purchased the entire stock of a famous Manufacturer of PA Equipment at a very low price, and are offering a £5/5/- Super Moving Coil Mike, with a chromium plated folding stand to match. The list price of the stand was £3/3/-.
WE OFFER THE PAIR AT 79/6. LESS THAN HALF THE USUAL PRICE.

THERE ARE THOUSANDS OF RADIO AND TELEVISION BARGAINS IN THE PREMIER CATALOGUE 3d.

R107. ONE OF THE ARMY'S FINEST COMMUNICATIONS RECEIVERS. (See "W.W." August, 1945.)



9 valves. R.F. amp. osc. Frequency Changer, 2 I.F.'s. (465 kc.), 2nd Detector, A.V.C. Af. amp. B.F.O. A.C. mains, 100-250 v. or 12 v. accum. Frequency range 17.5 to 7 mc/s, 7.35 mc/s to 2.9 mc/s, 3.0 to 1.2 mc/s. Monitor L.S. built in. Complete. Write for full details. Price **£12/12/-**, plus 21/- carriage and packing.

PREMIER MIDGET RADIO KIT. Due to greatly increased production we are now able to offer this Kit at a greatly reduced price. Including an attractive Bakelite case, 12in. long × 5in. wide × 6in. high. The valve line up is 6K7, 6J7, 6V6 and a Selenium Rectifier in the A.C. model; and 6K7, 6J7, 25A6 and Selenium Rectifier in the A.C./D.C. model. Both are for use on 200 to 250 volt mains. The dial is illuminated, and the receiver presents a very attractive appearance. Coverage is for the medium and long wavebands.
Complete kit of parts with cabinet and diagrams, **£4/19/6**, inc. Purchase Tax.

PREMIER MIDGET SUPERHET KIT. This powerful Midget Superhet Receiver is designed to cover the short-wave bands between 16 and 50 metres and the medium wavebands between 200 and 557 metres. Two models are produced, one for 200-250 volt A.C. mains, and the other for 200-250 volts A.C. or D.C. mains. Both are supplied with the same plastic cabinet as the TRF Receiver. The A.C. valve line-up is 6K8, 6K7, 6Q7, 6V6 and a selenium rectifier. The A.C./D.C. line-up is the same, with the exception of the output valve which is a 25A6. The dial is illuminated, making a very attractive receiver.
Complete kit of parts with cabinet and diagrams, **£6/19/6**, inc. Purchase Tax.

PLASTIC CABINETS, as illustrated above. In Brown, **17/6.** In Ivory, **22/6.**

METER KIT.
A FERRANTI 500 MICROAMP M/C METER, with separate High Stability, High Accuracy, Resistors to measure, 15, 60, 150 and 600 volts D.C. Scale length 1½in., diameter 2½in. **10/-** the complete kit.

SECTIONAL WHIP AERIAL. Seven sections which plug into each other making an aerial 14ft. long. Thinnest section ¼in. diam., thickest section ½in. diam. Weather proof enamel. **3/6** each complete.

INSULATED BASE for above, **2/6** each.

METERS.

Full Scale Deflection	Scale Marking	Scale Length	Movemen	Price
1 mA.	0—100	2½in.	M/C D.C.	15/11
1 mA.	0—1	2in.	M/C D.C.	7/6
5 mA.	0—5	2in.	M/C D.C.	5/-
30 mA.	0—30	2in.	M/C D.C.	10/6
50 mA.	0—50	2in.	M/C D.C.	8/6
150 mA.	0—150	2in.	M/C D.C.	6/-
200 mA.	0—200	2½in.	M/C D.C.	8/6
2.5 Amp.	0—2.5	2in.	Thermo	5/-
3 Amp.	0—3	1½in.	Thermo	5/-
3.5 Amp.	0—3.5	1½in.	Thermo	5/-
20 Amp.	0—20	2in.	M/C D.C.	7/6
25 Amp.	0—25	2½in.	M/I D.C.	2/11
40 Amp.	0—40	2in.	M/C D.C.	7/6
20 v.	0—20	2in.	M/C D.C.	5/9
40 v.	0—40	2in.	M/C D.C.	5/9
300 v.	0—300	1½in.	M/C D.C.	10/-
5,000 v.	0—5,000	3½in.	Elect	50/-
500 u.a.	0—15 0—600	2½in.	M/C D.C.	5/-
500 u.a.	0—500	2in.	M/C D.C.	7/6
500 u.a.	0—500	2½in.	M/C D.C.	19/6

NEW 2-VALVE ALL WAVE KIT. 16 to 2,000 metres. Switched Coil Pack ready wired and tested. 2 Mazda HL23 Valves, 'Phones, H.T. and L.T. Batteries, Condensers, resistors, diagrams and steel case, all ready to assemble, **£3/10/-** including Purchase Tax.

207, EDGWARE ROAD, W.2 Phone: AMBassador 4033 **BRANCHES AND AT—**

All **POST ORDERS** to 167, LOWER CLAPTON ROAD, LONDON, E.5. 'Phone: AMHerst 4723

Terms of Business: Cash with order or C.O.D. over £1. Send 2d. stamp for list.

EDGWARE ROAD IS OPEN UNTIL 6 p.m. ON SATURDAYS

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

You can build a commercial looking and working

TELEVISOR WITH PREMIER KITS FOR

—£17.17.0—

This Receiver consists of 4 units:

The Sound Receiver, Vision Receiver, Time Base and Power Pack. As is usual in all Premier Kits, every single item down to the last bolt and nut is supplied. All chassis are punched and layout diagrams and theoretical circuits are included.

The cost of the Kits of Parts is as follows :

VISION RECEIVER with valves, **£3/13/6.** Carriage 2/6.

SOUND RECEIVER with valves, **£2/14/6.** Carriage 2/6.

TIME BASE with valves, **£2/7/6.** Carriage 2/6.

POWER SUPPLY UNIT with valves, **£6/3/-.** Carriage 5/-.

THE TUBE ASSEMBLY UNIT.

Which contains the VCR97 Cathode Ray Tube and Socket. 6in. P.M. M.C. Loudspeaker with closed field for televisors. Tube Mountings, etc. **£2/18/6.** Carriage and packing 2/6.

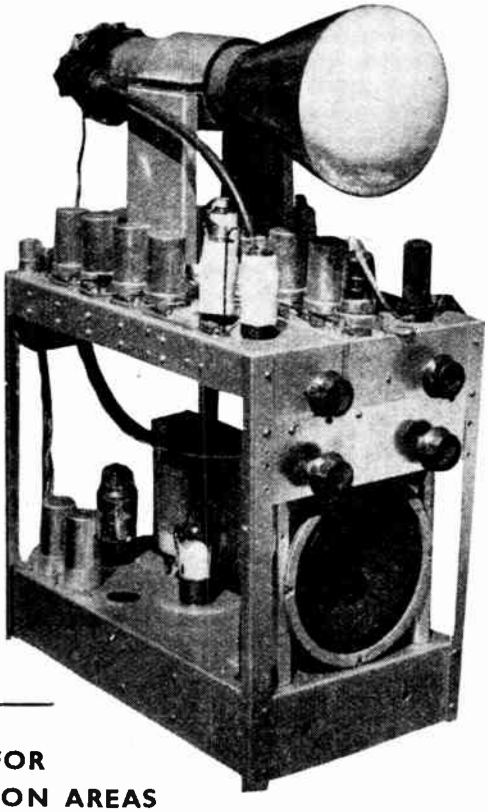
A well-made pedestal cabinet in walnut is available at **£5/10/-** plus 10/- packing and carriage.

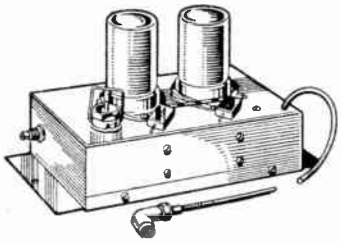
The Instruction Book costs 2/6, but is credited if a Kit for the Complete Televisor is Purchased.

Any of these Kits may be purchased separately ; in fact any single part can be supplied. A complete priced list of all parts will be found in the Instruction Book.

20 valves are used, the coils are all wound and every part is tested. All you need to build a complete Television Receiver is a screwdriver, a pair of pliers, a soldering iron and the ability to read a theoretical diagram.

Those wishing to build the **MIDLAND** version of this Televisor can obtain the complete kit with the exception of the coils and rejectors from stock. These will be available a few days after the commencement of full power transmission. The Coils and Rejectors are included in the price of **£17/17/-.**





PRE-AMPLIFIER FOR FRINGE RECEPTION AREAS

We can supply the complete kit of parts to make this wide band width Pre-Amplifier, using 2 EF54 Pentodes. Powered by the TV Kit, it is completely screened. With all parts, valves, chassis, diagrams, etc., **27/6.** All parts available separately.

WORKING MODELS CAN BE SEEN DURING TRANSMITTING HOURS AT OUR FLEET ST. & EDGWARE RD. BRANCHES

AT—**152-153, FLEET STREET, E.C.4** Phone : CENtral 2833

All **POST ORDERS** to 167, LOWER CLAPTON ROAD, LONDON, E.5. *'Phone: AMHerst 4723*

Terms of Business: Cash with order or C.O.D. over £1. Send 2½d. stamp for list.

EDGWARE ROAD IS OPEN UNTIL 6 p.m. ON SATURDAYS

*Perfect Reproduction?

THE LOUDSPEAKER AND ITS ASSOCIATED POWER AMPLIFYING STAGE

We now come to the last and most important link in the chain of reproduction — the loudspeaker and its associated power amplifying stage. They cannot be considered separately since the amount of electrical power required obviously depends upon the efficiency of the loudspeaker itself. In fact, all one need say about the output stage is that it must be capable of giving an output of about 10 times that of normal listening level if it is to handle peaks of modulation. For good quality it is essential that the harmonic distortion and — more important, the intermodulation products shall be kept low even at full output.

There are no inherent difficulties in achieving this result though it is bound to be somewhat costly. For average loudspeakers a power of at least 15 watts will be required and to handle this without distortion involves a large output transformer and an expensive power supply.

When we come to the loudspeaker itself we are assailed by enormous difficulties, many of which are, as yet, unsolved. If we ask of our loudspeaker — as we academically should — that it shall provide a pressure distribution which is a faithful copy of the power applied to it; that it should do this over a range of frequencies from 30 c.p.s. to at least 15,000 c.p.s.; that it should add nothing of its own character, either by harmonic distortion or ringing to the desired reproduction, then we have to admit that we are nowhere in sight of this desirable end. In fact, it is only the coarseness of the ear as a measuring instrument which allows one to feel that present day reproduction can be extraordinarily good.

The magnitude of the problem can easily be seen by a brief examination of the two ends of the frequency scale. In the deep bass from 50 c.p.s. downwards we need a vibrator of very large area mounted in a truly gigantic baffle or cabinet to produce adequate sound. In the high frequencies, we require a tiny radiator to which must be added some diffusing mechanism if the radiation is to be spread over a wide angle. If we could proceed regardless of cost, good results could be achieved from a series of loudspeakers, each carefully designed to cover a relatively narrow band of frequencies, the whole lot being fed from a suitable power dividing net work so that each loudspeaker is excused from handling those frequencies for which it is not adapted. The design of all the speakers would be controlled by one general principle, i.e. that its diaphragm size shall be small enough for it to behave as a piston over the range of frequencies which it is to produce.

The really remarkable thing is that almost any type of paper cone loudspeaker tends to produce the sort of response that we require for the following reason. Let us examine the behaviour of a paper cone, say, 8 in. in diameter when it is driven by the apex at frequencies from 50 cycles upwards. At the low frequencies the whole cone will move as one piece, provided, of course, that a suitable flexible surround is used. But it is easy to see that at some higher frequency the outer edge of the cone will fail to follow the movement of the centre — because, in fact, the frequency is so high that there is no time for the force applied at the centre to spread to the edge of the cone before the reversion of motion has started at the centre. In other words, the velocity of a sound wave in the cone material is too low.

As the applied frequency is increased still further a smaller and smaller portion of the cone faithfully follows the applied power whilst the annular area outside behaves in an almost unpredictable manner. If we could assume that this annular area remained at rest, then a plain paper cone loudspeaker would, to a first approximation, give a similar answer to a large number of separate loudspeakers of decreasing size, each fed from a frequency selective net work.

Unfortunately, the outer parts of a cone do not remain at rest. They continue to vibrate in various ways, sometimes in phase and sometimes in antiphase with the central portion so that the pressure measured at a distance from the loudspeaker is a resultant of a number of different movements. It is this that causes the response curve of a normal loudspeaker to be covered with peaks and troughs. Worse still, the rebellious parts of the cone which are failing to follow the central directive will continue to move if the applied force is suddenly removed; for a short while they will "ring" at their own natural frequency. Methods have been developed over the past few years of measuring the behaviour of loudspeakers by the application of transient inputs. A great deal can be learnt from the shape of the resultant pressure wave after the input has been removed.

It will be readily seen that the application of mathematics to such a complicated mechanical system as a paper cone is not likely to give useful results.

Loudspeaker development of this type calls for enormous numbers of painstaking experiments with different cone materials, different thicknesses, different shapes of cone, different surrounds — and hosts of other small details, each of which may be vitally important. By years of experience, certain broad generalisations can be found which reduce the almost infinite variety to more manageable proportions; even so the labour is immense.

Of course, there are some aspects of loudspeaker design which are more amenable. For example, if we confine our attention only to the centre portion of the cone and the driving coil, we can see that to avoid distortion the whole of the suspension must obey Hook's law over the largest excursions which are to be used. We must arrange that even at low bass frequencies the amplitude of movement of the cone does not produce non-linearity in the stress/strain relation of the surround and centre spider. Equally, the dimensions of the coil and the magnetic field must be chosen so that the average field strength through the coil shall be constant whatever the excursion. Some niceties in design are involved in securing this requirement for we may adopt several methods. The magnet gap may be made long, ensuring that the whole coil always operates in a uniform field, or the gap may be short so that the coil embraces the whole field, however far it moves. Both these methods are relatively easy but are uneconomic and inefficient and it is more usual for the coil length and distribution of the magnetic field to be chosen so that as one part of the coil moves out into a weaker field, another part compensates by moving into a stronger field.

From what has been said so far, it might be thought that we have only been considering normal moving coil loudspeakers such as are usually found in radio sets. Actually, this is not intended since the same fundamental considerations apply in all cases. It matters not what method of driving is chosen though a change of method will usually ease some parts of the problem and make others more severe.

We in Murphy Radio have spent an enormous amount of our research time on the problem of reproduction, and if we are honest, we must admit that the more we learn about it the more far off the final goal appears to be. We do, however, find great comfort when we come to compare the reproduction of today with what it was a few years ago. Although we are more dissatisfied now than we were then, it is quite obvious that our present standards are higher than in the past.

*** Problems referred to in previous notes.**

- Spatial Distribution of Sound.
- Echoes in the Listening Room.
- Limitations of Single Channel.
- Limitations of the Human Ear.
- Distortions and Faults caused by Apparatus.
- The Radio Link.
- Frequency Response.
- Non-Linearity.
- The Signal Rectifier.
- The A.V.C. Rectifier.

murphy radio limited

WELWYN GARDEN CITY, HERTS

C.R.C. 10

Webb's RADIO

A Christmas suggestion

MORE ACCEPTABLE THAN

PURPLE NECKTIES WITH YELLOW SPOTS

Why not hint gently to Aunt Maud that you'd prefer **Webb's Radio Globe of the World** 50/- carriage paid (or 47/6 to callers). A handsome adjunct to either the parlour or radio shack.

EDDYSTONE "5/10 METRE CONVERTERS"

Originally listed at £14, we have a few to offer at reduced price. The Converter will allow experimental reception of 5 and 10 metre signals on your receiver, also

TELEVISION SOUND

(Midland and London Frequencies)

Tested and new, with valves and instructions, **£6 . 10 . 0**

(Descriptive leaflet free on request.)

NEW 'Leak'

MOVING COIL PICK-UP

Call and hear this outstanding addition to our large range of disc reproducing apparatus. Price with ruby stylus and transformer, **£14 . 10 . 8.**

COMMUNICATIONS RECEIVERS

We advise our friends that all stocks of Eddystone '640' receivers are now sold. The new Eddystone '750,' price £45, will be available soon, details free on request. As regards the Eddystone '680,' price £85, the outstanding performance of this specialised receiver has resulted in Export orders taking the bulk of production, but WEBB'S usually have a demonstration model and orders are being booked for rotational delivery. Also we often have interesting second-hand bargains in receivers of U.S.A. and British origin—enquiries invited, though Webb's offers do not remain long unsold!

Webb's Radio, 14, Soho St., Oxford St., London, W.1.

Phone : GERrard 2089. Shop Hours : 9 a.m.—5.30 p.m. Sats. 9 a.m.—1 p.m.

A NEW

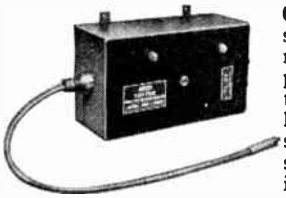
FIELDEN TECHNIQUE

in micro - measurement and control

FOR ANY INDUSTRIAL OR RESEARCH PROBLEM RESOLVABLE INTO MINUTE ELECTRICAL CAPACITANCE CHANGE

ACTUATION BY PROXIMITY of solid or liquid conductors or insulators to an electrode terminating a co-axial cable.

THE FIELDEN PROXIMITY METER—SENSITIVITY 0.01 mmf— indicates minute capacitance changes, whether caused by very small mechanical displacement or dielectric change. It measures, for instance, strains in structures, it gauges components to less than 0.00001in., monitors sheet, foil and wire sizes, measures liquid and other levels precisely, monitors dimensions and compositions, compares dielectric properties of non-conducting, liquids etc. It does what is impossible mechanically and, in many fields, surpasses all other micro-measurement methods.



THE FIELDEN TEKTOR—SENSITIVITY 0.25 mmf — is a unique, stable, high-speed capacity relay which solves many problems of counting, temperature control, level control of liquids and solids, and so on where simple direct-switching is impossible.

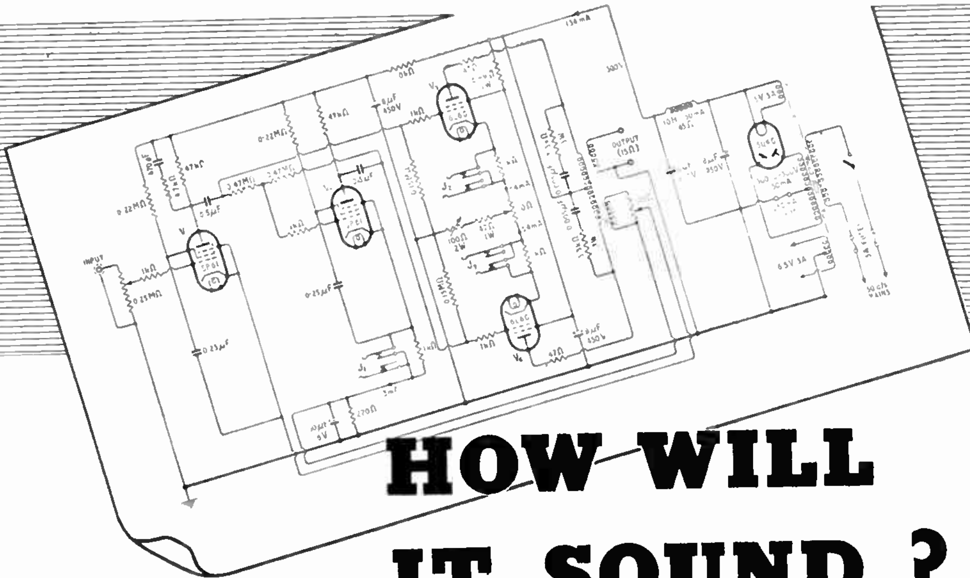
Please send for specification FE/4 to the **SPECIALISTS IN INDUSTRIAL ELECTRONIC EQUIPMENT**

Fielden

(ELECTRONICS) LIMITED

HOLT TOWN - - MANCHESTER

Telephone: ARDwick 2619.

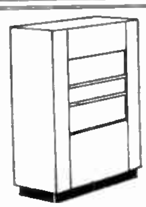


HOW WILL IT SOUND ?

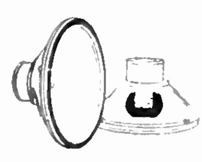
It may look O.K. on the blueprint, but the only thing that really matters is—how does it sound? Time and money are often spent by enthusiasts who neglect the essential feature of all sound equipment—a high quality, reliable speaker—best of all, a VITAVOX. Consult us on your sound problems and remember—

IT WILL SOUND BETTER THROUGH

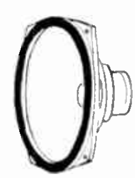
VITAVOX ***LOUDSPEAKERS***



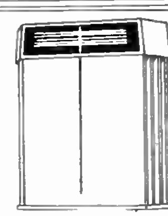
Console Reproducer
Model KC. 10. £21.



12" Cone Loudspeaker
Model K.12/10 £7.



15" Cone Loudspeaker
Model K.15/40. £18.



Klipschorn Reproducer
£135.

Fullest Information gladly sent on request

VITAVOX LIMITED

WESTMORELAND ROAD · LONDON · N.W.9 · ENGLAND

Telephone: COLindale 8671/3 · *Telegrams:* Vitavox, Hyde, London · *Cables:* Vitavox, London

The MAGNAVISTA TELEVISION LENS

When Seeing is Believing

The man who says "I saw it with my own eyes" is simply endorsing the general conviction that seeing is believing. That is why you should insist on a demonstration with a Magnavista lens, for then you can see with your own eyes how greatly the image is enlarged, how brilliant the picture becomes, how wide an angle of view is secured, and seeing these things, you believe in the advantages of Magnavista viewing.

PRICES

Type	Tube	£	s.	d.
A.7	6″	3	3	0
A.1, A.2, A.4, A.5, A.8, A.9, A.9a, A.10, A.11 and **A.12**	9″	4	14	6
B.1, C.1	10″ & 12″	5	5	0
D.1	15″	5	15	6
A.3 (Universal)	9″	6	16	6
B.2 (Universal)	10″	7	7	0
C.1x	12″	7	7	0

Subject to Trade Discount

MAGNAVISTA Magnification

is Television Perfection

METRO PEX LTD

Head Office:
38, Gt. Portland St., London, W.1
('Phone: Museum 9024-5)
Midlands Depot:
Kings Heath Stn., Birmingham, 14
('Phone: Highbury 2765)

T.P.R.I. COMPLETE PORTABLE RECORDER

EASIEST DISC RECORDER to operate.

NO EXPERT KNOWLEDGE REQUIRED.

PLUG IN AND RECORD IMMEDIATELY,

Speeches, Lectures, Meetings, Concerts and Special Radio Programmes.

The lightest and most compact Portable Disc Recorder including Amplifier, Speaker and high quality Microphone, in one Carrying Case, 14″ × 15″ × 10½″. WEIGHT 37 lbs.

PRICE **£85 . 0 . 0**

ELECTROSOUND SUPPLIES LTD.

99, BELGRAVE ROAD, S.W.1

'Phone : VIC 8814

OSMOR "Q" COILPACKS

As specified for conversion of the T.R.1196.

No need to spend hours puzzling over coil and switching problems. Just 5 connections (1-hole fixing), and the job's done—quickly, efficiently and cheaply. Full-circuit layouts and instructions with every pre-aligned "Q" Coilpack. Portable Battery—Model now available.

Send stamp for free circuits and our new lists of coils, coil-packs and matched radio components, also ***"Bargain Bulletin."***

OSMOR RADIO PRODUCTS LTD.

Dept. W.I.

BRIDGE VIEW WORKS, BOROUGH HILL, CROYDON SURREY.

Telephone: Croydon 1220

WESTINGHOUSE BRAKE & SIGNAL CO., LTD., 82, YORK WAY, KING'S CROSS, LONDON, N.1

Why you should use...

1. Maximum "Wetting" Capacity.
2. Accelerated Fluidity.
3. Moderate soldering bit temperatures.
4. Mechanical bonding and perfect Electrical conductivity ensured.
5. Minimum amount of solder used per joint.
6. Residue sets hard, is non-corrosive, and of high dielectric strength.
7. No harmful fume deposits.
8. Continuous, unvarying core.
9. Even distribution of activator in core.
10. Approved by Air Ministry and General Post Office.

Supplied in a wide range of Gauges and Alloys on 1 lb and 7 lb reels, works coils, or as required. Prices on application.

Sole Manufacturers :

H. J. Enthoven & Sons, Ltd.

89, UPPER THAMES STREET, LONDON, E.C.4.

Phone: Mansion House 4533. Works: Rotherhithe, Croydon, Darbyshire.

FOR QUICK DELIVERY
AT
REASONABLE PRICES
OF
RADIO & ELECTRONIC PRODUCTS
(Wholesale Only)

Write or phone:—

S. Szymanski

(pronounced SHE-MAN-SKEE)

ELECTRONIC ENGINEER & STOCKIST
95 STRODES CRESCENT
STAINES, MIDDLESEX

Staines 3971

VALVES are our speciality—Probably the Largest Actual Stockist in England

EXPORT ENQUIRIES WELCOMED

First of an occasional series from Charles Amplifiers (Sales) Ltd.

Facts On Figures

A fairly recent trend in High-Fidelity Reproduction has been the insistence on very low distortion figures. The general expression we use with both our "Concerto" and the "K.1." amplifiers is "Distortion below ½ per cent." although our production test figure averages 0.15 per cent. The reason for this figure is simple. It is extremely doubtful whether 1 per cent. of 2nd-harmonic distortion is ever audible with normal equipment. Cross-modulation occuring in the amplifier, the speaker (including its chamber or other mounting) and in the pickup is much more important and much research is still needed in this field.

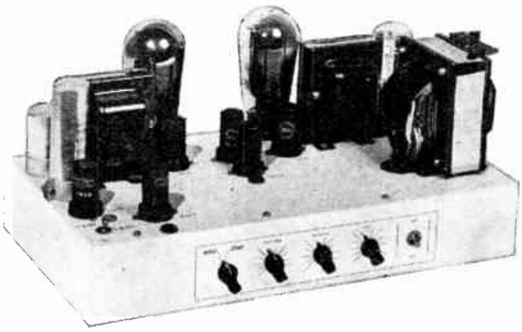
There is really little doubt that any high-fidelity amplifier worthy of its name has inaudible distortion—and so far as harmonic distortion is concerned that is almost all that need be said. Except for one important point: our distortion figure holds good at all settings of the tone controls, and this is particularly significant if treble boost is required.

Furthermore, we have found time and time again that the choice of the type of tone control is most important. The enormous popularity of the "Concerto" is certainly due in part to the fact that it has two networks of bass boost; their effect can not only be seen on a meter, but the improvement is obvious on first listening. This is specially noticeable on recorded organ music and it may be for this reason that the "Concerto" was used by Mr. Alan Douglas when he gave a lecture at the Royal Academy of Music and demonstrated records of electronic organs.

Our range of equipment consists of amplifiers, speaker chambers and an excellent tuning unit which has just been redesigned and reduced in price. The units are all designed with an eye on the users' requirements and our catalogue makes interesting reading. May we send you a copy?

Since Radiolympia we have been rather overwhelmed with enquiries and we have opened new offices for enquiries and demonstrations at the address shown below. Trade and export enquiries should be addressed to Charles Amplifiers Ltd., 1e, Palace Gate, London, W.8.

The CONCERTO *Amplifier*



. . . acclaimed by music lovers for its exceptionally high fidelity, this magnificent amplifier covers all normal requirements for home or concert hall. Distortion level below 0.5 per cent. *Two channels* of bass boost ensure unusually smooth balance and depth. Designed for any type of pickup. Radio input socket provided. Two year guarantee. Price £27.10.0. Heavy perforated steel cover with bottom plate and rubber feet, 45/- extra. Delivery by passenger train, Carriage Paid. 10/- deposit (returnable) for crate.

Deferred terms now available.

Our Equipment is used abroad in :—

ARABIA	MALAYA
ARGENTINE	NIGERIA
AUSTRALIA	N. RHODESIA
EIRE	PAKISTAN
GERMANY	SUDAN
HONG KONG	TANGANYIKA
INDIA	U.S.A.

Charles AMPLIFIERS (SALES) LTD.

181c KENSINGTON HIGH STREET, LONDON, W.8. Phone: WEStern 3350.

Our products can also be seen and heard at :—

WEBB'S RADIO,
SOHO STREET, LONDON, W.1

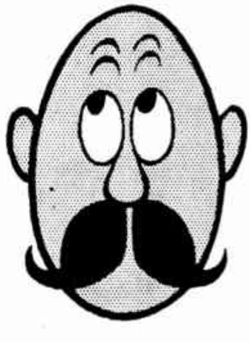
UNIVERSITY RECORDING CO.,
16 BURLEIGH PLACE, CAMBRIDGE

also

ERNEST BUCHAN,
28 BELMONT STREET, ABERDEEN

EDX.22G

The best HIGH and LOW



Exide AND Drydex

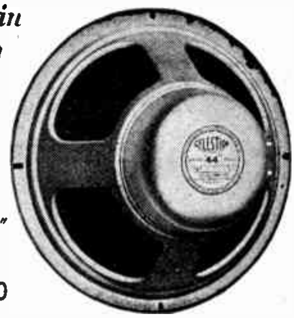
LOW TENSION ACCUMULATORS HIGH TENSION BATTERIES

for better battery radio reception

ISSUED BY THE CHLORIDE ELECTRICAL STORAGE COMPANY LIMITED

CELESTION

The Foremost Name in Sound Reproduction



MODEL P44.

- Overall Diameter $12\frac{3}{16}$"
- Voice Coil Impedance ohms 3.0
- Magnet Pole Diameter $1\frac{1}{2}$"
- Flux Density (Gauss) 10,000
- Total Gap Flux (Maxwells) 60,000
- Peak Power Capacity 10W

The General Public should please order through their Local Dealers.

Manufacturers are invited to write for details of the full range of Celestion speakers.

CELESTION LTD. SUMMER ROAD, THAMES DITTON, SURREY

Telephone: EMBERBROOK 3402-5

M.R. SUPPLIES Ltd.

for exclusive and completely reliable material. All prices nett.

RECTIFIER UNITS. For E.H.T., H.T., and L.T. (D.C.) supply. Unit "A" (E.H.T.), input 200/250 v. (10 v. taps) 50 c. 1 ph., output fully choke/capacity smoothed, 1,200 volts D.C. 200 mA. at 50 deg. C. ambient. In ventilated steel housing 19 in. by 18in. by 9in., approx. weight 60 lb., **£7/10/-**. Unit "B" (H.T. and L.T.) input 200/250 v. (10 v. taps) 50 c. 1 ph. outputs 6.3 v. D.C. 13 amps and 220 v. D.C. 110 mA., both choke/capacity smoothed. In ventilated steel housing 19in. by 18in. by 12in., approx. weight 50 lb., **£8/10/-**, or the pair for **£15**. These are new, slightly store soiled, in perfect electrical order. Prices are ex this address.

E.H.T. TRANSFORMERS. Primary 100/250 v. 50 c. 1 ph. (in 10 v. taps), secondary 2000/0/2000 v. (4,000v. C.T.) 400 mA. (50 deg. C.), size 10in. cube, enclosed with top terminal panel. Weight approx. 50 lb., **£4/10/-** (despatch 7/6).

VOLTAGE CHANGING TRANSFORMERS (Portable). 100, 110 v./200, 220, 240 v. (and vice versa) auto-wound, loading 1.25 kVA., in steel cabinet 9¼in. by 8in. by 6in., with carrying handle. Just right for mobile cine work. Brand new, **£4/15/-**. (despatch 5/-).

ROTARY CONVERTERS (new) Input 110 v. D.C., output 230 v. 50 c. 1 ph., 100-watts, under half current price, **£5/17/6** (despatch 5/-).

ELECTRIC BLOWERS. For electronic and lamp cooling, air conditioning, drying, etc., 24 v. A.C./D.C., 6000 r.p.m., reasonably quiet in running. Small, efficient model, 5in. by 3¼in. overall, brand new in cartons, **18/6** (despatch 1/-).

MINIATURE MICRO-AMMETERS. 0/500 micro-amps, m/coil, only 1¼in. dia., single hole mount, back terminals, new, boxed, **10/6** (despatch 6d.).

MILLIAMMETERS. Very special offer to clear overstocks. Brand new, m/coil 0/20 mA., 2¼in. proj. panel, with back terminals, **5/-**. Here is a real opportunity which this announcement will clear. Also some 6in. s/board meters, 0/30 volts (calibrated at 500 c. but suitable for 50 c.). First grade jewelled movement, to clear, **15/-** each (despatch 1/6).

F.H.P. MOTORS. 200/250 v. A.C. Brand new shaded pole type, suitable for stirrers, tape recorders, cine projectors, etc., running torque 400 gram/Cms. 1200 r.p.m. Double-ended shaft, frame 3¼in. by 3¼in., ventilated enclosed, **29/6** (despatch 1/-).

OPERATION COUNTERS. (Mechanical). To 99,999, **7/6**. **FOOTSWITCHES**, 1 make and 1 break when depressed, 15 amps, mains voltage, **6/-**. **THERMOSTATIC SWITCHES** (ex A.M.). On at 32 deg. F., off at 49 deg. F. (adjustable) capacity 1.5 amp mains voltage, **4/6**. **THERMAL DELAY SWITCHES**, (Varley) 4-volt, **4/6**. **TUMBLER SWITCHES** (Crabtree) 2-pole, 15-amp., plated, **4/6**. **MERCURY SWITCHES**, lined, 6/10 amps, with beaded leads, new **7/6**. **HIGH-SPEED KEYING RELAYS** (Siemens—ZA 3193) Twin-coil, 2,000 ohms, new, **7/6**. **P.O. RELAYS**, 2,000 ohms, 1 m. and 1 b., new, **4/6**.

STAGE LIGHTING DIMMERS. Full-bright to blackout at stated load at 220/240 v. Sliding type, 100-watt, **32/6**, 200-watt, **37/6**, 500-watt, **50/-** (despatch 2/-). Screw motion, with handwheel, 1,000-watt, **£6/3/-**, 2,500-watt, **£9/5/-** (despatch 5/-). All fully protected.

SYNCHRONOUS ELECTRIC CLOCK MOVEMENTS. Ready for use with chromium hands (hrs. mins., secs.) to suit 5/7in. clock, 200/250 v. 50 c. Size 3¼in. dia., 2in. deep, silent running. **37/-** (desptach 9d.).

ELECTRIC PUMPS. The reliable Stuart range from stock. 220 250 v. 50 c. No. 10 (120 g.p.h.), **£5 15 -** (despatch 1/6). No. 12 (600 g.p.h.), **£8/10/-** (despatch 3/6). Larger models and Piston Pumps also available from stock. Details on request.

HIGH DUTY BRONZE PUMPS (ex-Admiralty), brand new. Power required to drive, 1 h.p. Vane-type impeller, approx. 2,000 g.p.h., **£6/10/-** (despatch 4/6).

Illustrated lists of Pumps, Clock Movements, Variable Resistances and Dimmers, Transformers, etc. Please send stamp.

M. R. SUPPLIES Ltd., 68, New Oxford Street, London, W.C.

Telephone: MUSeum 2958

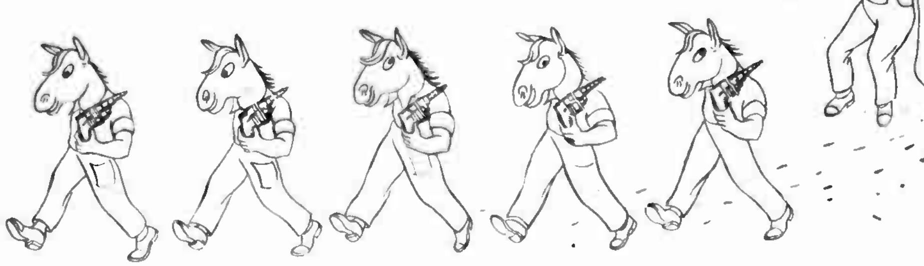
men talk —

said Desoutter's Little Horse—

of More productivity per *Man*. But who does the extra work? Horses of courses. Man without horsepower is but an ass. Can Man drive a screw at 3000 r.p.m.? Or bite through duralumin at 12 ft. per minute? If Man wants greater productivity—to drill ten holes where he drilled one, to run ten nuts where he was slowly winding one—let him

call up the little horses

DESOUTTER *Specialists in Lightweight Pneumatic and Electric Portable Tools*



DESOUTTER BROS. LTD., THE HYDE, HENDON, LONDON, N.W.9. TELEPHONE: COLINDALE 6346-7-8-9. TELEGRAMS: DESPNUCO, HYDE, LONDON

CRC 206

NATIONAL PHYSICAL LABORATORY REPORT

On tests of 12 watt amplifier

marked: "POINT ONE", TL/12, H. J. LEAK & CO. LTD.

Ref. E.388.150. Aug. 30th., 1949

Test Conditions. In all cases the input was applied to a 50 000Ω resistor connected to the amplifier by 3 feet of screened cable. The output load was in all cases a resistor of 18Ω and the output transformer secondary windings were connected for the "15Ω — 20Ω" condition.

HARMONIC DISTORTION.

0.03% for 10 watts output at 1,000 c/s.
0.1% for 10 watts output at 60 c/s.
2nd and 3rd harmonics predominated, and were approximately equal in magnitude.

HUM AND NOISE.

−80 db. referred to 10 watts.

SENSITIVITY.

148 mV.r.m.s. input gave 12 watts output at 1000 c/s.

LOAD DAMPING FACTOR. (Load impedance/output impedance)

42 for 10 watts output at 1,000 c/s. (Output impedance 0.43Ω).
45 for 2.5 watts output at 1,000 c/s. (Output impedance 0.40Ω).
The output impedance was found to be substantially resistive.

FREQUENCY RESPONSE.

Gain relative to that at 1,000 c/s. measured at 7.5 watts output, including the losses introduced at the higher frequencies by the capacitance of the input cable shunting the input resistance of 50,000Ω.

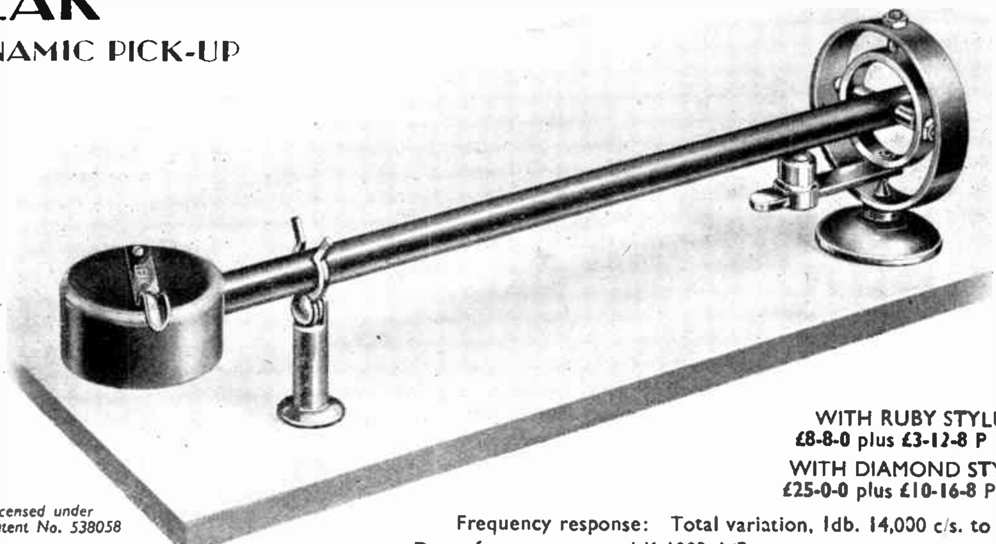
c/s.	db.
20	+0.1
60—1,000	0
5,000	−0.1
10,000	−0.3
15,000	−0.4
20,000	−0.7

WRITE FOR BOOKLET W/TL/12 which explains how these amazing results are achieved.

THE

LEAK

DYNAMIC PICK-UP



WITH RUBY STYLUS
£8-8-0 plus £3-12-8 P. TAX
WITH DIAMOND STYLUS
£25-0-0 plus £10-16-8 P. TAX

Licensed under Patent No. 538058

Frequency response: Total variation, 1db. 14,000 c/s. to 40 c/s. from Decca frequency record K.1803-A/B.

In mechanical detail and electrical performance the LEAK DYNAMIC PICK-UP is as far ahead of other pick-ups as the LEAK "POINT ONE" TL 12 AMPLIFIER is ahead of other amplifiers.

WRITE FOR LEAFLET W/P.

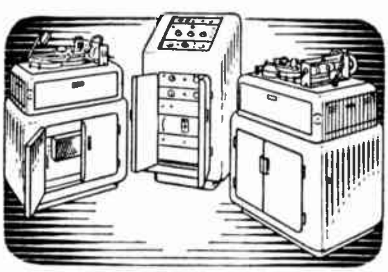
BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3

Phone: SHEpherds Bush 5626. Telegrams: Sinusoidal, Ealux, London. Foreign: Sinusoidal, London

DIRECT RECORDING ON DISK

THE year 1930 marked a vital point in sound recording progress. It was then that Mr. C. E. Watts, founder of the M.S.S. Recording Co. Ltd., produced the first cellulose lacquer-coated disk—an achievement which paved the way to—indeed made possible—to-day's high-fidelity sound reproduction. That same pioneering spirit, consistently prompting every endeavour of the M.S.S. organisation, has produced a range of sound recording equipment which is acknowledged supreme wherever there is an appreciation of true fidelity in sound reproduction. Apart from its "quality" performance, every item of M.S.S. equipment—whether a complete recording channel or a cutter head—is built to a standard of technical excellence which assures long-maintained efficiency under the most exacting operating conditions. In this connection it is interesting to mention that the first disk recorder used by the B.B.C. for broadcast programmes and supplied by M.S.S. in 1933, is still in use in their training school.

Illustrated below is a typical M.S.S. Studio Recording equipment, but the M.S.S. range includes Portable Studio Recording equipment, Portable Recorders for the professional and also home recording equipment. Full details will gladly be sent on request.



M.S.S. RECORDING CO., LIMITED
POYLE CLOSE, COLNBROOK, BUCKS
Telephone: COLNBROOK 115

RECORD PLAYERS

by

Richard Allan

C.D.M. With variable speed regulator, automatic start and stop, 12" cloth covered turntable. Price £15 : 1 : 0 Tax Paid

C.D.U.M. Universal model operating on A.C. or D.C. Current. Price £20 : 15 : 8 Tax Paid

R.D.M. (illus.) This powerful rim driven model is fitted with fool-proof start and stop mechanism beneath the unit plate. Price £12 : 0 : 8 Tax Paid

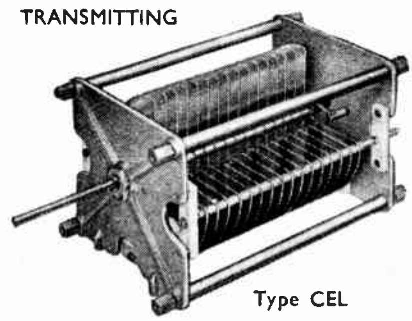
FROM ALL GOOD DEALERS

There is a most comprehensive range from which to choose

RICHARD ALLAN RADIO LTD.
BAFFLETTE HOUSE · BATLEY · YORKS
Makers of the famous BAFFLETTE Extension Speakers

"Cyldon" VARIABLE *Capacitors*

TRANSMITTING



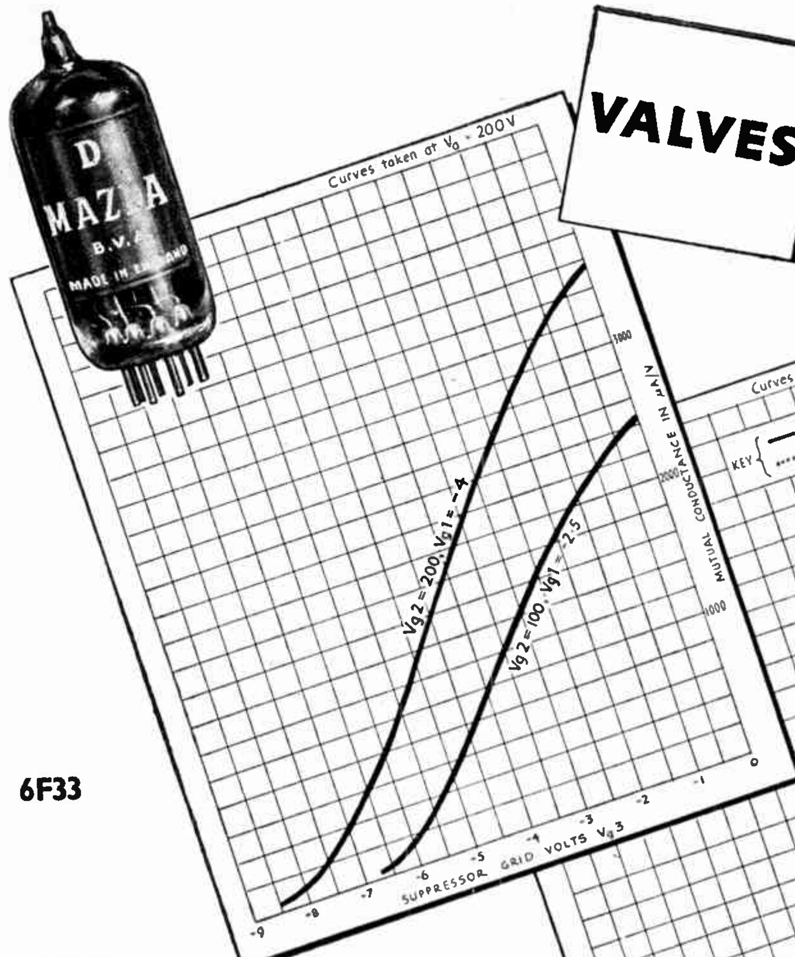
Type CEL

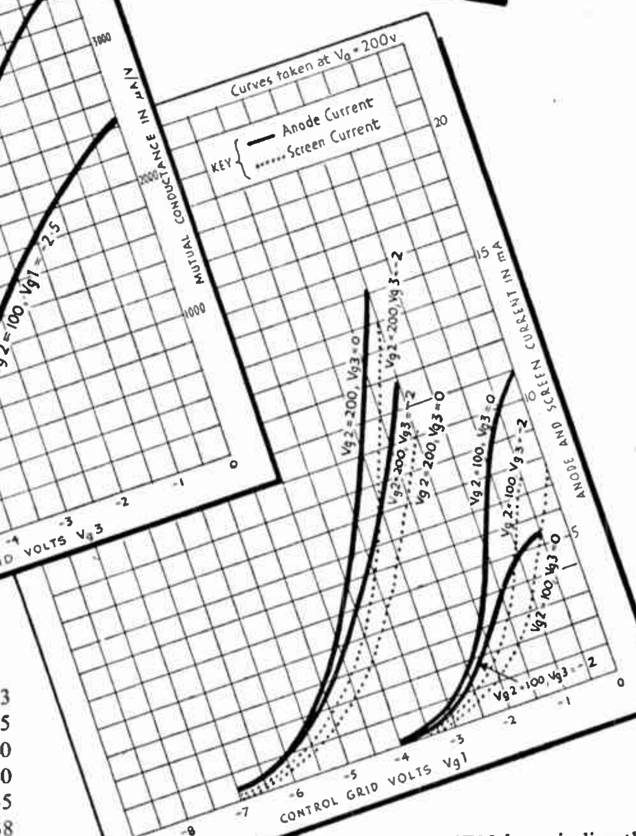
13¾" long (excluding spindle). 8" wide. 7¼" high. Air gap .218" Range of max. capacities. 100—1000pF.

MICA TRIMMERS *to* AIR DIELECTRIC HIGH-VOLTAGE *Transmitting Capacitors*

SYDNEY S. BIRD & SONS, LTD.
CAMBRIDGE ARTERIAL RD., ENFIELD, MIDDX.
Phone: Enfield 2071-2. Grams: Capacity, Enfield.

VALVES For SPECIAL PURPOSES





6F33

RATING

Heater Voltage (volts)	Vh	6.3
Heater Current (amps)	Ih	0.35
Maximum Anode Voltage (volts) ...	Va(max)	250
Maximum Screen Voltage (volts) ...	Vg2(max)	250
Mutual Conductance (mA/v) ...	gm	* 4.35
Inner μ †	μg1g2	* 38
Maximum Anode Dissipation (watts)	pa(max)	2.5
Maximum Screen Dissipation (watts)	pg2	0.8
Maximum Potential Heater/Cathode (volts DC)	Vh-k(max)	100

*Taken at V_a = 200v ; V_{g2} = 100v ; V_{g1} = −1.5v ; V_{g3} = 0v

†i.e $\frac{\delta V_{g2}}{\delta V_{g1}}$ with I_a constant

The Mazda 6F33 is an indirectly heated screened R.F. Pentode on a B7G base. It has a short cut-off Suppressor Grid characteristic which makes it particularly suitable for use in Modulator, Variable Reactance and Timing Circuits. In order that the Suppressor Grid may be driven positive, a diode has been tied to this grid. **List Price 17/6d.**

Further details will be supplied on application to the Radio Division.

EDISWAN
MAZDA

RADIO VALVES AND CATHODE RAY TUBES

THE EDISON SWAN ELECTRIC CO. LTD., 155 CHARING CROSS RD., LONDON, W.C.2

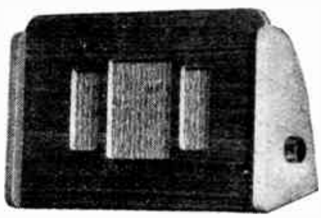
RA13

CELESTION

The Foremost Name in Sound Reproduction

"BAFFLE" SPEAKERS

It is worth considering that whichever CELESTION Extension Loudspeaker you purchase, you are certain of getting the accumulated experience of over **25 years specialisation** in the design and construction of Loudspeakers. For appearance, perfect tonal quality and many years trouble free service, CELESTION Extension Loudspeakers are second to none.



MODEL "FIVE B"
5in. P.M. SPEAKER
Without transformer
Size: Height 8in. Width 11½in. Depth 5in

PRICE 39/6

MODEL "SIX B"
6½in. P.M. SPEAKER
Without transformer
Size: Height 9in. Width 2½in. Depth 5½in.

PRICE 49/6

Both above models have Polished Walnut Baffle, cream sides and are fitted with Volume Controls.

CABINET SPEAKERS

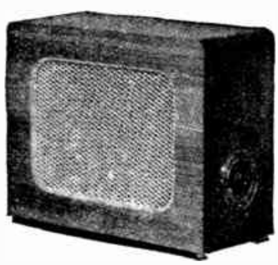
There are several excellent CELESTION Cabinet Model Extension Loudspeakers to choose from. The Senior 8, as illustrated has a cabinet of selected walnut veneer and the expanded metal grille is most attractive.

SENIOR 8
8in. P.M. SPEAKER
Without transformer

Size · Height 10½in. Width 12½in. Depth 5½in. Fitted with Volume Control.

PRICE £4-5-0

Price with Multi-Radio transformer £4-11-0



OUR NEW ILLUSTRATED BROCHURE AND PRICE LIST "B.C." WILL BE SENT YOU ON REQUEST.

SOLE DISTRIBUTORS
to the Wholesale and Retail Trades

Cyril French Ltd.

HIGH STREET, HAMPTON WICK, KINGSTON-ON-THAMES, SURREY

Telephone: KINgston 2240

• CONSTANT VOLTAGE • POWER SUPPLY UNITS

NEW SERIES 101

Our new Laboratory Power Supplies, Series 101, are based on our well-known Model 101-A, but incorporate a number of improvements and refinements.

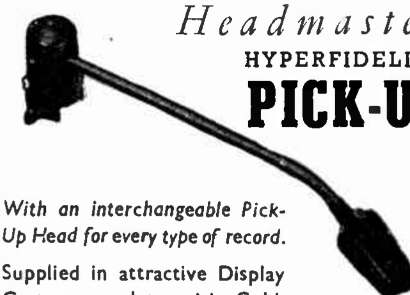
DETAILS ON REQUEST.

ALL-POWER TRANSFORMERS LTD.
8a, GLADSTONE ROAD, WIMBLEDON, S.W.19
Tel.: LIBerty 3303.

The Revolutionary

GOLDRING

Headmaster
HYPERFIDELITY
PICK-UP



With an interchangeable Pick-Up Head for every type of record.

Supplied in attractive Display Carton complete with Goldring Tonaliser and Transformer

★

Goldring Products include:

PICK-UPS, PICK-UP HEADS, SAPPHIRE JEWEL POINT NEEDLES, AND RADIOGRAM ACCESSORIES.

Write for full Descriptive Lists and Technical Information:

ERWIN SCHARF
49-51a DE BEAUVOIR ROAD, LONDON, N.1
Telephone: CLISSOLD 3434


Play the Ace of Trumps
against Ignition Noise
SUPPRESSOR
ERIE
D8
Reduced List Price
1/6 each
ERIE
D8
5000 Ω
ERIE

THE **MOBILE**
SIGNAL GENERATOR
FOR FIELD OR FACTORY

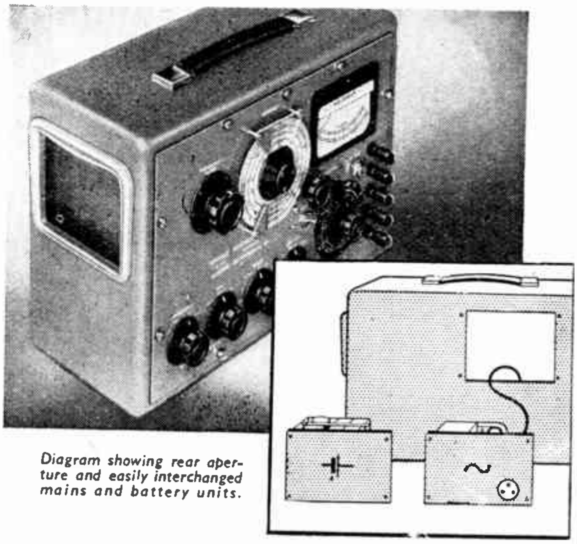


Diagram showing rear aperture and easily interchanged mains and battery units.

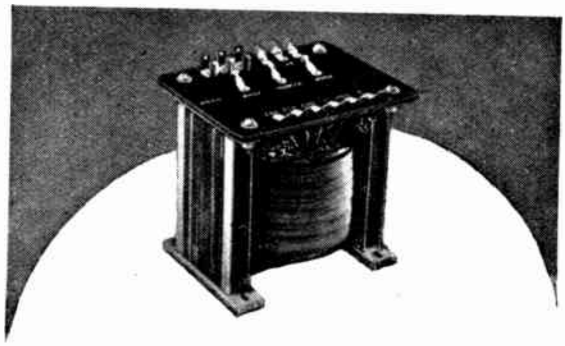
Originally styled for service in the front line, this mobile Marconi Signal Generator has proved itself supremely adaptable. Light and compact as an attachê case it is mains operated ordinarily but independent of power supplies when fitted with its special battery unit. Technically a triumph of ingenuity, it combines in so small a compass a SIGNAL GENERATOR with wide frequency coverage—70 kc/s to 70 Mc/s—OUTPUT POWER METER, up to 1 W with impedance matching — and CRYSTAL CALIBRATOR accuracy 2 parts in 10^4. Accuracy of output and frequency calibration is above the average for so moderately priced an instrument. Please ask for further particulars of:

The Portable Receiver Tester Type TF888

MARCONI INSTRUMENTS LTD.

ST. ALBANS, HERTS. Telephone: St. Albans 6161/5

Northern Office: 30 Albion Street, Hull. **Western Office:** 10 Portview Road, Avonmouth. **Southern Office & Showrooms:** 109 Eaton Square, London, S.W.1. **Midland Office:** 19 The Parade, Leamington Spa.



When an unusual Specification is required

We can give you the benefit of 20 years' experience in transformer construction and design. We do NOT mass produce. Every instrument is built to suit your most exacting individual specification.

Send your enquiries for the personal attention of our Mr. W. Bryan Savage.

SAVAGE TRANSFORMERS **OF** LIMITED **DEVIZES**

SAVAGE TRANSFORMERS LTD. NURSTEED ROAD, DEVIZES, WILTS

"REPRODUCTION OF RECORDS"

by J. H. Brierley

Booklet. Price 3/6 (by post 3/11).

In this booklet inter alia is described a pre-amplifier incorporating all necessary equalising and variable tone control circuits that will fully load any standard amplifier if fed with an input of 5 mV., the noise and hum level being not higher than—60 dbs. at full gain.

Fullest practical details are given with photographic illustrations of the exact location of the components and method of wiring.

General principles are discussed with particular reference to the illogical and incorrect procedures that are always the root cause of difficulties associated with low output high fidelity pick-ups.

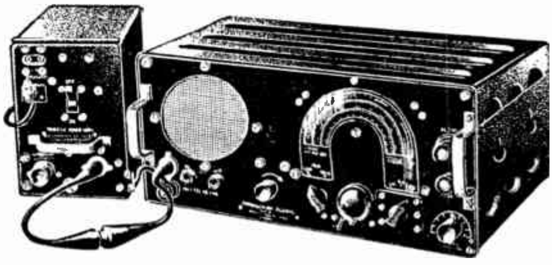
J. H. BRIERLEY (Gramophones & Recordings) LTD.

46, Tithebarn Street, Liverpool, 2

LONDON CENTRAL RADIO STORES

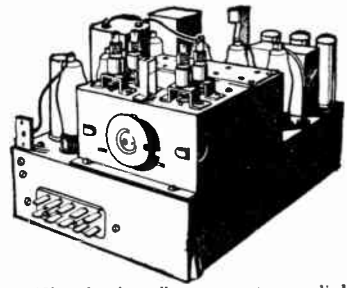
Government Surplus — Immediate Delivery from Stock

PHILIPS 6-VALVE COMMUNICATIONS RECEIVER



16-50, 200-550 and 800-2,500 metres. R/F, F/C, 2 I.Fs. D.D.T. Pentode Output. Spin-wheel tuning. In black metal case with built-in speaker. Complete with power pack, AC 200-250 v. Can also be supplied with 12 v. D.C. power pack if required. BRAND NEW—EX-GOVT. **£17.10.0**

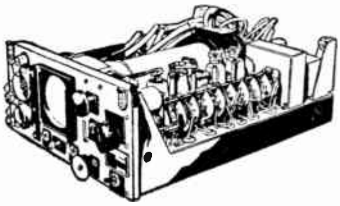
R.A.F. 6-VALVE SUPERHET RECEIVER UNIT No. 25



All valves guaranteed. This unit is easily adapted to Short-wave reception for home use. In addition to two EF36, two EF39, one EK32 and one EBC33 valves, it contains 1 pr. 460 Kc/s iron dust I.F. Transformers, Mic. and phone output transformers, a number of resistances and fixed condensers of useful values, two 1 mfd. 500 v. wkg. and four .1 tubular condensers, pot'meters, Int. Octal Valve holders, Tuning Coil, etc., mounted on steel chassis 8¼ × 6¼ × 2¼in. FREE circuit diagram 9in. × 19in. showing all components, supplied with each set.

In new condition. **22/6**

TYPE 73A VISUAL UNITS.

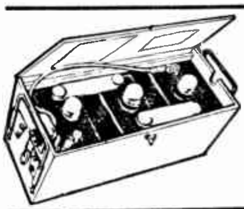


With 4in. Cathode Ray Tube, VCR138A, 4 SP61, 1 EB34 valves, potentiometers, etc. Complete on chassis, 16 × 12 × 5¼in. **35/-**

EX-GOVT. SUPERHET UTILITY SET. Medium Wave only. Valves · ECH35, EF39, EL33, DW4/350. P.M. Speaker. In pine wood cabinet 13¼ × 12 × 6¼ins. In good condition. Carr. and pkg. 5/- **77/6**

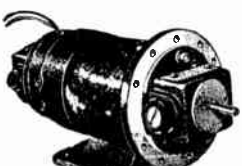
EX-R.A.F. TEST SET TYPE 202. 7 EF50, 2 VR116, 1 5Z4G, 2 VR54 valves, electrolytic condensers, transformer, potentiometers, resistances and condensers. **60/-**

BRAND NEW ACCUMULATORS.



6 v., 85 a. Size 12 × 9 × 7in. Weight 45 lbs. British made. **£3.10.0**

FRACTIONAL H.P. A.C. MOTORS
Converted from ex-Govt. Generators



Brushtype 220-250 v. 50 cycles approx. 5,000 r.p.m. Overall diam. 10 × 4in. ¼in. spindle extends 1in. both ends. **21/-**

COSSOR MODEL 900 TELEVISION, 15in. TUBE.
with All-Wave Radio. Walnut Console Cabinet. In perfect working order. For callers only. **£85**

HEADPHONES. Low resistance with headbands, new, 4/6 pair. New American midget Reed type, 90 ohms, no headbands, 3/9 pair. American light weight. Suitable for deaf aid, 7/6 pair.

BLOWER MOTORS. 12-24 v., 17/6. 80 v., 15/-.

2-VOLT VIBRATORS. Self-rectifying. Output 200 v. at 60 mA., 7/6.

VIBRATOR PACK. Admiralty pattern, 12 v. D.C., 300 v., 100 mA. output, 30/-.

POWER UNIT, Type 280. Contains four VU133, one 5U4, one VR65 valves, 22/6.

VISION UNIT, Type 162. Complete with 6in. 517 CR. Tube, 2in. 139 C.R. Tube, one 807, three VR65, one 6J5 valves. 0.5 milliammeter, condensers, etc. Suitable for Television, 55/-.

VISION UNITS, Model 6A. Consisting of 6in. VCR97 Electrostatic C.R.tube, 7 valves, including four EF50, potentiometers, resistances and other associated components. In metal cabinet 18 × 8 × 7½in. These units are in perfect condition. Ideal for Television. 67/6.

20-VALVE RECEIVER Type No. 3515. Includes 13 Mc. strip suitable for Television sound or vision when used in conjunction with R.F. unit Type 25. Contains the following valves: 10 SP61, 5 EF36, 3 EBC33, 1 EB34, 1 Mazda A832, relays, condensers, resistances, etc. Brand new in metal case and supplied in wood transit case. 55/-.

The R.F. Unit Type 25 suitable for use with the above and for other television purposes is 12/6 extra.

NEW MILNES H.T. UNITS (everlasting) 120 v. 600 mA. Will charge from 6 v. accumulator. Callers only. 67/6.

Ex-R.A.F. CAMERA MOTORS. Dimensions 3in. × 2in. × 1¼in. 24 v. AC/DC. 8/9.

EX-GOVT. TELEPHONE HAND SETS (Sound Power). New stock. Self-energising. Need no battery or current, 7/6.

1/30th H.P. MOTORS. Constant speed. Double-ended spindles. 220-250 v. These motors are new, not surplus conversions and are suitable for 16 mm. projectors and many other purposes. AC/DC, with feet, 42/6. AC, without feet, 35/-.

MOVING COIL HAND MICROPHONE. Complete, 5/6. **INSERTS,** as above, 2/9.

7-VALVE U.H.F. RECEIVER, Type R1147A. Range approx. 200 megacycles (with 4 Acorn valves). A Real Opportunity. Beautifully constructed and fitted with micro-condenser drive. Valve types: two EF36, one EBC33, thre 954 one 955. In black metal case, 8 × 7 × 6in. Set complete with valves. 30/-.

Ex-ARMY TEST SET—NEW, Type Demolition Mk. 1. For circuit continuity and general testing. In hardwood carrying case, 42/-.

FIVE-WAY RUBBER COVERED CABLE. Suitable for lighting and other purposes. Per doz. yds., 6/-.

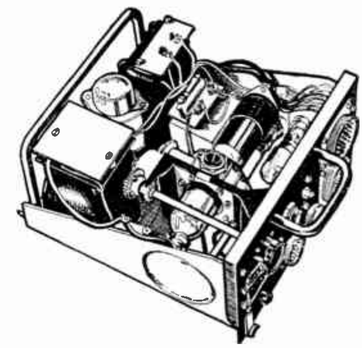
Ex-GOVT. 100ft. COPPER AERIALS, ebonite chain insulators, 30ft. guy rope, 4/3.

PHOTO-ELECTRIC CELLS. Type GS16. These cells are the gas-filled type with caesium Cathode. Made by Cintel. Minimum sensitivity 100uA/lumen, working volts 100 D.C. or peak A.C. Projected cathode area 16 sq. cm. Suitable for 16 mm. Home Cinema Talkie equipment, Safety Devices, Colour and Photo Matching, Burglar Alarms, Automatic Counting, Door Opening, etc. Brand new in original cartons. 42/6.

PLEASE NOTE

● All carriage paid unless otherwise stated. ● Carriage charges relate to British Isles only. ● We do not issue lists or catalogues. ● We have hundreds of items in stock too numerous to list, including Special Admiralty Transmitters, Receivers, etc., so when in Town pay us a visit.

EX-R.A.F. TUNING UNIT TYPE 207A.



BRAND NEW. Includes Clystron valve, 3 Neon tubes CV71, 1 5Z4G and other useful components. As illustrated, plus metal cover. **21/6**

NEW VCR97 CATHODE RAY TUBES, 37/6.

R.C.A. CINEMA SPEAKERS. 110 v. Complete with wood horns. 2ft flare. For CALLERS ONLY. **£5.10.0**

12in. C.R. TUBES VCR140 Blue Screen, 90/-.

WESTERN BALL MICROPHONE.
Manufactured by Standard Electric.

Suitable for broadcasting and recording. Moving Coil (Dynamic). Omni-directional.

No energising necessary. High Fidelity. Coil Impedance 15 ohm. and will work very well in conjunction with an ordinary speaker transformer. **£4.17.6**

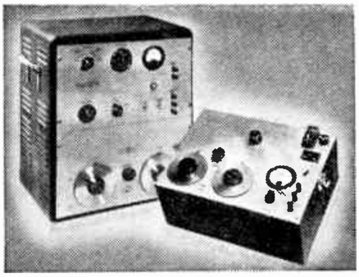
Is of the type used by many leading bodies, such as the B.B.C. and G.P.O. for high fidelity reproduction.

EX-R.A.F. TUBULAR CONDENSERS. .02 mfd. 8 Kv. D.C. working, 6½in., 4/-.
4 MFD. CONDENSERS 2,000 v. D.C., 4/6.

LONDON CENTRAL RADIO STORES, 23, LISLE ST. *(GERrard 2969)* LONDON, W.C.2

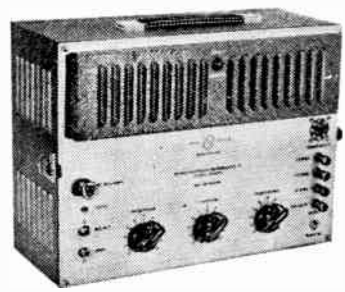
Closed Thursday 1 p.m. Open all day Saturday and weekdays 9 a.m.—6 p.m.

