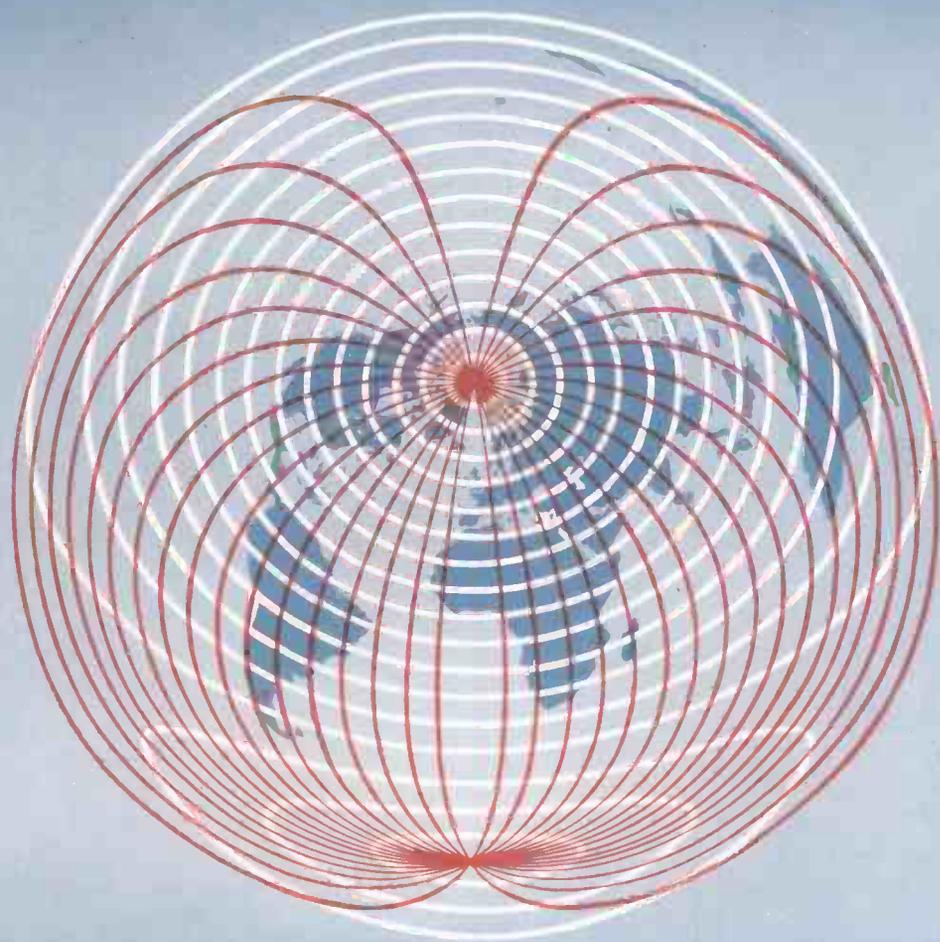
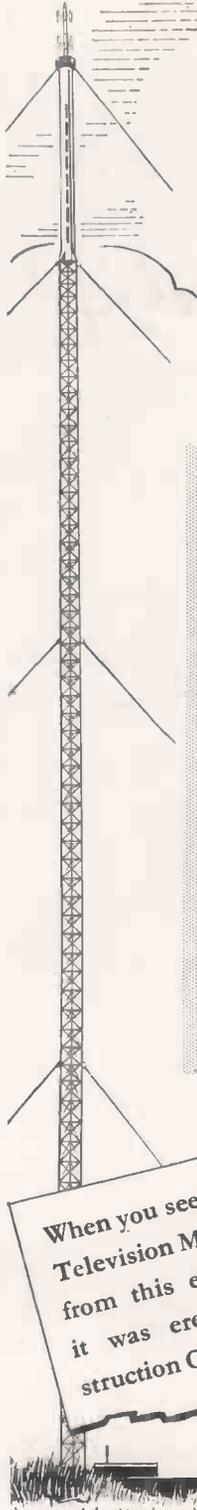


# Wireless World

RADIO AND ELECTRONICS



*Vol LVI No 9 Two Shillings September 1950*



# Radio Engineers!

## VISIT STAND 80

at the National Radio Exhibition

for these **BICC** products

### RADIO CAPACITORS



Paper dielectric and electrolytic types for all radio applications.

### PUBLIC ADDRESS CABLES

Microphone and loudspeaker cables suitable for indoor or outdoor use.

### WINDING WIRES

Comprising Enamelled, Bicalex, Textile Covered and Litz Wires.

### T/V DOWNLOADS

Full range of service and fringe area T/V download cables.

### ANTI-INTERFERENCE AERIAL

For better radio reception.

### T/V CAMERA CABLE and MOULDED CABLE-COUPPLERS

Individual designs available to your requirements.



When you see the Sutton Coldfield Television Mast, standing 4½ miles from this exhibition, remember, it was erected by B.I.C. Construction Co. a subsidiary of BICC.



## EQUIPMENT

FOR THE

# RADIO INDUSTRY

BRITISH INSULATED CALLENDER'S CABLES LIMITED  
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

40th YEAR OF PUBLICATION

## In This Issue

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

Editor: H. F. SMITH

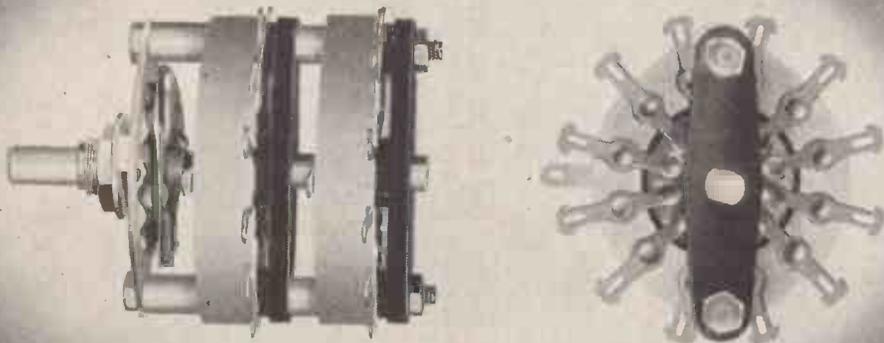
PUBLISHED MONTHLY Price 2/- (last Thursday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford St., London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Ethaworld, Sedist, London."

ANNUAL SUBSCRIPTION: Home and Overseas, £1 6s. 0d.; U.S.A. and Canada, \$4.50

### BRANCH OFFICES:

Birmingham: King Edward House, New Street, 2.  
Coventry: 8-10, Corporation Street.  
Glasgow: 26B, Renfield Street, C.2.  
Manchester: 260, Deansgate, 3.

EDITORIAL COMMENT .. .. .	305
17th NATIONAL RADIO EXHIBITION .. .. .	306
FLYBACK E.H.T.—2. By <i>W. T. Cocking</i> .. .. .	313
WORLD OF WIRELESS .. .. .	316
MEASUREMENTS WITH SIMPLE APPARATUS. By <i>Donald Robinson</i> .. .. .	320
AIR TRAFFIC CONTROL .. .. .	323
NEW BOOKS .. .. .	324
GRAMOPHONE SPEED CONVERSION. By <i>R. L. West</i> .. .. .	325
IMPROVED STEREOPHONY. By <i>E. Aisberg</i> .. .. .	327
SHORT-WAVE CONDITIONS. By <i>T. W. Bennington</i> .. .. .	330
R.C. OSCILLATORS. By " <i>Cathode Ray</i> " .. .. .	331
MONITORING AIRWAYS RADIO .. .. .	335
UNBIASED. By " <i>Free Grid</i> " .. .. .	336
LETTERS TO THE EDITOR .. .. .	337
RANDOM RADIATIONS. By " <i>Diallist</i> " .. .. .	340



### CERAMIC SWITCHES

For applications where only the best is good enough. Stators and rotors of Frequentite "R" ceramic. All contact members of silver alloy.

# Wright and Weaire Limited

138, SLOANE ST. · LONDON · S.W.1 TEL SLOANE 221415 FACTORY: SOUTH SHIELDS, CO. DURHAM



# Important trends in VALVE DESIGN

## MULLARD TELEVISION H.F. PENTODE TYPE EF80

The main application of the EF80 is as R.F. or I.F. amplifier in television receivers. It is, however, suitable for use also as a video output valve, as a synchronising pulse separator and as a frequency changer. In order to meet the requirements of the latest trends in receiver practice, and particularly the trend to use the transformerless technique for D.C./A.C. operation, the valve has been designed to give adequate performance when operated from a 170 V high tension line. The EF80 is a miniature R.F. pentode of all-glass construction. The adoption of the Noval (B9A) base with its extra pin connection permits the use of two cathode leads, as a result of which the input conductance is greatly reduced—a point of considerable importance at the higher television frequencies. In the radio frequency stages of receivers for use in the 41.5-65 Mc/s band, and also in the I.F. amplifying stages of superhet receivers operating on the higher television frequencies where intermediate frequencies of the order of 45 Mc/s, are commonly employed, the damping due to the input conductance of the valve is a limiting factor in performance. The low value of input conductance of the EF80 (330  $\mu$ mhos

at 100 Mc/s) renders the valves superior to previous types in this respect.

The following table gives the gains obtainable in a 4-valve amplifier for the following conditions:—

- (a) Bandwidth 6 Mc/s centred on 45 Mc/s.
- (b) Bandwidth 3.5 Mc/s centred on 65 Mc/s.

These conditions correspond to Channels 1 and 5 in the British television frequency band, and also represent the most severe conditions under which the valve is likely to be used, either as R.F. amplifier in T.R.F. receivers for the 41.5 to 68 Mc/s band, or as an I.F. amplifier in superhet receivers for higher carrier frequencies.

Gain (decibels)  
Amplifier (a)    Amplifier (b)

Staggered tuned circuits	100	84
Transformer coupled circuits	114	135

For direct-view receivers a gain of 90 db from the aerial terminal to the detector is necessary. It is therefore seen that the EF80 gives ample gain in a 4-valve amplifier at 45 Mc/s using either staggered-tuned single circuits or transformer coupling. At 65 Mc/s, however, transformer coupling must be employed.

### RATINGS AND CHARACTERISTICS

HEATER			
$V_h$	....	....	6.3 V
$I_h$	....	....	0.3 A
CAPACITANCES			
$C_{in}$	....	....	7.5 $\mu$ F
$C_{out}$	....	....	3.3 $\mu$ F
$C_{a-g1}$	....	....	< 0.007 $\mu$ F
$C_{a-k}$	....	....	< 0.01 $\mu$ F
$C_{g1-h}$	....	....	< 0.15 $\mu$ F
CHARACTERISTICS			
$V_a$	....	....	170 V
$V_{g2}$	....	....	170 V
$V_{g3}$	....	....	0 V
$I_a$	....	....	10 mA
$I_{g2}$	....	....	2.5 mA
$V_{g1}$	....	....	-2.0 V
$g_m$	....	....	7.4 mA/V
$r_a$	....	....	0.5 M $\Omega$
$\mu_{g1-g2}$	....	....	50
$R_{eq}$	....	....	1,000 $\Omega$
Input damping (at 50 Mc/s)	....	....	12,000 $\Omega$



Reprints of this article together with additional data may be obtained free of charge from the address below.

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

# Wireless World

VOL. LVI. No. 9.

SEPTEMBER 1950

## *National Radio Exhibition*

**E**CONOMISTS and sociologists tell us that over-centralization is one of the major defects in the organization of our national economy. *Wireless World* is hardly qualified to comment on that matter, but, if it be true, radio must indeed be in a bad way. With remarkably few exceptions, all purely radio manufacture and most industrial development work has long been concentrated in London or at least in a small part of the area known to weather forecasters as "S.E. England." True, as a result of post-war planning of industry a few radio factories have been set up in the North and West, but, rightly or wrongly, they are generally regarded as mere production units working under the direction of a central organization in London.

• Now, for the first time, the annual National Radio Exhibition is to be held outside London. This departure from precedent will, we expect, have a salutary effect in showing that appreciation of the finer points of radio design is not confined to the Metropolis. The site of the show at Castle Bromwich is by no means ideal, but at least one of its defects has been overcome by making special arrangements for the transport of visitors from the centre of Birmingham. Consequently a good attendance can be expected.

Although the show is distinctly smaller than last year's Radiolympia—90 exhibitors compared with 172, occupying about two-thirds of the floor space—it is fair enough to call it representative. This is especially true in the field of domestic broadcast and television reception, in which the exhibits will typify fully present-day tendencies and practice. Though television will naturally predominate, few aspects of radio will be entirely unrepresented, except the "heavy engineering" side. In several branches of the art visitors will be able to examine new apparatus and techniques which have not hitherto appeared before the public.

In this issue of *Wireless World* we are publishing a guide to the Exhibition in the form that, we hope, will be found most convenient both to visitors and to others who wish to keep in touch with the present activities of the British radio industry.

### *Worth-While Tests*

**O**VER two years ago *Wireless World* urged that the B.B.C. should not allow itself to be stampeded into initiating an e.h.f. broadcasting service until all the relevant factors had been investigated by means of a large-scale experiment. Naturally enough, we were highly gratified when the B.B.C. decided that both amplitude and frequency modulation should be tested simultaneously from the same site on high power. These tests have now started.

Although comparative f.m./a.m. tests are not new, we believe that they have not hitherto been conducted with such high power, or on such a favourable basis for comparison.

So far, little information is available as to the precise nature of the tests to be made, and the transmissions are not to a rigidly fixed schedule. No doubt, however, one of the first things to be determined will be the coverage obtainable from a high-power e.h.f. station of modern design, and secondly, to what extent, if any, coverage is dependent on the type of modulation.

Apart from matters mainly connected with transmission, there are many problems which concern the designers of receivers. For example, it has not yet been finally decided if a domestic f.m. set at a strictly economic price can be expected to maintain its alignment sufficiently well for the advantages of f.m. to be fully realized. If only to allow receiver designers to conduct large-scale field tests, a regular schedule of a.m./f.m. transmissions should be started as soon as possible.

# 17<sup>TH</sup> National Radio Exhibition



## Classified Guide to the Principal Classes of Exhibits

**P**ERHAPS it is fitting that Birmingham should be the chosen venue for the first national radio exhibition to be held outside the metropolis, in view of the position it now occupies as the centre of the Midlands television service.

In the following pages the products of the various firms exhibiting are tabulated in a similar manner to that adopted last year as it is believed this serves a very useful purpose by conveying the maximum amount of essential information in a way that is easy to follow. It also enables quick reference to be made when it is desired to trace all the makers of a particular class of equipment.

All the indications are that television will be the dominant feature, but perhaps this was to be expected in view of the recent opening of Sutton Coldfield, and the still further extension of the service in the near future. Indeed some makers of television sets are already catering for additional stations, particularly Holme Moss. In the majority of cases the provision is made as an alternative, effected either by an interchangeable r.f. unit or by suitable pre-set tuning adjustments.

Broadly speaking the television sets fall into three

**Organized by the Radio Industry Council; Venue, B.I.F. Buildings, Castle Bromwich, Sept. 6-16; Admission, 2/6 (11-5 and all day Sat.), 1/6 (5-10)**

main categories, direct viewing, projection and television combined with all-wave radio. As the tables show direct viewing constitutes the largest class and nearly 40 firms are expected to show models of various kinds. They range from relatively inexpensive table models to quite elaborate consoles.

The popularity of the 9-in tube appears to be waning as, from the information available at the time of going to press, most makers of direct-viewing receivers have adopted the 12-in size as the standard whilst retaining a few 9-in models in order to provide a slightly cheaper set. Large 15-in tubes do not appear to have attracted much support and it is doubtful if more than two or three sets with them will be shown this year.

## ALPHABETICAL LIST OF EXHIBITORS AND GUIDE TO THE STANDS

Name	Stand	Name	Stand	Name	Stand
A.R.B.M. .. .. .	31	" Electronic Engineering "	15	<b>Peto Scott</b> .. .. .	84
A.T.M. .. .. .	41	English Electric .. .. .	35	Philco .. .. .	38
Acrylite (Motor and Air Prods.) ..	14	Etronic (Hale) .. .. .	60	Philips .. .. .	42, 45
Aerialite .. .. .	76			Pilot .. .. .	56
Air Ministry .. .. .	19	<b>Ferguson</b> .. .. .	67	Portogram .. .. .	94
Alba (Balcóme) .. .. .	54	Ferranti .. .. .	55	" Practical Wireless "	20
Ambassador (Fitton) .. .. .	68	Fine Wires .. .. .	101	Pye .. .. .	8, 49
Amplion .. .. .	82				
Antiference .. .. .	18	<b>G.E.C.</b> .. .. .	58, 77	<b>R.G.D.</b> .. .. .	50
Avo (Automatic Coil Winder) .. ..	26	G.K.N. .. .. .	29	Radiomobile .. .. .	70
		G.P.O. .. .. .	21, 34	Regentone .. .. .	66
<b>B.C.L.</b> .. .. .	9	Garrard .. .. .	32	Romac .. .. .	88
Baird (Scophony) .. .. .	39	Goodmans .. .. .	85		
Barclays Bank .. .. .	6			<b>S.T.C.</b> .. .. .	43
Belling-Lee .. .. .	71	<b>H.M.V.</b> .. .. .	12, 65	Scott .. .. .	104
B.I. Callender's .. .. .	80	Hobday .. .. .	23	Sobell .. .. .	63
" Birmingham Gazette " .. .. .	27				
British Railways .. .. .	107	<b>Invicta</b> .. .. .	46	<b>Taylor</b> .. .. .	2
Brown Brothers .. .. .	72			Telcon (T.C.M.C.) .. .. .	79
Bulgin .. .. .	3	<b>J.B. Manufacturing</b> .. .. .	98	Telection .. .. .	100
Bush .. .. .	48, 105			" Television Weekly " .. .. .	17
		<b>K.A. (Kimber, Allen)</b> .. .. .	99	Trix .. .. .	25
<b>Champion</b> .. .. .	73	K.B. .. .. .	36		
Concord .. .. .	5	Kerry's .. .. .	95	<b>Ultra</b> .. .. .	59
Co-op. .. .. .	61			<b>Vidor</b> .. .. .	47
Cossor .. .. .	7, 52	<b>Lloyds Bank</b> .. .. .	30		
Coulphone .. .. .	97			<b>W.B.</b> .. .. .	62
		<b>McMichael</b> .. .. .	57	Westerman .. .. .	87
" Daily Mail " .. .. .	89	Magnavista (Metro Pex) .. .. .	78	Westinghouse .. .. .	16
Decca .. .. .	22, 37, 40	Marconiphone .. .. .	51	Westminster Bank .. .. .	75
Domain .. .. .	103	Masteradio .. .. .	28	Winter Trading .. .. .	96
Dynatron .. .. .	69	Midland Auto Components .. ..	24	" Wireless & Electrical Trader " ..	93
		Midland Bank .. .. .	91	" Wireless World " and " Wireless	
<b>Econasign</b> .. .. .	13	Mullard .. .. .	64, 74	Engineer " .. .. .	10
Eddystone (Stratton) .. .. .	83	Multicore .. .. .	86	Wolsey .. .. .	102
Ediswan .. .. .	33	Murphy .. .. .	44	Wood .. .. .	90
Ekco (Cole) .. .. .	11, 53, 92				
" Electrical and Radio Trading " ..	106	<b>National Provincial Bank</b> .. ..	108		
Electro Dynamic .. .. .	9				

One or two makers are using a plastic filter to reduce the effects of ambient light and so enable viewing to be enjoyed in ordinary room lighting. Looked at in ordinary light with the set switched off the tube face has a distinctly dark shade and this has given rise to the description "dark screen" television set. One manufacturer is marketing a light filter as a separate unit.

The second largest category among television sets is the combined broadcast and television receiver. A wide variety of styles will be seen. Some manufacturers have striven to provide in one cabinet all the domestic radio entertainment likely to be desired. For instance, such combinations as an all-wave radio set, automatic electric gramophone having provision for the normal 78 r.p.m. discs as well as long-playing records and projection television.

Nothing very striking is forecast by the advance details in the realm of ordinary broadcast reception. The wider use of miniature valves and, in some cases, components, has led to an all-round reduction in the size of chassis, but this may not be reflected in the external appearance of the set, since the size of the cabinet is largely governed by the loudspeaker.

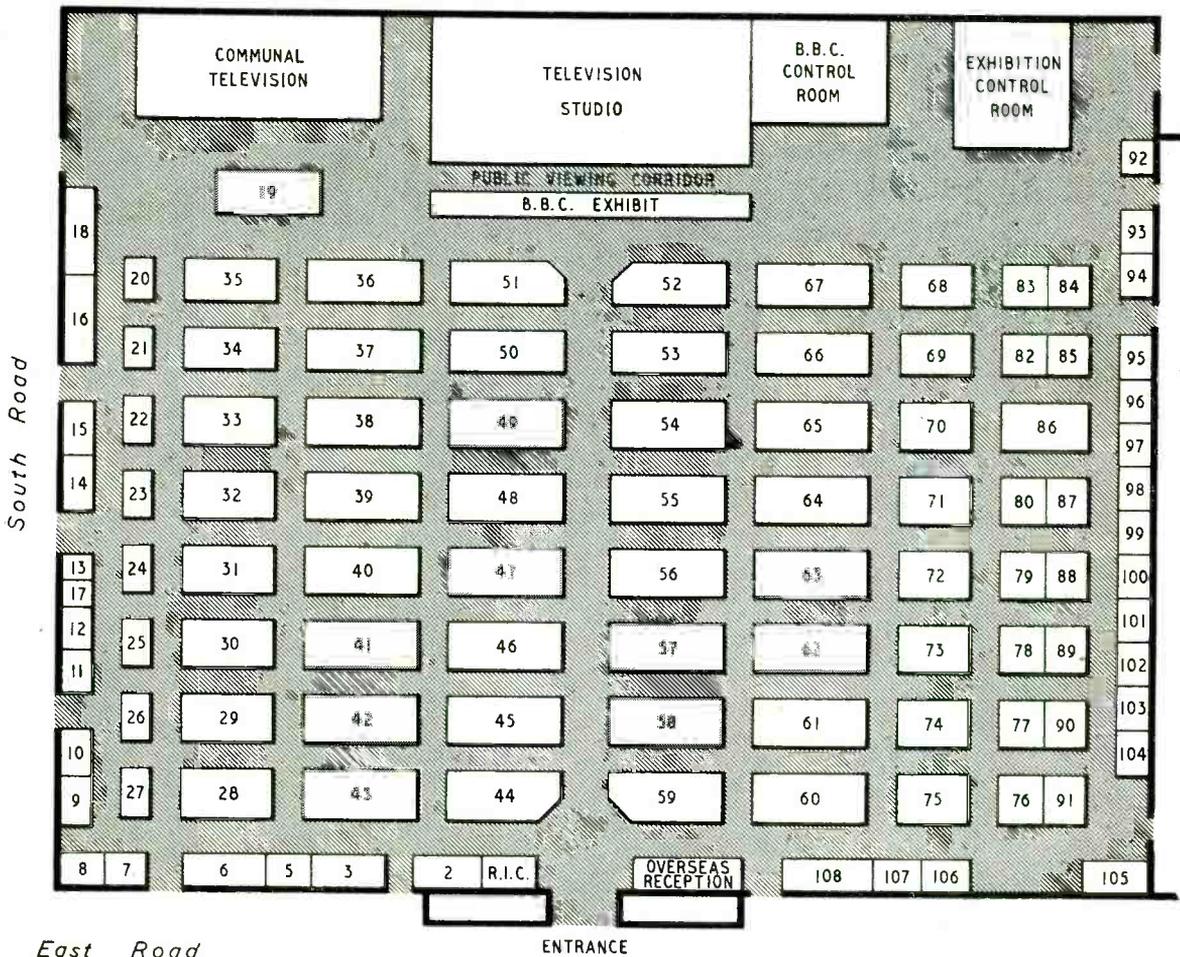
Portables have certainly benefited by the use of miniature parts and the division between ordinary portables and the so-called personal portables is now somewhat indefinite.

Conservation of battery power has come in for more attention and not only are there sets which are either mains or battery driven, but many makers are providing this feature in the form of an optional attachment. Another method of saving battery power is by substituting a small a.c. power unit, which occupies the same space as the battery, when the set is used indoors.

The advent of the long-playing record has had an inevitable repercussion on the design of new gramophone equipment. Almost all the latest radiograms are adaptable for either 78 r.p.m. or 33 1/3 r.p.m. operation and some also for 45 r.p.m. The pick-up has to be changed of course and one firm will be showing a tone arm with interchangeable heads; others use separate pick-up assemblies. These features will be seen embodied in some of the automatic record changers and record playing desks.

Although our classification of equipment is fairly broad it is inevitable that some apparatus will not readily fall within its scope. It must not be taken therefore that every piece of equipment is classified. There will, for instance, be examples of line transmission equipment and coil winding machines.

A noticeable omission at the show will be the lack of what can readily be called the "heavy engineering" side of radio. This is indicated by the scarcity of entries in the section of our tabular matter devoted



to transmitters. Moreover the entries in the section originally devoted to scientific and industrial equipment were so few that it has been omitted.

So far as the non-commercial exhibits are concerned there are three main exhibitors—G.P.O., Air Ministry and B.B.C. To emphasize the importance of a good aerial the G.P.O., who last year received 94,272 complaints of interference, of which, over 15,000 were due to poor aerial-earth systems, will be demonstrating the advantage of increasing the height of the aerial and its distance from the house electrical wiring. They will also be demonstrating a 3-cm radio link using a lens-horn aerial. Another exhibit will show how repeaters are used when transmitting television video signals over the ordinary Post Office telephone cable.

The Air Ministry will be featuring a scale model showing how a chain of early-warning radar stations functions. Among the equipment to be seen will be the TR1934 ten-channel v.h.f. set which is the latest radio-telephone transmitter-receiver used by the R.A.F. for both air-to-air and air-to-ground communication. A synthetic radar trainer, used for training controllers in air-to-air interception techniques, will also be demonstrated.

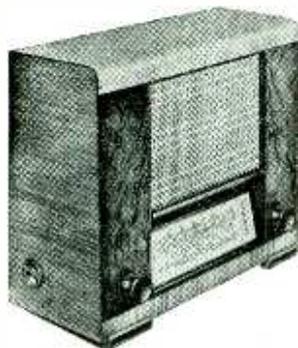
As at Radiolympia, provision is made for visitors to make comparative tests of television receivers in the Hall of Television where 85 sets will be working side by side throughout the greater part of each day. In addition 90 sets will also be in operation on individual stands.

To enable sets to be demonstrated almost continuously and not merely during the normal B.B.C. transmitting hours arrangements have been made to instal a small transmitter working on a closed circuit, which, to avoid interference from Sutton Coldfield, will operate on the Alexandra Palace frequencies. The programmes will include, in addition to B.B.C. transmissions, performances in the exhibition studio, which will be open to the public, and also films.

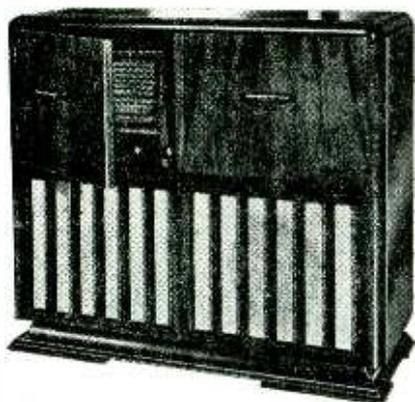
When the Sutton Coldfield programme is being used it will first be demodulated, passed through a video fader for programme control purposes and will then re-modulate the exhibition transmitter. The film scanner and output from the exhibition studio will be handled via the fader at vision frequency. The wave form will conform to B.B.C. standards.

Broadcast receivers will not be demonstrated at the exhibition.

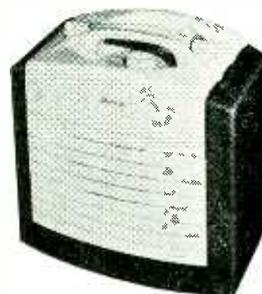
Ultra "Leader" five-valve a.c. superhet designed for ease of servicing.



The Alba D611 has bandspread tuning on six short-wave bands and it incorporates an automatic record changer.



The Pilot "Blue Peter" table receiver which covers the trawler band. It is a.c. operated.

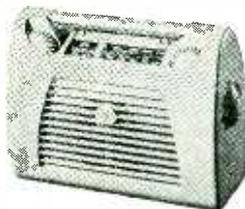


The Etronic "Rambler" EPZ4213 mains-battery portable.

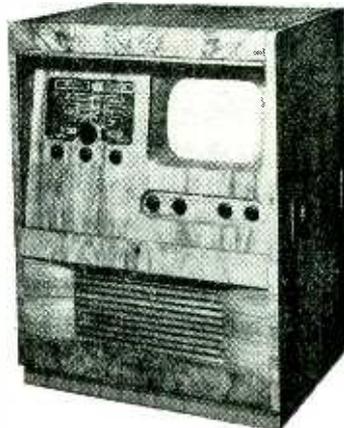


Built-in aerials for long and medium waves are used in this Ferranti Model 005.

K.B. Model FP11 battery portable (below) with thumb controls.



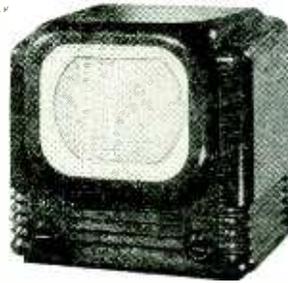
(Below) McMichael television-broadcast receiver fitted with 12in tube. It has two short-, medium- and long-wave bands.



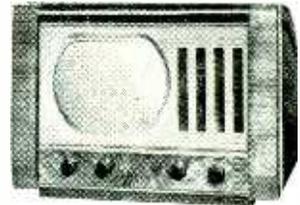
**RECEIVERS : Broadcast, Television, Communications and Special Purpose**

FIRM (Stand)	Broadcast										Special purpose	
	Mains	Battery	Mains, battery	Portable	Radio- gramophone	Direct-view- ing television	Projection television	Television- broadcast				
Alba ... (54)	•	•	•	•	•	•						
Ambassador ... (68)	•	•	•	•	•	•						
Amplion ... (82)	•	•	•	•	•	•						
Baird ... (39)	•	•	•	•	•	•						
Bush ... (48, 105)	•	•	•	•	•	•						
Champion ... (73)	•	•	•	•	•	•						
Co-op ... (61)	•	•	•	•	•	•						
Cossor ... (7, 52)	•	•	•	•	•	•						
Decca ... (22, 37, 40)	•	•	•	•	•	•						F
Dynatron ... (69)	•	•	•	•	•	•						C, Y
Eddystone ... (83)	•	•	•	•	•	•						S, M
Ekco ... (11, 53, 92)	•	•	•	•	•	•						F
English Electric ... (35)	•	•	•	•	•	•						
Etronic ... (60)	•	•	•	•	•	•						
Ferguson ... (67)	•	•	•	•	•	•						
Ferranti ... (55)	•	•	•	•	•	•						
G.E.C. ... (58, 77)	•	•	•	•	•	•						C, F
H.M.V. ... (12, 65)	•	•	•	•	•	•						T
Invicta ... (46)	•	•	•	•	•	•						T
K.B. ... (36)	•	•	•	•	•	•						T
McMichael ... (57)	•	•	•	•	•	•						M
Marconiphone ... (51)	•	•	•	•	•	•						
Masteradio ... (28)	•	•	•	•	•	•						
Midland Auto ... (24)	•	•	•	•	•	•						
Mullard ... (64, 74)	•	•	•	•	•	•						
Murphy ... (44)	•	•	•	•	•	•						
Peto Scott ... (84)	•	•	•	•	•	•						
Philco ... (38)	•	•	•	•	•	•						M
Philips ... (42, 45)	•	•	•	•	•	•						S
Pilot ... (56)	•	•	•	•	•	•						C, M
Portogram ... (94)	•	•	•	•	•	•						S, T
Pye ... (8, 49)	•	•	•	•	•	•						
R.G.D. ... (50)	•	•	•	•	•	•						
Radiomobile ... (70)	•	•	•	•	•	•						M
Regentone ... (66)	•	•	•	•	•	•						
Romac ... (88)	•	•	•	•	•	•						M
Sobell ... (63)	•	•	•	•	•	•						
Trix ... (25)	•	•	•	•	•	•						S
Ultra ... (59)	•	•	•	•	•	•						
Vidor ... (47)	•	•	•	•	•	•						
W.B. ... (62)	•	•	•	•	•	•						K

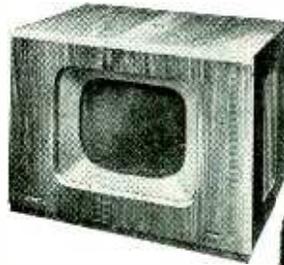
C, communications; F, f.m.; K, kit; M, car; S, schools; T, trawler-band; Y, yacht.



Adjustable tuning over the whole television band is provided in this Bush Model TV22 receiver, which incorporates a gin tube.



Baird portable television receiver, Model TI65, which utilizes the mains lead as an aerial.

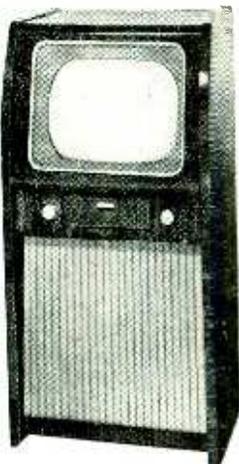


Pye "dark screen" television receiver, Model LV30, incorporating a gin tube.



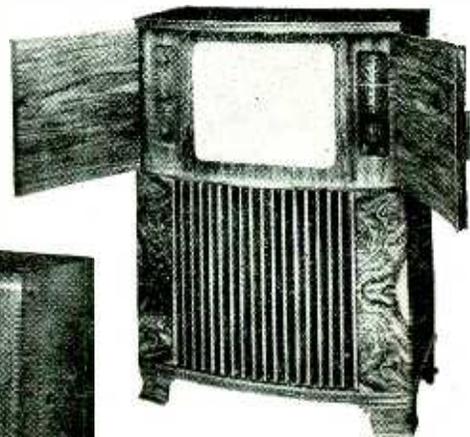
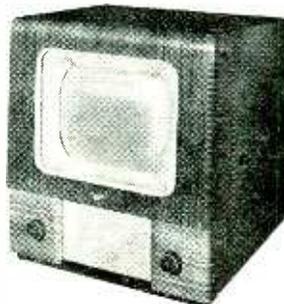
Flat-ended tube with aluminized screen and permanent-magnet focusing are features of the G.E.C. Model BT2147 receiver.

(Below) Vidor television receiver fitted with 12in tube. All controls are at the front.



(Above) Philips projection television receiver, Model 600A, giving a picture  $13\frac{1}{4} \times 10\frac{1}{4}$  in.

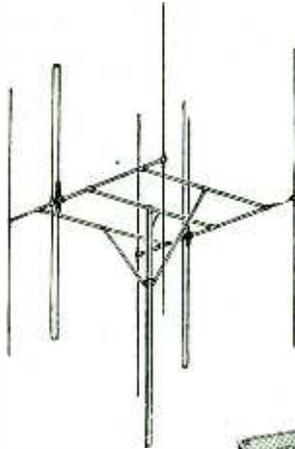
(Right) Marconiphone, Model VT75A, table television receiver.



Decca projection television receiver incorporates a broadcast chassis covering eight wave-bands.



Belling-Lee B7G valve holders and screen.



Wolsey six-element broad-side-array with two folded dipoles.



Mullard "Noval-based" 9-pin television valves.



Amplion Model DB3 a.c. power unit for all-dry battery portables.

**TRANSMITTERS: Including Low-power Transmitter Receivers**

FIRM	(Stand)	Broadcasting	Point-to-point	Airborne	Marine	Mobile V.H.F.	Keying and Control
A.T.M. ...	(41)						
G.E.C. ...	(58, 77)						
Pye ...	(8, 49)						
Romac ...	(88)						
S.T.C. ...	(43)						
Wolsey ...	(102)						

**TEST AND MEASURING GEAR: Including Signal Generators and Test Sets**

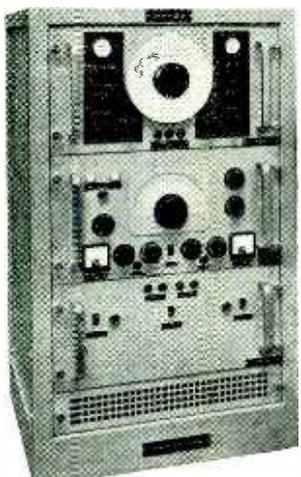
FIRM	(Stand)	Single-range pointer meters	Multi-range meters	Bridges and accessories	Valve voltmeters	Test sets	Signal sources	Television signal sources	Oscilloscopes	Servicing tools and materials
A.T.M. ...	(41)									
Amplion ...	(82)									
Avo ...	(26)									
Bulgin ...	(3)									
Cossor ...	(7, 52)									
Eddystone ...	(83)									
Ediswan ...	(33)									
English Electric ...	(35)									
Kerry's ...	(95)									
Mullard ...	(64, 74)									
Pye ...	(8, 49)									
Taylor ...	(2)									

**COMPONENTS: Excluding Accessories and Sub-Assemblies**

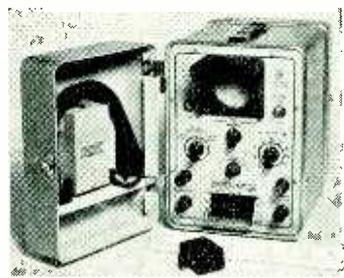
FIRM	(Stand)	Capacitors			Resistors			Switches	Coils, R.F.	Transformers, mains	Transformers, audio (inc. output)	Chokes	Plugs, sockets, connectors, adaptors	Chassis fittings (valveholders, etc.)	Cabinets, racks, chassis	Dials, drives, knobs	Relays	Vibrators	Television scan-components
		Fixed	Variable	Trimmers	Non-ohmic	Fixed wire-wound	Variable												
A.T.M. ...	(41)																		
Aeralite ...	(76)																		
Amplion ...	(82)																		
Antiference ...	(18)																		
Belling-Lee ...	(71)																		
B.I. Callender's ...	(80)																		
Bulgin ...	(3)																		
Bush ...	(48, 105)																		
Coulphone ...	(97)																		
Dynatron ...	(69)																		
Eddystone ...	(83)																		
Ediswan ...	(33)																		
G.K.N. ...	(29)																		
J.B. Manufacturing ...	(98)																		
Mullard ...	(64, 74)																		
Pye ...	(8, 49)																		
S.T.C. ...	(43)																		
Telcon ...	(79)																		
W.B. ...	(62)																		
Winter Trading ...	(96)																		
Wolsey ...	(102)																		

ACCESSORIES : Including Materials, Valves and Non-electronic Rectifiers

FIRM	(Stand)	Aerials				Valves	C.R. tubes	Photocells	Metal rectifiers	Crystal valves	Time switches	Batteries	Power units (inc. rotaries)	Interference suppressors	Magnets	Magnetic materials (inc. dust cores)	Wire and cable	R.F. cable	Insulants	Solder	Television pre-amplifiers	Television E.H.T. units	Television lenses
		Broadcast	Television and E.H.F.	Anti-interference	Car																		
A.T.M.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Acrylite	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Aerialite	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Amplion	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Antiference	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
B.C.L.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Baird	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Belling-Lee	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
B.I. Callender's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Concord	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cossor	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Decca	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Eddystone	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ediswan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Electro Dynamic	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ferranti	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fine Wires	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
G.E.C.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H.M.V.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
K.A.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kerry's	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Magnavista	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Marconiphone	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Masteradio	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mullard	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Multicore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Radiomobile	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Romac	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
S.T.C.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Scott	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Telcon	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Telerection	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Vidor	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W.B.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Westinghouse	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Winter Trading	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wolsey	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...



S.T.C. frequency-shift keying equipment for short-wave transmitters.



Telegraph distortion measuring set made by A.T.M.



Marconi Instruments (English Electric) television sweep generator, Model TF923, is shown below. It can be used for checking receivers, aerials and feeders.



(Right) Cossor, Model 1320, television alignment and pattern generator.

(Right) Avo universal bridge for measuring inductance, resistance and capacitance.

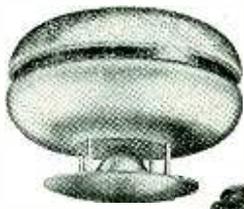


## SOUND REPRODUCING EQUIPMENT

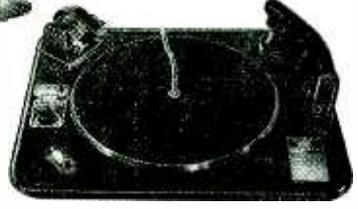
### Audio-Amplifiers and Electro-Acoustic Apparatus

FIRM (Stand)	Microphones	Pickups	Amplifiers	Loudspeakers	Gramophone motors	Record changers	Electric gramophones	Record players	Recorders, magnetic	Hearing aids
Amplion ... (82)	—	●	—	●	—	—	—	●	—	—
Baird ... (39)	—	—	—	—	—	—	—	—	T	—
Co-op ... (61)	—	—	—	—	—	—	—	—	—	—
Coulphone ... (97)	—	—	●	—	—	—	—	—	—	—
Decca (22, 37, 40)	—	—	●	—	—	—	—	—	—	—
Dynatron ... (69)	—	—	●	—	—	—	—	—	—	—
Eddystone ... (83)	—	—	—	—	—	—	—	—	—	—
Ediswan ... (33)	—	—	—	—	—	—	—	—	—	—
G.E.C. (58, 77)	—	—	—	—	—	—	—	—	T	—
Garrard ... (32)	—	—	—	—	—	—	—	—	—	—
Goodmans ... (85)	—	—	—	—	—	—	—	—	—	—
H.M.V. (12, 65)	—	—	—	—	—	—	—	—	—	—
K.B. ... (36)	—	—	—	—	—	—	—	—	W	—
Marconiphone ... (51)	—	—	—	—	—	—	—	—	—	—
Peto Scott... (84)	—	—	—	—	—	—	—	—	—	—
Portogram ... (94)	—	—	—	—	—	—	—	—	—	—
Pye ... (8, 49)	—	—	—	—	—	—	—	—	—	—
R.G.D. ... (50)	—	—	—	—	—	—	—	—	T	—
Trix ... (25)	—	—	—	—	—	—	—	—	—	—
Vidor ... (47)	—	—	—	—	—	—	—	—	—	—
W.B. ... (62)	—	—	—	—	—	—	—	—	—	—
Westerman ... (87)	—	—	—	—	—	—	—	—	—	—

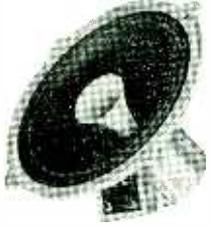
T, tape; W, wire.



Goodmans omni-directional public - address loudspeaker, known as the Concentric Diffuser.



Garrard three-speed automatic record changer, Model RC7z.



(Below) Stentorian 12in Concentric Duplex loudspeaker (W.B.).



Model P358 three-speed "Trixette" electric gramophone (Trix).

## NUMERICAL LIST OF STANDHOLDERS WITH NAMES AND ADDRESSES

- 2 Taylor Electrical Instruments, 419, Montrose Ave. Slough, Bucks.
- 3 A. F. Bulkin & Co., Bye-Pass Rd., Barking, Essex.
- 5 Concordia Electric Wire & Cable Co., Long Eaton Nr. Nottingham.
- 6 Barclays Bank, 54 Lombard St., London, E.C.3.
- 7 A. C. Cossor, Highbury Grove, London N.5.
- 8 Pye, Radio Works, Cambridge.
- 9 Electro Dynamic Construction Co., St. Mary Cray, Kent.
- Battery Construction, Bristol Rd., Bridgwater, Som.
- 10 "Wireless World" & "Wireless Engineer," Dorset House Stamford St., London, S.E.1.
- 11 E. K. Cole, Ekco Works, Southend-on-Sea, Essex.
- 12 Gramophone Co., Hayes, Middx.
- 13 Econsanig Co., 92, Victoria St., London, S.W.1.
- 14 Motor & Air Products, 24, Bridge St., Leatherhead, Surrey.
- 15 "Electronic Engineering," 28, Essex St., London, W.C.2.
- 16 Westinghouse Brake & Signal Co., 82, York Way King's Cross, London N.1.
- 17 "Television Weekly," 50 Old Brompton Rd., London, S.W.7.
- 18 Antiferre, 67, Bryanston St., London, W.1.
- 19 Air Ministry, Parliament Sq. House, Parliament St., London, S.W.1.
- 20 "Practical Wireless," Tower House Southampton St., London, W.C.2.
- 21 General Post Office, London, E.C.1.
- 22 Decca Record Co., 1-3, Brixton Rd., London, S.W.9.
- 23 Hobday Bros., 21-27, Gt. Eastern St., London, E.C.2.
- 24 Midland Auto Components, 38, Cambridge St., Birmingham.
- 25 Trix Electrical Co., 1-5, Maple Place Tottenham Court Rd., London, W.1.
- 26 Automatic Coil Winder & Electrical Equipment Co., Winder House, Douglas St., London, S.W.1.
- 27 "Birmingham Gazette," Gazette Buildings, Corporation St., Birmingham, 2, Warwick.
- 28 Masteradio, 16-20, Fitzroy Place, London, N.W.1.
- 29 Guest, Keen & Nettelfolds, Box No. 24, Heath St., Birmingham, 18, Warwick.
- 30 Lloyds Bank 71, Lombard St., London, E.C.3.
- 31 Association of Radio Battery Manufacturers, 41 Gordon Square, London, W.1.
- 32 Garrard Engineering & Manufacturing Co., Newcastle St., Swindon, Wilts.
- 33 Edison Swan Electric Co., 155, Charing Cross Rd., London, W.C.2.
- 34 General Post Office, London, E.C.1.
- 35 English Electric Co., Queens House, Kingsway, London, W.C.2.
- 36 Kolster-Brandes, Footscray, Sidcup, Kent.
- 37 Decca Record Co., 1-3, Brixton Rd., London, S.W.9.
- 38 Philco (Overseas), 204-206, Gt. Portland St., London, W.1.
- 39 Scophony Baird, Lancelot Rd., Wembley, Middx.
- 40 Decca Record Co., 1-3, Brixton Rd., London, S.W.9.
- 41 Automatic Telephone & Electric Co., Strouger House, Arundel St., London, W.C.2.
- 42 Philips Electrical, Century House, Shaftesbury Ave., London, W.C.2.
- 43 Standard Telephones & Cables, Connaught House, Aldwych, London, W.C.2.
- 44 Murphy Radio, Welwyn Garden City, Herts.
- 45 Philips Electrical, Century House, Shaftesbury Ave., London, W.C.2.
- 46 Invicta Radio, Parkhurst Rd., Holloway, London N.7.
- 47 Vidor, West St., Erith, Kent.
- 48 Bush Radio, Power Rd., London, W.4.
- 49 Pye, Radio Works, Cambridge.
- 50 Radio Gramophone Development Co., Pale Meadow Works, Bridgforth, Salop.
- 51 Marconiphone Co., Hayes, Middx.
- 52 A. C. Cossor, Highbury Grove, London, N.5.
- 53 E. K. Cole, Ekco Works, Southend-on-Sea, Essex.
- 54 A. J. Balcombe, 32, Tabernacle St., London, E.C.2.
- 55 Ferranti, Hollinwood, Lancs.
- 56 Pilot Radio, 31-33, Park Royal Rd., London, N.W.10.
- 57 McMichael Radio, 130, Strand, London, W.C.2.
- 58 General Electric Co., Magnet House, Kingsway, London, W.C.2.
- 59 Ultra Electric, Western Ave., Acton, London, W.3.
- 60 Hale Electric Co., Radio Works, Talbot Rd., West Ealing, London, W.13.
- 61 Co-operative Wholesale Society, 1, Balloon St., Manchester, 4, Lancs.
- 62 Whiteley Electrical Radio Co., Victoria St., Mansfield, Notts.
- 63 Sobell Industries, Langley Pk., Nr. Slough, Bucks.
- 64 Mullard Electronic Products, Century House, Shaftesbury Ave., London, W.C.2.
- 65 Gramophone Co., Hayes, Middx.
- 66 Regentone Products, Eastern Ave., Romford, Essex.
- 67 Ferguson Radio Corp., 105, Judd St., London, W.C.1.
- 68 E. N. Fitton, Princess Works, Brighouse, Yorks.
- 69 Dynatron Radio, Perfecta Works, Ray Lea Rd., Maidenhead, Berks.
- 70 Radiomobile, Cricklewood Works, London, N.W.2.
- 71 Belling & Lee, Cambridge Arterial Rd., Enfield, Middx.
- 72 Brown Brothers, Gt. Eastern St., London, E.C.2.
- 73 Champion Electric Corp., Champion Works, Scaford, Sussex.
- 74 Mullard Electronic Products, Century House, Shaftesbury Ave., London, W.C.2.
- 75 Westminster Bank, 51, Threadneedle St., London, E.C.2.
- 76 Aerialite, Castle Works, Stalybridge, Cheshire.
- 77 General Electric Co., Magnet House, Kingsway, London, W.C.2.
- 78 Metro Pex, 38, Gt. Portland St., London, W.1.
- 79 Telegraph Construction & Maintenance Co., 22, Old Broad St., London, E.C.2.
- 80 British Insulated Callender's Cables, Norfolk House, Norfolk St., London, W.C.2.
- 82 Amplion, 230, Tottenham Court Rd., London, W.1.
- 83 Stratton & Co., Eddystone Works, Alvechurch Rd., West Heath, Birmingham, 31, Warwick.
- 84 Peto Scott Electrical Instruments, Adlestone Rd., Weybridge, Surrey.
- 85 Goodmans Industries, Lancelot Rd., Wembley, Middx.
- 86 Multicore Solders, Mellier House, Albemarle St., London, W.1.
- 87 F. Westerman (Wholesale), 94, Dale End, Birmingham, 4, Warwick.
- 88 Romac Radio Corp., The Hyde, Hendon, London, N.W.9.
- 89 "Daily Mail," Northcliffe House, E.C.4.
- 90 E. A. Wood, 100, Aston Rd., Birmingham, 6, Warwick.
- 91 Midland Bank, Poultry, London, E.C.2.
- 92 E. K. Cole, Ekco Works, Southend-on-Sea, Essex.
- 93 "Wireless & Electrical Trader," Dorset House, Stamford St., London, S.E.1.
- 94 Portogram Radio Electrical Industries, Priel Works, St. Rule St., London, S.W.8.
- 95 Kerry's (G.B.), Watton Rd., Stratford, London, E.15.
- 96 Winter Trading Co., 8 Harrow Rd., Paddington, London, W.2.
- 97 Coulphone Radio, 53, Burscough St., Ormskirk, Lancs.
- 98 J. B. Manufacturing (Cabinet) Co., 86, Palmerston Rd., Walthamstow, London, E.17.
- 99 E. K. Kimber, Allen & Co., Myron Works, Myron Place, Lewisham, London, S.E.13.
- 100 Telecrection, 12, Suffolk Parade, Cheltenham, Glos.
- 101 Fine Wires, Grove Rd., Castle Boulevard, Nottingham.
- 102 Wolsey Television, 75, Gresham Rd., Brixton, London, S.W.9.
- 103 Domain Industries, Domain Works, Barnby St., London, N.W.1.
- 104 Geo. L. Scott & Co., Cromwell Rd., Ellesmere Port, Cheshire.
- 105 Bush Radio, Power Rd., London, W.4.
- 106 "Electrical & Radio Trading," 95, Long Acre, London, W.C.2.
- 107 British Railways, 222, Marylebone Rd., London, N.W.1.
- 108 National Provincial Bank, 15 Bishopsgate, London, E.C.2.

# Flyback E. H. T.

## 2—Characteristics of the Circuit

By W. T. COCKING, M.I.E.E.

(Concluded from page 282.