Leaders in their field



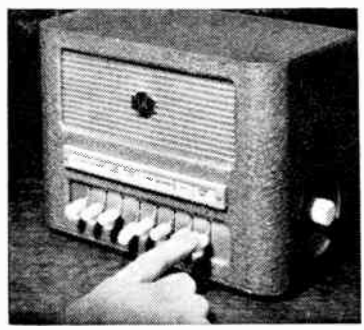
BEAT FREQUENCY OSCILLATORS & LABORATORY INSTRUMENTS

INDUSTRIAL SOUND INSTALLATIONS

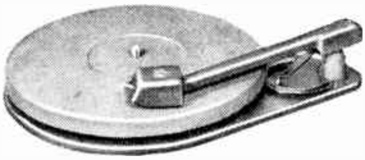


PORTABLE AND MOBILE AMPLIFIERS

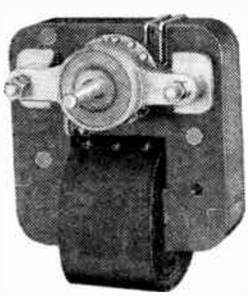
DIRECT DISC RECORDERS FOR HIGH FIDELITY DISC RECORDING



TELEMASTER INTER-OFFICE COMMUNICATION EQUIPMENT



G.U.2 GRAMOPHONE UNIT



SHADED POLE MOTORS

T.U.2 TURNTABLE UNIT

BIRMINGHAM SOUND REPRODUCERS LTD.

Telephone: Cradley Heath 6212 — CLAREMONT WORKS, OLD HILL, STAFFS. — 'Grams: 'ELECTRONIC' Oldhill, Cradley Heath

Wireless World

RADIO AND ELECTRONICS

39th YEAR OF PUBLICATION

DECEMBER 1949

Proprietors: ILIFFE & SONS LTD.

Managing Editor: HUGH S. POCOCK, M.I.E.E.

Editor: H. F SMITH

Editorial Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telephone: Waterloo 3333 (60 lines).

Telegrams: "Ethaworld, Sedist, London."

PUBLISHED MONTHLY

Price: 2/-

(Publication day: last Thursday o preceding month)

Annual Subscription: Home and Overseas, £1 6s. 0d. U.S.A. and Canada, $11.00

Branch Offices:

Birmingham: King Edward House, New Street, 2.

Coventry: 8-10, Corporation Street.

Glasgow: 26B, Renfield Street, C.2.

Manchester: 260, Deansgate, 3.

In This Issue

OUR COVER: Anti-Echo Chamber (See Page 503)

Valves and their applications

TELEVISION SYNCHRONIZING & TIME BASE CIRCUIT USING EF42, ECC34 & EL38. No. 3.

SYNCHRONIZING PULSE SEPARATOR USING EF42.

The circuit of Fig. 1 with its associated waveforms in Fig. 2 will be recognised as part of the complete circuit in last month's issue of the "Wireless World".

The effectiveness of the time base synchronization profoundly affects the quality of the final picture. With the system of synchronization described in this series of reports a clean vertical edge and steady interlace are secured even in the presence of considerable interference, thus realising the full benefits of high definition obtained from specially designed signal circuits.

The process of synchronization is achieved in four major stages. In the first stage a slicing action takes place in which the composite video signal is truncated with the elimination of the picture signal and the tips of the synchronizing pulses which contain noise and interference.

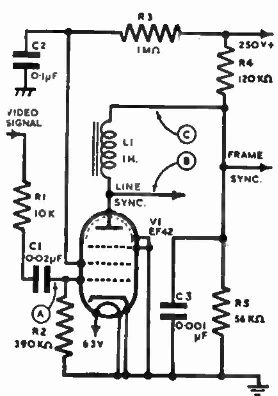


FIG. 1.
CIRCUIT OF FIRST LIMITER IN SYNCHRONIZING PULSE SEPARATOR.

In the second stage, the synchronizing pulses are fed to the line time base in such a way that the time base is synchronized or fired at the correct instants of time by the leading edges of the pulses.

In the third stage, amplitude differentiation of the line pulses and the chain of frame pulses is obtained. In the transmitted signal the differentiation is one of pulse length.

The fourth and final stage is a further slicing operation. The results of the third stage are sliced so that a single pulse of about 400μs duration, corresponding to the chain of eight frame pulses, is passed on and other pulses, corresponding to the line pulses, are eliminated.

In the circuits discussed these stages are somewhat interrelated but the conception of the four steps will assist in following the more detailed description of the circuits which is given in the additional notes and next month's advertisement.

The first limiter (see Fig. 1) has a double clipping action by driving the EF42 well into grid current on the tips of the pulses and having a sufficiently short grid base so that the base of the pulses and the vision signal are beyond cut-off. The inductor L1 causes the valve to bottom as if it had a very large resistive anode load which gradually decreases in value during the period of a synchronizing pulse. This has the effect of increasing the limiter base (the range of grid potential between cut-off and bottoming) during the pulse and the maximum amount of noise and interference is cut off at the beginning of the pulse period when the line blocking oscillator is fired and is taking current. If a large value resistor were used instead of an inductor to obtain this short limiter grid base the frame pulses would not be effectively developed across the capacitor C3 for lack of sufficient anode current. With the circuit employed large frame pulses are obtained, the amplitude of the first being practically equal to that of the last.

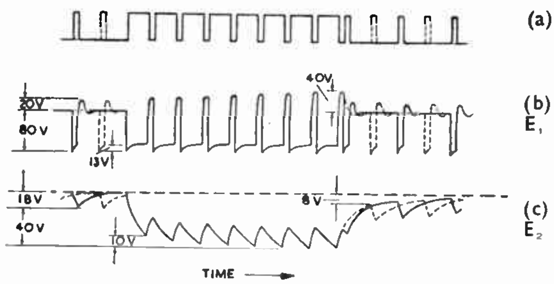


FIG. 2.
WAVEFORMS OF POTENTIAL ASSOCIATED WITH THE FIRST LIMITER STAGE OF THE SYNCHRONIZING PULSE SEPARATOR.

(a) *Transmitted Synchronizing Pulses.*
(b) *Waveform at Anode of Valve V1.* (E_1)
(c) *Waveform showing Amplitude Differentiation of Frame and Line Pulses (at point C, Fig. 1).* (E_2)

Mullard

Reprints of this report from the Mullard Laboratories, together with a fuller description of the circuit, may be obtained free of charge from the address below.

MULLARD ELECTRONIC PRODUCTS LTD., TECHNICAL PUBLICATIONS DEPARTMENT, CENTURY HOUSE, SHAFTESBURY AVE., W.C.2

(MVM108)

E 6

VOL. LV. NO. 12

Wireless World

RADIO AND ELECTRONICS

DECEMBER, 1949

Monthly Commentary

G.P.O. AND INTERFERENCE

A CORRESPONDENT whose letter is printed elsewhere in this issue draws attention to a matter that has become of increasing importance since the Wireless Telegraphy Act was passed.

As everyone knows, the General Post Office has long undertaken to investigate complaints of interference with broadcast reception, and to give help, within its power, in removing the cause. It is less generally known that this help has been mainly restricted to dealing with interference affecting reception of B.B.C. stations, though we believe that no official pronouncement has been made to support the statement, quoted by our correspondent, that reception of foreign broadcast stations is no concern of the P.O. engineers.

Even before the passing of the Wireless Telegraphy Act such an attitude seemed hardly tenable, or at least highly arbitrary. In law, the listener pays his licence fee, not for the B.B.C. programmes, but for the use of a very small part of the Postmaster-General's monopoly in wireless telegraphy. If the licensee chooses to listen to foreign stations, he is surely entitled to equal protection within reason, though it would clearly be unreasonable to expect a signal of excessively low field strength to be effectively protected.

Although the Postmaster-General's obligations to protect his broadcast listener licensees may not be sensibly affected by the passing of the Wireless Telegraphy Act, his powers to afford effective protection are now greatly increased. These powers should, we submit, be wielded in such a way as to encourage the development of broadcast listening in every direction. The P.M.G. has always had authority to curb encroachments on the broadcast band by stations licensed by him, but it would seem that British beacon stations do at present interfere with the reception in this country of non-B.B.C. stations. As to machine-made interference, it is hoped that the new powers of suppression will be wielded in such a way as to confer the greatest possible benefit to all, and not in a dictatorial or arbitrary manner.

QUICK-TUNING SYSTEMS

COMMENTING last month on the trend of design of broadcast receivers, as exemplified at the Olympia Exhibition, we referred to a tendency to provide the simplest possible form of tuning for the selection of B.B.C. programmes. This, as we said, is a change we have long expected to see. Domestic broadcasting is, at present, organized on a basis of three programmes—or two programmes for a large proportion of the population. Therefore there would seem to be a need for some quick and easy change-over device from one to the other, irrespective of the complexity or otherwise of the main tuning system of the receiver—and also irrespective of the skill of the user.

A surprisingly large number of readers seem to agree with the desirability of this innovation. A few of our correspondents, it must be admitted, chide us gently for detecting a summer when only one or two swallows in fact exist; they say, in effect, that the very small number of sets in which this feature is included hardly warrant its being hailed as a trend in design. Be that as it may, no dissentient voice is raised against the value of the feature, and our regular contributor, "Cathode Ray," suggests the general public lack the spirit to demand a facility of which he assumes the value to be self-evident. We think, now that the ordinary listener has been shown that switch selection of the main B.B.C. programmes is practicable, he will soon expect to find it in every type of receiver, at every price level.

SUPPRESSED AIRCRAFT AERIALS

Various Methods of Reducing "Drag"

By G. E. BECK, B.Sc., A.M.I.E.E.

(Marconi's Wireless Telegraph Company)

ONE of the principal ways of improving the overall performance of aircraft—and hence increasing the payload of civil aircraft—is to reduce "drag" to a minimum, by eliminating or suppressing external fittings on wings and fuselage. Conventional radio and radar aerials have proved serious offenders in this matter of "drag," so that the immediate need has been to produce aerials which do not project beyond the normal skin of the aircraft. For example, by eliminating 1 lb of "drag" from a medium-sized airliner whose cruising speed is 230 knots, the pay-load can be increased by 20-30 lb, and this might well be achieved by replacing an existing external aerial with a suppressed aerial. Again, by suppressing all the aerials on a modern airliner it is possible to eliminate 25 lb or more of "drag." Apart from this, suppressed aerials have obvious mechanical advantages at high speeds, when it is difficult to secure such things as projecting rods or wires.

Types of aerial.—Aeronautical radio services use frequencies in a great many wavebands. Some idea of the complexity of the problem this presents to radio designers and engineers can be obtained from a study of the table. This table gives some of the services concerned, the frequency coverage of those services, and the types of aerial that the fre-

TABLE OF AERONAUTICAL RADIO AND RADAR SYSTEMS

Service	Frequency Coverage Mc/s.	Type of Aerial
Automatic direction finding	0.15 to 2.0	Sense aerial and rotating loop.
M.F. weather reports and "Consol" navigation.	0.15 to 2.0	Reception only, omni-directional, vertically polarized.
H.F. communication	2.0 to 20.0	Transmission (150W) and reception, omni-directional.
V.H.F. communication.	118 to 132	Transmission and reception, vertical polarization.
Instrument landing system. Marker.	75	Reception, downward-looking.
Instrument landing system. Localizer.	108 to 118	Reception, omni-directional, horizontal polarization.
Instrument landing system. Glide path.	329 to 336	Reception, forward-looking, horizontal polarization.
Secondary radar homing system. (Rebecca).	208 to 234	Directional aerials for vertically polarized transmission and reception.
Radio altimeters.	1,600 to 1,700	Downward-looking, transmission and reception.
Cloud and collision warning radar.	10,000	Narrow rotatable beam transmission and reception.

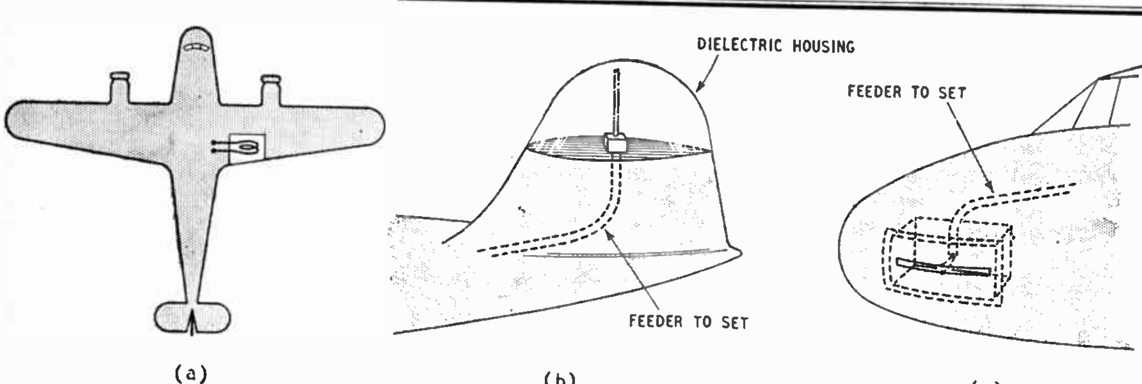


Fig. 1. Types of suppressed aerial : (a) wing radiator, (b) buried aerial, (c) slot aerial.

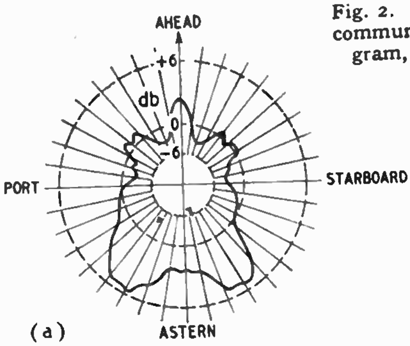
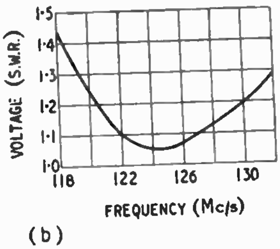


Fig. 2. Buried rod aerial for v.h.f. communication: (a) polar diagram, (b) measured bandwidth.



quencies demand. It is by no means a complete list, but all the items on it—or their equivalents—are required by aircraft flying on the international air routes of the world.

To cover such a wide range of frequencies it is obvious that the aerials of an aircraft must be of diverse forms, and some of the possibilities of suppressing these aerials are discussed below.

Wing radiators (Fig. 1 (a)).—Below 20 Mc/s the conventional aerials are trailing wires up to 200ft in length, or a fixed horizontal wire carried a few feet above the fuselage. The trailing type has a high loss resistance and the fixed wire a very low effective height, but it is not easy to produce as good a radiator within the aircraft structure. This structure is nearly always wholly metallic and the insulation of an appreciable part of it is not generally possible for mechanical or structural reasons.

One interesting approach to this problem is to excite the whole structure of the aircraft as an aerial.[1] If the aircraft span is considered as a single "turn" secondary of a transformer whose primary is a small coil at the root of the wing, there will be some transference of energy which will be radiated. The same method can be applied to the excitation of the fuselage, and, if the wing and fuselage are energized in the correct phase relation, a "crossed dipole" system is produced from which the radiation pattern will be more or less uniform in azimuth.

Considerable success has been reported for this method over the frequency range for which the wing span is not less than 0.2 wavelengths (*loc. cit.*). Communication ranges equal to those with a fixed wire aerial have been obtained, and the radiation pattern deviates from circular by less than ±2 db.

Buried aerials (Fig. 1 (b)).—Rod or loop aerials may sometimes be mounted in a way which does not cause any additional "drag" if a small part of the aircraft skin (such as the tip of a wing or a tail fin) is made from an insulating material. This is of value in the frequency band 100-200 Mc/s where an aerial approaching a quarter-wave in length can be housed inside a section not exceeding one or two feet long. Fig. 2 shows the polar diagram and measured bandwidth of a buried rod aerial for v.h.f. communication. It will be seen that the polar diagram variations do not exceed ±6 db and the voltage standing wave ratio is below 1.5:1 over the band. This compares favourably with an external aerial of the whip type.

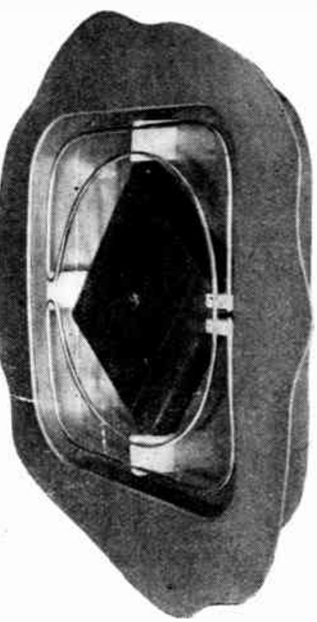


Fig. 3. Recessed iron-cored D/F loop and sense aerial; external view.

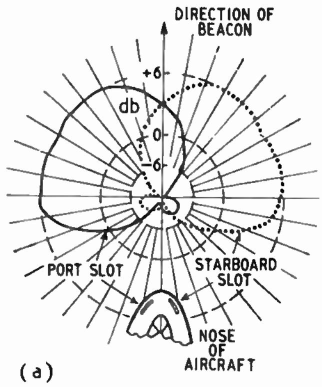
Another example of a buried aerial is the rotating loop for medium-frequency direction finding. By the use of a dust-iron core sufficient pick-up is obtained from a shallow loop mounted in a tray below the aircraft skin. The skin of the aircraft is continued over the loop aperture with insulating material. The photograph (Fig. 3) also shows a symmetrical arrangement of rods inside the aperture which gives the vertical signal for sense determination.

All parts of the aircraft surface carry some mechanical stress and so the material for covering these aerials must possess good mechanical as well as electrical properties. This need is met by a laminate of woven glass cloth bonded together with a resin of good dielectric properties.

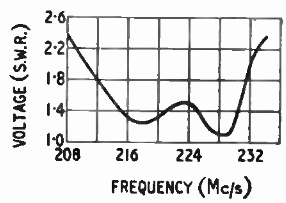
Slot aerials (Fig. 1 (c)).—It has been shown[2] that a rectangular slot cut in a metal plate will radiate if fed from an energized cavity placed behind it, or by a transmission line directly connected to opposite sides of the slot. The slot exhibits resonance similar to a half-wave dipole if it is a half-wavelength long at the operating frequency. If its width is small compared with a wavelength the radiation is polarized in a direction perpendicular to the length of the slot. (The slot is filled with a woven-glass type dielectric, otherwise the opening would defeat the purpose of suppressed aerials and create "drag.")

Radiation will take place from both sides of the sheet carrying the slot so that even when direct connection to the transmission line is used, as in Fig. 1 (c), a resonant cavity must be placed behind it to prevent unwanted radiation into the aircraft. The size of this cavity and the length of the slot which can be cut without weakening the structure make the applications to aircraft useful only for wavelengths less than 2 metres (frequencies greater than 150 Mc/s). A pair of directional receiving aerials formed by slots c

Suppressed Aircraft Aerials—
either side of the aircraft nose will give an equisignal course for homing on a radar beacon (Rebecca-Eureka system). Fig. 4 shows the polar diagram and bandwidth of this type of aerial. The incoming signal energizes the slot which, in turn, energizes the cavity behind it. Within the cavity lies a probe which is energized by the cavity and provides receiver coupling.



(a)



(b)

Fig. 4. Directional slot aerial: (a) polar diagram, (b) measured bandwidth.

Design methods.—One feature common to all these types of aerial is the dependence of aerial characteristics on the contours of the aircraft. The curvature of the metal skin surrounding a slot, the shape of a dielectric housing within which a rod aerial must be fitted, the presence of adjacent wings or tail fins; all have an effect on the aerial performance, so that the development of suppressed aerials must be based upon considerable experimental work.

A suppressed aerial which has been designed for one type of aircraft can rarely be used for any other type.

The final test of an installation is made on flight trials, but all the preliminary data can be obtained from experiments with models and full-size mock-ups of those parts of the aircraft which are concerned. The directional properties of an aerial can be gauged with considerable accuracy from a scale model of the aircraft and by using operating frequencies in proportion to the scale used.

Using a scale factor of 1/24, an aircraft of 100ft wing span would be represented by a model a few feet across and an aerial intended to operate on 100 Mc/s in such an aircraft would be tested in the model at 2,400 Mc/s. The model can be raised sufficiently clear of the ground to simulate actual flying conditions. Fig. 5 shows such an arrangement.

A full-sized mock-up consisting of a framework formed in the shape of an aircraft nose is generally used to find the impedance characteristics of the aerials. The metal skin is represented by close-mesh wire netting over the framework. The figures thus obtained are those at ground level, but the change in impedance when flying is generally small enough to be neglected.

Team work in design.—Suppressed aerials are so much a part of the structure of an aircraft that the radio engineer and the aircraft designer must begin collaboration at a very early stage. The alternative designs which can be suggested, and the structural problems they raise, can be adequately resolved only while the aircraft is still on the drawing board. The possibilities of fitting suppressed aerials to machines which are already constructed are very limited.

This situation is now realized by the aircraft and radio manufacturers, and the aircraft of the future will carry suppressed aerials which are the result of good team work by the design staffs of both industries. Care must also be taken to see that potential users of the aircraft have been consulted at this early stage, so that the radio services they are likely to require may be catered for.

In all cases the performance of the suppressed aerials must not be inferior to that of the original external aerials which they are intended to replace, both as regards polar diagram and impedance variations within the specified frequency band. The most desirable terminal impedance depends on the particular equipment concerned, and so it is of the utmost importance that characteristics of aircraft aerials should be properly standardized throughout the radio industry if the aerials are to be suitable for any changes in equipment that may be required.

It should be pointed out, however, that already this matter has been greatly assisted by the publication of recommended aerial feeders and characteristics by the Air Radio Panel of the Radio Communication and Electronic Engineering Association[3].

References

[1] Johnson, W. A. "Recent developments of aircraft communication aerials." *J.I.E.E.*, Part IIIA, Vol. 94, p. 452, 1947.

[2] Booker, H. G. "Slot aerials and their relation to complementary wire aerials." *J.I.E.E.*, Part IIIA, Vol. 93, p. 620, 1946.

[3] Report of Sub Panel "H." (*Minutes of Air Radio Panel meeting, R.C. and E.E.A.*, 6.10.47.).

Fig. 5. Scale model aircraft used for polar diagram measurements.

MEASURING TURNTABLE SPEED FLUCTUATIONS

By E. W. BERTH-JONES, B.Sc.
(E.M.I. Studios)

A Sensitive Method of Checking "Wow" and "Flutter"

ONE of the most distressing forms of distortion which can occur in the reproduction of a sound recording, particularly a recording of music, is that caused by speed fluctuations. When this takes the form of slow cyclic variations, it is usually known as "wow," whereas rapid fluctuations are commonly referred to as "flutter." Erratic, non-cyclic speed changes are frequently called "watering."

The precise measurement of these variations in speed has offered considerable difficulty. The ear is particularly sensitive to this form of distortion, and anybody with a reasonably good sense of musical pitch will notice quite small variations, often as small as a tenth of one per cent, on a sustained note. In high-quality equipment it is commonplace to maintain speed constancy to within a twentieth of one per cent, and in order to measure the residual error with any accuracy, it is necessary to have a measuring instrument with a sensitivity of the order of one hundredth of one per cent, or one part in ten thousand.

Moreover, it is not sufficient to measure slow changes in the mean speed over a complete revolution. It is necessary to make the measuring period as short as possible in order to get accurate information of any rapid flutter which may occur, but this makes very severe demands upon the measuring apparatus. Fortunately, due to the inertia of the turntable, it is unlikely that speed changes will take place very rapidly, and a measurement averaged over one-tenth of a revolution would appear to give a satisfactory compromise.

A method which has met with some success employs a phonic wheel mounted concentrically with the turntable, the teeth of which are used to generate an alternating electrical signal whose frequency will be proportional to the speed of rotation. This frequency may then be measured by bridge methods with the required degree of accuracy, and will be an indication of the speed. To attain an accuracy of one part in ten thousand, each tooth of the phonic wheel must be cut with this accuracy of tooth spacing, which makes the wheel a very costly item. With a wheel of normally realizable accuracy, the method is excellent, though expensive, for the measurement of "wow," but it is useless for the more subtle forms of "flutter."

Change of Wavelength

For disc-recording purposes, a method which gives more reliable results at much lower cost consists simply of recording a continuous tone, at the same time playing back from a point slightly displaced from the point of application of the recording. It may safely be assumed that the oscillator producing the tone can be made to give a train of waves which are substantially identical in shape and spacing, to the required degree of accuracy. Methods of stabilizing oscillators have been described in the literature, and the problem becomes resolved into choosing the type which will maintain the required degree of constancy. The waveform is relatively unimportant, the governing factor being the precision of repetition.

The fundamental frequency of the reproduced wave may be measured as before, and if the speed is constant this will be identical with the oscillator frequency, since recording and reproduction are taking place at the same speed. If the rotational speed changes while the element is moving from the recording point to the reproducing point, the reproduced frequency will differ from that of the oscillator during the period of change. For instance, supposing that the disc is accelerating: the speed of an element when it passes the reproducer point will be higher than it was at the recording point, and the reproduced frequency will be correspondingly higher than that of the oscillator. This change in frequency can be made to give us a reading, not of the absolute speed, but of acceleration measured between recording and reproducer points For normal cyclic variations, the amplitude of the speed change can be derived from this. It is unnecessary to measure the reproduced frequency directly. It may be compared with the original oscillator frequency on a ratio basis, or more conveniently on a difference basis, by means of beats. In the latter case, the beat frequency would be proportional to the acceleration.

Unfortunately, in practice, in any good recording system the accelerations to be measured have only a very low order of magnitude, so that a very high initial frequency has to be used in order to obtain a beat which will fall within a measurable range, and this high frequency may fall outside the limits of the recording system.

However, this method is capable of a modification which overcomes this limitation, and which can be made to yield a display which represents the speed deviation directly. For the purpose of this description, the method will be considered in its application to the measurement of flutter on

Measuring Turntable Speed Fluctuations—

78 r.p.m. gramophone recording. It is a simple matter to adapt it to other problems.

The first requirement is an audio-frequency oscillator capable of supplying a tone of known frequency, constant to within a tolerance rather closer than the errors it is required to measure. This is fed through the recording channel to the cutter head, which is mounted in position on the recording lathe which is to be tested. A pickup is also mounted on the machine, in such a manner that it will track the groove cut by the recording head, at a distance of a few inches behind it, preferably adjustable. The output of this pickup is amplified until it can be matched in level with a second output tapped off from the recording channel. The recording machine is adjusted to run at correct mean speed, either by counting the number of revolutions in a given time, or by stroboscopic methods.

Procedure

Cutting is now commenced, and the pickup is slipped into the groove, a little behind the recording point. Now if the turntable speed is constant, the output from the pickup will be, theoretically at least, a duplicate of the input wave, displaced from it only in time. Either by adjusting the oscillator frequency, or by moving the pickup mounting slightly, it is possible to arrange that both reach their maxima at the same moment, that is, they are in phase. Assuming no distortion of wave shape, the two outputs can be connected back-to-back, giving a resultant of zero.

Suppose now that the turntable speeds up, by a very small amount. Any individual wave peak, cut by the recording stylus, will now reach the reproducing point sooner, due to the increased speed of travel. This increase is very small, so that the saving in time is less than the duration of a single wave, but it is sufficient to ensure that the reproduced wave is now out of phase with the oscillator wave, and when the two are connected back-to-back, cancellation no longer occurs. There is a residual resultant whose amplitude is a function of the change in speed, and which can be made to operate a meter. This is illustrated diagrammatically in Fig. 1.

Putting this in another way, supposing we set up the apparatus so that with correct mean turntable speed there are exactly 100 waves between recorder and reproducer points. If now the speed increases by, say, one tenth of one per cent, the wavelength will increase by one tenth of one per cent, and the length of 100 waves will increase by one tenth of one wave, which is 36° of phase difference, and easily measurable.

As an example of the dimensions involved, consider a gramophone recording turntable revolving at 78 r.p.m. The linear velocity of the groove under the needle point is given by

$$V = \frac{2\pi RN}{60} \text{ in/sec} \quad \ldots \quad (1)$$

where R is the radius of the groove, measured from the disc centre, and N is the speed in revolutions per minute. At a radius of about 4in, the linear velocity will be, say 30in/sec. If a 6,000 cycles per second tone is applied, then 6,000 cycles occupy 30in of arc on the disc, and the wavelength measured along the groove will be 0.005in. If now the spacing between recording and reproducing styli, again measured along the arc, is made exactly two inches, there will be exactly 400 waves between the two points, and the output will be in phase with the input.

Suppose now that the turntable speed is increased by, say, 0.01%, so that the linear velocity becomes 30.003in/sec. Now 6,000 cycles occupy 30.003in of arc, and the wavelength becomes 0.0050005in, so that there are now only 399.96 waves between the two points. The reproduced signal will be 0.04 of a wave in advance of the oscillator, which is a difference in phase angle of 0.04 × 360°, equal to 14.4°, which is capable of giving a measurable output. At the present stage of the art, a speed fluctuation of 0.01%, which we have presumed, is generally considered to be quite inaudible.

It is worth noting here that this measurement has been averaged over an arc of only 2in, on a circumference of 23.1in, that is, less than one-tenth of a revolution. The very high order of sensitivity of the method thus becomes evident.

General Relationships

Generalizing from this example, it may be seen that, if we designate the number of waves between the two styli as W, and the distance along the arc in inches as D, then

$$W = D/\lambda \quad \ldots \quad \ldots \quad (2)$$

where λ is the wavelength measured along the arc, in inches.

From (1) we have seen that $V = \frac{2\pi RN}{60}$, and we have also

$$V = f\lambda \quad \ldots \quad \ldots \quad (3)$$

where f is the applied frequency.

Hence, the number of waves between the points is given by

$$W = \frac{60Df}{2\pi RN} \quad \ldots \quad \ldots \quad (4)$$

Letting the suffix o denote the desired condition, for which the system is set up, we have N_0 as the mean speed, in revolutions per minute, and W_0 as the number of waves between the points when the speed is correct (which may be made any integral number of half wavelengths.)

The phase difference producing output, measured in degrees, will be the angle ϕ, where

$$\phi^\circ = 360\,(W_o - W) \quad \ldots \quad (5)$$

or, measured in radians

$$\phi_{rad} = 2\pi\,(W_o - W) \quad \ldots \quad (6)$$

Substituting from (4), this latter becomes :—

$$\phi_{rad} = 60f\,\frac{D}{R}\cdot\left(\frac{1}{N_o} - \frac{1}{N}\right) \quad \ldots \quad (7)$$

$$= 60f\cdot\frac{D}{R}\cdot\frac{N - N_o}{NN_o}$$

$$= -\frac{6f}{10}\cdot\frac{D}{R}\cdot\frac{n}{N}$$

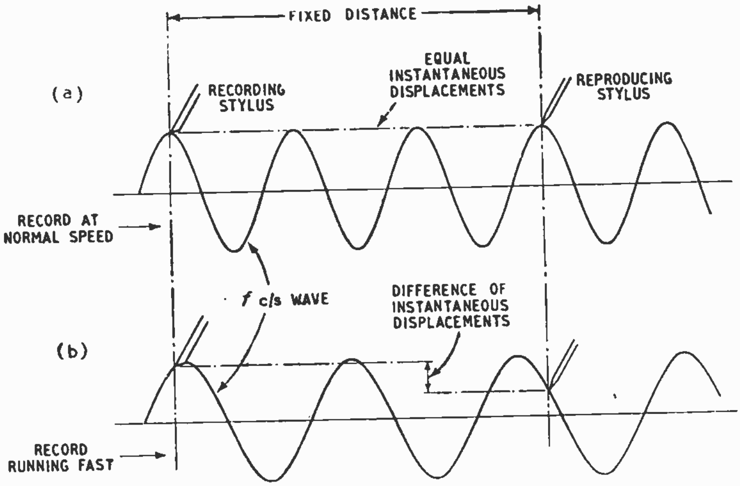
where 'n' is the percentage change in speed.

Since the actual change of speed is very small, it is permissible to write N_o for N in this equation, which then becomes

$$\phi_{rad} = -\frac{6f}{10}\cdot\frac{D}{R}\cdot\frac{n}{N_o} \quad \ldots \quad (8)$$

From equation (8) it will be seen that the phase angle changes in direct proportion to the percentage change of speed, so that any meter suitable for measuring the phase difference between the

Fig. 1. Illustrating the principle underlying the method of measurement.



two waves may be calibrated directly in percentage change of speed.

If the phase change exceeds π radians (or 180°), the output will commence to fall again, and it is not, therefore, possible to deal with phase variations greater than this. For illustration, Fig. 1(b) shows a phase change of about 280° from the peak of the third wave measured from the recorder point, which is the initial condition shown in Fig. 1(a). The meter reading for 280° (360° − 80°) would be indistinguishable from that obtained for 80°, and the amount of flutter would therefore be underestimated. This can, however, easily be dealt with by reducing the oscillator frequency, so that the wavelengths become larger, and the phase changes proportionately smaller. For large amplitudes of flutter, therefore, we require a low frequency, and for high sensitivity a high frequency, as equation (8) suggests.

Radial Tracking Essential

In practice, there remain several difficulties in the method outlined. For example, for a linear relationship between phase angle and percentage speed variation to be maintained, it is essential that the ratio D/R remains constant, unless readings are always taken at one particular radius. This involves precisely radial tracking of both recording and reproducing heads, which is difficult to achieve, and which leads to mechanical complications at small radii. Also this method is confined to disc recorders.

It may, however, be extended and rendered almost universal in its application by the substitution of magnetic recording methods. If an annular magnetic track is substituted for the disc record, and the cutting head and reproducer are replaced by a magnetic recording head and replay head, the validity of the method remains unaltered. If, in addition, an erasing head is added, to wipe out the wave after it has passed the replay head, the same piece of track will return fresh and unmodulated under the recording head again and again, while the positions of the various components remain unchanged. With some forms of phase-meter the waveform from the replay head can be allowed to depart considerably from the sinusoidal shape, particularly near the peaks, and it is therefore quite permissible to use d.c. for erasing and for recording bias, with considerable simplification of equipment. A magnetic track may be deposited on the underside of a gramophone turntable, for instance, and the heads mounted below with their gaps arranged radially, and just clear of the track. In order to obtain a strong enough signal in spite of this clearance, the recording head may be heavily overloaded, again because we are indifferent to waveform. This arrangement may be left *in situ*, and used to monitor the flutter on an attached meter while recording is in progress.

For the measurement of the phase changes in the laboratory, it is sufficient to feed the reproduced output to one input of a double-beam oscilloscope, the other input being fed from the oscillator output, and used to synchronize the time base. Then the difference in phase between the two traces can be read off the screen directly. If the gain of the oscilloscope is turned up so that the wave peaks fall outside the screen area, amplitude variations will be found to be less disturbing. For routine measurements, a phase-meter giving a direct scale reading has been devised, to simplify checking by non-technical operators.

Sense Discrimination

As so far described, it will no doubt be noticed that there is no discrimination between acceleration and retardation. Both positive and negative speed changes will produce a positive reading on the meter. However, by using a slightly different oscillator frequency, we can arrange that the correct mean speed shows a phase-shift of 45°, instead of zero, and the meter will give a half-scale reading, which can be calibrated as zero fluctuation. Then a slightly lower speed will give a lower reading, and a higher speed a higher reading on the meter, thus showing whether any flutter which may be present represents an acceleration or otherwise.

One of the great advantages of this method is that the sensitivity of the system can be so easily varied, simply by changing the frequency of the applied tone. Further, the magnetic track method is capable of resolving very much smaller deviations than others hitherto used, and its low cost and absence of loading enable it to be fitted to every channel in a commercial recording system, and to be used during actual recording, instead of only as an occasional test.

For film recording, a magnetic

(*Continued at foot of following page*)

TELEVISION RADIO RELAY

London - Birmingham Link

A DEMONSTRATION of the London to Birmingham radio-relay link was given on 3rd and 4th Nov. Designed and constructed by the General Electric Co. to a performance specification of the Post Office, the link comprises two terminal stations and four relay stations at Harrow Weald, Dunstable, Blackdown and Rowley Regis. It provides a single-vision channel which can be used in either direction; that is, it can be employed to send a picture from London to Birminghai or from Birmingham to London. When the remaining equipment is installed two reversible channels will be available and then it will be possible to send pictures simultaneously in both directions.

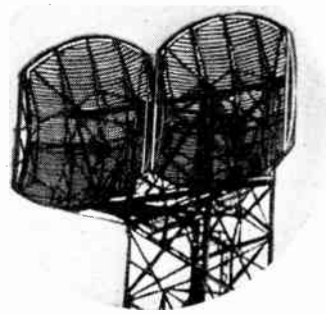
It is claimed that this link is the first television relay link in the world which is installed on a permanent basis and which has been designed throughout with reliability as a prime consideration. Many other television relaying schemes have been tried, but all have been primarily experimental in nature.

In this link all apparatus is duplicated. There are duplicate transmitters, duplicate receivers and duplicate power supplies. In the event of a failure, therefore, the spare can be brought immediately into service with the briefest of interruptions.

The relay stations are unattended and are operated by remote control from London or Birmingham. In the event of a major fault in such a station the unit affected is automatically taken out of circuit and replaced by its duplicate. At the same time the terminal stations are automatically notified. The change-over from one unit to another at a relay station can also be carried out at any time by an operator at one of the terminal stations, who has only to press a button to effect the change. Even power failures are allowed for. The relay stations are normally fed from the grid; should the supply fail, a petrol-electric generator is automatically started up and the station is again operating within two minutes!

Because of the great flexibility of control provided, the control circuits are exceedingly complicated and embody some 3,000 relays! The radio side of the equipment almost tends to be buried in the welter of control and indicator equipment—which is a pity, since it is highly ingenious.

Transmission is carried out on about 30cm. Frequencies of 870 Mc/s and 890 Mc/s are used and a change from one to the other is made at each relay station. At the terminal station the v.f. signal, containing frequencies up to 2.7 Mc/s, is used to modulate a 34-Mc/s carrier in frequency, the deviation being ±1.5 Mc/s.

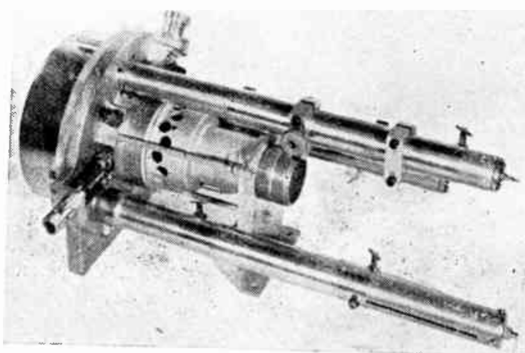


A pair of mirrors at a terminal station

The modulated 34-Mc/s carrier varies in frequency between the limits of 32.5 Mc/s and 35.5 Mc/s and after amplification it modulates in amplitude a second carrier of, say, 904 Mc/s. The result is a 904-Mc/s carrier with sidebands centred on $904 \pm 34 = 938$ Mc/s and 870 Mc/s. The sidebands vary in frequency in accordance with the vision signal over the range of ±1.5 Mc/s or 936.5–939.5 Mc/s for one set and 868.5–871.5 Mc/s for the other. Band-pass and band-stop filters allow the 868.5—871.5-Mc/s band to pass to the aerial and prevent the other frequencies from doing so.

I.F. Amplification

At a relay station the signal on, say, 870 Mc/s is received and passed to a crystal mixer and brought down to 34 Mc/s by the ordinary superheterodyne technique. It is then amplified in a somewhat elaborate i.f. amplifier of 10-Mc/s bandwidth which is provided with a.g.c. Then, just as in a terminal station, it is brought back to signal frequency



Typical r.f. component.

Measuring Turntable Speed Fluctuations.

(*Continued from foot of preceding page*)

track coated on to the film base allows fluctuations in speed of the film itself to be checked, and forms a valuable tool for the investigation of sprocket ripple.

A disc coated with magnetic material may easily be fitted to the sound drum of film recording systems, and the method is therefore equally applicable to this medium, or in fact to any problem involving the measurement of very small speed fluctuations.

by modulating an appropriate frequency. If the input is at 870 Mc/s, as in the example, the output is at 890 Mc/s and this can be obtained by modulating a 924-Mc/s carrier. At the next relay, the input is at 890 Mc/s and the output at 870 Mc/s, and so on. The arrangement is sketched in the block diagram.

The locally generated frequencies are derived from a crystal oscillator of high stability and by arranging for both signal frequencies to lie on the same side of the local frequencies, their frequency difference is virtually independent of any drift.

Station Details

Coaxial circuits are used at signal frequency with triode valves. The transmitter output is 10W and the gain in a relay station is about 70db. Dipole aerials are used with reflectors, some 10ft by 14ft, giving about 28-db gain. The beam width to the half-power points is about 3° in elevation and 5° in azimuth. The reflectors are constructed of light alloy tubing and the tubes contain heating elements for de-icing.

During the demonstrations the relay stations had temporary masts for the aerials and all equipment was at ground level. In the final installation all equipment apart from power supplies will be at the mast head and feeder losses of some 12db at present existing will be eliminated. The final mast-head apparatus for the double link is to be four mirrors, four receivers and four transmitters, the two last being housed in a "room" about 9-ft square. The height of the masts vary from 60ft to 120ft in the different relay stations.

Two items of the equipment deserve especial mention; a filter and a switch. The former is a combined band-pass and band-stop filter which provides 70-db discrimination between the wanted and unwanted frequencies in the amplitude-modulation process. It is built of co-axial resonant circuits and two of the filters are shown in the photographs. There are three sections to the filter, A, B and C. The long tubes control the band-stop characteristics and relatively very short tubes opposite them control the band-pass characteristics. The sections A and C are alike, but the middle one, B, is of smaller diameter and has one-half the characteristic impedance of the end sections. These tubes have inner conductors and so form resonant lines; however, the dielectric is not uniform but consists of alternate short sections of air and polythene. By adopting such a series of abrupt discontinuities in the dielectric the length of the section has been reduced from the 10-ft required with air to something like 18in only. Screw "trimmers" are provided at the ends for adjusting the precise characteristics. Similar "trimmers" are also provided on the short tubes controlling the pass-band.

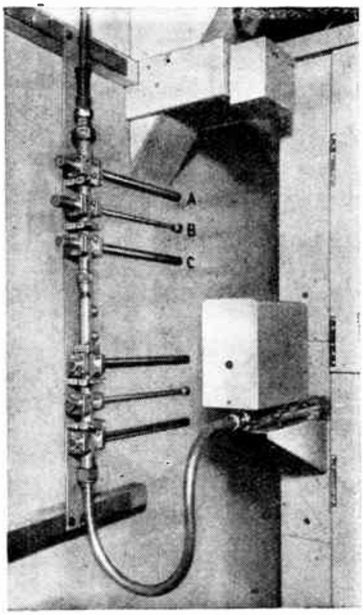
"Contact-less" Switch

The switch operates at radio frequency to switch the coaxial circuits of the transmitters and receivers. It has no contacts and operates by moving plungers into coaxial stubs. Two input (or output) coaxial lines are T-junctioned to a single outlet (or inlet). At the proper distance from the T on each inlet line a stub is fitted. Now the input impedance of such a stub depends on its length and on its termination. In this case the termination is a movable plunger and in its two extreme positions it makes the input impedance tend to zero on the one hand and to infinity on the other. When the impedance is zero the line to which it is attached is short-circuited, whereas when it is infinity the line is unaffected by the stub.

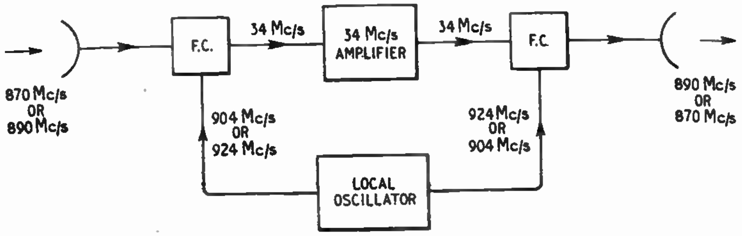
The plungers in the stubs attached to the two lines move in opposite ways so that one line is blocked while the other is opened. Actually, two stubs $\lambda/4$ apart are used on each line to increase the attenuation in the "closed" line and some 70db is attained.

These "switches" are motor-driven and are used to change over the r.f. sides of the transmitters and receivers. They are used on the one hand to bring the duplicate units into circuit in the event of a fault, and on the other hand, to reverse the aerials to change the direction of transmission. This last feature makes great demands on the switches, as the output of the transmitter and the input of the receiver are necessarily coupled by any leakage through them. Some 70-db attenuation between paths in the switch is obtained and with the special circuitry employed the attenuation between aerials is kept down to 140db.

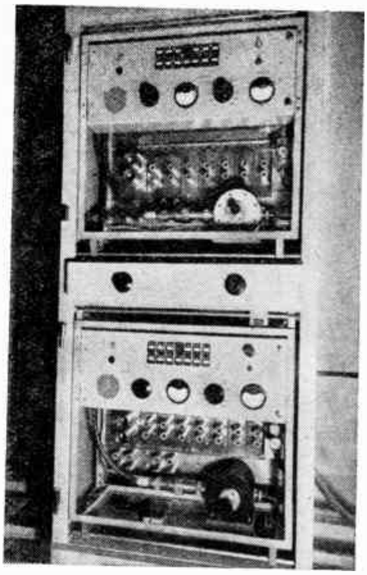
During the demonstration a



Two combined band-pass and band-stop filters are shown here.



This block diagram illustrates the general arrangement of a relay station. The blocks labelled F.C. represent the frequency-changer on the receiving side and the modulation on the transmitting.



The receiver and its spare with front covers removed.

picture originating in London was seen on a monitor tube in Birmingham and no visible form of distortion could be detected. The picture was free from noise and interference and the definition was indistinguishable from what one is accustomed to in London. There is no doubt whatever that when Sutton Coldfield relays a London programme, Midland viewers will be under no disadvantage compared with Londoners.

All concerned with the design, development and construction of this link deserve the highest praise for a fine achievement.

EDUCATIONAL FILM

Putting Free Electrons to Work, a ten-minute film produced by Merton Park Studios Ltd. for the British Electrical Development Association, explains the thermionic effect and its application to the radio valve. A diagrammatic illustration is given of how electrons can be made to leave the surface of a conductor; then follows a simple explanation of the diode and triode, using conventional symbols. The photo-electric effect is similarly dealt with, and its application to the photo-electric cell. This film will be lent free, in either 16mm. or 35mm., to any responsible organization, on application to the General Manager and Secretary, British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

SHORT-WAVE CONDITIONS

October in Retrospect : Forecast for December

By T. W. BENNINGTON (Engineering Division, B.B.C.)

DURING October the average maximum usable frequencies for these latitudes increased very considerably during the daytime, and decreased somewhat by night. This was in accordance with the normal seasonal trend, though, from the second week of the month onwards, the daytime increase was greater than had been expected. Daytime working frequencies were thus high: those as high as 28 Mc/s, for example, becoming regularly usable over most circuits. Night-time frequencies up to 9 Mc/s were still generally usable.

Sunspot activity was, on the average, slightly higher than during September, a fact which may account, in part, for the high m.u.fs.

The rate of incidence of Sporadic E did not, as might have been expected, decrease very much compared with the previous month.

October was a very disturbed month, particularly during its latter part. Ionospheric storms, all of them relatively severe, occurred during the periods 5th-9th, 14th-18th, 23rd-26th and 27th-30th. During the latter three of these storms, on the nights 14th-16th, 22nd-24th and 27th, the Aurora Borealis was widely seen in this country. Sixteen "Dellinger" fade-outs were reported as occurring during the month, the most intense being at 1406 on 2nd, 1318 on 8th, 1148 on 11th and 1145 on 13th.

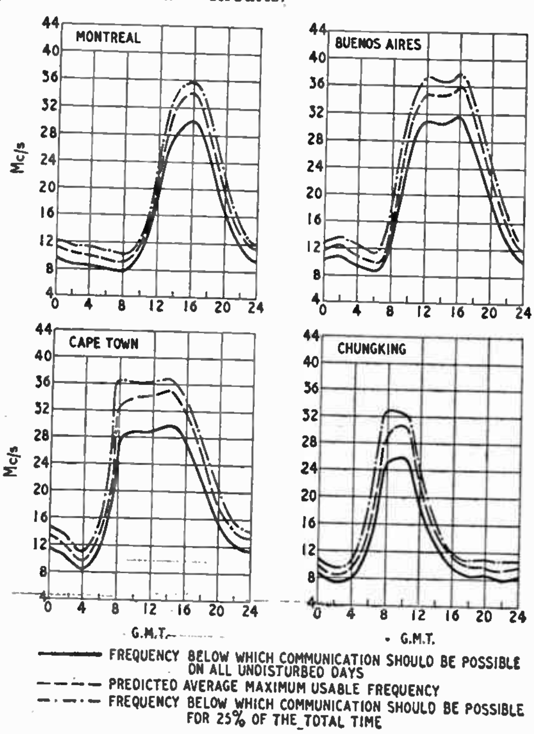
Long-range tropospheric propagation occurred frequently between 1st and 10th of the month, and particularly on 6th and 7th, when Eiffel Tower television was widely received in southern England.

Forecast. — Daytime m.u.fs in these latitudes during December should be somewhat lower than during November. This decrease is a usual feature at the extreme mid-winter period, and it may, perhaps, be accentuated by decreasing sunspot activity. Night-time m.u.fs should also decrease to their lowest winter values.

Long-distance working frequencies will still be relatively high by day, and those as high as 28 Mc/s should be regularly usable over most, but not all, circuits at the appropriate time of day, among which should be that to the eastern part of North America. At night only the lower short-wave frequencies will be generally usable, 7 Mc/s being about the highest *regularly* usable frequency for most circuits.

Ionospheric storms, though not usually particularly frequent during December, are apt to be troublesome after dark, because of the already low ionization prevailing during the winter night. At the time of writing it would appear that such disturbances are most likely to occur within the periods 1st-4th, 7th-9th, 16th-17th, 21st-22nd and 27th-30th.

The accompanying curves indicate the highest frequencies likely to be usable over four long-distance circuits.



A new approach to "High Fidelity"...

and the coming of " New-True Fidelity "

PERHAPS no phrase in sound reproduction has been more loosely used in the past than " high fidelity." What some people would term high-fidelity reproduction caused others to shake their head. Obviously, ideas and ideals of fidelity were measured by differing standards. What, then, is " true fidelity " ? Fortunately, this can accurately be measured and graphically expressed, but we have to seek the assistance of a very critical science—that of acoustics—which provides objective rather than subjective answers.

Here we are concerned more particularly with the reproduction of sound via an electrical pick-up. The authority of acoustic science has laid down a performance which it regards as ideal, but naturally, one that is unconcerned with the practical limitations which beset the manufacturer. For matters of cost and usage are no concern of the theorist. Indeed, the manufacturer could produce a pick-up with the approved ideal response, but such an instrument might cost, say, twenty-five guineas ; and again it is conceivable that it would be so fragile as to preclude its use in the home. Further, even given a pick-up with the ideal response, and built on the most robust lines, its actual reproduction is still limited by the characteristics of commercial recordings. A *practical* pick-up must be capable of being used with a wide range of equipment, each item of which has its own idiosyncrasies. So the manufacturers problems multiply, and a compromise of some kind is necessary.

The Quest . . .

A year ago, however, after long experience in the design and mass production of pick-ups, Cosmocord Limited were convinced that an entirely *new* approach was essential. The easy way might have been to set a new, good, practical standard and say " This *is* high fidelity, and you ought to like it." But the honest approach starts the other way round, viewing everything from the users point of view and the while, stimulating research at every step. That was the Cosmocord way.

And the Conclusions . . .

The most important conclusions were :

(1) That the average user does not want to spend time and money finding suitable equalising networks, etc. The pick-up must be a success from the word "go."

(2) he wants his records to last—the pick-up must, therefore, cause the minimum possible wear.

(3) he wants the pick-up to be robust enough to withstand even the most careless of handling.

(4) and lastly, he wants the pick-up at a price he can afford.

Moreover, defects such as high tone-arm resonance, high needle-tip impedance and high tracking weight, excessive needle talk, reproduction of motor rumble and tracing distortion in the upper register, all these must be eliminated. So with these considerations in mind **acos** research set about developing the ideal pick-up—and the result is the GP.20.

Stage by Stage Achievement

First the stiffness of the assembly was reduced until the pick-up satisfactorily tracked commercial records at seven grams. Then, because warped records or badly aligned turntables and badly sprung motors might cause the pick-up to jump grooves, the tracking weight was deliberately increased to 13–14 grams. This extremely low needle pressure, coupled with the use of a flexible, sprung permanent sapphire stylus, reduces record wear to an absolute minimum, thus ensuring vastly longer life to records. Further, this flexibility of the assembly makes the unit virtually damage-proof.

Needle talk, tracing distortion and distortion due to " pinch effect," were greatly reduced by increasing the vertical compliance of the assembly until it was little less than the lateral compliance. The outstandingly good frequency-response was achieved by making the crystal assembly appear as a terminated mechanical transmission line, and arranging that the terminating section would give pre-emphasis of approximately 6 db per octave above 1,000 cps. This resulted in the working pick-up characteristic from commercial recordings (turn over at 250 cps) being substantially flat from 20 to 250 cps, dropping approximately 6 dbs between 250 and 1,000 cps, and flat beyond that frequency up to 9 Kcs, the response falling above this frequency.

The pre-emphasis between 250 and 1,000 cps provides an automatic bass boost, *eliminating equalising circuits of any kind.* The frequency response was set flat to 9,000 cps, as being completely adequate to give the best reproduction from commercial records.

The output of the GP.20 is more than half a volt at 1,000 cps, and sufficient to load fully any domestic set or amplifier.

The tone-arm design is unique in that it is supported on a single needle point, thereby reducing lateral and vertical friction to the barest possible minimum. Torsional arm resonance is eliminated.

Finally—the Cost . . .

Last, but not least, is the cost. The list price of the GP.20 in Great Britain is 50*s.* plus 21*s.* 5*d.* purchase tax. So **acos** research and **acos** mass production techniques, utilising the most efficient piezo-electric assembly, have produced an instrument comparable in price with ordinary pick-ups, but with a laboratory performance. Indeed a justification of the new approach to " high fidelity " reproduction, since it produced the GP.20 and achieved what we like to term " New-true Fidelity "—for that, assuredly, it provides

COSMOCORD LIMITED • ENFIELD • MIDDLESEX

E 18

HIGH-QUALITY AMPLIFIER: New Version

(*Continued from page 427 of November issue*)

Design for a Radio Feeder Unit

By D. T. N. WILLIAMSON
(Ferranti Research Laboratories)

THE preceding articles in this series have described amplifier, tone compensation and gramophone pre-amplifier units which are capable of driving a loudspeaker from the output of a pickup or a radio receiver. The design of a radio receiver which would be suitable for use under the varied reception conditions which exist in the populous parts of the country, and which at the same time could be constructed simply and with certainty of results, would be a difficult undertaking. In addition, such a receiver would be unnecessarily complex for the needs of that section of the community which lives within the primary service area of high-powered twin-wave transmitters, and which desires only to receive transmissions from these by the simplest possible means.

In order that the units described in the series should form a complete domestic sound installation, it is proposed to outline the design of a small two-stage receiver suitable for the reception of medium-wave transmissions within the primary service area. The type of receiver to be described gives satisfactory results where the spacing between the carrier frequencies of the principal transmitters is high, say 200 kc/s. It is not suitable for use in districts where closely-spaced powerful transmissions exist, or where interference is severe. The receiver circuit is offered as an indication of the general lines on which to proceed, and is capable of being adapted to individual requirements and conditions.

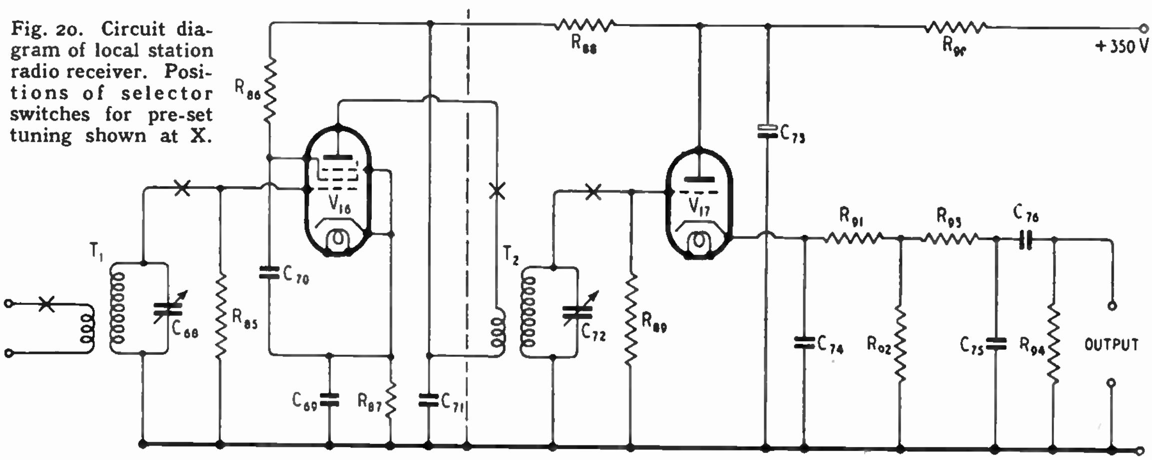


Fig. 20. Circuit diagram of local station radio receiver. Positions of selector switches for pre-set tuning shown at X.

COMPONENT VALUES FOR CIRCUIT OF FIG. 20

		Rating
R_{85}	0.1 MΩ	
R_{86}	0.1 MΩ	½ W
R_{87}	330 Ω	
R_{88}	1.5 kΩ	
R_{89}	0.1 MΩ	
R_{90}	10 kΩ	2 W
R_{91}	47 kΩ	
R_{92}	4.7 kΩ	
R_{93}	22 kΩ	
R_{94}	2.2 MΩ	

All resistors may be ¼ W rating, tolerance 20 per cent unless otherwise specified.

		Type	Rating (V d.c. working)
C_{68}, $_{72}$	See text		
C_{69}	0.1μF	Paper	250
C_{70}	0.1μF	Paper	350
C_{71}	0.1μF	Paper	350
C_{73}	16μF	Electrolytic	450
C_{74}	100pF	Silvered mica	
C_{75}	100pF	Silvered mica	
C_{76}	0.1μF	Paper	500

VALVES.
V_{16} Mullard EF39, Osram KTW61. V_{17} Mullard EF37.

High-Quality Amplifier—

The basic circuit, shown in Fig. 20, consists of an r.f. amplifier, transformer-coupled to a negative-feedback detector. Circuit values for a number of alternative tuning arrangements are given. Possibly the simplest scheme, from the point of view of construction, is to use a twin-ganged capacitor to cover the range, although by this method it is not easy to secure a uniformly good performance at each end of the medium-wave band. Alternatively the receiver may be pre-tuned, stations being selected by a push-button or rotary switch. The use of variable inductors in this arrangement provides a simple method of achieving a uniform selectivity and sensitivity over the range, with the disadvantage that two coils or tuned circuits must be provided for each station to be received. In the unlikely event of serious thermal drift, correction is easily applied by the use of negative temperature coefficient capacitors.

R.F. Transformers.—Winding data are given to enable r.f. transformers to be wound simply on standard formers without the use of a wave-winding machine. The correct number of turns are pile-wound in a random manner between thin Paxolin or cardboard cheeks, which serve to guide and support the edges of the winding. This gives an approximation to the performance of a wave-wound coil.

The table gives winding data for transformers to be used with a twin-ganged capacitor with a capacitance swing of 485 pF with trimmers, covering a frequency range of approximately 550-1,550 kc/s.

WINDING DATA FOR R.F. TRANSFORMERS

Transformer	Winding	No. of turns	Inductance (μH)	Coefficient of coupling (approx.)
Aerial	Primary	35	30	0.35
	Secondary	95	160	
Coupling	Primary	60	80	0.65
	Secondary	95	160	

When separately-switched tuned transformers are to be used, the values of secondary inductance and tuning capacitance may be read from the curve of Fig. 21 against transmitter frequency. This curve has been computed for an L/C ratio of unity (L in μH, C in pF), which is nearly optimum. The number of turns necessary to produce the required inductance with the formers and dust-cores specified may then be obtained from Fig. 22. The dimensions of the coil formers and windings are shown in Fig. 23. When the capacitance is being chosen, allowance should be made for strays, which will probably be about 25 pF. The values used should therefore be less than those indicated by this amount. In practice the nearest standard value should be chosen, and allowance made in the value of inductance. Movement of the core will enable a variation of approximately ± 18 per cent to be made in the inductance.

Construction.—In order to preserve stability, precautions must be observed when constructing the receiver. The most likely cause of instability is the presence of undue stray capacitance between the anode and control grid of V_{16}. The valve types used have an anode-grid capacitance of less than 0.003 pF, and a layout should be chosen which does not materially increase this figure. The design, based on this value, has a factor of safety of about 4. Although the valve is metallized, a screening can may be necessary to reduce leakage to the valve base. All

Fig. 22. Curve relating inductance and number of turns for windings discussed in text.

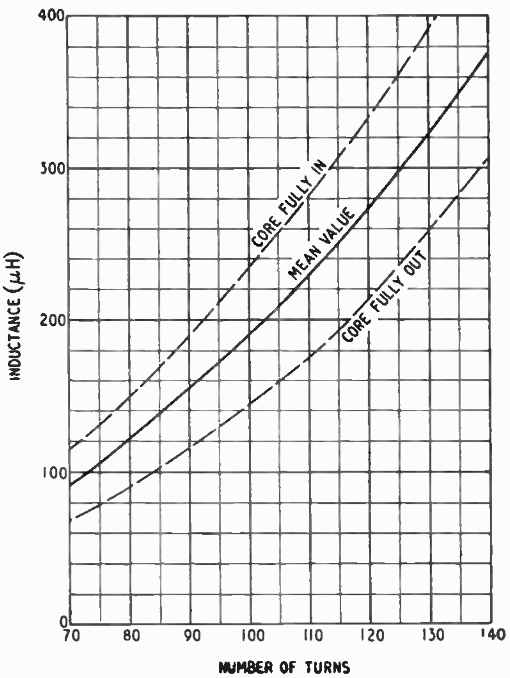
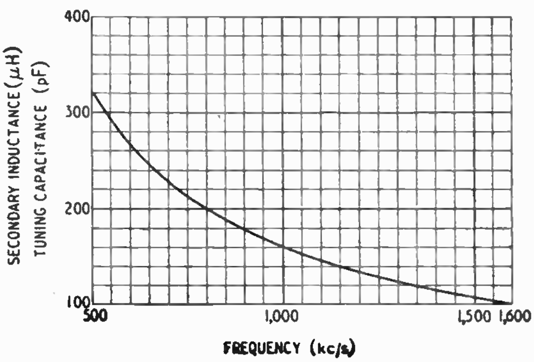
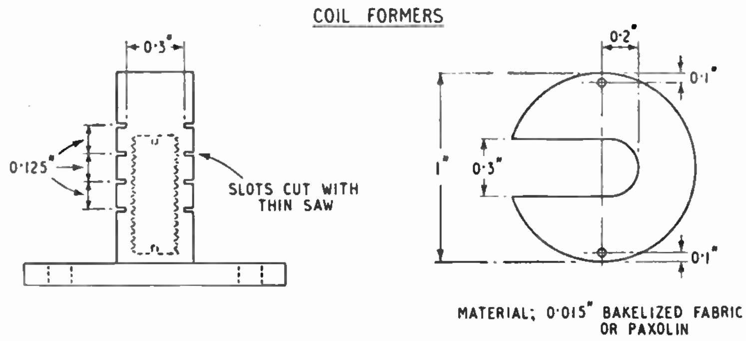
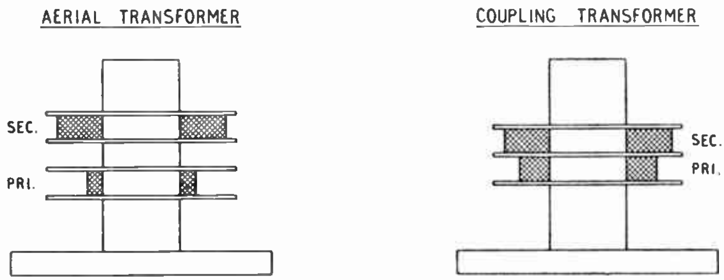


Fig. 21 (Below). Curve relating tuned circuit parameters and resonance frequency.







DATA FOR FIXED TUNING

PRIMARY WINDING. (DIRECT AERIAL CONNECTION)
1/3 NUMBER OF SECONDARY TURNS
PRIMARY WINDING. (70Ω FEEDER)
1/10 NUMBER OF SECONDARY TURNS
SECONDARY WINDING. SEE TEXT

PRIMARY WINDING.
2/3 NUMBER OF SECONDARY TURNS
SECONDARY WINDING. SEE TEXT

Fig. 23. Formers are standard moulded type, fitted with 8-mm threaded iron-dust cores. All coils are wound with Litz wire consisting of 7-9 strands of 45-48 s.w.g. enamelled copper wire.

components in the grid circuit should be kept above the chassis, and all components in the anode circuit below the chassis. Where components in the anode circuit, or in the following grid circuit must be brought above the chassis, as is the case when tuning is by means of a ganged capacitor, they must be screened carefully from the aerial circuits. Figs. 24 and 25 show suggested layouts for continuously variable and switched tuning arrangements.

The Detector.—To give low distortion, the detector requires to work at a fairly high signal level—say 5V r.m.s. output. As the receiver is intended to feed the tone compensation unit, which requires an input of only 200 mV peak, the output is taken from a tapping on the detector load resistance. This greatly reduces the a.c. loading on the detector and enables it to handle high modulation levels without distortion.

Alignment Procedure.—(1) Set ganged capacitor at a position about five degrees from the minimum capacitance end, and adjust trimmers for maximum output from the high-frequency 3rd Programme.

(2) Set capacitor about twenty degrees from maximum capacitance position and adjust dust-cores for maximum output from the low-frequency 3rd Programme.

(3) Repeat this process until both stations are accurately tuned.

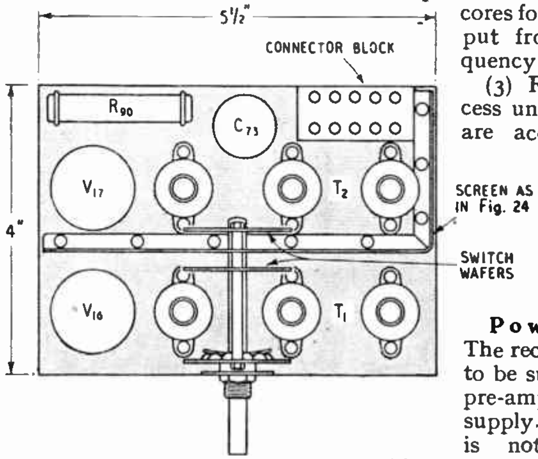


Fig. 25. Plan view of top of chassis. Switched model.

Power Supplies.—The receiver is intended to be supplied from the pre-amplifier power supply. The decoupling is not adequate to enable it to be fed from the main amplifier supply.

Acknowledgment. — The writer is indebted to Mr. A. T. Shepherd of Ferranti, Ltd., for his assistance in the compilation of data for these notes.

Note: In the list of components below Fig. 15, page 424, of the November issue, the value of R69 should be 1 MΩ, not 0.47 MΩ. C56 should be 0.5 μF paper, 250 V d.c. working, ±20 per cent; C57, 50 μF, electrolytic, 12 V d.c. working, C64, 16 μF, electrolytic, 450 V working.

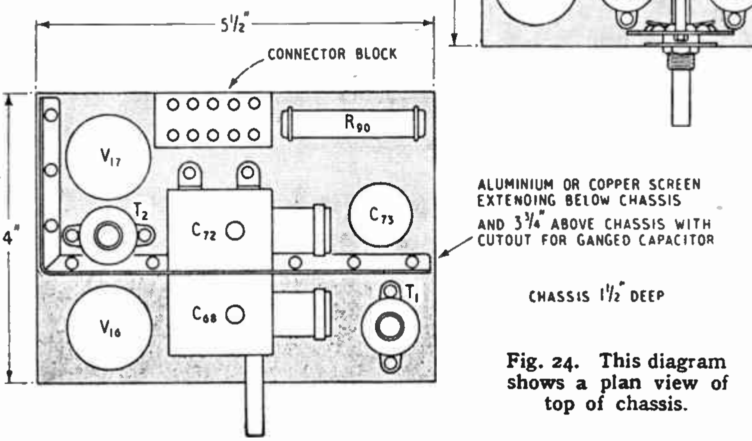
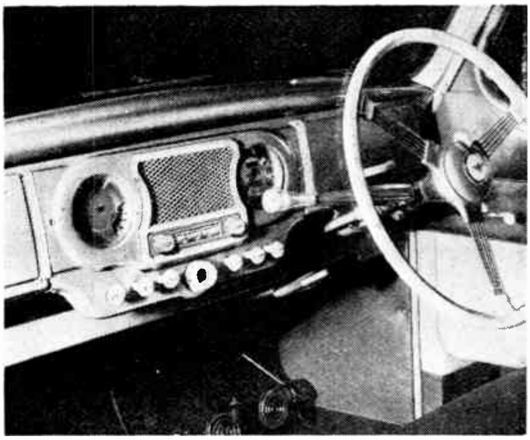


Fig. 24. This diagram shows a plan view of top of chassis.

TEST REPORT

EKCO MODEL CR61

All-wave Car Radio with Permeability Tuning



Ekco model CR61, all-wave set fitted in the Austin Hampshire saloon. The loudspeaker grille is immediately above the tuning head.

DESIGNED primarily for the overseas motorist this car radio receiver is an eight-valve superheterodyne possessing a number of quite unusual features. Not the least is the exceptional wide range of wavelengths it covers, not necessarily continuously since no useful purpose would be gained, but by a judicious selection of the principal broadcast bands a coverage of from 19 metres to 1,800 metres is provided. Reception on the long waveband is, however, limited to a single pre-set station, but the user can choose which station he prefers.

Bandspread

Tuning is not critical on any waveband, as the short wave ranges are, with one exception, restricted in coverage to a band of frequencies actually less than that on the normal medium waveband. Five free tuning ranges and four pre-set stations are selected by a nine-way rotary switch, which actuates a drum dial having the various ranges marked on it in megacycles as well as indicating which of the pre-set circuits are in use. The waveband table shows the sequence in which they appear, the ranges provided and their limits, also the actual coverage of each in kilocycles. The equivalent wavelengths in metres are included also.

While the three shortest wavebands have a very small coverage, the fourth, which is marked "SW" on the dial, covers 40 to 90 metres (3.3 to 7.4 Mc/s) approximately. Broadcast stations are so widely scattered throughout this part of the short wave band that it would be extremely difficult, if not impossible, to select any one portion and bandspread it into a coverage of, say, 1,000 kc/s or less and take in all the stations likely to be required in various parts of the world.

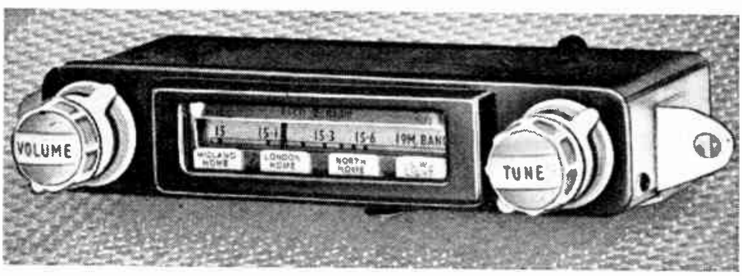
Of the four pre-set positions one is for a long wave station and three are in the medium waveband. The positions on the dial are indicated in two ways; one is by an arrow-head pointing to a station name plate, the other by a small figure, 1 to 4 inclusive, which appears on the extreme right of the dial. These numbers correspond to similar numbers marked against the four pre-set adjustments on the receiver unit, being provided to act as a guide should it be required to change the pre-set stations at any time.

The equipment is divided into four main units, the receiver, power unit, tuning head and loudspeaker. The use of two, or more, loudspeakers is quite feasible with this receiver and, indeed, the makers actually recommend it where facilities allow as a speaker in the back of the car is a great boon to rear-seat passengers. The set is well able to take the extra load as it gives about 4 watts output.

The Circuit

The various units can be mounted separately or joined together to form a coherent whole of very compact form. When the items are separated it becomes necessary to mount the receiver and tuning head in reasonable juxtaposition as they are interconnected by shafts with flexible couplings. A considerable latitude is, however, possible in regard to their relative positions.

Eight valves of the latest all-glass type are used in the set which has an EAF42 r.f. amplifier, ECH42 frequency changer, EAF42 i.f. amplifier on 465 kc/s, and EAF42 functioning as detector, a.g.c. and first a.f. amplifier, EA50 noise limiter and a pair of EL42s in push-pull for the output stage. The eighth valve is an EZ41 rectifier which is in the



Close-up of the tuning head with the 19-m scale on the drum dial showing and below the four pre-set station name plates. Note the two sets of concentric controls.

power unit and provides h.t. in conjunction with a vibrator and transformer. The l.t. consumption is 3.4A at 12 volts. On a 6-volt supply it is 5.6A.

An interesting departure from the more orthodox practice is the use of permeability tuning for the variable, as well as for the pre-set, circuits. These are quite independent, being separate sub-assemblies and apart from other considerations the separate circuits help to lessen the risk of complete failure of the radio as it is possible for a defect to appear in one unit without putting the set entirely out of action. Either free tuning or pre-set operation would be available.

Permeability Tuning

The free tuning system consists of six coils mounted in a screening box with six dust iron cores mounted on a carrier driven by a spindle, which is linked by shaft and flexible coupler to the tuning knob on the remote control unit. These six coils form the primary tuning elements of the receiver. One set of three is for medium wave tuning of the r.f., f.c., and oscillator, the remaining three being brought into circuit by the waveband switch initially for the 40- to 90-metre band (3.3 to 7.4 Mc/s) and subsequently as the tuning system for all the other short wave bands. As the switch is moved from one short wave position to another it switches loading coils in parallel with these primary circuits and as the variable elements of the tuned circuits are a part only of the total circuit inductances the coverages on the 19-m, 25-m and 31-m bands are restricted to the amounts given in the table.

Orthodox practice is adopted for the i.f. and noise limiter stages and these need no comment. A combined diode and r.f. pentode valve is unusual for the detector and first a.f. stage, but as a.g.c. is applied to the pentode portion a valve with variable-mu characteristics is needed.

Resistance-capacitance coupling links the a.f. amplifier with the push-pull output stage and an interesting feature of this part of the circuit is that one of the push-pull valves serves as a phase inverter for the other. A resistor of 1.8kΩ is included in the screen grid supply to one of the valves and this electrode is coupled via a 0.01-μF capacitor, to the input grid of the second push-pull valve. Signal voltages on the screen grid of the first valve being of opposite phase to those on its input grid gives the necessary phase inversion and it is only necessary to select component values that provide the required amplitude of signal to preserve the balance in the stage.

WAVEBAND TABLES

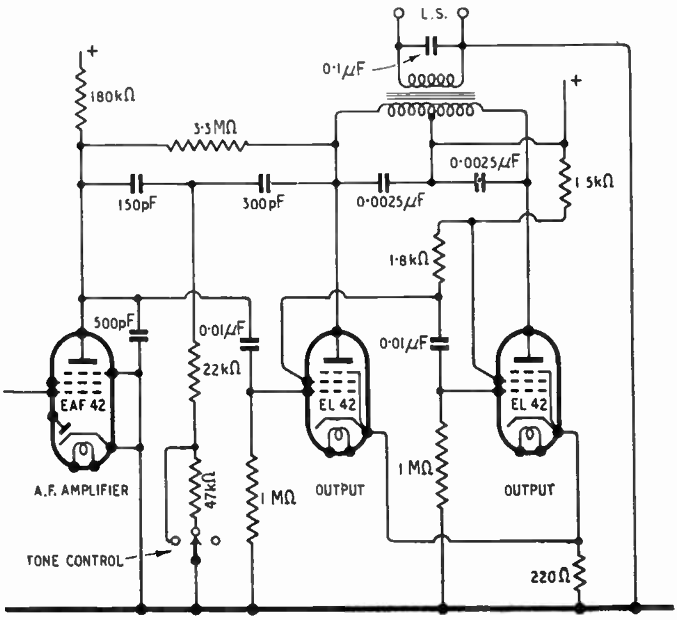
Waveband	Frequency limits	Wavelength (approx.)	Coverage
19-metre	15.0 to 15.6 Mc/s	20 to 19.2 met.	600 kc/s
25-metre	11.6 to 12.3 Mc/s	25.8 to 24 4 met.	900 kc/s
31-metre	9.3 to 10.1 Mc/s	32 3 to 29.7 met.	800 kc/s
sw band	3.3 to 7 4 Mc/s	91 to 40.6 met.	4,100 kc/s
med. waveband	515 to 1,640 kc/s	583 to 183 met.	1,125 kc/s
Pre-set 1	1,000 to 1,540 kc/s		
Pre set 2	790 to 1,220 kc/s		
Pre-set 3	550 to 880 kc/s		
Pre-set 4	167 to 245 kc/s		

Tone Control

Another interesting feature is the tone control system which is obtained by modifying the negative feedback circuit linking the anode of one output valve to the anode of the first a.f. amplifier. Normally there is a fixed amount of feedback via a 3.3 MΩ resistor and this is augmented by extra feedback applied over a frequency discriminating network that favours the upper register. A simple three-way switch, located in the tuning head, controls the amount fed back over this network.

In general a preponderance of treble is not unwelcome in a car as the rather confined space is inclined to over-emphasize the low notes. Possibly opinions will differ on this matter, but the range of control provided is quite sufficient to satisfy all tastes.

The road test was made with a CR61 fitted in an Austin A70 Hampshire saloon. As shown in the illustration the tuning head and loudspeaker form an integral part of the instrument panel as in



Phase inverting output stage with negative feedback tone control used in the CR61 receiver.

Ekco Model CR61—
this case the fitting was carried out on the Austin production line. A telescopic aerial is mounted in an insulating bush just ahead of the near-side front screen pillar, its position being such that it is almost invisible from the driving seat and does not interrupt the view of the road.

On each side of the scale window in the tuning head are two concentric controls, the outer one on the right being for free tuning and its inner one is the three-position tone control. Of the left-hand pair the outer is a combined volume control and on-off switch, while its companion is the waveband switch.

Concentric controls are often a little awkward to manipulate unless one is very much larger than the other, but in this set the problem has been tackled in two ways. First, the inner controls are slightly larger, and secondly, they have two ears, which not only assist their operation but makes them easily distinguishable by feel, and is a great advantage for night driving.

As the suppression of interference is now well understood it is, perhaps, redundant to comment on the absence of interference by the ignition and the electrical accessory circuits. If the receiver be tuned to a blank spot on the dial then a faint background of engine noise is discernible and it is just possible to hear the screen-wiper motor.

At times a little interference was noticed from passing lorries, buses and tramway cars, but in general, private cars caused surprisingly little interference. It may be that many private owners have fitted suppressors, but there is also the possibility that the anti-interference filters used in the CR61 contribute more than is realized to the suppression of interference picked up by the aerial.

Performance

Sensitivity and selectivity of the receiver are more than adequate for all normal requirements. On the road between London and the South Coast the main B.B.C.'s medium-wave stations were received with volume to spare, the Midland station, for example, providing an exceptionally good signal. The Light programme on 1,149 kc/s, which is often a little elusive on the South Coast at sea level, was received at good strength at all hours.

In the dense traffic of London Continental stations were well in evidence, but away from the Metropolis, especially on high ground, they were almost predominant. Judged on this basis there should be no difficulty in receiving the B.B.C.'s medium-wave stations almost anywhere on the Continent.

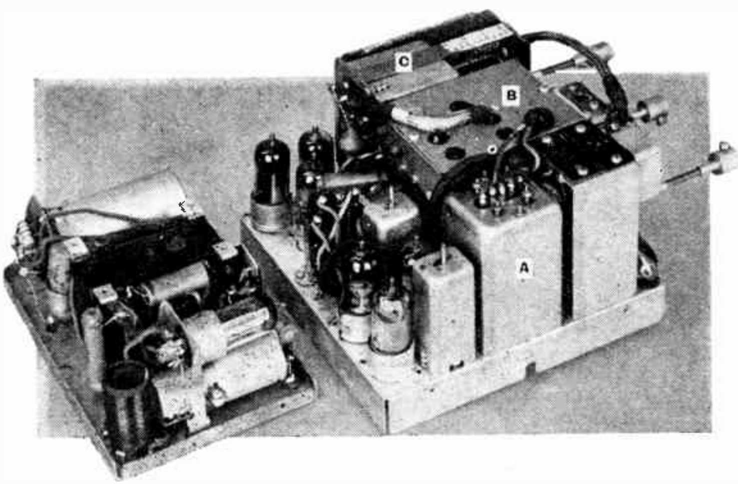
Turning to the short waves, all four bands provided a plethora of signals, and the difficulty was not finding something to listen to, but in identifying those that were receivable.

On these bands the effect of fading began to be noticed, but through no defect in the a.g.c. system, which behaved as well as could be expected in the circumstances. A.g.c. is impotent when signals fade to almost inaudibility, but it did operate very well indeed on the rapid "flutter" type of fading encountered on the short waves. The flutter was, of course, audible by rise and fall of background noise, but taken by and large the signal remained reasonably steady.

The action of a.g.c. often became apparent on medium-wave stations when passing under bridges, between tall buildings and through avenues of trees, but during the whole of the test no single instance was recorded when a signal, normally of good programme value, was lost due to inadequate sensitivity or a.g.c. action.

Not the least important of the short-wave performance was the steadiness of the local oscillator after the receiver had reached its normal operating temperature. The bandspread tuning on the three shortest ranges undoubtedly contributes largely to the absence of drift, but even on the non-bandspread range of 3.3 to 7.4 Mc/s very little adjustment to tuning was needed. Incidentally, broadcast is not the only form of entertainment this Ekco set provides, as, if one's inclination leans towards amateur radio, the 3.3-7.4 Mc/s range offers a little diversion. On one occasion on the South Coast we overheard a two-way contact between a London and a Manchester amateur on the 40-metre band, both stations being strong enough to need toning down a little with the volume control.

The Ekco CR61 all-wave car radio receiver is, with good justification, termed a 'luxury" model by the makers (E. K. Cole, Ltd., Southend-on-Sea, Essex). It is intended especially, though not exclusively, for the overseas motorist. The price of the set is £34 13s (exclusive of accessories), plus £7 10s 2d purchase tax on home sales.



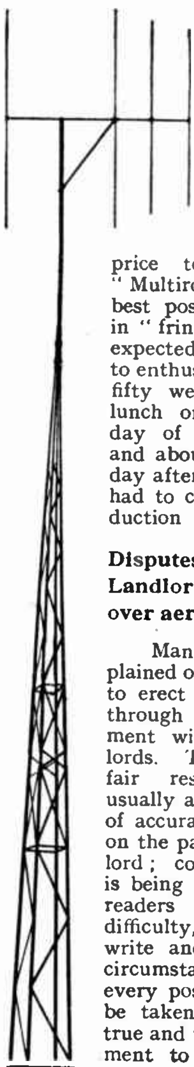
Receiver and power units removed from their cases. The pre-set tuning coils (A), waveband switching and loading coils (B) and the primary tuning circuit (C) are contained in separate sub-assemblies on the receiver chassis.

THE "BELLING-LEE" PAGE

Providing technical information, service and advice in relation to our products and the suppression of electrical interference

Radiolympia Notes, Prices, etc.

The public and trade demonstrated their confidence and interest in "Belling-Lee" aerials at Radiolympia by continually surrounding our stand and we have learnt a great deal from their questions; number one outstanding item that is called to mind is the agreeable surprise registered by many visitors on hearing (a) the prices of aerials and (b) the cost of installations. Most of the people to whom the writer spoke, expected higher prices. Number two is the interest in "fringe area" reception, and a surprising number of people think ten guineas plus the cost of a pole and erection is a very reasonable price to ask for a "Multirod"*1 to give best possible reception in "fringe areas." We expected to sell a few to enthusiasts, but when fifty were sold before lunch on the opening day of the exhibition and about a hundred a day afterwards we have had to change our production arrangements.



Disputes between Landlord and Tenant over aerials.

Many visitors complained of their inability to erect outside aerials through lack of agreement with their landlords. This is an unfair restriction, and usually arises from lack of accurate information on the part of the landlord; concerted action is being taken. If any readers are in this difficulty, do please write and give us the circumstances, when every possible step will be taken to present a true and unbiased statement to the landlord.

When the location is within eight to ten miles of a transmitter and interference is not severe it is likely that either a "Veerod,"*2 "Doorod" or "Viewflex"*2 will serve adequately. All these are indoor types.

Unsuitable aerial recommendations.

We have recorded some black marks; one is, a customer who lives within two miles of Alexandra Palace and whose dealer refused to guarantee satisfaction unless an "H" type "Viewrod" was installed; aerial plus installation costing twelve pounds. The customer was swamped with signal and had to be told to go back to the dealer and ask that an attenuator be fitted. Such an erection could only be justified if there was some **extraordinarily virulent** interference behind the aerial and in a straight line with the transmitter. Another is when a dealer was stated to have fitted "Doorods" by the "dozen" eight to ten miles from the transmitter, apparently without due regard to peculiarites of individual locations. This is unfair to the "Doorod," nor is the dealer being fair to his own reputation or to the receiver manufacturer. When asked if one could guarantee a "Doorod" or "Viewflex" within a few miles of a transmitter our general reply was that we could guarantee to position **any indoor aerial** (in relation to pipework, etc.) so that **little or no signal** could be picked up, but **that** these aerials should give every satisfaction if carefully sited and where interference is not too severe.

Suppression and indoor broadcast aerials.

Many questions were asked about suppression: the first reply invariably went back in the form of another question; what aerial is being used? It is rarely worthwhile doing much about suppression unless at least part of the aerial is outside and standing away from the house. Such aerials are the "Winrod" and "Twinrod"*3. It is not much use fitting a set lead suppressor when the only aerial is round the picture rail or under the carpet.

The Post Office Exhibit.

We are indebted to the General Post Office for telling our story so very much better than we could ourselves. Of course we **are** "shareholders" and they are always most co-operative. We were particularly impressed by their model house, and by their demonstration of suppression of interference from motor car ignition systems. The motor car is the one really severe form of interference that is everywhere spoiling television, and actually hindering the sale of television receivers in towns over thirty miles from a transmitter. The trouble can be cured in 97 per cent of cases (independent statistics) for 1/6 per car.

Motor ignition interference.

Surely your neighbours and tradesmen with vans would co-operate. It does not take a minute and does not affect the engine. A car with car radio has already been treated, so this covers most police cars, and army fighting vehicles.

Many public utility services and operators of large fleets of vehicles are co-operating. Are your local taxis suppressed? If you have neighbours with unsuppressed motor cars, you can obtain from us, or from the Television Society a few "courtesy" leaflets for distribution among them explaining the matter. It might be well worthwhile The suppressors are usually obtainable from your radio dealer or garage

Types and Prices

*1 "Multirod" with 9ft mast. £10/10/-. See illustration.

*2 "Veerod" attic aerial, 25/-.

	Twin.	Coax.
"Doorod" indoor T.V. aerial ..	26/6	30/-
"Viewflex" all flexible dipole ..	17/6	21/-
*3 "Twinrod" dual purpose aerial ..	29/-	32/6

Registration and patents applied for.

BELLING & LEE LTD
CAMBRIDGE ARTERIAL RD., ENFIELD, MIDDX., ENGLAND

WORLD OF WIRELESS

New Television Advisers ♦ Aircraft Radiotelephony ♦ Amateur Show ♦ Television Servicing Certificate

Television Committee

IT was announced by the P.M.G., in reply to a question in the House on November 2nd, that the Television Advisory Committee had been reconstituted. He stated that, in view of the appointment of the Broadcasting Committee, under the chairmanship of Lord Beveridge, which was considering the wider aspects of broadcasting (including television), it had been decided to alter the Advisory Committee's terms of reference to "advise the Postmaster-General on current development problems of the B.B.C.'s television service."

In addition to Sir William Coates, who was recently appointed chairman, the membership of the Advisory Committee includes I. A. R. Stedeford, who is also a member of the Broadcasting Committee; Professor J. A. Ratcliffe, of Cavendish Laboratory; H. Townsend, Director of Telecommunications, G.P.O.; Sir William Haley, Director-General, B.B.C.; and an official of the Treasury. The secretary, H. Baker (G.P.O.), is also assistant secretary of the Broadcasting Committee.

Some misgivings have been voiced by the Radio Industry Council at the curtailing of the terms of reference, which were previously very wide. It has, however, been pointed out that complete liaison is being maintained between the two committees, and, moreover, that whereas the Beveridge committee will consider the long-term policies, the Coates committee will deal with current developments.

Civil Aviation Radio

THE Ministry of Civil Aviation recently introduced a v.h.f. radio-telephony system providing continuous coverage for all aircraft flying on the routes between Aberdeen and the Shetlands. The system, which employs seven stations, is designed to give coverage along the whole route. D.F. is provided on the communication frequencies.

This is the first part of a project to cover the whole of the British Isles with v.h.f. radio-telephony and direction finding. The intention is that this will supersede the existing system of m.f. and h.f. morse communication and direction finding.

The introduction of this plan will mean a reduction in the amount of equipment carried by aircraft flying on internal routes.

The plan provides for transmitters and receivers strategically located on high ground throughout Great Britain and part of Northern Ireland. The transmitters, operating on the multi-carrier principle, will be modulated from Air Traffic Control centres at Uxbridge; Barton Hill, near Preston; and Prestwick. The receiver outputs will, of course, be fed to the same centres.

Amateur Exhibition

THE third annual amateur radio exhibition, organized by the Radio Society of Great Britain, is being held at the Royal Hotel, Woburn Place, London, W.C.1, for four days from November 23rd. Admission to the show, which is open daily from 11 a.m. to 9 p.m., is by catalogue, price 1s.

The 24 exhibitors include the G.P.O. Engineering Department and the Air Ministry; eighteen manufacturers and four publishers. The manufacturers include Standard, Webb's, Quartz Crystal, Radiocraft, Oliver Pell, T. C. C. Philpott's Metalworks, Salford, Denco, Taylor, Cyril French, Imhof, Automatic Coil Winder, Southern Radio, Sangamo Weston, G.E.C., Woden and E.M.I.

We hope to give a review of the exhibits in our next issue.

Television Servicing

THE first examination for the Television Servicing Certificate, organized jointly by the Radio Trades Examination Board and the City & Guilds of London Institute, will be held on May 2nd and 4th next year. The practical examination will be held at a later date. As London will be the only centre, it may be necessary to restrict the number of entries.

Admission to the examination is limited to candidates who have passed one of the following examinations:—

(a) The Radio Servicing Certificate Examination held jointly by the City & Guilds and the R.T.E.B.

(b) The Radio Servicing Examination held by the R.T.E.B. from 1944 to 1946.

(c) The examination in Radio Service Work of the City & Guilds held from 1938 to 1947.

(d) The "third year" examination in Radio Service Work of the Union of Lancashire and Cheshire Institutes.

(e) The examination in Radio Servicing held prior to 1944 by the Brit. I.R.E.

(f) The examination in Radio Servicing held prior to 1944 by the Scottish Radio Retailers' Association.

Regulations and entry forms are obtainable from the secretary of the R.T.E.B., 9, Bedford Square, London, W.C.1. The closing date for entries is December 15th.

PERSONALITIES

Sir Edward Appleton, until recently Secretary of the D.S.I.R. and now Principal and Vice-Chancellor of Edinburgh University, is to receive the honorary degree of Doctor of Laws from London University. From 1924 to 1936 Sir Edward was Wheatstone Professor of Physics at the University.

R. C. Wansbrough, M.A., M.I.E.E., M.Brit.I.R.E., who has been appointed personal assistant to E. J. Emery, managing director of E.M.I. Sales and Service, Ltd., recently retired from the R.A.F. with the rank of Air Commodore. Among the positions he held during his 30-odd years' service in the R.A.F. were those of Deputy Director of Radio Repairs (M.A.P.) and Director of Radio at the Air Ministry.

L. H. Bedford, O.B.E., M.A., B.Sc. (Eng.), of Marconi's, was elected president of the British Institution of Radio Engineers for a second year at the recent annual general meeting.

UN - RETOUCHED picture taken directly from the screen of a *Wireless World* superhet television receiver at Bath, some 100 miles from Alexandra Palace.

World of Wireless—

Paul Adorian, a director of Redifon, and W. E. Miller, M.A., Editor of *The Wireless and Electrical Trader*, were re-elected vice-presidents.

L. Hotine, who joined the B.B.C. in 1923 and has been Senior Superintendent Engineer since 1943, has been placed in charge of that section of the Operations and Maintenance Dept. of the B.B.C. Engineering Division which consists of the studio, transmitter, recording and lines departments.

M. J. L. Pulling, M.A., M.I.E.E., has been appointed Senior Superintendent Engineer (Television) to take charge of the television side of the B.B.C. Engineering Division's work. He joined the Corporation in 1934 and became Superintendent Engineer (Recording) in 1941. He is a vice-president of the British Sound Recording Association. **D. C. Birkinshaw,** M.B.E., M.A., A.M.I.E.E., will continue as Superintendent Engineer (Television), to which post he was appointed in 1945 after 13 years' service with the Corporation. During the war he was engineer-in-charge of the Daventry short-wave station, prior to which he held a similar position at the London television station.

Harry A. Woodyer, who was until recently sales manager of Kolectric, Ltd., has been appointed managing director. He has been in radio for over 26 years, having been on the staffs of Dubilier and T.M.C., and from 1940 to 1946 was radio sales manager of Simmonds Aerocessories.

OBITUARY

Walter G. Pye, who founded in 1899 the company of Cambridge instrument manufacturers bearing his name, died recently at the age of 80. He worked in the Cavendish Laboratory, Cambridge, prior to setting up in business. When W. G. Pye and Co. started manufacturing broadcast receivers, Pye, Ltd., was formed to develop this side of the business.

IN BRIEF

Licences.—With increases of 65,250 and 8,850 sound and vision licences, respectively, during September, the totals at the end of the month were sound 11,920,600 and vision 171,000.

Amateur Television.—The Radio Society of Great Britain has asked the Postmaster-General for permission for selected amateurs to use television transmitting equipment within certain sections of the 420 to 460-Mc/s amateur band. The request has been refused.

For the Blind.—A Braille edition of the "Admiralty Radio Handbook" is in course of preparation by the National Institute for the Blind which, when completed, will comprise 18 volumes. It is also recorded in the annual report of the Institute that since its commencement in 1929 the "Wireless For The Blind Fund" has supplied 84,887 free sets. During last year 4,065 sets and relay installations were supplied. The response to last year's Christmas Day broadcast appeal was £30,596.

Amateur Power.—The Postmaster-General has granted permission for U.K. amateurs, other than those holding licences limiting power to 10 and 25 watts, to use a power of 150 watts on all amateur frequency bands above 28 Mc/s with the exception of the 420-460-Mc/s band on which the limit remains at 25 watts. The concession is for an experimental period of one year from October 18th.

R.E.C.M.F. Exhibition.—The ballot for stands at the exhibition of components, valves and test equipment, to be held at Grosvenor House, Park Lane, London, W.1, from April 17th to 19th next year was held on October 26th. There were nearly 100 applicants for space at this, the seventh show to be organized by the Radio and Electronic Component Manufacturers' Federation.

Antarctic D.F.—The two aircraft to be used to reconnoitre the ice fields and to guide the Anglo-Scandinavian Antarctic Expedition ship *Norsel* through them will be equipped with Marconi Type AD7092 automatic direction finders for guiding them back to the ship after reconnaissance. These have been fitted to obviate the errors which may be introduced in the planes' magnetic compasses when flying within the magnetic influence of the South Pole.

Marconi marine radar equipment, Radiolocator III, has been given the Ministry of Transport's "type approval" certificate which is granted after tests conducted to ensure efficiency, mechanical sturdiness and conformity with the M.o.T. specification.

A Student's Guide to the courses of study in engineering available in the Manchester district is published by the Manchester and District Advisory Council for Further Education. Particulars are obtainable from the Education Officer, Deansgate, Manchester, 3.

Colour Television.—At a meeting of the Institution of Electrical Engineers on October 31st, Dr. P. C. Goldmark gave a lecture on "The C.B.S. Colour Television System in the U.S.A." After dealing with the general history of colour television, Dr. Goldmark discussed the requirements of illumination, the choice of primary colours, and colour flicker. A demonstration of Pye three-colour television equipment, which is similar to the C.B.S. system, was given.

"Radio Data Charts," which gives in graphical form most of the essential data for the design of receivers, has been revised and is again available from booksellers, price 7s 6d, or by post from our Publisher, price 7s 10d.

"B.B.C. Year Book."—The 1950 edition of this annual contains the usual wealth of information on the B.B.C. activities and an extensive reference section. This copiously illustrated 176-page book, costs 3s 6d.

Plastics.—In the book "Experimental Plastics for Students," by C. A. Redfarn and A. Allcott, published for *British Plastics* by our Publisher (price 10s 6d), thirty-four experiments are described to give readers an appreciation of the principles involved in the production and moulding of plastic materials.

EXPORTS

Radio-Telephony in S.A.—A u.h.f. radio-telephone link has been installed by Standard Telephones and Cables for the South African Post Office to extend communications between Port Elizabeth and Uitenhage—a distance of about fifteen miles. Half-wave dipoles (with directors) with corner reflectors are used at both stations. The "Standard" time-sharing multiplex system has been used which provides 24 channels and allows direct dialling between the telephone exchanges.

MAGNIFICATION of dental operations to eight times life size were given, with the aid of Marconi portable television equipment working on a closed circuit with monitors in the lecture theatre, to those attending a recent function at the Royal Dental Hospital, London.

Marconi Demonstrations.—A week of demonstrations of television test equipment is being held by Marconi Instruments at their showrooms, 19, The Parade, Leamington Spa. During the week, which ends on November 26th, demonstrations are also being given by Marconi's W.T. Co. of a complete portable television camera chain. The showrooms are open from 10 a.m. to 5 p.m.

Brazil.—Tenders are being sought by the Rio Grande do Sul State Commission for Electric Energy for wired-wireless equipment, for use on the high-tension cables to provide a communication system between the main generating stations and the sub-stations. The frequency to be used on the 66 kV lines will be between 90 and 150 kc/s. The audio-frequency equipment includes 50 telephones. A copy of the specification (in Spanish), Ref. CRE(IB) 31194/49, is available at the Commercial Relations and Exports Department, Board of Trade, Room 1080, Thames House North, Millbank, London, S.W.1, from whom further information is obtainable.

Pye Television is to make its début in the United States. A complete transmitter, including cameras and monitoring equipment, for operation on the American 525-line standard has been shipped to the U.S. and is to be set up for demonstrations in Washington, New York and Chicago. The whole of the equipment is transportable in suitcase-size containers.

Aeradio (Pakistan), Ltd. Technical training of aviation staff is being undertaken by the company on behalf of the Pakistan Government.

Londex.—Additional premises close to their present works at 207, Anerley Road, London, S.E.20, have been acquired by Londex, Ltd., manufacturers of remote-control equipment.

Kolectric, Ltd., manufacturers of coil-winding machines, have opened offices and showrooms at 73, Uxbridge Road, London, W.5 (Tel.: Ealing 9096). All correspondence should now be sent to this address and not to the works at Grove Hill, Beverley, E. Yorks.

C. G. ALLEN, a director of McMichael's and a well-known amateur, was recently filmed talking to Henry Rieger, a South African amateur who frequently receives the London television transmissions. The film was televised and here is the un-retouched picture as received on the screen of a McMichael set.

B.E.A.M.A. Catalogue.—The first (1949/50) edition of this 868-page catalogue of the products of members of the British Electrical and Allied Manufacturers' Association has been issued by our Publisher for B.E.A.M.A. Thirteen thousand copies have been printed, ten thousand of which are being distributed overseas. The catalogue section, consisting of 740 pages, is printed in three colours. The buyers' guide and directory of addresses includes over ten thousand entries.

Marconi Instruments.—Two members of the staff of Marconi Instruments, Ltd., F. G. Cook, manager, instrumentation exports, and E. Garthwaite, development manager, are paying a six-weeks' visit to the United States to explore the possibilities of marketing Marconi test and measuring gear.

Falkland Islands.—An order for forty fixed-frequency transmitter-receivers to supplement the existing inter-island line communication system is to be supplied to the Falkland Islands authorities by Berry's (Short-Wave), Ltd.

Decca.—*Navigator*, the demonstration vessel of the Decca Navigator Co., has sailed for Holland and Belgium to demonstrate Decca radar equipment in those countries.

CHANGES OF ADDRESS

International Aeradio, Ltd., has moved its head office to Aeradio House, 40, Parker Street, London, W.1 (Tel.: Regent 5024). A subsidiary of the company has been formed in Karachi with the title International

MEETINGS

Institution of Electrical Engineers

Radio Section.—"Solar Radio-Frequency Radiation," by J. L. Pawsey, M.Sc., Ph.D., at 5.30 on December 7th.

"The Acoustics of Studios and Auditoria," by W. Allen, at 5.30 on December 19th.

Discussion Circle.—"The Electron Theory Approach to Electro-magnetism," discussion opened by Prof. J. Thompson, D.Sc., M.A., at 6.0 on November 29th.

The above meetings will be held at the I.E.E., Savoy Place, London, W.C.2.

Cambridge Radio Group.—Address by R. T. B. Wynn, C.B.E., M.A., chairman of the Radio Section, at 6.0 on December 13th, at the Cambridgeshire Technical College.

North-Western Centre.—"Some Electromagnetic Problems," by Prof. G. W. O. Howe, D.Sc., LL.D., at 6.15 on December 6th, at the Engineers' Club, Albert Square, Manchester.

North Lancashire Sub - Centre.—"Some Electromagnetic Problems," by Prof. G. W. O. Howe, D.Sc., LL.D., at 7.0 on December 7th, at the North-Western Electricity Board Demonstration Theatre, North Road, Lancaster.

South Midland Centre.—Faraday lecture on "Radar," by R. A. Smith, M.A., Ph.D., at 6.0 on December 5th, at the Town Hall, Birmingham.

South Midland Radio Group.—"The Observation of Ionospheric Interaction," by D. A. Bell, M.A., B.Sc., F. J. Hyde, B.Sc., and C. C. Newton, at 6.0 on November 28th, at the James Watt Memorial Institute, Great Charles Street, Birmingham.

British Institution of Radio Engineers

London Section.—"Electronics in Aircraft Design," by A. L. Whitwell, at 6.30 on December 15th, at the London School of Hygiene, Gower Street, W.C.1.

Merseyside Section.—"The Acceleration of Atomic Particles to High Energies," by J. D. Craggs, M.Sc., Ph.D., at 7.0 on December 7th, at the Accountants' Hall, Derby Square, Liverpool.

North-Eastern Section.—"A Review of the Basis of Electronics," by C. Laverick, at 6.0 on December 21st, at Neville Hall, Westgate Road, Newcastle-on-Tyne.

Scottish Section.—"Electronics in Industry," by A. A. M. Turnbull, at 6.30 on December 1st, in the Electrical Department, Glasgow University.

South Midlands Section. — "H.T. Supply for High Power Transmitters," by M. Lane, at 7.0 on December 15th, at the Technical College, The Butts, Coventry.

British Sound Recording Association

London.—"Some Aspects of L.F. Performance of Loudspeakers," by G. A. Briggs, at 7.0 on November 25th at the Royal Society of Arts, John Adam Street, W.C.2.

"Acoustics and the Film," by C. W. Glover and John McLaren, at 7.15 on December 7th at the G.B. Theatre, Film House, Wardour Street, London, W.1. (Joint meeting with the British Kinematograph Society.)

Birmingham.—Dr. L. E. C. Hughes will address a meeting at 2.15 on November 26th at the Imperial Hotel, Temple Street.

Institute of Navigation

"Navigational Systems and Instrumental Aids," by Dr. D. E. Adams and Dr. A. N. Uttley, at 6.0 on December 15th, at the Institution of Civil Engineers, Great George Street, London, S.W.1. (Joint meeting with the Royal Aeronautical Society.)

"Radar Charts," discussion opened by Lt. Cdr. P. G. Satow, D.S.C., R.N., on the adaptation of marine charts for use with radar, at 5.0 on December 16th, at the Royal Geographical Society, 1 Kensington Gore, London, S.W.7.

Institute of Physics

Electronics Group.—"The Nervous System as an Electrical Machine," by Dr. W. Grey Walter at 5.30 on December 13th, at the Institute's House, 47 Belgrave Square, London, S.W.1.

Radio Society of Great Britain

Annual general meeting at 6.30 on December 16th, at the I.E.E., Savoy Place, London, W.C.2.

Television Society

Constructors' Group.—"Baird Television Receivers," by P. Wigley, B.Sc., at 7.0 on December 8th, at the Cinema Exhibitors' Association, 164 Shaftesbury Avenue, London, W.C.2.

Bedford Centre.—"Television Aerial Problems," by E. M. Lee at 7.30 on December 14th, at the Flying Services Club, St. Mary's Street, Bedford.

Bristol and S.W. Centre.—"Television Aerials and Interference Problems," by E. M. Lee, on December 6th at the Royal Hotel, Bristol.

Guild of Radio Service Engineers

Edinburgh Branch.—"Radio Capacitors," by a member of T.C.C. staff, at 7.30 on December 15th, at Unity House, 4, Hillside Crescent, Edinburgh.

ELECTRONIC DIVERSITY SWITCHING

(Concluded from Page 418 of November issue)

Design and Operation of Triple Diversity System

By H. V. GRIFFITHS and R. W. BAYLIFF

(Engineering Division, B.B.C.)

IN the first part of this article the advantages of switched over combined - output methods in diversity reception were discussed, and an electronic switch for two receiving circuits was described. We shall now consider the extension of the method to three circuits.

Fig. 3 shows the full schematic of the triple-diversity version of the switch. It will be seen that three triode-hexode valves, instead of two, are used in the gate. Otherwise this part of the circuit is identical with that used in the dual switch.

The discriminator contains duplicate circuits of the type used in the dual switch, together with additional circuits which interpret and rearrange the switching voltages developed by the four valves V_1, V_2, V_5 and V_6. The three a.f. signals from the diversity receivers are introduced into the three input channels, and the negative control potentials, E_1, E_2 and E_3, are separated by the centre-tapped resistor combinations R_{35}-R_{36}, R_{45}-R_{46}, and R_{50}-R_{51}. E_1 and E_2 are applied through the cathode followers V_{10a} and V_{10b}, to the first pair of discriminator valves, V_1 and V_2. E_3 is similarly applied, through the cathode follower V_{11} to V_5, the first of the second pair of discriminator valves. V_6 derives its control potential from

Values of Components used in Circuit of Fig. 3.

Component	Value	Rating
R_1	510 kΩ	½ W
R_2	510 kΩ	½ W
R_3	100 kΩ	½ W
R_4	15 kΩ	2 W
R_5	47 kΩ	½ W
R_6	10 kΩ potr. linear (wire-wound)	2 W
R_7	47 kΩ	½ W
R_8	150 Ω	½ W
R_9	240 kΩ	½ W
R_{10}	240 kΩ	½ W
R_{11}	15 kΩ	2 W
R_{12}	100 kΩ	½ W
R_{13}	510 kΩ	½ W
R_{14}	510 kΩ	½ W
R_{15}	20 kΩ potr. linear (wire-wound)	2 W
R_{16}	510 kΩ	½ W
R_{17}	4.7 kΩ	½ W
R_{18}	20 kΩ potr. linear (wire-wound)	2 W
R_{19}	4.7 kΩ	½ W
R_{20}	47 kΩ	½ W
R_{21}	4.7 kΩ	½ W
R_{22}	47 kΩ	½ W
R_{23}	10 kΩ	1 W
R_{24}	20 kΩ potr. linear (wire-wound)	2 W
R_{25}	240 kΩ	½ W
R_{26}	15 kΩ	2 W
R_{27}	47 kΩ	½ W
R_{28}	10 kΩ potr. linear (wire-wound)	2 W
R_{29}	47 kΩ	½ W
R_{30}	240 kΩ	½ W
R_{31}	150Ω	½ W

Component	Value	Rating
R_{32}	15 kΩ	2 W
R_{33}	100 kΩ	½ W
R_{34}	50 kΩ	2 W
R_{35}	39 kΩ	¼ W
R_{36}	39 kΩ	¼ W
R_{37}	10 kΩ	¼ W
R_{38}	20 kΩ	2 W
R_{39}	5 kΩ	2 W
R_{40}	100 kΩ	½ W
R_{41}	100 kΩ	¼ W
R_{42}	240 kΩ	½ W
R_{43}	600 Ω	½ W
R_{44}	1.8 MΩ	½ W
R_{45}	39 kΩ	¼ W
R_{46}	39 kΩ	¼ W
R_{47}	100 kΩ	¼ W
R_{48}	240 kΩ	½ W
R_{49}	1.8 MΩ	½ W
R_{50}	39 kΩ	¼ W
R_{51}	39 kΩ	¼ W
R_{52}	100 kΩ	¼ W
R_{53}	1 MΩ	½ W
R_{54}	240 kΩ	½ W
R_{55}	1.8 MΩ	½ W
R_{56}	1 MΩ	½ W
R_{57}	1.5 kΩ	½ W
R_{58}	15 kΩ	½ W
R_{59}	6.8 kΩ	½ W
R_{60}	3.3 MΩ	½ W
R_{61}	1 MΩ	½ W
R_{62}	1.5 kΩ	½ W
R_{63}	220 Ω	¼ W
R_{64}	220 Ω	¼ W
R_{65}	470 Ω	¼ W
C_1	8 μF	550 V
C_2	500 pF	550 V (mica)

Component	Value	Rating
C_3	8 μF	550 V
C_4	8 μF	550 V
C_5	50 μF	25 V
C_6	5,000 pF	350 V (mica)
C_7	5 000 pF	350 V (mica)
C_8	5,000 pF	350 V (mica)
C_9	0.1 μF	350 V
C_{10}	0.1 μF	350 V
C_{11}	3,000 pF	350 V
C_{12}	0.1 μF	350 V
V_1	EF 55	
V_2	,,	
V_3	,,	
V_4	6H6	
V_5	EF 55	
V_6	,,	
V_7	,,	
V_8	6J5	
V_9	6H6	
V_{10}	6SL7GT	
V_{11}	6SQ7	
V_{12}	6K8	
V_{13}	6K8	
V_{14}	6K8	
V_{15}	6SN7GT	
T_1	1 : 11.5	Line/grid
T_2	,,	,,
T_3	,,	,,
T_4	4.44 : 1	Anode/line
N_1	Osglim "G"	
N_2	,,	
N_3	,,	

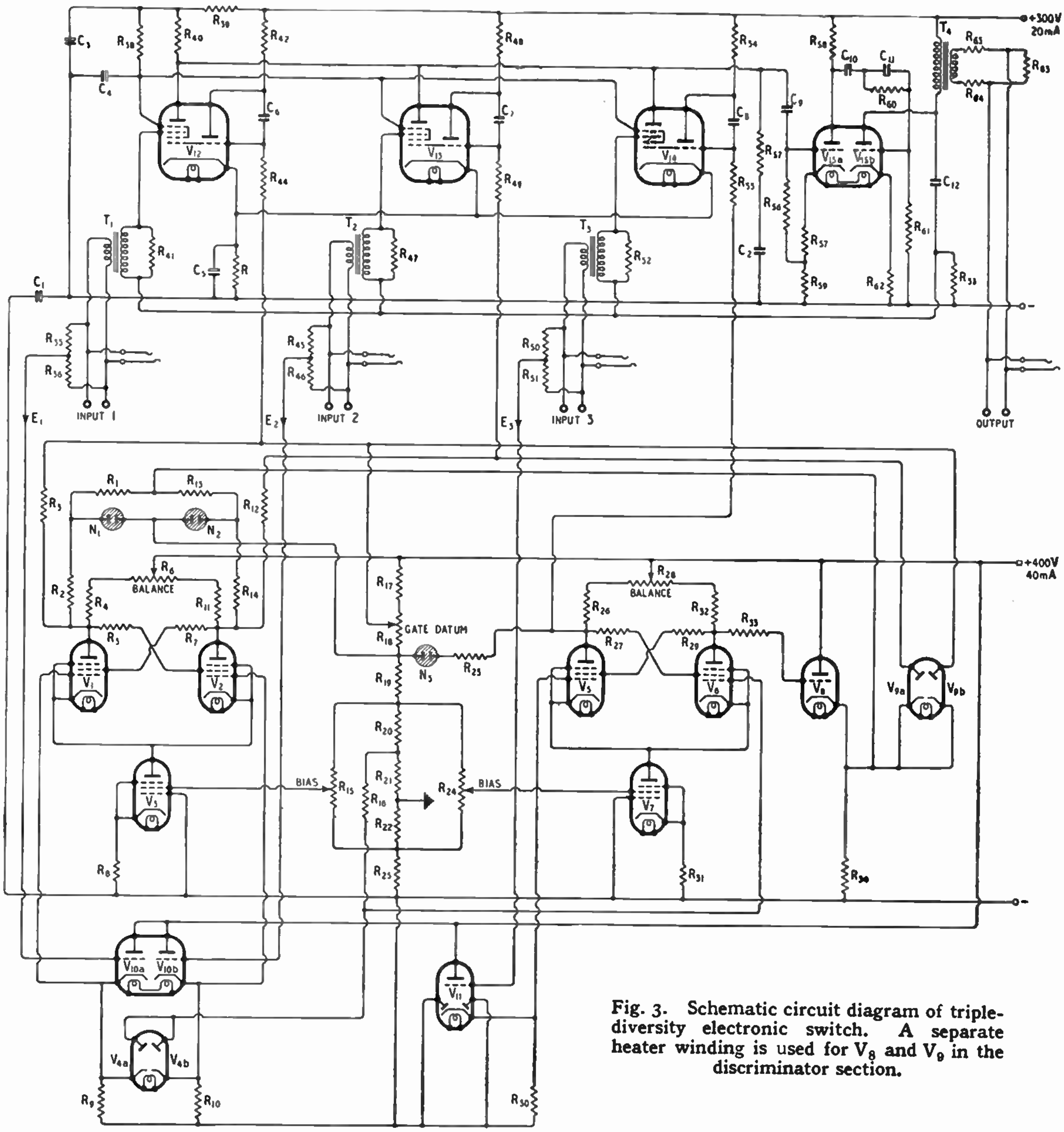


Fig. 3. Schematic circuit diagram of triple-diversity electronic switch. A separate heater winding is used for V_8 and V_9 in the discriminator section.

the anodes of the diodes, V_{4a} and V_{4b}, whose function is to select the "better," i.e., more negative, of the control potentials fed to V_1 and V_2. Suppose, for example, that of the three signals No. 1 is the best (E_1 is, say -12 V); No. 2 is next best ($E_2 = -10$ V); and No. 3 is worst ($E_3 = -7$ V). The cathodes of the three cathode followers, V_{10a}, V_{10b} and V_{11}, will then change by like amounts, so that V_1's grid becomes 12 V negative with respect to its no-signal value; V_2's grid changes by -10 V; and V_5's grid changes by -7 V. Of the two diodes V_{4a} and V_{4b}, the cathode of V_{4a} has changed by -12 V, whilst that of V_{4b} has changed by -10 V.: V_{4a} conducts and its anode becomes equal in potential to its cathode; V_{4b} is cut off, because its anode is -2 V with respect to its cathode. Therefore V_6's control grid has a change of -12 V impressed on it. The comparisons by the two discriminators are thus effected as follows: V_1 and V_2 compare signals Nos. 1 and 2; V_5 and V_6 compare signal No. 3 with the better of Nos. 1 and 2.

For simplicity, the anode voltages of V_1, V_2, V_5 and V_6 will be considered merely as being either positive or negative with respect to the slider of R_{18}, i.e., the negative pole of the gate h.t. supply; the anode will be positive when the valve concerned is near cut-off; it will be negative if the valve is heavily conductive.

Electronic Diversity Switching—
Further, if one valve of a pair has its anode positive, then the other must be negative. Reverting now to the example used in the previous paragraph, where E_1, E_2 and E_3 are -12, -10 and -7 volts respectively, it will be seen that the V_1-V_2 pair are in the state where V_1's anode is positive and V_2's is negative; the V_5-V_6 pair are in the state in which V_5's anode is negative and V_6's is positive. The operation of the gate valves in these conditions is as follows: V_{12} will be turned "on" by the positive potential from V_1 (thus signal No. 1—the best signal—is passed on to the output); V_{13} and V_{14} will be turned "off" by the negative potentials from V_2 and V_5 (hence signals Nos. 2 and 3 will be blocked). The resistors R_3 and R_{12}, through which the switching voltages are fed to V_{12} and V_{13}, are small compared with R_{44} and R_{49} and so they do not appreciably alter the switching time constant.

The function of the cathode-follower buffer, V_8, and the diodes V_{9a} and V_{9b}, is to prevent the positive anode potential from V_1 or V_2 from being effective in turning "on" V_{12} or V_{13} if signal No. 3 happens to be the best one. It also avoids the faulty indication which would otherwise be given by one of the neon lamps, N_1 or N_2. This action can best be illustrated by another example. Suppose that signal No. 3 is the best ($E_3 = -15$ V); signal No. 1 is next best ($E_1 = -10$V); and signal No. 2 is the worst ($E_2 = -6$ V). The V_1-V_2 pair operates in favour of E_1, i.e., V_1's anode is positive and V_2's is negative; the V_5-V_6 pair operates in favour of E_3 because V_5 receives -15 V (E_3) and V_6 receives -10 V (the better of E_1 and E_2). V_5's anode is, therefore, positive and V_6's is negative. The cathode of V_8 and hence the cathodes of the diodes V_{9a} and V_{9b} also will follow the potential of V_6's anode and will become negative (with reference to the slider of R_{18}). The positive voltage at V_1's anode is prevented from turning V_{12} "on" by the negative voltage from V_{9b}. The presence of R_3 increases the apparent impedance of the V_1 source and enables the potential from V_{9b} to override that from V_1. Thus both V_{12} and V_{13} are turned "off." and V_{14}, which is associated with the best signal, is turned "on" by the positive potential from V_5's anode. The neon lamps N_1 and N_2 are each fed from two sources through high resistances. The potentials are such that the neons will light only if both sources are positive. Thus, in the last example, although V_1's anode is positive and tends to strike N_1 it is prevented from doing so by the negative supply, through R_1, from the cathode of V_8. N_2 is also extinguished since it is driven from V_2 anode (negative) through R_{14} and V_8 cathode (negative) through R_{13}. N_3 is, however, illuminated by the feed from V_5 anode (positive) through R_{25}. This gives the correct indication, for gate-valve V_{14} is "open," signal No. 3 being the best.

The diodes V_{9a} and V_{9b} are necessary (as opposed to straight-through connections) in order that the negative potential from V_1 or V2 can override, by cutting, off the appropriate diode, the positive voltage from V_8 cathode when the best signal is either No. 1 or No. 2.

Results in Service

After more than two years' experience with the electronic switch it is considered that the switched diversity system is superior to combined diversity, the effects of selective carrier fading especially being less marked The receivers and aerials must, however, be more strictly matched than is usually necessary with the combining system, and more frequent routine examinations of the radio—and intermediate—frequency amplifier alignment are necessary. This is because the rapid change-over enables the ear to detect very small differences of background noise, a disparity of as little as 2 db being perceptible when the signal/noise ratio does not exceed 20 db. For this reason, when aerials having widely different characteristics are used, in "polarization diversity," for example, with weak or moderate signals, the change-over is marked by an abrupt change in the background noise. In these conditions it is preferable to increase the mix period beyond the 50 milliseconds, which was adopted on other grounds, to about 150 milliseconds by increasing the value of the capacitors C_6 and C_7 (Fig. 2) or C_6, C_7 and C_8 (Fig. 3). The change-over is then less abrupt and will generally be inaudible. Although rapid selective fades may occasionally cause distortion, the results are still superior to those of combined diversity.

"VIEW MASTER"

THE "View Master" is a television receiver sponsored by several component manufacturers and intended for the home constructor. It is for the London area, and the constructional details and wiring drawings are obtainable from wireless dealers, price 5s.

The set has a 9in tube with electromagnetic deflection. Two valves are used in each time base and e.h.t. is taken from the line fly-back. The receiver has three r.f. stages with coupled pairs of tuned circuits for the intervalve couplings. Noise limiters are included.

The h.t. supply comes straight from the mains via a half-wave metal rectifier, and a transformer is only included for the valve heaters. The set is thus suited to a.c. mains only.

The drawings supplied are very clear, and, if carefully followed, no constructional difficulty should be encountered. The receiver must be aligned for single-sideband reception of the sidebands remote from the sound channel, and the use of a signal generator for this is advised. A procedure is given, however, for alignment on a signal.

NEWS FROM THE CLUBS

Basingstoke.—At the meeting of the Basingstoke District Amateur Radio Society on December 9th the design and construction of communication receivers will be discussed. The meeting will be held at the British Workmen's Restaurant, Basingstoke, at 7.45. Sec.: L. S. Adams, 16, Bramblys Drive, Basingstoke, Hants.

Birmingham.—A talk on loudspeakers, with demonstrations, will be given to members of the Slade Radio Society by A. E. Falkus of Reproducers and Amplifiers, Ltd., at the meeting on December 9th at 7.45 at the Parochial Hall, Slade Road, Erdington. Birmingham, 23.

Northwich employees of Imperial Chemical Industries have formed the Crescent Radio Society, which meets on alternate Tuesdays in the works conference room. Membership is limited to employees of I.C.I. Sec.: W. Houseman, 15, Snowdon Street, Barnton, Northwich, Cheshire.

SUPPRESSING IMPULSE NOISE

New Type of Eliminator Operating on Pulse Duration

By **D. C. ROGERS,** A.M.I.E.E.
(*Standard Telephones and Cables*)

IMPULSE noise consists of very short bursts of electrical energy originating from atmospheric disturbances, or from such devices as switches, motor commutators, etc. These pulses of energy have a duration nearly always substantially less than one microsecond, and hence less than the response time of the radio-frequency amplifiers of the receiver. They are, therefore, lengthened on their passage through the tuned amplifiers of the receiver and arrive at the detector with a duration which is dependent on the receiver bandwidth—in fact a duration which is of the order of twice the reciprocal of the receiver bandwidth. A further feature of these noise pulses, and one in which they differ from valve and circuit noise is that the interval between pulses is long compared with their duration at the output of the amplifier; in other words, they occur as separate pulses, and very rarely "overlap."

Any circuit which is to discriminate against impulse noise must embody some means of distinguishing between the noise pulses and the desired modulation. In most circuits of the so-called limiter type the noise pulses are distinguished by the fact that their amplitude is greater than that of the signal either before or after detection. For example, one well-known form of limiter is arranged to discriminate against any noise pulse whose amplitude exceeds twice the incoming carrier amplitude, this being the maximum value attained by the incoming signal at 100 per cent modulation. A circuit of this type cannot operate on pulses which have a small amplitude, but are nevertheless irritating to the listener.

Bandwidth Considerations

The circuit to be described[1] uses the duration of the noise pulse instead of its amplitude to distinguish it from the desired modulation; it is therefore capable of discriminating against noise pulses, even when their amplitude is equal to or smaller than the incoming signal.

It has been mentioned that the duration of the noise pulse at the detector is dependent on the receiver bandwidth, and that it decreases as the bandwidth is increased. In order to be able to discriminate against noise pulses without distortion of the desired signal, it is necessary for the pulse to have a duration less than that of a half-cycle of the highest modulation frequency. This implies that the bandwidth of the section of the receiver prior to the detector should be greater than that needed for the reception of the transmitted modulation sidebands.

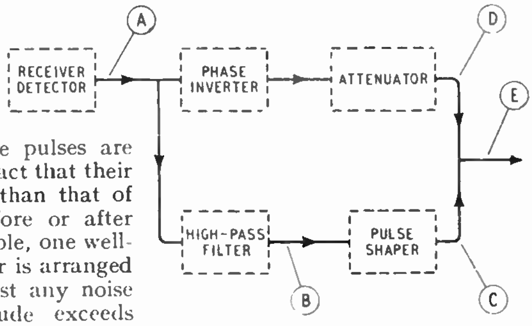


Fig. 2. Functional diagram of the circuit. The letters A, B, C, etc., refer to the points at which the waveforms of Figs. 1(a), (b), (c), etc., respectively, are observed.

For this reason it will be seen that the use of the circuit is restricted to cases where selectivity is unimportant, and its application will generally be confined to frequencies above, say, 30 Mc/s. A typical case where it may be of use is in the sound section of a television receiver, where interference is frequently encountered from motor-car ignition and similar sources. It is not applicable to ordinary domestic broadcast receivers, or radio receivers of the "communication" type, where a high degree of selectivity is essential.

Principle of Operation. — The output of the receiver detector will consist of the desired modulation waveform, on which is superimposed a noise pulse, as shown in Fig. 1(a). The noise pulse may be analysed into a spectrum of frequencies extending from zero up to a maximum which is dependent on the receiver bandwidth, and, if this bandwidth is greater than that necessary to receive the transmitted carrier and sidebands, there will be noise components at frequencies correspondingly higher than the highest modulation frequency.

Referring now to Fig. 2, which

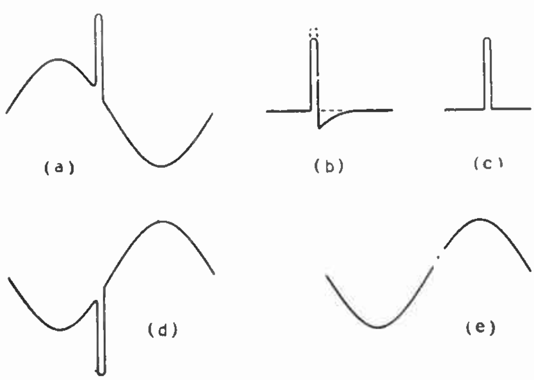


Fig. 1. Waveforms appearing at various points in Fig. 2

[1] Patents pending

Suppressing Impulse Noise—

shows a block schematic diagram of the circuit, it will be seen that the output from the detector is fed into a high-pass filter. This filter transmits only those frequencies above the modulation band, and its purpose is to remove all modulation frequencies and the lower frequency components of the noise pulse. This has the effect of distorting the noise pulse, as shown in Fig. 1(b). (The distortion can be seen by comparing with the dotted line in Fig. 1(b), which shows a noise pulse free from the modulation wave but undistorted.)

The distorted noise pulse then passes to the pulse shaper, where the overswing is removed, thus restoring the pulse approximately to its original shape, although with a slight loss in amplitude, as shown in Fig. 1(c).

The restoration of the pulse shape must clearly be equivalent to the re-insertion of the low-frequency components of the pulse, and, hence, the output from the pulse shaper consists of noise pulses of slightly smaller amplitude, but otherwise equivalent to those originally present in the detector output. A second output from the detector passes to a phase inverter, where the sense of the modulation wave and noise pulse is reversed, and thence to an attenuator which is arranged to give the same loss in amplitude as that suffered by the noise pulse in its passage through the filter and pulse shaper. The output from the attenuator is shown in Fig. 1(d).

The two outputs from the pulse shaper and attenuator are then combined, when the noise pulses, being in opposite sense, cancel completely, leaving the modulation free from noise as shown in Fig. 1(e).

Circuit Variants.—It will be apparent that it is possible to devise a variety of circuits which will perform the functions described above, differing, for example, in the form taken by the high-pass filter, the method of re-shaping the noise pulse, and the method of combining the output voltages. Two possible arrangements are shown in Figs. 3 and 4. In both these circuits the valve V_1 performs the two functions of inversion of the signal, and provision of a low-impedance source to feed the high-pass filter. In Fig. 4 it has been assumed that the ratio of the high-frequency bandwidth of the receiver to the highest modulation frequency is so large that the filter can consist simply of a capacitance-resistance network shown by condenser C_1 and resistor R_1; two diodes are used to shape the pulse instead of one, as in Fig. 3, this arrangement presenting a higher impedance to the output of V_1. In both circuits the two output voltages are combined by applying them to opposite ends of potentiometer R_2, R_3, and taking the output from the junction of R_2 and R_3. The ratio of R_2/R_3 is adjusted so that the voltage from the anode of V_1 suffers the requisite attenuation. (It should be noted that this method of combining the two voltages results in an additional loss of two-to-one in signal voltage.) The total resistance of this potentiometer can conveniently be about 1 megohm.

Suggested component values are shown in Fig. 4 for a modulation band of 10 kc/s and a high-frequency bandwidth of, say, 200 kc/s.

There is an alternative method by which substantially the same principle can be applied. Referring again to Fig. 1(b), it will be recalled that the effect of removing the negative "overswing" from the noise pulse as it emerges from the high-pass filter is to restore to it the low-frequency components which were removed by the filter. It may be deduced, therefore, that this negative "overswing," i.e., that part of the waveform below the zero axis in Fig. 1(b), must contain the low-frequency components in anti-phase. Hence, if the pulse-

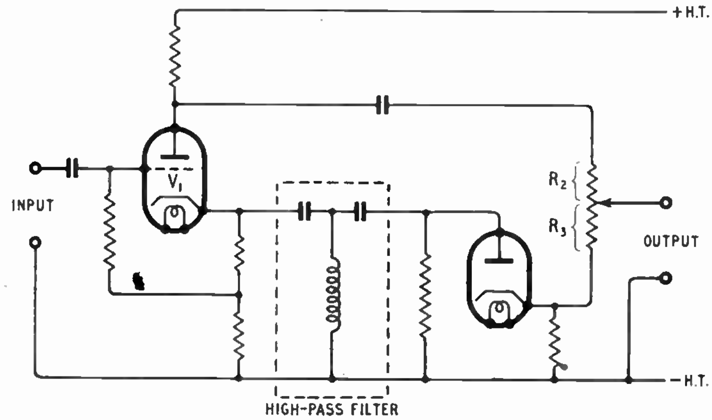


Fig. 3. Possible arrangement of a practical circuit.

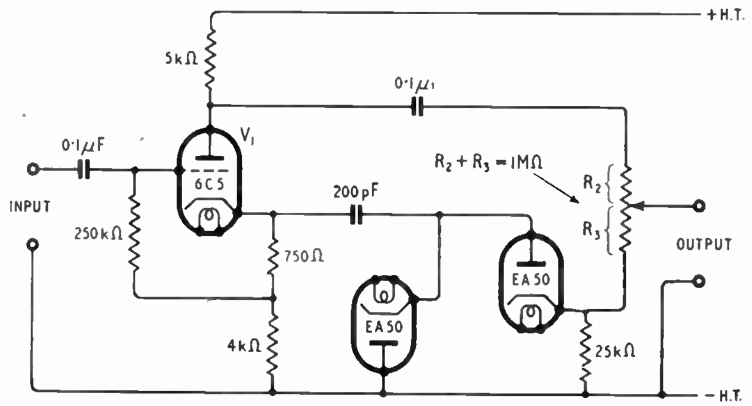


Fig. 4. An alternative circuit arrangement.

shaping circuit is arranged to remove the upper part of the waveform of Fig. 1(b), and the residue is then combined with the original waveform, this time without phase inversion, but with a suitable reduction in amplitude, the low-frequency components in the original noise pulse will be cancelled. The remaining high-frequency components can then be removed by a low-pass filter.

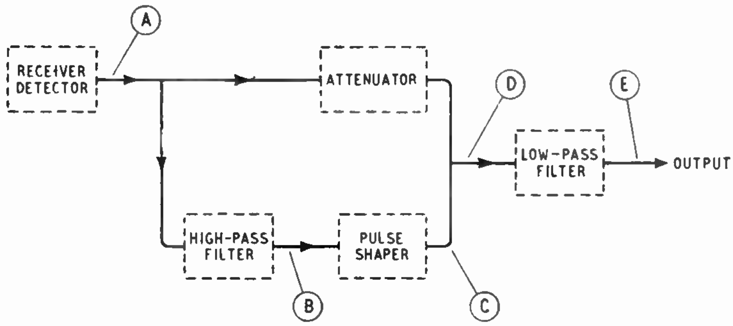


Fig. 5. Functional diagram of a variant of the circuit. The letters A, B, C, etc., refer to the points at which the waveforms of Fig. 6(a), (b), (c), etc., respectively, are observed.

A functional diagram of this alternative arrangement and the waveforms appearing at various points in the circuit are shown in Figs. 5 and 6 respectively. A further note is necessary concerning the low-pass filter of Fig. 5. It is true that if the high-pass filter is designed to cut off at a frequency in the region of the upper limit of audibility, the noise components remaining at the output of the circuit will be above the audible range, and the loudspeaker, or indeed the human ear, would function effectively as a low-pass filter. However, any distortion taking place, due to valve non-linearity, in the amplifiers feeding the loudspeaker would result in the reintroduction of audible-frequency noise components. It is therefore very desirable that a low-pass filter should be provided to remove the high-frequency noise pulse components immediately after the combination of the original and re-shaped noise pulses, and before any further amplification takes place.

Again, it is possible to devise many circuits which will perform the functions indicated in Fig. 5. The circuit shown in Fig. 7 is of interest, however, since it illustrates the small number of components with which the circuit can be built. For the successful operation of this circuit, however, it is necessary that the output impedance of the detector be very low, possibly as little as 1,000 ohms, if the output waveform of the detector is not to be distorted

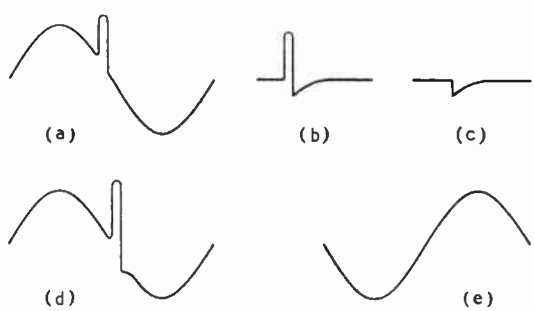


Fig. 6. Waveforms appearing at various points in Fig. 5.

by the severe loading imposed by the filter and diode combination. This low impedance will cause a considerable loss in gain, and in practice it would be preferable to use a cathode follower to feed the filter and diode.

It should be noted that in all the circuits described it has been assumed that the output from the receiver detector is in the positive sense. The necessary changes for negative output from the detector will be quite obvious.