August Issue)

THE general argument leads to the conclusion that the requirement for good regulation is a high ratio of energy in the deflector-coil circuit to the energy drawn from the e.h.t. system by the tube. It tells us nothing about how big the ratio must be for a given regulation, however, nor does it indicate how the magnitude of the damping affects matters. The detailed analysis of the Appendix is necessary for this and its results are presented in Figs. 5, 6 and 7. The damping is here indicated by the  $Q$  of the circuit ( $Q = R\sqrt{C/L}$ ). It is interesting to notice that the  $Q$  has very little effect on the regulation. For values of  $LI^2/V_{HT}i_{HT}$  over  $4.5 \times 10^{-3}$  the effect of varying  $Q$  is indistinguishable on the curves. For smaller values,  $Q$  does have a noticeable effect, but it is still very small.

This at first seems surprising for the power dissipated in  $R$  increases as  $Q$  is lowered and one would expect the ratio of circuit volt-amperes to e.h.t. power to increase to make up for this loss. This would occur if the curves were plotted in terms of  $Li_0^2/V_{HT}i_{HT}$  instead of  $LI^2/V_{HT}i_{HT}$  for the value of  $I/i_0$  depends very much upon the  $Q$ .

The peak-to-peak current  $I$  is regarded here as more fundamental than the peak current  $i_0$ ;  $I$  must be provided for deflection,  $i_0$  depends on  $I$  and  $Q$ , and  $Q$  depends on what is practically obtainable and upon what is usable in a given type of circuit. The relation between  $I$  and  $i_0$  is dependent on scanning requirements only and is either settled by the  $Q$  available or  $Q$  is chosen to provide the required relation. Of course,  $I/i_0$  is affected somewhat by the load of the e.h.t. supply, but this is taken into account in Fig. 5.

The measure of volt-amperes in the deflecting circuit is made  $LI^2$  because this is also a convenient measure of deflector-coil characteristics. It is not actually a volt-ampere product; to be this it would have to be divided by the repetition period of the saw-tooth. Time does come into the expression used in computing Fig. 5, but it has been included as a numerical figure of 98.77  $\mu$ sec.

A typical deflector coil has an  $LI^2$  figure of 1.3 mH-A<sup>2</sup> with a tube operating at 5 kV. A transformer may have a field efficiency of 70 per cent. The effective  $LI^2$  figure at the primary then becomes  $1.3/0.7 = 1.86$  mH-A<sup>2</sup>. With a current of 120  $\mu$ A at 5 kV,  $V_{HT}i_{HT}$  is  $5 \times 0.12 = 0.6$  watt and so  $LI^2/V_{HT}i_{HT} = 1.86 \times 10^{-3}/0.6 = 3.1 \times 10^{-3}$ . Reference to Fig. 5 shows  $V_{HT}/V_m = 0.88$ , about. The zero to full-load regulation is thus  $100(1 - 0.88) = 12\%$ . With  $V_{HT} = 5$  kV,  $V_m$  becomes  $5/0.88 = 5.68$  kV and the change of voltage is 680 V; therefore, the internal resistance of the supply is  $680/120 = 5.7$  M $\Omega$ .

If better regulation is needed, then it is necessary to increase  $LI^2$ . This means, of course, that a less efficient deflector coil or transformer must be used. The pursuit of efficiency in these components may,

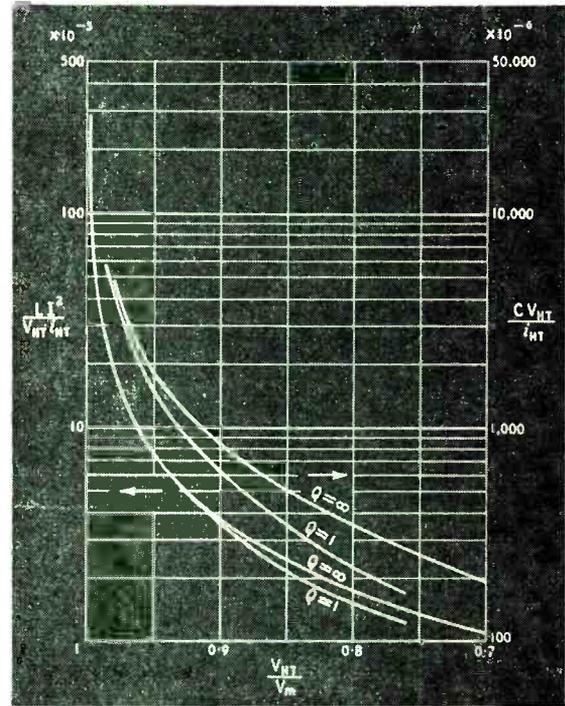


Fig. 5. Variation of  $LI^2/V_{HT}i_{HT}$  and  $CV_{HT}/i_{HT}$  with  $V_{HT}/V_m$  for  $Q$  values of 1 and  $\infty$ .

therefore, be a waste of time when e.h.t. is taken from the fly-back!

In the case quoted the  $LI^2$  figure was taken as a reasonable one for good components and it led to a usable figure for the regulation. Suppose now that the tube voltage is doubled so that  $V_{HT}$  becomes 10 kV, the current remaining unchanged.  $LI^2$  is also doubled, because the current needed for deflection increases as  $\sqrt{V_{HT}}$ , so that  $LI^2/V_{HT}i_{HT}$  is unchanged and the regulation is unaffected. This is very important because it means that the regulation is independent of the voltage.

The LC product needed in the circuit is also independent of voltage (Equ. 24 in the Appendix) but depends on the fly-back time, the  $Q$  and the regulation. For a given  $Q$ , if LC is chosen to give the required fly-back time at full current, then at lower current the fly-back will be a little quicker. The change is not large because the conduction time of the diode is only a small fraction of the total fly-back time and it is the conduction time which is directly affected by the current.

For a given maximum current, the voltage obtainable is inversely proportional to the circuit capacitance. As capacitance cannot be reduced indefinitely this sets a limit to the maximum voltage obtainable.

For the case of  $LI^2 = 3.1 \times 10^{-3}$  and  $V_{HT} = 5$  kV, we see from Fig. 5 that for a low-Q circuit  $CV_{HT}/i_{HT} = 480 \times 10^{-6}$  and for a high Q it is  $670 \times 10^{-6}$ . With  $i_{HT} = 120 \mu A$ , we have  $5.86 \times 10^{-8}$  and  $8.2 \times 10^{-8}$  respectively for  $CV_{HT}$  and so C becomes 11.9 pF and 16.4 pF. A high-Q circuit has an advantage in permitting a higher circuit capacitance. In both cases the circuit capacitances are low and may be impracticably low. Certainly, appreciably smaller values, and hence much higher e.h.t. voltages, would be impossible.

If the circuit Q is large so that the losses in R are negligibly small the equations in the Appendix can be greatly simplified for then  $\omega L = \sin^{-1} V_{HT}/V_m$  and  $I/i_0 = I + V_{HT}/V_m$ . Then

$$\frac{LI^2}{V_{HT} i_{HT}} = 2\tau \frac{I + V_{HT}/V_m}{I - V_{HT}/V_m}$$

$$\frac{CV_{HT}}{i_{HT}} = 2\tau \frac{(V_{HT}/V_m)^2}{I - (V_{HT}/V_m)^2}$$

Eliminating  $i_{HT}$  between the two equations we get

$$C = \frac{LI^2}{V_{HT}^2} \cdot \left( \frac{V_{HT}/V_m}{I + V_{HT}/V_m} \right)^2$$

which shows that for a given regulation and deflector-coil energy the capacitance required is inversely proportional to the square of the voltage. If  $LI^2$  is fixed at the requirements for scanning there is a decided limit to the e.h.t. voltage obtainable because there is a physical limit to the extent to which C can be reduced. However, this limit of voltage is only for a given type of rectifier. If a voltage-doubler rectifier is substituted for a half-wave, then in the ideal case the rectifier output voltage  $V_T$  and input current  $i_{HT}$  are doubled. Since  $i_{HT}$  does not appear in the above equation and  $V_{HT}$  still refers to the circuit voltage, the permissible capacitance is increased four times or, for the same capacitance the tube voltage is doubled. Voltage-multiplying rectifiers are thus essential for high tube voltages.

The regulation is unaffected by the use of such a rectifier for although the input voltage and current are changed their product is constant. This is, of course, in the ideal case. In practice, the regulation of a voltage-multiplying rectifier is itself poorer than that of a half-wave because there is a greater power loss within it. Where it is practicable to use a half-wave rectifier, therefore, this kind should be used.

We have seen that the regulation is hardly affected by the Q of the circuit. This does not mean, however, that the effect of the regulation on the width of the

picture is unaffected by Q. The deflection D is inversely proportional to the square root of the tube anode voltage and directly proportional to the deflecting current I; that is,

$$D \propto I/\sqrt{V_T} \propto I/\sqrt{V_{HT}} \text{ and } D \propto I$$

Now  $I = i_0 \left( I + \frac{V_{HT}}{V_m} \epsilon^{-\pi\delta/\omega} \right)$  where  $i_0$  is the peak current in the circuit at the start of fly-back and is constant because it is supplied by the driving valve. We get, therefore,

$$D = k \left[ \sqrt{\frac{V_{HT}}{V_m}} \epsilon^{-\pi\delta/\omega} + \sqrt{\frac{V_m}{V_{HT}}} \right]$$

where k is a constant, and  $\alpha/\omega = I/[2Q\sqrt{I - I/4Q^2}]$ . Writing for simplicity  $x_1$  for any given value of  $V_{HT}/V_m$ ,  $\Delta x$  for a small change from this value,  $D_1$  for the picture width at  $x_1$  and  $\Delta D$  for the change of picture width corresponding to  $\Delta x$  we get

$$\frac{\Delta D}{D_1} \approx -\frac{I}{2} \cdot \frac{\Delta x}{x_1} \cdot \frac{I - x_1 \epsilon^{-\pi\alpha/\omega}}{I + x_1 \epsilon^{-\pi\alpha/\omega}} + \frac{I}{8} \left( \frac{\Delta x}{x_1} \right)^2 \frac{3 - x_1 \epsilon^{-\pi\alpha/\omega}}{I + x_1 \epsilon^{-\pi\alpha/\omega}}$$

For a given  $\Delta x/x_1$  it is clear that  $\Delta D/D_1$  becomes smaller as  $x_1 \epsilon^{-\pi\alpha/\omega}$  approaches unity; if  $Q = \infty$ ,  $\epsilon^{-\pi\alpha/\omega} = 1$  and  $\Delta D/D_1$  is at its minimum. Therefore, in order to minimize the effect of the regulation on picture width the circuit Q should be as large as possible. As an example, consider two limiting cases with  $x_1 = 0.9$  and  $\Delta x = \pm 0.1$ . If  $Q = \infty$  the above expression gives  $\Delta D/D_1 = -0.0012$  and  $0.0046$  whereas if  $Q = 1$  we find  $\Delta D/D_1 = -0.037$  and  $0.046$ . The high Q circuit is thus at least ten times as good as the low Q.

It seems, therefore, that the use of a high-Q circuit offers a very considerable advantage. In fact, any reasonably good regulation of the e.h.t. supply is sufficient for the effect on picture width to be negligible.

Unfortunately, this is only part of the story. The frame-scanning current is constant so that picture height will be proportional to  $I/\sqrt{V_{HT}}$ . The picture height will, therefore, change more than the picture width and the aspect ratio will be affected by the regulation of the e.h.t. supply. With a low-Q circuit this effect will not be appreciable.

Also, variations of  $V_{HT}$  affect the focus and the compensating action of a high-Q circuit does nothing to reduce this. The best results are thus clearly obtained by using a low-Q circuit and making the regulation adequate by keeping  $LI^2$  large. This is an uneconomical condition, however, in that it leads to a line-scanning stage which demands a large power input from the h.t. supply.

From the technical point of view, the right answer to all these problems is to keep the load on the e.h.t. system constant, so that  $V_{HT}/V_m$  and I remain constant. The tube current necessarily changes, so that the maintenance of a constant load on the e.h.t. circuit demands the connection to the output of a shunt circuit having special characteristics. It must absorb little or no current when the tube is drawing full current, and the full tube current when the tube ceases to take current.

The obvious thing to use is a shunt valve stabilizer, but this is ruled out by the absence of a suitable valve. A high- $g_m$  triode or pentode is required which is capable of withstanding the full e.h.t. voltage on its anode.

It is, however, possible to approach the regulated

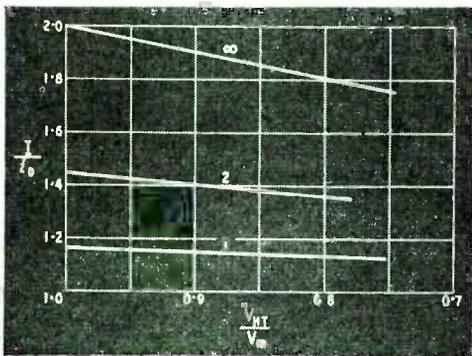


Fig. 6. Variation of  $I/i_0$  with  $V_{HT}/V_m$  for Q values of 1, 2 and  $\infty$ .

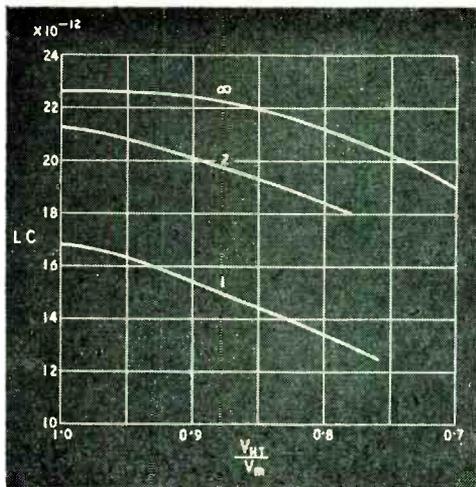


Fig. 7. Variation of LC with  $V_{HT}/V_m$  for Q values of 1, 2 and  $\infty$ .

condition by shunting the output by a suitable semiconductor. Such materials have a resistance which, above a certain applied voltage, decreases rapidly with an increase of voltage. The back resistance of selenium rectifiers is an example and a considerable improvement in regulation is possible if a suitable rectifier is connected across the e.h.t. supply.

Since the back resistance of the e.h.t. rectifier is in shunt with the supply during the "non-conductive" period, this rectifier can provide the stabilizing action as well as the rectifying. By careful choice of the operating conditions, therefore, it should be possible to obtain better regulation with metal rectifiers than with thermionic rectifiers.

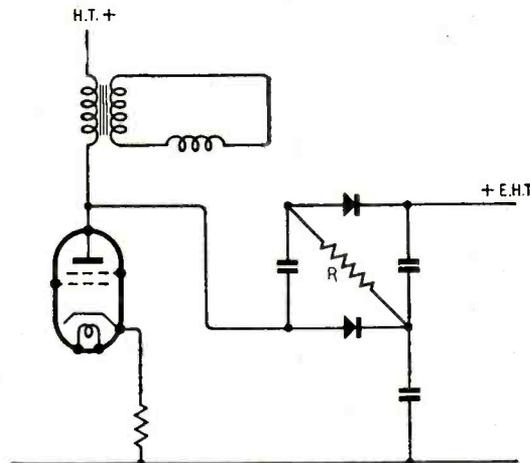
Since these rectifiers need no filament supply they are especially convenient in voltage-multiplying circuits. These circuits have a bad reputation for regulation, but this has been acquired in mains-supply service where the source is of low impedance and the rectifier itself is the major cause of poor regulation. In fly-back systems it is the source which is mainly responsible for the regulation with the result that the greater power loss in a voltage-doubler has relatively little effect.

Most of the regulation effects of the voltage-doubler are due to the series resistance R of Fig. 8 and this is usually around 1-2 M $\Omega$ . It can be taken into account by adding it to the effective internal impedance of the source, viewed from the output.

Thus, suppose  $V_{HT} = 3kV$ ,  $i_T = 200 \mu A$  and  $V_{HT}/V_m = 0.9$  at full current. Then  $\Delta V_{HT} = 300V$  and the source impedance is  $300/200 = 1.5 M\Omega$ . The equivalent impedance viewed from the output is four times this, or 6 M $\Omega$ , because the voltage is doubled and the current halved in the voltage-doubling rectifier system. This is also the impedance of a half-wave system supplying 6 kV at 100  $\mu A$ .

Taking the feed resistor of 1 M $\Omega$  into account the impedance becomes 7 M $\Omega$ . For a change of current of 100  $\mu A$  in the output (200  $\mu A$  at the input of the voltage-doubler), the change of voltage is 700 V instead of 600 V and so the regulation is  $100 \times 700/6,000 = 11.6\%$  instead of 10%. In fact, it is slightly worse than this for there are two rectifiers in series instead of one only. It can, however, be made still better by replacing the resistance by a third rectifier,

Fig. 8. Typical voltage-doubling e.h.t. rectifier system.



since this will have a lower forward resistance. The gain is not usually sufficient to justify this, however.

In conclusion, the main properties of fly-back e.h.t. systems can be summarized as follows:—

(1) With a given deflector coil, transformer and rectifier system the regulation is independent of the tube operating voltage because  $I \propto \sqrt{V_{HT}}$  and  $LI^2/V_{HT}i_{HT}$  is, therefore, constant. This assumes that the changes of tube current are independent of the tube anode voltage.

(2) The regulation is nearly independent of the Q value of the circuit comprising the deflector coil and transformer.

(3) With a given deflector coil, transformer and rectifier system the maximum tube voltage is limited by circuit capacitance. The circuit Q also has an appreciable effect and a very high-Q circuit enables about 40% more voltage to be obtained than with a very low-Q circuit for the same capacitance.

(4) The capacitance limit to the voltage can be overcome by using a voltage-multiplying rectifier system. The circuit regulation is unaffected by this if the power loss in the rectifier system is negligible.

(5) With a very low-Q circuit the regulation affects picture width and height nearly equally and the aspect ratio is hardly affected. With a high-Q circuit the regulation affects I and this largely compensates for the effect on picture width. Picture height is directly affected by the regulation and so with a high-Q circuit the regulation affects the aspect ratio.

(6) In all cases the regulation affects the focus.

(7) Because of the high source impedance the regulation with a voltage-doubling rectifier is only slightly poorer than with a half-wave.

For the benefit of those who like to know how results are derived a full analysis of the circuit is given in the Appendix. It leads to the results which, for the British 405-line system, are summarized in Figs. 5, 6 and 7.

#### APPENDIX

Referring to Fig. 1 let the initial current in L be  $i_0$ . The instantaneous current  $i_L$  resulting from its decay is the same as that which would be obtained if  $i_0$  were maintained indefinitely and a unit impulse of current  $i_0 \delta t$  were applied to the circuit so that the current in L resulting from it is in opposition to  $i_0$ . Then

$$v = i_0 Z \mathbf{1} \quad \dots \quad (1)$$

$$i_L = i_0 - i_0(Z/pL)\mathbf{1} \quad \dots \quad (2)$$

where  $p = d/dt$

$$Z = \frac{I}{pC + \frac{I}{R} + \frac{I}{pL}} = R \frac{2\alpha p}{p^2 + 2\alpha p + \omega_0^2}$$

$$\alpha = 1/2RC; \quad \omega_0^2 = 1/LC$$

Whence

$$v = i_0 R \frac{2\alpha p}{p^2 + 2\alpha p + \omega_0^2} \mathbf{1} \quad \dots \quad (3)$$

$$i_L = i_0 \frac{p^2 + 2\alpha p}{p^2 + 2\alpha p + \omega_0^2} \mathbf{1} \quad \dots \quad (4)$$

Writing  $\omega^2 = \omega_0^2 - \alpha^2$  these equations have the following solutions when  $\omega_0 > \alpha$

$$v = i_0 R \frac{2\alpha}{\omega} \sin \omega t \epsilon^{-\alpha t} \quad \dots \quad (5)$$

$$i_L = i_0 \left[ \cos \omega t + \frac{\alpha}{\omega} \sin \omega t \right] \epsilon^{-\alpha t} \quad \dots \quad (6)$$

If  $V_2$  is disconnected, the voltage  $v$  across the circuit reaches a maximum value  $V_m$  when  $dv/dt = 0$ . By differentiating Equ. (5) and equating to zero this is found to occur when  $\omega t_m = \tan^{-1}(\omega/\alpha)$  and so\*

$$V_m = i_0 R \frac{2\alpha}{\omega_0} \exp\left(-\frac{\alpha}{\omega} \tan^{-1} \frac{\omega}{\alpha}\right) \quad \dots \quad (7)$$

When  $V_2$  is connected the reservoir capacitance is charged to  $V_{HT}$  and so  $V_2$  becomes conductive at some instant  $t_1$  when  $v = V_{HT}$  ( $0 < t_1 < t_m$ ); writing  $i_1$  for the current at this instant we get

$$V_{HT} = i_0 R \frac{2\alpha}{\omega} \sin \omega t_1 \epsilon^{-\alpha t_1} \quad \dots \quad (8)$$

$$i_1 = i_0 \left[ \cos \omega t_1 + \frac{\alpha}{\omega} \sin \omega t_1 \right] \epsilon^{-\alpha t_1} \quad \dots \quad (9)$$

After  $t_1$  Eqs. (3) and (4) no longer apply because the ideal diode  $V_2$  keeps the voltage constant at  $V_{HT}$ . Therefore, C no longer draws current and R draws a constant current  $V_{HT}/R$ . The current in L must fall linearly with time because  $V_{HT}$  is constant and becomes  $i_1 - V_{HT}/R$ , time now being reckoned from  $t_1$  as zero. The current  $i_v$  through the diode  $V_2$  is the current in L less the current in R, therefore

$$i_v = i_1 - V_{HT} \frac{t}{L} - \frac{V_{HT}}{R} \quad \dots \quad (10)$$

This current flows until  $i_v = 0$  at  $t = t_2$ , therefore,

$$t_2 = \frac{L}{V_{HT}} \left( i_1 - \frac{V_{HT}}{R} \right) \quad \dots \quad (11)$$

Since  $i_v$  varies linearly from  $i_1 - V_{HT}/R$  at  $t = 0$  to zero at  $t = t_2$  its mean value is one-half of its initial value. The total charge conveyed through  $V_2$  into C, during the conducting interval  $t_2$  is thus

$$q = \frac{t_2}{2} \left( i_1 - \frac{V_{HT}}{R} \right) \quad \dots \quad (12)$$

This charge must, in the equilibrium state, equal the charge withdrawn from C, by the constant current  $i_T$  of the c.r. tube during the whole interval  $\tau$  between successive fly-backs. Therefore,

$$i_T \tau = \frac{t_2}{2} \left( i_1 - \frac{V_{HT}}{R} \right) = \frac{L}{2V_{HT}} \left( i_1 - \frac{V_{HT}}{R} \right)^2 \quad \dots \quad (13)$$

After  $t_2$  the diode becomes non-conductive again and the performance is that of an LCR circuit having for initial conditions a current  $V_{HT}/R$  in L and a voltage  $V_{HT}$  across C. Time is now to be reckoned from  $t_2$  as zero. From Equ. (6) the current in L due to the initial current is

$$i_{L1} = \frac{V_{HT}}{R} \left[ \cos \omega t + \frac{\alpha}{\omega} \sin \omega t \right] \epsilon^{-\alpha t} \quad \dots \quad (14)$$

The current in L due to the charge on C is calculated with the aid of Fig. 2. By inspection,

$$i_{L2} = \frac{V_{HT}}{I} + \frac{pLR}{pC + pL + R} \cdot \frac{pLR}{pL + R} \cdot \frac{I}{pL} \mathbf{1}$$

$$= \frac{V_{HT}}{L} \cdot \frac{p}{p^2 + 2\alpha p + \omega_0^2} \mathbf{1} \\ = \frac{V_{HT}}{\omega L} \sin \omega t \epsilon^{-\alpha t} \quad \dots \quad (15)$$

The total current after  $t_2$  is, therefore,

$$i_L = \frac{V_{HT}}{\omega L} \left[ \frac{\omega L}{R} \cos \omega t - \left( I - \alpha \frac{L}{R} \right) \sin \omega t \right] \epsilon^{-\alpha t} \quad (16)$$

This has a maximum negative value, found by differentiating and equating to zero, at  $t_3$ , or

$$\omega t_3 = \tan^{-1} \left( -\frac{\omega}{\alpha} \right) = \pi - \tan^{-1} \frac{\omega}{\alpha} \quad \dots \quad (17)$$

Therefore, the negative current maximum is

$$i_{Lm} = -\frac{V_{HT}}{\omega_0 L} \exp \left[ -\frac{\alpha}{\omega} \left( \pi - \tan^{-1} \frac{\omega}{\alpha} \right) \right] \quad \dots \quad (18)$$

and the peak to peak scanning current is

$$I = i_0 - i_{Lm} = i_0 + \frac{V_{HT}}{\omega_0 L} \exp \left[ -\frac{\alpha}{\omega} \left( \pi - \tan^{-1} \frac{\omega}{\alpha} \right) \right] \quad (19)$$

The total fly-back time is

$$\tau_2 = t_1 + t_2 + t_3 \quad \dots \quad (20)$$

The ratio of the voltage on full load to the voltage on open circuit is a design factor of major importance; it is given by the ratio of Eqs. (8) and (7).

$$\frac{V_{HT}}{V_m} = \frac{\omega_0}{\omega} \sin \omega t_1 \exp \left[ -\frac{\alpha}{\omega} \left( \omega t_1 - \tan^{-1} \frac{\omega}{\alpha} \right) \right] \quad \dots \quad (21)$$

Now  $\omega_0 = 1/LC$  and we define  $Q$  as  $R/\omega_0 L$ ; therefore,  $Q = R\sqrt{C/L}$  and so

$$\frac{\alpha}{\omega_0} = \frac{\sqrt{LC}}{2CR} = \frac{\sqrt{L/C}}{2R} = \frac{I}{2Q}$$

$$\omega = \omega_0 \sqrt{I - \alpha^2/\omega_0^2} = \omega_0 \sqrt{I - I/4Q^2}$$

$$\frac{\alpha}{\omega} = \frac{I}{2Q \sqrt{I - I/4Q^2}}$$

From Eqs. (7) and (8)

$$\frac{V_{HT}}{V_m} = \frac{\exp \left( \frac{\alpha}{\omega} \tan^{-1} \frac{\omega}{\alpha} \right)}{\sqrt{I - I/4Q^2}} \sin \omega t_1 \epsilon^{-\frac{\alpha}{\omega} \omega t_1} \quad \dots \quad (22)$$

From Eqs. (8), (9) and (11)

$$\omega t_2 = \sqrt{I - I/4Q^2} \left( \cot \omega t_1 - \frac{\alpha}{\omega} \right) \quad \dots \quad (23)$$

$$\omega t_3 = \pi - \tan^{-1} \frac{\omega}{\alpha} \quad \dots \quad (17)$$

From Eqs. (17), (20) and (23)

$$LC = \frac{\tau_2^2 (I - I/4Q^2)}{(\omega t_1 + \omega t_2 + \omega t_3)^2} \quad \dots \quad (24)$$

From Eqs. (8), (19) and (22)

$$\frac{I}{i_0} = I + \frac{V_{HT}}{V_m} \epsilon^{-\pi\alpha/\omega} \quad \dots \quad (25)$$

From Eqs. (8), (9) and (13)

$$\frac{LI^2}{V_{HT} i_T} = 2\tau \left[ \frac{I/i_0}{\left( \cot \omega t_1 - \frac{\alpha}{\omega} \right) \sin \omega t_1 \epsilon^{-\omega t_1 \alpha/\omega}} \right]^2 \quad \dots \quad (26)$$

From Eqs. (8) and (26)

$$\frac{CV_{HT}}{i_T} = \frac{2\tau}{(I - I/4Q^2) \left( \cot \omega t_1 - \frac{\alpha}{\omega} \right)^2} \quad \dots \quad (27)$$

The units are ohms, henrys, farads, volts, amperes, seconds.