Experiment.—A simple receiver, incorporating a circuit similar to that of Fig. 4, was built to test the effectiveness of the system. It consisted of two radio-frequency amplifier stages, a diode detector, audio-frequency amplifier and output stage. The radio-frequency amplifiers were tuned to 41.5 Mc/s (the frequency of the sound transmission of the B.B.C. television service) and had a bandwidth of about 200 kc/s. Impulsive noise was generated by means of an ordinary spark coil located near the aerial. The reduction in noise output, as measured by an "average" type rectifier meter, was 24 db. Subjectively, the improvement was such that an almost unintelligible noise became a programme of reasonable entertainment value.

The circuit also operated satisfactorily on other interference, such as from motor car ignition systems, although precise measurements were not made.

On occasions bursts of interference have been observed on which the circuit has not been effective. Whilst it was not possible at the time to take oscillograms, it was presumed that this particular noise consisted of pulses of much longer duration, and, hence, the high-class filter and pulse re-shaping circuits were not able to operate satisfactorily. Fortunately this form of interference was found to be comparatively rare.

Conclusion.—It is believed that this method of reducing the effect of impulse noise in amplitude modulation receivers represents a new approach to the problem. It will be seen that the only restriction imposed on the noise amplitude is that it shall be large enough to operate the pulse-

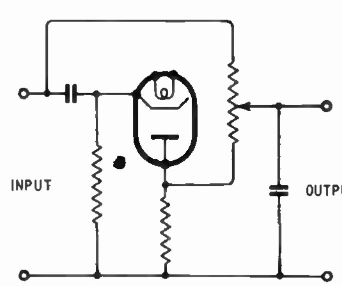


Fig. 7. A practical arrangement of Fig. 5.

shaping circuit correctly. No restriction exists on the ratio of the amplitudes of the noise pulse and the incoming signal.

In a recent article, Nicholson[2] suggests that frequency modulation offers little advantage over amplitude modulation if the two systems are compared under similar operating conditions. He himself describes a new noise limiter by means of which an amplitude modulation receiver may be made superior to one for frequency modulation in its ability to discriminate against impulse noise. The circuits described here achieve a similar object and will normally entail the use of less additional components in the receiver. It is probable that the overall cost of an amplitude modulation receiver, incorporating these circuits, would be less than that of the equivalent frequency modulation receiver.

[2] "Comparison of Amplitude and Frequency Modulation," M. G. Nicholson, *Wireless Engineer*, July 1947.

ELECTRONIC CIRCUITRY

Selections from a Designer's Notebook

By J. McG. SOWERBY (*Cinema Television, Ltd.*)

Some Notes on Phase Splitters

PHASE splitters are widely used in audio amplifiers and were treated in some detail in this journal[1] some time ago. The notes that follow are merely disconnected jottings on a few points which, although not original, may be of interest to some readers.

One of the most widely used phase splitters is known as the "concertina" and is shown in Fig. 1(a). In this circuit a triode, V, has equal anode and cathode loads and these are effectively in series. Consequently, any signal current in the valve passes through both resistors and so equal output signal voltages are obtained at anode and cathode. The arrangement gives a gain of little less than one (usually about 0.9) between input and either output. It has the advantage that the balance of the output voltages depends only on the maintenance of equality of anode and cathode resistors. At (a) the bias for the valve is determined by R_b which is small compared with R_k. Consequently the cathode of V is positive to earth by anything up to 100 or more volts. This being so it seems logical to couple the grid of V directly to the previous anode as shown at (b), then the cathode potential of V will be very nearly the same as the anode potential of the previous stage. Besides saving three components the coupling eliminates any phase shift at low frequencies and this is often advantageous if V is within a feedback loop, as in Mr. Williamson's amplifier[2]. To a sufficiently close approximation the current in V can be taken as $i_a = V_a/R$ where V_a is the anode potential of the previous stage. The anode-cathode voltage of V is nearly $V_{ak} = (V_b - 2V_a)$ where V_b is the supply h.t. potential. From this we see that it is reasonable to design for $V_a = V_b/3$ or less. Even so, it is wise to ensure from the valve curves that no grid current flows in V even when V_a is 30% more than the design figure, making due allowance for the resultant reduction of V_{ak}. This arises because some variation in V_a is to be expected with time and with valve replacement.

Fig. 2(a) shows a cathode-coupled phase splitter in which the usual positive bias is supplied from a fixed potentiometer across the h.t. supply. A more economical arrangement is shown at (b using fewer components, in which the positive bias is the anode potential V_a of the previous stage. Both grids are obviously maintained at the same standing potential, but the signal is applied only to the grid of V, as the

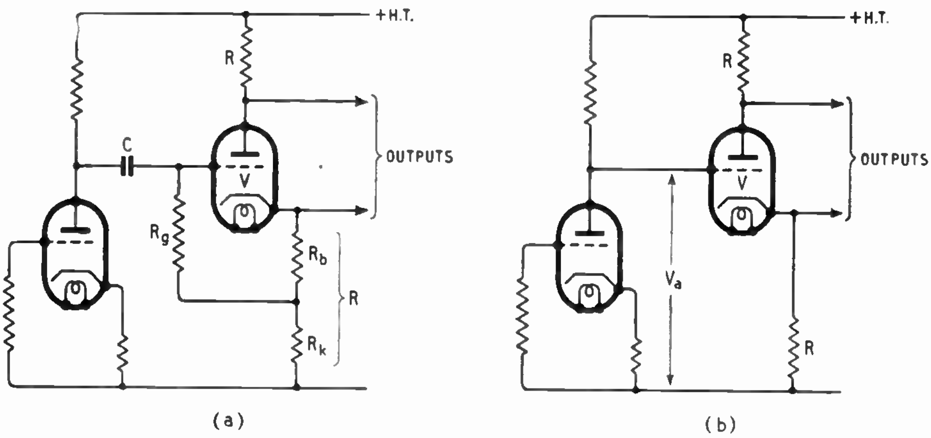


Fig. 1. "Concertina" phase splitter: (a) a.c. coupled, (b) direct coupled.

[1] W. T. Cocking. *Wireless World*. Jan., Feb., March, April and May, 1948.

[2] D. T. N Williamson. *Wireless World*. Aug. 1949, p. 282.

Electronic Circuitry—

"smoothing" circuit CR prevents the signal reaching the grid of V_2. Similar time constants are used in the two circuits, and at medium and high frequencies the performances are identical. At very low frequencies, however, CR in circuit (a) merely leads to attenuation of both outputs, whereas (b) reverts to a push-push output of low gain as the frequency approaches zero, because the grids of V_1 and V_2 both follow the anode potential of the previous stage, and are in phase with one another.

may have undesirable results on subsequent stages.

In designing the circuit of Fig. 2(b) the anode current of V_1 or V_2 may be taken to be $V_a/2R_c$ and the anode-cathode potential of each valve will be $V_{ak} = V_b - V_a(1 + R_a/2R_c)$ nearly. Previous remarks concerning grid current in the circuit of Fig. 1(b) apply here too.

Some designers are disinclined to use the "concertina" and cathode-coupled circuits as both involve operating the cathode of a valve at a considerable potential to earth. A commonly used

necessary to make R_{a1} less than R_{a2} to obtain equality of output *voltages*. On analysis it turns out that

$$R_{a1} = R_{a2}\left[1 - \frac{r_a + R_{a2} + 2R(1 + r_a/R_{a2})}{r_a + R_{a2} + (\mu + 1)R}\right]$$

where μ = amplification factor, r_a = a.c. resistance, of either valve, for equal signal output voltages.

In practice it is convenient to

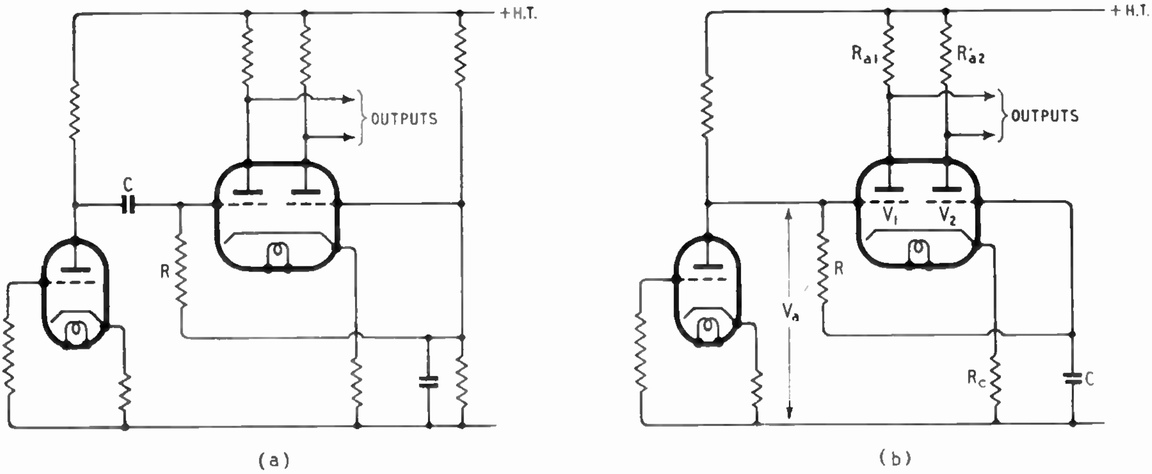


Fig. 2. Cathode-coupled phase splitter with two types of coupling.

An advantage of circuit (b) compared with (a) is that a large value of C can easily be used—say $2\mu F$ or more. Such condensers are usually of the paper-block-in-metal-can type and if used in the circuit at (a) may lead to loss at high frequencies due to the additional stray capacitance at the grid of V_1. One such condenser measured by the writer recently had a condenser-can capacitance of more than 100 pF, and if such a condenser is fixed to an earthed metal chassis and used as a coupling condenser in (a), that 100 pF will appear between the grid of V_1 and earth. In the circuit at (b) this condenser-can capacitance will only add to C, and so be slightly beneficial.

The circuit of Fig. 2(b) has a disadvantage inasmuch as variations in the h.t. supply potential may lead to a large push-push output from the splitter, and this

alternative is the "see-saw" circuit. Another circuit which might be regarded as a combination of the cathode-coupled and see-saw arrangements if available, however, and is shown in Fig. 3. It will be remembered that the cathode-coupled circuit of Fig. 2 tends to maintain equality of signal currents in the two valves, and that exact equality is approached as R_c is increased, eventually becoming exact when R_c is infinite. The circuit of Fig. 3 behaves in exactly the same way, provided that we substitute R for the R_c of Fig. 2. However, in this case there must always be some signal voltage across R (to operate the grid of V_2) and this signal will be in phase with that obtained from the anode of V_1. Consequently, however large R may be made to achieve equality of signal *currents* in V_1 and V_2, it will always be

make R_k the common bias resistance for the two valves; this largely controls the direct current through the two valves and hence through R. Next, R is made as large as possible having due regard for the voltage drop across it. R_{a2} is then fixed, and R_{a1} calculated. The time constant $C_1 R_{g1}$ is calculated as for a normal amplifier stage, and it is preferable to make $C_2 R_{g2}$ several times larger than $C_1 R_{g1}$ to maintain a phase displacement of 180° between the output signals at low frequencies.

The gain from input to either output (when R_{a1} is properly chosen by means of the preceding equation) is

$$A = \frac{\mu R_{a1}}{r_a + R_{a1} + \dfrac{R_{a2} - R_{a1}}{R_{a2} + R}R}$$

Substitution of practical values indicates that this circuit yields a gain approaching twice that for the ordinary cathode—coupled circuit of Fig. 2 when $R_c = R$, and the other constants are the same in both circuits. In this respect the splitter of Fig. 3 is more like the see-saw from which a correspondingly increased gain can also be obtained, and it also suffers from the disadvantage that any disturbances on the h.t. line are fed preferentially to one grid, so that the arrangement should be used only with a well-smoothed supply.

In using the circuit of Fig. 3 and see-saw circuits one point needs watching. A common bias resistor is quite in order as long as it is bypassed. If it is not, then as there is feedback from both anodes to one grid, and feedback from one valve to the other via the cathode resistor, an unfortunate accidental combination of stray capacitances may easily turn either circuit into a cathode-coupled multivibrator[3] at high frequencies. A relatively small cathode bypass capacitor will stop this trouble completely, but may also lead to a non-uniform frequency response. By using a capacitor of more usual value—10 to 100 μF—these faults are

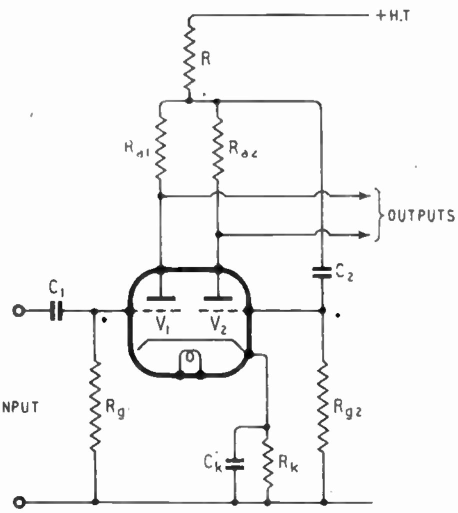


Fig. 3. Common-anode-coupled phase splitter. Typical values: V_1, V_2, = 6SN7, $R_{g1} = R_{g2} = 1M\Omega$, $R_k = 1.8k\Omega$, $R = 39k\Omega$, $R_{a1} = 80k\Omega$, $R_{a2} = 100k\Omega$, $C_1 = 0.05 \mu F$, $C_2 = 0.25\mu F$, $C_k = 20\text{-}50\mu F$, h.t. = 350V. Gain (input to one output) = 17 (approx.).

both removed. If this is omitted and "multivibration" takes place, the amplitude may be quite low and of quite high frequency—100 kc/s or more—and so difficult to find except with an oscilloscope, of low input capacitance, or a high-impedance valve voltmeter.

[3] "Electronic Circuitry," *Wireless World*, July, 1948, p. 249.

this varies the leakage field used for focusing. Unequal adjustment to the screws tilts the core tube and so moves the picture on the tube and provides a shift control.

Because focus and shift are carried out by the same three screws the two are interdependent but, in practice, the adjustment is by no means difficult. The focus obtainable on a test was as good as with an electro-magnet and is free from "warming-up" drift. It is not, of course, free from any change brought about by variations of the tube e.h.t. supply. The magnet has a much larger external field than the usual electro-magnet and it may be necessary to take this into account if valves are mounted very close to it.

There are three types of magnet; the R17 at 21s for tetrode tubes, the R20 at 22s 6d for triodes at medium e.h.t. voltages and the R25 at 25s for triodes operating at high voltages. The makers are Electro Acoustic Industries, Ltd., Stamford Works, Broad Lane, Tottenham, N.15.

Portable Radio-Amplifier

DESIGNED for use in small factories, schools, etc., the "Hadley" portable radio-amplifier is housed in a metal case 18in × 9in × 9in and provides facilities for relaying radio programmes, gramophone records and microphone announcements.

"Hadley" portable radio-amplifier.

There is a choice of four pre-selected radio programmes, and both radio and gramophone are automatically cut off when the microphone is switched on. A self-contained oscillator provides a push-button-controlled tone for time signals or fire alarms.

A small built-in loudspeaker unit with independent volume control is provided for monitoring.

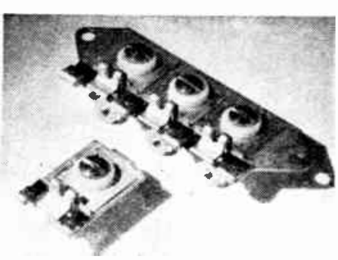
The power output is 20 watts and the mains consumption is 120 watts at 200-250 V, 50-60 c/s. The price, including tax, is £52 7s 9d and the makers are Hadley Sound Equipment, 587-9, Bearwood Road, Smethwick, Birmingham, 17.

NEW PRODUCTS

Mica Trimmers

THE new "M" type trimmer introduced by the Plessey Company, Ilford, Essex, is of particularly robust construction and very stable in operation. The construction of the multiple units simplifies mounting and permits economy in space where a common earth is acceptable. Single capacitors are also available.

Best quality mica, with a power factor of approximately 10×10^{-4} measured at 1 Mc/s, is used and the insulation resistance is greater than 1,000 MΩ at 500 V d.c. Capacitance range is 5-65 pF.



Single and multiple units of the Plessey "M" type trimmer.

P.M. Focus Unit

THE Elac permanent magnet focusing unit replaces the commonly used electro-magnet for focusing the electron beam of a cathode-ray tube. It comprises a ring-type permanent magnet with fixed end cheeks and an inner core tube which is adjustable by three screws. Equal adjustments to the screws move the core tube along the axis and so vary the air gap between the tube and the front end cheek. In its turn

DECEMBER — MONTH OF GOOD CHEER

And why not? We are cheered by the knowledge that our products will bring pleasure to crowds of good people, the world over, and that is cheery compensation for our 20 years concentration on the design and production of Quality Equipment—not purely for the money, but for the sheer fun of producing something better.

May we also wish a Merry Christmas to all fellow enthusiasts?

TONEMASTER AMPLIFIER

R-N-W PICK-UP

DX PLUS 2 RADIO UNIT

CONCERT GRAND—SUPER LOUDSPEAKER

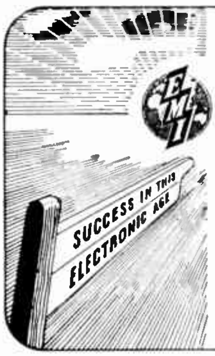
They are sound by name and nature—uplifting in quality.

Write for details of our latest ideas—better still call at

OUR NEW OFFICE and SHOWROOM

125, OXFORD STREET, LONDON, W.1. GERRARD 8782

Sound Sales Limited



PLAN YOUR CAREER

RADIO · TELEVISION and other INDUSTRIAL ELECTRONIC subjects

ELEMENTARY & ADVANCED COURSES

WRITE FOR FREE BOOKLET summarising careers available in Electronics and giving particulars of Courses offered by E.M.I. Institutes.

The booklet contains full details of elementary and advanced HOME STUDY and DAYTIME courses in Radio, Television, Telecommunications and Industrial Electronics.

Courses ideal for those seeking recognised qualifications are also available.

Payment for tuition can be made in easy instalments if required.

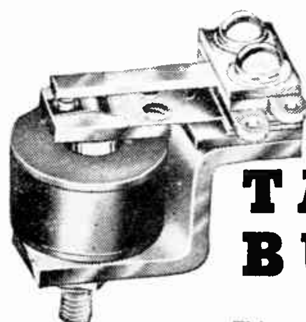
Write to Dept. 16A

E.M.I. INSTITUTES

43, GROVE PARK ROAD, LONDON, W.4. CHIswick 4417/8

Associated with "H.M.V." MARCONIPHONE COLUMBIA ETC.

E.147



THE TAYLOR BUZZER

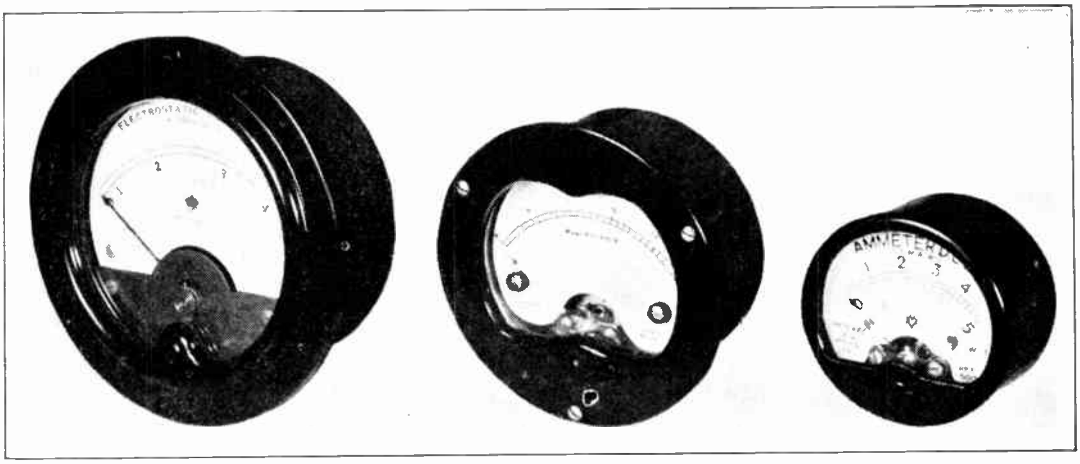
This small buzzer has a number of applications, such as continuity testing, a signal for telephones and communication circuits, or as a source of interrupted supply for bridge circuits.

It operates at approximately 500 cycles per second, and the consumption at 3 volts is very approximately 100 mA. Also it will operate satisfactorily from 4 volts A.C. 50 cycles.

TAYLOR ELECTRICAL INSTRUMENTS LTD

419-424 MONTROSE AVENUE, SLOUGH, BUCKS, ENGLAND

Telephone SLOUGH 21381 (4 lines) Grams & Cables TAYLINS, SLOUGH



POINTER INSTRUMENTS

Types for Test Gear

By E. H. W. BANNER,
M.Sc., M.I.E.E., F.Inst.P.

INDICATING instruments of the pointer type are commonly incorporated in test gear, using the term widely to cover valve voltmeters, oscillators, bridges, attenuation meters, Q meters, output meters, etc. They are included for one of two purposes; they may provide the final means of indication, as in valve voltmeters, Q meters, etc., or they may be merely a means to an end such as assisting the correct setting of voltage and current in oscillators, bridges, etc. In the former case a larger size is normally required than in the second, where several instruments may be needed, all ancillary to the final measurement or other output.

Specifications for indicating instruments include B.S.89:1937 (now under revision).—This covers chiefly performance, but also includes desirable constructional and other features. Dimensions are not covered in it, but an inter-Service Specification, K113, is largely complementary, and gives dimensions for overall size and fixings. This renders instruments interchangeable as regards mounting, while leaving individual designers free to modify the movement design as required.

An inter-Service Specification for hermetically-sealed instruments for use in all climates from tropical to arctic is in preparation and has been circulated in draft form. Instrument sizes include 2, 2½ and 3½in, all in metal cases for flush mounting.

Tests specified include a full 84-day tropical cycle, involving dry and wet heat, dust, water immersion, mould growth, etc. Vibration and bumping tests are prescribed, as are many details of design and construction.

Another inter-Service specification dealing with equipment under extreme physical conditions is K.114, "Climatic and Durability Testing of Service Telecommunication Equipment."

The sizes in most demand for test gear are the so-called miniature series. These started with the 2½in (a nominal size), which is a compromise between small size and length of scale. The latter is just sufficient for a reading accuracy of 1 per cent of full-scale deflection near full scale. Next came variations up and down; a 3½in type which gives a better reading accuracy, as well as enhanced scale visibility, and a 2in pattern. This has a lower reading accuracy and so is hardly good enough for first-grade accuracy, but it is of great application where small size is of more importance than accuracy. During the 1939-45 war Lipman, of Nalder Bros. and Thompson, Ltd., produced a sub-miniature design in which the permanent magnet is inside the moving coil, and only a small iron ring surrounds it. This is a 1½in instrument, and is extremely useful where minimum size and weight are the most important features and accuracy is second. Finally, an extension in the upward direction is the 4in, which really overlaps the former switchboard range of instruments, but is in a moulded case instead of metal as are most larger switchboard instruments. All these are round-pattern instruments, usually available for mounting either flush or projecting, flush being most common; the 4in may be in a square case or have a square flange on a round body, the latter also applying to the 2in.

In addition to the above sizes to K113 another maker has for years supplied a nominal 2½in instrument which is larger than the K113 dimensions, but which has the advantages of a longer scale—2½in—more room inside for additional ranges and higher self-contained ranges. It is even

Typical instruments of the 2in to 3½in types are illustrated above.

Pointer Instruments—

possible to include an internal range-changing switch.

Shapes, other than round and square, include a sector 2½in, projecting; and edgewise, horizontal and vertical mounting, flush. None of these is covered by K 113, but each has applications. Sector instruments have longer scale length for given area of instrument front than a corresponding round type. For minimum panel space, therefore, the edgewise pattern scores, but it has the limitation that it is necessary to use a smaller scale arc to avoid parallax.

The 4in type is not covered by any Specification. In some makes, however, it comprises a square flange, containing the pointer and dial, with a round body mounted flush in a hole which is standard for the 3½in flush pattern. In this way it partly complies with K 113, and its mounting is interchangeable, except that the panel space is greater, which leads to wider spacing for adjacent instruments. The projecting pattern 2in and 2½in sizes are also manufactured with a two-pin plug for socket mounting, which makes their rapid removal and changing easy. Illumination is provided in some instruments on the market. Generally, the lamp is external, with a window in the instrument case, and for ease of renewal this is preferable to an internal lamp. The 4in flange instrument mentioned above may be of this type, with a translucent dial.

For an instrument such as a valve voltmeter, where the instrument dial is the only part of real interest to the user, the 4in, or the 3½in, are the two best sizes, for they give maximum scale length and reading accuracy. Many of these instruments are so mounted in output meters, Q meters, X-ray monitors, etc.

Moving-coil Meters

The moving-coil type is nearly universal for direct-current measurements, but for high-voltage ranges the electrostatic voltmeter is often preferable, especially as it requires no current, and so has, in effect, infinite ohms-per-volt resistivity. Shunted moving-coil instruments usually have a volt drop of 75 mV, in accordance with B.S. 89, but this is not necessarily the case for low ranges with internal shunts. As voltmeters, resistivities of 200 and 1,000 ohms per volt are common, with 5- and 1-mA movements respectively, but as microammeters down to 5μA full scale are made by some firms, they may be made into voltmeters with resistivities up to 200 kilohms per volt.

Where mains voltage or current is to be measured, the moving-iron type of movement is the best, but it is not made in all the sizes and shapes given above. Minimum ranges for miniature instruments are about 1 A and 10 V; below these ranges rectifier instruments are available down to a few microamps and 1.5 V, but the limitations, referred to later, should be noted. Also available with the moving-iron movement for mains use is the induction type, miniature sizes of 2½ and 4in being available in round-pattern cases. The great advantage of this type is, of course, the long scale arc of about 330°, which provides a scale length of 5in in the 2½in instrument.

Marconi Instruments H.F. Circuit Magnification Meter using a square-face instrument for its built-in valve voltmeter.

For very high voltages the electrostatic type is again often to be preferred as for d.c.; it has a lower bulk than any electromagnetic type with its associated resistor or transformer. The current consumption of the electrostatic voltmeter on a.c. is also very small, depending on the capacitance, and this current is wattless.

At audio frequencies the rectifier instrument is supreme, with its wide frequency range up to about 100 kc/s. Rectifiers are being developed for the Mc/s range, apart from the use of crystal rectifiers for h.f. circuits. Ranges of microamps and milliamps are directly available and higher ranges by current transformers. Thermal instruments may also be used, with the advantage of independence of waveform, but their lack of robustness restricts their use when rectifier instruments will serve.

High Frequencies

At high frequencies the thermal types have the field, with a very high upper frequency limit. They are nearly equally accurate on direct current, and completely independent of waveform, reading the true r.m.s. value. The thermocouple type is better than the old hot-wire type, although more expensive. Generally ranges from 10 or 20 mA upwards are available. All thermal instruments suffer from a lack of robustness due to the low overload capacity, as the working wire is heated to a temperature approaching its melting point at full-scale deflection.

There is a tendency on the part of many engineers to specify and use rectifier instruments for all a.c. circuits. But as already mentioned, moving-iron instruments are better for normal ranges at power frequency, partly because of the lower cost, but mainly because the rectifier instrument reads the mean value of the rectified current and as r.m.s value is normally required, and the instrument is so calibrated, there is a waveform error which may be quite serious, although frequently overlooked. Further, the rectifier has an effect on the a.c. circuit, when the circuit is a low-power one, due to the resistance of the instrument varying with current and not remaining constant as for other types. At low currents the resistance, or impedance, is many times that at full-scale current. On the other hand, the advantages include the good damping and snappiness of response of the moving-coil instrument, and lower consumption and lower minimum ranges than for other a.c. instruments. Most instruments of this type have a self-contained metal rectifier, either copper-oxide or selenium, but any moving-coil instrument may have an external rectifier. This is of use for the 1½in instrument, where there is no room inside the very small case for a rectifier.

Other factors to consider in specifying a suitable instrument include whether the panel on which it is to be used is ferrous or non-ferrous. Most miniature instruments are in moulded cases and have no internal shielding, so that there is a tendency to stray field error. This may be shown up by a steel panel, hence the need for having an instrument calibrated on a panel similar to that on which it is to be used. Electrostatic voltmeters may be similarly affected by electrostatic fields and a metal panel, not only a ferrous panel, will act as a screen and may affect the readings if it is not taken into account in the calibration. It may also be affected by local high-voltage fields.

Scales and scale marking require much care to ensure maximum legibility and to give all necessary information, while excluding extraneous matters of no interest to the user. B.S.89 lays down scale proportions, relative lengths of scale marks, etc. Scale factors of 2 and 5 are recommended as a compromise between the minimum number of ranges to overlap and the maximum per cent scale reading for any numerical quantity. A scale factor of 3 is not recommended, although it has applications to cell-testers

It is generally desirable to indicate on the scale the type of the instrument, or its range of measurement. A linearly scaled instrument marked "Milliamperes" and scaled 0-10 may be either moving-coil or rectifier, and so should be unmistakably marked which. Such an instrument could either be scaled "Milliamperes D.C." (or A.C.) or else a symbol showing d.c. or a.c. used, or the symbol for a rectifier instrument added, preferably both, as an a.c. ammeter may be moving-iron or rectifier and not always readily distinguishable by its scale shape. Symbols for this have been proposed for international use and have been adopted in some countries, and by some makers here, for many years. Their general employment is to be commended.

RECORDS UNDER THE MICROSCOPE

Microphotography as an Aid to Research

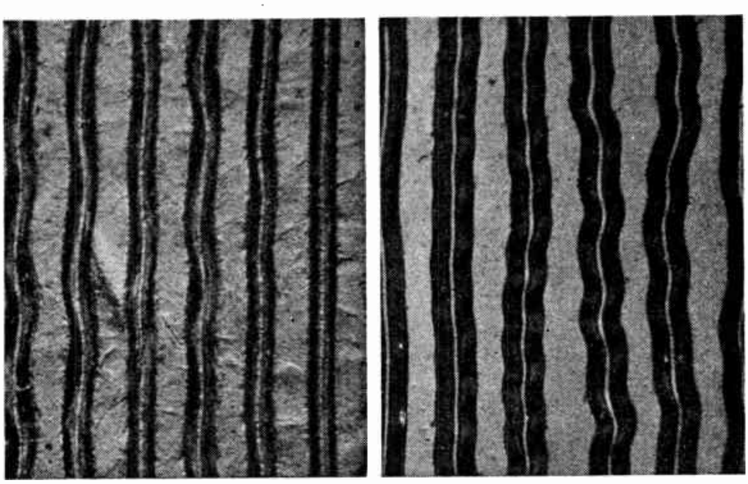
At a meeting of the British Sound Recording Association, on 21st October, C. E. Watts described the apparatus he uses to obtain the very instructive microphotographs of record grooves, cutters and styli for which he has acquired a well-deserved reputation.

By the use of polarized light and careful adjustment of the angle of incidence, it is possible to bring into relief any effects which may require prolonged and detailed examination; for example the angle of ejection of swarf from the cutter, its subsequent spontaneous expansion and the reasons for the generation of subsidiary shavings. Similarly, the walls of the groove can be examined for signs of wear, and the lines of contact (if any) between the needle tip and the groove walls during playback can be traced.

Mr. Watts has also devised a means of viewing the contact between stylus and groove under actual playing conditions, and he has stated that on loud passages "daylight" could be seen at these points for most of the time, even with the lightest of modern lightweight pickups. The only arrangement showing any semblance of continuous contact consisted of a fragment of sapphire broken from the extreme tip of a stylus and cemented to a segment of watch hair spring.

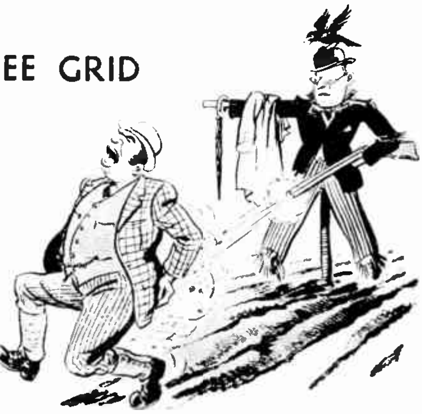
The surprising thing was that the lack of continuous contact did not seem to have any detectable effect on the quality of even the best recordings, as judged by critical and experienced listeners. It came as something of a shock to many of these people to be shown the movement of the stylus relative to the groove after having praised the quality of a recording. Was it possible that the quality of modern disc recordings is better than the ear can appreciate.

That such a question should ever arise was in itself a tribute to the value of microphotographic methods in recording research, and provided the stimulus for continued investigation along these lines.



Two untouched microphotographs by C. E. Watts illustrating 50 years' progress in disc recording. On the left is an early Berliner pressing (circa 1899) and on the right a modern (1949) pressing.

Unbiased
By FREE GRID



Painfully Peppered

On Exhibitions

COMPARISONS are said to be odious but are none the less useful on that account, and in any case who am I to discard what great men like Attlee and Churchill both freely use? The comparison which I wish to draw is between the running of Radiolympia and two other exhibitions which happened to have their doors open at the same time as the wireless show. I refer, of course, to the exhibition of the Royal Photographic Society and to the Motor Show.

Now both these exhibitions, which I studied in some detail, fell lamentably short of Radiolympia in two opposite directions. In the case of the photographic exhibition there was on show the results given by the apparatus which the photographic industry makes and sells, but no attempt was made to show the apparatus itself. In the case of the Motor Show the apparatus was exhibited but results in the shape of free rides for all were singularly lacking. At Radiolympia, on the other hand, not only was the apparatus exhibited, but the results obtainable from it were demonstrated for all to see or hear, as the case may be.

It is true that in the case of the photographic show no sordid charge was made for admission but we were all invited to disclose our identity by signing the visitors book and a somewhat expensive catalogue was brought to our notice by the presiding goddess. Fortunately, I had Mrs. Free Grid with me and she quickly dealt with the goddess and took entire charge of the proceedings rather too thoroughly, in fact, as I was quickly piloted past photographs belonging to the "September Morn" school of art.

Quickly Piloted.

My object in going to the Motor Show, apart from comparing it with Radiolympia, was to choose a car for a grandson who is expected to enter this world shortly. My daughter and son-in-law have journeyed specially to the land of dollars for the event so that he will be entitled to American citizenship. On his arrival in this country with his parents, who will, of course, retain their British nationality, he will be able to have immediate delivery of as many new cars as he pays for provided that he makes no attempt to sell them. I, as one of his duly appointed chauffeurs, will have the use of one of them. The idea is Mrs. Free Grid's, but I cannot help feeling that there is a snag in it somewhere.

At any rate, after all this it was with a great sense of relief that I arrived at the well-organized and racket-free radio show in which both apparatus and the results they gave were freely exhibited, and the former freely sold to all without subterfuge.

Applied Science

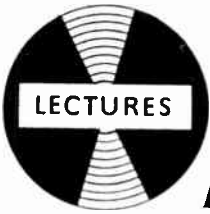
ACCORDING to one of the more sober Sunday newspapers experiments are being made at one of our great airports to find a remedy for the danger caused by the collision of large birds with aircraft, which constitutes a very real menace. Apparently the trouble is particularly prevalent and exceptionally dangerous when aircraft are hurtling down the runway to take off or land.

A certain amount of success appears to have been had by taking advantage of the fact that birds, like dogs and certain other animals, can readily hear frequencies which are supersonic to human ears. Supersonic sounds, if I may use such a contradictory expression, are, therefore, generated which scare the birds without annoying the passengers. I cannot, however, see why a bird should be scared of a 20,000 c/s note and yet remain stolid and phlegmatic at hearing the appalling roar of the aircraft's engines, but doubtless my ignorance of ornithological psychology accounts for this. Unfortunately, the supersonic frequencies are disliked by dogs who set up a mournful howling which reminds superstitious passengers of banshees and causes those awaiting the departure of their planes to hurriedly cancel their passages.

Personally, I should have thought that the problem could have been solved by using simple radar beams which on striking the birds rebounded and thereby operated a series of shotguns suitably mounted in the nose of the plane and I offer this suggestion, without charge, to the harassed authorities. Doubtless they can improve upon it; but I do know what I am talking about as some time ago I was called into consultation by a farmer who was troubled with marauding birds. They treated the ordinary scarecrows with contempt and did the same even when loudspeakers, concealed in the clothing of each scarecrow and coupled to an outsize in amplifiers housed in a nearby barn bellowed forth the B.B.C. Third Programme.

I quickly designed a series of radar scarecrows which were triggered off by the approach of intrepid and insolent birds, and in their turn triggered off a concealed shotgun. Unfortunately, the radar apparatus was no respecter or discriminator of persons and the farmer was well and painfully peppered one day when he approached too near one of them.

I offered to design for him and members of his staff a special I.F.F. unit which they could carry on their persons, the idea of this being that when a beam from a scarecrow struck them it caused an answering signal to be sent out which temporarily short-circuited the gun-operating mechanism. However, he was not long-sighted enough after the accidental peppering incident to proceed with the idea even though I pointed out to him that the radar scarecrow would deal impartially with either trespassers or birds.



If they are worth hearing . . . they are worth recording!

Simple to operate and readily portable, the E.M.I. Portable Disc Recorder enables brilliant " on the spot " recordings to be made of outstanding events. Produced by E.M.I. technicians with 50 years' experience in recording, this new E.M.I. Portable Recorder is a remarkable technical achievement. Here in transportable form is a complete recording and play-back equipment designed to produce high quality recordings on lacquer blanks without demanding expert knowledge of recording technique. Operation is extremely easy and the equipment which is contained in three transportable cases needs 200/250 volts 50 cycles A.C. mains supply or a Car Battery and converter. Facilities for play-back and for sound amplification form an integral part of the Recorder. **RECORDING BLANKS:** EMIDISC Recording Blanks are ready for playback immediately after cutting. They are available in the following sizes—6", 10", 12", 16". **PROCESS BLANKS**—enabling the recording to be pressed in quantity, by E.M.I., are obtainable for 11", 12", 13", 17½" recordings.

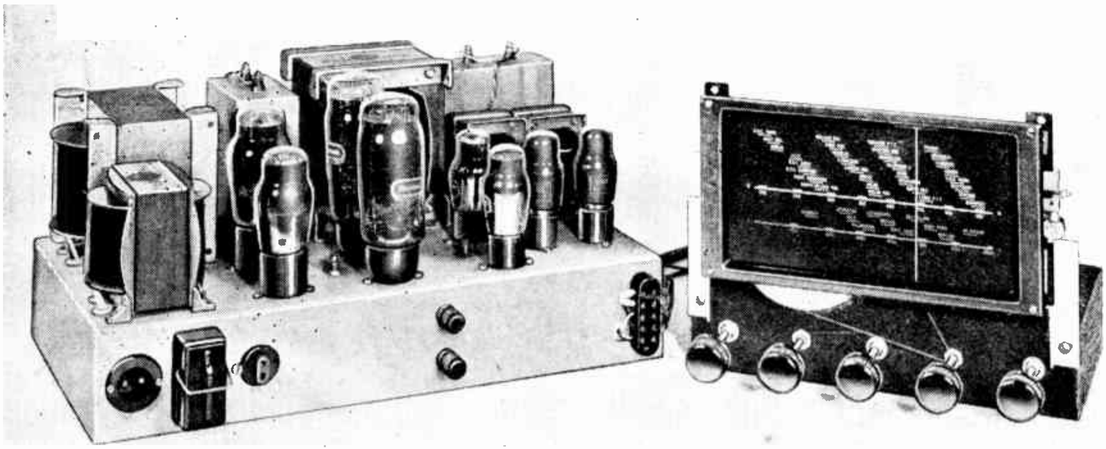
MICROPHONES: Alternative types of microphones are available. **Model 2350** on a heavy chrome stand (detachable). **Model 2351** with hooks, equally adaptable for suspension, mounting on a boom or floor stand.

A descriptive leaflet giving full details of Model 2300, extra Microphones and Recording Blanks is available on request.

E.M.I. PORTABLE RECORDER No. 2300

E.M.I. SALES & SERVICE LTD. HEAD OFFICE: HAYES, MIDDX.

S.S.7



GOODSELL

HI-FIDELITY AMPLIFIERS

As described by D. T. N. Williamson in "Wireless World."

ALSO HI-FIDELITY TUNERS & PRE-AMPLIFIERS

PRICES

Amplifiers .. .. from	£19 19 0	No Tax
Pre-Amplifiers .. from	£8 0 0	No Tax
Tuners with Pre-Amplifiers	£10 10 0	Plus Tax

Send for free illustrated brochure.

Manufactured by **GOODSELL LTD., 40, GARDNER ST., BRIGHTON, SUSSEX** *'Phone : 6735*

£EARN MORE

FREE BOOKLET

giving details of home study and daytime courses:—

HOME STUDY

- Practical Radio Receiver Servicing
- Basic Radio } for R.T.E.B.—
- Basic Television } "The practical man's diploma"

DAYTIME

- Principles and Practice of Radio—1 year
- Telecom. Engineering—2 years
- Electronics Engineering—3 years (*including 1 year in E.M.I. Factories*)

★ *The value of E.M.I. Institutes correspondence courses is known the world over—large numbers of our students come from such widely scattered lands as India, Pakistan, Palestine, Ceylon and Europe.*

Write to Dept. 16

E.M.I. INSTITUTES

43, GROVE PARK ROAD, LONDON, W.4 CHIswick 4417/8

Associated with "H.M.V." MARCONIPHONE COLUMBIA ETC.

E.148B

BAKERS 'Selhurst' RADIO

PIONEERS OF MOVING COIL SPEAKERS SINCE 1925

NEW IMPROVED 1950 MODELS

HIGH FIDELITY SPEAKERS

The World Famous 12" triple cone 12.B.

The standard 12" P.A. model 12.C.

The Cinema Model 18" "Duplex" C.T.

Write for illustrated list and technical details of SPEAKERS, TUNERS and AMPLIFIERS.

BAKERS 'SELHURST' RADIO
Dingwall Road, Croydon
Telephone · CROydon 2271/2

THIS and THAT

"End-of-Term" Relaxation

By "CATHODE RAY"

BECAUSE it would have left the 1949 volume with its shirt hanging out, the Editor ruled against beginning my two-part treatise on filters in this December issue. And it may not be such a bad thing anyway; two big helpings of smoothing circuits followed without a break by a similar dose of filters might upset even hardened technical digestions. Something a bit lighter sandwiched between may be all to the good. Even Shakespeare admitted the need for comic relief.

Some time ago a correspondent made an extremely penetrating observation. He argued against the present G.P.O. practice of demanding a separate licence for car radio sets, not because it was an act of social injustice against the new poor, but (as he explained) on strictly technical grounds. By compelling the thrifty motorist to install his aerial under the running board or in some such inconspicuous part of the vehicle, it made mobile reception even worse than it need be. One more example, it would seem, of car design being influenced by the tax-gatherer rather than by the engineer.

Sudden De-licencing

Talking about licences, have you realized that if you (or anyone else) charged for people to come into your house, say for the purpose of getting a good view of a procession from the upstairs windows, your wireless licence, even if you had bought it only yesterday, would forthwith expire? I confess I didn't until I took the unusual step of reading it. This is what it says: "M. Cathode Ray" (or words to that effect) "is hereby authorized . . . for a period *ending on the date mentioned above or on any earlier date on which a charge for admission to the premises shall be made by the Licensee or any other person*, to install and work apparatus for wireless telegraphy in the premises occupied by the Licensee . . . . " There is nothing to limit this sudden de-licencing to situations where the mercenary activities of the Licensee have anything to do with "wireless telegraphy."

By the way, I suppose that to the legal mind it appears quite fitting to refer to the process that permits us to view our undeniably attractive television announcers as "wireless telegraphy." It reminds me of the enactment authorizing the closing of roads in the Isle of Man for the T.T. races, in which these thrilling events were defined as "the testing of light locomotives."

Such uses of words are quaint old legal customs at which we can smile tolerantly. But I don't feel at all the same about those commercial interests who, either from sheer ignorance or deliberately, try to make an impression on the gullible public by misusing scientific terms as names for their wares. With their high-pressure publicity they sometimes succeed in getting their counterfeit meanings into general circulation first, so that when the genuine article comes on the scene it is mistaken for an imposter. You know the sort of thing—somebody is not satisfied with selling suppressor resistors at the usual one and sixpence, so he calls them cyclotrons or isotherms and charges half-a-crown.

I see it is eleven years since I commented on the mentality of those who started the absurd habit—now thoroughly established—of classifying receivers into two kinds, television and radio. When a thing reaches a certain pitch of absurdity it becomes impossible to caricature it. So I pass on.

People say "What's the use of protesting about sloppy technical language? You can never change it once it's got a hold." But once upon a time the idea of substituting the new word "resistor" for the universally-used "resistance" seemed quite hopeless; yet it has been done. And "capacitor" is well on the way. There is still more justification for finding and putting into use a word to distinguish broadcast receivers and programmes without vision from those with.

Now that the radio industry has grown up there is much less about it to make fun of than when it was an adolescent. That is why I have of late years been driven to writing so much about solemn things like smoothing circuits and filters. However, there is one thing that makes me rock with mirth every time. It is the thought that several times every day, year in, year out, millions of the ever-patient British public grind away uncomplaining at their tuning controls to change from Light to Home and Home to Light, when all they need do is to push a switch, if they had the spirit to demand it. It isn't even as if sets were so scarce that they were under the counter and the customer was always wrong. There is a buyer's market. But the buyer doesn't seem to have noticed it.

Words and Music

Having from time to time chided the B.B.C. in these columns for maintaining approximately the same depth of modulation for announcements as for brass bands, mighty Wurlitzers, and massive orchestras, I was rather taken aback by published complaints from listeners to the effect that if the volume control was set right for speech, music was too loud. These complaints arose particularly during the summer, as an excuse for turning up the volume control to the discomfiture of the neighbours.

The only explanation that occurs to me is that while music continues to be generally regarded

THIS and THAT—

as something that must be allowed to go on, but not so loudly as to interfere with conversation, there are now many owners of receivers who have ceased to consider spoken broadcasts in that light and insist on actually listening to the words, presumably in the hope (analogous to that of football pool addicts) that some time, some day, someone in a variety programme may say something really funny. A contributory cause may well be that as a result of the popular demand for "mellow" tone, (in pre-war days, when buyers could and did demand), speech can't be followed unless turned well up. If it were not that it would send up the purchase tax too much, and might interfere with export, manufacturers could incorporate a device for automatically cutting bass during speech and cutting top and most of the volume during music. The trouble would be that the B.B.C. is so seldom content to let us have them separately, so that the device would be in the same sort of dilemma as the chameleon who found himself on a tartan.

While on the subject of colour, my feeling is that though Hallows may wish to increase the number of frames per second in order to prevent things from looking as if they were leaning over when they flash across the television screen, my impression is that viewers couldn't care less. You may remember that focal-plane camera shutters were a success *because* they did that, making racing cars look as if they really were racing. Television, I think, is at the stage that . . . *teleaudition*, shall we call it? went through when theorists were insisting on the necessity for frequency characteristics level within a few per cent over the whole audible range, and whose efforts were received with such indifference by the listening public. Apart from a clear picture and a rather larger screen than they can get for the money, the only thing the viewing public know that they want is colour.

Well, if Hallows was (as he said) trailing his coat, I may almost be said to have been trailing several bags marked "Fully-fashioned Nylons." But next month, noses to the grindstone once more! Filters . . . .

NEW BOOKS

International Radio Tube Encyclopædia. Edited by Bernard B. Babani. Pp. 410+lxxxiv. Bernards, Ltd., The Grampians, Western Gate, London, W.6. Price 42s.

THIS voluminous compilation of data on some 15,000 valves of many different countries starts off with four pages in English which explain the tabular matter contained in the body of the book. The following 80 pages repeat this in various languages—French, Italian, Spanish, Portuguese, German, Dutch, Swedish, Norwegian, Danish, Russian, Polish, Czech, Turkish and Hebrew.

The main tables cover receiving and transmitting valves, thyratrons, regulator and control valves, tuning indicators, c.r. tubes and photo-electric tubes.

Valves are arranged in numerical and alphabetical order of their type numbers, and in the case of receiving valves the information given comprises: type of cathode, class of valve, filament current and volts, anode and screen volts and currents, grid bias, cathode-bias resistor, a.c. resistance, g_m, μ, load resistance, power output, base connections and the makers' name.

British, American and Continental types are included as well as many British and American Service types.

The base connections are given with the valve characteristics, and drawings of the bases themselves are included at the end. Standard base designations are not always used. The B8B is not mentioned but the B8G and loctal, which are interchangeable with it, are given. The American UX bases are not so called but are given various unfamiliar names, such as US4E, US4N, USM4, USM7B, etc.

The book should be extremely useful to anyone who requires to find out the characteristics of a given valve, but does not meet the inverse requirement of indicating what valves have given characteristics.

W. T. C.

Permanent Magnets. By F. G. Spreadbury, A.M.Inst.B.E. pp. 280+viii. Sir Isaac Pitman & Sons, Ltd., Parker Street, London, W.C.2. Price 35s.

AS the author points out in his preface, permanent magnetism has been known for about 2,500 years, but only since 1910 has there been marked progress in the subject. Since then it has been so rapid that few have been able to keep up with it; yet permanent magnets are used on such a large scale for so many purposes that the need for a comprehensive and up-to-date book on the subject has become acute. The present work fills this need admirably.

Its substantial size it not due to a diffuse style—quite the contrary, for it is notably concise—but to its comprehensiveness. It is, moreover exceptionally self-contained, as the author has not followed the common practice of putting the onus on the reader of looking up innumerable references.

The chapter headings are: 1, Magnetism and the Permanent Magnet; 2, Permanent-Magnet Materials; 3, Theory of Magnetism; 4, Magnetic Leakage; 5, Applications of Permanent Magnets; 6, Magnet Design; 7, Magnetic Measurements and Measuring Instruments; 8, Magnetization and Magnetizers; and 9, Demagnetization and Demagnetizers. There is, unfortunately, no reference to the rationalized m.k.s. system of units, c.g.s. units being used throughout. The author does not shirk mathematical proofs of his statements, including some that even the most sceptical might be prepared to take as read. In the last two chapters, particularly, all the factors involved are painstakingly investigated, and are illustrated by some examples of the author's design. Readers who may find some of the mathematics rather beyond them, or who are prepared to take the author's word for the findings, should have no difficulty in picking out what they want. Those who have not kept in close touch with the theoretical physics of magnetism will be fascinated by the account of some of the attempts, such as the Stern-Gerlach experiments, to solve the mysteries of permanent magnetism.

The practical problems of design, and especially those resulting from magnetic leakage, are clearly such as to call for specialized study and experience; but all radio engineers should be acquainted with them if only to know what it is reasonable to expect of the magnet designer. This book is an excellent reference for the purpose.

Though the price is perhaps rather high, it can be said that the standard of the book-production is on the same level.

M. G. S.

LETTERS TO THE EDITOR

Interference with Foreign Broadcasts ♦ Cathode-ray Tube Limitations ♦ Tone Control Circuits ♦ Record Reproduction ♦ Spoiling New Records

Beacon Interference

MAY I add my astonished censure to "Mikcrobe's" letter in your November issue on the subject of m.f. beacons in the broadcast band?

I say "astonished" as up until I saw "Mikcrobe's" letter I hadn't the faintest notion what caused the interference and had vaguely attributed it to something quite illegitimate and "on the Continent." The idea that it emanated from authorities in this country didn't enter my head.

If you will permit me to say so, I cannot recall having seen this matter raised before in either the correspondence columns or the editorial of *Wireless World*, a fact (if true) which causes me considerable surprise.

With regard to the Wireless Telegraphy Act: does this provide for interference with foreign stations? When I asked the Post Office to investigate some particularly bad electrical interference (before the Act), the engineers ascertained the fact that the Home and Light carriers over-rode the interference, and left saying that proper reception of foreign stations was no concern of theirs.

C. E. KNIGHT-CLARKE.
London, S.W.19.

C.R. Limitations

IN reports on the performance of amplifiers the phrase "no distortion was visible on the screen of an oscilloscope" often occurs.

Many readers may have wondered what this statement really means, for there appears to be little published information on the minimum percentage of harmonic distortion which is visible by means of a c.r.o.

The results of rough tests to obtain some guidance on this point are given below:—

Harmonic	Minimum % visible
2nd	9%
3rd	4¾%
4th	3½%
5th	1¼%

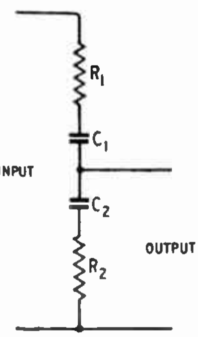
These figures are probably rather low, as instantaneous comparison between the pure and distorted waveforms was available. They refer only to the addition of one harmonic to the fundamental.

It would appear from these results that sometimes more faith than is justifiable is placed in the c.r.o. as an indicator of distortion.

E. W. ROYSTON.
Flixton, Manchester.

Tone Control Circuits

IN the article on a High-Quality Amplifier in your October issue, D. T. N. Williamson describes a tone control circuit to provide continually variable treble and bass rise and fall. Whilst the circuit shown will operate quite satisfactorily at the extremes of control settings, the slope of the rise and fall is by no means ideal at other settings of the controls.



Referring to the basic potentiometer circuit for bass control, Mr. Williamson short-circuits C_1 and applies a variable resistance in parallel with C_2 to provide variable bass boost. This arrangement controls the *extent* of the boost and does not affect the frequency at which it commences, nor its initial slope. At a low setting it will merely cause a step in the response curve.

Practical tests which we carried out in the development of similar circuits showed that a control which varies the *slope* of boost is very much to be preferred. Assuming the source impedance can be neglected and the ratio of the reactance of C_1 to R_1 is the same as C_2 to R_2, then a variable resistance in parallel with C_1 will shift the curve bodily along the frequency axis. If this is coupled with a variable resistance in parallel with C_2, then a close approach to a variable slope control can be obtained over the essential range.

Letters to the Editor—

If R_1 is ten times R_2, then a good compromise can be obtained with a single logarithmic control for rise and fall with level response in the centre of the movement. Close-tolerance components are essential if kinks in the response are to be avoided.

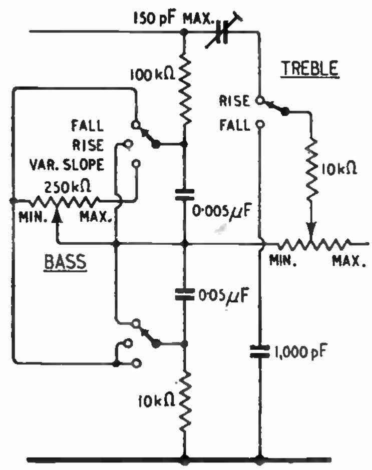
Similar modifications to the treble control can be introduced, although for high frequencies a variable *extent* of rise and fall is usually more desirable.

Tone control should be applied with the greatest discretion, but a small amount of "compensation" correctly shaped can on occasions prove beneficial. The scale, perspective, or apparent distance of the programme is controlled at the studio and is (or should be) correct for average listening-room level. Variations from this optimum volume level will require only small correction for good balance, always assuming, of course, that the remainder of the equipment does not suffer from deficiencies.

P. J. WALKER.
The Acoustical Manufacturing Co.,
Huntingdon.

The Author replies:—Mr. Walker's letter raises the interesting but vexed question of the most suitable type of bass accentuation. I feel that the answer to this question must depend upon individual circumstances, and that there is no unique solution.

Circumstances can be visualized where the "variable slope" method preferred by Mr. Walker would be distinctly advantageous, but, equally, there are occasions on which raising the general level below, say, 200 c/s can produce more pleasing results. Where the control is to be used solely for the correction of transmission defects, a third type of characteristic, namely, a constant slope of, say, 6 db/octave, the cross-over frequency of which is variable, has much to recommend it. This type of characteristic is used for the treble control. Unfortunately, at low frequencies there is danger of overloading when a characteristic of this type is used for purposes other than the correction of deficiencies of the input.



Where circumstances warrant it, the circuit of Fig. 5 may readily be adapted, as shown in the accompanying figure, to incorporate the type of control recommended by Mr. Walker.

D. T. N. WILLIAMSON.
Edinburgh.

Record Reproduction

IN his article on "Pickup Design" Mr. Marshall rightly suggests that needle scratch is caused more by the rough composition of the material than by an abrasive put in the material by the manufacturer, as has been most popularly supposed in the past.

I should like, however, to draw attention to three points which appear to be somewhat misleading. In his reference to Fig. 4 (a) Mr. Marshall states that the groove is cut with a chisel-shaped edge and that as far as a spherical reproducing point is concerned will vary in width throughout the cycle. He then goes on to say "this is descriptively known as the 'pinch effect'; so that where the stylus is too small, over at least part of the cycle the stylus will lose contact with the groove walls." This latter remark may be true, but it cannot accurately be described as "pinch effect." The groove width varies when modulated, but although it can be smaller it will not usually be larger than the recording stylus size, even with maximum amplitude. "Pinch effect" is the inability of a reproducing stylus of normal dimensions correctly to trace this smaller groove width, causing a riding up of the stylus on the groove walls. A reproducing stylus of optimum dimensions will not be too small, but it may be subject to this "pinch effect."

My second point concerns Fig. 3, where Mr. Marshall says "It will be seen that point B . . . . will only just fit this particular groove . . . ." In fact, it will be seen that point B does not fit the groove, but rides on the bottom, a condition almost as bad as that shown in Fig. 3 (c). Most modern records of British manufacture have a groove width of 0.0067in, a radius of 0.0015 to 0.0018in, an angle of between 85 and 90 degrees, and a depth of 0.0027in. It will usually be found that a reproducing point with a radius of 0.0025 to 0.003in will satisfactorily trace both old and new records.

Third, radius compensation is rarely, if ever, resorted to in commercial gramophone records in this country, although most 33⅓ r.p.m. transcription records use it to a greater or lesser degree. Amplitudes in the higher end of the frequency scale are so small that a "boost" in recording of, say, 6db at 10,000 c/s can be tolerated, but the "boost" of between 15 and 30db, which is so often found in American recordings, can be the cause of considerable distortion.

RICHARD W. LOWDEN.
Farnborough, Hants.

Spoiling New Records

IN view of the high quality (and cost!) of the modern gramophone record it is very galling to find that a new disc has been ruined by demonstration on obsolete reproducers such as are still to be found in many shops. I know of one, 1934 vintage, the needle of which is changed once a day, with luck!

Might I suggest to the makers that they put a proper seal on the envelopes so that one may be sure of a record in mint condition?

Returnable demonstration records would fill the gap until good reproducers are installed.

J. E. ELLIS.
Harrow, Middx.

"High-voltage Measurements"

I HAVE read with interest the article in the October *Wireless World* describing a peak voltmeter.

It may be of interest to know that the Osram U37 valve could be used with advantage in the circuit. It gives:

1. Instantaneous operation with a possibility of push-button control, due to its directly heated filament.
2. The possibility of using only one dry cell for filament heating.

F. E. HENDERSON.
The General Electric Co.,
London, W.C.2.

"Q and L" Measurements

IN saying that my statement "Frequency is the most accurately-measurable quantity there is" was misleading in relation to the measurement of Q, W. T. Cocking (your November issue) has taken it out of its context. It occurred in a section devoted to the meaning and measurement of Q at such high frequencies that L and C are not separately measurable. So it was not quite the right text on which to hang his very instructive sermon on

OUR COVER

The acoustic characteristics of the anti-echo loudspeaker testing chamber at Plessey's, which is illustrated on our front cover, are comparable with those of free air. This erstwhile air-raid shelter has been lined with wedge-shaped blocks of sound insulating material to render it almost completely non-reflective. The free space area of the chamber is 12ft x 9ft x 6ft 9in.

the advantages of the capacitance-detuning method!

As regards even the general truth of the statement there can hardly be any question, for the accuracy with which frequency is known is several orders of magnitude better than that of any other quantity used in radio measurements. The G.P.O. reckon they have it within ± 1 in 10^8, but what is more remarkable in its way is that any owner of a broadcast receiver has at his disposal one audio-frequency and several radio-frequency standards accurate to ± 1 in 10^6. With quite cheap apparatus and a good deal of patience, these can be interpolated over the whole useful range of frequency in a positive manner—cheap, that is to say, when compared with the cost of a standard variable capacitance one thousand times less accurate.

For frequencies at which capacitance is measurable at all, I entirely agree with Mr. Cocking about the greater convenience of the apparatus for the capacitance-detuning method. But unless one cheats by buying two accurately calibrated variables, one of them reliable within 0.1 pF, how does one get these calibrations? Surely by a method based on known frequencies! The thing I dislike about capacitance measurements is the uncertainty of the absolute value, especially when there are several items in parallel, including a self-capacitance; and at the frequency of 40 Mc/s referred to by Mr. Cocking the errors due to distributed reactances and the necessary auxiliary measurements of L and C_0 are usually regrettably large.

Mr. Cocking goes rather out of his way to make the frequency method look worse than it is. Anybody with the sense to use a separate low-reading capacitor for measuring ΔC would hardly make the elementary blunder of trying to read Δf on the same frequency scale as f_r! His point, of course, is that one might have to, for lack of the elaborate apparatus he describes. There are, however, reasonable methods of obtaining a known Δf without any crystals or anything at all more elaborate than a fixed audio frequency that has been set to a multiple of the B.B.C.'s standard 440 c/s broadcast daily. The horrid example of what would happen if one were to measure Δf as the difference between two nearly equal frequencies with errors of $+1\%$ and -1% respectively is as unrealistic as measuring the height of a man by taking the difference between two independent measurements of height above sea level.

Incidentally, in view of Mr. Cocking's basis of distinction between Q-meters (direct-reading) and Q-measuring methods (which arrive at Q by calculation), it may be necessary for me to repeat that most so-called Q-meters do not give true Q without subsequent calculation. The practical significance of true Q having been called into question,* a main point of my article was to reinstate it. Nobody appears to have questioned the reinstatement.

"CATHODE RAY."

* *Wireless World*, June, 1949, p. 216.

MANUFACTURERS' LITERATURE

FOLDER (Y13, printed in three languages), describing "Solon" electric soldering irons, from W. T. Henley's Telegraph Works Co., 51 and 53, Hatton Garden, London, E.C.1.

Leaflet (CL534), giving details of "Tom Thumb" service replacement electrolytic capacitors, from A. H. Hunt, Bendon Valley, Garratt Lane, London, S.W.18.

Illustrated leaflets describing "Volmar" electric gramophones and record players, made by Industrial Sound Equipment and sold by the General and Overseas Trading Corporation, 6, Duke Street, London, S.W.1.

Catalogue of data sheets relating to the Type 103 cathode-ray oscilloscope made by Nagard, Ltd., 245, Brixton Road, London, S.W.9.

Catalogue (D) of "Eclipse" permanent magnets from James Neill & Co., Napier Street, Sheffield, 11.

Details of Record "Major" insulation tester (500 V, range 0-50 MΩ) from the Record Electrical Co., Broadheath, Altrincham, Cheshire.

Illustrated leaflet (No. 40), dealing with the new range of precision-ground ceramic radio coil formers, from Steatite & Porcelain Products, Stourport-on-Severn, Worcs.

Brochure describing television aerial service and new aerial types, from Validus Aerials, 69, Hornsey Road, N.7.

RANDOM RADIATIONS

By "DIALLIST"

Capacitors as Dry Cells

YOU REMEMBER my recording a while ago instances of misbehaviour on the part of old paper-dielectric capacitors, which had so far forgotten their mission in life as to turn into dry cells, each with a definite polarity and terminal potential differences of from 0.1 to 0.4 volts? Several readers who have examined their stocks of old capacitors confirm that this kind of thing is by no means uncommon. In some instances capacitors tested with valve voltmeters with an input resistance of 20-50 MΩ have shown p.ds as high as 3 volts. That these arise from genuine e.m.fs and are not just static charges is proved by the fact they have a definite polarity and that they persist even after repeated short-circuitings of the terminals. I suggested, you may recall, that a capacitor mistaking its vocation in this way might give rise to some queer effects in a receiving set. A kind Irish reader sends me a record of one that did. In a t.r.f. battery set the manual volume control worked by varying the bias on the grid of the r.f. valve. Reception had become very weak and the v.c. was out of action; examination showed that its sliding contact had broken off. Tests disclosed a steady bias of 2V negative on the control grid—a surprising state of affairs, since the grid had apparently no d.c. connection to anything. Between the bottom end of the grid coil and the earthed chassis was a 0.5 μF paper capacitor. Due to the breakdown of the volume control it, too, was able to apply to the grid the whole of the 2V e.m.f. which it was found to be generating; and that was sufficient to reduce the set, with its pretty well worn out valves, almost to silence.

Ingenious!

Another reader offers an explanation of the e.m.fs from old capacitors recorded by the valve voltmeter which is at any rate highly ingenious. In capacitors of old types, he writes, there is usually quite appreciable inductance. This, with the capacitance, would form a resonant circuit. The leads to the meter act as an aerial; oscillations at, or in the neighbourhood of the resonant frequency are picked up, a voltage appears across the circuit and is duly registered by the valve voltmeter. This e.m.f. varies from capacitor to capacitor because differences in their inductance and capacitance may sometimes produce a circuit resonating at a frequency quite close to that picked up by the meter leads and at other times one which is more or less "off tune" . . . . Ingenious, as I've said; but I'm afraid it won't work. Any capacitor, you see, which behaves in this way is invariably found to have a definite and fixed polarity; like a dry cell, it has its positive and negative terminals. If the resonant circuit explanation were correct, the meter reading would not be affected if the capacitor connections were reversed.

It Doesn't Make Things Easy

WHAT A PITY it is that there can't be some kind of international uniformity in the use of the symbols—letters, figures, punctuation marks, lines, and so on—by means of which authors put their ideas on to paper and readers endeavour to discover what they are trying to convey. One is always coming across instances of the difficulties created—quite unnecessarily—by the lack of a single world-wide system in these things. When, for example, we express in figures two thousand six-hundred and eighty-three point four seven we write 2,683.47; but in many other countries it appears as 2.683,47, the point and the comma having exchanged roles. A trillion with us is 10^{18}; elsewhere it may be 10^{12}—it certainly is in France and I *think* in the United States. Our practice seems the more logical, for our *tri*llion is the third power of a million; a *quad*rillion, the fourth power, and so on. One of the most annoying bits of perversity I've come across is the habit at which at any rate some French publications have of turning the symbols for cell or battery upside down. I used to think that the use of a longish thin line for the positive end and of a short fat one for the negative end really was universal. The other day, though, I could not see from a circuit diagram in a French publication how a gadget containing two batteries could possibly work—until I realized that the short fat lines were there the positive ends of the batteries and the longer thin lines the negative.