\* The expression  $\exp(-x)$  is merely an alternative way of writing  $\epsilon^{-x}$  and means exactly the same; it is a convenient one when the index is at all complicated.

# WORLD OF WIRELESS

## Anti-interference ♦ Beveridge Committee ♦ Views on Television ♦ U.R.S.I. Meeting

### Interference Suppression

PROVISION was made in the Wireless Telegraphy Act, 1949, for the setting up of an Advisory Committee with which the Postmaster General will consult before making regulations prescribing such requirements as he "thinks fit for the purpose of ensuring that the use of the apparatus does not cause undue interference with wireless telegraphy."

The committee has to be appointed from a panel of persons nominated by the Institution of Electrical Engineers, who either "possess expert knowledge of the matters falling to be dealt with" or "represent persons whose interests are likely to be affected" by the regulations. The I.E.E. has now nominated 45 people to constitute the panel from which the P.M.G. has appointed an advisory committee of seventeen members to consider the question of ignition interference and another of eighteen members to deal with refrigeration.

The "ignition systems" committee, of which Sir Stanley Angwin is chairman, and the "refrigeration" committee, include a number of well-known radio personalities and embrace a very wide variety of interests.

It would appear, from the names of the remaining thirteen members of the panel on whose services the P.M.G. will be able to call when regulations in respect of other types of apparatus are to be framed, that electro-medical equipment will be considered at a later date.

### B.B.C. Enquiry

THE Broadcasting Committee, which was set up last year under the Chairmanship of Lord Beveridge, to "consider the constitution, control, finance and other general aspects of the sound and television broadcasting services in the U.K. . . . and to advise on the conditions under which these services and wire broadcasting should be conducted after December 31st, 1951 [when the present Charter of the B.B.C. ends]," completed the hearing of evidence at the end of July.

The first meeting of the Committee was held on June 24th, 1949, and during the past 13 months some one hundred organizations and individuals have given oral evidence before the Committee. It is understood that four members of the Committee are visiting North America to obtain additional information on the services in the U.S.A. and Canada.

The Lord President of the Council, Mr. Morrison, recently stated that he hoped the report of the Committee would be presented to him by the end of the year.

### European Television

FOLLOWING the meeting in London of the Television Study Group of the International Radio Consultative Committee (C.C.I.R.), at which a preference for a 625-line standard was expressed by the majority of delegates, a meeting was held in Geneva in July.

At this meeting, attended by delegates from Belgium, Denmark, Italy, the Netherlands, Sweden, Switzerland, France, the U.S.A. and the U.K., it is understood detailed standards were established which are to be recommended to countries wishing to adopt a 625-line system.

### Television: U.S. Opinion

THE Editor of our U.S. contemporary, *Electronics*, who as a member of the C.C.I.R. Television Study Group recently inspected the television systems of Europe and the United States, gives some general impressions of the visits in the July issue of his journal.

After stating that many of the delegates considered that the U.S. standard of 525 lines, 60 frames, with a 4.25-Mc/s vision bandwidth "is the happiest compromise among the systems demonstrated," he adds "this is not to say that the American television industry leads the

world in all respects." He considers that British manufacturers are ahead of the American industry in these respects: First, "the transient response of British television studio equipment, co-axial cables, radio relays and transmitters is much superior"; secondly, in the use of the flying spot method of scanning films; thirdly, the C.P.S. camera has several advantages over the image orthicon; and fourthly, in the use of high-power transmitters such as that at Sutton Coldfield.

Among criticisms of the British system are (a) that the use of positive modulation, resulting in white ignition-interference spots on the screen "is more annoying than the black spots of the American system" which, of course, employs negative modulation; and (b) that the use of a.m. rather than f.m. for sound is apt to be noisy.

### Scientific Radio

BETWEEN the meetings of the General Assembly of the International Scientific Radio Union (U.R.S.I.), of which Sir Edward Appleton is the President, the work is continued by seven commissions. In addition, at each general assembly national committees submit progress reports on the work undertaken in their own countries in the various fields of scientific radio. The British National Committee for Scientific Radio, which is organized under the auspices of the Royal Society, has nominated seven delegates to the ninth general assembly of the U.R.S.I. which meets in Zurich from September 11th to 22nd.

The British delegates and commissions to which they are especially responsible are: C. W. Oatley (measurements and standardization), who is in the Engineering Laboratory, Cambridge University; Dr.

EYE OPERATIONS, magnified ten times, were seen on 15-in. tubes by the 1,200 delegates to the Sixteenth International Congress of Ophthalmology when Marconi television gear was used on a closed circuit at the Moorfields, Westminster and Central Eye Hospital, London. Inset is the reflecting mirror attachment on the television camera.



R. L. Smith-Rose (troposphere and wave propagation), Director of Radio Research, D.S.I.R.; Dr. W. J. G. Beynon (ionosphere and wave propagation), Dept. of Physics, Swansea University; Dr. J. W. Findlay (terrestrial atmospherics), who, during the war, was in the M.A.P. Directorate of Communications Development and is now at Cambridge University; Dr. A. C. B. Lovell (extra-terrestrial radio noise), who was at T.R.E. and is now at Manchester University; W. Proctor Wilson (waves and oscillations), Head of the B.B.C. Research Dept., and Prof. J. Sayers (electronics), who with Prof. Randall and Dr. Boot developed the cavity magnetron.

### Meeting Cancelled

IN view of the international situation the Extra-ordinary Administrative Radio Conference which, as mentioned last month, was to be held at the Hague from 1st September, has been cancelled.

### Educational Opportunities

PROSPECTUSES and information on special radio and electronics courses are sent to us by a number of educational institutions prior to the opening of the academic year. Among those recently received is the prospectus of the evening courses in telecommunications, and television and radio servicing, issued by the Electrical Engineering Department, of the Polytechnic, Regent Street, London, W.1.

The prospectus from the Northern Polytechnic, Holloway, London, N.7, gives details of both full-time courses in radio and television technology, and evening courses in servicing, telecommunications engineering and electronic measuring instruments.

At the University College, Southampton, the full-time courses include radar, radio engineering and radio operating. There are also part-time day and evening courses in telecommunications engineering and radio and television servicing.

### B.B.C. APPOINTMENTS

R. T. B. Wynn, C.B.E., M.A., M.I.E.E., who has been Asst. Chief Engineer of the B.B.C. since 1943, becomes Deputy Chief Engineer responsible under the Chief Engineer (Harold Bishop) for the general control and direction of all the corporation's engineering departments. He joined the B.B.C. as Head of the Engineering Information Department in 1926 after four years at the Marconi experimental transmitting station at Writtle, Chelmsford. He was chairman of the I.E.E. Radio Section for 1949-50.

H. L. Kirke, C.B.E., M.I.E.E., who succeeds R. T. B. Wynn as Asst. Chief Engineer, was also among the Writtle pioneers. He joined the Marconi Co. in 1920 and in 1924 went to the B.B.C. to become, in the following year, Head

of the Development Dept., which later became the Research Dept. He will now be responsible for the co-ordination and direction of the technical work of the departments concerned with research, design, planning and installation.

W. Proctor Wilson, C.B.E., B.Sc., M.I.E.E., is the new Head of the Research Dept. of which he was appointed Asst. Head in 1945 on his return from war service. He joined the B.B.C. in 1927, having previously been with the Western Electric Co. He is one of the British delegates to the next meeting of the U.R.S.I.

E. C. Drewe, M.I.E.E., is now Asst. Head of the Research Dept. During his twenty years with the B.B.C. he has successively been Engineer-in-charge of the Brookmans Park transmitter, Senior Asst. to the Supt. Engineer (Transmitters), Asst. Head of the Engineering Secretariat and Research Manager.

### IN BRIEF

**Licences.**—12,251,350 broadcast receiving licences, including 406,600 television licences, were current in Great Britain and Northern Ireland at the end of June.

**Interference Suppression.**—According to our associated journal *Motor Transport*, the principal operators of goods and passenger vehicles have taken the lead in fitting interference suppressors. All petrol-engined vehicles used by British Railways within 60 miles of Alexandra Palace and Sutton Coldfield have been fitted with suppressors—diesel engines do not cause interference. London Transport now employs only 30 petrol-driven buses and these have been suppressed.

**B.V.A.**—The chairman, J. W. Ridge-way (Ediswan), and vice-chairman, G. A. Marriott (G.E.C.), of the British Radio Valve Manufacturers' Association have been re-elected for the current year.

**Canadian Television.**—In addition to the equipment which Marconi's are supplying for two television studios in Toronto and two in Montreal the company has been awarded the contract to supply two specially designed television outside broadcasting vehicles for the Canadian Broadcasting Corporation. Each vehicle will be a complete television station equipped with three cameras and providing a radio link with the main transmitter. The total value of the equipment to be supplied by Marconi's is \$875,000. Canadian television will operate on American standards; some thousands of Canadians within range of American stations have already purchased receivers. The number of sets sold in Canada during the first half of the year exceeded 15,000.

**Duddell Medal for 1950** has been awarded by the Physical Society to D. W. Fry who during the war was at the Telecommunications Research Establishment working on the problems of centimetre-wave techniques. Since the war he has been at the Atomic Energy Research Establishment.

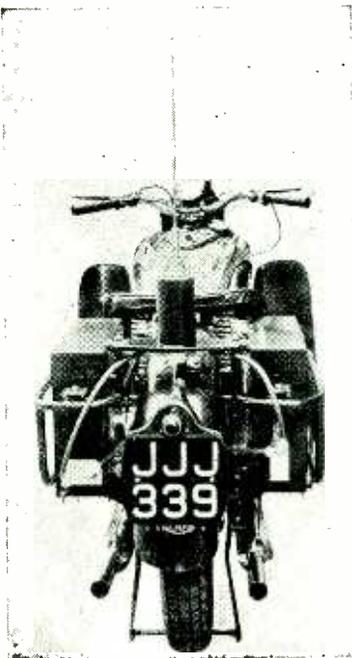
"**Heavyside Centenary Volume**" to be issued by the I.E.E. will contain a complete record of the proceedings of the meeting of the Institution in May to commemorate the centenary of the birth of Oliver Heavyside. The volume, which will be available to non-members at 10s, will also include "Some Unpublished Notes on Oliver Heavyside."

**Reunion.**—We are asked to announce that the reunion dinner for those who served in the Test Dept. No. 1 Signals Depot, R.A.F., West Drayton, will be at the Lotus Restaurant, Norris Street, Haymarket, London, W.1, on October 21st. Details are obtainable from H. Coker at 5, Turnpike Parade, London, N.15.

**Haifa Volunteer Fire Brigade** is seeking quotations from U.K. manufacturers for a 50-watt fixed transmitter and two 20-watt sets for installation on fire appliances. The quotations and descriptive literature should be sent to the Taylor Transport Co., 35, Kingsway, P.O. Box 162, Haifa, Israel.

**Valve Vade Mecum.**—Copies of the Brans "Vade Mecum" reviewed in our July issue are obtainable from Peter Armstrong, 136 Bickenhall Mansions, London, W.1, at 21s including postage.

**Cable Centenary.**—The submarine cable, which we would have described in the old days of intense competition between wire and wireless as "our poor relation," is celebrating its centenary. Now that co-operation has largely replaced competition in this field of communications, and radio-like techniques are widely used in all, we can properly offer our congratulations. To mark the event, an exhibition, opening on August 28th, is being staged at the



PLESSEY f.m. transmitter-receivers are being fitted on motor cycles used by the London Metropolitan Police. The equipment is housed in two cases carried on either side of the rear wheel above which is mounted the telescopic aerial. A selective calling system permits any one, or all, of 90 units to be called by the central station which is also being equipped by the Plessey Co.

*There has been no change in the position with regard to the withdrawal of overtime working by a section of the printing industry. A slight reduction in the number of pages in "Wireless World" is still unavoidable. All journals printed in London are similarly affected, to a greater or lesser extent, but journals printed in the provinces are not affected. It is greatly regretted that publication of our last issue was delayed.*

Science Museum, South Kensington. An interesting and highly informative handbook, "One Hundred Years of Submarine Cables," written by G. R. M. Garratt, of the Museum, is on sale there, or from H.M. Stationery Office, price 2s 6d.

## BUSINESS NOTES

**Decca Radar, Ltd.**, has been formed as a subsidiary of the Decca Record Co., to undertake the design, manufacture and sales of Decca marine radar, which in addition to receiving the Ministry of Transport's Certificate of Type Approval has the distinction of being the only British equipment to be approved by the American Federal Communications Commission. The head office is at 1-3, Brixton Road, London, S.W.9, and the factory at Shannon Corner, Kingston By-Pass, New Malden, Surrey. Grp. Capt. E. Fennessey is managing director.

**D. W. Heightman**, the well-known amateur, G6DH, has, as a result of a divergence of views on a matter of policy, resigned from the board of Denco (Clacton), Ltd., of which he was the founder in 1938 and has been managing director since 1946 when it became a limited company. A. N. Heightman, who was works manager, has also resigned.

**Co-ordination of Resistance Production** was the theme of a meeting earlier this year in the Philadelphia office of the International Resistance Co. of representatives of resistor manufacturers from Australia, Canada, Denmark, Italy and the U.K. who operate under I.R.C. licence. The U.K. representative was John Goodman (Dubilier).

**Marconi's W.T. Co.** and Marconi Instruments have now issued a house magazine the title of which is self-explanatory—"The Marconi Companies and their People." It is stated that this will not in any way supersede the "Marconi Mariner" issued by the Marconi International Marine Communication Co.

**Ekco** search radar equipment, which serves not only for the location of storm clouds but also as an aid to navigation, is to be installed by the British Overseas Airways Corporation in the de Havilland "Comet" and other aircraft operated by the corporation.

**R. F. Gilson.**—In the report on ironed components shown at the B.S.R.A. Exhibition (p. 257, July issue), we regret the mis-spelling of the name of R. F. Gilson, Ltd., 11a, St. George's Road, London, S.W.19.

**ECHO-FREE ROOM** at the G.E.C. Research Laboratories the walls, floor and ceiling of which are covered with nearly 3,000 "Fibreglass" wedges, each 3-ft long. The sound-"transparent" floor can be seen in this illustration showing a television set undergoing audio tests.



**S. American Market.**—Empiria Products, Ltd., of 229, High Holborn, London, W.C.1, manufacturers representatives and exporters, will be interested to hear from British manufacturers of radio components who are anxious to extend their connections in South America. A director of the firm is visiting Venezuela, Colombia, Peru, Chile, Brazil and Uruguay in September.

**A New Zealand client** of Jepson, Bolton & Co., of 120, Moorgate, London, E.C.2, is visiting this country and is interested in the purchase of radio equipment other than domestic receivers. Further information is obtainable from the company.

**Appointment** of Philip Hickson as Director of Buying (radio and television) is announced by the John Lewis Partnership, Ltd. He was for many years technical director of Ardent Acoustic Laboratories.

## NEW ADDRESSES

**A.B. Metal Products, Ltd.**, have opened a new factory at Ynysboeth, Abercynon, Glam., South Wales.

**Bonochord, Ltd.**, manufacturers of hearing aids, are now operating from their new factory in Lancaster Road, High Wycombe, Bucks. (Tel: High Wycombe 2136.) The London office is moving from 48, Wigmore Street, W.1, to 48, Welbeck Street, W.1. (Tel.: Welbeck 8245.)

**G.R.S.E.**—The registered office of the Guild of Radio Service Engineers has been transferred from Bank Chambers, 6, Station Road, Clacton-on-Sea, to 2, Stevenson Street West, Accrington, Lancs. The new general secretary is H. Hill.

**"Q-Max" (Electronics), Ltd.**, are moving on September 1st from 10, Little Turnstile, London, W.C.1, to 95, Villiers Road, London, N.W.1.

**Radar Association.**—The address of the head office of the association is now 83, Portland Place, London, W.1. (Tel.: Langham 8183.)

**T.R.D.**—The head office of the Television Retailers' Development Co., and the Midlands T.R.D. Service, Ltd., which were formed as non-profit making organizations to provide dealers with an aerial installation service and advice bureaux, has been transferred from 47, Maddox Street, London, W.1, to 63, Portobello Road, London, W.11. (Tel.: Park 4491.)

## MEETINGS

**British Institution of Radio Engineers** Twenty-fifth annual general meeting at 6.30 on 27th September at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, followed at 7.15 by the presidential address of Paul Adorian.

**British Sound Recording Association** Presidential address of C. E. Watts at 7.0 on 29th September, at the Royal Society of Arts, John Adam Street, London, W.C.2.

**Society of Relay Engineers** "Medium Voltage Feeders and their Associated Transformer Equipment for Long-distance Transmission of A. F. Power" by K. A. Russell, B.Sc., at 2.30 on 3rd October at the Engineers' Club, 17, Albert Square, Manchester, 2.

**Hull Electronic Engineering Society** Details of the new Mullard c.r. tube for television projection systems and a description of the associated optical system, coil unit and e.h.t. supply will be given by E. Jones, B.Sc., A.M.I.E.E., at 7.30 on 8th September at the Y.E.B. Showrooms, Ferensway, Hull.

"Frequency Modulation" by E. D. Hart, M.A., A.M.Brit.I.R.E., A.Inst.P., and A. G. Wray, M.A. (Marconi Instruments), at 7.30 on 29th September, at the Y.E.B. Showrooms, Ferensway, Hull.

# Measurements with Simple Apparatus

## Potentialities of a Common-or-garden Voltmeter

By DONALD ROBINSON (Londex, Ltd.)

IN his article "Solving Parallel Problems," in the March issue of *Wireless World*, Mr. D. A. Pollock describes a method of thinking which can be developed and used to solve many other problems besides the particular ones he mentions. He gives an excellent example of how to produce one's own formulae instead of always relying on the text-book and also illustrates the really useful "ratio idea." It is, in fact, this "ratio idea" which enables us to make our measurements with simple apparatus.

Before going any further, it is worth pointing out that the method Mr. Pollock gives for calculating the combined value of two resistances in parallel can be extended by the same reasoning to deal with the much more trying case of three or more resistances in parallel. The formula then becomes:

$$R = \frac{R_1}{1 + \frac{R_1}{R_2} + \frac{R_1}{R_3} + \frac{R_1}{R_4} + \dots \text{etc.}}$$

As an example, let us take 3, 4, 6 and 12 ohms. In this case it is easiest to take the highest value, 12, as  $R_1$ , and then:

$$R = \frac{12}{1 + 2 + 3 + 4} = \frac{12}{10} = 1.2 \Omega$$

It is sometimes best, however, to take one of the lower values as  $R_1$ . For instance, with 3, 6 and 20 ohms it would be best to take 6.

### Measuring Resistance

There are at least two ways by which the "ratio idea" enables resistance to be measured with little more than a voltmeter. One of them is as follows.

Let us first measure some convenient source of volts and then connect the unknown resistance,  $R$ , in series with the meter, as in Fig. 1. Clearly, providing  $R$  is not inductive and the source impedance is not too high, its value will be in the same proportion to the resistance of the meter ( $R_m$ ) as the voltage across  $R$  is to the voltage across the meter ( $E_m$ ).

Now we know  $R_m$ ; it is the "ohms-per-volt" figure of the meter multiplied by the full-scale reading of the range in use—although it would probably be best if the opportunity presented itself to measure

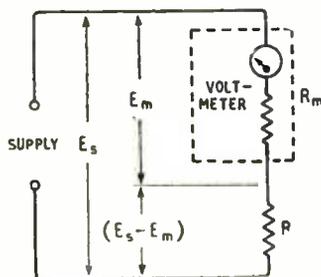
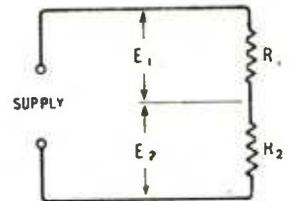


Fig. 1. Simple method of measuring resistance employing a voltmeter.

Fig. 2. Measuring resistance by comparison; an alternative method to that in Fig. 1, for low values.



the resistance of each range accurately, once and for all. We also know  $E_m$ : it is what the meter is saying. The voltage across  $R$  is the source volts ( $E_s$ ) minus  $E_m$ . Therefore:—

$$\frac{R}{R_m} = \frac{(E_s - E_m)}{E_m}$$

$$\text{or } R = R_m \times \frac{E_s - E_m}{E_m}$$

This is well worth remembering, if only for those occasions when the ohms-range battery dies unexpectedly!

It is advisable to select the meter range that has an  $R_m$  nearest to the suspected value of  $R$ , and then to find a source that gives a voltage near to, but below, the full-scale reading of the range. It must not, of course, be affected by the load of the meter.

The h.t. and bias voltages of a receiver often provide a good choice of  $E_s$ , but if  $R$  is not significantly reactive and a meter with a.c. ranges is available the mains can be used, either direct or from between suitable taps on the primary of a mains transformer.

Thus, if the meter resistance is 1,000 ohms-per-volt and  $R$  is non-inductive and believed to be between about 50k $\Omega$  and 250k $\Omega$  you might use the 100-volt a.c. range and the 50 volts obtainable from between the 200- and 250-volt taps on a mains transformer.

Before using a low a.c. range—say under 12 volts—it is best to take into account the method the meter manufacturer has used to minimize the inaccuracy that can arise on these ranges as a result of the variation in the resistance of metal rectifiers at low currents. Some makers avoid the effect by providing a special non-linear scale for low a.c. volts, but this means that the variation in rectifier resistance is high enough compared with the multiplier resistance to affect  $R_m$  significantly. Such ranges should not be used for this method below about two-thirds of full scale.

Other makers, however, overcome this difficulty and are able to use one linear scale for all ranges by reducing the ohms-per-volt figure for the low a.c. ranges, often to a tenth of the figure for other ranges. No difficulty will be experienced with these meters, provided the lower ohms-per-volt figure is used in working out the answer and the increased possibility of loading down the source is considered.

Otherwise, the limit of useful accuracy is perhaps

reached when R is either about a fifth, or five times,  $R_m$ . A 1,000-ohms-per-volt meter of the latter type with ranges running from 10 to 1,000 volts can thus be used to check resistors between 2k $\Omega$  and 5M $\Omega$ .

### Comparison Method

An alternative method that can be used for lower values and which gives a greater accuracy up to perhaps 100k $\Omega$  is that shown in Fig. 2.

In addition to a voltmeter and some volts, a known resistor,  $R_1$ , is needed. If  $R_1$  and the unknown resistor,  $R_2$ , are connected in series across the supply and the voltage across each is, respectively,  $E_1$  and  $E_2$  and the current is  $I$ , then:—

$$R_2 = \frac{E_2}{I} = \frac{E_2}{E_1/R_1}$$

$$= R_1 \times \frac{E_2}{E_1}$$

A noteworthy feature is that the accuracy is but little affected by the shunting effect of the meter or by the accuracy, or otherwise, of its calibration. In fact an uncalibrated meter can be used provided it has an evenly divided scale.

The nearer  $R_1$  is to  $R_2$  the greater the accuracy. If their ratio is not more than 2 or 3 and neither is more than about a quarter of the resistance of the meter, considerable reliance can be placed on the result.

### Checking Impedance

The comparison method can also be used to check impedance, and it is generally more accurate than the two-meter method (one for E and one for I) as it is not dependent on the accuracy of calibration. This is particularly likely to be so at 400 c/s or more when the accuracy of many meters falls off.

The accurate measurement of impedance needs careful precautions and finer measuring devices than the ordinary moving-coil meter, but the method we are dealing with has wide use for rough practical checks—for such purposes as testing a transformer for shorted turns by finding its impedance at 50 c/s., and for obtaining an idea of the impedance of a group of loudspeakers in a factory or public building in order to check the matching and see that there are no line shorts or reversed transformers.

As loudspeaker impedance is mostly reflected resistance, the waveform or frequency of the test signal is not of great importance, provided it is steady and well away from the upper and lower resonant frequencies. I have often used one of the whistles with which most radio receivers are only too well endowed.

If the loudspeaker system normally operates at the usual figure of 100 volts, this test can be made at a level hardly audible to any possible listener, and because of this low level a one-watt resistor can be used for  $R_1$ , even when the amplifier is rated at hundreds of watts. This is perhaps the most useful test that can be made on a big amplifier system.

An inexpensive and readily obtainable resistor for use as  $R_1$  is the half- or one-watt, 1% accuracy, cracked-carbon type. A set of four—10, 100, 1,000, 10,000—will meet most needs, though for greater accuracy a set of seven—10, 33, 100, 333 . . . etc.—is better.

They can be usefully made up into a small adaptor,

wired as in Fig. 3. Switch  $S_1$  selects  $R_1$  and also has two extra positions,  $E_s$  and  $E_m$  to facilitate tests by the series-voltmeter method.

Thus, if it is found that 10k $\Omega$  is not high enough for  $R_1$  the switch can be moved in succession to the next two positions and the value found by the series method. It is best to use for  $S_2$  a push-button or a non-locking key, spring loaded to the  $E_1$  position. It can then be left alone when making a test by the series method.

When first using this adaptor one is inclined to select a hopelessly unsuitable supply voltage, value of  $R_1$  and/or meter range, but as one has then to think in ratios in the way shown by Mr. Pollock to find which way to alter the constants, one soon becomes able to handle with facility both this unit and any other ratio problem that comes along.

### Internal Resistance

The internal resistance of a battery, h.t. supply, valve stage or other source is often found by dividing the change in volts by the change in current that occurs when two values of load resistor are connected in turn, i.e.  $R_i = \Delta E / \Delta I$ . A method of doing this is illustrated in Fig. 4.

$$E_s = I_1(R_1 + R_i) = I_2(R_2 + R_i)$$

$$\therefore I_1 R_1 - I_2 R_2 = I_2 R_i - I_1 R_i$$

$$\therefore R_i(I_1 - I_2) = E_2 - E_1$$

$$R_i = \frac{\Delta E}{\Delta I}$$

$$\text{or } R_i = \frac{E_2 - E_1}{\frac{E_1}{R_1} - \frac{E_2}{R_2}}$$

Accuracy is likely to be greatest when  $E_2$  is about twice  $E_1$ , but it should be remembered that internal heating may change  $R_i$  if the current is excessive.

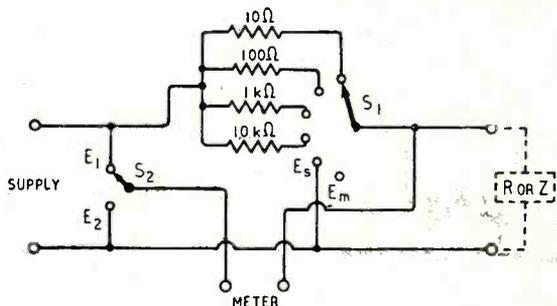
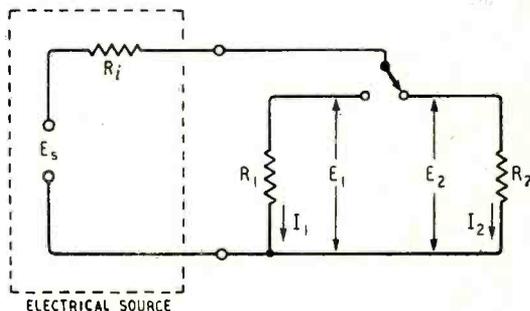


Fig. 3. Adaptor for measuring a wide range of resistance or impedance with the aid of a voltmeter.

Fig. 4. Method of measuring the internal resistance ( $R_i$ ) of an electrical source, using two load resistors.



It often happens that the internal resistance to be measured is high enough for the open-circuit voltage indicated on one range of a meter to be distinctly different from that shown on another range. In such cases the internal resistance is best found from these two readings only, without the use of load resistors.  $R_1$  and  $R_2$  are then the ohms-per-volt figure multiplied by the full-scale reading of each range.

### Amplifier Power Output

Although the rated output of an amplifier or receiver—the so-called “maximum undistorted output”—can only be measured with accuracy if complex apparatus is available, there is a method whereby it can be checked to a practical degree of accuracy with very simple apparatus.

I have found that, except in some special cases we shall come to later, the accuracy is of the same order as that obtainable from visual examination of the output wave-form on an oscilloscope; that is, within about 10%. This order of accuracy cannot always be reached, however, with fixed bias and other special types of amplifiers, so we will begin by considering first the most common class of amplifiers, those employing auto-bias.

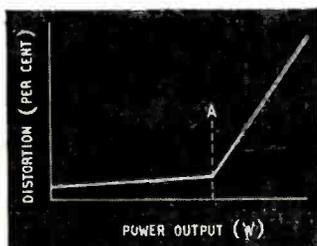


Fig. 5. Curve showing the relationship of percentage distortion to power output in amplifiers using auto-bias.

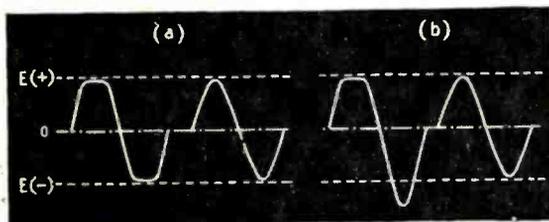
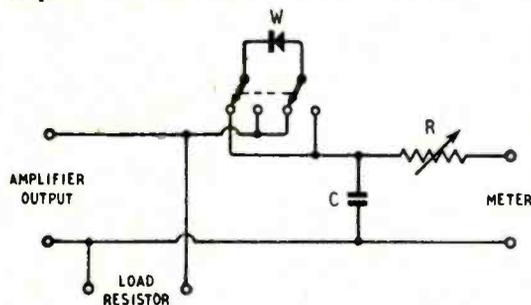


Fig. 6. Amplifier output waveforms, (a) flattening on both peaks, (b) flattening on the positive peak first.  $E$  is the peak voltage available at point A in Fig. 5.

Fig. 7. Tester for enabling the maximum output of an amplifier to be measured with an ordinary voltmeter.



Now what is the relationship of percentage distortion to output in such amplifiers? Except in some special cases dealt with below it is always much as shown in Fig. 5. Distortion stays at a reasonably low level until the peak input voltage to the grids of the output valves exceeds the auto-bias voltage. After this point distortion increases quickly, producing the knee shown at point A in the curve. The power at this point can conveniently be termed the maximum output.

The factor used to check this quantity is that the peak output voltage never exceeds that available at point A, i.e., for maximum output. As shown in Fig. 6(a) (we will come to 6(b) later) the waveform at any level above point A is flattened, due to grid current, and there is no increase in the peak value. In fact it often falls.

If therefore we can measure the highest peak voltage obtainable,  $E$ , and then find the r.m.s. value of the sine wave with the same peak value ( $= E/\sqrt{2}$ ), square it, and finally divide by the value of the load resistor,  $R$ , we obtain the maximum output, i.e.:

$$P_{out\ max} = \frac{(E/\sqrt{2})^2}{R} \text{ watts}$$

The components used in practice are shown in Fig. 7.  $W$  is a small stick-type metal rectifier with a voltage rating at least twice the amplifier's output voltage; and, assuming the amplifier's output voltage is in the normal range of 100-120 volts and the meter resistance is 100 ohms-per-volt,  $C$  can be about  $2\mu F$ .

To set up the unit, a source of sinusoidal a.c. (the mains will often, but not always, do) has to be set to the amplifier's nominal output voltage, which is usually 100 volts. The output tester is then connected to this supply and to a meter set to the d.c. range nearest to 250 volts. The resistor  $R$  is then adjusted until the meter reads exactly 100 volts. The meter will now indicate the r.m.s. value of a sine wave of the same peak value as whatever voltage is applied to the tester; i.e.,  $1/\sqrt{2}$  or 0.707 of the peak value.

In use, the unit is connected to the amplifier's output, to the meter and to a suitable load resistor. The last-mentioned can be a heater element adjusted to have a resistance of  $E^2/W$  where  $E$  is the nominal output voltage and  $W$  is the rated output; (don't use lamp bulbs, their  $R$  varies with  $E$ ). The amplifier is now driven by any continuous tone which, it may be interesting to note, need *not* be sinusoidal. The input is increased until the maximum possible reading is obtained on the meter with the switch in Fig. 7 first in one position and then in the other. The square of the lower of these two readings divided by the value of the load resistor can then be taken as equal to the maximum output.

The need for the two readings is shown by Fig. 6(b); if there is any appreciable amount of even harmonics it is necessary to use the reading taken on the half wave that flattens first. Incidentally a difference in these readings indicates a defect if the amplifier is push-pull, for such amplifiers should not have a noticeable amount of even harmonics.

Unless alternative values of  $R$ , and perhaps  $C$ , are provided, the unit can only be used with the type of meter on the particular range with which it was first set up. In addition the accuracy deteriorates below about half the voltage at which the setting up

was done. This matters little, however, as the amplifier would then only be giving a quarter of its rated power.

The accuracy is also reduced if the distortion/output curve is smooth and without a definite knee. This occurs in varying degree with fixed-bias amplifiers and with auto-bias amplifiers with such defects as an early stage or transformer overloading before the output valves. It is, however, quite easy to detect this state of affairs, as the output meter will not then come to a definite stop as it does with a good auto-bias amplifier.

Readings taken by this method on an auto-bias

amplifier exhibiting such properties, or on a class AB<sub>2</sub> or class B amplifier with positive drive, are of little value; but a reasonable indication can be obtained with fixed-bias amplifiers that are not meant to be driven positive by looking for the point at which the rate of movement of the pointer—normally in proportion to the increase in the input level—suddenly slows down considerably. That is, with such amplifiers the pointer does not so much hit the buffers as run into a heap of sand!

I have found it valuable to make up the circuits of Figs. 3 and 7 with some load resistors into one unit for checking R, Z and maximum output.

# Recording Air Traffic Control Telephony

## *Equipment Adopted by the Ministry of Civil Aviation*

**A**IRPORTS coming within the jurisdiction of the Ministry of Civil Aviation are shortly to be provided with sound recording equipment for all radio-telephone communications between air traffic control officers and pilots of aircraft in flight. Development work initiated by the Directorate of Telecommunications, M.C.A., and implemented by recommendations of the International Civil Aviation Organization has been carried out by the Royal Aircraft Establishment, Farnborough, in association with Simon Sound Service who were given the development and production contract. Initially, about 100 installations will be required and the actual manufacture is being carried out by an associated company, Simon Equipment, Ltd. The first production model is already undergoing trials at Prestwick.

The system of recording adopted complies with I.C.A.O. recommendations that the recording medium shall not be capable of being erased or altered without leaving visual evidence of interference (which rules out magnetic recording). Accordingly a direct-recorded embossed track with lateral modulation on standard 35-mm uncoated cellulose acetate film stock is used.

The recording and reproducing heads are of the moving-iron type with replaceable styli. The pickup head can be traversed by hand to select any part of the track, and passages can be played back while recording is in progress.

Approximately eight hours' recording time is provided by one loading of film, which is formed in a continuous loop with a reversed butt joint. After passing the recording stylus, a given point on the film is turned through 180 degrees so that, after traversing the loop, it comes up for recording on the reverse side. In this way both sides of the film are filled with the recorded track, which, incidentally, has a pitch of 0.007 in. There are 120 tracks in the width of each side of the film and the time taken from the start to the reappearance of the groove alongside the starting point (after two revolutions from joint to joint) is four minutes.

The linear speed is 40ft/min, and, although this may seem low by normal recording standards, the quality and intelligibility of speech recorded by the 0.0015-in radius stylus is more than adequate for the operational requirements of air traffic control. The overall frequency response is within  $\pm 4$  db over

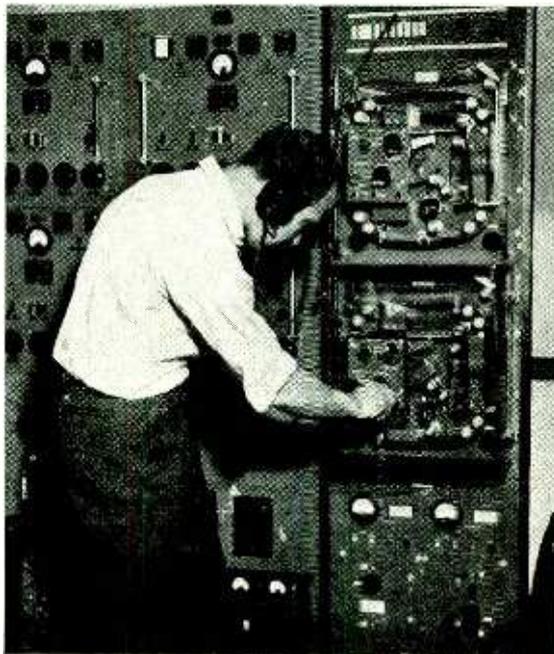
the range 200-3,000 c/s; ultimately only the band 500-3,000 c/s, carrying the principal elements of intelligibility, will be used, and coded time signals will be superimposed on the speech track at 300 c/s.

Duplicate recorders are provided and a relay mechanism gives an "instantaneous" changeover (of the order of milliseconds and well within the duration of a single syllable) in the event of breakdown or when the film is full; normally a recorded overlap of about four minutes is allowed.

A voice-operated clutch mechanism can be used to economize film when traffic is slack.

The equipment will be shown working on the Ministry of Civil Aviation's stand at the S.B.A.C. exhibition at Farnborough (15th-16th Sept.).

Sound-recording equipment at Prestwick Airport for continuous monitoring and recording of all radio-telephone conversations between the Control Unit and pilots.



## NEW BOOKS

**Radio Servicing: Theory and Practice.** By Abraham Marcus. Pp. 775; figs. 400. George Allen & Unwin Ltd., Ruskin House, 40, Museum St., London, W.C.1. Price 35s.

FROM the title the reader might expect a description of the art of repairing radio receivers. What the author presents here is a very comprehensive survey of domestic radio receiver practice, with some notes on faults and service methods. It is all very useful indeed to the novice entering the field of radio service work, but a better title would have been "Domestic Radio Receiver Circuits."

The opening chapter is a "refresher" course on electrical and radio theory, followed by another on components and one on the valve, tracing its development from the diode to multi-electrode and multiple valves. This provides the raw material, as it were, for several following chapters on various aspects of valves. Three chapters on circuitry round off the receiver design section at page 560. Each chapter is followed by a list of revisionary questions.

The chapter on servicing instruments is a curious mixture of academic meter sketches and modern commercial equipment. Three chapters on servicing methods (88 pages) complete the text.

A servicing flavour is introduced into the body of the book by the addition of a section of "Service Notes" at the ends of appropriate chapters, although they are rather in the nature of an afterthought than the primary purpose of the chapter. They summarize the probable faults that can occur in the stage concerned, and are frequently repetitive and generally of a simple nature.

This repetitive tendency pervades the final chapters, which seem to rush through the processes of fault-finding at a breathless speed. A primary dictum that certainly would not be endorsed by a practising serviceman is: first test all valves, irrespective of the symptoms.

The treatment throughout the book is mainly descriptive, with a minimum of mathematics, and the author has a very readable and easily assimilated style, but whereas radio theory is explained in a thoroughly practical manner, the essentially practical subject of service work gives the impression of being treated somewhat theoretically. No attempt has been made to Anglicize the Americanese for this English edition.

Despite the size of this volume, the number of subjects dealt with is so great that some of them receive hardly more than a passing mention, although it is difficult to think of anything that is not mentioned at all.

To the servicing improver who wishes to familiarize himself with receiver design this book contains as much as he can expect to find between two covers. To the student who requires a good readable, descriptive introduction to receiver design it can be recommended.

E. A. W. S.

**Sound Reproduction.** By G. A. Briggs. Second edition. Pp. 248; figs. 193. Published by Wharfedale Wireless Works, Bradford Road, Idle, Yorks. Price 10s 6d.

THE first part of this book deals with loudspeakers and is an extension of the author's earlier work "Loudspeakers."

He has carried out a large number of experiments with loudspeaker cabinets and provides in this volume a wealth of figures and curves relating to every size and shape of baffle—plane, enclosed, vented, pipe, horn, etc. For the most part the results are given in terms of the peaks produced in the speech-coil impedance characteristic, which is not always a criterion of acoustic output; but if one cannot always agree with his conclusions, one is grateful for the evidence, which is not to

be found elsewhere in the literature on anything like this broad basis.

Up-to-date information has been added to this second edition and includes such items as the slant-plate divergent lenses of Kock and Harvey for h.f. diffusion. There is also a good new chapter on cross-over networks, with practical design data.

Part II, which deals with recording, has been extended, and more information has been included on magnetic recording, and also on long-playing records. New evidence is produced on the relative merits of sapphire, tungsten carbide and diamond as stylus materials. Questions of stylus and record wear are viewed from all angles and beautifully illustrated by the photomicrographs of C. E. Waits. Surface noise, hum and motor rumble are investigated on a quantitative basis, and the author has something to say on every aspect of recording and reproduction.

Summarizing, this work may be regarded as the personal notebook of a loudspeaker manufacturer of nearly 20 years' standing who has succeeded in retaining the fresh and enquiring outlook of the amateur on high-quality reproduction—the term amateur being used in its original derivation of one who loves his subject.

What the book may lack in the rigour or orderliness of subject treatment usually demanded in a textbook is more than compensated by the writer's entertaining and forthright style. One thing is certain: no reader, whatever his height of brow, will fail to find something instructive or stimulating to thought in this generous collection of facts, dicta and opinion on the reproduction of sound.

F. L. D.

**Communication Circuit Fundamentals.** By Carl E. Smith. Pp. 401+x. McGraw-Hill Book Co. Price in U.K. 42s 6d.

THIS book is the second in a series by the same author, intended as a course in radio and other communication engineering. It is self-contained, however, and covers the basic principles of circuits and valves, beginning with matter and energy, electricity, and d.c. circuits, continuing through a.c. circuits, and ending with an introduction to valves and cathode-ray tubes. The treatment is on the whole quite simple, and, being intended especially for home study, each chapter includes examples and exercises, and is followed by a summary of the main points. Nearly 50 pages at the end of the book are devoted to appendices, including lists of symbols and abbreviations, tables, useful formulae (mathematical and electrical), and analysis of waveforms. There is a good index and full answers to all the exercises.

It would have been a pleasure if it had been possible to record that a book so well and carefully organized for its purpose of instructing beginners had been equally well written. Unfortunately, however, it is very uneven and contains many unnecessary difficulties for the student, of which the following are one or two examples.

"A resistance is said to have one ohm when an emf of one volt causes a current of one ampere to flow. This is a statement of Ohm's Law." In fact, of course, it is a statement concerning a particular system of units. As regards units, the book starts with the hitherto usual mixture of practical and c.g.s. units; then on p. 102, in the middle of a paragraph on skin effect (of all things!) one finds a short table headed "Reduction of Quantity in C.G.S. Units to M.K.S. Units." Neither here nor anywhere else is there an explanation of what this means, but a few pages later there is a sudden transition from maxwells to webers (incorrectly defined), and from centimetres to metres. After some pages of mixed m.k.s. and c.g.s. units, inductance and capacitance formulae are given in inch units. The subject of units in general is not included.

The author does not hesitate to use terms and ideas to which the reader has not been introduced. In the paragraph on skin effect just mentioned, at least five

important new terms are used, which are defined or explained only in later chapters. The treatment of magnetism is very confusing; and the chapter on series resonance leads to the conclusion that "with a given value of  $Q$ , the selectivity will increase as  $L$  is made larger." For the most part the treatment is by numerical example, avoiding anything but the simplest algebra; then, without warning, the circuit containing  $R$  and  $L$  is solved in the most uncompromisingly mathematical manner by differential equations; but in the corresponding  $R$  and  $C$  circuit in the next chapter the author reverts to elementary school methods. Consequently, whereas the current in the inductive circuit keeps on growing for ever, the current in the capacitive circuit soon reaches a definite zero.

It must be recorded, however, that the sections and chapters on circuit networks and theorems are excellent; the treatment is simple yet concise, and includes important matter that is not always attempted at all in elementary books. The use of reactance sketches for qualitative study is a good feature. The chapters on valves and the brief one on the cathode-ray tube are also reasonably free from the type of flaw referred to above.

The imperfections would be less marked if the reader could be assumed to have some knowledge of the subject, and it is suggested therefore that the book would be a good one for students' revision. One would, however, also venture to recommend some author's revision.

M. G. S.

# Gramophone Speed Conversion

## Possibilities of Adapting Existing Types for Long-playing Records

By R. L. WEST, B.Sc., A.M. Brit. I.R.E.

THE recent release of LP records in this country has aroused considerable interest among experimenters. The most expensive single item in the changeover is undoubtedly the motor. Some people feel they would like to try out LP before scrapping their existing motor and buying a new dual-speed type. Others just can't afford it after buying a new pickup and a couple of LP records! Either way, the idea of converting the existing motor appeals, so here are a few notes on the subject.

Only simple modifications are envisaged in this article and only simple hand tools will be needed. Readers with well-equipped workshops have unlimited scope for their talent, and I expect their projects are already well under way.

All governor-controlled types should be convertible to dual-speed operation. This covers the commutator types—d.c. and universal, as well as the brushless induction motors and the eddy-current motor. Theoretically the commutator type would be the better, since the torque is almost independent of speed, whereas most induction motors show rather less torque at the lower speed.

Those without governors are generally synchronous motors, and speed, usually 3,000 or 1,500 r.p.m., depends on the supply frequency. Rim-driven synchronous motors can be converted to 33½ r.p.m. by fitting a smaller motor pulley, but dual speed involves skilled engineering design.

With a 33½ r.p.m. stroboscopic disc on the turntable (a stop watch for the unfortunate on d.c.), see if the speed adjuster will go far enough to reach the low speed. This may entail grub screw adjustments beneath the turntable, or may necessitate moving the whole governor bodily along its spindle a short distance towards the friction pad, or even forcing the pad through its holder to make it, say ¼ inch longer. It is usually just possible to get both speeds within the limits of travel of the speed regulator arm or screw. If this cannot be done, then the remainder

of this article acquires only academic interest!

At 33½ r.p.m. the turntable speed will probably prove to be far from steady. A number of causes can be found, but first a little theory, starting with the formula

$$\text{Change of angular velocity} = \frac{\text{Driving torque} \times \text{time}}{\text{Moment of inertia}}$$

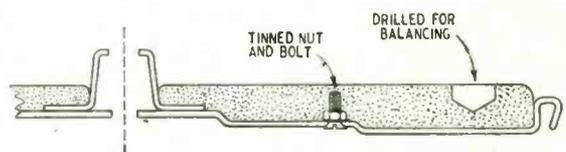
At 33½ r.p.m. each tooth is transmitting the drive for 2.34 times as long as at the higher speed. The driving torque is more or less the same, the inertia identical, hence much larger speed changes due to imperfections of gear shapes or meshing are to be expected.

When rotating, the turntable has kinetic energy proportional to (r.p.m.)<sup>2</sup> × moment of inertia. At the lower speed this is reduced to less than ¼th of its 78-r.p.m. value.

Regular and irregular abstractions of energy take place due to variations in friction of the governor bearings, gears, and the pickup itself, thus producing further speed changes. This can be countered by increasing the moment of inertia of the turntable by a factor of 2.34 times from the first point of view, and 5.5 times from the second—hence 5.5 times, to be on the safe side!

Now the moment of inertia of a circular flat disc—our turntable—equals  $\frac{1}{2}mr^2$  where  $m$  is its mass and  $r$  its radius. To increase its inertia either  $m$ ,  $r$ , or both can be increased. If the loading is evenly distributed and the diameter unchanged, the new

Fig. 1. Section of inverted turntable, showing effect of surface tension in holding the level of lead above the height of the rim.



weight will have to be 5.5 times the old. If the loading is arranged mainly near the outside of the turntable, less will be needed since 1lb, 4in from the centre, is as effective as 4lb, 2in from the centre. In favour, however, the first way, since the heavier turntable will be relatively immune from vibration in any other direction as well.

### Adding the Weight

Lead is probably the most useful material for this purpose, since it can be melted quite easily over a gas-ring. A layer on top of the turntable is attractive, since it puts the magnetic pickup farther from the steel turntable. This will need machining on the upper face and the spindle will have to be lengthened—a major engineering feat. It is quite easy, however, to put 8-12 lbs of lead underneath the standard 12in turntable.

First, drill the turntable to take six 6 BA counter-sunk brass bolts. Use the radial ribs and then there is no fear of the heads projecting. Tin the visible part of the bolt and the nut, and when cool smear on more flux to make sure the lead will adhere properly. Invert the turntable and level it carefully on a stone or concrete floor—firmly, because it is very heavy once the lead is poured in. If a blowlamp is available the lead need only be just above its melting point when poured. The blowlamp is to keep the surface molten long enough to allow it to run perfectly level. The lead will finish neatly at the edge of the turntable (not tinned) up to  $\frac{1}{8}$ in above the level of the rim, due to surface tension. This neat

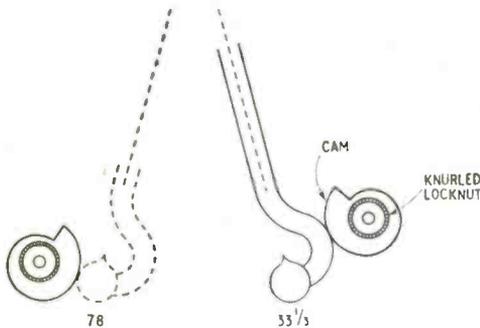
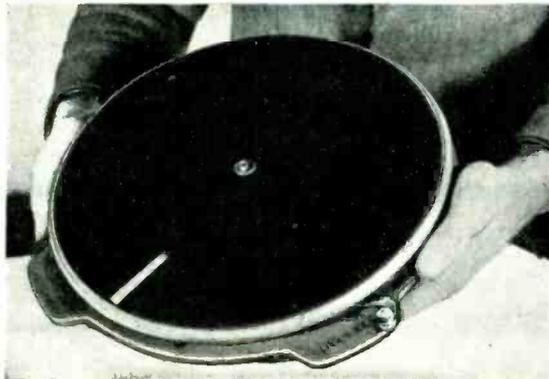


Fig. 2. Pre-set cam stops facilitate a quick and accurate change of speed.

Illustrating the method of testing the turntable for balance.



finish minimizes the amount of balancing necessary. If the centre boss is an alloy casting, be careful not to overheat it. In the absence of a blowlamp, the lead must be made much hotter, skimmed more thoroughly, and poured as quickly as possible. Preheating the turntable would obviously help too.

After cooling, place on the spindle, rotate and check for flatness. If out of true, remove, invert on to a firm surface and a judicious hammer blow on the lead, about a third of the way out from the centre, on the correct radius, will do the trick.