Radio Roundabout

FROM A MEDICAL READER comes a query about alleged effects of wireless waves on pigeons. It was solemnly stated, I gather, by someone at a meeting of medicos that carrier pigeons released near a certain transmitting aerial circle round it indefinitely when a particular wavelength is in use. He asks whether the report is fact or fiction. I have no hesitation in plumping for the latter. Tales of this kind are continually cropping up and, to the best of my knowledge, investigations have always shown them to be pure bunk. Carrier pigeons invariably circle when released, gaining height as they do so. It is some little time before they get their bearings and make a bee- (or pigeon-) line for home. Release a basketful near any high aerial mast and the odds are that they'll probably circle round it for a while. That, possibly, was the "proof" given to the lay journalist who wrote the original story. Experiments have been made in America with a view to discovering whether e.m. radiations of certain frequencies could have any effect on birds. The scale of the experiments was too small to be conclusive, but no definite or sustained effects were recorded. Actually, when you come to think of it, experiments of the same kind are conducting themselves on a vast scale on every day of the year in this country. Pigeon flying is a popular hobby, especially in the North. Enormous streams of migrant birds of many kinds pass into, through, and out of Britain. At any moment there must be radio, radar and television aerials radiating on wavelengths of every order from centimetres to kilometres. Nobody to my knowledge has ever observed birds of any kind circling willy-nilly round any of these aerials.

The Practical Aspect

My correspondent wonders whether, if the story were true, the pigeons would fly always either right-about or left-about. I wonder, too! Presumably, those which were the subject of the alleged report described their circles in the horizontal plane. The radiations would most likely be vertically polarized. A really convincing demonstration could have been arranged by providing a change-over switch and an aerial for horizontal polarization as well. Flicking over the switch should then have caused the birds to describe circles in the vertical plane—which would have been well worth seeing!

Some Television Station!

By the time that these notes are printed the Sutton Coldfield television station is sure to have started test transmission, if it is to be ready (as doubtless it will be) for the opening ceremony on December 17th. I expect to hear of good reception at quite considerable distances at places on high ground. As the output power is just over twice that of the Alexandra Palace station, one would expect the service area to have a radius nearly one-and-a-half times as great in any event. I believe, though, that this radius may well turn out to be the best part of 60 miles in most directions. The station is well sited and some of the "fringe-area" receiving aerials now available are remarkably good performers. And I'm betting that soon after the station comes into action there'll be reports of consistently good reception at points 100 miles or even more away. Sutton Coldfield is a station for whose existence the country in general and the B.B.C. in particular may well feel that pats on the back are deserved. It is by far the most powerful television station in the world and I doubt whether there are many others anywhere which can as justly claim a vision modulation range of 2.75 Mc/s without appreciable amplitude—or phase—distortion. It's a fine Christmas present to Birmingham and the Midlands.

RECENT INVENTIONS

A Selection of the More Interesting Radio Developments

C - R Tubes

FOR producing a high-intensity electron beam one method is to heat a thermionic cathode by electronic bombardment; thereby high temperature operation may be secured while maintaining a long operating life, as well as other advantages. However, it is difficult to avoid disturbing effects due to secondary electrons resulting from the bombardment. These difficulties are avoided by the fact that bombardment is only effected periodically during the operating cycle by making the cathode periodically positive relatively to the source of bombarding electrons; for television or oscilloscope use the bombardment is effected during the flyback intervals of a scanning process.

In a practical circuit a filament heater surrounds the cathode proper and the latter is coupled through a diode to a transformer energized from a time-base generator and arranged to make the cathode positive to the heater during the flyback, and thus effect the bombardment heating of the cathode during the same period.

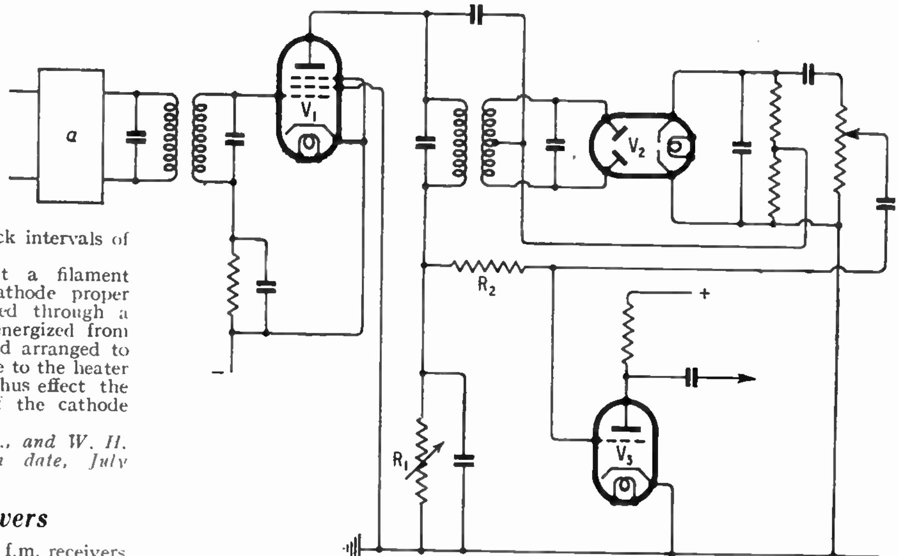
Cinema-Television, Ltd., and W. H. Buchanan. Application date, July 10th, 1947. No. 624,832.

F.M. Receivers

THE accurate tuning of f.m. receivers is difficult because there is usually an increased response on each side of the correct position. To avoid this difficulty the amplitude limiter provides a muting voltage which is operative when the receiver is detuned from the signal.

In the circuit diagram *a* represents the i.f. amplifier, the output of which is fed to an amplitude limiter V1, and thence to the detector, e.g., the twin diodes V2. Negative voltage is applied to the grid and cathode of V1, the screen of which is earthed. V3 is an a.f. amplifier, which is fed from the diodes V2. The anode current of V1 is a maximum for zero signal and decreases as the f.m. signal amplitude increases, due to grid rectification. This current produces a voltage across R1 which is fed to the grid of V3 through R2 to mute the a.f. circuits. At the correct tuning point, however, the anode current of V1 is so small that muting is ineffective and the receiver gives normal a.f. output.

Marconi's Wireless Telegraph Co., Ltd. (assignees of A. Wright). Convention date (U.S.A.), November 6th, 1945. No. 625,449.



Muting circuit for f.m. tuning.

Chassis Construction

IN unit chassis construction, e.g., for i.f. amplifiers and for other sections of apparatus using thermionic valves, difficulties are sometimes met with when using valves having a base grid terminal. The construction described divides the valveholder between adjacent units. An i.f. unit might comprise a screening box having that part of the i.f. valveholder carrying all except the grid and anode terminals, the i.f. transformer and the part of the holder of the following valve containing the grid and cathode terminals. The holder parts match with other parts to form complete holders, when the units are assembled.

Philips Lamps, Ltd. (Convention date (Netherlands), September 14th, 1943. No. 626,142.

The British Abstracts published here are prepared with the permission of the Controller of H.M. Stationery Office, from specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2/- each.

RADIO SPARES

MAINS TRANSFORMER
Potted—fully shrouded and impregnated, fitted primary screen. 280-0-280 at 150 mA., 6.3 v. at 10 amp. and 5 v. at 3 amp. Primary suitable for 50-cycle mains, 110-250 v., 27/6.

MAINS TRANSFORMER
Half-shrouded drop-through type, 350-0-350 at 80 mA., 6.3 v. at 4 amp., 5 v. at 3 amp., primary tapped for 200-240, fitted primary screen and impregnated, 16/6.

MAINS TRANSFORMER
260-0-260 at 60/70 mA., 6.3 v. at 3 amp., 5 v. at 2 amp., otherwise as above, 13/9.

TUNING CONDENSER
Standard size 2-gang, .0005 long (2in. spindle), 3/6.

AMPHENOL INTERNATIONAL
Octal valve holder, 6d. each.

MIDGET TUNING CONDENSER
2-gang, .00035, fitted with trimmers, and complete with perspex dust cover, type used for tuning personal receivers, 6/6, plus 8d. postage.

4-GANG TUNING CONDENSERS
.0005 each section, fitted trimmers —ceramic insulation, 29/6, plus 1/3 postage.

ELECTROLYTIC CONDENSERS

8 mfd. 350 v.	1/6
16 mfd. 350 v.	1/11
32 mfd. 350 v.	1/11
25 × 25 mfd. 200 v.	3/11
8 mfd. 150 v.	1/3
25 mfd. 25 v.	1/-
25 mfd. 50 v.	1/6
50 mfd. 12 v.	10d.
10 mfd. 25 v.	10d.
2 mfd. 450 v.	1/-
4 mfd. 450 v.	1/3
8 mfd. 450 v.	1/11
16 mfd. 450 v.	2/8
8 × 8 mfd. 450 v.	3/4
8 × 16 mfd. 450 v.	3/4
16 × 16 mfd. 450 v.	3/9
16 × 8 × 24 mfd.	4/2
8 mfd. 500 v. BR.850	2/6
16 mfd. 500 v. BR.1650	3/6

P.M. SPEAKERS

Size	With trans.	Less trans.
2½in.		10/6
3½in.		8/6
5in.	11/3	9/3
6½in.	12/6	10/6
8in.	14/6	12/6
10in.	21/6	
12in.		39/6

MOVING COIL METERS
0-1 mA. 2½in., 12/6, 2in., 8/6. 5-0-5 mA. 2½in., 10/6. 0-500 mA. 2½in., 15/-.

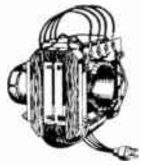
FILAMENT TRANSFORMERS
6.3 v. 2 amp., 6/-.

I.F. TRANSFORMER
465 kc/s, iron cored, 6/9 pr.

OUTPUT TRANSFORMERS
Standard pentode matching midget, 3/6, small, 3/-, standard, 3/3. Push-pull matching, 4/-. Multi-ratio, 4/6.

6½in. ENERGISED SPEAKER
700 ohm. field with output transformer, 'ROLA,' 11/6.

PARTS FOR MAGNETIC T.V.



FRAME AND LINE COIL ASSEMBLY. Perfectly made by a very famous maker, for standard type magnetic tubes, 9in., 10in., 12in. or 15in., we have a limited number only, the price is 16/6, and cannot be repeated once these are cleared, so please act quickly.

PERMANENT MAGNETIC FOCUSING UNITS. No current drain—for all makes of tubes—patented method of adjusting the gap, giving really clean pictures and even focus of whole of the tube free. Price 16/6 each.

P.M. FOCUSING for clear pictures

R.F. E.H.T. Non-Lethal

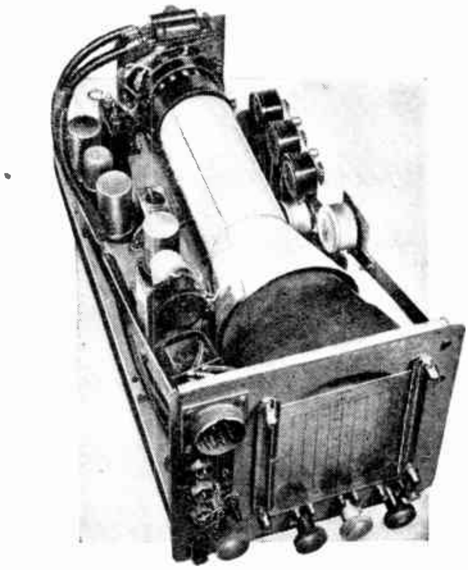
R.F. E.H.T. We were so pleased with the quality of this unit that we have taken up the entire output of the manufacturer, the voltage can be adjusted to make it suitable for working 9in., 12in. or 15in. tubes, the unique design and vacuum impregnation combine to give a trouble-free unit which will give years of satisfactory service, and, of course, the big point about the R.F. E.H.T. is that it is not lethal, the size is only 4½ × 3¾ × 4in., price, complete ready to operate, 65/-.

£16 FOR A MAGNETIC TELEVISOR (and H.P. terms if you wish), this we think you will agree a remarkable low price, even though the tube is not included, but the quality of the picture has not suffered, this was demonstrated to thousands of people at Radiolympia. We will demonstrate to you if you call. Full constructional data for novice or expert, 5/-. Explanatory leaflet free.

MISCELLANEOUS ITEMS

Blocking Osc. Transformer, 6/6. 9ft. dural. tube for aerial, 4/6. .1 mfd. 2.5 kV., 2/6. .1 mfd. 5 kV., 4/9. .02 8 kV., 3/9. .1 7 kV., 13/6. Vision Receiver strip (type 194), 45/-. Varley E.H.T. Transformer, 4 kV., 67/6. 2.5 kV., 27/6. B7G Valve Holder, 1/3. EF50 Valve Holder, 6d. Chokes, 200 mA. 10 henry, 10/-. 200 mA. 3 henry, 6/-. 80 mA. 10 henry, 4/6. 80 ohm. feeder, thin, 10d. per yd.; thick, 8d. per yd. Plastic 8 kV. Sleeving, 3/- doz. yds.

OSCILLOSCOPE PARTS



TYPE 6 INDICATOR. As specified for the "Wireless World" oscilloscope (reprint of data 9d.). Also for the "Inexpensive Televisor" (booklet 1/6), and the Mark I Televisor (constructors envelope, 2/6). These indicators are brand new, packed and sealed in manufacturer's original crates, they contain VCR97 Cathode Ray Tube, 4 EF50 valves, 3 other valves, and hundreds of useful components, including wire wound pots. Price is only £4/10/-, plus carriage and packing, 7/6.

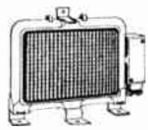
SPECIALS

PARTS FOR PERSONAL RECEIVERS

New ex-W.D. chassis containing three B7G Valve Holders, resistors and other spares with valves type 1S4, and 2 1T4's, 29/6, complete with diagram of a midget receiver. **H.T. BATTERY UNITS**, 15 volts, but measure only 1¾in. × 2¾in. × ¾in., 1/3 each; 10 for 10/-. **L.T. UNITS, 3d.** each; 2/6 dozen. **MIDGET .0005 TUNING CONDENSER, 4/6** each. **MIDGET P.M. SPEAKER, 2½in., 10/6.**

SHORTED TURNS COIL TESTER
You know that it is almost an impossibility to test for shorted turns in I.F. Transformers, Coils, L.T. Transformers, etc., with an ordinary ohmmeter. Our mains operated shorted turns coil tester will reveal these faults in a second. For one month only we are offering these to you at the remarkably low price of £5/10/- each.

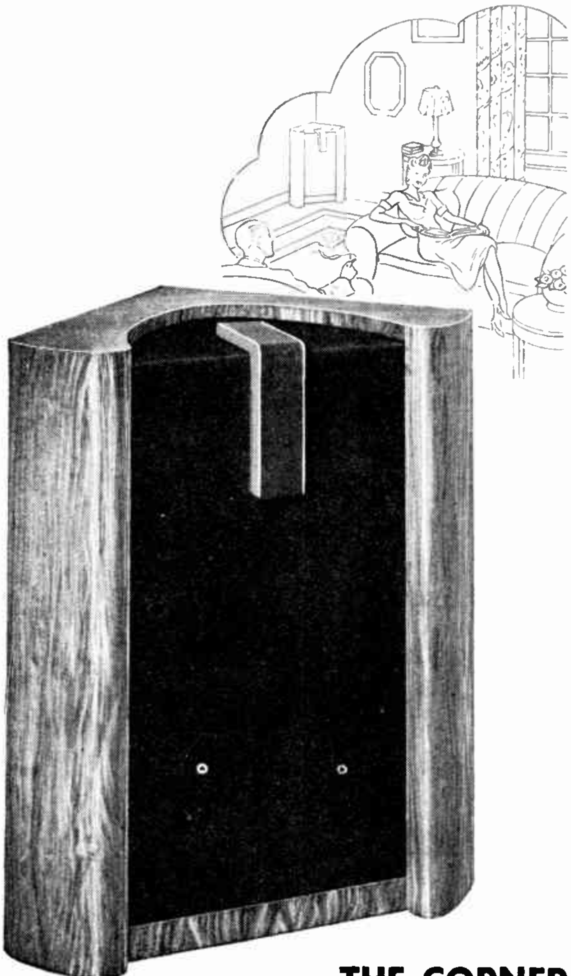
THE "SPEE-DEE" SIGNAL TRACER
A small metal case a few inches square, a flex terminating in a probe, a twin lead for connecting to either A.C. or D.C. mains, no switching, no tuning controls, and there you have the "SPEE-DEE" Signal Tracer. H.F., I.F., or L.F. checks—makes no difference: note frequency change is automatic. The fault is in the no-note stage. Yes, it's as simple as that. Price, with directions, £4, leaflet free.



ELECTRIC HEATERS
Heavy cast framework totally encloses the elements, so these are 100% safe even in confined spaces, just right for your radio den, garage, office, shop, etc. 900 watt (general) model, 19/6, plus 3/6, 250 watt (personal) model keeps legs and body warm for less than a farthing per hour, 23/6, plus 3/6.

HOUSE TELEPHONES
Suitable for intercommunication between offices, workshops, stores, garages, big houses, kitchens, etc. Each station consists of normal size Bakelite handsets and desk or wall mounting cabinet with built-in selector switch, buzzer and push. All stations can communicate with one another independently. Each installation is absolutely complete and internally wired. 3-station installation complete with 50 yards 5-core cable £6/10/-. 4-station installation, complete with 50 yards 6-core cable, £8/10/-. 2-station installation, complete with 25 yards 4-core cable, £3/17/6.

ELECTRONIC **PRECISION EQUIPMENT** (2) ELECTRON HOUSE, Windmill Hill, RUISLIP MANOR, MIDDLESEX



THE CORNER RIBBON LOUDSPEAKER

Details of this loudspeaker and its development are now available and will gladly be sent to you on receipt of a post card. In view of its specialised nature, the Corner Ribbon will not be released for random trade distribution. Enquiries may be placed initially through our normal distributors but subsequent demonstration and supply will be controlled from our laboratory in Huntingdon. Arrangements have been made for private test demonstrations in your own home by our own engineers at very low cost.

Price ex works £83 . 0 . 0

ACOUSTICAL MANUFACTURING CO LTD

HUNTINGDON · HUNTS · TEL: 361

TELEVISION
WITHOUT TEARS

OUR Kit of Parts (down to the last nut and bolt) is proving doubly popular because (a) the price of **£16/19/6** is amazingly low and (b) the explicit nature of our instructions and easy to follow point-to-point wiring diagrams ensures **success for all.** Its most convincing feature, however, is that the conversion of ex-government units is NOT involved.

The Televisor is built from standard radio components and assembled on two chassis, one for the Vision Receiver, Sound Receiver and Time Base, the other for the Power Supplies. It operates on A.C. Mains 200-250 volts.

If price is the primary consideration we can supply the **Complete Kit** for only **£15 0s. 0d.** The valves and C.R.T. are slightly used but guaranteed perfect in this case. The carriage charge on either Kit is 10s.

Price of the comprehensive point-to-point wiring diagrams and 17 pages of data is **5s.** post free. May we urge you to send for these initially. If a Kit is subsequently purchased the 5s. will, of course, be credited. PLEASE SPECIFY LONDON OR SUTTON COLDFIELD WHEN ORDERING THIS DATA.

NOTE THESE ★ FEATURES

★ No knowledge of television technique essential. All parts complete brand new and of the finest quality.

★ All parts may be purchased separately.

★ Rock-steady picture assured because six EF50 valves are used in the Time Base and Synch. Separator.

★ Unique "after-sales" service. Testing and alignment of receivers after completion of assembly undertaken for a nominal sum. WE GUARANTEE RESULTS.

Our Televisor is equal to many commercial models. Why not come along and see a demonstration during viewing hours ?

FURTHER BARGAINS !

Mullard Resistance Capacity Bridge. Absolutely brand new. Measures 10 pf. to 10 mfd. and 0.1 ohms to 10 megohms, A.C. Mains Operation, **£8 19s. 6d.**, carriage paid.

Indicator Unit Type 162. Included in this equipment is a VCR517 6½in. C.R.T., a VCR139A 2¾in. C.R.T., and the following valves: one 807, three SP61, four EA50, one 6J5 and a Klystron CV67. Also, incorporates an 0-1 mA meter and a 24 v. motor. ONLY **£2 2s. 6d.** plus 7s. 6d. carriage. Most wonderful value.

Test Set 73. This unit consists of a special purpose Oscilloscope with a 3½in. tube. Controls are Brightness, X and Y Shift, Focus, Amplifier, In/Out, Velocity, etc. The equipment is contained in a metal case size 19 x 12 x 8½in. and is complete with C.R. tube and all valves. Operates from A.C. Mains 230 v. 50 cycles. Supplied complete with comprehensive instructions for conversion to a standard oscilloscope, together with all the necessary parts for conversion. IN BRAND NEW CONDITION. Remarkable value at ONLY **£7 19s. 6d.** carriage paid.

Receiver R1224. Still going strong ! A 5-valve battery superhet of outstanding performance and sterling quality, the R1224 makes an excellent communications receiver. Valve line-up: two of VP23, one FC2A, one HL2 and a 220PA. Frequency coverage 30-300 metres. Batteries required are H.T. 120 v., G.B. 9 v., and L.T. 2 v. Ideally suited for operation by trawlers and similar craft. May we suggest you submit your order promptly, as stocks are limited. Most reasonably priced at **£4 19s. 6d.**, plus 7s. 6d. carriage and packing. Brand new and complete. Circuit diagram provided.

Receiver Unit Type 71. Will prove of interest to the Amateur. It is part of the TR1143 and tuned to the 124 Mc/s band. Contains eight valves, types; four EF50, two EF39, one EBC33 and one EL32. Numerous small components are included—four I.F. Transformers, etc. In excellent condition and offered at ONLY **19s. 6d.**, plus 3s. carriage and packing.

Amplifier Unit 18/165. A neat and compact equipment incorporating the following valves - two EF36, one EBC33, two EL32, together with microphone transformers, intervalve transformers, countless condensers and resistors, etc. A goldmine for only **19s. 6d.** carriage paid.

Shortage of space prevents us from listing more than a fraction of our tremendous stocks. In addition to "Surplus" items we also stock a comprehensive range of standard radio components, valves, 9in. and 12in. C.R.T.s and all parts for "Viewmaster," "Electronic Engineering," and other popular television kits.

More and more people are turning to us for expert advice and practical guidance. Why not call and discuss your problems with our fully competent technical staff ? A cordial invitation extended to all.

Best Buy at Britain's

CHARLES BRITAIN (Radio) Ltd.

11, UPPER SAINT MARTIN'S LANE, LONDON, W.C.2 TEM 0545

3 minutes from Leicester Square Station (up Cranbourne Street)

Shop Hours: 9-6 p.m. (9-1 p.m. Thursday). Open all day Saturday

UNIVERSITY RADIO, LIMITED

Offer Guaranteed Used Equipment at Attractive Prices

Decca Deccalian, 3 only, in perfect condition and working order. As new £23 10 0
Collaro Microgram, 1948 model. Perfect. As new £11 0 0
Pre-war Columbia Record Changer, in polished table cabinet. In almost new condition £11 0 0
Collaro Record-changer Unit. As new £9 0 0
Collaro Record-changer Unit, bar type. As new, each £12 0 0
Collaro Record-player Unit, centre drive. As new, each ... £6 5 0
Garrard Auto-changer, Model RC65, fitted with Decca FFRR head. As new. AC mains £15 0 0
Garrard Auto-changer, AC/DC, Model RC65/U-16C, in portable case. As new.......... £16 0 0
MSS Recorder Unit, 1948 model (disc). Complete less amplifier. As new, unused. 2 only £35 0 0
German Recording Motor, with heavy 12in. turntable. Perfect £9 0 0
Another of similar make, complete with tracking-gear, less cutting-head. Perfect £12 0 0

Marconi Console Radio, 1939 Model 564, 9 valve, 5 band (floor model). Complete with all valves, in perfect condition and working order £35 0 0
Hallicrafter's SX28A, in perfect condition and working order, 110 to 250 AC £40 0 0
AR88LF, one, as new, in original carton £42 10 0
Another, perfect, less valves.......... £32 10 0
Another, complete at £34 0 0
Eddystone 640, as new, with speaker, at £22 10 0
Hambander, as new £13 0 0
Eddystone 358X, with 8 coils and power-pack, in perfect condition and working order.......... £25 0 0
BC348, converted for AC 200/250 volts. Perfect £14 0 0
MCR-1, complete with power-pack, coils, phones, etc. As new £8 0 0
S.T.C. Ex-W.D. Ball Mikes, 4021C, moving coil, the finest make. Limited number only, each £5 5 0

Avo Model D, Ex-W.D., equivalent to model 40. In perfect condition. As new £8 10 0
E.D.C. Rotary Convertors, 220/240 DC to 230 AC 50 cycles, 1 phase, 120 watts, with Radio Filter Unit £10 10 0
As above, 180 watts £12 10 0
As above, 250 watts £15 0 0
Rotary Convertor, 24 volts DC to 230 AC 300 watts.......... £12 10 0
E.D.C. Rotary Convertor, 230 DC to 230 AC, 50 watts £4 10 0
Presto Portable Disc Recorder and play-back, with built-in amplifier, complete with valves. Ready for immediate use, and in perfect working order £39 10 0
C.D.P. Disc Recording Unit, as new. Latest model, only 3 months old. Cost £39. Our price...... £27 0 0
Vortexion Recording Amplifier, Model AD47, as new. Complete with all valves £28 10 0
Lexington Amplifier, as new, Including pre-amplifier for M/C mike and pick-up. Cost £68. Our price £19 10 0

WE HAVE RECEIVED FURTHER SUPPLIES OF GOODS ADVERTISED IN PREVIOUS ISSUES

VG Tracking-gear, as new, a very fine job £10 10 0
BSR Ampligram, Model AG4. As new £22 0 0
H.M.V. Record-player (1949), table model, with built-in amplifier. As new £15 10 0
Mullard Oscilloscope, in perfect working order. Cost £63 in 1946. A real bargain at £17 10 0
United Electronics 15-watt AC/DC Amplifiers. Brand new, in sprayed metal cases. Moving coil mike and 'gram inputs. Complete with valves. £9 9 0
R.C.A. Amplifier Chassis, 50 watts, complete with valves. Four 6L6's in parallel push-pull. AC 110-volt operating. One only £5 0 0
50-watt Amplifier, in metal case, 3 Mc. mike inputs and 'gram. input, 200/250 AC, complete with all valves. Two 807's in P.P. Built to former owner's specification £10 0 0
12-watt Amplifiers, in wood cases, complete with valves, two 6V6's in P.P., with built-in M/C. mike transformer £4 10 0
Pre-war "Wireless World" quality Amplifier and Radio Unit, in metal case, with separate unit for energising speaker field. Complete with all valves £8 10 0
Pre-war Philco (U.S.A.). 6 valve, 6-volt car radio, complete and in good working order £6 0 0

E.T.A. Wave Coil Winders. Hand wind—can be motorised. Complete with all accessories. As new, each £22 0 0
Taylor Model 20A Circuit Analyser. As new £11 0 0
Labgear Electronic Fault-Tracer, 1948 model. As new... £18 0 0
Another, as above, with outer case slightly soiled, but internally perfect £15 0 0
Taylor 65B Signal Generator. As new £11 0 0
Avo 1948 Model Signal Generator. As new £10 10 0
Avo Model 40. As new.......... £11 10 0
Avo Valve Testers, 1948, with roller panel. As new £11 10 0
Hunt's Capacity and Resistance Bridge, Model CRB. As new £11 0 0
Mullard Cap. and Res. Bridge. As new £6 10 0
Avo Cap. and Res. Bridge. As new £7 0 0
Thrush Cap. and Res. Bridge. As new £7 15 0
Weston AC/DC Multi-range Test Meter, Model E665, 1,000 O.P.V., in perfect condition and working order.......... £6 15 0
Weston All-wave Battery Oscillator, less batteries, with calibration charts. As new...... £6 10 0
G.B. Sound-on-Film Projector, 16 mm., Model L516. Complete in every detail, including large screen, spools, etc. In very good condition and working order. A real bargain at £95 0 0

Lexington Radio Unit. As new £9 0 0
Recording Turntable, 12in. ... £2 0 0
Scott ex-W.D. Communication Receiver, 11 valves, 50 to 100 kc/s, 5 to 9 megs., 9 to 16 megs. Complete with valves. AC 200-250 volts. In perfect working order £16 0 0
Magnavox 66 Speaker, with built-in output transformer, perfect £4 0 0
¼ h.p. Motors, 1 phase, 1248 revs., 220/250 volts AC. Various first-class makes. New, each... £4 10 0
Evershed's Bridge Meggers, 500 volts, with built-in resistance box. Perfect condition ... £15 0 0
Another, as new £20 0 0
Goodmans 15 ohm, 12in. P.M. 20-watt Speaker. As new £5 15 0
Goodmans 12in. P.M. Latest model As new £4 10 0
Goodmans Axiom 12. As new £5 17 6
Goodmans Axiom 22. As new £9 10 0
Hartley-Turner, 1949 model P.M. Speaker. As new.......... £6 0 0
Barker 148A Speaker. As new... £9 10 0
Vitavox 12in. P.M. Speaker. As new £4 0 0
Tannoy 25-watt Amplifier, complete with valves. Two mike inputs. In metal and wood case, AC 200-250 volts. Perfect £10 0 0
B.T.H. RK Senior Speaker. Mains energised. 15 ohm. speech coil. Perfect £3 0 0
National H.R.O. Seniors, complete with 7 coils, power-packs. In perfect condition, some as new. From .... £25 to £29 0 0

THE ABOVE ITEMS ARE ONLY A SMALL SELECTION FROM OUR EXTENSIVE STOCKS

We have other types of equipment arriving daily. We urgently need good used equipment, and will buy for spot cash. Bring, send or phone for offer.

CASH OR CHEQUE WITH ORDERS. ALL ITEMS LISTED ARE CARRIAGE PAID.

22 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2

'Phone GERrard 4447 and 8582. Hours 9 to 6. Thursdays 9 to 1.

CLYDESDALE

Bargains in Ex-Service Radio and Electronic Equipment

RECEIVERS OF THE AN/ARC-S SCR-274-N 'COMMAND' SERIES

The Q. Fiver. R-23/ARC-5, B.C.453, I.F. 85 kcs., 550-190 kcs., 545-1,850 metres, or R-25/ARC-5, B.C.454, I.F. 1415 kcs., 3.0-6.0 mcs., 100-49 metres, or a few only: R-27/ARC-5, B.C.455, I.F. 2830 kcs., 6.0-9.0 mcs., 49-33 metres. Each a 6-valve superhet receiver, with valves: 2/125K7, 12K8, 125F7 or 125K7, 125R7, 12A6. The Receiver is totally enclosed, excepting the dynamotor (not supplied) for 24v. operation. Dimensions 11 x 5¼ x 5in. Complete with circuit. Brand new in maker's cartons, or unused, good condition. Mainly R-23/ARC-5 and BC-453.

CLYDESDALE'S PRICE ONLY. 50/- each. POST PAID

Or used, with case slightly dented, mainly BC-454, at 37/6 each, post paid. Set of Circuits for Command Equipment (SCR-274-H) at 4/6 or BC-453 1/3; BC-454 1/3; BC-455 1/3; BC-946 1/3; post paid.

MEDIUM WAVE CONVERSION COIL ASSEMBLIES.

Cat. No. H67, for 85 kcs. I.F., BC-453. R23/ARC-5, or Cat. No. H68, for 1415 kcs. I.F., BC-454, R-26/ARC-5, or Cat. No. H69, for 2830 kcs. I.F., BC-455, R-27/ARC-5. Each unit comprised, Ae., H.F. and Osc., coils, wound on former 4⅜in. long, maximum diameter 1in. minimum diameter ⅜in., with circuit and data.

CLYDESDALE'S PRICE ONLY. 10/- each POST PAID.

★ STILL AVAILABLE.

★ Units of SCR-522, B.C.624 Receiver Chassis, with valves, etc., plus **free gift** B.C.625 Transmitter Chassis (partly stripped by B.O.T.) at **37/6.**

★ R.1481 V.H.F. Receiver Unit at **99/6.** A.C. Power Unit Type 3 at **79/6**, or both above items at **£8.8.0.**

★ Crystal Multiplier type MI-19468 at **39/6.**

★ R-28/ARC-5 100-150 mcs. Receiver Unit at **37/6.**

★ Bridge Megger 100 megs. at 1,000 v. at **£35.**

★ Wee Megger 20 megs. at 250 v. at **£5 19. 6.**

★ Battery Amplifier A.1368 at **11/6.**

★ SCR-720 Blower, with shunt motor at **17/6.**

★ Reflector Ariel (MX-137/A) at **5/6.**

As previously advertised, price includes carriage.

BC-733-D CRYSTAL CONTROLLED RECEIVER UNIT.

Part of RC-103-A Beam Approach Equipment. Operates on frequencies 108.3, 108.7, 109.1, 109.9 and 110.3 mcs. with suitable crystals (not supplied). Valve line-up:—3/717A, 2/12SG7, 125Q7, 12A6, 12AH7GT, 2/125R7, operates from 14 v. or 28 v. dynamotor (not supplied) complete in black crackle finish metal case, dim:—overall length 14⅝ × 7.3/32 x 5in.

CLYDESDALE'S PRICE ONLY. 30/- each POST PAID

R9/APN-4 RECEIVER UNIT.

Part of the "Loran" equipment, 4 preset frequency positions, three in band 1 (1.6-3.3 mcs.) and one in band 2 (7.6-11.7 mcs.), 15 valves, 4/65K7GT, 65A7, 65N7GT, 6H6, 65L7GT, 65J7GT, 3/GB4, 5U4G, 2/2X2, plus VR105 stabiliser. Slug tuned I.F. Trans. 1.05 mcs. In metal case 9 x 8 x 19½ in. height with 400 cs. power unit which also feeds Ind. Unit.

CLYDESDALE'S PRICE ONLY. 42/- each CARRIAGE PAID

Ideal as **SHORT WAVE CONVERTERS.**
Brand new in maker's carton.
R.F. Unit type 26 for 65-50 mcs., 5-6 metres. Variable tuning 2/VR135 (EF54), VR137 (EC52). Output approx. 7-8 mcs. in metal case 9½ x 7¼ x 4¾in.

CLYDESDALE'S PRICE ONLY. 35/- each POST PAID

HIGH VOLTAGE DYNAMOTOR UNIT PE-73-G.

Input 28 v. D.C., 19 amps.
Output 1,000 volts D.C., .35 amps.
5,000 r.p.m., .35 KVA, 55°C. temperature rise, ½ hour time rating, with Dynamotor Contactor, and suppressed for Radio use. Dim: overall height 10 x 10¾ x 6½in.

CLYDESDALE'S PRICE ONLY 32/6 each CARRIAGE PAID

NOW READY

New Illustrated List No. 6 (152 pages). New applicants please send 6d. to cover distribution cost. Please print name and address.

POWER UNIT 247.

For 230 v., A.C., 50 cycles. Output 600 v. at 200 mA. smoothed D.C. 6.3 v., A.C. 3 A. Complete power pack, with 5U4G rectifier, etc., built on metal tray 10¾ x 9 x 1⅞in. with grey finish metal cover 11 x 9¼ x 7¼in., two chromium handles, red indicator and inspection door, giving access to rectifier and pilot bulb.

CLYDESDALE'S PRICE ONLY. 59/6 each CARRIAGE PAID
with transit box.

CAMERA CONTROL ELECTRICAL.

Type 35, No. 26, ref. 14A/2206. Input 24 volts, D.C. Time Interval selection switch, 2-51 seconds. One pulse per revolution. Exposure counter. Ideally suitable as the basis of an enlarger timer, data and circuit supplied. Also many other timing uses. In metal case 8 x 3¾ x 4in. overall inc. controls. Supplied in padded wood transit box 8⅝ x 4¾ x 5⅝in.

CLYDESDALE'S PRICE ONLY. 27/6 each POST PAID

PARAGON INTERVAL TIMER.

H.3 Time Delay Relay 110FB/260, 220v. A.C., 50-60 cs. 3.6 w. Suitable for time delays 0-10 seconds. S.P.D.T. scale graduated in seconds. Automatically re-set when switched off. Dim: 3⅞ x 2½ x 2⅝in.

CLYDESDALE'S PRICE ONLY. 21/- each POST PAID

EX. U.S.A.A.F. VACUUM PUMP 137J/3749.

With 24v. 11.2 amps. ¼ H.P. Motor 6,600 r.p.m. Data (constant exhaust). 2,200 strokes per minute (running free). Pump capacity 10 cubic in.; pumping capacity (Air) 13 cubic feet per minute; pumping rate (water) 5¾ gallons per minute (5/6 cubic feet per minute); Air pressure 36 lb. per sq. in.; water pressure 60 lb. per sq. in. (safe); water pressure 130 lb. per sq. in (max.); eight ⅝ in. inlet valves; eight ⅝in. outlet valves —internal. Whole assembly 12 x 7½ x 7in. shock mounted on board 14½ x 6¾ x ⅞in., accessories include: eight nozzles (various sizes), one with rubber tube, and Schwien regulating valve.

CLYDESDALE'S PRICE ONLY 40/- each CARRIAGE PAID

Brand New, in maker's original carton.

ADM. PATT. W7460 VIBRATORPACK.

H71. Input 12 volts, D.C. Output 300 v. 100 mA. unsmoothed. Complete with 7-pin, reversible, synchronous vibrator, etc., in metal case 5¼ x 4 x 5⅜in. overall, finish grey (similar to E954 in appearance).

CLYDESDALE'S PRICE ONLY 21/- each POST PAID

R.C.A. DRIVER TRANSFORMER (110K/117) XT.3202.

E562. C.T. Primary: Inductance 3.4 henries. Two Secondaries: Inductance 14 henries each. Ratio: whole primary to one secondary 1:2 approximately. Dimensions: Height 4¼ x 3½ x 3¼in., weight 6¼ lb. Four hole fixing.

CLYDESDALE'S PRICE ONLY. 15/- each POST PAID

Brand New.

2 VOLT, 7 A.H. ACCUMULATOR.

Lead acid type, non-spill top. Transparent plastic case, height 4¼ x 3⅜ x 1⅝ in. Ideal for test sets or midget radios.

CLYDESDALE'S PRICE ONLY. 3/11 each POST PAID

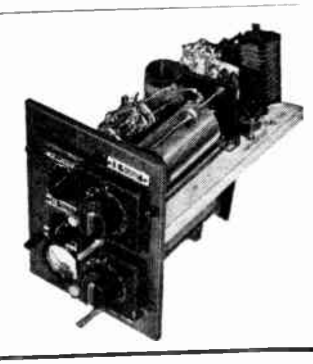
CO-AXIAL CABLE, any length supplied. 12 mm. 52 ohms solid core at **6d.** per yard Minimum 20 yards, **10/-**, post paid.

Brand New, in maker's carton.
Ex-U.S.A.S.C.

MASTER OSCILLATOR TYPE MI-19467-A.

A "ready-made" V.F.O. Unit, ranges 2-10 mcs. With 807 valve, grid current meter-E.C.O. circuit, variable inductances, calibrated micrometer controls, etc., in metal case 12 x 10 x 6ins. with Instruction Books.

CLYDESDALE'S PRICE ONLY 79/6 each. CARRIAGE PAID.



ATTENTION PERSONAL SHOPPERS.

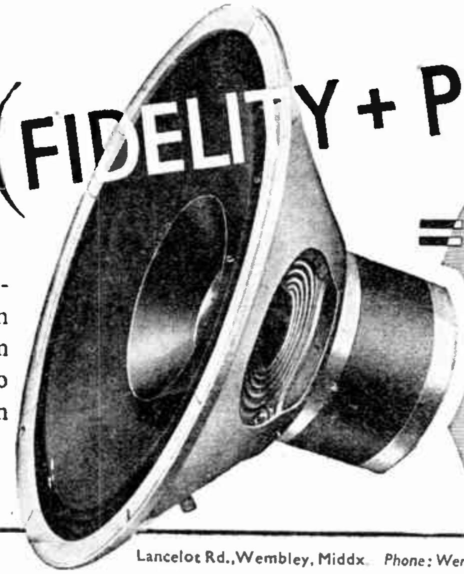
NOW OPEN, bargain department, at No. 18, Bridge Street, large selection of items available too varied to list, (small quantities) all at Clearance Prices. Well worth a visit.

Order direct from:
CLYDESDALE SUPPLY CO. LTD. 2 BRIDGE STREET GLASGOW - C.5
Phone: South 2706/9.
Visit our Branches in Scotland, England and Northern Ireland.

Another GOODMANS Axiom

Regd.

HIGH (FIDELITY + POWER)



= AXIOM "22"
12" DUSTPROOF
20 WATT
LOUDSPEAKER

With an exceptionally high electro-acoustic efficiency, this new version of the well-known "Axiom Twelve" has been developed to satisfy the great demand for High Fidelity power reproduction.

Send for illustrated folder D129

GOODMANS INDUSTRIES LTD., Lancelot Rd., Wembley, Middx. *Phone: Wembley 1200. Grams: Goodaxiom, Wembley*

AERIALITE

makers of the world's best AERIALS & EQUIPMENT

Introduce their NEW — AERIAL *Fitting* SERVICE

AERIALITE...
the most advertised aerials made!

According to statistics supplied by "The Statistical Review," Aerialite Aerials are easily the most extensively advertised aerials made. Our present campaign includes advertising in the "Radio Times," "Daily Express," "Daily Mail," "News Chronicle," "News of the World," "The People," "Sunday Express," "London Evening News," "The Star," "London Evening Standard," and the leading Midlands papers. The public are asking for "AERIALITE," —The Best!

Are you missing sales through the inability to fit an aerial? If so, cash in now on the AERIALITE AERIAL FITTING SERVICE. This new service by the World's Largest Makers of Aerials applies to the wide range of AERIALITE TELEVISION and MASTATIC AERIALS.

We shall also be pleased to receive applications to join our organisation from dealers who have experience in aerial fitting.

EXAMPLE: Fitting of our new Popular D.P.O. MODEL 52. You can supply this low-priced Television Aerial complete and erected for **£8.0.0** only. D.P.O. MODEL 52. Complete with 10ft. steel mast and Chimney Lashing Brackets, etc., £4.10.0. Complete Erection Costs, £3.10.0—Total Cost £8.0.0. *Write today for full details.*

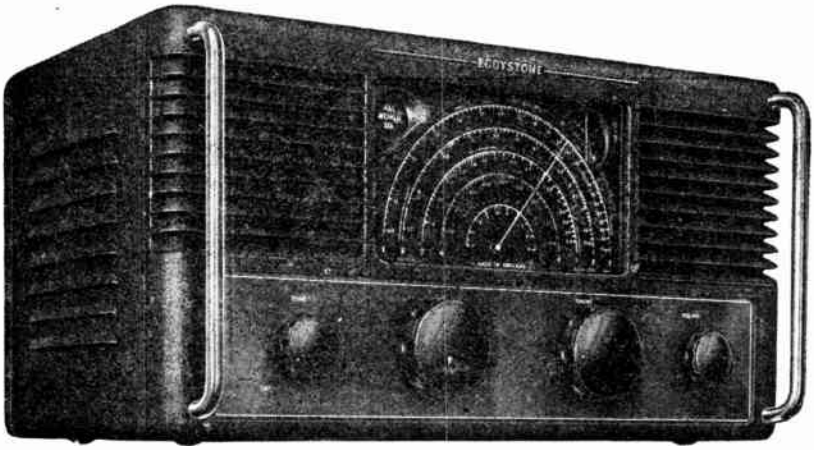
AERIALITE Ltd.
STALYBRIDGE, CHESHIRE

Make sure you can meet the demand!

THE NEW EDDYSTONE "ALL-WORLD 6" RECEIVER

A British Product

Specially designed for the remote Overseas listener



★ **6 volt Accumulator Operation**

★ **Low Current Consumption**

★ **Outstanding Performance**

A wealth of practical experience in the design of shortwave receivers for tropica markets has been embodied in the Eddystone "All World Six" Receiver. It is designed to provide the remote "out-station" listener with a specialist built receiver capable of first-class performance and possessing the important feature of low battery consumption. Selectivity, sensitivity, quality of reproduction and performance on all wave bands, including the highest frequencies, will satisfy the most critical. Workmanship and quality of materials used are of the finest to ensure the highest degree of reliability.

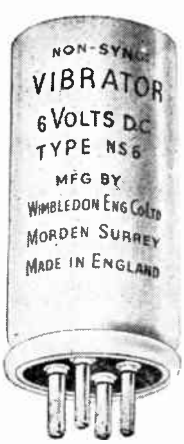
The wave range of the "All World Six" Receiver is continuous from 30.6 Mc/s to 484 Kc/s (9.8 to 620 metres). The current consumption is only 2.5 amperes from a 6 volt accumulator and no H.T. battery is required. This receiver is eminently suitable for those who, lacking electric supply mains, want performance equivalent to a mains-operated receiver, allied to the utmost economy in current consumption.

PRICE: £37. 10. 0d. ex Works

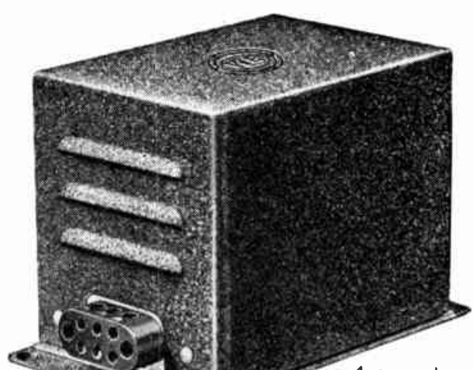
You are invited to write for descriptive literature and the address of your nearest Distributor to the sole manufacturers :

STRATTON & CO., LTD., EDDYSTONE WORKS, WEST HEATH, BIRMINGHAM, 31

It's got to be good



The heart of a Vibrator Power Unit (which supplies H.T. Current from low power D.C.) is the vibrator itself. Unless that gives a first class performance and goes on giving it for many, many hours, you have a heap of trouble on your hands. Hence the popularity of the "Wimbledon" Vibrator among many well known radio and electronic engineers. We have done a great deal of work on this Vibrator and *we* think it is just a little better than any other you can get. We are producing both synchronous and non-synchronous Vibrators and a complete range of Vibrator Power Units. Write for full details and judge them for yourself.



Approved and used by leading British manufacturers of car radio sets and receivers operated entirely from low voltage supplies.

WIMBLEDON

ENGINEERING COMPANY · LTD

GARTH ROAD · LOWER MORDEN · SURREY · TEL.: DERWENT 4814, 5010

CRC

EX GOVERNMENT SURPLUS BARGAINS

LASKY'S RADIO

CUNNINGHAM 1979

MEMBER R.T.R.A.

World Renowned for Service & Reliability

Wish all our friends, old and new, seasonal greetings

XMAS SPECIALS

FOR TELEVISION CONSTRUCTORS

7 DAYS APPROVAL OFFER. "THE VIEWMASTER."

Complete assembly instructions for building a 9in. or 12in. tube television set.
A 32-page booklet packed with information on construction and other necessary data is supplied together with 8 full size working drawings, and stage by stage wiring instructions.
This receiver incorporates a brilliant black and white picture, with all the latest developments, and can be built from standard components.
PRICE 5/-. Post free. The demand for this job has been terrific.
A FULL SIZE TELEVISOR FOR A MINIMUM OUTLAY OF CASH.
All components, valves, c.r. tube, etc., in stock.

RADAR RECEIVER TYPE 3084A.
BRAND NEW AND UNUSED. IN MAKER'S ORIGINAL WOOD TRANSIT CASE.
Specifications: 14 brand new valves. 7 EF50; 2 VR136; 1 VR137; 1 HVR2; 1 R3; 1 V507; 1 EA50.
Dozens of useful components, including an 80 volt A.C. motor used for aerial switching, front panel tuning control, etc. With little modification this unit will be ideal for television reception. Also suitable for converting to a 2 metre receiver.
Totally enclosed in metal case, size: 19in. × 8in. × 7in. Weight in case 40 lbs.
LASKY'S PRICE 59/6. Carriage 5/- extra.
CIRCUITS NOW AVAILABLE.
Circuit for the 3084A receiver. **PRICE 1/6.** plus 3d. postage.
Conversion of the receiver type 3084A to television sound and vision reception. **PRICE 2/6** plus 3d. postage.
Full circuit diagram giving suggested sound and vision television receivers, time base and all associated circuits, power packs, etc., utilising available ex Government equipment (3084A, VCR97, etc.) **PRICE 3/6.** plus 3d. post.
PRICE FOR THE COMPLETE SET OF 3 CIRCUITS. 7/-. Post free.

CATHODE RAY TUBES TYPE VCR97. BRAND NEW EX. GOVERNMENT. FULLY GUARANTEED. SUPPLIED IN SPRUNG WOOD TRANSIT CASE.
Characteristics: Heater 4 volts 1 amp., H.T., 2.5 KV., maximum.
LASKY'S PRICE 35/-. Carriage free.

E.H.T. TRANSFORMER FOR THE VCR97 CATHODE RAY TUBE.
200-250 volts primary. Secondary 2.5 KV., 4 m/a., 4 v. 1.1 a., 4 v. 1.5 a. C.T.
LASKY'S PRICE 35/-. Post free.

E.H.T. SMOOTHING CONDENSERS. .1 mfd. 2.5 KV. working.
LASKY'S PRICE 2/6 each. Post free.

EX. A.M. RECEIVER TYPE 69.
Contains 10 valves: 4 VR55 and 6 EF50.
Also motor generator with 27 volt input and 250 volts and 12.6 volts output. Dozen of components, resistances, coils, condensers, etc.
A GRAND BARGAIN AT LASKY'S PRICE OF 34/-. Carriage 4/6 extra.

BRAND NEW AND UNUSED I.F.F. RECEIVERS. SUPPLIED IN ORIGINAL CARTONS.
Each contains 8 new valves: 4 SP41; 1 EA50; 1 VR78; 2 CV6. Also hosts of components, coils, condensers, resistances, switches, etc. A motor generator which can easily be converted to a fractional horse power motor running off 230 volts A.C. or D.C.
Type 3108 input 12 volts and output 480 volts. Type 3109 input 24 volts and output 480 volts.
LASKY'S PRICE 25/- EACH. Carriage Paid anywhere in the U.K.

EX A.M. INDICATOR UNIT TYPE 184A.
Containing 17 valves, 2 c.r. tubes, components etc.
Valve line up: 5 EF50; 3 EB34; 3 SP61; 2 VR78; 4 EA50; also a 3in. cathode ray tube type VCR139 and one 6in. cathode ray tube type VCR517. Hundreds of other components, totally enclosed in black metal case, size 12in. × 9in. × 19in. Weight 40 lbs.
LASKY'S PRICE 59/6. Carriage 7/6 extra.

AMERICAN AIR CORPS RECEIVER TYPE BC624A.
11 valve superhet, frequency covers 100-156 Mc/s.
Valve line up: 3 9003; 1 9002; 1 12C8; 3 12SG7; 1 12J5; 1 12AH7; 1 12H6.
Dozens of useful components, coils, variable condensers, etc.
Size: 15½in. × 7½in. × 6in. Weight 28 lbs. Supplied less the buzzer.
This is the receiver section of the SCR522.
LASKY'S PRICE 19/11. Carriage 5/- extra.

BRAND NEW AND UNUSED. IN MAKER'S ORIGINAL CARTON.
EX. A.M. UNIT TYPE 8621.
Containing 11 new valves: 2 5Z4G; 2 5U4G; 1 VU120; 1 6X5GT; 2 EF50; 2 VS70 (voltage stabilisers); 1 6V6G.
Dozens of various components, including high voltage condensers, pot./meters, resistances, condensers (8 mfd. 500 v.w.), chokes, etc.
Totally enclosed in metal case, size: 12in. × 11½in. × 8in. Weight 40 lbs.
LASKY'S PRICE 49/6. Carriage 5/- extra.

POWER UNITS TYPE CP/11. NEW AND UNUSED.
200/250 volts 50 c.p.s., tapped primary input. Contains 2 heavy duty mains transformers, 2 U50 rectifier valves, 3 chokes, condensers etc. Output 350 volts, 6 volts and 5 volts. A GREAT BARGAIN AT
LASKY'S PRICE 65/-. Carriage and packing 7/6 extra.

Send a 2½d. stamp with your name and address (in block letters please) for a copy of our current Lasky's Radio Bulletin.

LASKY'S RADIO

370 Harrow Road, Paddington, London, W.9
(opposite Paddington Hospital)
Telephone: CUNningham 1979
Hours Mon. to Sat. 9.30 a.m. to 6 p.m. Thurs. half day

ICS

HOME STUDY

backs radio experience with sound technical knowledge

MANY men who wished to link their radio experience with a sound technological background have received successful instruction by means of an ICS Course. Its value has been proved not only to amateurs but to men who already have a professional interest in radio and television engineering, including those taking qualifying examinations. It is invaluable, also, to students who wish to prepare themselves for a job in this field. Courses of Instruction covering radio and, if necessary, television include the following:

Complete Radio Engineering **Radio Service Engineers**
Radio Service and Sales **Advanced Short-Wave Radio**
Elementary Electronics, Radar and Radio
Television Technology

And the following Radio Examinations:

British Institution of Radio Engineers
P.M.G. Certificates for Wireless Operators
City and Guilds Telecommunications
Wireless Operators and Wireless Mechanics, R.A.F.

Write today for our FREE "Radio" booklet which fully describes the above ICS Courses and the facilities for the complete study of Radio and/or Television technology. The ICS Advisory Department will also give free and impartial advice on the need of and the means of instruction

International CORRESPONDENCE SCHOOLS

Dept. W.L.S., International Buildings, Kingsway, London, W.C.2

MIDLAND INSTRUMENT CO.

For Govt. Surplus Stock, etc.

TYPE 21 RECEIVERS, 2-band, 4.2 to 7.5 and 19 to 31 mc/s, contains 11 valves, ARP12/VP23 (7), AR8/HL23DD (4), one of each are spares, also Mallory Type 650 6v. vibrator, 3 I.F. stages, 3-gang and 2-gang variable condensers in tandem to give separate R.F. sections for each waveband, slow motion drive and dial, volume, on/off and wave-change, etc. controls, chassis mounted with side protection frame, 9¼ × 8¼ × 6½in., operating data supplied, brand spanking new, **37/6**, post and packing 2/6 extra. **PACKARD BELL PRE-AMPLIFIERS**, Model K-1, contains 2 valves, 6SL7/GT and 28D7, input and output transformers, gain control, etc., operates from single battery supply 24v. at .4 amp., simple input, output and battery terminations, will raise electro magnetic, etc., microphones to L.S. level, in smart metal cases, 5 × 4¼ × 3½in., instructional booklet and accessories, brand new in sealed cartons, **15/-**, post 1/-, ditto with 2 spare valves **25/-**, post 1/-. **ROLLS PACKARD AIR COMPRESSORS**, piston type, develops 450 lbs. sq. in. at 1,200 r.p.m., bore 1in. and 11/16in., stroke 1in. and 3/16in., splined shaft fitting, superior make and finish, brand new boxed, **25/-**, post 1/3. **G.22 CAMERAS**, fitted Dallmeyer 12in. f/7.7 Dallon Tele-anastigmat lens unit, 3-speed louvred shutter, "bright" "dull" "fair," delayed action device and other incidentals, takes standard 120 roll film, brand new in wood transit cases, **55/-**, carriage 5/-. **ROTARY CONVERTORS**, D.C. input 12v., A.C. output, 230v. 50 cycles, 80/100 watts, **50/-**, carriage 5/-. **MAINS TRANSFORMERS**, input 230v. 50 cycles, output 50v. 11 amp., or with little alteration, 100v. at 5½ amp., **25/-**, carriage 5/-. **VENTAXIA EXHAUST FANS**, standard bakelite model, 24v. D.C., 30v. A.C. at 1 amp., in metal wall fixing cases, fitting aperture dia. sq., front fitted louvres, back fitted adjustable louvres, 10in. deep overall, an exceptionally fine job, brand new boxed, **45/-**, carriage 5/-. **CO-AX CABLE**, brand new 40ft. lengths, ¼in. diameter, 52 ohms impedance, suitable for television, fitted Pye socket, bargain offer, **7/6**, post 1/-. **VCR-97** C.R. tubes, suitable for television, supplied brand new in special suspension crates, **35/-**, carriage paid. Crates are charged 5/- extra, returnable. **MAINS MOTORS**, 200/250v. A.C./D.C., one end fitted enclosed fan blower, the other reduction gearbox, with 3 final ¼in. shaft drives of approx. 5, 25 and 125 r.p.m., fan blower can be removed for using initial drive of approx. 3,000 r.p.m., size overall 12in. long, 6in. wide, 4½in. high, special bargain offer, brand new, **35/-**, post 1/4. **BURGESS MICRO SWITCHES**, make and break, 4 assorted, **5/-**, post 9d. **WALKIE TALKIE AERIALS**, copper collapsible, 9-sections, total 7ft., base ¼in. diameter, tapers to 3/32in., also makes a good fishing rod, **2/6**, post 6d., 3 for **6/9**, post 9d. **TELEPHONE SETS**, consists of 2 combined dual purpose phones and mikes, 25ft. twin connecting flex, provides perfect 2-way communication, self-energised, no battery required, complete ready for use, the perfect Christmas present, brand new boxed, **7/6**, post 9d. **EX-U.S.A. GOVT. UNITS**, contains 12 valves, 6SH7 (6), 6H6 (3), 7193 (3), also 2 relays, over 80 resistors and condensers, chokes, coils, volume control, etc., chassis mounted with louvred cover, size 12½ × 8 × 6in., as new, bargain, **15/-**, post 1/4. **INDICATOR UNITS TYPE 198**, contains a VCR-138 C.R. tube 3½in. diameter, 8 valves, VR65 (4), VR92 (3) and VR54, and a mass of other components, in metal cases, size 16½ × 12 × 5½in., brand new in sealed cartons, **40/-**, carriage 5/-. **FREQUENCY METERS TS-69/AP.**, covers 341 to 1,000 mc/s with high precision cavity, 341 to 700, limits of 1 mc., 700 to 1,000, limits of 2 mc/s., indicated on veeder counter, fitted super 0-200 microammeter, crystal valve, stub aerial, calibration sheets in hinged frame, smart crackle finish cases, 22 × 6 × 5in., also super transit case, brand new, now limited stock, **70/-**, carriage 7/6.

Also hundreds of other interesting items, send for current lists, 2d., with s.a.e., for those who have received our current lists, a supplement is now available, send s.a.e.

MOORPOOL CIRCLE, BIRMINGHAM, 17

Tel. HARborne 1308 or 2664

Economical in Time and Money!

YOURS FOR ONLY 6/- MONTHLY

£1 DEPOSIT SECURES

10 monthly payments of 6/-

Get instant soldering heat! Invaluable for radio servicemen, engineers and home mechanics. Simply plug in, press the button, and in seven seconds the iron's hot! Absolutely safe, the bit cools instantly button is released and lies clear of bench when not in use. Complete with two spare bits and four yards of flex. Suitable for A.C. 200-250V. or 100-130V State model required. Limited stock. No interest charge. Send your deposit to-day for this ultra-rapid electric soldering gun. Leaflet on request. Cash Price £3 19s. 6d. complete.

BURGOYNE 7 SECOND *Instant Heat* SOLDERING GUN

SEND YOUR DEPOSIT *Today* TO-

Trade Terms upon Request.

The RING LAMP CO.

81 City Road, London, E.C.1

Telephone CLErkenwell 7103

PRATTS RADIO

1070 Harrow Road, London, N.W.10

(Nr. Scrubbs Lane) Tel. LADbroke 1734

AMPLIFIERS. College general purpose Amplifiers. **Model AC.10E** 10 watt 4 valve unit. Neg. feedback. Separate microphone stage, separate inputs for mike and gram. Separate faders and tone control. Complete in case with chrome handles. **£8/18/6** **Model AC.18E** 6-valve Push-Pull Amplifier with feedback over 3 stages. Separate mike stage with separate faders for mike and gram. Separate gram input. Tone control. Output 18½ watts. Complete in case with chrome handles. **£13/17/6.** **Model U10E** 6 valve 10 watt P.P. amplifier with feedback over 3 stages for D.C./A.C. mains. Specification as AC.18E, **£11/11/-.** All the above have outputs to match 3.8 and 15 ohm speakers and are complete for immediate use. Guarantee with each unit. Input voltages average, on mike, less than 5 m/v, on gram less than .33 v. R.M.S. for full output. No pre-amplifier required. **Model AC4C,** A.C. or **Model U4C,** D.C./A.C. 3-valve gramophone amplifiers. Output 4 watts to 3 ohms, **£4/19/6.** Stamp for fuller details.

TRANSFORMERS. E.H.T. 2,500 v. 5 m.a. 4 v. 1½ amp., 4 v. 2 amp. C.T. (for VCR. 97). Input 200-240 v. (in 10 v. steps), **27/6.** 2 x 350 v. 120 m.a. 6 v. 6 a.; 5 v. 4 a., 4 v. 4 a., **35/-** (available trade). Fil. Tranfr., Input 115/230 v., 6.3 v. C.T., **7/6.**

SPEAKERS. Brand new by famous makers, 5in., **9/11**; 8in., **11/9**; 10in., **18/6** and **23/6**; 12in. Truvox 3 ohm, **45/-.** Goodmans or Rola 12in. (15 ohms), **£5/15/-.** All P.M., less tranfr.

CONDENSERS. Brand new fresh stock. Midget 16 x 8 mfd. 450 v., **3/9**, 16 x 16 mfd. 450 v., **4/6**; 8 x 8 mfd. 450 v., **3/6**; 8 mfd. 350 v., **1/11**; 32 mfd. 350 v., **1/11**; 16 mfd. 350 v., **1/11**; B.I. C'b'd' blocks 500/550 v. 8 mfd., **3/3**; 8 x 8 mfd., **4/9**; 16 x 8 mfd., **6/-**; Ediswan Midget C'b'ds., 8 mfd. 450 v., **3/-**; 16 mfd., **4/-.** Paper condensers, .0001 to .0005, .1, .5, .01 x 100 v. all **6d.**

VARIABLE CONDENSERS. 2 gang .0005 mfd., **4/6**; .0005 mfd. 3 gang, **6/9.** Both with feet and 2¼in. shaft. Solid dielectric variables, Wavemaster .0003 mfd., **3/4**; .0005 mfd., **3/6.** Ceramic presets, 50pF, **4d.**, 100pF and .0005, **1/3.**

MISCELLANEOUS. U.S. Octal, Brit. 4.5 and 7 pin, **4d.** each. Volume controls Egan, less sw., **2/9**, with sw., **4/6.** Jack-plugs and sockets, bakelite, **2/6.** Mains droppers, .3 a. 750 or .2 a. 1,000 ohms, **4/6**, with 2 sliders and ft. Chokes. 60 ma. 20 hy. 360 ohm, **6/6**, 90 mA 10 hy., **10/6**; 150 mA 10 hy., **14/3.**

WEARITE "P" Coils, all types, **3/-** each **DENCO** L. & M.W. Coils with reaction, A. & H.F., **6/6.**

All goods are new and unused and offered on a money back guarantee basis. C.O.D. or C.W.O. Postage extra under £1. Shop hours 10-6.

You'll do better at

LAWRENCES

3 good reasons why

1. **EXTRA SPECIAL VALUES**
   You buy at Lawrences at lowest possible prices. You get the best and most carefully selected Radio Surplus available in the country, *plus* substantial savings on every order.
2. **QUICKEST SERVICE**
   Backed by years of experience, encouraged by customers' commendation, our technical staff give express delivery, speed your order to you carefully packed against all hazards
3. **ABSOLUTE SATISFACTION**
   We guarantee you'll be satisfied. You play safe when you buy at Lawrences.

FREE! NEW COMPLETE RADIO SURPLUS BULLETIN

Send at once for your copy of this great up-to-the-minute publication. No advertisement could keep you advised of the countless astonishing bargains available. Whether you be Amateur, Industrial Buyer, Service Engineer or Experimenter, *EVERY* "Wireless World" reader will find something of interest in the fully illustrated pages, packed with technical data. In addition, you get pages of hard-to-find technical information, surplus conversion data, station lists, etc., and it's all *FREE.*

FOR RADIO SURPLUS, A TO Z, YOU MUST GET A COPY NOW

LAWRENCES RADIO, Dept OS,
61, BYROM ST., LIVERPOOL, ENGLAND

PHILCO 3 VALVE TELEVISION PRE-AMPLIFIER. A.C. Mains. 200/250 v. Slug tuned input, inter-stage and output. Size 7in. x 6in. Complete with own power supply and valves. £4, plus post and packing 2/6.

PORTABLE CABINET, rexine covered, leather carrying handle, size 12½in. long x 10in. high x 6½in. deep. Complete with back, aerial wound, scale and pointer, 25/- plus 1/6 postage.

UNIVERSAL REPLACEMENT MAINS TRANSFORMER, primary 200/250 v., secondary 280-0-280, 60 mA., 6 v. 3 amp. tapped 4 v. 5 v. 2 amp. tapped 4 v. 6 v. 0.3 amp. 10/6 plus 1/- postage.

2½in. MOVING COIL METER, 0-300 v. A.C. and D.C., fitted internal rectifier, 15/-.

SUPERHET COIL KIT, comprising long, medium and short wave coils, standard twin gang, pair 465 I.F.'s, 4 pole, 4-way switch, 6 trimmers and two trackers, complete with circuit, and 5 valve super-het chassis, I.F. and speaker cut-outs. 14/6 plus 1/- post.

HEATER TRANSFORMER, 230/250 input, 6.3 v. 2 amp. 6/- plus 1/- post.

SELENIUM RECTIFIER H.T., half-wave 250 v. 125 mA. 4/3 plus 6d. post.

PUSH-PULL 10 watt transformer. 6 v. 6 matching. 3/- plus 9d. post.

TWIN GANG. .0005 fitted feet, trimmers and 1¼in. drum: spindle tapped 6 BA. 4/6 plus 6d. post.

10in. P.M. less transformer. 14/6 plus 1/- post.

8in. P.M. less transformer. 11/9 plus 1/- post.

6in. P.M. less transformer. 8/9 plus 1/- post.

MAINS DROPPER. 0.2 amp. 1,000 ohms. 1/9 plus 3d. post.

MAINS DROPPER. 820 ohms. 0.2 amp. 1/6 plus 3d. post.

Write for lists:

D. COHEN

Radio Engineer

67, RALEIGH AVENUE, HAYES MIDDLESEX

You are offering

*PEAK PERFORMANCE

with the GRAMPIAN D.P.I.

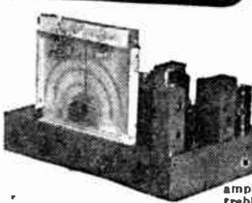
THE IDEAL MICROPHONE FOR P.A. WORK, BROADCASTING AND RECORDING

Here is a wide range high fidelity moving coil type Microphone which combines good sensitivity with a level response curve. Equally suitable for Auditorium or Outdoor Work, and its use can confidently be advised for Amateur as well as Professional use. Housed in modern streamlined die cast alloy case of great strength and finished in hammered metallic lacquer with chromium plated grille. Delivery from stock. List price £8.8.0

Dimensions 3" diam. 3¾" back to front. Net weight 2 lb. Frequency response 60-9,000 c.p.s. Output impedance 15 ohms. Fitting 5/16" B.S.F. Connection 2-pin plug.

GRAMPIAN
P.A EQUIPMENT

Grampian Reproducers Ltd., Hampton Road, Hanworth, Middx.
'Phone: Feltham 2657.



THE *Fidelia*
LUXURY 7-VALVE RADIOGRAM CHASSIS

Features include variable selectivity, infinite impedance detector, electronic bass and treble controls, triode output stage; 3 wavebands 16-50, 190-550 and 1,000-2,000 metres. Audio amplifier response 30-18,000 cycles: bass, treble and volume controls operate on gramo. suitable for light weight p.u.
Guaranteed 12 months Price £17 . 2 . 6

Data Sheets on request, also for 'Preciton' 5-valve chassis, £12-17-6; 2R F eed 8 ms; 5watt amp. £14-10; 6watt amp, £12-12

ELECTRO *Acoustic* DEVELOPMENTS
18 BROAD RD., WILLINGDON, SX.

WILCO ELECTRONICS
204, LOWER ADDISCOMBE RD., CROYDON.

CO-AXIAL Feeder Cable 80 ohms. 10½d. per yard.
METAL RECTIFIERS. 230 volt 60 m/A. ½ wave, 3/- each.
P.O. RACKS for standard 19in. panels, 5ft., 60/-; 6ft., 70/-, also a few transmitting cabinets 6ft. 6in. × 21in. × 21in., door each side, £8/10/-.
SPEAKERS P.M. 4in. Rola in Cabinet 9 × 7½ × 4., 17/6 each.
POWER UNIT. Including 1-SU2150A and 1-524J valve .1 mfd. 2,500 volt Condenser, Relay, etc. Bargain, 17/6 complete.
SLOW MOTION DIALS. 200-1 Reduction or direct, 6in. diam. scaled 0-100. Front of panel mounting. 5/6. Muirhead S/M., 7/6.
CONDENSERS. Paper block type. 8 Mfd. 750 V.DC., 10/6. 4 Mfd. 750 V.DC., 5/-. 4 Mfd. 2,000 V.DC., 10/6. 1.5 Mfd. 4,000 V.DC., 10/6.
VIBRATORS. Brand new Ex-Govt., W. & W. NS/B6, NS6, No. 6. Oak V6606, 5/6 ea.
TELEVISION UNIT. 2 R.F. 1 Det., 1 Video stage using EF50s and EA50. Iron cored coils. Make good sound channel. Complete with valves, 45/-. Brand new. Boxed.
VOLTMETERS. 0-300 A.C. Moving Iron, 2½in., flush. 17/6; 3½in. Surface type, 22/6; 0-250 A.C. Moving Coil Rectifier. Type 3½in., flush, 30/-. Electrostatic 750 v. 2½in., 25/-; 2,000 v., 2½in., 35/-; 5,000 v., 3½in., 90/-.
WEE MEGERS. In leather carrying case. Brand new, £8/10/- each.
MICROAMMETER F.S.D. 25 microamps, scaled 0/500, 2in., 57/6.
SELECTOR UNIT, in metal case consisting of 2 Uniselectors, 4 pole, 25 way, 4 full wipers, internal connections to adjustable tag board, 55/-.

G. W. SMITH & CO., (RADIO) LTD.

Special Offer

Ex R.A.F. Type 1225 Receivers. Complete with 5 E.F.50 valves, and 2 EF39 1. EB34. Suitable for conversion to Television. Limited number only at 15/6 each.
Ex-R.A.F. Type R.1124 Receivers. Complete with valves, very easily adapted for Television Sound, no modification needed, 12/6, carriage paid.
Ex-R.A.F. Type 203 Control Units. Containing 12-volt 1 amp. rectifier, 2 1000 mfd. 25 volt condensers. LT smoothing choke, High Speed relay Switches, Indicator lamps, in fact all you need is a Mains transformer and you have a complete LT supply unit. Brand new. 14/- each.
Mains Transformers. 700 volt 20 mA 4 v. 1.25 amp. Twice. Test 5,000 v. RMS, ideal for scope, primary input 230 volt 50 cycle. 17/6 each.
Filament transformers. 5 v. 3 amp., 6.3 v. 1.25 amp. Twice. 6.3 v. .5 amp. 230 volt input. 12/6 each.
Bendix 453 Receivers. complete with valves, 45/- each.
Switches 1 p. 7-way. 9d. each. 1 pole 11-way, 1/3 each, both 1½ dia. Ceramic 1 pole 7-way. 2/6 each.
High Voltage Condensers. Trouble Free Oil Filled Mansbridge type .1 mfd. 3 kV, 2/9; .1 mfd. 4 kV, 3/-; .1 mfd. 5 kV, 3/3, .001 m.fd. 5 kV mica, 1/3 each, .001 9 kV, 1/6; 001 mfd. 15 kV, 1/6 each.

OPEN ALL DAY SATURDAY

3 LISLE STREET, LONDON, W.C.2

Telephone: GERrard 8204

Varley
REGD. TRADE MARK

Products of Quality & Reliability

MAINS TRANSFORMERS
A. F. TRANSFORMERS
THERMAL DELAY SWITCHES
SMOOTHING CHOKES
POWER RESISTANCES

Made by
OLIVER PELL CONTROL LTD
Telephone: WOOLWICH 1422-1426
CAMBRIDGE ROW · WOOLWICH · S.E.18

RADIOMENDERS LIMITED
FOR SPECIAL TRANSFORMERS AND REWINDS

We specialise in

AMATEURS' WINDINGS, TRANSFORMERS ALL TYPES, CHOKES, PICK-UP COILS, INSTRUMENT COILS, Etc.

LOUD SPEAKER SERVICE

Highest workmanship — **Good Delivery**

★

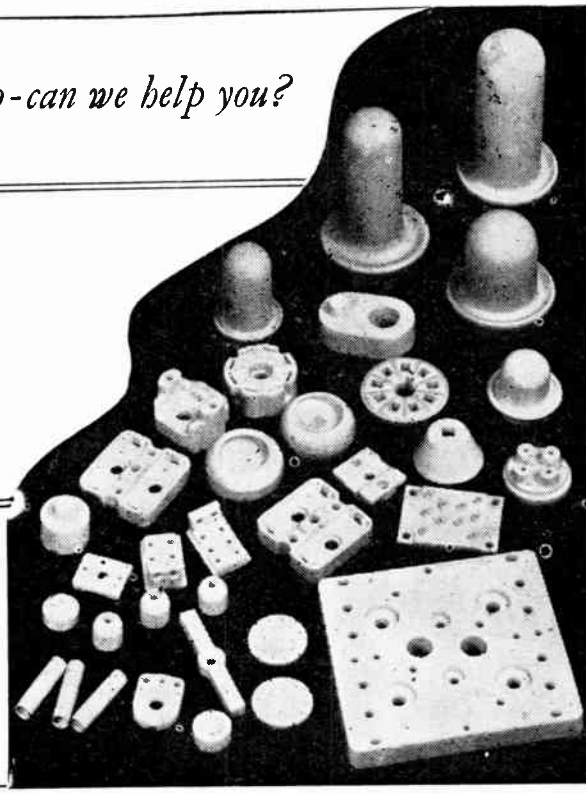
RADIOMENDERS, LTD.
Television & Radio Apparatus, Transformer & Coilwinders.
123-5-7 Parchmore Road, THORNTON HEATH, SURREY
LIV 2261. Trade enquiries invited. Established 16 years.

Success through constant research—can we help you?

LOW LOSS CERAMICS

by

TAYLOR TUNNICLIFF

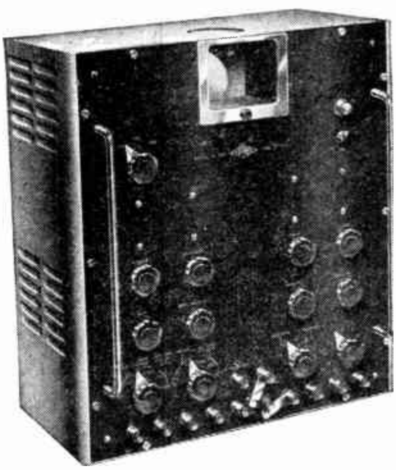


TAYLOR TUNNICLIFF (REFRACTORIES) LTD., Albion Works, Longton, Stoke-on-Trent, Staffs.
London Office: 125 High Holborn, W.C.1.
'Phones: Stoke-on-Trent 5272 & Holborn 1951/2.

T.A.5/T.T.3

AN ADVANCED DESIGN IN OSCILLOSCOPES

AIRMEC



● The new Airmec Oscilloscope has been designed to incorporate features found from practical experience to be advantageous. Some characteristics are indicated briefly below. Further details are given in pamphlet No. 19 available on request. The instrument has been designed to have minimum forward dimensions and is therefore suitable for bench or rack mounting on the standard P.O. centres. Racks are available if required.

Tube: 4" electrostatic type with optically flat screen and provision for direct connection to deflecting plates.

Sensitivity: Maximum 15 mV/cm.

Shifts: Instantaneous and symmetrical.

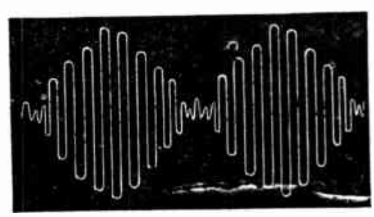
Amplifiers: Balanced "Y" amplifier and additional auxiliary amplifier for "X" trace or independent use, e.g. beam modulation.

Frequency response: D.C. to 5 Mc/s flat within $\pm$ 2 db.

Time Base: 0.5 second to 1 microsecond with provision for single stroke.

Brilliancy Control: Manual, and automatic compensation for photography of high speed traces. 4 kV. for extra brilliance.

Photography: Motor operated camera provided for mounting above oscilloscope. Screen visible up to instant of exposure.



Controls: Switches and rotary controls are provided to minimise need for manipulation of external connections.

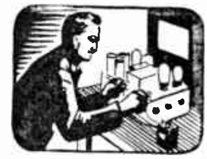
AIRMEC LABORATORIES LTD.

HIGH WYCOMBE • BUCKINGHAMSHIRE • ENGLAND • Tel. High Wycombe 2060 • Cables: Com.nlabs.

MANUFACTURERS OF ALL TYPES OF INDUSTRIAL ELECTRONIC EQUIPMENT & TEST GEAR

TEST! – RADIO – TELEVISION EVERYTHING ELECTRICAL

Not only radio but everything electrical can be tested with this world famous PIFCO Radiometer. Bell and telephone circuits, radio, television, vacuum cleaners, irons, car lighting, H.T. and L.T. milliamps, etc. Increasing supplies now available for the home market.

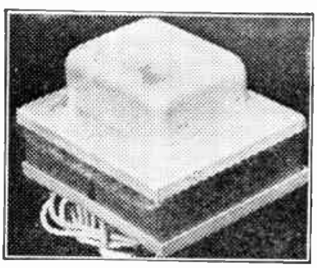


- **CIRCUIT TEST** Tests for open or faulty circuits in all radio and electrical apparatus and domestic appliances. Equally for testing car lighting and starting circuits.
- **H.T. TEST** — 0-240 volts. May be used direct on any mains, AC or DC
- **L.T. TEST** 0-6 volts AC or DC
- **MILLIAMPERE TEST** 0/30 m.a. scale for testing total discharge from battery or testing single cell
- **VALVE TEST** Made by inserting valve in socket on front of meter.

Price **25/-**. *Obtainable from your local dealer.*

PIFCO ALL·IN·ONE RADIOMETER

PIFCO LTD., PIFCO HOUSE, WATLING STREET, MANCHESTER, 4
and at PIFCO HOUSE, GT. EASTERN STREET, LONDON, E.C.2



UNDRILLED 16 S.W.G. ALUMINIUM CHASSIS. 9in. × 5in. × 2½in., 10in. × 6in. × 3in. 10in. × 8in. × 3in. **8/6** ea. 12in. × 9in. × 3in., **10/6**; 14in. × 9in. × 3in., **11/6**; 16in. × 8in. × 3in. **11/6**; 20in. × 8in. × 3in., **12/6**.

SMOOTHING CHOKES. 40 mA., **5/-**; 60 mA., **6/6**; 90 mA., **7/-**; 100 mA., **12/6**; 200 mA: **21/-**.

EDDYSTONE COMPONENTS. Full range stocked. Eddystone illustrated catalogue **6d.**

B.V.A. VALVES. Large stocks. Valves sent C.O.D.

S.T.C. BALL MICROPHONES. High fidelity. Makers' list price approx. £22. Special Offer. **£4/19/6.**

MINE DETECTOR AMPLIFIERS. Containing three 1T4 valves and ceramic valveholders, **£1/2/6.**

GOODMANS T2/1205 12in. P.M. Speakers. **£6/15.**
GOODMANS AXIOM 12in. P.M. Speakers **£8/8.**
ROLA 8in. P.M. Speakers, **18/6.**
INSTRUMENT WIRES. Comprehensive range in enamelled, cotton and silk covered copper wires

SEND NOW. **5d.** in stamps for LATEST CATALOGUE.

Terms: C.W.O. or C.O.D.

MAINS TRANSFORMERS

16/6 POST PAID

Coulphone Mains Transformers are made to the highest electrical standards and are fully guaranteed. We supply them to the Ministry of Supply Atomic Research Stations, so they will no doubt meet your requirements. Special quotations for quantities and types to order.

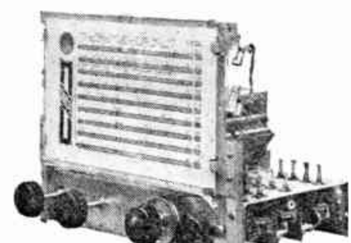
Standard Replacement Types. Drop-through chassis type with top shroud. Impregnated and interleaved. Screened Primaries tapped to 200/230/250 volts.

(a) 250-0-250 v. 60 mA. 6.3 v. 3 A., 5 v. 2 A.	16	6
(b) 250-0-250 v. 60 mA. 4 v. 4 A., 4 v. 2 A.	16	6
(c) 250-0-250 v. 80 mA. 0/4/6.3 v. 4 A. C.T., 0/4/5 v. 2 A.	19	0
(d) 300-0-300 v. 80 mA. 0/4/6.3 v. 4 A. C.T., 0/4/5 v. 2 a.	19	0
(e) 350-0-350 v. 80 mA. 0/4/6.3 v. 4 A. C.T., 0/4/5 v. 2 A.	19	0
(f) 250-0-250 v. 100 mA. 0/4/6.3 v. 4 A. C.T., 0/4/5 v. 2 A.	22	0
(g) 300-0-300 v. 100 mA. 0/4/6.3 v. 4 A. C.T., 0/4/5 v. 2 A.	22	0
(h) 350-0-350 v. 100 mA. 0/4/6.3 v. 4 A. C.T., 0/4/5 v. 2 A.	22	0
(i) 350-0-350 v. 150 mA. 0/4/6.3 v. 6 A. C.T., 0/4/5 v. 3 A.	39	0
(j) 425-0-425 v. 180 mA. 6.3 v. 4 A. C.T., 6.3 v. 4 A. C.T., 5 v. 3 A.	44	6
(k) 425-0-425 v. 180 mA. 4 v. 8 A. C.T., 4 v. 4 A. C.T., 4 v. 4 A.	44	6
(l) 425-0-425 v. 180 mA. 6.3 v. 4 A. C.T., 4 v. 2 A. C.T., 4 v. 2 A. C.T., 5 v. 3 A.	47	0

Types (a) (b) (c) (d) (e) (f) (g) (h) (k) illustrated on left. Types (i) (j) (l) upright shrouded type

WILLIAMSON OUTPUT TRANSFORMER

A super job exactly to author's specification. Upright mounting **£3/12/6.**



FEEDER UNITS

MODEL B DE LUXE (illustrated above). High gain R.F. stage operative on all nine wavebands. 45/145 M., 190/550 M., 900/2000 M. Plus six ranges of Bandspread, 13.5-14.8, 16-17.4, 19-20.5, 24.2-26, 30-32, 41-43.5 metres. Large colour printed glass dial, 10in. × 6in. aperture. Horizontal drive. Waverange indicator and magic eye. Switched pick-up sockets. Volume and Tone Controls. Completely aligned ready for connection to audio amplifier. Price less valves **£18 7 6.**
Price for set of five valves, **£3/11/5.**

MODEL A. A first class feeder unit with R.F. stage operative on all wavebands, 16/50, 190/550, 900/2000 metres. Switched pick-up sockets. Volume control. Glass dial 8in. × 8in. in colours. Completely aligned ready for connection to audio amplifier. Price less valves, **£10/8/6.**
Valves required, 6K7G, 6K8G, 6K7G, 6Q7G. Price for set of four valves, **£2/11/3.**

A.F. AMPLIFIER POWER UNIT. Specially designed for use with above units. Employs 6V6G output (4 watts) and 5Z4G rectifier.
Price less valves **£4/10/-.**
Two valves if required. **£1/13/10.**

NEW GOODS ONLY

COULPHONE RADIO

53 BURSCOUGH ST. ORMSKIRK, LANCS.

'The Return of Post Mail Order Service'

Tel.: Ormskirk 987

THE NEW B.P.L. SUPER RANGER

20,000 OHMS PER VOLT.

D.C. VOLTS : 100 mV to 5 kV

D.C. CURRENT : 1 μA to 1 Amp.

A.C. VOLTS : 0·5 V to 5 kV.

A.C. CURRENT : 10 mA to 10 Amps

RESISTANCE : 1 ohm to 2 meg-ohms

OUTPUT : 0 to 62 db

METER : 5-inch Long arc, fitted with knife-edge pointer and mirror scale.

LIST PRICE : £21 - 10 - 0.

BRITISH PHYSICAL LABORATORIES

HOUSEBOAT WORKS, RADLETT, HERTS.

Tel: Radlett 5674-5-6

A HAPPY EVENT

We are pleased to announce a brand new addition to our range of high fidelity amplifiers :

"THE BABY"

At present available in kit form only. It features high-grade components, including Partridge transformers and chokes throughout, together with performance figures altogether better than would be suggested by its low price.

Push-pull EL33s provide 6-8 watts output, heavy NFB being applied to reduce distortion. Phase shift is minimised by the use of direct coupling. The input is suitable for the majority of lightweight pick-ups.

Complete kit of parts including wiring diagram, circuit, drilled chassis and all valves. **£8.10.0.**

A leaflet describing the " Baby " (Model RD5) in detail will gladly be forwarded on request.

A demonstration model of the amplifier may be seen and heard at our Hampstead premises.

THE NEW WILLIAMSON PRE-AMPLIFIER, as described in *Wireless World, NOV. 1949*, is now being demonstrated.

ROGERS DEVELOPMENTS Co.,

106, Heath Street, Hampstead, London, N.W.3.

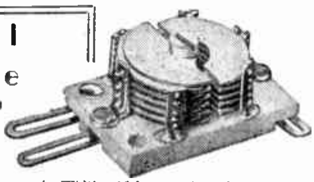
HAMpstead 6901.

Technical Excellence

combines with beauty and soundness of DESIGN in the

OXLEY

DIFFERENTIAL AIR DIELECTRIC TRIMMER



★ Width : 16.5 m/m Length : 25 m/m
Height :
1.5 to 8pF—8 m/m
1.5 to 20pF—10·5 m/m
2 to 26pF—11·5 m/m
2 to 32pF—12·5 m/m
Law : Straight line capacity
Power Factor : Less than ·001
Insulation : Over 2,000 megohms
Voltage : 500 D.C.

OXLEY DEVELOPMENTS CO., LTD.,
ULVERSTON, N. LANCS. TEL. ULVERSTON 3306

KERSHAW'S KORNER KALLING

SPECIAL!!!

M.O.S. LINES

TELESONIC RECEIVERS, brand new, complete with four 1.5 v. Hivac Midget valves ideal for making your own personal portable 32/6 each. Post paid.

H.T. and L.T. BATTERIES, combined for above telesonic receivers. 8/6 each. Post paid.

INERT 1.5 v. CELL BATTERIES, long life, fill with plain water and have continuous use. Ideal for every purpose. 3 for 2/6. Post paid.

MAKE YOUR OWN CRYSTAL SET, with polished terminal box complete with volume control, resistance, etc. 1/6 each. Post paid.

S. KERSHAW

93/95 PERSHORE STREET, BIRMINGHAM, 5.

TELEVISION COMPONENTS

NOW IN STOCK FOR

The View Master Televisor!

Complete Assembly Instructions and 8 full size Drawings 5/-

Send for latest list—6d. post paid

COVENTRY RADIO

DUNSTABLE ROAD, LUTON, BEDS.

THE BEST TUNER UNITS for THE BEST AMPLIFIERS

Model SH6: Superhet, 3 waveband. 4 miniature valves. RF stages. Flywheel tuning.

£12.10.0 plus £3.2.6 tax.

Model PB5: 4 stat on preset TRF. Pushbutton control. All miniature valves.

£8.15.0 plus £1.18.6 tax.

Prices include multiway connectors.

FELICITY GRAMOPHONE CO.

87a Upper Richmond Rd., London, S.W.15

PUTney 1665

RELAYS

for A.C. and D.C.

VA Coil consumption from 2 to 500 volts and tested to 2,000 volts, Aerial Change-over Relays, Mercury Relays, Measuring Relays and Time Delay Relays.

Multiple Contact Relay LF.

Ask for leaflets REIWW

— LONDEX LTD. —

Manufacturers of Relays

207 Anerley Road, London, S.E.20. SYDenham 6258

Rate 6/- for 2 lines or less and 3/- for every additional line or part thereof, average lines 6 words. Box Numbers, 2 words plus 1/-. Trade discount details available on application: Press Day: January, 1950 issue, first Post Monday, December 5th. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components which may be offered for sale through our columns carry no manufacturers' guarantee: Many of these components will have been designed for special purposes making them unsuitable for civilian use, or may have deteriorated as a result of the conditions under which they have been stored. We cannot undertake to deal with any complaints regarding any such components purchased.

NEW RECEIVERS AND AMPLIFIERS

NEXT to nothing clearance sale.

18-valve receivers, containing practically all the valves and components you will need for a TV set, EF54s, EA50s, Pen46, VU39s, SP61, P61, J50 rec. transformer is H.F. but will give 24v at about 4a from 230v a.c. 50cs, 5 I.F. trans., 13 to 16 mc/s, and hundreds of res. and cons., chokes; a gold mine, price 22/6, plus 5/- carr.
R1124 6-valve receivers, with 6 brand new universal valves, enough gear, with a few oddments from the junk box to make a couple of midget sets, 12/6 each, plus 2/6 carr., fil. trans. to suit these for 200-250v A.C. to 12v L.T., 6/-; 2-gang 0.0003 condensers, 1/9 each, 3-gang, 0.00015, 1/9, toggle switches, shockproof, SPDT, or one on and one off, 1/- each.
RECEIVER R1225 with 5XEF50, 2XVR53 and VR54, 13 mc/s, I.F.s, for valves and spares, 17/6 each, carr. 2/6.
R.F. units 24 8/6, 24 mod. 27 8/6, 25 12/6, 27 22/6, all with valves and good condition. Double headphones, LR 2/6, bal. arm for crystal sets, etc., 3/6, moving coil, 5/6, with mike 8/6, Mallory Vibrapacks, 12v, 150v, 75ma, unsmoothed, with vib., 6/6 each, indicator units, with 97, etc., 7 types, from 55/- to 85/-; RCA TE3149 crystal wavemeters, new and unused, but need slight repair, £3 10 each, s.a.e. for lists.
H. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex. [4543

MASON'S, Wivenhoe, nr. Colchester.

ILLUSTRATED catalogue, price 9d, full details of Denco and Eddystone range, tuning units, television kits and surplus radio bargains. [4578

UNIVERSAL ELECTRONIC PRODUCTS, 36 Marylebone High St., London, W.1. Tel Welbeck 4058.
SPECIALISTS in the design and manufacture of high fidelity reproducing equipment from 4-100 watts for domestic or industrial purposes. Our U.E.5 (6 watts) and U.E.7 (12watts) series amplifiers are designed especially for the connoisseur who requires the finest possible reproduction from recorded music; both amplifiers have a linear response over 30-20 000 cycles with a damping factor of 12, and incorporate pre-amplifier stage, together with independent control of bass and treble. Our policy is to produce an instrument which represents the highest standards in workmanship and performance and no expense has been spared to achieve this object. A new addition to our range is the type U.E.3 (4watts) at £11 10. We also supply a range of tuning units both t.r.f. and superhet, for use in conjunction with either our own or other makes of amplifiers. We should be pleased to quote you for the design and construction of a unit or replacement chassis to your exact requirements. Full details of our products will be forwarded on request, and we would welcome the opportunity to demonstrate our equipment at any time to suit your convenience. [3352

HALLICRAFTERS dual diversity receivers, complete with power units and loudspeakers, few only available.
McELROY ADAMS MFG. GROUP, Ltd. (Hallicrafters), 46, Greyhound Rd., London, W.6.

R.A.F model 1155, new, complete with valves, converted models from £8 10, send for lists.—Broadcast & Acoustic Equipment Co. Ltd., Tombland, Norwich. [2906

EDDYSTONE S640, with speaker and moving coil headphones, cost £48, in perfect condition, very little used, accept £17, no offers.—E. G. Holford, 51, Tuffley Avenue, Gloucester.

AMPLIFIERS, new, 60 watt heavy duty P.A. models, built for continuous rating and rack mounting; £40; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich.

NORTHERN ELECTRONIC INDUSTRIES, Ltd., Windsor Works, Manchester St., Oldham, Lancs, have now in production a portable electric gramophone designed for high quality reproduction of gramophone records in schools, hotels, clubs, small halls and similar installations; immediate delivery; send for illustrated leaflets giving further details, prices, etc. [4191

3/6.—For this modest sum we supply you with full constructional details for building our latest 10watt quality amplifier with variable negative feed-back; these constructional sheets are simplified so that the most inexperienced person may build and obtain first-class results. Complete Home Constructor's Handbook with circuit of this and many other sets, 1/- extra.—Supacoils, Mail Order Office, 98, Greenway Ave., London, E.17. [0053

NEW RECEIVERS AND AMPLIFIERS

THE world's finest communications receiver, Hammarlund Super Pro SPX400, power pack, matched speaker, in maker's carton, new and perfect, offers considered.—The Radio Centre, 33, Tottenham Court Rd., W.1. [4497

12 watt high quality amplifiers complete, embodying latest developments, precision built; £12 15; sent on 7 days' approval, send for lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [2907

DC mains? This new 8watt all miniature valve amplifier has been designed to give you high fidelity reproduction from DC mains supply, matched for moving coil pickup, output 2.5-15 ohms, bass and treble controls, complete £21 10, or with mic. stage, £24.
FELICITY GRAMOPHONE Co., 87a, Upper Richmond Rd., S.W.15. Putney 1665. [0041

C.T.R. ELECTRICAL AND ELECTRONIC DEVELOPMENT, Ltd., Hubert St., Birmingham, 6 (Aston Cross 2440), the Midlands specialist manufacturers of high fidelity equipment for the "W. W. Williamson" and other quality amplifiers, also tone control stages, loudspeaker crossover units, distortionless contrast expanders and radio feeders, see our illustrated advert in alternate issues of this publication; send for full details and prices. [3503

TELRAD ELECTRONICS, 70, Church Rd., Upper Norwood, London, S.E.19, designers and manufacturers of Telrad quality amplifiers for commercial and domestic use, these unique amplifiers with exceptional quality, gained instant popularity when first introduced at recent exhibition, built to satisfy the discriminating ear, bass and treble independent controls, providing widest possible variation to suit all recordings and varying acoustic properties of one room with another, £18, complete, full details on request.—Write, call or 'phone Livingstone 4879. [0019

MIDCO amplifiers for the enthusiast, type AA/5, 5watt fidelity model on enamelled chassis with tone and vol. controls, £5 10 complete, AA/10 10-watt push pull model with two-stage drive, twin inputs tone control, complete, £10, PA 12 high fidelity models, 12-watt record reproducer with bass and treble tone controls, twin inputs £14 complete, PA/12M very high gain mic version, one high one low impedance inputs with full mix fade complete £14 10; PA 12 amplifiers are built in steel cases in cellulose enamels with chrome fittings, catalogues available, trade inquiries invited. Midland Radio Coil Products, 19, Newcomen Rd., Wellingborough. [4582

CONNOISSEUR'S receiver, acclaimed by its users as the finest receiver for the enthusiast and the only one with the following facilities: 9-1,500-metre world-wide results on highly sensitive 10-valve receiver, comparable with any good communication set, or by change of switch, maximum fidelity reception of local stations on non-superhet receiver with high quality 2-PX4 push-pull amplifier incorporating all refinements, bass and treble tone control (boost to cut), whistle filter and gram input, etc., basis rebuilt R1155, write for details or call for demonstration. FEEDER units as above for use with external high-quality amplifiers. R1155 specialists, receivers repaired and re-aligned also modified as above, or to your requirements. R1155 circuit and values 2/- post free.—R.T.S. Ltd., 5 Gladstone Rd., Wimbledon, S.W.19. Tel. Lib. 3303.

THE R.T.M.C. version of the Williamson amplifier is now by general opinion recognised as the finest reproducer in this country. To speak of the R.T.M.C. version you immediately know that only the finest components are used and that the ultimate product is the finest you can buy irrespective of price. We will go so far as to say that products charged at three or four times the price will not excel the R.T.M.C. amplifier for quality in reproduction or parts employed in the building of this superb amplifier. Original 7-valve version, £25 (ex cover) or new 9-valve version with built-in pre-amplifier £30 (ex cover), new type tuner, 3-waveband, with large dial, £10 10; gram motors and record changers supplied, all products specially hand built and not mass produced, buy the best and be satisfied.—Details from R.T.M.C. (Ealing) Ltd., Laurel House, 141 Little Ealing Lane, W.5. Ealing 6962. [3674

RECEIVERS AMPLIFIERS SECOND HAND

CR100 communication receiver, 11-valve, 6 wavebands, perfect.—Box 566. [4553

BC318, built-in 230 a.c. maker's speaker; £11. Royal Oak Hotel, Ringwood, Hants.

NATIONAL H.R.O. Senior, 50 kc/s to 30 mc/s, 9 coils with power pack, good condition; offers over £25.—Box 495. [4518

15-watt Williamson amp. in Imhoff case, Partridge windings, Osram valves, with high gain stage output meter, thermo-switch, plugs and jacks, as new, unused, suit youth club, etc.; £23. 17, Penulver Rd., S.E.16. Ber. 3629.

AR88D R.C.A. communications receiver, £60; C.43 receiver, modified and converted, £16, het frequency meter type, CRR74028, crystal controlled mains adapted, £8.—Apply Needham, Rushlands, Hamble, Southampton.

A.128 Murphy 8-band receiver, as new, with band spread tuning on all S.W. bands; ideal set for combined B.C. and S.W. listening; T.91 Bush TV console, sensitivity 65 microvolts, peak white, sound and vision interference limiters, recently checked by makers; two TV pre-amplifiers (A.P.); one R.1155 receiver (bandswitching needs attention, otherwise as new), reasonable offers for part or whole of above, to Box 496.

RADIOLYMPIA AND AFTER

Advertising copy in a monthly journal can never be "news" as it has to be written long before publication. But as our copy seeks to be informative and accurate rather than "selling," this is our first chance to report on what happened to us during the radio show period and immediately after.

A very large number of musical enthusiasts called to see us and hear our equipment, especially the 215 speaker. We gave them absolutely unfaked demonstrations using gramophone records. The equipment was all openly visible, and nobody was twiddling knobs behind the scenes. We never have faked demonstrations nor ever will because it seems to us to be of the highest importance to let the potential customer hear exactly what he can hear in his own home. To give only one reason—it saves future arguments.

We were told that it seems uncanny that one single ordinary-looking speaker unit should be able to give such an impression of three-dimensional repro duction. We were told that the bass response of our speaker is quite phen omenal, and many were mystified by the performance of a nine-inch speaker at the lower limit of audibility. Over and over again surprise was expressed that an unpretentious 18-inch cubical box, the Boffle, should apparently impart no sort of coloration whatever to the acknowledged fine response of the 215 speaker.

But what pleased us more than anything else was the constantly reiterated statement that, judged purely on listening to the reproduction, no effective challenge to Hartley-Turner has yet been heard, and the price we ask makes the speaker and Boffle the best buy without any shadow of doubt. Here, as in the U.S.A., people are finding out that price alone does not determine the quality of the final result.

If you have not yet read "New Notes in Radio" send 2/6 today for your copy of the little book which has been called the most honestly written treatise on high-fidelity that has so far appeared, and if you would like a regular service of technical data sheets, send an extra half-crown. Descriptive literature free.

HARTLEY-TURNER 215 SPEAKER **£9.** Output transformer **£3.**
The BOFFLE, 18" cube. Kit of parts **£6/15/0.** Assembled **£8/10/0.**

H. A. HARTLEY CO. LTD
152, HAMMERSMITH ROAD
LONDON, W.6. *RIVerside 7387*

RECEIVERS, AMPLIFIERS—SECOND-HAND

FERRANTI T.136 T.V. console, London model, 9in flat tube, £50 with pre-amplifier.—Dudley, 228, Long Shoot, Nuneaton. [4565

TELEVISION receiver, oak cabinet, 12in tube, newly constructed for high reliability; may be seen working Wembley; £65; ditto, less cabinet and tube, £40; with 9in used tube, £44.—Box 492.

TELEVISION Console, 12-inch G.E.C. BT9121, £15, new spare CRT 12-inch electrostatic G.E.C.4603, £12; power unit, type 3, for R1132A, £3/5.—Banham, West Mersea, Colchester, Essex. [4552

AR88D and L.F. receivers for sale; R1124 receivers with six valves, 12/6; miniature G.E.C. split-field motors, 2/9 each; motor generators, 24 volts, 5/6 each, etc., etc.—J. Rae, 39 Penn Rd., Wolverhampton. [4592

RECEIVERS type 76, 3 valves, ARTH2, VR53, VR92, IF output, 560 kc/s, 22/6; modulator unit type 76 (IF and output unit for the above), 2 stages of IF, detector, a.v.c. and output, also 4 valve push-pull amplifier, 9 valves, 2KT33C, 2EF36, 3EF39, 1EBC33, 1EF50, 49/6 plus 5/- carriage; the two units for 70/-; both brand new. Condensers: Sprague, .01, 1,000, 3/- doz; .25, 500, 3/6 doz; .25, 1,000, 6/6 doz; 4mfd 425 Micropack, 10/6 doz; .03 2.5kv, .05 3.5kv, 1/- each; transformers: 200-250v, DR1-RCA, 2,000v at 800ma, 90/-; 500-0-500 at 120ma, 3 and 4v 10v, 25/6; 350-0-350 at 200ma, 5 and 6.3v, 30/-; 300ma chokes, 20h, 15/9; many other items; s.a.e. list.—Cross Skerries, Cross Lane, Grange, West Kirby, Ches. [4573

NEW LOUDSPEAKERS

STILL the best for the barker, the Tridem 12D corner cabinet, supplied with or without speaker unit.
FELICITY GRAMOPHONE CO., 87a, Upper Richmond Rd., S.W.15. [0040

5in cabinet extension speaker, in handsome brown or cream plastic cabinet, fitted with volume control and lead; 29/6, post free.
8in cabinet model, with multi-ratio trans., vol/control, etc., 47/6, post free.
RADIO, UNLIMITED, Elm Rd., London, E.17.

LOOKER'S Flexicone Conversions will immensely improve reproduction of your present speaker; write for free descriptive leaflet.—Looker's "Quality" Radio, 106 Davidson Rd., East Croydon. [4458

LOUDSPEAKERS, SECOND-HAND

HARTLEY TURNER 215, perfect, £6/10.—15, Glover Rd., Pinner. (Pin. 931.) [4551

SOUND Sales DX1 feeder unit, as new; £12/10.—Ferrous Castings, Ltd., Warrington. [4508

GOODMANS infinite baffle, Partridge transformer, £10.—Marshall, 5, Isis Court, Chiswick, W.4. [4310

UNUSED manufacturers' surplus, P.M. speakers, 3½in, 5in, 8in, 10in, 12in, 8/6, 10/6, 12/6, 18/6, 35/-.—Radio, Unlimited, Elm Rd., London, E.17. Key. 4813. [4555

HARTLEY-TURNER 215 speaker, £6; 21in cube baffle (new), £6; new boxed pickups, Connoisseur, £2; Lexington senior, sapphire, £3/10.—170, Baginton Rd., Coventry. [4495

DYNAMOS, MOTORS, ETC.

ROTARY convertor for sale d.c. 220v input, a.c. 230v single phase 50 cycles output, 200w; ex-naval, as new, £15 or near offer.—Apply Preston, Home Farm, Laverstoke, Whitchurch, Hants. [4489

BATTERY chargers, 4 models 2-6-12v, 1-2-4 amp D.C.; any mains voltage; also larger types special transformers, chokes, test gear, interior car heaters etc.—The Banner Electric Co Ltd., Hoddesdon Herts. [2212

ALL types of rotating electrical machinery up to 20kw available, including rotary converters, motors, rotary transformers, petrol and diesel-engined generators, alternators and d.c. generators; we are also in a position to quote for power transformers; as actual manufacturers, we will be glad to quote for any quantity for home or export.
REVOLVING armature alternators, with separate exciter generators, 4-pole, ball bearing, 1,500rpm output 230v 50 cycles, 3kva excitation at 24/30v; new, price £28 nett ex works.
J.A.P., type 2a single-cylinder air-cooled petrol engines, 1.2bhp at 2,600rpm; price £14 ex-works.
ROTARY transformers, input 11.5v d.c., output 600v at 250ma, price £3; ditto, input 20v d.c. and dual outputs of 6.5v d.c. and 300v d.c., price 25/-.
CHAS. F. WARD, Lordscroft Works, Haverhill, Suffolk. Tel. Haverhill 253. [0039

MOTORS, 230v a.c. approx. 1/6th hp, converted rotary generators, new method, constant speed, for intermittent use, 18/6; 12 and 24v bulbs, S.B.C. half reflector car head lamp size, dozen 9/9; transparent glass lacque, red, green, amber, 2 dram, 7d; transformers, 230v to 24v 2amps, cased, leads, 18/6; transformers, 15v at 80amps, £4.—Maiden Transformer Supplies, 200-202, Cambridge Rd., Norbiton, Surrey.

PETROL and T.V.O. charging and lighting plants, 12 and 24volt, no A.C. plants; engines, Douglas 349cc twin, air-cooled, new, £20 plus carr.; J.A.P. 1-2hp air-cooled, No. 2a, not ex-M.O.S., new, £14 delivered, 14-32v 290watt generators with or without control box, new, 6 and 12volt 85amp hour batteries; all engines and dynamos tested on load before dispatch; enquirers please state exactly voltage and size of plant, or engine required; large 3-phase chargers still available; please see advertisement on page 79 for S.T.C. rectifiers and terms of business.—Pearce, 66, Gt. Percy St., London, W.C.1. [0014

AMC

TELEVISION

Manufactured to "*Electronic Engineering*" Televisor Specification.

MIDLAND T.V. Sound and Vision Panels fitted with formers and dust cores now available.

LINE OUTPUT TRANSFORMERS

NEW Improved SET OF GANTRIES COMPLETE

FOCUS COILS

LINE AND FRAME SCANNING COIL ASSEMBLIES

All Steel CADMIUM PLATED POWER AND TIME BASE CHASSIS valve-holders, 3 point and single socket and all necessary cut-outs.

SOUND PANEL CHASSIS ASSEMBLY, fitted with screens, valve-holders formers and dust cores.

VISION PANEL CHASSIS ASSEMBLY, fitted with screens, valve-holders, formers and dust cores.

9" C.R. TUBE SUPPORT for mounting on top of Gantry Assembly.

9" CREAM MASKS.

5, SHAKESPEARE RD., FINCHLEY, N.3
Phone FINchley 2188

SOLON electric soldering irons have proved their capacity for continuous service under the most exacting conditions. 5 models; 240 watt oval tapered bit; 125 watt oval tapered and round pencil bits and 65 watt oval tapered and round pencil bits. Each model complete with 6 feet of Henley 3-core flexible. Now available from stock. Write for folder Y.10.

HENLEY SOLON ELECTRIC SOLDERING IRONS

W.T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51-53 Hatton Garden, London, E.C.1

DYNAMOS, MOTORS, ETC.

BATTERY chargers, 2-6-12volts, 1-amp. enclosed steel case with ammeter, a.c. mains operated; 42/6.—Thames Valley Products (W), 28, Camden Ave., Feltham. [4264

NEW rotary converters with special smoothing equipment f r television, radiograms, etc., 300 watts output £23. 500 watts £30; other converters various voltages, from £2/10; also new electric motors, a.c. and d.c., B.T.H., Metrovick, etc., at low prices; trade supplied; list available. JOHNSON ENGINEERING, 319, Kennington Rd., London, S.E.11. Reliance 1412-3 [4156

97/6, charging switchboards, 12v-32v, 500 and 1,260 watts, volts, amps, cut-outs, fuses, resistances, etc., 4 take-offs, superb unit, in case, or send £5 carriage paid; 75/-, dynamos, 24 volts, 1,000 watts, 9in×7in, ¾in spindle, or send 80/- carriage paid, 75/-, 230v/1/50, ⅙hp electric motors, incorporating 1,260 cycle converter, or send 80/- carriage paid; 58/-, mains transformer switchboards, 230v a.c. to 12v, 5 separate take-offs, complete distribution panel, all switches, fuses, amps, etc., brand new, or send 60/- carriage paid; 55/-, electric motors, 12v and 24 v, ¼hp, 4in×4in, with ½in spindle for drive, beautiful job, or send 60/- carriage paid; 45/-, dynamotor units, containing 12v, 24v, 130v and 300v d.c. dynamo or suitable as 6v, 12v or 24v motor, approx. ¼hp, 11in× 5in, with spindle to take small grindstone, mop, etc., also contain adjustable 24v cut-out automatic voltage control, smoothing condenser, resistances, and many other extremely useful fittings, beautifully made or send 50/- carriage paid; 38/-, radio wavemeters, adjustment dial, 350-370 Mc/s, beautiful instrument in case, or send 40/- carriage paid; host other valuable equipment; lists free.—Benmotors, Summerley St., Earlsfield, S.W.18. Wim. 3833. (100 yds S. Rly. Electric Line; 10 minutes Waterloo).

TEST EQUIPMENT

AVO electronic test meter with stand and multiplier, perfect; £27/10.—Box 593.

NO. 1 Douglas coil winding machine, as new; s.a.e.—89, Manor Rd., Itchen, Southampton. [4485

TAYLOR circuit analyser 20A, new condition, price 10gns.—Gridley 52 Adelaide Grove. W.12. [4539

WIDE range universal test meters, mirror scale, 1,000 OPV with cap. range and a.c.-d.c. 38 range; brand new ex manufacturer, £10 nett.

UNCLE TOM'S RADIO CABIN, 5, Seven Stars Court, Manchester, 4. [3210

MARCONI TF 144G standard S generator, 85kc to 25mc, as new; many other instruments in stock, s.a.e. details and lists.—Eldridge 254, Grove Green Rd., E.11. Ley. 4966.

OSCILLOSCOPE and wobbulator complete £20 T.B. c/s 10 to 350 000 c/s X and Y plate amplifiers, easy to handle, has outstanding performance, fully guaranteed, immediate delivery with set of leads and booklet. "Oscilloscope Technique"; further details from the manufacturers.—Erskine Laboratories, Ltd., Scalby Scarborough [3456

SIGNAL Generators range 100kc/s-100mc/s directly calibrated scale 4½in diameter hair line cursor incorporates designed attenuator unmodulated modulated 400cps and separate AF etc., new instruments built to a standard not to price, operation AC 100/250 accuracy ½ of 1%, £13/17/6; accuracy 0.05% included crystal £15 17/6.—See below.

BEAT frequency oscillators range 30-15,000cps directly calibrated 5½in diameter scale amplified variable and meter measured output matched 600 ohms incorporated constant accuracy check low harmonic content new precision instruments, £12/19/6.—See below.

HF oscillator units, covering range 100kc/s-100mc/s ready wired and tested for immediate use less 6J5 valve, 59/6 directly calibrated scale 9×5.n matched to unit, 9/6, also attenuator units engraved panels cases and all parts construction signal generator circuits, 2/- for illustrative data send stamp.—See below.

MODIFICATION, we can undertake rebuilding modification old type signal generators to cover range 100kc/s-100mc/s directly calibrated scales fitted new panels, etc., accuracy guaranteed 1%, send instrument or write quotation.

ELECTRONIC EQUIPMENT Co., Connaught House, West Malling, Kent. [4544

METERS.—150v 2in, m/c, 10/-; 2,000v, 2½in electro-static 14/6; 3,500v, 3½in, m/c, 20/-; 6,000v, 3½in, m/c, 57/6; 15/600v, 2in, m/c, double reading, 8/-; 100ma 2in, m/c, 7/6; 40/120ma, 2in, m/c, double reading, 8/-; 3.5amp, 2in T.C., 5/-; 4amp 2½in T.C. in case with switch, 7/6; 20amp, 2½in, m/i, 9/6. Meter movements, 2in size with magnet and case (500-microamp), 2/6; Units containing two movements, 5/-. All meters post extra. Ex-R.A.F. 2-valve (2volt) microphone amplifiers, as used in plane intercom., in self-contained metal case, can be used to make up a deaf-aid outfit, intercommunication system, or with crystal set, complete with valves, 20/-, post 1/6, wooden box to hold amplifier, 2/- extra; crystal sets, with permanent detector, 9/6, in oak case, 18/6; headphones, 5/6, 7/6, 10/- and 12/6 pair; permanent detectors, 2/6, soldering irons, streamline, 50w, 9/-, standard 60w, 9/6; heavy duty, 150w, 12/6, all post extra; letters only; new illustrated list sent on request with 1d stamp and s.a.e.

HIGHSTONE UTILITIES, 58, New Wanstead, London, E.11. [3540

ELECTRADIX

for Best British Bargains

MOTORS. A.C. 50 cycle single phase ¼ h.p. 230 volts, 1,425 r.p.m., new, **£5/10/-**. ¼ h.p. 230 volts, capacitor start, 1,425 r.p.m., new, **£9/10/-**. Reconditioned A.C. Motors, 230 volts 50 cycles single phase G.E.C. ¼ h.p., 1,425 r.p.m., **£4/10/-**. Crompton Parkinson, **£4/10/-**. A.C. 50 cycles 3-phase motors, ½ h.p., 1,425 r.p.m., 230 volts, new, **£7/10/-**.

FANS. Keith Blackman 400/440 volt 3-phase 50-cy. A.C., with 10in. blade, **£4**. 24 volt D.C. Wall or Table Fans, G.E.C., with 6in. blade and guard, **£2/5/-**. 220 volt D.C. Sterilzair Fans, for ceiling fitting, 10in. blade in copper Oxy. bowl and fixing chains, **£3**. 220 volt A.C. Table Fans, 10in. blade and guard, **45/-**.

DYNAMOS. D.C. 12 volt 10 amp., totally enclosed car type, 1,400 r.p.m., **40/-**. 12 volt 30 amp., 2,500 r.p.m., **25/-**. 30 volt 5 amp., 1,500 r.p.m., **35/-**. 24 volt 20 amp., 1,200 r.p.m., **£12/10/-**. Carriage on any dynamo, 5/- extra.

FREQUENCY METERS. 230 volt, 6in. Ironclad Switchboard Meters, 40/60 cycles, **£4/10/-**.

A.C. METERS. 5in. dia. Switchboard mounting, 0-300 volts 50 cy., **35/-**. 0-50 amp. to match, **35/-**. G.E.C. Meters, A.C., 50 cy., 0-40 amps. Ironclad Switchboard mounting, **35/-**. Voltmeter to match, 0-60 volts, **35/-**.

PORTABLE A.C. METERS. 6¼in. x 6¼in. x 4in., luminated dial mirror scale, 0-50 amps. and 0-75 volts, **40/-** each.

RADIO SUPPRESSORS. Choke and condenser type, in iron box, 2-way, **5/-** each; 3-way, **7/6** each.

IRONCLAD SWITCHGEAR. We have a large stock of Ironclad Fuses and Switch Fuses by leading Makers, 15-30 and 60 amps. Write for special leaflet "W.W."

ROTARY SWITCHES. 10 amp. D.P. on-off, on porcelain base with bakelite cover and knob, **3/6**. 10 amp. S.P. Fuses, **2/-** each.

VARIABLE RESISTANCES. Wire wound, 10 ohms 3 amp., **12/6**. 1.5 ohms 15 amp., **7/6**. 5 ohms 6 amp. **17/6**. Small radio type, 10 ohms 1 amp., **2/6**.

DIMMER RESISTANCES. 100 ohms ½ amp., **2/-**; 50 ohms ½ amp., **2/-**, postage 6d.

GAUGES. Bourdon air gauges, plus 8 lbs. per sq. inch to minus 7 lb. per sq. inch luminous dial, for testing blowers, vacuums, etc., **5/-**.

G.P.O. MAGNETO BELL in polished box, **5/-**. G.P.O. Candlestick Mike, with cord and switch-hook, **7/6**, postage 1/6 extra.

SPARK COILS. 6-12 volt D.C. input to give ½in. spark, with trembler and contacts, **5/-**; the coil as above, fitted spark gap, **6/-**, postage and packing, **1/6**.

MAGNETS. Swift Levick S.L.S.36 instrument type, circular horseshoe 1⅞in. dia. ⅜in. thick, ⅛in. polar gap drilled poles, weight 2 ozs., lift 3 lbs., **2/6** each, or **12/6** for six. The Alni disc magnet, the wonder midget magnet, ⅝in. dia., ⅜in. thick, 3/16in. hole in pot with keeper, **3/6**. D.C. Electro Magnets, weight 10 ozs., lift on 2 volts 1½ lbs., 4 volts 3 lbs., 6 volts 4 lbs., **5/-**. Permanent flat bar magnets, 2¼in. x 1in. x ½in., drilled two holes each end, **2/-** pair. Large stock of Horseshoe Magnets. Send for special leaflet, "W.W."

LIGHTING PLANTS. Villiers 550 watt sets, 2 h.p. engine direct coupled to 18 volt 30.5 amp. dynamo with switchboard in steel cabinet, **£22/10/-**.

Pelaphone 500 watt water cooled 1 h.p. engine, coupled to 50/70 volt 10 amp. dynamo, **£35**.

Chore Horse 300 watt single cylinder 4 stroke engine direct coupled to 12 volt dynamo with switchboard, **£17**.

PARCELS. 10 lb. useful oddments for the junk box. All clean, dismantled from Government and other surplus apparatus, **7/6** post free. (For home buyers only.)

Please include postage for mail orders.

ELECTRADIX RADIOS

214 Queenstown Road, London, S.W.8

Telephone : MACaulay 2159

TEST EQUIPMENT

TAYLOR 85a, 95 ranges, 20,000amp. P. volt, with leads and booklet, as new, £14.—Jordan, 14, Carr St., Lincoln. [4571

OSCILLOGRAPH Mullard E805, £45; signal generator Advance B3 mode, C £17; both in new condition; London area.—Box 497.

STROMBERG-CARLSON trigger oscilloscopes. U.S.A. make, brand new with 5in CRT and 13 valves—4×6SJ7, 2×6H6, 2×6N7, 2×VR 150/30, 6AC7, 5Y4 and 2x2. Controls for signal intensity; TB frequency; velocity; TB shift; intensity; focus; sensitivity and pulse sync. Mains input 115/230v 50c/s; case 21in×11½in×10½in. Complete with circuit diagram and instructions for 15 minute modification to self running time base. Price £12/10, carriage paid.

FRITH RADIOCRAFT, Ltd., 69-71 Church Gate, Leicester. [0025

TRANSMITTING EQUIPMENT

WALTON'S WIRELESS STORES, 203, Staveley Rd., Wolverhampton.

STILL another amazing bargain offer in partly stripped transmitter units; if you were unsuccessful in obtaining a unit before, now is your chance; just released by The Ministry of Supply, approx. 1,500 Type 1154 transmitter chassis, to conform with regulations these have been partly dismantled by the Ministry and are sold by us for the parts therein and not as transmitters; our special price, including carriage, 12/6; also a small number of the popular 1196 transmitter at 5/6; another useful item is the mounting rack for the complete 1196 installation, which includes Jones sockets for the power unit, T/X, R/X, a 24v impulse motor, a light duty relay P.O. type, and a heavy duty relay, terminals, etc., our price, complete, 10/6; send s.a.e. to-day for our clearance list, a colossal stock must be cleared and in this instance the prices are of secondary importance.

STOP press! Special offer in very sensitive headphones, ex-Army double headphones, complete with lead and jack plug, low resistance, balanced armature type, ideal for use with all types of sets or make super microphones, no batteries required, simply plug into the pick-up terminals of any domestic receiver and talk! These phones are very cheap at 30/- per pair; our price, 5/6 per pair or 2 pairs in their original box for only 10/-, carriage paid.

ALL Mail Orders to 203, Staveley Rd., Wolverhampton. Callers only, 48, Stafford St., Wolverhampton. [0010

HALLICRAFTER transmitters Type HT4E (BC610), complete to makers' latest specification, covering all frequencies from 1mc to 30mcs, complete with speech amplifier, connecting cables, etc.; limited quantities only now available.

PANORAMIC adaptor, Type MCA44, British-made, suitable fitment to any good-class communication receiver, in addition to all Hallicrafter models, immediate delivery.

BRITISH-MADE under Hallicrafter licence, SX42 receiver, now available for export only.

McELROY-ADAMS MFG. GROUP, LTD., 46, Greyhound Rd., London, W.6. Tel. Fulham 1802 Cables Hallicraft London [4114

GRAMOPHONE AND SOUND EQUIPMENT

FRITH RADIOCRAFT, Ltd., offer:—

LATEST radiogram units from stock include Collaro rim-drive, magnetic PU, £5/3/2; Garrard ditto model S, £5/10/6; Plessey press-button start, magnetic PU, £6/18/3; Collaro auto-change lightweight PU, £10/15; Marconi AC100 auto-change lightweight PU, £10/0/8; all inc. P.Tax, post free.

FRITH RADIOCRAFT, Ltd., 69-71, Church Gate, Leicester. Phone 58927. [0027

PLESSEY autochanger record player, perfect, hardly used; £14, best offer.—Box 597.

R.C.A. ribbon mic. and S.T.C. ball mic., £5 each.—Dudley, 228, Long Shoot, Nuneaton.

NEW, Hartley Turner output transformer, £2; Hartley Turner amplifier and pack, complete, £9; particulars.—Abbott, Rufforth, York.

NEW Lexington Senior pick-up trans, Mu screen, sapphire; cost £9; sell, exchange Axiom 12 or 22.—Tugby, 56, Park Ave., Potters Bar, Middlesex. [4479

INFINITE baffle corner deflectors, scientifically designed acoustic chambers for 8 to 15in speakers; lists.—Broadcast & Acoustic Equipment Co., Tomb and, Norwich. [2904

MAGNETIC ¼in TAPE recording heads, standard model record-playback with split winding for bias and 5 or 15Ω audio, 30/- each, erasing heads 30/- each.

HI-FIDELITY ¼in tape heads, circular Mu-metal laminations stacked ¼in, fully screened, single unit (record-play), £4/10; twin unit with tape lifting (record-play and erase), £9; full assembly (record, play, erase) with tape lifting, £14; impedance 5 or 15Ω to order, bias winding, for 75T osc. sec. coil; ¼in Emitape, 3,000ft, £4/10; osc. coils, 15/-; circuits supplied free. Trade enquiries invited.—Morecambe Sound Service, 4-6, Green St. Morecambe. Tel. 1161. [4464

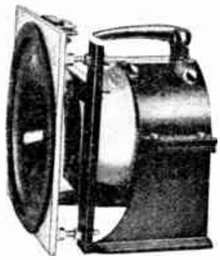
MAGNETIC sound recording wire, stainless steel, temporary wooden spools approx. 1½ hours' running time at 2ft per sec.; 14/- per spool.—A. Smart, 40, Grange Rd., Halesowen.

FOR sale heavy duty recording machine and separate motor recording amplifier, Prestage, and crystal mic, line trans.—H. Burton, Higher Reedley Road, Brierfield, Burnley, Lancs. Tel. 379 Nelson. [4523

-towards perfection-

LOWTHER P.M.2

is one of the most efficient loud-speaker drive units in existance.



Specification

Flux Density : 19,500 gauss average over gap area.
Magnet Gap. 1.5 mm. × 5 mm.
Diaphragm. Incorporating Messrs. Voigt Patents Ltd re-matched light coil twin diaphragm, 6in diameter, aluminium wire speech coil.
Weight : 19 lb. average.
Dimensions. 8½in. high, 8in. wide, 7¼in. deep, over plug.
Dynamic Impedance. 15 ohms.
Sound Power Output estimated 2 × 10⁶ ergs/sec. for normal speech and music with approx. 6 watts R.M.S. speech current.
Connections : Moulded 2-pin socket and plug at rear of unit.
(Pat. Nos. 618,802, 625,432 and Pending.)

Used in conjunction with Corner Horn type P.W.I. or Voigt Reflector type horn is the most outstanding combination for natural reproduction and therefore a perfect compliment to your electro-acoustic equipment.

NEW LEAFLET NOW AVAILABLE

THE LOWTHER MANUFACTURING CO.

(The Laboratory Production Unit.)

Lowther House, St. Mark's Road, Bromley, Kent RAV. 5225

THESE ARE IN STOCK

Elements of Sound Recording. By J. G. Frayne and H. Wolfe. 51s. Postage 1s.

Cathode Ray Tube Traces. By Hilary Moss. 10s. Postage 6d.

Wireless Simply Explained. By R. W. Hallows. 10s. 6d. Postage 6d.

Technique of Radio Design. By E. E. Zepler. 25s. Postage 9d.

Basic Mathematics for Radio Students. By F. M. Colebrook. 10s. 6d. Postage 4d.

Television Servicing Manual. By E. N. Bradley. 4s. 6d. Postage 3d.

Radio Valve Data. Compiled by "Wireless World." 3s. 6d. Postage 3d.

Radio Amateur's Handbook. By A. R. R. L. 15s. 6d. Postage 9d.

Brimar Radio Valve and Teletube Manual. 4s. Postage 3d.

Superheterodyne Television Unit. London and Birmingham Areas. 2s. 6d. Postage 2d.

Radio Receiver Servicing and Maintenance. By E. J. G. Lewis. 8s. 6d. Postage 5d.

Vade-Mecum 1948 Edition. Two volumes. By P. H. Brans. 19s. the set. Postage 9d.

We have the finest selection of British and American radio books. Complete list on application.

THE MODERN BOOK CO.

(Dept. W. 12)

19-23 PRAED STREET

LONDON, W.2

GRAMOPHONE AND SOUND EQUIPMENT

30 watt amp, stand mike, twin 10in spkrs., playing desk, twin 12in turn tables and p.u.s., complete, £75 or offer.—34, Grasmere Ave., Preston Rd., Wembley. Arn d 7532. [4542

LATEST American wire recorder which includes radio transmitter and crystal record player; hi-fidelity reproduction; 60 min spools; portable, 12v-250v; £95.—Parsons, 37, Woodland Way, Mitcham. [4521

WEBSTER wire recorder, Continental suitcase model, made for 110-240 volts 50 cycles, modulation level indicator, crystal mike and three spools wire, new September and hardly used; highest offer over £30 secures.—Box 565.

ONE B.B.C. recorder, disc, rack, less cutting head and traverse gear, and 6J5s; offers over £30, or would consider exchange for wire or tape recorder, or purchase of gear as above, or what have you?—Surplus Supplies, Northbrook St., Newbury. [4506

TAPE recording; an entirely new, simple and efficient method of recording is now becoming generally available; we are now publishing a booklet describing the system in simple terms and we can supply recording heads and other essential components for the construction of suitable equipment; private and trade enquiries invited.
AUDIGRAPH, Ltd., 7, St. Peter's Place, Birmingham, 1. [4509

BRITISH SOUND RECORDING ASSOCIATION.—Membership is open to all professional and amateur recording engineers and high-quality reproduction enthusiasts. The official Journal, "Sound Recording," Vol. 3, Nos. 1-2-5 available at 2/8 post free. B.S.R.A. Diary for 1950 at 4/6 with eight pages of data on recording and reproducing topics, brochure and application form from Membership Secretary, Harrie J. King, 48, Mount View Rd., N. Chingford, London, E.4. [2119

COMPONENTS—SECOND-HAND, SURPLUS

WIRELESS World televisors.

FOR approved components all enquiries should be addressed to the makers, "Handyparts," 226-228, Merton Rd., Wimbledon, S.W.19. Lib 7161 S.a.e. for replies [0033

TRANSFORMERS to exact specification.

LINE O/P trans., for W.W. televisor, 45/-; O/P trans., for Williamson amplifier, 75/-; mains trans., for Williamson pre-amp and radio feeder unit, 60ma O P, 28/6; television filament trans., 6.3v 8amp and 2. 4, 6.3v 2amp, 23/6; tag panels fitted as specified, trans., for amplifiers, televisors, valve testers, test gear, chargers, etc., to any published specification, or to your own design.
E.P.D. TRANSFORMER PRODUCTS, 31, Queenstown Rd., Battersea, S.W.8. Tel. Mac. 4180. [4579

SOUTHERN RADIO'S Wireless Bargains.

BENDIX command receivers, B.C.454 (49-100 metres), B.C.455 (33-49 metres), complete with 6 valves, new 35/-, plus 1/6; B.C.455 (28-41 megs for television sound), 50/-; control boxes for Command receivers, 13/6; 14ft control cables 9/6; knob and adaptor for same, 2/9; T.R.1196 6-valve superhet receiver, with circuit, 22/6; contactor time switches by Smith or Venner, 11/4; crystal detectors, 2/6; throat microphones with lead and plug, 3/6; universal Avo minor cases with carrying strap, leather 10/-; Marconi lightweight headphones, 4/-; Thermal delay switches, 5/-; bombsight computers, 60/-; inspection lamps with lead and plug, 2/6; Westectors W×6 and W112 6/4 per dozen, special line, limited quantity only, type 58 Mk I transmitter receivers, complete with vibrator pack and batteries, complete brand new in sealed cartons, £19; Telesonic receivers, new, complete with 4-Hivac valves, 32/6; Iufbra hole cutters, 5/-; most lines previously advertised still available; full range of radio books in stock; please send 2½d for complete publications list.
SOUTHERN RADIO SUPPLY Ltd., 46, Lisle St., London W.C. Gerrard 6653. [0016

THE simplest s'het pack type Ml., M L. waves 22/6, thousands in use.
DOUGLAS COIL Co., Brinklow Nr. Rugby

CRYSTAL microphone inserts (Cosmocord Mic-6), guaranteed brand new; 15/6 post free.
RADIO-AID, Ltd., 29, Market St., Watford. Tel. Watford 5988. [0036

HAVE you seen our new component catalogue. Many bargains. May we send you a copy?
M. WATTS & Co., Baker St., Weybridge, Surrey. [4538

B7G valveholders and screens, 1/6.—Sevenoaks London Rd., Davenham, Northwich Cheshire [4076

LITTLEWOODS, North London's best selection of radio and television components, pay us a visit or post or phone your enquiries, no lists.
LITTLEWOOD & GR NER Ltd, 27, Ballards Lane, Finchley, N.3 Fin. 5060. [0055

WILLESDEN high quality transformers available ex-stock for the D T N Williamson Amplifier, Electronic Eng. Televisor, and all well-known circuits
WILLESDEN TRANSFORMER Co., Ltd., 23, Palmerston Rd., N.W.2. Tel No. Willesden 2476.

CONDENSERS, resistances, T.V Inductances, E.H.T. transformers, chokes, indicator units, control units, etc., etc.; send for latest lists of genuine bargains.—Slack, 66, Tudor Rd., Leicester. [4568

OPPORTUNITIES IN RADIO

Get this FREE Book!

"ENGINEERING OPPORTUNITIES" reveals how you can become technically-qualified at home for a highly-paid key-appointment in the vast Radio and Television Industry. In 176 pages of intensely interesting matter, it includes full details of our up-to-the-minute home study courses in all branches of **TELEVISION and RADIO, A.M. Brit. I.R.E., A.M.I.E.E., City & Guilds, Special Television, Servicing, Sound Film Projection, Short Wave, High Frequency, and General Wireless Courses.**

We definitely Guarantee

"NO PASS—NO FEE"

If you're earning less than £10 a week, this enlightening book is for you. Write for your copy today. It will be sent FREE and without obligation.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
388b SHAKESPEARE HOUSE
17/19 STRATFORD PLACE, LONDON, W.1

BIET

TELEVISION CONSTRUCTORS

Build the television receiver which proved to be successful and popular at Radiolympia!

Suitable for use with 9in., 10in. or 12in C.R. Tubes.

INSTRUCTION BOOK 5/- post free.

Containing all the information required for building the set, including point to point wiring diagrams. (Please state London or Midlands).

CAN BE BUILT FOR £16. C.R. TUBE extra.

Write for leaflet giving further details.

Standard Range of Components :

Deflection coils, type DC1, per set	£1 2 6
Line Output Transformers LT1, each	£1 2 6
Focus Coils, type FC1 (High Resistance) each	17 6
Focus Coils, type FC2 (Low Resistance) each	17 6
Pre-amplifier, with self contained power pack	£7 10 0

London or Midlands.

HOUGHTON & OSBORNE
ELECTRON WORKS, THAME, OXON
Phone : THAME 182

K 18

COMPONENTS—SECOND-HAND, SURPLUS

TELEVISION. HANNEY OF BATH Offers:—

POLYSTYRENE and Paxolin formers for the "Wireless World" superhet receiver. All other components are available ex-stock; condensers resistors, Reliance potentiometers, aerials etc.

MULLARD MW31/14c c.r.t.s. limited number. £15 2 5.

MULLARD MW22 14c c.r.t.s now available for immediate delivery £11/6 10, carr. pd.

CHASSIS in 16 s.w.g. ali., 4 sides, 9 sizes; 2 4 and 6 B A nuts, bolts and washers; enamelled copper wire in ¼, ½, 1 or 7.b reels. 16 to 40 s.w.g.

COMPLETE set of parts for the Williamson amplifier 11gns (less valves), or wired and tested £25/10 (with valves), guaranteed 2 years ALL high stability resistors and matched condensers in stock for the new Williamson pre-amp. and tone system.

B.S.R. gram motors £3/4/3 inc. tax, and the new E.M.I. auto-changer at £9/19/10 inc. tax.

WE CARRY comprehensive stocks by all makers of repute. Eddystone, Raymart, Denco Wearite T.C.C., B.I., Hunts, Dubilier Morganite, Reliance., Elstone Gardner, Goodmans, Avo Taylor, Partridge, etc. etc.—new goods only.

SEND NOW for (a) T.V. list; (b) amplifier list; (c) S.W. list. 2½d stamp please, for a host of useful literature.