Balance is important since it will affect the speed unless the spindle is perfectly vertical. Even then, it may rock the motor on its rubber mounting, producing an effect like a "swinger" record. Mount the turntable on its spindle and tip the whole motor till the spindle is approximately  $45^\circ$  to the vertical. Holding the motor in both hands, rock it to and fro sharply about the axis of the turntable. This leaves the turntable almost stationary in space, but rotating in its own bearings. The heaviest point gradually finds its way to the bottom. Mark it with chalk. Check it by causing it to descend from either side in turn. This will give a more accurate position. In order to decide roughly how much lead to remove, stick various lumps of lead, in turn, on to the turntable with Plasticine, at a point diametrically opposite the mark and repeat the rocking process. Finally drill out some lead and repeat. If persevered with, it shows a sensitivity of less than 1 gram at the periphery, even if 13 lb of lead are run in.

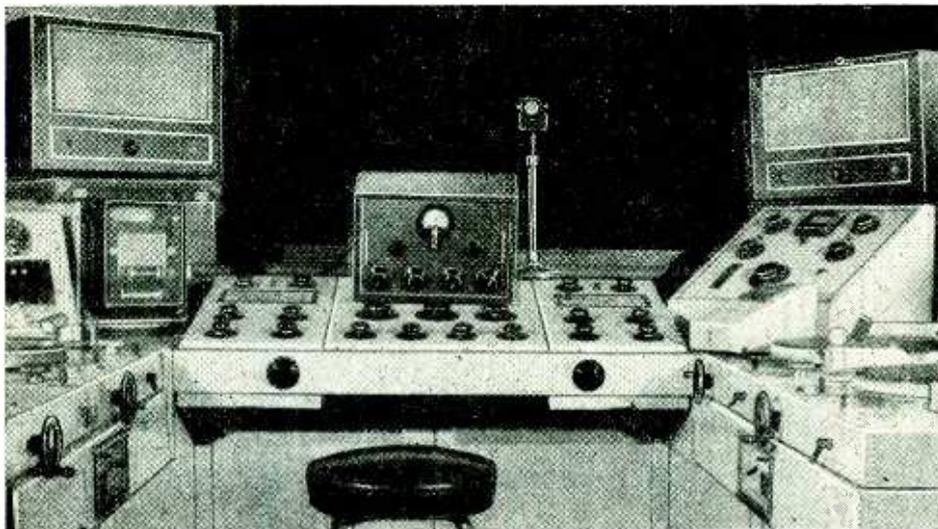
Success will also depend upon very careful attention to the lubrication of governor, gears and bearings. Some concern was felt for the extra loading of the turntable vertical thrust bearing, particularly the type that sits on a  $\frac{1}{16}$ in ball. No evidence of failure of the lubricant has been observed, but the addition of colloidal graphite, or replacement by one of the extreme-pressure car rear axle lubricants is recommended.

Whilst on the subject of lubrication, a further point arises. Due to the increased weight, the turntable tends to jam on the taper seating of the spindle, making removal difficult and increasing the risk of distorting it during removal. A smear of graphite-loaded grease covering the full length of the taper will be found advantageous.

Due to the increased inertia, the turntable takes quite a time to settle at the selected speed, so that some system of pre-set stops could be devised with advantage. For the moving-arm type of speed adjuster, a couple of snail-shaped cams anchored down to the motor baseplate with knurled nuts is one simple solution.

Really accurate assessment of the final result is quite complicated and something on the lines of the method described by E. W. Berth-Jones in the December 1949 issue of *Wireless World*, or the method described in *Electronics*, July 1950, would be necessary. A useful estimate of success or otherwise can be obtained by setting the speed to  $33\frac{1}{3}$  r.p.m. and placing on the turntable any 78-r.p.m. frequency record having bands of constant frequency in the range 1,000-2,000 c/s. Centralize the record accurately by watching carefully for lateral motion of the pickup. When satisfied with the centring, listen to the reproduced tone. If no "wow," flutter, or irregular waver is audible, then it is safe to assume that no trouble from this source will be experienced when listening to music.

Control cabin for stereophonic transmission. The only equipment additional to that of a standard cabin consists of the two loudspeakers on the right and left and the central control desk between them.



# Improved Stereophony

*French Broadcast Using Extra Facilities for Simulating Displacement*

By E. AISBERG (Editor, *Toute la Radio*, Paris)

THE first broadcast of stereophony, the system in which sources of sound are restored to their relative positions in space, took place in France on June 19th, 1950. The transmission was made simultaneously by two chains of French broadcasting stations, the Parisian and the Paris-Inter.

To make use of this transmission two receivers were needed. For some days before it took place, the broadcasting authorities made frequent announcements, urging friends to join forces in small groups so as to receive it under optimum conditions. To obtain these, it was explained that two receivers should be placed from 5 to 7 feet apart, with the axes of their loudspeakers converging at a very small angle; the listeners should be at the apex of an isosceles triangle with the sides some 7 to 10 feet long, the base being a straight line joining the two loudspeakers. It was also necessary that the receivers should be adjusted to give the same volume of sound and that their response should be matched as nearly as possible by means of the tone controls.

Lastly, it was strongly recommended that listening should be done in a darkened room, or at any rate, with the eyes closed, in order to prevent any conflict between aural and visual impressions. This point was found to be of very great importance.

At 8.50 p.m., the programme began with an opening speech by René Clair, of French film fame, who had undertaken the task of producing it. After briefly reminding listeners of the conditions required for hearing the transmission properly, he went on to the reproduction of a series of sounds, which showed the acoustic possibilities of the new technique.

The listener's ears could follow a train as it started, gathered speed and crossed from left to right; troops, headed by a band, appeared to march from one side to the other of the room in which he was sitting; the sounds of footsteps going quickly up a spiral staircase could be followed. In each of these examples the ears "pin-pointed" the source of sound readily and very exactly. The impression of movement was strikingly realistic.

Next, listeners were regaled for more than an hour by the production of an unpublished play of Théophile Gautier's, *Une Larme du Diable*. The new technique proved particularly suitable for the reproduction of this piece, in which the author gives speaking parts not only to men and women, but also to God, the Virgin Mary and a number of inanimate objects. The sounds were heard coming now from one direction, now from another, exactly as the author had intended. It must be recorded that the success of this part of the programme was due in no small measure to René Clair's personal touch.

The idea of making reproduction reconstitute the spatial relations of sources of sound is by no means new. It is well known that, provided it does not come from a point immediately in front of or behind the head, the brain determines the direction from which a sound arrives mainly through its differing intensity at the two ears. In other words, the appreciation of what we may term acoustic depth is essentially a product of binaural hearing. In the same way, the visual sensation of depth, which allows us to see objects standing out in relief, depends chiefly upon the simultaneous use of two eyes, the

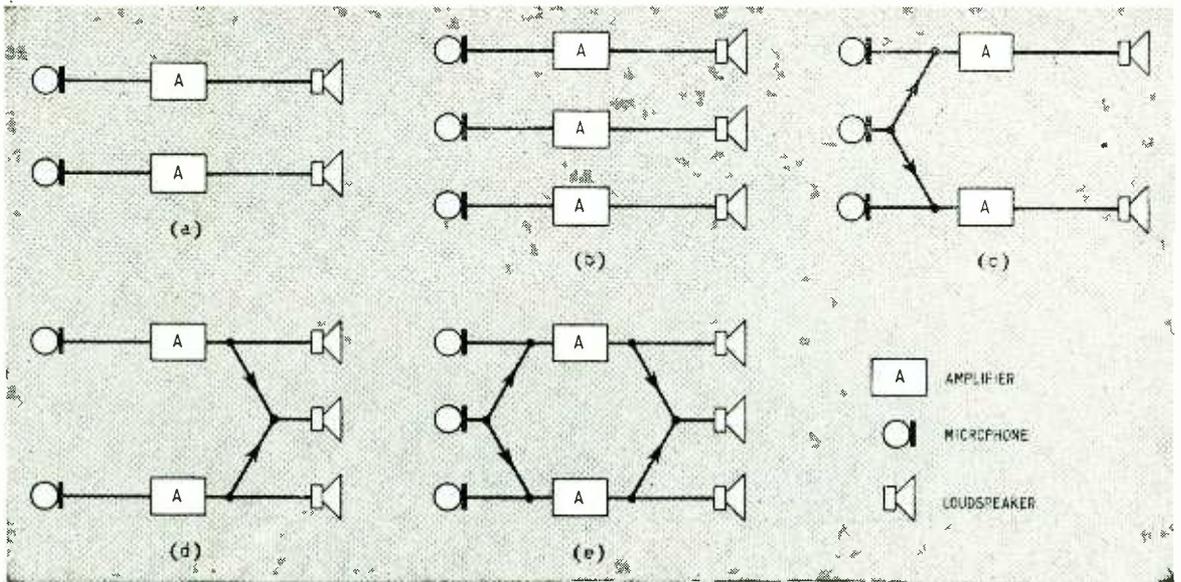
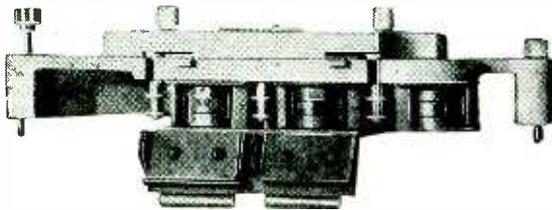


Fig. 1. Various arrangements used in stereophony : (a) the most widely used two-channel system ; (b) three-channel system designed to avoid the dead-spot found mid-way between the outer microphones or loudspeakers ; (c), (d), (e) two-channel systems using three microphones and three loudspeakers either separately or at the same time.

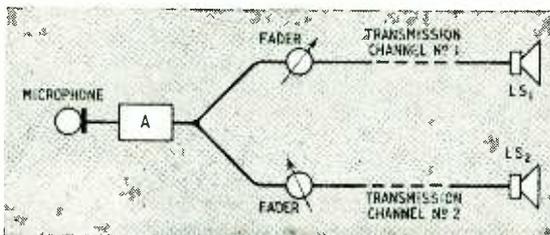
angle of convergence enabling the brain to determine distances.

When listening to broadcasts made by ordinary methods we would be quite satisfied if we used only one ear, because all the sounds which reach the microphone are reproduced by the single small surface of the loudspeaker diaphragm. The use of a number of loudspeakers connected to the same output would make no difference. There is only one way of restoring the directions of sound-sources in reproduction and that is to use two loudspeakers fed by the outputs from two separate channels ; the differences



The two recording heads and the erasing head for double-track tape. One track "lags" 14 cms behind the other, and this relationship remains constant both during the recording and during the play-back.

Fig. 2. An electrical method of simulating displacement of a sound-source in the process of reproduction.



between their respective volumes then serve to "place" the sounds.

The problem of stereophony (*Greek stereos, solid*) has provided material for a vast amount of research work. Clément Ader, who did such fine pioneering work in the field of aviation, made one of the first practical attempts as long ago as 1881, when he used his "théâtrophone" for the transmission of operas over telephone lines. But one of the most striking experiments was that made by the American Telephone and Telegraph Company on April 27th, 1933, when a concert given at Philadelphia was reproduced in a Washington hall by means of a two-channel system. Sounds were picked up by two microphones on the right and left of the orchestra and sent, with suitable amplification, to two loudspeakers similarly placed in the Washington hall.

What may be termed the acoustic perspective was faithfully restored in the reproduction. When the producer walked across the stage, speaking as he went, from one microphone to the other, the listeners in Washington could follow his movements as easily as if a single loudspeaker had been moved about on the stage of the hall in which they were sitting.

An analysis of the technical details of the experiment and of the conclusions which might be drawn from it formed the subject of a series of articles in the *Bell System Technical Journal* for April, 1934. An important point emerging from these is that a number of transmission links of different kinds (see Fig. 1) were tried out. The best results, however, appear to have been obtained with a two-channel system. With its faithful reproduction of the constantly changing positions of the sources of sound, such a system is perfectly adapted to all direct transmissions from theatres or concert halls ; but it does not lend itself to those electrical artifices to which the presentation of items specially prepared for broadcasting owes so much of its flexibility.

A completely different system can be conceived in

which sound-sources would be made to change their positions by artificial methods of an entirely electrical nature. As shown in Fig. 2, a system of this kind uses only one microphone, the resulting modulation being distributed to two transmitting links by means of suitable faders. At the receiving end two loudspeakers are required, placed at a suitable distance from one another. The source of sound will then appear to move, in accordance with the relative volume from each loudspeaker, to points on an imaginary line between the two. When one loudspeaker is silent and sounds are coming only from the other, the listener's ears place their source at the position occupied by the latter. When the volume from both loudspeakers is equal, the source of sound appears to be at a point midway between the two. Any other variation in their relative volumes makes the source of sound appear to be at a corresponding point between the two loudspeakers.

Working on these lines, a controller with his fingers on the knobs of the faders can, at will, make the voice of a broadcaster not moving an inch from one position in the studio, seem to the listener to come from any point between his two loudspeakers. It is not difficult to see that the system lends itself readily to the production of a vast variety of sound effects; in particular the position of the source of sound may be changed instantly from right to left, or *vice versa*. On the other hand, such a system can make no worthwhile use of a number of sources of sound in different positions, for all sounds, no matter whence they originate, are picked up by one single microphone.

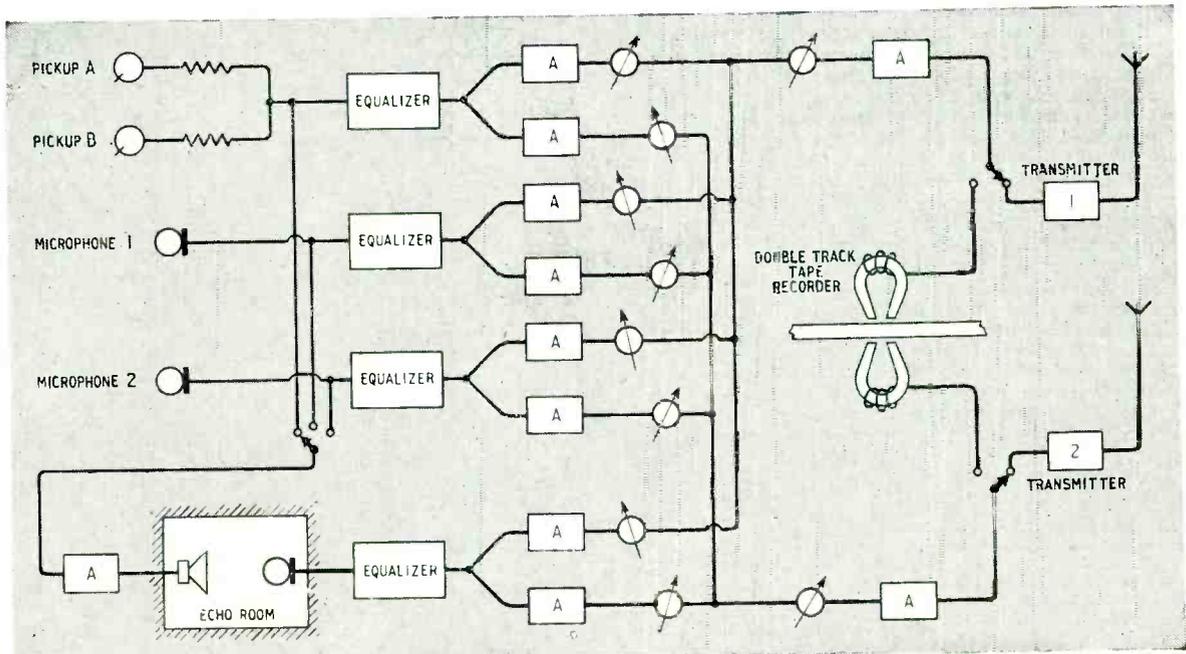
The outstanding merit of the improved system of stereophony, due to José Bernhart and Jean Willrid Garrett, with which the French broadcasting authorities have recently experimented, is that it combines all the advantages of that tried out some years ago by the American Telegraph and Telephone Company with the facilities for deceiving the ear offered by the system using a single microphone and two transmission channels.

In the improved system a number of microphones



J. W. Garrett (left) and J. Bernhart (right), the engineers responsible for the system, at the control desk.

Fig. 3. Block diagram showing the complete layout used in the Bernhart-Garrett process. The number of pickups and microphones may be increased as required. It will be seen that sound effects from the pickups, as well as the outputs of the microphones, are fed to both channels on the principle of Fig. 2.



may be used; but transmission takes place on two channels only. The basic feature of the system is that the output of every microphone is fed through faders to both channels. Thus either of the listener's loudspeakers can be made to receive at will a suitable "ration" of the output of any microphone.

The less active the controller, the more closely does the working of the improved system resemble that of the old A.T.T.C. stereophonic system. Hence, it is readily adaptable to direct transmission from theatres and concert halls. On the other hand, when the controller wants to show what he really can do, he can make sound-sources which are in fact fixed, appear to move about it any way that he fancies—and he can do this with speed and flexibility that it would be difficult to match.

During the transmission of *Une Larme du Diable* four microphones were in use. The effect of "depth" was produced by means of an echo room. By these means an utterly amazing acoustic perspective was brought into being, with no sacrifice whatever of classic production methods.

The broadcast on June 19th was recorded. With this in view the modulation of the two channels was recorded simultaneously on two sound-tracks on the same magnetic tape. In this way perfect synchronization was ensured during the replay.

It is to be hoped that further experimental transmissions will take place to assist the development of the new system. In this way listeners will make the pleasant discovery that it is not for nothing that Nature has provided them with two ears.

## SHORT-WAVE CONDITIONS

### July in Retrospect : Forecast for September

By T. W. BENNINGTON

(Engineering Division, B.B.C.)

DURING July the average maximum usable frequencies for these latitudes were slightly lower, both by day and night, than they were during June.

Day-time working frequencies for long-distance communication were relatively low, and conditions were very seldom favourable on the higher short-wave frequencies. The 28-Mc/s amateur band, for example, was almost unusable for communication to North America, and even in more southerly directions did not appear to give very good results. Frequencies somewhat lower than this were, however, very frequently usable in north-south directions, though 20 Mc/s was about the highest useful frequency for east-west communication. Medium-high frequencies were usable over a large part of the day and over most paths, 15 Mc/s was regularly receivable till well after midnight.

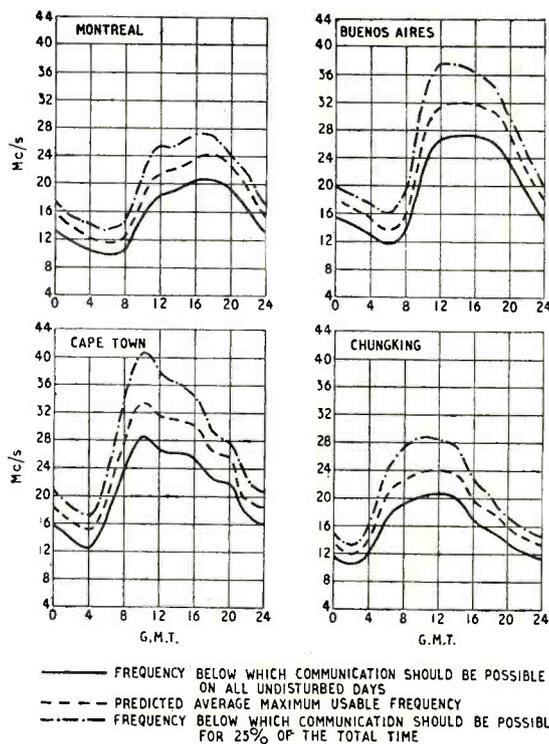
Sporadic E continued to be prevalent, though that with high critical frequency seemed somewhat less prevalent than during June. On the 28-Mc/s band "short skip" contacts with European countries appeared somewhat less frequent than during June. Occasionally, however, distant Continental stations on frequencies up to 50 Mc/s were heard here, and their signals no doubt came in by way of Sporadic E. On a few occasions, nearer Continental stations on 90 Mc/s and on 40-46 Mc/s were heard, most probably by means of tropospheric refraction.

Sunspot activity was about the same average level as during last month, and has now decreased by approximately one-third since sunspot maximum.

There was more ionospheric disturbance during July than during the past few months. Of the several prolonged periods of disturbance which occurred the most severe were those of 4th-6th, 12th-14th and 25th-26th. Only two Dellinger fadeouts were reported, the most severe of these occurring at 1610-1705 on 12th.

**Forecast.**—There should be a considerable increase in the day-time m.u.f.s and a small decrease in the night-time m.u.f.s during September, as compared with those for August.

Day-time working frequencies for long-distance communication should, therefore, be fairly high, though it is not expected that frequencies as high as 28 Mc/s will often be usable over east-west paths except, perhaps, towards the end of the month. Over north-south paths, however, such frequencies should be usable almost regu-



larly. Medium-high frequencies should remain usable for a large proportion of the total time and frequencies below about 10 Mc/s should seldom be really necessary at night.

Working frequencies for medium-distance communication will be somewhat lower than during August, both by day and night, and such communication will be by way of the E and F<sub>1</sub> layers for only a short daily period. There should be a considerable decrease in the prevalence of Sporadic E, though some medium-distance communication on the higher frequencies by way of this medium may still be possible. There is often an increase in ionospheric storms during September, and periods of disturbed conditions are, therefore, to be expected.

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

# RC Oscillators

*Explaining Why They Are Not Just the Poor Relations of LC Oscillators*

By "CATHODE RAY"

**M**OST of the books on radio explain inductance-capacitance (or LC) tuning at great length and either omit resistance-capacitance (RC) tuning altogether or give it rather scanty notice. Consequently some readers, who are more or less familiar with the theory of the normal LC tuned circuit, are somewhat mystified that apparently similar results are obtainable without inductance. The puzzling aspect is that in the LC circuit these results depend on the peculiar ability of inductance to store energy and to cancel or neutralize capacitance at one particular frequency, whereas resistance can do neither of these things.

The resemblance between the two systems is, in fact, only partial. One cannot with RC circuits do everything that one can with LC circuits. On the other hand, for some purposes RC tuning has advantages over LC tuning. They are not simple equivalents. The fact that there is a resemblance at all is very interesting, but it should not be pressed too far.

The use of RC circuits for obtaining selectivity has been explained quite recently by J. McG. Sowerby† so we shall concentrate now on oscillators. The essential heart of an oscillator is an amplifier, because of its being able to give an output at least as powerful as the input, so that by connecting one to the other in a suitable manner the amplifier can be made to keep itself going; in other words, can oscillate. A transformer by itself, for example, is unable to do this; because the output power is always less than the input. The first condition for keeping oscillation going, then, is *output at least as great as input*.

The second is that the *output must be in phase with the input*. The output at the anode of a single-valve amplifier is in phase opposition to the input at its grid, so connecting anode straight back to grid does not make an oscillator. Some device such as a transformer is needed for reversing the phase. The tuned-anode tuned-grid oscillator is only apparently an exception; actually the phase reversal system is there, though it is mixed up with the frequency-determining parts of the circuit.

The two conditions for oscillation are not necessarily confined to one frequency at a time, but it is usual for them to be. The LC tuning circuit is particularly effective in keeping oscillation definitely to a single frequency, because it exerts a very strong control on both the conditions for oscillation. Both amplitude and phase are altered more or less sharply when the frequency is shifted from resonance, as shown in Fig. 1.

Fig. 2 is a simple and well-known example of how the LC circuit can be incorporated in the amplifier, with a back-coupling or retroaction coil  $L_r$  to apply

part of the voltage developed across LC to the grid in opposite phase. If  $L_r$  is adjusted so that the two conditions are only just fulfilled at the frequency of resonance, then it is clear from Fig. 1 that at any other frequency, even if it is only slightly different, the output is likely to fall below the critical amount

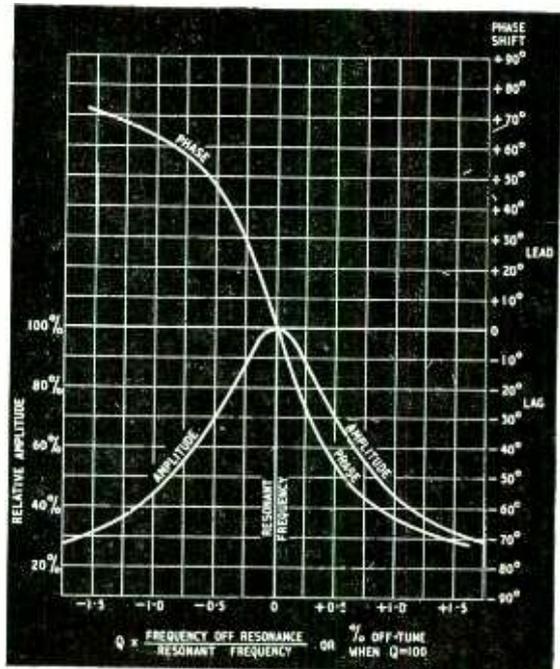


Fig. 1. Graphs of amplitude and phase angle of voltage developed across a parallel resonant LC circuit when fed from a source having infinite resistance. They approximately represent the results in a circuit such as Fig. 2 when the valve is an r.f. pentode.

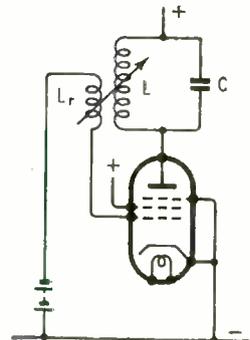


Fig. 2. Very simple LC oscillator circuit, in which the purpose of  $L$  is (i) to reverse the phase and (ii) to reduce the voltage developed across LC by the same factor as the valve amplifies, making the voltage received by the grid equal to that necessary to produce the voltage.

† *Wireless World*, June 1950, p. 223.

needed to maintain oscillation, and the phase will be right off.

Fig. 2 and its modifications are very simple and convenient, except that at low frequencies the amount of inductance required demands an enormous number of turns of wire and/or an iron core which introduces the objectionable feature of non-linearity. So at the low end of the frequency scale it is much better to use resistance, which is cheap, linear, easy to vary, and does not pick up hum so readily. But at first sight a ban on inductance seems to raise considerable difficulties. Gone is the convenient transformer method of phase inversion. Gone, too, are the sharply discriminating characteristics shown in Fig. 1. Connecting the output device on the cathode side of the valve instead of the anode would certainly make the phase right for the grid, but would also reduce the output voltage below the input voltage (see theory of cathode follower), so is ruled out on that ground.

If we are obliged to stick to a single valve, then the qualifications of our RC system must be these: it must be capable of shifting the phase of the valve's output by  $180^\circ$  without attenuating it more than the valve amplifies.

A simple combination of one R and one C can be used to cause a phase shift of anything between (but not including)  $0^\circ$  and  $90^\circ$ . In Fig. 3, if R and  $X_C$  (the reactance of C) happen to be equal, then the voltage  $V_R$  across R is  $45^\circ$  ahead of V, the applied voltage, and  $V_C$  is  $45^\circ$  behind it. And  $V_R$  and  $V_C$  are both  $1/\sqrt{2}$  (about 71 per cent) as large as V. If R is made smaller relative to  $X_C$ , say by reducing C or the frequency, the phase lead of  $V_R$  is increased, but the magnitude of  $V_R$  is inevitably reduced. The lead can only be increased to  $90^\circ$  by making  $V_R$  zero, when it isn't any good to anybody. Similarly with  $V_C$ .

Suppose, however, that we apply  $V_R$  (say) to another RC circuit; the output across R in that circuit will lead  $V_R$ , and hence lead V by a greater angle, at a further sacrifice in voltage. Obviously even this cannot give us a total phase shift of  $180^\circ$ , but we can get it by using three "stages" of RC,

each with a  $60^\circ$  shift, or four stages each giving  $45^\circ$ , and so on. Only very elementary a.c. theory is needed to calculate the phase shift and voltage reduction at any frequency due to one RC stage (as we have just done); but the total shift due to  $n$  equal stages is not  $n$  times that of one stage, nor is the total voltage ratio equal to the  $n$ th power of that of one stage. Connecting a second stage upsets the impedance of the first stage; and the third upsets both. The calculation of  $n$  stages is quite a difficult mathematical problem, but here is a table of the attenuation of 3 to 6 stages at the frequency at which the total phase shift is  $180^\circ$ :

Number of Stages $n$	Attenuation $\alpha$
3	29.0
4	18.4
5	15.4
6	14.1

The figure  $\alpha = 29$  for 3 stages means that the voltage across the final R or C is  $1/29$ th of that put in across the first pair. So to obtain oscillation it is necessary for the voltage amplification of the valve to be 29 times. A 4-stage system allows a valve with a lower  $\mu$  and higher power output to be used, if that is wanted. As we have seen, anything less than 3 stages is insufficient to give the required  $180^\circ$ ; and the above table makes it seem (as is indeed the truth) that increasing the number of stages above 3 or 4 is unlikely to reduce the attenuation enough to be worth the extra components. Actually the amplifier input and output impedances generally introduce phase shifts that modify the above figures. Fig. 4 is a simple example of this type of oscillator.

Before going on, it may be as well to make sure that we are quite clear why such an oscillator oscillates at one frequency at a time, and why varying C or R varies that frequency. The answer, of course, is that there is only one frequency which makes the total phase shift through the RC "ladder" equal to the  $180^\circ$  necessary for bringing the oscillatory voltage at the grid into the correct phase to maintain itself. (To be strictly correct, other frequencies are possible, but only with an abnormally large number of RC stages, and in any case voltages at these frequencies are too heavily attenuated to cause oscillation.)

With the Fig. 4 type of circuit, in which the series elements are C and the shunt elements R, there is hardly any phase shift at very high frequencies, because the capacitances are almost short-circuits; and at very low frequencies the shift approaches  $90^\circ$  per stage. But whereas with a high-Q LC circuit the phase changes very rapidly indeed in the region of resonance (see Fig. 1), with the RC system the shift is spread gradually over the frequency range. In other words, it behaves in this respect like an LC circuit with very low Q. And whereas the amplitude falls off more or less steeply on both sides of an LC resonance peak, on one side of the working frequency of an RC system the amplitude actually increases. With the Fig. 4 arrangement, this is obviously the high-frequency side; but if the R's and C's were interchanged the slopes of both phase and amplitude graphs would be reversed. Fig. 5 shows the graphs for the Fig. 4 system, on the assumption that the

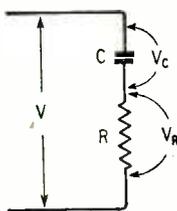
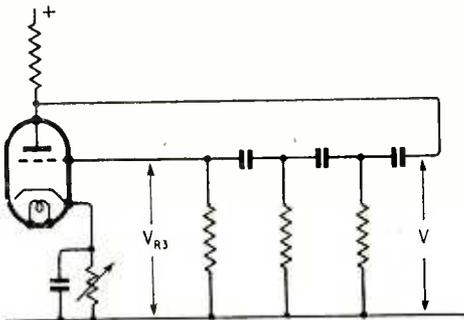


Fig. 3. Basic RC phase-shifting circuit.

Below: Fig. 4. How a 3-stage phase shifter can be connected to the single-valve amplifier to make it an oscillator. The variable cathode resistance acts as an oscillation control.



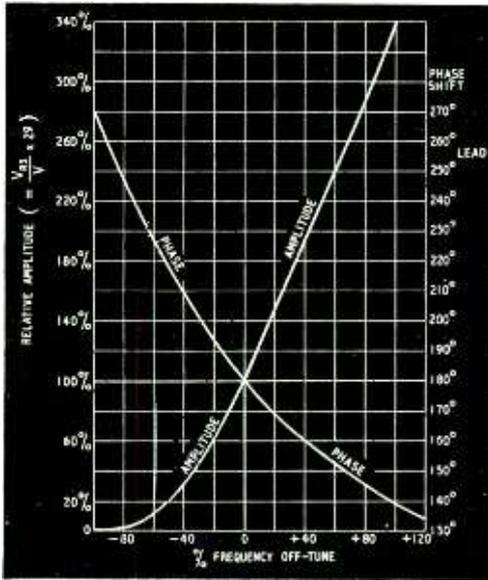


Fig. 5. Phase and amplitude graphs for 3-stage RC circuit as in Fig. 4, assuming negligible valve output impedance. When comparing with Fig. 1, note change of scale.

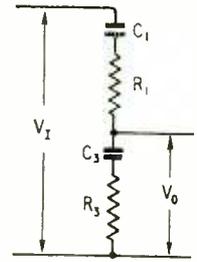
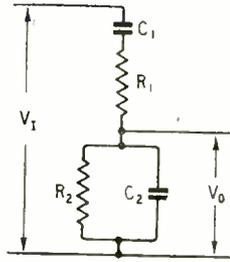
output impedance of the valve is negligible. The relative voltage figures ( $V_{R_3}/V$ ) have been multiplied by 29 (the correct valve amplification) so as to make the figure at the  $180^\circ$ -shift point equal to 1, or 100 per cent. Comparing Fig. 5 with Fig. 1 we see that for a given phase shift near the oscillation point the corresponding frequency shift is 200 times as great with the RC circuit as with a 100-Q LC circuit, so on this basis the RC circuit can be reckoned to have a "Q" of 0.5.

In short, the control of frequency by phase shift, with this type of RC circuit is very much less keen than that of any reasonable LC circuit, while its control by amplitude is entirely one-sided.

If two valves can be spared for the amplifier, then with the normal type of resistance coupling the output is in phase with the input, so the RC tuning circuit is relieved from the duty of creating a phase reversal. All it has to do is to satisfy the conditions for oscillation (in this case, to transmit the necessary amplitude with no phase shift) at the desired frequency, and fail as thoroughly as possible to satisfy them at all other frequencies.

There are various ways of arranging resistances and capacitances to achieve this, but the simplest is to have one of each in series and another of each in parallel, as in Fig. 6, where  $V_1$  means input voltage and  $V_0$  output voltage. It is going to be simplest to calculate, and satisfactory in practice, to make  $R_1 = R_2$  and  $C_1 = C_2$ . Then it turns out that at the frequency which makes  $V_0$  in phase with  $V_1$  the reactance of  $C_1$  (or  $C_2$ ) is equal to the resistance  $R_1$  (or  $R_2$ ). It also turns out that the impedance of the  $R_2 C_2$  pair is half that of  $R_1 C_1$ , so  $V_0$  is one-third of  $V_1$ .

One way of seeing how Fig. 6 functions is to compare it with Fig. 7. If we assume first that  $R_3 = R_1$  and  $C_3 = C_1$ , then the impedance of the  $R_3 C_3$  pair is in every respect the same as that of  $R_1 C_1$ . The current flowing through  $R_1 C_1 R_3 C_3$  leads  $V_1$  by some angle



Left : Fig. 6. Series-parallel frequency-discriminating circuit for obtaining a phase shift of  $0^\circ$  or thereabouts at only one frequency.

Right : Fig. 7. At any one frequency, Fig. 6 is equivalent to this.

between  $0^\circ$  and  $90^\circ$ , but the angle is the same for  $R_3 C_3$  as for  $R_1 C_1$ . So obviously  $V_0$  is in phase with  $V_1$  and is half its magnitude. Now suppose  $R_3$  is reduced to half  $R_1$ , and  $C_3$  is doubled, so that its reactance is half that of  $C_1$ . The phase angle of the  $R_3 C_3$  pair will be unchanged, but its impedance will be halved, so that  $V_0$  will now still be in phase with  $V_1$  but equal to only one-third of  $V_1$  in magnitude. Next, replace  $R_3$  and  $C_3$  by their parallel equivalents, given by the standard formulae :

$$R_p = \frac{R_s^2 + X_s^2}{R_s} \text{ and } X_p = \frac{R_s^2 + X_s^2}{X_s}$$

where the subscripts  $p$  and  $s$  indicate, as you have no doubt guessed, "parallel" and "series" respectively. If we assume that the frequency is such as to make  $X_s$  (which is the reactance of  $C_3$ ) equal to the resistance  $R_s$  (which is  $R_3$ ), then they become delightfully easy to work out : the results are  $R_p = 2R_s$  and  $X_p = 2X_s$ . So, since  $R_3 = R_1/2$ ,  $R_p = R_1$  and is the same thing as  $R_2$ ; and similarly  $X_p$  is equal to the reactance of  $C_2$ . We have therefore proved that when  $R_1 = R_2$  and is equal in magnitude to the reactance of  $C_1$  and of  $C_2$ ,  $V_0$  is in phase with  $V_1$  and one-third its voltage. So if we make  $V_1$  the output of our 2-stage amplifier,  $V_0$  will supply the necessary input voltage, provided that the total voltage amplification is 3. That is not much to ask of a 2-stage amplifier ; in fact it will almost certainly be far less than the amplifier gives, so it will be necessary to lose most of the amplification somehow—a point we shall take up in a few moments.

In the meantime, note that if Fig. 6 were equivalent to Fig. 7 at all frequencies it would be unable to discriminate between one frequency and another, so that if the conditions for oscillation were satisfied at one frequency they would be at all frequencies. The object of connecting one RC pair in parallel is of course to introduce frequency-discrimination. If the frequency is raised,  $X_{C_1}$  falls,  $R_1$  becomes the dominating partner, and the current through  $R_1 C_1$  comes more nearly into phase with the voltage across them.  $X_{C_3}$  also falls, but that fact makes it dominate  $R_3$ , because the greater part of the current flows through it, and being  $90^\circ$  out of phase with  $V_0$  it widens the phase difference. So on both counts the phase of  $V_0$  departs from that of  $V_1$ . Similarly (but in the opposite direction) if the frequency is reduced.

It is also pretty clear that whether the frequency is increased or reduced it will reduce the magnitude of  $V_0$  relative to  $V_1$ . At zero frequency, the reactance of  $C_1$  is infinitely large, so  $V_0$  is nil. At infinitely high frequency the reactance of  $C_2$  is zero, so again  $V_0$

is nil. In this respect Fig. 6 is closer than Fig. 4 to the LC circuit with its resonance peak. But it still has a very low "Q" compared with any reasonable LC circuit. This is shown in Fig. 8, which can be compared with Figs. 5 and 1.

¶ An advantage of Fig. 6 is that there are two RC pairs instead of three or four, so a 2-gang capacitor (or rheostat) is sufficient as an effective variable frequency control.

Now the question of surplus amplification. What would happen if nothing were done about it? If the back-coupling of an LC oscillator is increased beyond the point at which oscillation starts, it makes the oscillation grow, and in so doing it drives the valve into heavy grid current or anode-bend cut-off, until its amplification is reduced sufficiently to restore the balance. In this process the oscillation is distorted. The same happens with an RC oscillator if the amplification is at first too great: the oscillation grows until the amplification is sufficiently reduced. But the distortion is very much worse, because in the LC oscillator the sine waveform is shaped mainly by the LC circuit itself, and is not very much dented even when the current through the valve consists of square waves or pulses. But the RC circuit lacks this flywheel or pendulum effect; if the amplification is increased even moderately beyond the necessary minimum the waveform goes all to pieces. That is why practical RC oscillators nearly always have an automatic device to keep them only just oscillating.

A 2-stage resistance-coupled amplifier of normal design is likely to have a voltage gain of several hundred times, even when no particular effort is exerted to make it large. In order to maintain good

waveform this must be reduced to 3; but we can make a virtue of necessity, by using negative feedback for the purpose. This means applying such a large amount of back-coupling in the direction tending to stop oscillation that it is only at the very peak of the RC "resonance" curve that it is counteracted and oscillation is possible. The very flat RC peak and gradual phase curve can thus be geared up until they compare with those of a typical LC circuit.

Fig. 9(a) is the skeleton of a 2-stage amplifier. Positive feedback, to make it oscillate, can be introduced at one particular frequency by feeding one-third of the output back to the grid by means of Fig. 6. At the same time the large surplus gain of the amplifier can be neutralized at all frequencies by tapping off very nearly one-third of the output and feeding it back in opposite phase to the cathode. The complete circuit is then as in Fig. 9(b). Drawn like this, it can be seen in another light—as a Wien (pronounced "Veen") Bridge. A and B are the "generator" terminals, receiving the output from the amplifier; whilst C and D are the "detector" terminals, connected to the input of the amplifier. If the bridge is balanced (which can be done at only one frequency) there will obviously be no signal input and therefore no oscillation. Assuming, as we have done, that  $R_1 = R_2$  and  $C_1 = C_2$ , perfect balance is obtained by making  $R_3 = 2R_4$ . Points C and D then both receive one-third of any output voltage there might be, in the same phase, so both are at the same potential. If  $R_3$  is made less than  $2R_4$ , there is a net voltage between C and D, but in the opposite phase for maintaining output. If  $R_3$  is greater than  $2R_4$ , there is a net voltage tending to maintain output, and if sufficient it will cause continuous oscillation. The greater the gain of the amplifier, the less the bridge has to be unbalanced to produce oscillation, and the easier it is to apply an automatic control to keep the system just oscillating and no more. The simplest method is to make  $R_3$  a thermistor, as described in the August, 1949, issue, page 296.

Before superhets came into general use, the most-used method of obtaining r.f. selectivity was positive feedback ("reaction") just short of the oscillation point. In the same way this RC oscillator system, if set just short of oscillation, can be used for getting a.f. selectivity. And that is the point where readers who want to pursue the subject farther can be handed over to J. McG. Sowerby (June, 1950, page 223).

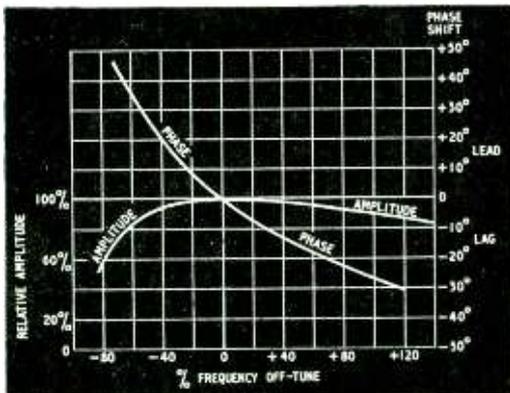
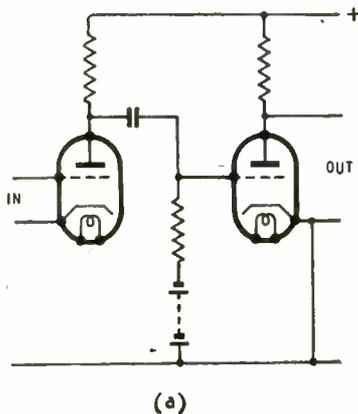
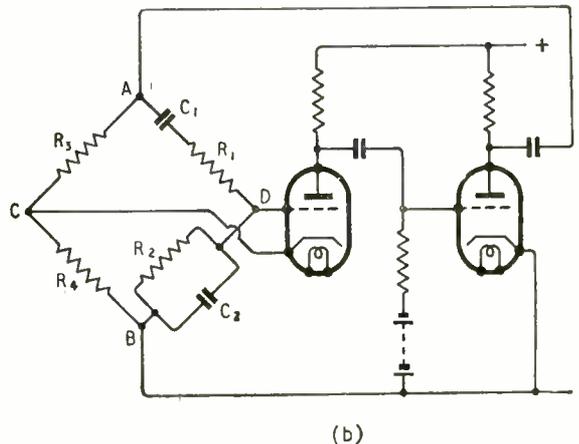


Fig. 8. Phase and amplitude graphs for Fig. 6 circuit, for comparison with Fig. 5.



Right: Fig. 9. (a) 2-stage amplifier alone, and (b) with output connected to input by Wien bridge circuit.

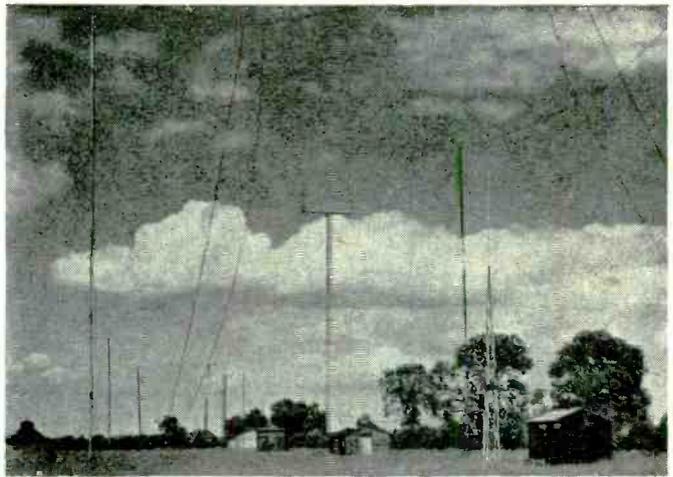


# Monitoring Airways Radio

*Frequency Measuring Station*

*Established by the*

*Ministry of Civil Aviation*



The aerials at the M.C.A.'s frequency checking station at Pailton. (Photo: Courtesy Ministry of Civil Aviation.)

THE photographs on this page show the imposing array of aerials and some of the precision measuring apparatus used at the M.C.A.'s frequency measuring station set up at Pailton, near Rugby.

Regular checking of the frequency and field strength of all airways navigational aids and communication sets, together with measuring the frequencies of all quartz crystal oscillators used in the various air and ground transmitters and receivers of civil airways, constitute the work of the station.

Pailton being roughly in the centre of England, most of the U.K. beacons, which operate in the 250- to 400-kc/s band, are received well enough for frequency and field strength measurement purposes. But the station has also some mobile equipment which makes on-the-spot measurements to supplement those taken at Pailton.

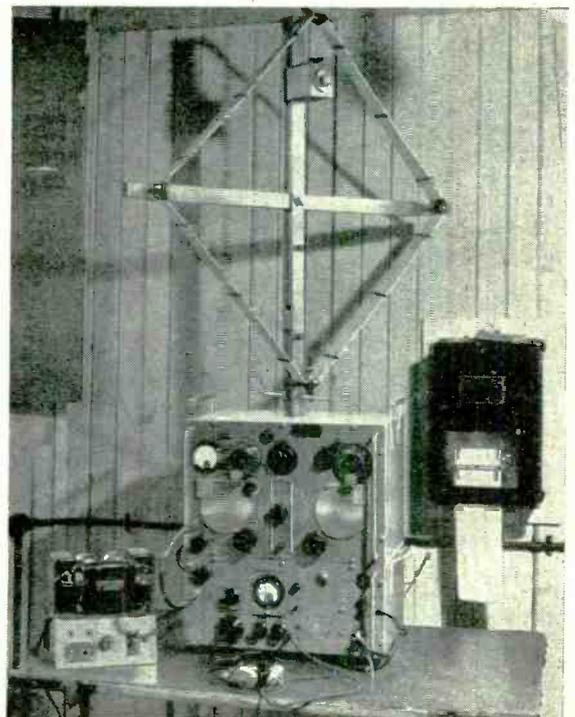
Records are kept of all routine measurements and a monthly graphical chart is prepared showing the day-to-

day behaviour of all the navigational beacons. By international agreement these have to keep within  $\pm 0.05$  per cent of their allotted frequencies. Checks are also made on all airport h.f. transmitters operating in the 3- to 11-Mc/s band.

Whilst the foregoing represents the principal activities at Pailton, numerous other tasks are also performed. For example, the frequency meters used by civil airways stations are periodically checked and re-calibrated if necessary and radio flight-tests are carried out with aircraft for the Ministry certificate of airworthiness.

Future plans envisage investigation into interference problems, measurement of harmonic and parasitic radiation from transmitters and a programme of work covering v.h.f. measurements.

Left: With this equipment regular measurements are made on beacons and ground transmitters used by civil airways. Right: The field strength measuring equipment used at Pailton. It is the Marconi Instruments type TME18 covering 150 kc/s to 25 Mc/s with interchangeable loops. (Photos: Courtesy Ministry of Civil Aviation.)



# UNBIASED

By FREE GRID

## Meteorology for the Million

**S**PEAKING as one of the "countless others" whom the Editor mentions in the July issue as being "more than usually dependent on sudden changes of weather," I cannot too warmly endorse his plea for the restoration of the discontinued "Airmet" meteorological broadcasting service and for its extension to cover the whole twenty-four hours of the day.

I have always made a point of carrying my umbrella, no matter how favourable the forecast; not because I lacked faith in it, but merely to safeguard my legal position lest at any time a "common informer," inspired by greed of gold, caused me to be arraigned before the Court on a charge of "aiding and abetting," since I have always understood that it is an offence against the law to "profess to tell the future." I am sure that, on paper at any rate, the learned scientist feeling his seaweed on the roof of the Air Ministry is equally guilty in this respect with Madame Estelle gazing into her crystal. If any of you who are



Further Outlook Unsettled.

learned in the law are of a different opinion perhaps you will quote chapter and verse to show me exactly when the law was altered to show discrimination between meteorological and matrimonial forecasts.

But while I whole-heartedly endorse the Editor's appeal for a 24-hour "Airmet" service, we part company when he lends support to a suggestion that the Third Programme channel should be employed during those hours of the day when it is normally not in use. To myself and other Third Programme listeners, among whom I am sorry to say it seems clear that the Editor is not numbered, such a sacrilege

can only be compared to a suggestion that the nave of Canterbury Cathedral be employed as a dance hall at such times as it is not in use for ecclesiastical purposes.

To my mind the obvious solution of the difficulty would be to use the Light Programme channels by putting the words of the forecasts into the mouths of dance band crooners. These songsters (?) have but a limited vocabulary consisting of words like "blue" and "true" and "you," and no doubt they would be glad of something fresh to sing, such as "the north wind doth blow and we shall have snow." Dancers and others who enjoy these programmes would be only too glad if their favourite fare were to be continued throughout the 24 hours, and dance band leaders would be glad of the extra money.

## Bob Allen Up to date

**E**NTERPRISE and initiative are qualities that have invariably appealed to me, and I am always pleased when I find outstanding instances of them in which radio plays a part. I was, therefore, agreeably surprised to see a television set in operation in the waiting room of a seaside doctor at whose surgery I called one evening in August to get something to ease the pain caused by a crab seizing my big toe when enjoying the delights of paddling.

The waiting room was crammed to the doors by patients, and it was obvious that most of them had only imaginary complaints and had come mainly to see the television programme, since the town was on a part of the coast well outside the nominal range of Alexandra Palace, and a television set in operation was a comparatively rare sight; indeed, it was only by the use of an elaborate aerial array and a super-sensitive pre-amplifier that it was possible to get and hold the programme.

At first I assumed that the only credit for enterprise was due to the dealer who had put in the installation and had affixed an artistic and yet conspicuous nameplate to it giving his name and address. I learned differently, however, when a fee was demanded of me for examining my toe, as I had expected to get it all free under the National Health Service as an emergency case, since I was well away from the area of my own doctor. Unfortunately, however, the seaside medico was not a member of the Service.

Subsequent enquiries laid bare the enterprising nature of this doctor, who had, without breaking any of Mr. Bevan's regulations or infrig-



Enjoying the delights of paddling.

ing any of the strict rules of professional etiquette about advertising, built up quite a lucrative practice. It was, in fact, fully up to the standard of permissible medical advertising set by Dickens' Bob Allen.

## Autophone Service Wanted

**C**AR radio is now regarded as indispensable by all self-respecting motorists. In a few years it will be considered equally indispensable for a car to be on the telephone. Nobody, however, seems to be interested in the idea to-day, although it is technically possible by means of a micro-wave link to the nearest telephone exchange. Such a system is, in fact, in actual operation in certain "furrin parts."

It should be easy to stimulate interest in this country since, as is well known to people who matter, one of the big motoring organizations has in operation a radio patrol-car service whereby you can ring their H.Q. from the nearest telephone box and get a first-aid car directed by radio to your broken-down vehicle.

It would be quite easy to improve on this. Members of the organization could be provided with small fixed-frequency micro-wave transmitter-receivers to link up with a counterpart on the roof of the telephone kiosk which would connect the caller by landline to H.Q., without the necessity of getting out of his immobilised car and trudging wearily to the 'phone box. This roof-top link would be completely automatic in operation like the chain of stations between Sutton Coldfield and the Alexandra Palace. Once get motorists used to this and they would soon demand a fully fledged telephone service. Centimetre wavelengths and a chain of roadside pick-up stations would probably be necessary.

# LETTERS TO THE EDITOR

The Editor does not necessarily endorse the opinions expressed by his correspondents

## Spot Wobble

THE letter of H. S. Chadwick in your July issue queries a previous statement of E. G. O. Anderson in the May issue that "the light output is increased" by the use of spot wobble. If Mr. Anderson will permit, I would like to enter the fray on his behalf, and also because I find that the inability to appreciate that conditions of scanning and focus can affect the total light output is widespread. The following may help.