L. F. HANNEY, 77, Lower Bristol Rd., Bath. [4585

DUKE & Co., 219, Ilford Lane, Ilford, Essex This month's bargains:—

SPEAKERS, all P.M. 3½in 10/-, 5in 10/-, 5in with transformer 13/6, 6in R. & A. 11/3, 8in 11/9, with transformer, best grade, 17/6; 10in 19/6, 12in 39/6; all guaranteed new goods Condensers; 32mfd 350v d.c., 3/6; 8+16mfd 450v d.c., 2/6; 16+16mfd, 350v d.c., 3/6; 16mfd 350v d.c., 3/-, 16mfd, 450v d.c., 3/3; 8mfd 500v d.c., 2/6; 8+8, 450v d.c., 3/6; .0001, .005, .0003, .01, .01 all at 6d. Transformers O.P. transformers, 45×1, 2/6; multi-ratio 4-ratio, 4/6, 6-ratio, 6/6; I.F. transformer, 465kc/s slug tuned, 8/6 pair; dual range t.r.f. coils aerial and h.f., 6/6 matched pair. Tuning condensers, .0005 single, 2/2, .0005 two-gang 4/6, 3-gang 2/6. Domestic radio receiver kits. A 3-valve t.r.f. 2-waveband receiver giving quite surprising results, all parts included, condensers, resistors, coils, speaker chassis valves and a smart imitation walnut bakelite cabinet, complete kit £4 19/6; ivory cabinet available at 6/- extra. Headphones New condition, low resistance 2/6 high resistance 4/6. Crystal sets, reception guaranteed a neat job in bakelite cabinet 8/6. Special offer First grade electronic condensers, 4mfd 200v d.c., 50mfd 25v d.c., 3 of each for 3/-; meters, 1.5ma full scale deflection, 2/- each E.H.T. transformers, 2,000v, 19/6; ideal for V.C.R. 97. Remember, we carry the largest valve stocks in E. London and at only B.o.T. prices. When remitting c.w.o. please, and allow sufficient for postage. Send stamps only for detailed lists. Trade enquiries invited. [4587

FRAME aerials M.L. chassis mounting, 9½in × 5½in 7/6, manufacturers' surplus midget L.F. chokes, 2/6.

HILLFIELDS MAIL RADIO, 8, Burnham Rd., Whitley, Coventry. [10022

VACUUM relays, thermal type 6v 35ma (approx.) will switch 230v 10amps length 5¼in diam. 1in, fitted with standard 4-pin valve base, 6/6 ea.

VELODYNES Magslip and Selsyns, many types in stock send for list; technical advisory service available.

HOPTON RADIO, 1, Hopton Parade, Streatham High Rd., London, S.W.16. Streatham 6165.

TELEVISION all parts in stock for EE televisor, Haynes scan and focus coils, line trans. mode. on view.—H.G. Radio, 1350 Stratford Rd., Birmingham 28. [441

TELEVISION scanning coils, 30/-; frame output transformers, 17/6, line output transformers, 25/-, also mains transformers, chokes, etc.—The Banner Electric Co. Ltd., Hoddesdon

CHASSIS, alum, complete with 5 valves, 6K7 6K3, 6Q7, 6V6, 5Z4, guaranteed new condition, 37/6, splendid selection of unused components at rock-bottom prices; comprehensive list, 1d stamp.

RADIO UNLIMITED, Elm Rd., London, E.17. Tel. Key. 4813. [4557

THE brain of any good radio is an Osmor Q coilpack, used with our matched components you can build a radio really worth boasting about, write to-day for free circuits and our latest lists including the Bargain Bulletin.

OSMOR RADIO PRODUCTS Ltd., Bridge View Works, Borough Hill Croydon. (Cro. 1220.)

"YOU'LL probably get it at Smith's, Edgware Rd!" Everything for the constructor, from a 1/10watt resistor to a radiogram cabinet, lowest prices, biggest variety.—Near Metropolitan Music Hall Pad 5891 [8005

HT eliminator and accumulator charger (a.c.) 40 60, 90 120-150 volts output charges at approx ½ amp size 9½×4¼×2 inches; price £2/17/6; 8-8 uf 450vw midget cans, 5/- ea.—Tanner Radio Service, East-Cliff, Lyme Regis Dorset [4379

HIGH quality output transformers, Williamson type, £2/12/6; standard drilled and tapped racks for 19in panels, 5ft 6in angle iron £1 each, 6ft 3in channel, new £3/15; VT104 trans. valves, new, £1 each.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [2909

You're SURE to get it at

STERN'S

ESTABLISHED 25 YEARS

Resistances. A parcel containing 100 popular assorted values for ½ watt type, 6/-, or 1 watt, 8/9.

Moving Coil Speakers. Well-known manufacturer's surplus all 2/3 ohms and P.M.: 10in. 23/6, 8in. 17/- (15 ohms 18/9), 6½in. 16/6, 5in. 10/-, 3in. 9/-, Rola 3in. 16/6, 12in. Truvox 47/6, Goodmans £6/15/-.

Potentiometers. New Centralab: 2K, 5K, 10K, 25K, 50K, 100K, ¼, ½, 1 and 2 meg., less switch 3/9, with switch 6/-. Midget Type 2/6. Midget with switch, ¼, ½ and 1 meg., 6/-.

Coils. Denco Maxi "Q." High "Q" with miniature size Litz wound on Polystyrene Formers with adjustable Iron Dust Cores. Aerial, H.F., or Oscillator for 465 k/c or 1.6 m/c. One for all wavebands 3.6 to 2,000 metres Wiring diagram. Prices: Chassis Mounting, 3/9 (with React. 4/9); Octal fitting pin base 4/- (with React. 5/-).

Denco T.R.F. Matched pair Medium and Long Waves, 6/6 pair. Weymouth T.R.F. Matched pair M. and L. Waves, 9/6 pair. Superhet Matched pair S. M. and L. Waves, 8/9 or 11/6 pair. All types Wearite "P" Coils 3/- each, in stock. Weymouth Midget 1½in. × ¾ dia., Iron Core, Aerial H.F. or Osc., 3/6 each.

SPECIAL OFFER !! New A.C. Mains Gram Record Player, having Garrard Motor and Pick-up, housed in Portable leatherette covered Attache Case. £7/19/6.

Electrolytic Condensers. B.E.C. Midget Can Tubular, 8 mfd. 450 v. (1¾in. × ⅞in. dia.), 2/6; 8-8mfd. 450 v. (1¾in. × 1in. dia.), 4/-; 16-8 mfd. 450 v. (1¾in. × 1in. dia.), 4/6; 32 mfd. 350 v., 2/6 (450 v., 5/-); 16-16 mfd. 450 v. (1¾in × 1¼in. dia.), 5/-; Dubilier "Drilitic" Card Tubular, 4 mfd. 500 v., 3/6; 8 mfd. 500 v., 4/-; 16 mfd. 500 v., 4/6; B.I. Can, standard size, 8 mfd. 500 v., 3/9; 8-8 mfd. 500 v., 5/-; 16 mfd. 500 v., 4/3; 16-16 mfd. 500 v., 5/3; 32 mfd. 500 v., 5/-. All New Stock.

Denco I.F. Liner for accurately lining-up 465 k/c, or 1.6 m/c. I.F. channels. Pre-tuned circuits, battery operated and completely self-contained. Price 39/6 (incl. btys.).

Osmor Midget Coil Pack. Size 3½in. × 2½in. × 1½in covering S. M. and L. Waves. Coils wound on Polystyrene Formers with adjustable Iron Cores, ensures efficient performance. Factory wired and aligned. Price including full circuits for Superhet 465 k/c Unit, 33/-. Also available for T.R.F. circuit covering M. and L. Waves, 30/-.

Output Transformer – Stern's. Midget 1¾in. × ⅞in. × 1in., ratio 60-1, 4/6 (or ratio 90-1, 4/6). Elstone Multi-ratio (over 12 ratios, some C.T.), 5/6 watts, 7/6. Stern's Heavy Duty Multi-ratio, all C/Tapped, handles 13 watts and suits P.X.4s, 6L6s, etc., 25/6. **Ex-Govt.** Multi-ratio with 4 windings (2 C.T.) over 10 ratios between 10 and 100-1 2in. × 1¾in. × 1¾in., 3/9.

L.F. Chokes. Midget 10 henry 250 ohm 40 mA., 3/6; 15-20 hny. 250 ohm 60 mA., 6/6; 20 hny. 300 ohm 100 mA. 12/9; 5 hny. 50 ohm 250 mA., 18/6; 20 hny. 250 ohm 120 mA., 18/6.

Inter-Valve Transformer. Midget 1⅞in. × 1⅜in. × 1¼in. ratio 3-1 (also ratio 5-1), 4/6 each. Varley "Niclet" ratio 4-1, 10/-; Heavy Duty, P. Pull Driver 3-1 each half, 40 mA., 8/-.

Aluminium Chassis. Substantially made of gauge 16 S.W.G. with four sides, 7in. × 4in. × 2in., 3/3; 9in. × 5in. × 2½in., 4/-; 10in. × 6in. × 2½in., 4/11; 10in. × 8in. × 2½in., 5/6; 12in. × 9in. × 2½in., 6/8; 14in. × 9in. × 2½in., 6/11; 16in. × 8in. × 2½in., 7/3; 16in. × 8in. × 3½in., 8/6.

I.F. Transformer, 465 k/c. New well-known manufacturer's surplus ⅞in. × ⅞in. × 1⅞in. Iron Core, 9/- each, or, size 1in. × 1in. × 2in. capacity tuned, 13/9 pair. Denco Iron Core, 465 k/c. or 1.6 m/c., 1¼in. × 1¼in. × 3½in., 16/6 pair. Wearite Stand Cap. Tuned, 465 k/c., 20/- pr.

Meter Rectifiers. Westinghouse 25 mA., 11/6, 1 mA., 10/6, 5 mA., 4/9. **Selenium Rectifiers.** H.T. ½ Wave, 250 v. 50 mA., 5/-, 200 v. 100 mA., 5/9, 250 v. 100 mA., 7/6. Bridge Rectifiers 6 v. 1 amp., 6/3. 12 v. 1½ amp., 12/6. 12 v. 3 amp., 21/-. 12 v. 5 amp., 25/-. 24 v. 3 amp., 23/6. 72 v. 5 amp. 37/6. Also L.T. 2/12 volt at 1 amp. max., 3/6.

Charger Transformer. Each has input of 230 volts, outputs 24 v. (tapped 15v., 9v., and 4 v.), 24/6 30 volts (tapped 15 v. and 9 v.), 23/6; 15 volts (tapped 9 v.), 16/9.

Filament Transformer. Inputs 230 volts, outputs 6.3 v. 1½ amp., 8/6; 4 v. 1½ amp., 7/9; Input 200/250 v., output 4 v. (C.T.) 1½ amp., 4 v. 2 amp., 6.3 v. 2 amp., 19/6.

Voltage Droppers. Ceramic Formers, size 1¾in. dia. × 2⅞in., .15 amp. 1,500 ohms, 4/11; .2 amp. 1000 ohms, 4/3; .3 amp. 600 ohms, 5/-, each has an adjustable tapping.

Denco Chassis Cutter. Adjustable between ⅝in. and 2½in., dia., used with Hand Brace. 7/6.

Marconi A.C. Mains Auto Changer, handles up to ten 10 or 12in. records, and has the new Moving Iron Lightweight Pick-Up, size 13¾ × 14½ × 8⅝in. overall depth. Price £10 0 8 (plus 10/- for Matching Trans.).

Surplus Components.—Carbon Hand Mikes, with S/R switch, 2/11. Complete Set Moving Coil Headphones, and M/Coil Mike, 7/6. Bal. Armature Headphones, 1/9 (3/6 pr. with leads). Muirhead Precision Slow Motion Drives, ratio 50-1, 7/9. Midget Output Transf., 1 × 1 × ⅞in., ratio 32-1, 3/-. .1 mfd. 5,000 volt Mainsbridge, 5/9. .1 mfd. 750 volt oil filled, 1/6. .1 mfd. 2,500 volt oil filled tubular, 2/6. .5 mfd. 2,000 v., 2/-. G.P.O. Telephone Head and Breast Set, complete, 10/6. 2 gang condenser .00035 mfd., 4/-. M. Trans., new, input 110 v., 200 to 250 v. output 235-0-235 v. 60 m/a. 6.3 v. 3 amp., 5 v. 2 a., 19/6. 100 ohm w wound Volume Control with switch, 3/9. L.F. Choke, 5 hny. 80 ohm 250 m/a., 10/6. Single Pole/On-Off Toggle Switch, 9d.; 9 hny. 250 ohm 120 mA., 8/6.

● ● ● ●

WIRELESS AND AMPLIFIER **ECONOMY KITS AND CIRCUITS**

All Kits and Circuits show a practical component layout.

● ● ● ●

A Midget T.R.F. Battery Portable "Personal" Kit. A complete Kit of Parts to build a Midget 4-valve All-dry Battery Personal Set. Consists of Regenerative T.R.F. Circuit employing Flat Tuned Frame Aerial, with Denco Iron Dust Cored Coil, thereby ensuring maximum gain for Single Tuned Stage covering medium Waveband. Valve Line-up: 1T4 R.F. Ampl., 1T4 (Detector), 1S5 (1st A.F.), and 3S4 (output). Includes latest Rola 3in. Moving Coil Speaker, and a Chassis already drilled and shaped. A consumption of only 7 mA ensures long battery life. The Kit is designed for a cabinet, minimum size 6½in. × 4¼in. × 3in. Detailed Building Instructions, with Practical Layout and Circuit included with Kit make assembly easy.

Price for Complete Kit £3 18 9 (plus 16/7 P.T.). Suitable unpolished Cabinet 6¼in. × 4¼in. × 3in., 12/9. Ever Ready B114 Battery, 9/7. Building Instructions, Circuit, etc., supplied separately, 1/6.

● ● ● ●

"Wireless World" Midget A.C. Mains 2-Valve Receiver. We can supply all the components, including valves and M/Coil Speaker to build this set as specified in the March issue at a total cost of £3. Reprint of detailed assembly instructions and circuit supplied separately for 9d.

● ● ● ●

We can supply all the Components including Valves, M/Coil Speaker etc., to build a **Midget A.C./D.C. Mains T.R.F. 3-Valve (plus Metal Rectifier) Receiver** as designed and specified in Nov. issue of a popular Technical Magazine, at a total cost of £4 17 6. A reprint of the assembly instructions, and layout available for 9d.

● ● ● ●

An Entirely Complete 3-Valve Amplifier Kit of Parts. Operating on A.C. or D.C. Mains 200-250 volts. Has an output of max. 4 watts, with valve line up 25A6, 6J7 and U31. A 6½in. Moving Coil Speaker is supplied. Price, including Wiring Diagram, 75/-.

● ● ● ●

TELEVISION !! The "Viewmaster" Televisor assembly instructions showing Wiring Diagram and Practical Component layout, now available for, 5/-. We have the specified Components, including the T.C.C.—Bulgin—Morganite —W.B.—Westinghouse—Plessey—Colvern etc. outfits in stock. Separate Components also available.

"Electronic" Televisor. Complete range of specified Components in Stock, instruction and explanatory booklet available for 2/6.

Denco Television Kit of Parts. We have the Complete Kit for both the 9in. and 12in. Televisors in Stock. Price complete 9in. Kit, £41/7 1 (including C.R.T.). Price complete 12in. Kit, £47/16/8 (including C.R.T.). Prices include simple assembly instructions, with Circuit and Practical Layout (these can be supplied separately for 6/-).

★ **Send 2½d. Stamp for our Comprehensive Stock List.** When ordering please cover packing and postage.

STERN RADIO LTD., 109 and 115 FLEET STREET, E.C.4.

Telephone: Central 5814 and 2280

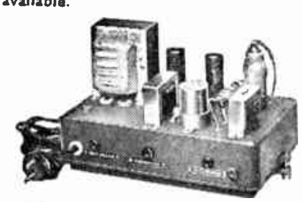
RADIO DEALERS AND SERVICE ENGINEERS

should write and ask for our November Monthly bulletin price 1d. Dozens of clearance bargains, and comprehensive lists of TUNGSRAM valves, T.C.C. condensers, EGEN volume controls, B.A. screws and nuts, etc., etc., FROM STOCK QUICKLY.

A.W.F. RADIO PRODUCTS LTD.,
Borough Mills, Bradford, Yorks.

CABINETS AND COMPONENTS

Receiver cabinets as illustrated. Beautiful walnut veneer. Size 12½" × 8¾" × 7½" deep. 35/-. *We can construct any type of cabinet to your requirements.*
All components to construct a T.R.F. or Superhet Receiver in above cabinet are available.



4½ Watt A.C. Amplifier with negative feedback. From £5.4.7d. 5 Watt Universal similar to above from £3.16.2d. 12 Watt Universal from £8.5.0d. Full details on request.
T.R.F.—Superhet—and Personal Portable Blueprints available at 2/6d. each.

LEWIS RADIO CO. (Dept. W.2.)
322, High Road, Wood Green, LONDON, N.22.
'Phone: BOWes Park 5997.

COMPONENTS—SECOND-HAND, SURPLUS

REMOTE control units, containing LF choke, 200 mfd. 12v condenser 2-1 transformer, 12v relay, 22 ohm resister, panel indicator, bulb and 5-point rubber plug and socket, 4/- each, 2 for 7/-, post paid.—R. S. Powell, 109, Colville Rd., Oulton Broad. [4490

ASSORTED tubulars, silver mica, ceramicons from 4pf to .1mfd. new and guaranteed 50 for 5/6; 50 for 8/-, post paid, fair selection given; other bargains include oak 4p4 switch, 1/4; standard .0005mfd twin gangs ceramic ins 3/9, etc.—List from T. B. Howell & Co., 29 McWilliam Rd., Brighton, 7. [4560

A BARGAIN—new portable volt-ohm-meters in plastic case, size 3¾in × 3¾in × 2½in with sling carrier; scale 0-1.5v, 0-5v, 0-60ma 0-500ohms, 0-5,000ohms, range easily extendable, instructions on back; 12/9 each, post paid; fully tested and guaranteed.—R. S. Powell, 109, Colville Rd., Oulton Broad. [4481

MANUFACTURERS.—Enamel, copper wires, all gauges, laminations, all types, huge stocks radio components, s/m, m/m, p/t and block condensers, close tolerance and high stability resistors to 1%; all goods guaranteed.—L. E. Simmonds, Ltd., 8a, Byron Rd., Harrow, Middx. Telephones, Harrow 2524 and 0315.

SYNCHRONOUS clock units, self-starting, 200-250v a.c. 50 cycle, fitted Sangamo motors consumption 2½watts, size 2¼in dia., 2in deep geared 1 rev 60 min. friction reset; ideal movements for making electric clocks, time switches, etc., nickel plated finish, complete with 12 to 1 dial train and 5in hands, price 22/6, post paid. Sangamo as above, final speed, one rev. per min less dial train, ideal for dark-room process time etc., price 20/- each, post paid.

CLOCK work; timers, new, suitable for process work, dark-room timing, etc., variable timing 1 to 60 seconds, relay to operate off 6v battery capable of handling 100watts supplied with each movement, price with relay, 36/- each, post paid, each movement is fully tested before dispatch.

CONDENSERS Electrolytic, 1,000mfd. 25v d.c., W.K.G., 4/6 each, post paid, 45/- per doz.

RECTIFIER units, a.c. to d.c., input 200/250v a.c., 50 cycles 1-phase, output 160/200v d.c., ½amp; price 41/- each, post paid.

SIEMENS high-speed relays, 2,000ohms, ideal for model control; 6/6 each, 72/- per doz.

INDICATOR units type 184A, fitted 3in and 6in cathode ray tubes type ACR10 and VCR 517B and 17 valves, viz., 6 VR92, 5 VR91, 3 VR54, 3 VR65, metal rectifiers, chokes, transformers, potentiometers, resistances, condensers, etc. £3/10 each, carriage 10/-.

A.C. mains wavemeters 230v 50cy, range 22 to 30mc/s, complete with valves and fitted in carrying case £3 each, carriage paid.

BATTERY wavemeter type 1095 wave range 1,540—1,220kc/s and 3,410 to 2,000kc/s; fitted microampmeter 0 to 500, in nice carrying case complete with valve, price 40/- each, carriage 3/-.

TYPE 24 R.F. units; new in maker's cartons these make excellent S.W. converters complete with valves 30 to 40mc/s, price 13/6 each, post paid.

MAINS transformers, 230v a.c. outputs 250v 90ma, 2.7v 8amps, 5v 2amps, price 17/6 each, post paid.

CONDENSERS, .25mfd 4,000v d.c. working, 4/- each or 40/- per doz, post paid.

PERFORMANCE meters type No. 2, fitted standard mains 230v a.c. 50 cycle power pack, 2 VR91, 1 VR137, 1 5Z4G, 1 CV51, 1 VR92 and other useful components, £2/5 each, carriage 3/6.

A.C. mains 230v 50 cycles power packs with variable output, 300v d.c. at 10ma, to 200v d.c. 25ma housed in nicely finished metal cabinet size 11in × 6½in × 6in complete with 5Z4G rectifier, also gives 18v a.c. ½amp, £2/10 each, post paid.

CONDENSERS electrolytic, 1,000mfd 25v d.c. wkg., 4/6 each, post paid 45/- per doz.

A LARGE quantity of single items which we do not list, which are available to callers; also assortment of various ex-W.D. radar and radio equipment, relays, power packs, oscillograph units, gears photographic apparatus; s.a.e. for lists.

H. FRANKS 58, New Oxford St., London, W.C.1. One minute from Tottenham Court Rd. Station Tel. Museum 9594. [0057

TELEVISION.—P.M. focus rings, self supporting micrometer adjustment, Ticonal magnet, triode or tetrode tubes, 9 or 12in, chrome-plated, boxed and with instructions, 35/-; coils: "E.E." London, 15/-; "E.E." B'ham, 18/6; ditto, less chokes, 16/6; "W.W." s'het, London or B'ham, 20 coils, 52/6; chassis: "W.W.," IF, RF and sound; units with 17 wound coils and two punched chassis £3; copper screening boxes, 2/6 ea; your retailer, factor, or

REL SOUND PRODUCTS Co., Marlborough Yard, Archway, London, N.19. Tel. North 1025.

EXCEPTIONAL bargain.—A fortunate purchase enables us to offer a complete kit of parts, including all valves, black crackle case, and circuit, etc., suitable for constructing the McMurdo 20 watt high fidelity A.C./D.C. amplifier; the kit features high-grade components throughout, including Partridge transformers; output stage-four CL33s in parallel push-pull; normal price for complete amplifier, 26gns; our price for complete kit, £12; trade enquiries invited.

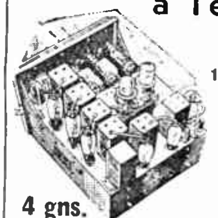
ROGERS DEVELOPMENTS Co., 106, Heath St., Hampstead, N.W.3. Hampstead 6901. [4574

SOUTHERN RADIO'S WIRELESS BARGAINS

T.R. 1196 SUPER-HET RECEIVER. Complete with Six Valves and circuit. Brand new, 22/6.
CRYSTAL MONITOR Type 2. Complete in case less crystals 6/6. With two Brand new crystals, 16/6.
CRYSTALS, brand new American and British 2-pin From 2040 kcs. to 38 mcs., 6/- each. Twelve assorted frequencies, 60/-.
SECTIONAL AERIALS. 8ft. interlocking, 3/6.
BENDIX COMMAND RECEIVERS. B.C. 454 (49/100 metres). B.C.455 (33/49 Metres). Complete New with Six Valves, 35/-, plus 1/6. A few converted to 28/41 metres for television sound, 50/-.
CONTROL BOXES for B.C.453/4/5 with slow motion dials, volume controls, etc., 13/6.
DRIVE ADAPTOR for BC453/4/5 with knob, 2/9.
R.A.F. BOMBSIGHT COMPUTERS. Complete with Motors, Gyro, Gyro Gears, Blowers, etc., etc., 55/-, Plus 5/-. The best component value ever offered.
INDICATOR UNITS. BC929A. Complete with 7 valves, C.R. tube 7BP1, etc. Complete in Metal case. Ideal for Oscilloscope conversion, 44/-, plus 5/-.
CONTACTOR TIME SWITCHES by SMITH or VENNER. 10-hour movement with thermostatic control. Complete in sound-proof case. Ideal for photographic and other use, 10/-, plus 1/4.
RADIO COMPASS INDICATORS with Selwyn Motors, 3-inch dial 360 deg., 13/6.
ALDIS LAMP. 6in. lens, Complete in transit case. Spare bulbs, cable, etc., 40/-.
FLASHER MOTORS, 24 volts with smoothing and gearing in case, 11/6.
DELCO HAND GENERATORS, 6 volt at 4 amps., 17/6.
RECEIVERS R28/ARC5. Ideal for 2 metre conversion. 100-156 Meg. V.H.F. 10-valves and Tuning Motor. Brand new in cartons and circuit, 50/-.
SLEEVING. 1 mm. to 2 mm. minimum quantity. 1 gross yards, 6/-.
LUFBRA HOLE CUTTERS. Adjustable from ¾in. to 3½in. For use on wood, metal, plastic, etc., 5/6.
CRYSTAL DETECTORS, 2/6.
OIL FILLED CONDENSERS. 0.1 mfd. and 0.5 mfd. 5 kV. 3/- plus 9d.
THROAT MICROPHONES. Complete with lead and plug boxed, 3/6.
WESTECTORS. Wx6 and W112, 6/4 per dozen.
Please send 2½d. for full publication list.

Southern Radio Supply Limited
46, LISLE STREET, LONDON, W.C.
GERrard 6653

Thinking of building a Television Set?

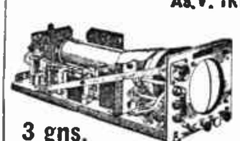


10 VALVE 1½ METER SUPER-HET

Ideal for conversion into Television Receivers. I.F. 12 Megs. Band width 4 megs. Co-axial input and output sockets. 10 Mazda Mains type VR65 (SP61) valves, 6·3 volt filaments.

4 gns.
Carriage Paid

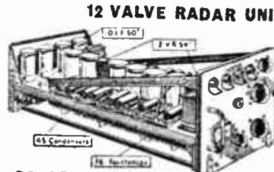
A.&V. INDICATOR UNITS Type 6 H.



Containing seven valves and one 6 in. Cathode Ray Tube type VCR 6 Brand new and unused. In sealed wooden transit case

3 gns.
plus 5/- Carriage

12 VALVE RADAR UNITS



New and unused. Contain 10 type VR 91 (EF 50) Valves, 2 type VR 54 valves, 45 Various condensers, 76 various resistances, 2 Transformers, 1 Relay.

£2.15.0 each Carr. paid.

Offered at a fraction of price of valves alone.

Dept W **WIRELESS INSTRUMENTS (Leeds) Ltd.**
54-56 The Headrow, Leeds. Tel. 22262.

COMPONENTS—SECOND-HAND, SURPLUS

SPLIT stator T.X. type condensers, accurately calibrated 300 and 37 p.f., O.K. for standard, 6/9; Sprague condensers, 0.1×350v, 0.02×750, 0.01×1kv, 3/- doz.; Micamold, 0.1×350, 2/6 doz.; 32 μF×350v, 1/9; 8 μF×500v, 1/-; Selenium recs., 12v 2a, 24v 1a, 3/6; 160v 40ma, 1/10; 275v 80ma, 3/11; post free over 10/-, under, 1/- please.
HATFIELD RADIO, 78, Stroud Green Rd., N.4. Arc 1593. [4588

MINE detector units, containing 3 1TH valves 20/-; Bendix 433G compass receivers 200-1,750kc/s, 15 valves, 6K7, 6F6, 5Z4, 6N7, etc., control panel, drive cable, handbook, £6; computor bombsight unit a.c./d.c. motor, etc., 25/-; BC306 antenna units, 7/6; telescopic 30ft antenna masts, 85/-; aircraft 6in compasses, 20/-; 12v, 14a accumulators, 30/-; 60+90v layer type h.t. batteries 7/-; heavy duty 230v transformers 350-0-350 175ma, 6.3v 6/8a, 5v 3a, 20/-; all items new and carr. paid.
R. HIGGINBOTHAM, 12, Gower Rd., Brinnington, Stockport, Cheshire. [4343

TELEVISION kit, including 21 valves, for £16 complete, for 9in black and white picture instructional booklet, 5/- post free, contains full details and point-to-point wiring diagrams, etc.; individual units supplied separately, sound and vision kit, £5, carr. 2/6; time base unit kit, £5 (including deflection coils and line output trans.), carr. 2/6; power pack kit, £6/10 (including mains and EHT trans.), carr. 12/6, 10/- ret. in p. case; C.R.T. control kit, £1 (including focus coil), carr. 2/6. c.w.o.—G. M., 43, Raleigh Rd., Hornsey, London, N.8. [4541

TELEBOOSTERS for long-range television reception. R.F.2L., 40/48 mc/s variable tuned for maximum sound or vision, 3 stages, 2 V.R.91 valves EQ to E.F.50, slug tuned interstage and output, coaxial plugs and sockets, flying leads for 6.3v heaters, 200 h.t., to tap into receiver, high gain, fully screened, price £3/12/6; R.F.1L., 40/48 mc/s, 2 slug tuned stages single valve, £2/12/6; for Birmingham R.F.2B., 55/65 mc/s twin and R.F.1B, single as above; power units for boosters, 230v, input 160v, d.c. and 6.3v output, £4. S.a.e. for particulars and trade test report.
BOSCOMBE RADIO ELECTRIC, 595, Christchurch Rd., Boscombe. Tel. 1704. [0032

ALLEN & GOULD, for components, air spaced tuning condensor: .3015mfd s/g, 2/3; .303mfd s/g, 2/6; .305mfd s/g, 2/9; mica spaced, .303mfd s/g, 2/9; .305mfd, 3/-; 465kc/s IDS IFT's, 8/6 per pair; 465 kc/s filter, 1/6; electrolytics: 2/200 micropack, 1/6; 2/350, 1/9; 4/200, 1/-; 4/350, 2/-, 8/450 cardboard tubular, 2/6; 8/450 canned, 3/6; 16/450 cardboard tubular, 2/9, 16/450 can, 3/6; 16/350 can, 2/6; 8-8/450, 4/-; 8-16/450, 4/6, 16-16 450, 5/-; 15-15/450 plus 20/25, 5/-; 8-8-8/450, 3/6; IN 22 crystal diodes, 3/6; inert cells, 1.5v, 12/6 for 50, 21/- per hundred; metres, 0-500 milliamp d.c., 3/6; 0-8a RF, 3/-; lf chokes, 5h 200 MA, 7/6; 10h 50ma, 6/-; Varley double chokes, each section, 30h/20h 150ma, 12/6, Ferranti push-pull driver transformers, 11/6, PX4 push-pull output transformers, 7/6; switches, 6 way paralleling, 6d, SP 3w 9d; 5P 3w, 1/-; SP 10w, 1/9, valves over 20,000 B.O.T. and transmitting valves; ask for list V7.
ALLEN & GOULD, 5, Obelisk Parade, Lewisham, S.E.13 (opposite Gaumont Cinema). 'Phone Lee Green 4038. [4581

BATTERY chargers, charger kits, Selenium h.t. and l.t. rectifiers, new goods with full guarantee and instructions; add postage 8d up to 12s, 1/4 above; sent carefully packed; standard charger kit, foolproof, simple to make, S.T.C. 12v 3 amp rectifier with 60 watt transformer and baretter for 2v, 6v, 12v charger, 45/-; ditto, but 6v only, 42/6; 2 amp kit as above for 2v, 6v, 12v, 36/6, for 6v only, 33/-; 1 amp kit for 2v, 6v, 12v, 31/-; cases for above specially manufactured with all small hardware, 17/6; medium duty kit, 12v 4amp S.T.C. rectifier with 75 watt transformer and baretter for 2v, 6v, 12v charger, 55/-, case, etc., 17/6; special minor kit with case terminals, etc., for 6v 2 amp, 12v 1 amp charger, 45/-, or ready for use 50/-; heavy duty kit, 12v 6 amp rectifier with 120 watt trans., slider resistance and ammeter for 6v, 12v charger, £4/15, ditto, but 4 amp, £3/15; Automat self regulating chargers for 6v, 12v, at 2 amp, as tested by motor weight 9lb, 57/6, carr. 2/6, E.772 charger for constant output 12-15v 3 amp, 77/6; E.776 for 6v 3 amp/12v 2 amp, 77/6; 4 amp slider type charger, £5/17/6, weight 22lb.
SELENIUM l.t. rectifiers, S.T.C. make, 12v 1 amp 8/6, 12-15v 3 amp 17/6, 12-15v 4 amp 19/6, 12v 2 amp 10/-, 6v 2 amp 9/6; giant finned type, 12-15v 6 amp 29/6, 5 amp 27/6, 24v 6 amp £3/2, 24v 3 amp 38/-, many other types with or without trans., state needs; also h.wave 12v 5 amp 25/-, 6v 10 amp c. tap, 25/-; H.T. rectifiers, small space compact, cool running, 250v 60ma 7/-, 110 60ma 6/6, 120v 30ma elim type 6/6, or with trans., trickle rect fltr, and 2×8mfds cond., 35/-, or with case 42/-; small choke 2/10 extra; 350-0-350v 80ma c.t. rectifiers, 9/-; 250v 100ma bridge 12/6 postage 7d; M.B.3 instrument rects., 3/6, Aerovox 2mfd 1,000v oil filled cond., 3/-; Lustraphone m.c. mikes, 55/- only; new Rola 8in P.M. spkrs. less trans., 11/-; transformers 230v inp., sec. 16v at 5 amp, tapped 10v, 23/-; also 110v auto trans., 500 watt, £2.
CHAMPION PRODUCTS, 43, Upland Way, London, N.21. Lab. 4457. [4594

GALPINS

ELECTRICAL STORES

408, HIGH ST., LEWISHAM, LONDON, S.E.13

Telephone Lee Green 0309. Near Lewisham Hospital

ELECTRIC LIGHT CHECK METERS (watt hour type), all for 200/250 volt A.C. 50 cycles, all electrically guaranteed: 2½ amp. load, **15/-** each; 5 amp. load, **18/6** each; 10 amp., **21/-**; 20 amp., **25/-**; 30 amp., **30/-**; 40 amp., **35/-**; 50 amp., **42/6**; 100 amp., **50/-**. Carriage on all types **2/-** extra.

SWITCHBOARD PANELS containing 3 VARIAC Transformers 100/120 watts 0 to 110 volts, also (1) Synchronous Motor operating Relay contacts approx. 40th h.p., also numerous large type mains toggle switches, a few only to clear, **75/-** each. Please note that the wire on one only of the Variacs is damaged, please allow **5/-** carriage.

EX-NAVAL TELEPHONE HAND-SETS, BAKELITE PATTERN (self-energized), no battery required, complete with wall bracket (new), **15/-** per pair, post 1/6. Ditto, complete with Buzzer ringing mounted in weatherproof box, 24 volt required for energizing Buzzer only, complete with Hand set, **15/-** each, or **25/-** per pair.

LARGE TYPE RECTIFIERS. Output 50 volts 1 amp. D.C. input 70/75 volts A.C. Half wave type, **8/6** each, post 1/6. **TANNOY P.M. SPEAKERS** (Small Hailers), 4 ohm speech coil, complete in wooden case with output transformer, **15/-** each, carriage 2/6.

EX-W.D. ROTARY CONVERTORS by well known makers, 24 v. D.C. input, 50 v. 50 cycles, 1 phase 500 watt output, **£6/10/-** each.

MAINS TRANSFORMERS. 230 v. input, 300 v 150 m/A. C.T. 6.3 v. 8 amp. 8 v. 2 amp., **15/-** each.

MOTOR ALTERNATORS, ex-R.A.F., as new, 230 v. A.C., 50 cys. 1 ph. input. Output, 250 v. 625 cys. 1 ph. at .24 amps., **75/-** each. Ditto, 1,725 cys. output, **85/-**. Please note both these machines require a 24 v. D.C. excitation at 4 amps.

EX-NAVAL CATHODE RAY INDICATOR POWER UNITS (new). Sold for component parts only, consisting of approx. 150 Resistances and Condensers of various values, H.V. Condensers, Chokes, all mounted on solid brass chassis, weight 90 lb., to clear **25/- each, carriage forward.**

EX-R.A.F. CRYSTAL MONITORS, type 2, complete in wooden carrying case, the frequency depending on crystal used, **5/-** each. Short Wave Aerial Coupling Units (Wavemeters), **5/-** each.

PRE-PAYMENT 1/- SLOT ELECTRIC LIGHT CHECK METERS, 200/250 volts, 50 cys. 1 ph., 2½ amp. load, **30/-** each, carriage 3/6; 5 amp. load, 35/-, carriage 3/6. 10 amp. load, **42/6** each, carriage 3/6.

EX-R.A.F. MICROPHONE TESTERS (new). These consist of a Ferranti 0 to 450 mA. 2½in. scale meter shunted to 1 mA. incorporated Westinghouse Rectifier, the whole encased in polished teak case, calibrated at present 0 to 10 v., **25/-** each.

MAINS TRANSFORMERS, all 200/250 v. 50 cys., 1 phase input, output 700/0/700 v. 70 mA., 4 v. 2½ a., 12 v. 1 a., **30/-** each. Another 525/525 v., 150 mA., 6.3 v. 5 a., 5 v. 3 a., **37/-** each. Another 2,350 v. at 500 mA., **85/-** each. Mains Smoothing Chokes, 10 Hy. 100 mA., **6/-**; 150 mA., **8/6**; 350 mA., **25/-**; 5 Hy. 250 mA., **17/6.**

MAINS TRANSFORMERS, input 200-250 v., 50 cycles, in steps of 10 v. Output 450/0/450 v. 250 mA., 4 v. 4 a., 5 v. 4 a., 6.3 v. 8 a., 6.3 v. 8 a., **62/6.** Ditto 450/0/450 v., 250 mA., 6.3 v. 4 a., 5 v. 4 a., 4 v. 8 a., 4 v. 8 a., **60/-.** Another 500/350/0/350 500 v. 250 mA., 6.3 v. 8 a., 0, 4, 5 v. 4 a. twice, 6.3 v. tapped at 2 v. 2 a., **67/6.** Another 350/0/350 v., 300 mA., 4 v. 8 a., 4 v. 4 a., 6.3 v. 4 a., 6.3 v. tapped 2 v. 2 a., **57/6.** Another 500/0/500 v. 300 mA., 6.3 v. 8 a., 6.3 v. 8 a., 6.3 v. 4 a., 4.4 a., 5 v. 4 a., **67/6.**

MAINS TRANSFORMERS (Auto Wound). Voltage Changers tapped 10, 20, 25, 90, 130, 150, 190, 210 and 230 v., all at 1,000 watts, a combination of 24 voltages can be obtained from this transformer, new ex-Government Stock, **£5/10/-** each, carriage **5/-**. Mains Booster Transformer, tapped 0, 6, 10, 19, 175, 200, 220, 225, 240 and 250 v. at 1,500 watts (new, ex-Government), **£5/5/-** each, carriage 5/-. Another Auto Wound, tapped 0, 110, 150, 190, 210 and 230 v. at 1,500 watts, **£6/10/-** each, carriage 5/-. Ditto, 2,000 watts, **£7/5/- each, carriage 5/-.**

COMPONENTS—SECOND-HAND, SURPLUS

CONDENSER bargains: Oil-filled types, 4uf/700vw 2/6; 4uf/2,000vw, 5/6; 0.05+0.1/3,000vw, 5/-; 2uf/500vw, 8d; 0.25uf/4kv (2¾in×1¼in×7in), 3/6; silver mica, standard mica, ceramics numerous values 2pf to 0.01uf, 2/3 doz; Muirhead 0.0005/20kv type AF51 in teak cases, size 5in×4in×7in, including terminals, 10/-; tubular types, waxed, 0.1/300ac, 0.15/400vw, 0.01/3,000, 3/- doz; 0.1/1,000, 3/6 doz; metal-cased tubulars, 0.01/750-1,000vw, 3/3 doz; 0.5/350vw micamoulds, 4/- doz; 0.002 metal-mites, 3/- doz; Duolier, 0.01/2,000, in plated cases, 5/- doz; bakelite coil formers, ribbed and threaded, 2/ft 1in×⅝in, ditto wound 4 t., 2/- doz; ceramic stand offs, ⅜in×¾in, 1/6 doz or 2/6 carton of 20; 2p 4w 4b double contact wafer switches, 2/-; meters, 0.5a RF, 3/6; electrolytic condensers, 50uf/20v, 8d or 7/6 doz; 100uf/50v (bakelite case) with terminals, 1/3 or 12/6 doz; 16uf/300v, square metal case, 2/- or 20/- doz; all first-class clean goods; please add sufficient postage, excess refunded.
J. E. L. POSTAL SUPPLIES, 133, St. James Rd., Blackburn. [4567

BENDIX 522 transmitter chassis with 2 832 valve bases, coils, transformers and tuning condensers, etc., 5/6 each; new 6v Vibrator power pack H.T. 250v, 80ma, 32/6 each; new boxed collapsible wire mesh reflector aerials, 5/- each; 184A indicator units complete with 3 VR65, 3VR54, 5 VR91, 6 VR92, VCR, 517B, etc., etc., 80/- each. 14ft Telescopic whip aerials with base 5/- each. K.24 aerial camera, new boxed 2.5 lens £9/5 each, rotary converters, new rewinds, and unused 200-240v d.c. input, 200v-230v a.c., 1 phase 50 cycle, 150 watts output £7 10 each; a.c./d.c. f.h.p. motors, 1/20hp, 200v-250v a.c./d.c., ideal for sewing machines, etc., these motors are as new, fully guaranteed, and are not converted rotary transformers 40/- each. Heater transformers, 200-230v a.c. input, 6v, 3amp 12/3 each, L.T. transformers, most ratings from stock, 12v, 16v, 20v, 24v, 1-10amps, from 22/6 each; special sizes wound at short notice; type H.176 H.T. rectifiers 5/6 each; J.50 3/6 each; new 5mfd 3,500v wkg. condensers 3/6 each; .02, 8,000v working 4/6 each; large stocks of all types of condensers at competitive prices. Send us your enquiries; we can help you with receiving and transmitting valves, 12v a.c./d.c. motors, these are ideal for models, new 7/6 each; Aldis signal lamps 27/6 each; new hand-bearing compass with prism and provision for battery in handle for illumination 45/- each; American telephone repeater and amplifier equipment in stock. New rack mounting a.c. amplifiers, complete with power pack less valves, P/P PX4 output 105/-; large stocks of meters, 0-25amp 2¼in 15/- each; 0-1m/a 12/6 each; voltmeters, micro-amp meters, etc.; send us your enquiry, postage extra on all goods.
SERVICE RADIO SPARES, 4, Lisle Street, W.C.2. Ger. 1734. [4561

SUPREME RADIO, 746b, Romford Rd., Manor Park, London, E.12. Tel. Ilf. 1260. Est. 15 yrs. Buy now at these bargain prices; line trans., 21/- ea.; fly-back type line trans., with provision for EY51 valve, 22/6 ea.; line and frame scanning coils, 25/6 ea.; P.M. focus units from £1; H.T. trans.: 350-0-350v, 6.3v 6 amp, 4v 8amp, 4v 3amp, 0, 2v 6.3v 2amp, 250ma with screen, 70/- ea.; 5hy, 250m/a choke, 15/9 ea.; 10hy 80ma choke, 7/9 ea.; ceramic E.F.50 valve-holders 6d ea., 5/6 doz.; retaining rings for same, 8d ea.; bakelite E.A.50 valve-holders, 6d ea.; co-axial plug and socket, 1/- complete; all parts in stock for London or Birmingham; E.E. televisor, ¼ watt resistances, from 10Ω to 10 megΩ 1/9 doz., 18/6 gross only; ½ watt resistances, 100Ω to 2megΩ 2/- doz., or 21/- gross only; 1 watt resistances, 270Ω, 470Ω, 1 kΩ, 3.3 kΩ, 8.2 kΩ, 18 kΩ, 33 kΩ, 56 kΩ, 75 kΩ, 68 kΩ, 1 mΩ and 2 megΩ, 4/- doz. or 45/- gross only, or assorted gross; 2 watt resistances, 2 kΩ, 18 kΩ, and 1 megΩ 5/6 doz., or assorted; noise suppressor units consisting of 2.01 mfd cond. and iron-cored choke, 6d ea., 5/- doz.; 3 meg vol. controls, 7½d ea.; 1 mΩ and 5 kΩ, vol. controls, 1/- ea.; 4 mfd 350v screw base metal cond., small type 6d, 5/- doz.; 12 mfd 50vw screw base metal cond. 6d, 5/- doz.; 50 mfd 50v, 50 mfd 12v, 10 mfd 25v and 25 mfd 25v 1/- ea., 11/- doz., or ass. doz. only; tubular wire end cond., 0.01 mfd 1 k/v, 0.02 mfd 750v, 0.05 mfd 500v and 0.1 mfd 350v 6d ea., 5/6 doz., or ass. doz. only; 0.1 mfd 500v, 6 6 doz.; midget mica cond., 0.001 mfd, 0.0005 mfd, 0.0003 mfd, 6d ea., 5/6 doz., or ass.; metalmite cond., 0.01 mfd 350v and 0.002 mfd 500v, 9d ea., 8/- doz.; can-type cond., 8 mfd 450v, 2/6 ea.; 16+32 mfd 350v, 3/6 ea.; 16+8 mfd 450v, 3/6 ea.; 32+32 mfd 350v, 6/6 ea.; 32 mfd 500v drylitic cardboard case outer cover, wire ends, 5/- ea.; 16 mfd 350v drylitic can-type cond., 1/9 ea.; 4 mfd screw base 550v metal tubular cond. 1/- ea., 11/- doz., 2 mfd 350v cardboard wire end electrolytic cond., 1/- ea., 11/- doz.; we are Denco stockists, Denco catalogues 9d ea.; 5 ma meter rectifiers, 4/- ea.; 4 pole 3 way, 4 pole 2 way and 3 pole 2 way rotary switches, med. spindle, 1/6 ea., fixed mica cond., ppf type, 3 ppf, 40 ppf, 50 ppf, 60 ppf, 65 ppf, 180 ppf, 305 ppf, 307 ppf, 500 ppf, 530 ppf, 570 ppf, 590 ppf, 700 ppf, 4,550 ppf, all at 2/6 doz., or ass. 23/- gross only; 8 mfd 600v PK 700vw metal can screw base condensers, 2/6 ea.; 0.01 mfd 3 k/v and 0.005 mfd mica tag end cond., 3/- doz.; selenium metal rectifiers, 200v R.M.S. 120 m/a, 4/- ea.; 0.1 mfd 2.5 k/vw can type cond., 2/- ea.; many other bargain lines in stock; terms, c.w.o., no c.o.d.; send 6d extra for postage orders under £5; 2½d s.a.e. all enquiries and lists. [0021

THE CANDLER SYSTEM will train you for your MORSE CODE TEST

Read the following extracts from unsolicited letters sent us by Candler students :—

Ref. No. 3795. (*First five lessons.*) "I recently passed my G.P.O. Amateurs' Morse Examination after your first five lessons." (*Junior Course.*)

Ref. No. 2245. (*Glad to announce.*) "I am glad to announce that I recently passed the P.M.G. Special Exam., and as you will see on my report, my speeds are now far ahead of the speeds needed in the examination. I therefore walked through the telegraphy part." (*Junior Course.*)

Ref. 2573. (*A really wonderful course.*) "I feel it my duty to express my appreciation for a really wonderful course. Before taking the course my 'solid' receiving speed was about 16 to 18 w.p.m., this I copied letter by letter—'and was I nervous.' To-day I can copy 25 to 26 w.p.m. at one word behind. I can read 30 to 35 w.p.m. as easily as reading a book. Frankly I think that *all* the 'profit' I have gained from the Candler System cannot be represented by—so many words per minute; but, rather as a lifetimes experience gained in a few weeks. It has been said 'you have to pay to learn'—true, but with Candler you pay so little and learn so much." (*Advanced Course.*)

There are Candler Courses for the absolute *Beginner* and for *Operators* desiring to increase their accuracy and speed in the Receiving and Sending of the Morse Code.

Full details of Candler Courses are given in the

"BOOK OF FACTS"

Sent post free on request.

Courses on Cash or Monthly Payment terms.

THE CANDLER SYSTEM CO.
(55w), 121 Kingsway, London, W.C.2
Candler System Co., Denver, Colorado, U.S.A.

Pennine RADIO

AUDIO SIGNAL GENERATOR

- HIGH STABILITY
- WIDE RANGE 40-16000 C.P.S.
- LOW PRICE
- 3 WATTS OUTPUT

LIST PRICE **£9-9-0**

Write for Particulars

PENNINE AMPLIFIERS
SOUTHGATE, ELLAND, YORKS, ENG.
Tel.: Elland 2107

COMPONENTS SECOND-HAND, SURPLUS

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. T.V. power packs, on chassis, a.l. 15×6½×2in, contains E.H.T. trans. 5.5v 5ma. 4v 1a H.T. trans. 360-0-360v. 220ma. 4v 8a C.T., 4v 3a 6.3v 3.5a wired with choke, 8×8+8mf 450v 2 octal sockets for outputs, mains (210 250v 50c/s) input socket, voltage adjuster, valveholder for rect. (5U8), new, unused, £4/2/6 carr. paid; these units were made for well-known T.V. set using 12in C.R.T.; 360-0-360v 220ma. 4v 8a C.T., 4v 3a, 6.3v 3.5a. trans., input 210 250v 50c/s, available separately, brand new, 32 6 carr paid; T.V. line transformers, shielded in al. can, with T.C. lead (used with PEN46), 11/6; chassis (steel), 5×5¼×1¼in, drilled 4 button base holes 1/9; 5×9¼×1½in, drilled 7 button base holes, 2/3; all 17×19¼×2¾in., drilled 7 int. oct. and square open-ends, 3/3; E.H.T. trans. 4.5v 1ma. 2v 2a. Pri. 230v 50c/s, 29/6; rec. R. 1481 covers 65-86Mc/s, 10 valves (6.3v), tuning meter 6in SM dial, circuit diagram, etc., brand new, in transit case, £4/4, carr. paid, personal receivers B.C.728c, 7 valve rec. using 1.4v valves, with 4 push buttons covering 2-6Mc/s, built in L.S. supplied brand new complete with valves (IT4 IR5, etc.) 2 and 12v VIB, 2v acc., telescopic A.E., instruction book etc., £8 19/6; mains trans., all PRI 200/250v 50c/s, Sec. 460v, 200mA, 210v 15mA, 6.3v 5A, 14/6, auto trans., 200/250v-110v, 60W rating enclosed 18/-; special line auto, 230/250-110v, 100W, 9/6; smoothing chokes 5H 120mA, 140Ω 3/3; 5H 200mA 100Ω 4/11; 6H 200mA, 100Ω 5/6; 5H, 250mA, 90Ω 7/-; 20H 300mA, 150Ω (7×5×5in) 13/6, electrolytics, 8mf, 150v 1/3; 8 170v 1/3; 8/350 card 1/6, can 1/11, 8/450v 2/3; 16/350v can 2/3; 16+8 450v large can or d/ended 3/6; 8+32 450v can 4/-; 16+24+8 450v can 5/-; 32/450 large can 2/9; 32/450v w e 3/6; 16+8 350v can 3/-; 60+100 350v 3/-; 32/350v card 2/3; 100 mf 3v 3d; 100mf 6v 6d; 25/25v 1/3; 100/25v 1/6; 25/50v 1/3; 16/350 card 1/9; 24/350 can 2/-; 8+24 350v can 2/6; P.M. loudspeakers 5in less trans. 9/11; with trans. 4500Ω 11/6; 6½in less trans. 10/11; 10in with trans. 21/-; R.F. units type 24 8/6; with valves, used in good condition, post 1/6 extra please; output trans. 2000/2Ω, 2500/2Ω, 2750/Ω, 3000/2Ω, 3/-; 4500/2Ω 7000/4Ω 3/6; 3 ratio 7000/3500/1750/4Ω 4/-; heavy duty 7000/2Ω 3/6, I.F. trans. 465 Kc/s small size, iron cored 7/6 pr.; 2 gang conds. .0005 ceramic ins., ¼in standard spindle 4/6; ceramic switches 2p., 3w, 1B 2/-; 3p., 3w, 1B 2/6, switches, small size, 2p., 6w 3p., 4w, single bank, 24/-, standard size 2p., 4w, 1B (additional wafer with shorting plate) 2/6; 4p., 3w, 2B 2/6; 2p., 4w 3B 2/6; 1p., 10w, 2B 2/6; all have 3in spindles; resistors 100 assorted 47 values ranging 180Ω ¼w-100K 3w, standard sizes, best makes 10/6, post 6d; ceramic trimmers 3 50pf 3 on a bar 1/3; 1/15pf single 4d; 3/30pf air spaced concentric 6d; 3/25pf V.I.C. type 3d; air spaced variables ¼in spindles 25pf, 50pf, straight, 50pf diff, ceramic bases 1/-; 35pf butterfly 1/-; "Eddystone" 60pf double ended 1/6, car radio vibrator packs with 12v 4 pin VIB, and OZ4 valve on chassis 5¾×3½×1¼in, output 250v 65mA output brought out on 8ft screened lead 17/6; meters moving coil, metal cased, 2in circular 0/500 microA 7/6; 0/15-600v req. ext. res. 6/6; 0/20 or 0/40A with shunt 5/-; Bakelite cased 2in square 0/1mA 7/6; 0/5mA 6/-; 0/50mA 7/-; 0/150mA 6/-; 0/300v series res. supplied 7/-; Bakelite cased 2½in circular, 0/500microA 16/6; 0/30mA 7/-; 0/50mA 8/6; 0/100mA 8/6; 0/200mA 8/6; 0/15v 7/-; 100-0-100v, 1mA, F.S.D. 7/-; 1mA desk type 15/-; visual indicators type 1 crossover needle, with 2 separate 60microA movements 5/-; type 3 with 2 300microA movements and 2 low voltage neons 5/6; S.M. dials as in R.F. 29 etc., 3/11; ex-Admiralty patt. 1257 1¾in engraved 0-100 fast/slow (50-1), panel mounting, fits ¼in spin., 2/6; rotary power units type 104 12v D.C. input, outputs 250v 60mA 6.5v 2.5A, P.M. rotary mounted on chassis with smoothing 6/11; type 87, outputs as above but 24v input 5/11; 10 valve receivers, R28/ARC5 cover 100-150 Mc/s, brand new with valves (inc. 4-717 A.C.), 42/6; modulator and mixer units W5332A, with 7 valves (1-5016, 2-6J5, 2-P61 1-VR55, 1-VR54) on chassis 10¼in×11½in also 5H 200mA choke large trans. (500 c/s), pots, res., conds., etc., in metal case with louvres 10¼×11½×6¾in 21/- carr. paid; Wilcox Gay V.F.O. covers 2-10 Mc/s, with 0-10 mA meter, supplied brand new in original carton, with 807 accessories (plugs, leads etc.) and instruction book £5 carr paid; Wilcox Gay Xtal multipliers 2-7 Mc/s, brand new, with 807 plugs, leads, instruction book etc., in original carton; 40/- carr. paid; superhet coils ¼×1¾in formers M.W. HF AE, osc., L.W. HF AE, osc., 1/6 per coil; I.F. trans iron cored 465 Kc/s 1/9 set of 6 coils and trans 9/6; 7 or 10 pin plugs and sockets with keyway 1/6 pr.; 3 way Jones plugs and sockets with cover 1/6 pr.; V.C. carbon with sw. 2¼in spindle 5K 25K, 50K, 100K 250K 500K, 4/-; 3 watt wire-wound no sw 200Ω, 500Ω, 1.5K, 2K, 5K, 20K, 25K, 2/-; twin w/w 2.5K/2.5K 2/6; 500/500Ω 2/6; 50K/50K 3/-; twin carbon 1m/1m 2/6; all. telescopic aerials, 15in closed 7ft 6in extended 3/6; receivers type 76, 150/505 Kc/s 3 valves ARTH2, VR53 VR92, I.F. output 560 Kc/s, brand new, in transit case, 22/6, carr. paid.

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015

GOVT SURPLUS UNUSED

CONDENSERS

of all types . . .

We can offer, FOR IMMEDIATE DELIVERY from very generous stocks, a wide range of ultra-high quality fixed paper Condensers, from .001 μF to 8 μF. Also STOCKS of small, genuine MICA Condensers from .00001 (10 pf) to .01 μF (10,000 pf). *Prices are exceedingly moderate.*

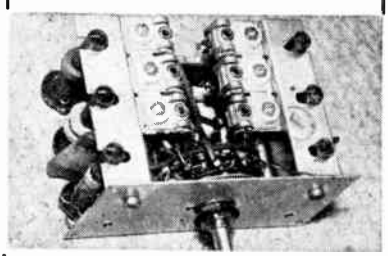
Enquiries are invited for manufacturers' requirements, wholesale and export only for bulk quantities, and for scheduled deliveries over a period as required.

Most condensers are now available for immediate delivery.

Please request our 4 page bulletin CONSEVEN 01114

CLAUDE LYONS LTD.
180 Tottenham Court Rd., London, W.1
and 76, Oldhall St., Liverpool 3, Lancs.

ALLEN COMPONENTS LTD.



Type 300 3-wave band coil unit.

A reasonably priced assembly of exceptional performance consisting of switch, complete set of aerial and oscillator coils with all associated trimming and padding condensers. Improved aerial coupling system gives high sensitivity with exceptional discrimination against unwanted signals. A four position switch gives facilities for gramophone pick-up connection and RF muting. Suitable for use with any of the standard frequency changer valves and an IF frequency of 455Kc. Calibrated glass scale available.

Ranges : 16-50, 190-550, 800-2100 metres.
Type 300B : 11.0-26.0, 30-90, 190-550 metres.

Television : Scanning yokes, Focus coils, Line output transformers and EHT transformers approved for Electronic Engineering televisor.

ALLEN COMPONENTS LTD.
Tower Road, Willesden, N.W.10
Telephone: Willesden 3675.

GEE BROS. RADIO LTD

FOR

QUALITY COMPONENTS

12V. 4 amp. METAL RECTIFIERS, 18/6 each.

24V. 4 amp. METAL RECTIFIERS, 30/- each.

230V. A.C. MAINS BELL, 3in. circular, Ex. Govt. (by Gents), 3/6 each.

ENGINE DRIVEN ALTERNATORS, type R. 1,300-2,600 cycles, 500 watts, 24v. D.C. field, 30/- each.

.1 mfd 3,500V. CONDENSERS, 3/- each.

100K TOTALLY SCREENED (CV25) 15 watts, potentiometers, new and boxed, 12/6 each.

10in. P.M. SPEAKERS, 3 ohms (by Plessey), 19/6 each.

MIDGET 465 KC. IFT'S, 16/- pair.

2-GANG MIDGET CONDENSERS, with trimmers and fixing bracket, .000375, 7/6 each.

MIDGET POTS., ½ meg. or 1 meg., 2/6 each.

The above 3 items all by famous battery persona receiver manufacturer.

THE OSMOR MIDGET COIL PACK, L.M.S. with diagram, 33/-.

H.F. STAGE for same with diagram, 15/-.

OSMOR MIDGET BATTERY COIL PACK with frame ariel and diagram for L.M.S., 37/6.

PULSE TRANSFORMERS (ex. radar). Ref. No. 10KB/6034, Cat. No. C76827., 30/- each.

CRYSTAL MIXER HOLDERS for klystron connection type 10AB/3942, 5/- each.

ALL WAVE R.F. CHOKES (Eddystone) type, 1/6. each.

5-CORE RUBBER INSULATED CIRCULAR ⅜in. DIAMETER CABLE, 9.012, 5 colours, per 100 yards, 40/-.

CARBON MICROPHONE INSERTS (Telephone type) P.O. No. 13 Mk. IV, 3/- each.

ELECTRIC LIGHT CHECK METERS, 200-250v. used but in good condition, 5 amp load, 17/6 each.

10-20 AMP, 20/- each.

25-50 AMP., 30/- each.

100-300 AMP., 35/- each.

SINGLE SCREENED FLEXIBLE CABLE 3/16in. diameter suitable for pickups, etc., 9d. yd., dozen yards, 7/6.

3½IN. C.R.T. (VCR138) MULLARD E.C.R.35. Complete with Mu metal screen and holder, 25/-.

HOLDERS SEPARATELY, also fits VCR97 tube, 2/6 each.

GYRO HORIZON INDICATOR (Sperry, U.S.A.), Type AN57361, in good order, 10/- each.

THE R3170 RECEIVER COMPLETE, suitable for television conversion 67/6 each.

CERAMIC VALVE HOLDERS B7G (for IT4, etc.), International octal English octal 5-pin UX, American 7-pin UX American, 7-pin English, all at 1/- each.

VALVE RETAINERS, all sizes 6d. each, 4/6 dozen.

CATALOGUES AVAILABLE FOR 2½d. STAMP. TERMS C.W.O. OR C.O.D. ORDER UNDER 20/-, 1/- EXTRA.

GEE BROS. RADIO LTD.

15, Little Newport St.

LONDON, W.C.2

GER 6794

COMPONENTS—SECOND-HAND, SURPLUS

EX-G.10 impulse clock units, 1 min. 1½v, 7/6 each; earphones from 2/6 pair; rotary trans., 7/6 each; 1 only communications receiver, complete with all coils (plug-in), £22/10; 1 Graham paper Morse recorder, 230 and 110v, £25; ex-A.N. 1224B battery sets, 1/10 m/c, 120v H.T. 2-volt ACCU, unused, 89/6 each; WEE Meggers, £6/10 each; AVO mirrors, £6; 100v meters, 6in dial, 30/-.—Surplus Supplies, Northbrook St., Newbury, Berks. [4505

48/6 only for the famous Model 30 tuning unit, consisting of 3-waveband Model 30 superhet coil pack, pair I.F transformers, 2-gang condenser and attractive dial (8in×6in); each component individually selected pre-aligned, sealed and the whole matched together as a unit; the superhet you build with this unit needs no further adjustment! Full details of this and our other high quality products (coils IFTs, mains transformers, etc.), together with many circuits and constructional tips, contained in the "Home Constructor Handbook," price 1/- Mail order office.
SUPACOILS, 98, Greenway Ave., London, E.17.

EX-M.O.S. waveform generators type 26 with valves—6 VR65 3 VR56 2 VR54, 1 each VR116, VR55, 60 resistances, 40 condensers, relays, trans., etc., 25/-; receiver in alum. case, approx. 30mc/s, 2 valves VR108s type R1125B, 8/-; 2in square micro-ammeters (radiator) scaled 40-140 F.S.D 200 micro amps, 3/6; chassis 8×3½×2 contains 1 25mfd 50v 2 other conds., octal valveholder, 3 resistances, 36v 50ma rectifier, 2 small xformers, 1 meg. vol control, long spindle, 3/9; special offer: 10 28v coloured M B C. bulbs 9 yds flex, 10 coloured insulators, makes fairy lights off any mains for Xmas, only need soldering, 8/6; 20,000ohm pots screwdriver control 1in diam, 6d, 5ma instrument rectifiers, 2/6; 2½d stamp brings list.
PASSINGHAM, 95, North St., Keighley. [1002

JACK PORTER, Ltd (Radio), for new Sprague oil condensers, 15mfd, 750v tapped 4, 4, 4, 3mfd, with clips, 7/6, Sprague can 2,000mfd, 15v, 2/6; Woden push-pull potted output transformers, 20watts load 10,000ohms plate to plate, speech 15ohms, weight 2¼lb boxed, 23/6, Dubilier 500v, .01mfd mica condensers, wire ends, 2/6 dozen; variable 30watt 300ohm slider resistances 1/-; 3watt, 100ohms variable pots, 1/6, R.C.A. sub-standard 100kc/s crystals, 10/-; immersion water heaters 200v, 750watts, U.S.A. make, 7/6; 20watt A.A.E., Ltd., driver transformers, 4/-; Eddystone 100pf split-stator variable condensers 1/6, Bendix BC433 flexible control drives, 3/9; (carriage extra under £2).—Jack Porter, Ltd "Radio," 30/31 College St., Worcester. [4410

MAINS TRANSFORMERS, fully interleaved and impregnated; primaries 200-250v 50 c.p.s., screened; drop through type, 250-0-250v 60/70ma 6.3v 3a, 5v 2a, 12/11; 350-0-350v 80ma 6.3v 3a 5v 2a 15/9; midget upright type, 2½-3-2½in, 250-0-250v 50ma 6.3v 1.5 a, 5v 2 a, 14/9; also full range of mains and output trans. at bargain prices; Williamson output trans, as specified by author, 57/6; selenium rectifiers 250v 65ma miniature 3/6, 250v 90ma 4/11, 120-0-120v 100ma 1/9, 120-0-120v 40ma 1/3, 60v 100ma (Bridge) 1/9 60v 40ma (Bridge) 1/3, 12v ½a H.W. C.T. 1/3 ea., 12/- doz; receiver chassis, 16 swg undrilled aluminium, 10-5½-2in, 3/3, 11-6-2½in 3/9, 12-8-2½in 4/6, 16-8-2½in 5/6, 20-8-2½in 6/11; special offer, amplifier chassis 16¼-10½-3¼in undrilled aluminium with black crackle finish, 5/6; electrolytics, can 8-8-8mfd 400v 2/11, 16-16mfd 450v 3/9, 8-16mfd 450v 3/3; tubular wire ended 2mfd 350v 11d; before you order elsewhere it will pay you to send for our full component and valve list of bargains; special list for trade; all brand new guaranteed goods; c.w.o. or c.o.d over £1, postage extra under £2.—Radio Supply Co., 15, Queen Square, Leeds, 2. [0003

NEW S.T.C. selenium rectifiers largest l.t. range from stock in Great Britain; a makers' latest products; not surplus; H4/100 E.H.T. for VR97, 18/6; H4/200 for "W.W." Televisor 28/- p.f.; H.W. rects., 16v ¾a 6/8, 1a 8/-, 2a 9/6, 3a 16/6, all p. 6d. 4a 18/-, 6a 22/6, p. 10d. 30v 1a 12/-, 2a 14/-, 4a 24/9, 6a 36/6 48v 2a 21/-, 4a 35/-, 6a 51/-, 100v 2a 34/6, 4a 65/-, all p. 1/-; H.D. H.W 7¾in sq. cooling fins, 16v 5a 21/6, 10a 24/6, 30v 5a 35/-, 8a 38/6, 48v 2.5a 26/-, 5a 48/-, 8a 54/-, all p. 1/-; Full-wave bridge conn. rects., 17v 1.5a 12/1, 2a 15/6, 2.5a 20/6, 3a 21/6, 4a 25/-, 5a 27/-, all p.f. 33v ¾a 18/6, 1a 21/3, 1.5a 28/6, 2a 29/6, 3a 35/-, 4a 42/-, 5a 43/6, all p. 10d. 54v 1.5a 39/-, 2a 47/6, 4a 65/-, 100v 1.5a 72/-, all p. 1/-; H.D. type with 7¾in cooling fins, 17v 6a 27/-, 10a 43/8, 12a 72/-, 20a 80/-, 33v 6a 64/-, 10a 71/-, 12a 124/-, 20a 140/-, 54v 6a 90/-, 10a 100/-, 72v 10a 130/-, 100v 10a 190/-, all p. 1/4; industrial type funnel cooled, 17v 12a 76/-, 20a 87/-, 30a 122/-, 50a 188/-, 33v 6a 69/-, 30v 10a 80/-, 33v 12a 124/-, 20a 144/-, 54v 6a 92/-, 10a 108/-, 72v 6a 114/-, 10a 136/-, 100v 6a 160/-, 10a 192/-, all p. 1/6; S.T.C. replacements for valve type chargers, fitted in 5 mins, no alterations to wiring; complete working chargers 2-12v 4a with H.D. trans., sliding res., fuse and ammeter and mains lead, in blk. crackle finish, louvered steel case, wt., 25lb £5/10, del. free; also 2a, 4a 5a, 6a kits; terms, c.w.o. or proforma invoice; c.o.d. over £1 on post goods only; wholesale and retail.
T. W. PEARCE, 66, Gt. Percy St., London, W.C.1, off Pentonville Rd., between Kings Cross and Angel. Est 17 years. [0015

MAINS TRANSFORMERS, FULLY INTERLEAVED, SCREENED AND IMPREGNATED ALL PRIMARIES ARE 200/250 v.

Half Shrouded

HS63. Output 250/0/250v. 60 m/a. 6.3v. at 3 amps. 5v. at 2 amps 15/6
HS40. Windings as above. 4v. at 4 amps. 4v. at 2 amps 15/6

Output
HS2. 250/0/250v. 80 m/a 17/6
HS30. 300/0/300v. 80 m/a 17/6
HS3. 350/0/350v. 80 m/a 17/6
HS2X. 250/0/250v. 100 m/a 19/6
HS30X. 300/0/300v. 100 m/a 19/6
HS3X. 350/0/350v. 100 m/a 19/6

Fully Shrouded

Output
FS2. 250/0/250v. 80 m/a 19/6
FS30. 300/0/300 v. 80 m/a 19/6
FS3. 350/0/350v. 80 m/a 19/6
FS2X. 250/0/250v. 100 m/a 21/6
FS30X. 300/0/300v. 100 m/a 21/6
FS3X. 350/0/350v. 100 m/a 21/6

All the above have 6.3-4-0v. at 4 amps., 5-4-0v. at 2 amps.

FS43. Output. 425/0/425v. 200 m/a. 6.3v. 4 amps. C.T. 6.3v. 4 amps. C.T. 5v. 3 amps. Fully shrouded 42/6
FS50. Output. 450/0/450v. 250 m/a. 6.3v. 2 amps. C.T., 6.3v. 4 amps. C.T., 5v. 3 amps. Fully shrouded 62/6
F30X. Output. 300/0/300v. 80 m/a. 6.3v. 7 amps. 5v. 2 amps. Framed, Flying leads 26/6
F35X. Output. 350/0/350v. 250 m/a. 6.3v. 6 amps., 4v. 3 amps., 0-2-6.3v. 2 amps. Fully shrouded 59/6

FILAMENT TRANSFORMERS

F4. Output. 4v. 2 amps 7/6
F6. Output. 6.3v. 2 amp 7/6
F12. Output. 12.6v. tapped 6.3 v. at 3 amps 15/6
F24. Output 24v. tapped 12v. at 3 amps 21/6
F12 and F24 framed with Flying Leads
FU6. Output. 0-2-4-5-6.3v. at 2 amps. 9/-
F29. Output. 0-2-4-5-6.3v. at 4 amps. 15/-
FU6 and F29 clamped with Flying Leads
F5. Output. 6.3v. at 10 amps. 5v. at 10 amps., 12.6v. at 5 amps., 10v. at 5 amps 31/6
F6/4. Output. Four at 6.3v. tapped at 5v. at 5 amps. per winding, giving by suitable series and parallel connections 24v. at 5 amp.; 20v. at 5 amp.; 18v. at 5 amp.; 15v. at 5 amp.; 12.6v. at 10 amp.; 10v. at 10 amp.; 6.3.v. at 20 amp. 5v. at 20 amp. ... 47/6
F5 and F6/4 framed with Flying Leads

OUTPUT TRANSFORMERS

MOPI. Ratios 26, 46, 56 66, 90, 120-1 50 m/a. max. current. C.T. for Q.P.P. Class B, etc. Secondary 2/4 ohms. Top panel and clamped, each 5/-
OPI. Midget Power Pentode, ratios 30, 60, 90-1, 40 m/a., Secondary 2/3 ohms, each 3/2
OP2. Midget Pentode, ratios 45-1, Secondary 2/3 ohms, 40 m/a. per doz. 33/-
OP10. 10/15 watts output. 20 ratios on Full and Half primary 16/3
OP30. 30 watts output 20 ratios on Full and Half primary 23/9
Williamson's O.P. Transformer to Author's specification £3/12/6
HS6. Output 250/0/250v. 80 m/a. 6.3v. 6 amps. C.T. 5v. 3 amps. For receiver R1355 Half shrouded 24/6
HS150. Output 350/0/350v. 150 m/a., 6.3v. 3 amps. C.T., 5v. 3 amps. Half shrouded 25/9
F36. Output 250/0/250v. 100 m/a., 6.3v. 6 amps. C.T., 5v. 3 amps. Half shrouded 25/9
FS120. Output 350/0/350v. 120 m/a., 6.3v. 2 amps. C.T., 6.3v. 2 amps C.T. 5v. 3 amp. Fully shrouded 27/6

The above have inputs of 200/250v.

C.W.O. (add 1/- in £ for carriage), all orders over £2 carriage paid.

H. ASHWORTH (Dept. W.W.)

673 GT. HORTON RD., BRADFORD, YORKS

HAPPY XMAS

If you use any of the following

AMPLIFIERS

Leak "Point One," £25/15/-.
Sound Sales "Tonemaster," £17/10/-.
Vortexion "Stereophonic," 36½ Gns
Williamson "New Version," £25/10/-.

SPEAKERS

Tannoy "Dual Concentric."
Barker 148a.
Goodmans 12 and 22.
Also Matched pairs with crossover unit covering 25-16,000 cycles, £14/17/6.

PICK-UPS

Leak Dynamic, Acos GP20, RNW, Decca, Connoisseur, Brierley, Wilkins & Wright Coil.
Also Radio Feeder Units, Tone Control Units and Speaker Cabinets.

Call and hear them at :—

HOLLEY'S RADIO STORES

285, CAMBERWELL RD., S.E.5

'Phone : RODney 4988

CHASSIS!

Build radios the easy way and save money! Our range of completely prefabricated chassis are punched for all components. These—and our *unique* Construction Sheets and Tuning Units—enable anyone to build a variety of domestic receivers with the sure knowledge that failure is impossible! Examples :

- 5 v. prefabricated chassis, size 12in. x 9in. x 2½in. 10/6
  "Easy-as-A.B.C." Construction Sheets, per set 3/6
  No. 1 Tuning Unit (comprising model 30 3 waveband superhet, coil pack, pr. "MM" I.F.T.'s, 8in. x 6in. dial and 2-gang condenser—the whole aligned and sealed ... ... 48/6 inc.

leaving only valves and small components to complete a factory designed receiver.

- 6 v. prefabricated chassis, size 12in. x 9in. x 2½in. 10/6
  Construction Sheets 3/6
  No. 2 Tuning Unit (comprising model 40 3-waveband superhet, coil pack with R.F. stage, pair of "MM" I.F.T.'S, 8in.x6in. dial and 3-gang condenser—the whole aligned and sealed) ... 76/9 inc.

leaving only valves and small components to complete a factory designed receiver, whose performance has been acclaimed second to none.

Send 1/- for your copy of the "Home Constructor's Handbook" for all the "gen" on how to construct these, and many other, receivers and amplifiers, etc. All standard radio lines in stock at current prices. So send us your enquiry or order for special attention.

RODING LABORATORIES,
(Mail Order Dept.)
70 LORD AVENUE, ILFORD, ESSEX

COMPONENTS—SECOND-HAND, SURPLUS

ARMOUR and U.S. Navy wide frequency range wire recorders. Details s.a.e.; 1,000 kc/s xtals, boxed, brand new, 30/-; TR9 battery receivers, coverage 6-9 mc/s, complete with 6 2-volt valves, 15/-, moving coil headphones 3/6 m/c microphones 2/6; type 18 amplifier unit, complete with 2 EF36, 2 EBC33, 2 EL32, transformers, etc., 17/3; brand new blower motors, input 12-24 volts, 8/5; 19 set variometers, containing westectors, resistors, condensers, coils, etc., 2/4; 6-volt vibrators, 4-p.n. 3/6; 12-volt 2/6; 1,000 mfd 25-volt working electrolytics, U.S. manufacture, 4/6.—Haynsons, 14, St. Mary's, Bedford. Tel. 5568. [0012

WANTED, EXCHANGE, ETC.

TAYLOR 75A or any accurate universal test meter.—Box 564. [4547

FINE wires in large quantities only, must be new and perfect material
L. E. SIMMONDS, Ltd., 8a, Byron Rd., Harrow. Tel. Harrow 2524 and 0135. [3661

AVO winding machines.—S.T.S., Ltd., 297-299, High St., Croydon. Tel. 4870. [3111

WANTED, surplus relays and push-button units, any condition, large or small quantities; highest prices paid.—Box 8485. [3532

WE pay top prices for used test equipment all types.—University Radio, Ltd., 22, Lisle St., London, W.C.2. Tel. Ger. 4447 and Ger 3582 [9992

AMERICAN radio and aircraft equipment of all types wanted.—Write for details or send list of Wilflo Products, Ltd., 222, Gorbals St., Glasgow. [4562

WANTED, all kinds of laboratory test equipment, standard signal generators, bridges, oscilloscopes, "Q" meters, etc; send price and details to:—
HATFIELD INSTRUMENTS, 175, Uxbridge Rd., Hanwell, W.7. Tel. Ealing 0779. [0037

WESTINGHOUSE rectifiers, 1ma, W.1, J.50 and other types, large or small quantities bought for cash.—Ivall, 37, Furnival Ave., Slough, Bucks. [4515

STRATTON & Co., Ltd., West Heath, Birmingham 31, wish to acquire an Eddystone two-valve short wave receiver with glass panel manufactured in 1925/27; they also invite offers of other early Eddystone receivers for museum purposes. [4503

WE buy for cash, new, used, radio, electrical equipment all types; specially wanted radios, radiograms, test equipment, motors chargers, recording gear, etc.—If you want to sell at the maximum price call, write or 'phone to University Radio, Ltd., 22, Lisle St., Leicester Sq., W.C.2. Ger. 4447.

REPAIRS AND SERVICE

MAINS transformers rewound new transformers to any specification.
MOTOR rewinds and complete overhauls; first-class workmanship, fully guaranteed.
F.M. ELECTRIC Co., Ltd., Potters Bldgs Warser Gate Nottingham Est. 1917 Tel 3855

REWINDS and conversions to mains and output trans., pick-ups, fields, etc., from 4/6 N. L. Rewinds, 4, Brecknock Rd., N.7. [4593

LOUDSPEAKER repairs, British, American any make, moderate prices.—Sinclair Speakers, 12, Pembroke St., London, N.1. Terminus 4355. [3302

MAIN and output transformers rewound to pattern or specification, return post service. —H. Pughe, Radio Rewind Service, Brithdir, Nr. Dolgelley, N. Wales. [3243

MAINS transformers rewound or constructed to any specification; prompt delivery.—Bede Transformer Co., Ltd., Bedesway Bede Trading Estate, Jarrow. [311?

MAINS transformers rewound or constructed to any specification, prompt deliveries.—Avon Transformer Co., 20, Heath Terrace, Leamington Spa, Warwicks. [4493

REPAIRS to moving coil speakers, cones coils fitted, field rewound or altered; speaker transformers, clock coils rewound; guaranteed satisfaction, prompt service.
L.S. REPAIR SERVICE, 49 Trinity Rd., Upper Tooting London, S.W.17. Balham 2359.

ALL types of ammeters, voltmeters, Avos, etc., repaired; quick, efficient service, estimates free.—Donvin Instrument Co., 91, Princedale Rd., London, W.11. Tel. Park 4469. [4323

ALL types of receivers and radiograms repaired; difficult sets a speciality; liberal discount to the small trader.—E. W. Shackle, High St., Harlington, Hayes, M'ddx. [4187

A REWIND service which duplicates or modifies as required; transformers, loudspeakers, etc.; prompt returns.—Raidel Services, 49, Lr. Addiscombe Rd., Croydon. Cro. 6537.

ELECTRICAL measuring instruments of every make repaired and standardised.—The Electrical Instrument Repair Service, 329 Kilburn Lane, London, W 9. Tel. Lad. 4168. [3715

REPAIRS.—E.H.T., mains and O.P. transformers, field coils and chokes; also armatures and motors; new transformers designed to any specification; all work fully guaranteed.
WILLESDEN TRANSFORMER Co., Ltd., 28, Balmoral Rd., N.W.2. Tel. No. Willesden 2476.

"SERVICE with a smile."—Repairers of all types of British and American receivers; coil rewinds; American valves, spares, line cord —F.R.I., Ltd., 22, Howland St., W.1. Museum 5675. [1575

RADIO MAINTENANCE SERVICE for guaranteed rewinds and repairs, armatures, F H P. motors, vac. units, portable tools etc., good deliveries.—139, Goldhurst Terrace, N.W.6. Mai. 6133. [9925

LABORATORY

Test Equipment.

MARCONI INSTRUMENTS equipment, reconditioned as new.

SIGNAL GENERATORS	
Type 144G	£80 0
Type 144F	£65 0
Type 390F	£45 0
Type 517E	£42 0
VALVE VOLTMETER Type TF.428A	£40 0
OUTPUT METER Type TF.340	£31 0
MISCELLANEOUS EQUIPMENT	
COSSOR Oscilloscope Type 339. New	£45 0
COSSOR Ganging Oscilloscope Type 343. New	£19 0
WEE MEGGARS, 500 volt. Evershed & Vignoles, complete with leather case and instruction book. New	£6 17
VARIACS, 2 kVA, 0-270 v., Type 100R	£14 0
VARIACS, 2 kVA, 0-130 v., Type 100Q	£14 0
VARIACS, 500 VA, 0-270 v., Type 200CMH	£5 10
VARIACS, 500 VA., 0-130 v., Type 200c	£5 10
WAVEMETERS by RCA. Type TE.149. Frequency range 200 Kc. to 30 Mc/s. by harmonics. Directly calibrated dial from 2.5 to 5 Mc/s. Scale length 9 feet. Absolute accuracy 0.02%. Crystal accuracy 0.005%. Supplied with instruction book, spare valves, components, etc., in fitted transit case. New...	£9 0

ALSO in stock, we have other wavemeters up to 10.0 Mc/s. Constant voltage transformers. Precision attenuators, etc.

Send for lists.

HATFIELD INSTRUMENTS
175, UXBRIDGE ROAD, HANWELL,
LONDON, W.7 Telephone : EALing 0779.

— WE DON'T —

supply anything Ex-Government
ALL BRAND NEW GOODS
— fully guaranteed —

GARRARD	
R.C.65, AC/DC **AUTO-CHANGER.** Mixed records	£20 15 0
R.C.65, A.C. **AUTO-CHANGER.** Mixed records	£15 13 6
U5, AC/DC Motor with turntable, pick up and Auto stop	£12 9 2
All the above are fitted with Magnetic head. With Decca HI-FI head extra	£2 2 0
With Connoisseur head and transformer extra	£2 13 8
COLLARO	
R.C.49, A.C. **AUTO-CHANGER.** Mixed records, Crystal head	£14 6 8
R.C.500, A.C. **AUTO-CHANGER,** non-mixer, Crystal head	£10 15 0
MOTOR AND TURNTABLE with Magnetic pick-up and auto stop, A.C.	£9 13 6
AC/DC	£12 18 10
MOTOR AND TURNTABLE only, A.C.	£5 18 4
AC/DC	£9 5 6
E.M.I./MARCONI	
A.C. **AUTO-CHANGER** non-mix, HI-FI head complete with transformer	£10 10 8

TAYLOR TEST GEAR

The entire range by this famous maker is now available on Hire Purchase. S.A.E. for catalogue and terms.

AVO TEST GEAR

AVO 7 Leather cases ... £2 2 6

We are the largest actual stockists of Avo meters in England. S.A.E. for catalogue and price list.

All items can be supplied C.O.D. up to 15lbs. in weight. Otherwise Cash with order please.

¶ *Special attention to Overseas orders which are free of purchase tax.*

MODERN ELECTRICS LTD.
164, Charing Cross Road, London, W.C.2.
Telephone : Temple Bar 7587.

K 24

NEWS

from

A. C. BARKER

The back room has been very active during past months preparing a further step towards our objective NATURAL REPRODUCTION.

We believe 148a is justly placed first amongst existing speakers for its qualities of brilliant clear-cut wide range sound, and at its price of 15 gns. offers the most economical high quality reproducer obtainable.

Now, for the connoisseur who owns first-class equipment and like ourselves, ever seeks the absolute standard, we introduce the

MODEL 150

This new unit retains our standard 12¼in. frame and patented coil construction, consisting of an aluminium former over which is wound a thin layer of special pure latex and a 15-ohm aluminium coil.

The cone is of linen moulded to shape with one continuous spiral corrugation of increasing amplitude from apex to rim—a fresh extension of our original basic patent which gives a markedly flatter, smoother output.

Work with many impregnants has led to the adoption of a recent ICI product, which is now also used for the 148a.

Finally there is a new magnet system giving over 17,500 λ lines, a 25 per cent. advance on the 148a.

The RESULT ? Well, according to our friends and critics who have heard it, the 150 stands ahead of contemporary achievement by a margin which makes its price of 18 gns. seem absurdly modest.

The 148a is, of course, still the best speaker for most people.

BCM/AADU, LONDON, W.C.1.

REPAIRS ANO SERVICE

LOUDSPEAKERS and transformers rewound cones replaced. prompt service.—Dodds. Radio Service. 131a Hurst St. Oxford [3650

"STURDY" rewinds,. mains transformers chokes. and fields. first-class work. prompt deliveries and satisfaction guaranteed. —Sturdy Electric Co., Ltd., D.pton. Newcastle-on-Tyne. [2430

A SECOND-to-none rewind service. reliable neat, return of post service; your television requirements promptly executed. EHT. LHT and heater transformers; stamp for quotations.—R. E. F., 137a, Ashton Rd., Oldham. [3519

24-HOUR service. 6 months guarantee. any transformer rewind. mains outputs and i.f s., etc.; all types of new transf., etc. supplied to specification; business heading or service card for trade prices.—Majestic Winding Co., 180 Windham Rd. Bournemouth.

L.T.P. rewind service, all rewinds are layer wound. vacuum impregnated, pressure tested at 2,000volts and guaranteed for three months. 48-hour service.—Enquiries London Transformer Products, Ltd., L.T.P. Works Cobhold Estate N W 10. Tel Willesden 6486

METROPOLITAN RADIO SERVICE for rewinds mains and e.h.t. transformers. chokes and field coils; delivery 3-5 days; new transformers designed and manufactured singly or in quantities.—Metropolitan Radio Service Company, 1021, Finchley Rd., London, N.W.11. Tel. Speedwell 300.

REWINDS.—Send your "burn outs" to be rewound; no technical data wanted; post transformer, etc., labelled with your name, address, and marked "for rewind"; our windings are double wound, interleaved and impregnated.—Southern Trade Services, Ltd., 297-299, High St., Croydon. Tel. 4870. [3110

NATIONAL RADIO SERVICE & TELEVISION Co., radio and television development engineers; high quality receivers and amplifiers built to specification and modernised, repairs to all makes of receivers, transformers, coils, armatures rewound, loudspeaker cones renewed, television aerial installations, conversion, etc.—63. High St., St. John's Wood, N.W.8. Primrose 6725. [2671

WORK WANTED

WE make wireless and radiogram cabinets for home and export, immediate delivery.—Radiac, Ltd., 88/90, Caledonian Rd., London, N.1. Tel. Terminus 7447. [8025

DRAUGHTING, tracing and photoprinting services; estimates free; contractors to the Ministry of Supply and the Admiralty for drawing and tracing work to their requirements and specifications, sub-contracting work of this nature undertaken.
DRAWING & TRACING, Ltd., 456a, Ewell Rd., Tolworth Surbiton. Tel Elmbridge 7406. [4183

FIRST-CLASS transformers and chokes manufactured, stock lines available; also special manufacturers' components made to specifications; armatures and fields wound and motors asesmbled.—Avis & Baggs, Ltd., 140-141, Friar St. Reading. Berks. [2715

MISCELLANEOUS

"W.W.," Jan., 1943, to date; offers.—BM/CKHZ, London, W.C.1. [4546

WIRELESS WORLD, 1931 to 1944, offers.—Phone Wallington 3528 after 6 p.m. [4501

90 Wireless Worlds covering 1940/47 for sale. Offers to 14, Old Slade Lane, Iver. [4531

"Q.S.L.s" and "G.P.O." approved log books. samples free.—Atkinson Bros., printers. Elland. [3082

CABINET for E.E. Televisor, mahogany console, £5/10.—Manor Cottage, Manor Road, Reigate. [4570

ELECTRONIC voltage stabilizers; process timers; 100 microampere power relays, etc.; enquiries invited.
BRITISH ELECTRONIC INDUSTRIES, 303-305, Burdett Road, London, E.14. [0031

WIRELESS WORLD, January, 1937 to December, 1947, four missing; good condition, offers.—Wilson, 26, Kings Park Ave., Glasgow.

NEON indicator lamps and holders, low voltage, 3 for 4/9; 15/6 doz; selenium barrier light cells from 6/6.—Lucas, 22, Hengrove Rd., Bristol, 4. [4532

EXPOSURE meter components. light cell 6/6. meter movement 8/-, moulded case 9/-, assembly instructions and conversion scale reproductions 3/6.—G. R. Products, 78, Repton Rd., Bristol, 4 [4054

TELEVISION mast sections, heavy steel tubular, 8ft 9in long. 3in dia 9in sockets; reach any height you require; 11/9 each plus carr.; sample 16/- carr. paid.—Foundation Oil Co., Ltd., 8, Orford Hill, Norwich. [4462

SPECIAL receivers, test gear, electronic apparatus, experimental and design work.—If you have a problem which needs expert handling, write in first instance to J. Mort, B.Sc., A.M.I.E.E., BCM/HIFIDEL, London, W.C.1.

MINE detector units with 3 IT4 valves, etc., 17/6; brown bakelite cabinets, 13in×7in×5½in, 15/-; 75w 230/110v autos, 10/6; all guaranteed; many other bargains; postage and lists free.—Electrad Radio, 64, Gt. Victoria St., Belfast. [4558

EX-GOVERNMENT steel instrument cases, copper plated and finished battleship grey. size 23in long, 10in high and 8in deep, excellent condition, 12/6 with carrying handles, 10/- less carrying handles, plus 2/6 packing and carriage England and Wales.—Weatherheads, Bletchley, Bucks. [4297

THE "FLUXITE QUINS" AT WORK

"What's on the tele to-night?
Let's hope it'll be something bright.
Well, what d'you know
Just owls! In a row!
Get cracking! We're needing FLUXITE!"

●

See that FLUXITE is always by you — in the house — garage — workshop — wherever speedy soldering is needed Used for over 40 years in Government works and by leading engineers and manufacturers. Of all Ironmongers—in tins, 10d., 1/6 & 3/-.

●

TO CYCLISTS! Your wheels will NOT keep round and true unless the spokes are tied with fine wire at the crossings AND SOLDERED. This makes a much stronger wheel. It's simple—with FLUXITE—but IMPORTANT.

●

The FLUXITE GUN puts FLUXITE where you want it by a simple pressure. Price 2/6, or filled, 3/6

ALL MECHANICS *WILL* HAVE

FLUXITE

IT SIMPLIFIES *ALL* SOLDERING

Write for Book on the ART OF "SOFT" SOLDERING and for Leaflets on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE. Price 1d. each.

FLUXITE LTD.

(Dept. W.W.), Bermondsey Street, S.E.1

M. WATTS & Co.

8, BAKER STREET,

WEYBRIDGE : SURREY

Telephone—Weybridge 2542.

TELEVISION COMPONENTS.

The following components were made by a famous manufacturer especially for Television. They are not ex-Government transformers made for another purpose.

Blocking Oscillator Transformers.

Line. Ratio 2.2 to 1.

Frame. Ratio 3 to 1.

Price 6/- each. 11/- a pair.

Line Output Transformers. Ratio 6 to 1. **Price 8/6 each.**

MAINS TRANSFORMERS.

Large transformers. Ideal for T.V. or amplifiers. Both types have normal 50 cycle primaries tapped for 200 to 250 volts.

Type A. 400-0-400 volts 300 mA., 6.3 v. 4a., 5 v. 3 a., 4 v. 3 a., 2 v. 1 a., 2 v. 1 a. Wire ends. **Price £2.**

Type B. 280-0-280 volts. 190 mA., 6.3 v. 9 a., 5 v. 3 a. Tag board. Service rating. **Price £2.**

PAPER CONDENSERS.

Brand new. By famous maker. 8 mfd., 500 volt working at 140 deg. F. **Price 4/- each.**

For details of many other lines send for our full list.

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE

ROD. BAR. SHEET. TUBE. STRIP, WIRE.

3,000 STANDARD STOCK SIZES

No Quantity too Small *List on application*

London: **H. ROLLET & Co., Ltd.** Liverp'l:
6 Chesham Place S.W.1. Kirkby Estate.
SLOane 3463 *SIMONSWOOD 3271/3*

HILL & CHURCHILL LTD.

BOOKSELLERS

SWANAGE, DORSET

Available from stock

Schelkunoff—"Electromagnetic Waves"	42/-
Fink—"Principles of Television Engineering"	33/-
C. J. Smith—"Intermediate Physics"	28/-
Starr—"Electric Circuits and Wave Filters"	25/-
Hudson—"An Introduction to Electronics"	15/-
A. R. R. L.—"The Radio Amateur's Handbook"	16/6
Williams—"Thermionic Valve Circuits"	12/6
Camm—"Wireless Coils, Chokes and Transformers"	6/-
S. T. C.—"Reference Data for Radio Engineers"	5/-

Postage Extra

CATALOGUE ON APPLICATION

MISCELLANEOUS

WALNUT radiogram and television cabinets, manufs. samples, few only; stamp details. —Walters, 5C1, Hale End Rd., E.4. [4442

DESIGNATION and valve-type waterslide transfers, black and silver, 1in×¾in, 44 different titles, 66 transfers in all; most useful for "those special jobs."—Send P.O. 2/6 and s.a.e. to Whixer Co., Farnham, Surrey. [4564

ENGRAVING, amateurs and trade could take the opportunity of engraving problems in the future by getting in touch with A. G. Engraving 19a, Windmill Rd., London, S.W.18. Brass, bronze, erinoid, perspex, dials; one knob or repetition equally entertained. [0034

FLUORESCENT lighting, 20w 5ft white enamelled curved trough reflector fitting, with complete ballast unit, tested 210-240v a.c. and 5ft tube, £4 only ex-works, or despatched less tube, 67/6.—Malden Transformer Supplies, 200-202, Cambridge Rd., Norbiton, Surrey.

COPPER wires enamelled, tinned Litz, cotton silk covered, all gauges; BA screws, nuts washers, soldering tags, eyelets; ebonite and laminated bakelite panels, tubes, coil formers; Tufnol rod; headphones, flexes etc.; latest radio publications, full range available; list s.a.e.; trade supplied—Post Radio Supplies, 33, Bourne Gardens, London, E.4 [1454

HANOVIA Senior sun lamp as new, 200-250v, £17/10. Avometer d.c. model good condition, £8/10; grinder, polisher, Runbaken, a.c./d.c., high speed for tools, etc. (cost £7/10), £4 15; signal lamp, powerful beam or automatic selectable morse symbols A to Z, very compact, 27/6; compass 7in de luxe, boxed, 57/6.—East Reading Radio, 1, Rupert St., Reading. Tel 61635

5-core cable rubber insulated 9/012 colour coded rubber covered, 35/- 100 yards; 7-core ditto, but cellulose covered, 45/- 10 yards stamp samples; Belling Lee type 5-pin plugs and sockets, 80/- per 100; 7-pin ditto, 100/- per 100, high grade panel lights, frosted domed red glass crystal, plated bezel, M.B.C., 80/- per 100, £14 for 400; Ceramic EF. 50 holders, 25/- per 100; VCR. 97 holders, 18/- per dozen; throat mikes, 15/- per dozen.—J. McMillan, 5, Oakfield Rd., Bristol, 8. [4372

SITUATIONS VACANT

Vacancies advertised are restricted to persons or employments excepted from the provisions of the Control of Engagements Order, 1947

GOVERNMENT OF IRAQ.

FIRST assistant radio engineer required by Basrah Port Directorate for one year in first instance. Salary I.D.60 rising to I.D80 a month. High cost of living allowance of between I.D.8 and I.D.12 a month, according to dependants, is payable on salary of I.D.60 a month (Iraqi Dinar 1 equals £1). Provident fund. Free passages. Candidates must possess P.M.G. 1st class certificate in wireless telegraphy and be A.M. (Brit.) I.R.E., or hold City and Guilds Final Certificate in radio communication. They must have had practical experience of commercial wireless transmitters and receivers and electrical equipment and preferably some experience at a large civil airport. Apply at once by letter, stating age, whether married or single and full particulars of qualifications and experience and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/25005 (3B) on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. [4535

CROWN Agents for the Colonies.

WIRELESS station superintendent required by the Gold Coast Government post and telegraphs department for one tour of 18 to 24 months in first instance; commencing salary (including overseas pay) according to qualifications and experience in scale £660 rising to £800 a year on agreement with prospect of permanency, or alternatively on temporary contract terms in scale £720, rising to £860 a year, with gratuity of £25 for each completed period of three months' service; outfit allowance £60; free passages; candidates, under 40 must had had practical experience of modern radio transmitters and receivers and be capable of taking charge (under an engineer) of the installation and maintenance of H.F. and V.H.F. stations and the training of African staff; knowledge of teleprinter maintenance or light diesel generating sets an advantage.—Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank London, S.W.1, quoting M/N/25006(3B) on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration.

BUSH RADIO, Ltd.—Applications are invited from engineers and assistants for positions in the following branches:—
(a) COMMUNICATIONS and Domestic radio development.
(b) TELEVISION Development.
(c) TEST Gear Development.
APPLY in writing giving age, qualifications, details of experience, salary required, etc., to The Personnel Manager, Bush Radio, Ltd., Power Rd., Chiswick, W.4 [4388

TELEVISION engineer required for factory, production and test, south of London, write, stating age, experience and salary expected to Box 966. [4583

RADIO CONSTRUCTORS' MECCA

The new, super **COLLARO RC49 A.C. MIXED AUTO-CHANGER** in black and chrome with hi-fi crystal pick-up, repeat mech. Immediate despatch, price **£14/6/8**, carr. paid.

The **COLLARO AC47** centre-drive **GRAM. MOTOR** and 12in. non-magnetic turntable, ideal for moving-coil pick-ups, etc., variable speed. Immediate despatch, price **£5 18/4**, carr. paid

COLLARO AC504 GRAMOPHONE UNIT—Motor, Pick-up (latest magnetic type) and Autostop, fixed speed, 10in. turntable. Immediate despatch, price **£5/3/2**, carr. paid.

COLLARO AC506 GRAMOPHONE UNIT—as 504, but centre-drive, variable speed and crystal pick-up. Immediate despatch, price **£8**, carr. paid.

The new **MARCONI AC100 AUTOCHANGER**, plays 10 records 10 or 12in. (not mixed), fitted high fidelity lightweight pick-up. Price, complete with pick-up transformer and packet of "Columbia 99" needles, **£10 15/-**. Immediate despatch.

4-watt **QUALITY AMPLIFIER**, single 6V6 output with special neg. feedback circuit giving equivalent to push-pull results. Pick-up and Tuner inputs, 3 ohm. output (other output to order). Price **£5 19 6**. Complete Kit, **£5 10/-**. Black crackle case **15/-** extra. Immediate delivery.

12-watt **QUALITY AMPLIFIER**, push-pull 6V6 output, special neg. feedback circuit, gram., mike and tuner inputs; 3, 7.5 and 15 ohm. output. Price **10 Gns.** Complete Kit, **£9**. Available in black crackle cabinet **£2** extra. Immediate delivery.

No. 1 HIGH-QUALITY TUNER. T.R.F. circuit, infinite impedance detector, M. & L. waves, excellent reports from "Williamson" and "Leak 1" users. Price **£5**. Immediate delivery. Complete Kit **£4/10/-**.

No. 2. SUPERHET TUNER. L., M. & S. waves, special "quality" band-width elaborate full-vision dial assembly. Price **£8/10/-**. Immediate delivery. Complete Kit, **£7/10/-**.

TERMS: C.W.O. or C.O.D. any amount.
"W.W." BARGAIN LIST 2½d.

Northern Radio Services,

102 PARKHILL ROAD, LONDON, N.W.3

TRANSFORMERS & COILS TO SPECIFICATION.

MANUFACTURED OR REWOUND

Filter Coils ± 1% a Speciality.

JOHN FACTOR LTD.

9-11 EAST STREET, TORQUAY, DEVON.
'Phone: Torquay 2162

LOCKWOOD

makers of

Fine Cabinets

and woodwork of every description for the Radio and allied trades

LOCKWOOD & COMPANY

Lowlands Road Harrow. Middlesex. Byron 3704

B. & H. RADIO
East Street, Darlington

Loud Speaker Bass & Treble Separator
Complete kit of parts and instructions. Enables speakers of different impedance to be used for bass and treble and also gives control of amount of treble relative to bass. Cross over 1000 c.p.s. £1 9 6

Scratch Filter 15 0
Gives a very marked reduction of scratch level without serious effect on treble response.

Variable Selectivity I.F. Transformer
465 Kc/s. Gives three degrees of selectivity. Circuit diagram of high fidelity receiver included.
Per pair £1 0 0

Aerial Circuit I.F. Filter 465 Kc/s 3 9

K 27

SITUATIONS VACANT

CROWN AGENTS FOR THE COLONIES

RADIO telegraph inspector required by Nigeria Government Posts and Telegraphs Department for one tour of 18 to 24 months. Salary £850 a year (including expatriation pay); outfit allowance £60; free passages; the duties of the post are those of a construction foreman engaged on the installation of radio diffusion or relay systems including fitting central receiving stations with diversity reception receivers, aerial arrays, etc., and subscribers lines and apparatus; candidates should have had experience with a company operating radio relay services. Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/24719(3B), on both letter and envelope; the Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. [4480

HIS MAJESTY'S COLONIAL SERVICE.

VACANCIES exist in the Colonial Engineering Service for Assistant Controllers of Telecommunications (Engineering), Federation of Malaya.

SALARY according to qualifications, experience and war service in the scale of $520 to $1065 Malayan dollars per month (equivalent to £728—£1,491 per annum) including expatriation pay and cost of living allowance 50% of basic salary depending on whether single or married.; candidates must be between 23 and 32 years of age and have been trained as telecommunications engineers; they must be Associate Members of the Institute of Electrical Engineers or possess educational qualifications carrying exemption from the relative examinations and should have not less than two years' practical experience with the British Post Office or with a manufacturer of telephone and telegraph apparatus; if the selected candidate has no previous experience he may be required to undergo a course of training with the British Post Office before departure to Malaya; half salary will be paid in respect of any period of training; the post is permanent and pensionable after a three-year probation period. The officer appointed will be provided with a free first-class passage for himself and his wife on first appointment and on leave; partly furnished quarters will be provided at low rentals; leave is granted at the rate of four days for each month of residential service after each tour of three to four years; income tax is payable at Colonial rates and is much less than in the United Kingdom.

INTENDING candidates should write forthwith for further particulars and application form to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith St., London, S.W.1, quoting Reference No. 27323/8. [4500

CROWN AGENTS FOR THE COLONIES.

TECHNICIAN (broadcasting) required by Northern Rhodesia Government Information Department for one tour of 36 months; commencing salary according to age and experience in scale £490 rising to £840 a year; gratuity payable on satisfactory termination of engagement; free passages; candidates, single and under 40, must have passed the B.B.C. Grade D examination for Overseas and Information Department Engineers (Tatsfield), or equivalent, and be capable of maintaining and installing receivers, from commercial to triple diversity types; knowledge of propagation of radio waves and receiving and transmitting aerials, aptitude in use of small tools and ability to drive a car are essential; knowledge of theory and practice of short-wave broadcasting transmitters an advantage. Apply at once by letter, stating age, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/24849(3B), on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration.

FOR South Sussex coast town domestic radio television mechanic; must have first-class experience and references; accommodation not offered.—Box 495. [4475

RADIO electronic engineer, capable design construction up to low power transmitter standard equipment; possible qualification City of London Guild Certificate.—Box 598. [4589

ELECTRONICS engineer required by firm in South Wales for original design and development of control gear; state full particulars of experience, age and salary required to Box 436.

VACANCY exists for scientifically minded person, preferably with experience, to undertake the processing of quartz crystals.—Write, stating wages required, to Box 8424 [2626

TELEVISION testers and inspectors urgently required at our Wembley works; merit bonus and overtime payment; men fully experienced in television preferred; radio testers also considered.

APPLY.—Scophony-Baird, Ltd., Lancelot Rd., Wembley, Middx. [4504

PILOT RADIO, Ltd., requires immediately fault finders and testers for radio and television alignment; experienced in factory production; five-day week with good rates of pay. APPLY or write to **Park Royal Rd., London, N.W.10.** [4517

SITUATIONS VACANT

HIS Majesty's Colonial Service. Gold Coast.

VACANCIES exist for wireless engineers in the posts and telegraphs department, to install and maintain police wireless network and to train police staff; the appointments are on probation for permanent and pensionable employment. or in the case of candidates over 40 years of age on contract/gratuity terms; the salary scale is £660-£1,300 per annum. including expatriation pay; point of entry depending on war service. qualifications and experience; a temporary non-pensionable cost of living allowance is payable on basic salaries below £840 per annum.

CANDIDATES must be Associate Members of the Institution of Electrical Engineers or hold equivalent qualifications giving exemption from Sections A and B of the associateship examination and have had at least two years' experience with an industrial concern engaged in the manufacture of electronic or radio equipment; experience of planning. installation and operation in either (a) H.F. radio-telephone and radio-teleprinter circuits, or (b) V.H.F. radio links. H.F. and V.H.F. direction finding.

PARTLY furnished Government quarters will be provided. if available. at a rent of £60. £75 or £90 per annum. according to salary; free first-class passages are provided for the officer and wife on first appointment and on leave; income tax is at local rates. which are very much lower than those in the United Kingdom; the tour of service is from 12-24 months; leave on full salary is granted at the rate of 7 days per month after normal tours of 18 months.

INTENDING candidates should write forthwith for form of application and further particulars to the Director of Recruitment. Colonial Office. Sanctuary Buildings. Great Smith St.. S.W.1. quoting Reference No. 27323/5 and giving brief details of age. qualifications and experience.

MINISTRY OF SUPPLY invites applications for unestablished post as principal scientific officer at the Royal Aircraft Establishment. Farnborough. Hants

CANDIDATES should be at least 31. and should possess a good honours degree in physics with good mathematical knowledge and research experience on radar display digital and analogue computors, pulse and pulse-coded communications.

SALARY assessed on age. qualifications and experience. within the range £910 to £1.177 (men) or £790 to £1.016 (women). plus F.S.S.U. benefits.

WRITE. quoting A264/49/EW. to Technical and Scientific Register (K). York House. Kingsway. London. W.C.2. for application form. which should be returned completed by 20th December. 1949. [4537

IN any grade or capacity there is usually a job for the right man at Sound Sales Limited: applicants should state age. details of experience. salary or wage required. by letter; testimonials should not be forwarded with inquiry.

THE Managing Director. Sound Sales. Ltd.. West St. Farnham Surrey. [0054

SERVICE mechanic required for leading hearing aid firm, West End; must be fully qualified and experienced in miniature L.F. amplifiers; state age, experience, and salary required to—Box A2996. Haddons, Salisbury Square, Fleet Street, E.C.4. [4512

REQUIRED for electronic laboratory development work, young engineer with laboratory experiences. to assist in the development of equipment associated with magnetic recording; commercial experience an asset but not essential; apply in first instance by letter to:

THERMIONIC PRODUCTS. Ltd.. Development Laboratories 7. Pratt Walk. London, S.E.11.

TELEVISION service engineers required by manufacturers to carry out servicing. instruct in service technique and take charge of servicing workshops; previous experience essential; must be able to drive; location Birmingham. Apply quoting Ref. 711 to Box 8391 [4206

YOUNG man with B.Sc. or Higher National Certificate in electrical engineering required, preferably with some knowledge of measurements to carry out electrical and magnetic measurements on all kinds of special alloys and the application thereof.—Full particulars to Box 537. [4540

WORKS manager required for small electrical works in west London engaged in the design and construction of individual indicator and signalling systems; knowledge of stock control and buying desirable.—Box No. B.R.. c/o Brockle, Haslam & Co.. 231. Strand. London W.C.2. [4491

RADIO engineers required for positions in the development laboratory of large manufacturer in East London area; applicants need not have academic qualifications but must have not less than three years' experience in radio receiver development laboratory; state full details to—Box 490. [4494

TOLL plant superintendent (Brazil).—The advertiser wishes to thank those applicants who answered the advertisement for this position under Box W W 409 at 191 Gresham House. E.C.2 and would state that those applicants whose qualifications were considered suitable have now been advised. [4523

SOBELL INDUSTRIES Ltd.. have a few vacancies in the main industrial areas for first-class service engineers operating from their own homes; there are responsible and well-paid posts with transport provided by the company.—Applications, with full details. to Service Manager. Langley Park. Slough. Bucks. [4516

SITUATIONS VACANT

TELEVISION/Radio service engineer, fully experienced, permanent position with excellent opportunities; full particulars and salary required to—W. J. Elliott, Ltd., Howardsgate, Welwyn Garden City, Herts. [4513

RADIO Service Engineer, age 25-35 preferred, fully qualified, smart appearance and accustomed to carrying out installation in the home; full knowledge of all H.M.V. and Marconiphone instruments essential.—Apply, stating experience and salary required, to Manager, His Master's Voice, 363 Oxford Street, W.1. [4563

SENIOR technical sales representative with experience of communications systems utilizing VHF, HF, or microwave equipments; technical qualifications not essential but sales experience and knowledge of operating and installing communications equipments required; state full details including age and salary required to—Box 491. [4496

RADIO service engineer required for provincial firm of high standing, must be to first-class technical standard, and have considerable practical experience, knowledge of television an advantage; wage according to ability and confirmed after one month's probation.—Apply Messrs. Barnes & Avis, Ltd., 140 141, Friar St., Reading, Berks. [4482

DEVELOPMENT engineers with industrial design experience in light engineering required to work near Esher, Surrey; good salaries and excellent working conditions are offered to qualified men; the work is of an important and interesting character with ample opportunities for advancement in a new organization.—Please reply to Box 494. [4514

APPLICATIONS invited from college-trained engineers with radar experience covering centimetre aerials, wave guides and receivers; circuit and general electronic experience also essential; salary offered will be from £650 p.a. upwards according to qualifications and experience.—Write, giving full particulars, quoting Ref. 733, to Box 498. [4529

ELECTRONIC engineer aged 25/30 required for work in inspection department, qualifications: Higher National Certificate standard with production experience of radio engineering, knowledge of A.I.D. work in this branch would be an advantage.—Please write giving full details to Personnel Dept., E.M.I. Engineering Development Ltd., Blyth Rd., Hayes, Middx. [4488

ELECTRONIC research and development engineers required, first class honours degree or equivalent preferred; vacancies for senior engineers with industrial experience and for juniors; interesting new projects; pension scheme; apply stating age, qualifications, experience and salary required to—Personnel Manager, Fairey Aviation Company, Ltd., Hayes, Middx. [4350

SENIOR and junior development engineers and draughtsmen for radio, radar, electronics, speakers, etc.; service engineers radio, television, radar, P.A. equipment; wiremen (skilled and semi-skilled) radar, instrument, radio; H.F. repairers, testers, inspectors, radio, television, radar; other positions vacant, consult.—Technical Employment Agency, 179, Clapham Rd., S.W.9 (Brixton 3487). [4444

EXPERIENCED estimators are required by large manufacturer of radio and allied equipment situated in East London area; applicants should be practically trained men with estimating experience either, of radio components and intricate mass-produced mechanisms, or of telephone and telecommunications equipment; state full details including age and salary required to—Box 489. [4493

LEADING component manufacturers situated Southern Scotland, require chief inspector possessing drive and initiative; applicants must be sound technicians with qualifications at least equivalent to inter-B.Sc., and with experience of modern testing technique; duties would include dealing wtih government inspection departments; initial training period in London; write stating experience and salary required to—Box 493. [4511

BRITISH INSULATED CALLENDER'S CABLES, Ltd. require a physicist for the development of sound recording media; candidates should be experienced in physical, electromagnetic and electroacoustic measurements and be capable of carrying out development work on own initiative; permanent position; salary according to age and qualifications.—Apply writing to Staff Officer, B.I.C.C., Ltd., Prescot, Lancs. [4494

E. K. COLE, Ltd., (Electronics Division) Malmesbury, Wilts, invite applications for the post of assembly shop charge hand (male), used to Government contract material and equipment and with a knowledge of training female labour, good disciplinarian; this post qualifies for entry into the pension scheme after a period of service.—Forms of application obtainable from Personnel Manager, Ekco Works, Malmesbury, Wilts. [4...

APPLICATIONS are invited by leadin... facturers of radio equipment ... men with electronic experience ... vacancies: (a) Test and in... radio, television and ... ture of equipmen... personnel wi... ing and ... Brit...

YOU SHOULD HAVE A NEW TAYLOR

* * * * * * * * *

We can supply the latest Taylor Test-Equipment, and take your used Equipment in part exchange. Balance by cash or hire purchase.

Write, phone or send your gear along for inspection and offer.

* * * * * * * * *

UNIVERSITY RADIO LTD.

22 LISLE ST. Tel. GERRARD 4447 & 8582

TELEVISION RECEIVERS SCANNING and FOCUS COILS TIME BASE COMPONENTS 7KV EHT. RF. UNITS and TRANSFORMERS

Publications post free

HR **HAYNES RADIO LTD.**

Queensway, Enfield.

INSTRUMENT WIRE

ENAMELLED, D.C.C. SILK COVERED, ETC. all sizes from 10 s.w.g. to 42 s.w.g. in stock. INSULATING MATERIALS, Empire cloth, leatheroid, paxolin, sleeving etc.

Send S.A.E. for list to

STAN. HOLT,

349, HIGH ST. SMETHWICK, STAFFS

Telephone WOODGATE 3789

'Radiospares' Quality Parts

THE SERVICE ENGINEER'S FIRST CHOICE

...ve not heard our ...LIFYING EQUIPMENT ...heard a record at its best... ...n't delay ... person... ...regret that ...rather than appointment ...on will imp...

L... & CO

...OW Avenue

Le...s ...-Sea, Essex.

Tel: ...end 75589.

Don't forget our ...panel and Rewinding Service—It's ...r and cheaper.

SITUATIONS VACANT

GARDNERS RADIO require qualified chief inspector for transformer test department, applicant should be conversant with Admiralty, M.O.S. and A.I.D. procedure.—Gardners Radio, Ltd., Somerford, Christchurch, Hants. [4612

GARDNERS RADIO require experienced transformer assembly supervisor, applicant is required to have had previous experience in the manufacture of all types of radio transformers.—Gardners Radio Ltd., Somerford, Christchurch, Hants. [4611

LABORATORY engineer required, holding City and Guilds Final or Higher National Certificate, experienced in work of general radio and television design; applicants should also be proficient at executive work.—Write, stating age, experience and salary required to Box 596. [4554

PYE, Ltd., Cambridge, have vacancies for experienced engineers in the television and radio communications divisions of their engineering department, vacancies also exist for senior and junior draughtsmen, salaries in accordance with qualifications and experience.—Applications by letter to Employment Dept., Pye, Ltd., Cambridge. [4619

DRAUGHTSMAN required for radio technical handbook work, ability to produce first-class diagrams from rough notes is essential, good prospects, permanency and superannuation scheme.—Apply stating age, qualifications, experience and salary required to The Secretary, Marconi's Wireless Telegraph Co., Ltd., New St., Chelmsford. [4597

ADVERTISEMENT manager wanted for the monthly technical journal "Electrical Engineering"; must have experience of advertising salesmanship and be capable of running department; applicants having acquaintance with products of manufacturers and knowledge of electronic industry will be given preference.—Send full particulars of experience and age to: Staff Director, Morgan Brothers (Publishers), Ltd., 28 Essex St., Strand, W.C.2. [4526

MARCONI'S WIRELESS TELEGRAPH COMPANY require for their works at Chelmsford a senior engineer to take charge of the research and development of domestic television receivers; applicants who must have had extensive experience in this class of work and a capacity for leading a development team should write giving full particulars quoting Ref. 296 to—Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., Westminster, S.W.1. [4502

FIRST-class technical representative required by electronic, television and radio accessory manufacturers; must be accustomed to dealing direct with high level technical executives in commercial concerns and Government departments and capable of continuing and expanding sales at present volume; excellent salary, commission and expenses allowance.—Write, stating age, positions held (in chronological order), technical qualifications, etc. to Box 499. [4534

A FEW unusual opportunities occur in the laboratories of Ferguson Radio Corporation, Ltd., for senior and junior development engineers for work on domestic radio and television receivers and electronic equipment for Government services; applicants must possess a university degree, preferably in engineering, or equivalent qualifications; designer-draughtsmen are also required for similar work; previous experience essential; excellent prospects for keen, enthusiastic men.—Write with full details to Chief Engineer, Ferguson Radio Corporation, Ltd., Great Cambridge Rd., Enfield. [4530

PAN-AMERICAN World Airways have immediate openings at London Airport for three radio, electrical mechanics. Applicants must have good background in electrical and radio theory, at least four years' experience in the maintenance of airborne equipment and components, be prepared to work shifts both indoors and outdoors in all seasons and all weather. Be prepared to perform electrical and related mechanical aircraft maintenance in addition to radio maintenance. Experience of American-type equipment helpful. Desired age is 21 to 27 years. Character references required. Starting salary is £8/14 per 48-hour week. All applications should be made in writing to Maintenance Dept., Pan-American World Airways, London Airport, Feltham, Middlesex. [4575

SITUATIONS WANTED

EXPERIENCED radio engineer, A.M.I.E.E. (34), eight yrs. with Admiralty, requires post in West of England, Devon or Somerset.—Box 438. [4492

DEVELOPMENT engineer, 11 years present post, seeks change, commercial and M.o.S., VHF AM/FM communication receiver development, ...ign, components.—Box 437. [4477

R... ...lege H... ...AINING ... Course, ...heory ...rate ...

...write, giving experience, ...must receive and ...and to serve brief particulars ...be given, Box 5675 ... H...

"CHRISTMAS CRACKERS"

Presented by

RADIO UNLIMITED

Elm Road, London E.17

Telephone: KEY 4813

Universal Mains Mic/Gram Amplifier. 6 watt, push pull output. Separate Vol. and Tone controls for Mic. and Gram. Tapped output 2, 4, 8, 15 Ohm. Housed in black crackle case with Chrome handles. 9 Gns. Carriage paid.

A.C. Mains Amplifier Chassis, 4 valve, 4½ watts output, Vol. and Tone controls, etc. Complete with valves and P.M. speaker. £5 10 6. Carriage paid.

M coil. Suspension Type Microphone. 30 ohms. A really first-class unit. 35/-. Post Free.

Superhet Chassis 5 valve, 3 waveband. For A.C. mains. Supplied complete with valves and Energised speaker. Very limited supplies at £9 18 6, inc. tax.

Folding Microphone Stand. Heavy Chrome. Less than half list price. 29/6. Post Free.

Our 1950 fully Illustrated Catalogue is now Available 3d Post Free

BERRY'S (SHORT WAVE) LTD

25, HIGH HOLBORN, LONDON, W.C.1

ELECTRONICS

DUPLEY LTD.

CRANMER AV. EALING.W 13.

Transformer and Coil Manufacturers to the Trade

Telephone: EALing 5688

---

mathematics

Our new Home-Study Course makes maths really interesting and easy to learn. Write for booklet to Dept. W.

T. & C. RADIO COLLEGE,

KING EDWARD AVE., AYLESBURY.

★**"Globe-King"** (REGD) **MARVEL IN MINIATURE**

SHORT-WAVE RADIO KIT

Probably the smallest one valve Short-Wave Radio receiver in the world using standard parts with Bandspread tuning device. "Magnificent performance" . . . vide testimonials British Isles and Abroad. Built and designed to precision standards, complete kit costs only 49/6d—write today for descriptive catalogue.

JOHNSONS (RADIO SPECIALISTS) MACCLESFIELD CHESHIRE (ENG)

POST RADIO SUPPLIES

OFFER EX STOCK

COPPER INSTRUMENT WIRE. ENAMELLED, TINNED, LITZ. COTTON AND SILK COVERED

Most gauges available.

B.A. SCREWS, NUTS, WASHERS soldering tags eyelets and rivets. EBONITE AND BAKELITE PANELS, TUFNOL ROD, PAXOLIN TYPE COIL FORMER AND TUBES, ALL DIAMETERS.

Latest Radio Publications.

Send stamped addressed envelope for comprehensive lists. Trade supplied.

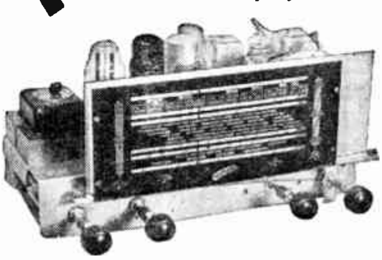
...ST RADIO SUPPLIES

...rne Gardens London E.4.

'Phone . CLIssold 4688

TELERADIO.

Radiogram Equipment



MODEL A70. 6 valve all-wave modern superhet chassis with tuning indicator, tone control and radiogram switch. The ideal replacement chassis. £12 12 0d. including Tax, plus valves, £3 3 0d.

MODEL 70 TU. As above but as 3 valve tuning unit feeding model 77 amplifier £8 0 0d. plus 34/10d. Purchase Tax.

MODEL 77. 4 valve push pull amplifier with 2 6V6 fed by phase invertor. Approx. 8 watts output £7 5 0d.

AVAILABLE AS KIT OF PARTS } Blueprints 4/-

Send for leaflet to:

THE TELERADIO CO.,
157, Fore St., Edmonton, N.18

SOUND-POWERED TELEPHONES

Ex-Admiralty, unused, famous British make. Require NO batteries, transformers or amplifiers. Just connect two together for instant clear speech over any length of line. Detach one earpiece and use as desk or wall mounting telephone; or lea e as twin headset and breast microphone (original purpose) for outdoors, T/V aerial installation on roof, etc., with both hands free. Countless uses in home, sickroom, office, shop, garage, farm, boat, etc. NOT a kit of oddments to assemble, but two excellent ready to use Telephones for 17/- post paid, with instructions and diagrams for bell circuits. *Instant despatch*

Bulk enquiries invited

WIRELESS SUPPLIES UNLIMITED
264-266 OLD CHRISTCHURCH RD.
BOURNEMOUTH · HANTS.
Telegrams: Limitrad, Bournemouth

TUITION

WIRELESS officer's attendance and "Radiocerts" postal course.—Apply Manager, The Wireless School, Manor Gdns., London, N.7.

WIRELESS, land, sea and air; students, both sexes, age 14 upwards, trained for interesting appointments in all branches of radio; low fees, boarders accepted; 2d stamp for pros.—Wireless College, Colwyn Bay. [0018

AIR and radio officers courses.—The 1st-class P.M.G. Certificate assures early and well-paid employment; obtain it with the help of our special day-time course commencing January, 1950.

WRITE for full details to E.M.I. Institutes, Ltd., Dept. W.W., 43, Grove Park Rd., London, W.4. Chiswick 4417-8. [0001

A.M.I.Mech.E., A.M.I.E.E., City and Guilds, etc., on "No Pass—No Fee" terms, over 95% successes; for details of exams. and courses in all branches of engineering, building, etc., write for 108-page handbook—free.—B.I.E.T. (Dept. 287B), 17, Stratford Place, London, W.1.

TELEVISION postal course for radio trades Examination Board's diploma, also postal courses for P.M.G. 2nd and 1st class Certificates and Amateur Radio Transmitting licence. —Apply British School of Telegraphy, Ltd., 179, Clapham Rd., London, S.W.9. (40 years' experience in coaching students in wireless telegraphy and allied subjects.) [2586

RADIO ENGINEERING SCHOOL Air Service Training, Hamble, Southampton, provides the best full-time training for responsible positions in industry or aviation; students coached for C. & G. Inter. and Final Certs. in radio or tele-communications; Graduateship of Brit. I.R.E., M.C.A. radio engineer licence, and for air and marine radio officers' licences; full details from the Commandant. [2260

TELEVISION.—Special evening class for members of the radio trade commences 6.30 p.m. Tuesday, 15th November, dealing fully with T/V theory and practical fault finding. Late entries accepted up to end of Nov. Class scheduled to complete course in six months.—For particulars apply The Principal, The Wireless Telegraph College, 25, John Dalton St., Manchester. Bla. 7501. [4590

TELEVISION.—The Gothic Television School specialises solely in training in television. All tutors possess university degrees and/or corporate membership of professional institutions and are appointed individually to postal course students to ensure complete and thorough training. Principals, M.B.E., B.Sc., M.Brit. I.R.E., education committee members, etc. Courses assume no previous television knowledge and provide guaranteed training for Brit.I.R.E., and R.T.E.B. examinations. Numerous well-known companies have adopted the School's Basic Television Course as standard television training for their staffs. Moderate fees. Details from Gothic Television School, 13, North Avenue, London, W.13. [0051

TRADE MARKS

THE trade mark Convette registered under No. 652213 in respect of battery eliminator units was assigned on March 24, 1949 by Amplion (1932), Limited, of 230, Tottenham Court Rd., London, W.1, to London & Provincial Factors, Limited, of 230, Tottenham Court Rd., London, W.1, without the goodwill of the business in which it was then in use. [4522

BOOKS, INSTRUCTIONS, ETC.

FRITH RADIOCRAFT, Ltd., offer:—

"VIEWMASTER" complete television assembly instructions by W. I. Flack (joint author "Electronic Engineering" Home Built Televisor), 8 full-size prints showing wiring in easy stages using standard parts by famous makers; large 32-page booklet giving the most complete "gen" ever offered to the home constructor. London version from stock—Midland version expected shortly. Price only 5/- +6d. post. Early delivery of all components—price list free on request. Brimar Radio Valve & Teletube Manual. The latest edition of this popular Valve Manual giving completely up-to-date list of all types manufactured by Standard Telephones & Cables together with relevant valve data, operating characteristics, etc., including metal rectifiers, Brimistors, Substitution Lists, Formulæ, Circuits, Equivalents, etc., 4/- +6d. post.
FRITH RADIOCRAFT, Ltd., 69-71, Church Gate, Leicester. [0028

WEBB'S 1948 radio map of world, new multi-colour printing, with up-to-date call signs and fresh information on heavy art paper, 4/6 post 6d; on linen on rollers 11/6, post 9d.—Webb's Radio, 1-4 Soho St., W.1. Gerrard 2089.

"HOME Constructors' Handbook," the latest edition of this famous handbook containing circuits, radio constructional and servicing hints and complete catalogue, is now available at only 1/-; mail order only.
SUPACOILS, 98 Greenway Ave., London, E.17.

"PERSONAL Portables," a new book by Edwin N. Bradley, is the first to describe a whole range of miniature personals, including the first-ever all wave personal set; with no theorising or padding the book is illustrated with circuits, layouts, drilling, constructional and point-to-point wiring plans of fully tested loudspeaker-type sets, and costs 2/6 (2/8 posted) from—Dept. W., Bradbooks, Sennen, Penzance, Cornwall. [4507

L·R·S

For Prompt & Efficient Service
CASH OR EASY TERMS

When you purchase on L.R.S. Convenient Terms Formalities are reduced to a Minimum and you deal direct with us from beginning to end.

AMSTRONG ALL WAVE CHASSIS
(incl. speaker and output transformer)

Model EXP/83/3. Cash price £18 17 1, or £4 12 0 with order and 12 monthly instalments of 26/-.

Model RF103/3. Cash price £26 10 0 or £4 12 0 with order and 12 monthly payments of £2 0 0. And other models.

Also available on our Easy Terms

Goodsell-Williamson Amplifier and Tuner Units
Collaro Radio-Gram Units and Record Changers
The Barker Loudspeaker
Goodman's Loudspeakers
Hartley-Turner Loudspeakers
Wharfedale Loudspeakers

Please let us know your Radio requirements (enclosing 2½d stamp) and we shall be pleased to quote.
Personal attention to all enquiries

THE LONDON RADIO SUPPLY CO.
Est. 1925
BALCOMBE SUSSEX

"You can rely on us"

FOR CLEAN COMPONENTS AT COMPETITIVE PRICES
IMMEDIATE DISPATCH

MIDGET SUPERHET COIL PACKS
MW/LW Size 2¼in. long, 1¼in. deep, 1⅞in. high, Type "R" 25/-
MW/SW Size 2¼in. long, 1¼in. deep, 1⅞in. high, Type "S" 25/-
SW/MW LW Size 3in. long, 1¼in. deep, 1⅞in. high, Type "C" 28/6
Comprising, iron-cored midget coils, wavechange switch, ceramic trimmers, neatly assembled for one hole fixing. The difficult part of a superhet overcome.

SPEAKER TRANSFORMERS
Super midget for "Personals" to match DL92, 3S4, etc. 4/3
Pentode output type 55 : 1 at bargain price for quality 4/6
Midget mains output transformer 3/9
All Brand New—Not Ex-Govt.

LOUDSPEAKERS
Celestion 2½in., 25/6; 3½in., 10/6; 5in., with dust cover, 9/9; 6½in., 12/6, with transformer, 17/6. 8in., 16/6, with transformer, 19/6.
All brand new.

COILS
Wearite "P" Coils 3/- each, full range stocked—Blueprint with data supplied.
T.R.F. Matched pair MW/LW First quality, pair 7/6

FILAMENT TRANSFORMERS
Primary 200-240 v., Secondary 6.3 v. 1.5 a. Black crackle finish of small dimensions, standard speaker transformer size 8/6

TUBULAR CONDENSERS
Up to .1 mfd., 6d. each; .5 mfd. 350 v., 1/3; 25 mfd. 25 v., 1/6; Midget .1 mfd. ⅜in. × ⅜in., 1/-; Metalmite, .005 mfd., .001 mfd., .01 mfd., 1/8 each.

RESISTORS
¼ watt, 3d. each; ½ watt, 4d. each; 1 watt, 8d. each.

BARGAIN OFFER
1 Pole 3 Way Rotary Yaxley type switch, 1/3.

VIEWMASTER TELEVISION
7 point to point circuits and booklet, 5/-. Components stocked.

HOST OF OTHER LINES.
Write, 'phone, or call for:
Price and Data folder containing Bargain List, 2½d. stamp.

RADIO SERVICING Co.
444, Wandsworth Road, London, S.W.8
'Phone: MACaulay 4155.
77, 77A, Bus 28, Tram, Wandsworth Rd. S.R. Station.
Open till 6.30 p.m.

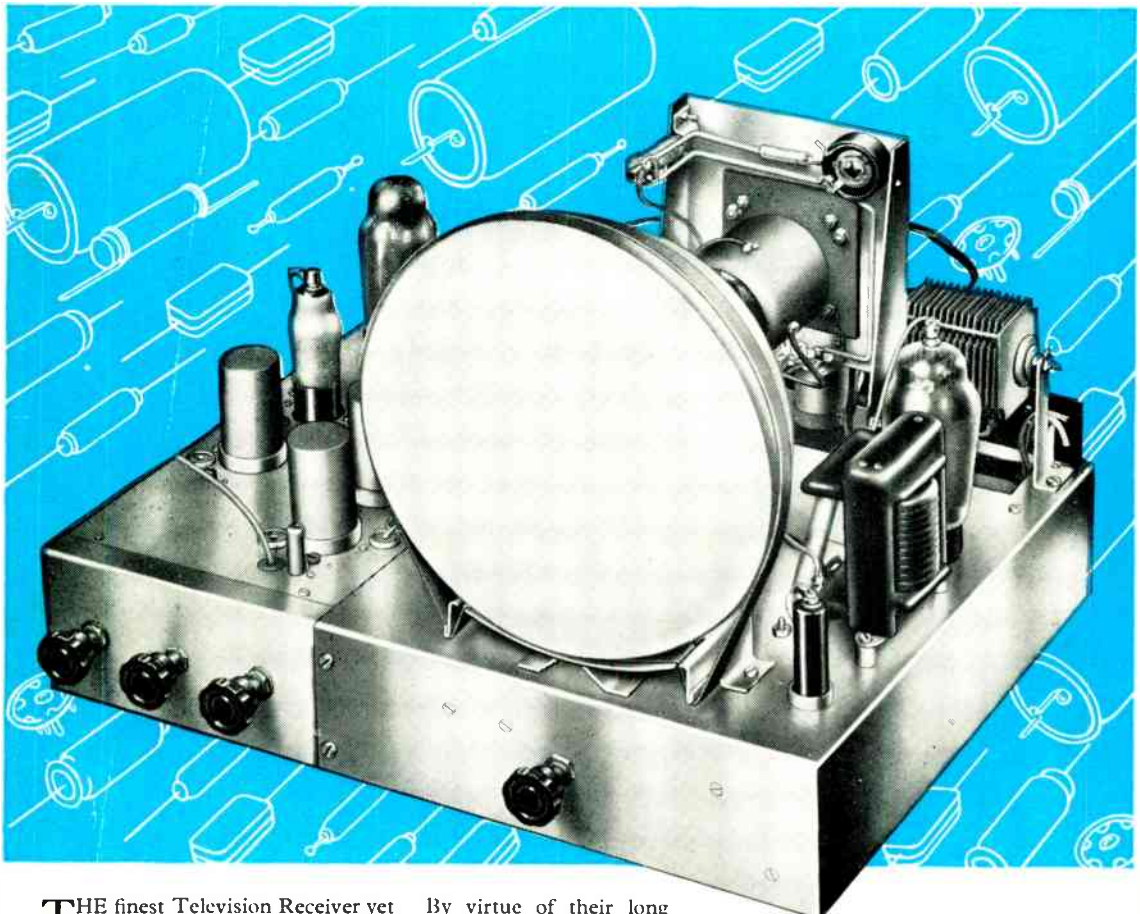
K 2

INDEX TO ADVERTISERS

Printed in Great Britain for the Publishers, ILIFFE AND SONS LTD., Dorset House, Stamford Street, London, S.E.1, by THE CORNWALL PRESS LTD., Paris Garden, Stamford Street, London, S.E.1 "Wireless World" can be obtained abroad from the following—AUSTRALIA and NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: Imperial News Co.: Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.: William Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co

T.C.C. CAPACITORS

exclusively specified for the "View Master"



THE finest Television Receiver yet designed for the Home Constructor* uses T.C.C. Capacitors exclusively. The reason is obvious. In any Television circuit capacitors play a vital role. According to their function some must be extremely accurate and stable, others highly resistant to heavy voltage surges. But whatever their function they must all give trouble-free dependable service throughout the life of the Receiver.

By virtue of their long experience and outstanding research facilities T.C.C. can rightly claim to be the logical choice for all capacitor requirements — with a range of types without equal in the industry.

** The "View Master" is fully described in a Constructor Envelope containing 8 full size wiring and assembly drawings together with a 32 page booklet profusely illustrated giving much practical information on Television. Copies 5/- each from all Wireless Shops or Newsagents. In case of difficulty direct from us post free 5/6.*

TCC

THE TELEGRAPH CONDENSER CO. LTD.

RADIO DIVISION

NORTH ACTON · LONDON · W·3 Telephone, ACORN 0061