Given a fixed set of scanning conditions but always maintaining optimum focus there are two main considerations affecting brightness.

(1) Final anode voltage (affecting depth of electron penetration into the screen) will increase the light output progressively with voltage increase. The upper limit of brightness is a function of the screen thickness.

(2) Current increase affects brightness by putting more electrons on to the screen. The upper limit of brightness is when the individual electrons are so crowded that they fall only on screen material which is already excited to saturation by the previous electrons.

Now the light output from a screen as measured by a photo-cell and galvo does not increase in a direct ratio to an increase of beam current, due to the current saturation conditions of the screen.

As can be seen from the curve extracts below, doubling the beam current gives less than double the brightness. The higher the current the less efficient the screen becomes.

Beam Current ( $\mu$ A)	50	100	200	400
Brightness	0.6	1.1	1.9	3.15

But if in doubling the beam current the scanned area is also doubled then the brightness is maintained.

Now look at it another way.

If we scan the whole of the screen as in television practice, then about one-third of the screen (between the lines) is not being excited at all. The two-thirds of the screen being excited, is, for modern conditions of

daylight viewing, working well up the current/brightness curve where the efficiency is reduced. If we now fill between the lines either by defocusing or by spot-wobble we reduce the current on the two-thirds previously bearing all the current, and we work on a more efficient part of the current/brightness curve.

The accompanying curve shows what can happen to brightness with changes of current through the focus coil, all other conditions remaining constant.

S. F. NUTKINS.

Hayes, Middx.

## Record and Stylus Wear

I FEEL that Mr. Wood, in his article in the July issue, did not sufficiently bring out the main advantage of the cantilever pickup, namely, its ability to "iron out" the distortion due to pinch effect. I have myself recently constructed a pickup of this type with a moving-iron movement, and find that it is now possible to obtain excellent results from records which previously I considered virtually unplayable. Since many of these are of excellent musical quality it is satisfying to hear these performances unmarred by "pinchy" recording. Possibly this is the reason for the great vogue enjoyed by cantilever pickups in America.

My own experience as regards life of styli shows that a sapphire or ruby may be expected to play 150 sides in a 14-gm non-cantilever pickup, and 300 in a 7-gm cantilever pickup. This requires qualification, in that the records used were by no means all new; some, indeed, are still showing signs of the use of fibre needles in the "pre-sapphire era!" (It is significant that "fibre-wear" will, in the course of later playings with sapphires, gradually heal up, due to the burnishing action of the stylus.)

Using brand new discs only, these figures might be doubled; but most collectors have a large proportion of older discs, and the already-mentioned superiority of the cantilever types makes it probable that these will be played still more.

I also feel that Mr. Wood's curves, showing the deterioration of quality due to stylus wear, are misleading. The test discs used at present invariably start with the



Fortable Model B 65 (open)

Can you provide a public address system at a moment's notice? With a B65 it is simple—just place the equipment in a suitable position and switch on. Incorporated within an easily portable case are the amplifier complete with loudspeaker, rotary transformer, 6-volt unspillable accumulator and microphone with cable. Power output is approximately 5 watts. The equipment is a most useful outfit for political meetings, religious gatherings, auctioneers, etc., and numerous other applications where no electric supply mains are available.

Price complete £29 10 0

An external speaker can be attached if desired.

## PORTABLE BATTERY-MAINS AMPLIFIER, B 619

Operates on 12-volt battery or, by means of separate plug-in adaptor unit, on A.C. mains. Power output approximately 16 watts.

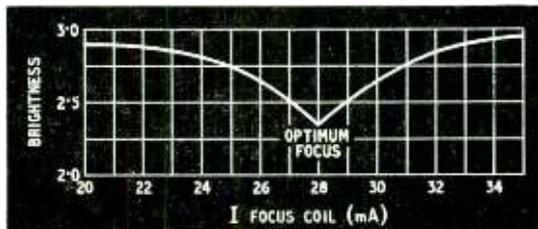
Full details of these models and others in the large Trix range of equipment available on request.

X  
 Meet us at  
**THE RADIO SHOW**  
 CASTLE BROMWICH  
 BIRMINGHAM Sept. 6-16  
 X

Send for latest catalogues and price list.

THE TRIX ELECTRICAL CO. LTD.  
 1-5 Maple Place, Tottenham Court Road,  
 London, W.1. Phone: Museum 5817  
 Grams & Cables: "Trixadio, Wesdo, London."

AMPLIFIERS · MICROPHONES · LOUDSPEAKERS



highest frequency on the outside rim (groove velocity 47 in/sec). This highest-frequency band is shown as falling off by some 2½ db at 10 kc/s after 2,000 sides at 7½ gm, and 5 db at 10 kc/s, at 14½ gm. However, at the inner rim the groove velocity may fall as low as 15½ in/sec, and one may therefore expect a loss of 2½ (or 5) db at 3,300 c/s and correspondingly more at higher frequencies. In actual fact, a falling off in clarity towards the end of a side is just about audible after 200 sides, and becomes troublesome after 300; although these figures only represent averages, the behaviour of sapphires being decidedly unpredictable. Unless a very high degree of magnification is available, wear is audible long before it becomes visible. S. C. HINE.

Harrow, Middx.

**Nomenclature**

FOR some considerable time now the words "capacitor" and "resistor" have been used to replace the original designations of "condenser" and "resistance." These designations I consider a great improvement. There is, however, another designation which I think is in need of alteration—"intermediate frequency." This should, in my opinion, be called "resultant frequency" or "resultant sub-frequency." It is not an intermediate frequency, but a sub- or lower-frequency created by the mixture of the signal frequency and the oscillator frequency.

Ormskirk, Lancs.

F. B. RUDD.

MAY I recommend to television manufacturers the discontinuance of the term "brightness control." "Brightness" on a knob tempts viewers to advance this control when contrast adjustment is actually needed.

The chief results are pictures which do a disservice to the television industry's future, and reduction of the life of the tube.

A change of name, plus improved instructions from some manufacturers on the use of their receiver controls, would go a long way to overcoming these troubles. Perhaps someone will complete the idea by suggesting a new word for the offending one.

W. P. ROWLEY.

East Molesey, Surrey.

**Reducing Television Interference**

THOSE who have to deal with complaints of interference radiated by the line time-base circuits of the modern television receiver might be interested to hear that some U.S.

radio manufacturers make a practice of coating the inside of the cabinets with graphite in order to reduce this effect.

The mixture employed is a dispersion of colloidal graphite in water or other volatile base which is easily brushed or sprayed on glass, bakelite, wood or rubber as required. There are several variations of the mixture available which will form a fairly low-resistance skin and act as an electrostatic screen. In cases where an "uncoated" tube is used, the outer surface of the flared part of the glass envelope should also be coated in order to complete the screening in the forward direction, i.e., from the front of the receiver. Contact is made between chassis and "screens" by means of strips of aluminium foil attached by gum prior to the application of the graphite.

From observations made during tests carried out on a typical receiver after the application of a coating of Acheson's colloidal graphite ("dag"), it should prove possible to reduce unwanted radiations by at least ten times (20db). In applying this remedy to a.c./d.c. receivers, care must be taken to restrict the coating to the internal parts of the cabinet in order to eliminate the possibility of leakage paths to the live chassis.

G. T. CLACK.

London, S.W.12.

**Pickup Design**

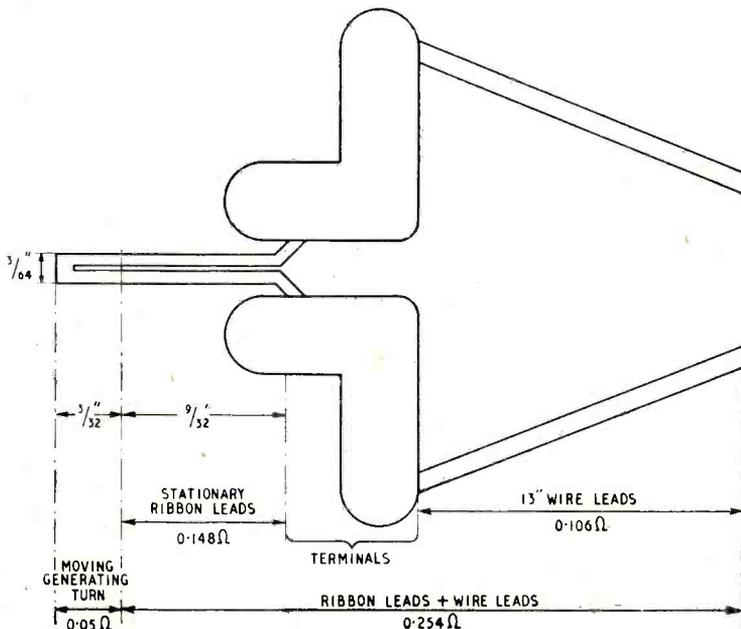
MY letter in your July issue mentioned the mass of the moving parts of the single-turn pickup

under consideration. A typing error converted the measured mass of 3.5 milligrams into the incorrect figure of 35 milligrams. I greatly regret the error, which many readers must have spotted, for it is widely known that single-turn pickups have been available for a considerable time where the moving parts have a mass of the order of 3 milligrams.

An objection has been made to my use of the word "new" to describe the pickup on which tests were made. The word was used to indicate that the pickup was in an unused condition. It was the latest model of which I had cognizance, and though I read the technical press thoroughly I have been unable to trace any announcement of a later model.

My statement regarding the proportions of resistance in a single generating turn and the leads has also been challenged. In confirmation of my statement I give a detailed drawing showing the relative resistance of the single generating turn, the remainder of the ribbon (ribbon leads), and the lead-out wires. The total resistance of the ribbon was measured as 0.198 ohm, the resistance of the moving part and the fixed part being calculated therefrom.

The drawing is approximately to scale, and it gives confirmation to my statement that the active signal-generating part of the ribbon is small compared with the rest of the loop formed by the remainder of the ribbon, the terminal connections and the leads running along the arm. This large non-signal-generating part of the loop is the main reason why



single-turn pickups tend to give higher hum/signal ratios than multi-turn generators. H. J. LEAK.

H. J. Leak and Company,  
London, W.3.

### American Insularity

I AM in entire agreement with Keith Henney (your July issue) that it is as a result of ignorance that the majority of American writers on technical subjects fail to give credit to foreign writers and inventors. In these circumstances, we must ask why this ignorance exists. The reason surely is that those writers who are aware of the facts do not all take the trouble to give credit, with the result that their readers are mis-informed, or not informed, as to the true situation. For example, Professor Maclaurin is in an exceptionally favourable position in that he writes from the Massachusetts Institute of Technology, whose library is obviously extremely well stocked and which, to my knowledge, contains many unpublished documents describing the work of foreign engineers. There is thus no excuse for his omission of this essential part of the story of the invention and development of ideas. Attention to details of this sort is a duty which an author must accept. The inclusion of these names is a courteous and pleasant way of acknowledging one's indebtedness to others both as an author and as one who has benefited by their work. It is interesting and instructive for the reader, and it rounds off a book which, without it, can cause much irritation to readers who know the true facts. O. S. PUCKLE.

Beaconsfield, Bucks.

### MANUFACTURERS' LITERATURE

Marine radar activities described in a review (No. 5) issued by Cossor Radar, Ltd., Highbury Grove, London, N.5.

High-vacuum pumps and allied equipment described in a "digest" catalogue from W. Edwards & Co., Worsley Bridge Road, London, S.E.26.

Ex-Government Equipment List No. 7 (price 6d) from Clydesdale Supply Company, 2, Bridge Street, Glasgow, C.5.

Process timers described in List 120/B from Londex, Ltd., 207, Anerley Road, London, S.E.20.

Laboratory equipment, including resistors, capacitors and inductors, bridges, oscillators, magslips and servo components are covered in the latest series of bulletins from Muirhead & Co., Beckenham, Kent.

Hospital Patient-call system; details of the equipment in a leaflet from Ardente Acoustic Laboratories Ltd., Guildford, Surrey.



At the 17th National Radio Exhibition at Castle Bromwich, Birmingham, there will be shown the full range of

## BULGIN

- ACCESSORIES
  - ADAPTORS
  - CONNECTORS
  - CROCODILE CLIPS
  - CHOKES
  - FUSES & FUSEHOLDERS
  - JACKS & PLUGS
  - KNOBES
  - LAMPHOLDERS
  - MAINS CONNECTORS & RESISTORS
  - PILOT LAMPHOLDERS
  - PLUGS & SOCKETS
  - POTENTIOMETERS
  - RESISTORS
  - SIGNAL LAMPS
  - SWITCHES
  - TERMINALS
  - TEST PRODS
  - VALVEHOLDERS, etc.
- together with entirely new products, including
- CONNECTORS
  - FUSEHOLDERS
  - KNOBES
  - MICRO SWITCHES
  - KEY SWITCHES
  - TOGGLE SWITCHES
  - ROTARY SWITCHES
  - SIGNAL-LAMP FLASHERS
  - TEST PRODS
  - etc. etc.

See all these new items at

**STAND 3**  
**No. 3**

**BULGIN**

**A. F. BULGIN & CO. LTD.**  
**BYE-PASS ROAD, BARKING**  
Telephone: R1Ppleway 3474 (5 lines)

# RANDOM RADIATIONS

By "DIALLIST"

## Preferred Valve Types

NO ONE COULD AGREE more heartily than I with the suggestion made by James Franklin in the correspondence columns of last month's *W.W.* that we should adopt a small number of preferred types for valves. The saving to manufacturers of resistors brought about by the general acceptance some time ago of preferred values must be enormous. Not so many years have gone by since one could readily buy resistors marked, or colour-coded, 40,000, 45,000, 50,000 and 55,000 ohms. Comparatively few purchasers realized that there was a  $\pm 10$  per cent tolerance in the values of standard grade resistors. But there was—and still is. Hence a resistor marked 45,000 ohms might have a true resistance of anything between 40,500 and 49,500 ohms; again, the genuine value of the resistor correctly marked 50,000 ohms could vary from 45,000 to 55,000 ohms. Except in certain precision circuits, such as those of the time-constant type, it does not greatly matter as a rule whether a resistor, specified by the designer as one of 50,000 ohms, has a real value as low as 50,000 - 10 per cent = 45,000 ohms or as high as 50,000 + 10 per cent = 55,000 ohms. Adopt a preferred value of 47,000 ohms and you assure the purchaser, if the tolerance is  $\pm 10$  per cent, that the true value lies between 42,300 and 51,700 ohms; with a  $\pm 5$  per cent tolerance it is between 44,650 and 49,350 ohms. The tolerances stipulated and accepted for valve characteristics are very much greater; it would seem, therefore, that the task of drawing up a short list of preferred valve types should not present any insuperable difficulties from this point of view.

## The Price Question

Everyone with whom I discuss the subject (not excluding some big noises in valve manufacturing concerns in their calmer and more human moments!) is of opinion that the prices of "replacement" valves are too high; replacement valves being those that the experimenter or constructor buys over the counter

for his work, and those bought in the same way by John Citizen to fill the gaps caused in his radio or television receiver by burn-outs, wear-outs or breakages. The style of both experimenter and would-be constructor is cramped. To my knowledge, the sales of radio receivers containing more than a modest number of valves—and still more so those of television sets necessarily sporting from 18 to 30—are restricted by the quite natural fear that some untoward happening involving his valves may land him in a position presenting two most disagreeable alternatives. Either he must spend on valve replacements an amount as great as, or even more than, the present value of his receiving apparatus, or he must be deprived of its services. One of the reasons given by valve manufacturers for the high prices charged for replacements is that they have to keep so many types on the market. The adoption of preferred types should help enormously here.

## A Golden Opportunity

If ever the radio industry is to adopt preferred valve types, the present affords a golden opportunity. We're told (and I've no doubt about it myself) that the miniature valve will rapidly supersede the old "bottle." There are comparatively few types of miniature now being made and one kind of base is suitable for all of them. Were the problem energetically tackled *now*, it should be possible to guard against any runaway increase in the types of miniature valves like that which has occurred to the disadvantage of everyone, in those of the now more familiar size and shape. A firm foundation could be laid by agreement on the part of radio manufacturers to use only the B7G base for miniatures for, say, the next five years. Nor should it be unduly difficult to work out a range of preferred characteristics for a.c., a.c./d.c. and battery valves. Curiously enough, one of the biggest difficulties might be to agree on the preferred battery types, for with the coming of the "all-dry" radio receiver and of the mains/battery set this kind of valve has gained

a new importance. The filament current has already been brought down to 50 mA and many of these valves will continue to function when the l.t. voltage has dropped to 1.1.

## The Set of the Future?

It wouldn't surprise me if the broadcast receiving set of the near future was normally a universal affair, based on miniature battery valves. I see it incorporating lightweight dry h.t. and l.t. accumulators of types yet to be developed. In my vision of things to come both batteries are served by a.c. and d.c. trickle-chargers, the appropriate one being brought into action when required by a 3-position switch, marked "a.c.," "d.c." and "off." When the user has no mains supply, but can get his accumulators charged, he will have duplicate batteries, both with "plug-in" connectors and easily removed from, or inserted into, the cabinet. Should there be no charging station available, he will run his receiver from dry batteries of the inert type. These are already well known. They live fully up to their name, for they are genuinely dry when purchased and remain chemically and electrically inactive until water is supplied to their cells. The set owner who has either a.c. or d.c. supplies available will use just the opposite of the present mains set procedure. He will switch *off* the mains supply when he wants to use his set and switch it *on* when the programme comes to an end. In other words, the h.t. and l.t. accumulators will take charge of the receiver when it is in use and the a.c. or d.c. mains will take charge of the accumulators when it isn't. Fantastic? I don't think so. Remember, I'm thinking only of the domestic broadcast radio receiver. In the small living room of to-day—and probably to-morrow—no great output is required from the loud-speaker. The latter is, from one point of view, a most inefficient instrument, with a very low input/output ratio. Nor, again, does the compact, lightweight "dry" accumulator exist to-day. But I firmly believe that both the efficient loudspeaker and the small, light secondary battery with its electrolyte in semi-solid form are not too far away. Could these things be realized, as I am sure that they will one day, one single range of radio valves would fulfil the needs of the great majority of broadcast listeners.

# Wireless World

DELAY IN PUBLICATION

The main body of this issue of "Wireless World" went to press before the recent printing trade dispute reached an acute stage. We apologize to readers for the long delay in publication, and also for the fact that certain matters referred to are no longer current. On this and the succeeding three pages we have endeavoured to bring the issue up to date by giving information on more recent events.

## Restoring Airmet

At a conference convened in October by the Royal Meteorological Society, strong demands were made by spokesmen of many diverse interests for early restoration of the Airmet weather broadcasts. As readers will remember, the 245-kc/s channel on which these detailed and frequent bulletins and forecasts were transmitted was allocated under the Copenhagen Plan for other purposes, and the transmissions stopped abruptly last March.

It was agreed at the conference to present a petition to the Government, and this is being organized by the Society's journal *Weather* (49, Cromwell Road, London, S.W.7) from where copies of the petition form can be obtained.

*Wireless World's* pleas for restoration of the service have been well supported by readers, but the official attitude is that no channel is available. There also seems to be the further difficulty that the respon-

sibility for the service cannot be definitely allocated to any particular Ministry or department; in fact, the service benefits nearly all of us, and not mainly air navigators, for whom it was originally mainly intended.

That being so, *Wireless World* contends that the responsibility for distributing Airmet should be passed to the B.B.C. Space for it could be found in the channels allocated to the Third Programme, which, until they were annexed quite recently for overseas propaganda broadcasting, were idle until 6 p.m. The amount of time and ether space given to propaganda seems to us to have become quite disproportionate. It is not generally realized that one of our two exclusive medium-wave channels is used entirely for propagating the British way of life overseas—instead of improving the British way of life at home.

## CURRENT TOPICS

### A.M./F.M. Tests

In the September issue we appealed editorially for a regular schedule of a.m./f.m. transmissions from the experimental v.h.f. station at Wrotham "if only to allow receiver designers to conduct large-scale field tests," and we are now glad to be able to give some details of the transmissions.

The two transmitters are radiating the same programme simultaneously. The 25-kW f.m. transmitter is at present tuned to 91.4 Mc/s and the 18-kW a.m. station to 93.8 Mc/s. The outputs are fed into a horizontally polarized omni-directional slotted aerial. It is understood that the main object of the tests is not so much to prove that one method of modulation is better than the other, but rather to ascertain whether e.h.f. broadcasting is a practical possibility.

At present the transmissions are being broadcast from Monday to Friday from 11 a.m. to 4.30 p.m. with an hour's interval at noon, and each week-day from 6.0 p.m. until the close of the programme—either the Home or Third—being radiated.

### U.S. Colour Television

FOR months past the American Federal Communications Commission has been considering the claims of various methods of colour television in the course of an investigation into the allocation of frequencies in the 475 to 890-Mc/s band to television

stations. It will be recalled that there has been a television "freeze" in the U.S. since September, 1948, stopping the licensing of new stations until the whole question of frequency allocation—at present limited to the 12 channels between 54 and 216 Mc/s—had been thrashed out. On 1st September the F.C.C. issued a report on colour television, giving its approval to the frame-sequential system developed by the Columbia Broadcasting System and regular transmission will begin on 20th November.

In the C.B.S. system the colours are changed after each vertical scanning period. There are 144 frames per second and, as in black-and-white, 2 to 1 interlacing is employed. The number of lines per picture is 405, or 202.5 per frame (262.5 in black-and-white). Thus, the total number of lines per second, or horizontal line frequency, is  $72 \times 405 = 29,160$  c/s.

Each colour—red, blue, and green—lasts for  $1/144$ th of a second, and the colour sequence repeats itself after  $1/48$ th of a second. This period is called a three-colour frame interval. Since only one-half the number of lines will have been scanned in all colours in  $1/48$ th of a second, twice this period, or  $1/24$ th of a second, is required for all lines to be scanned in all colours. This period of  $1/24$ th of a second is called a colour picture interval.

The C.B.S. frame-sequential system is the only one of the colour systems so far demonstrated which can utilize electronic or mechanical means for colour selection. The simplest and least expensive method

is the use of a colour disc. The disc rotates in front of the receiver tube at the rate of 1,440 r.p.m. When six colour filters are employed, two sets of red, blue, and green filters are used. In addition to the tube size, the shape of the filters determines the size of the colour disc.

The colour transmission process works as follows: At the camera, which is more or less of conventional design, a single image is produced by means of a lens on the light-sensitive surface of the pickup tube. A colour filter disc, fully enclosed, rotates in front of this pickup tube and contains a series of colour filters in the order of red, blue and green. If the camera disc has 12 filters (4 red, 4 green and 4 blue), the disc rotates at 720 r.p.m.

C.B.S. has developed a series of devices, among which is an attachment permitting the viewing in black-and-white on a colour receiver of both tricolour and monochrome transmissions. A convertor is also available for use with monochrome receivers permitting the reception of transmissions in colour. This colour convertor slides on tracks and when pushed aside, monochrome transmissions can be received.

It will be recalled that the colour system developed by Pye at Cambridge is based on the C.B.S. system.

### Amateur Exhibition

THE fourth annual amateur radio exhibition to be organized by the Radio Society of Great Britain will be held at the Royal Hotel, Woburn Place, London, W.C.1, from November 22nd to 25th.

Among the exhibitors are: Air Ministry, Avo, Berry's, C. H. Davis, Decca, Easibind, E.M.I., G.E.C., G.S.V. Marine and Commercial, Imhof, Oliver Pell Control, Philpotts Metalworks, Post Office, Q-Max, Salford Electrical Instruments, Sangamo-Weston, *Short Wave Magazine*, *Short Wave News*, Taylor Electrical Instruments, Westinghouse, Woden, *Wireless World* and *Wireless Engineer*.

The exhibition will be opened at 2.30 on the first day and at 11 a.m. on subsequent days. It will close daily at 9 p.m. Admission to the show, which will be opened by Hugh S. Pocock, will be by catalogue price 1s.

### Records: E.M.I. Policy

IN a letter to gramophone traders, E.M.I. Sales and Service, who issue H.M.V., Columbia, M.G.M., Parlophone and Regal-Zonophone records, state that until further notice they will continue to supply standard (78 r.p.m.) records only. They affirm their belief in the principle of a universal single turntable speed and state that if for any reason they consider that records should be played at any speed other than the present standard of 78 r.p.m., record dealers will be given a minimum of six months' notice of their intention to introduce such records.

### Amateur Television

WHEN asked in the House of Commons why he would not permit amateurs to transmit television as is done in the U.S.A. and the Netherlands, the Postmaster General announced that the question had again been reviewed and that arrangements were being made for licences to be issued.

The bands to be used will be 2,300-2,450, 5,650-5,850 and 10,000-10,500 Mc/s and special licences will be issued as soon as the detailed conditions have been worked out.

### OBITUARY

Sir Frank Gill, K.C.M.G., O.B.E., died on October 25th, at the age of 84, whilst attending meetings of the

International Telephone Consultative Committee (C.C.I.F.) in Geneva. At the time of his death he was chairman of Standard Telephones & Cables, the International Marine Radio Co., and Standard Telecommunication Laboratories. He was a past president of the I.E.E.

W. H. Peters, O.B.E., M.I.E.E., Assistant General Manager of the G.E.C.'s Coventry group of works, died recently at the age of 52. He joined the Company's Research Laboratories in 1925. In 1930 he was appointed Chief Engineer of the Radio Group at Coventry, and nine years later he became Manager of the Radio and Television Works. He had been Assistant General Manager of the Coventry group, in charge of its radio activities, since 1943.

### IN BRIEF

**Licence Figures.**—As is to be expected during the summer months when viewing and listening are not so popular, the increase during August in the number of receiving licences—both sound and vision—current in the U.K. was only 9,050. In September the increase was 35,550. The total at the end of the third quarter was 12,305,200. The quarter's increase in television licences was 64,200, bringing the total to 470,800.

**British Television in Berlin.**—Eight British television manufacturers—Bush, Cossor, Ekco, G.E.C., Marconiphone, Murphy, Pye, and Ultra—demonstrated receivers during the Industrial Fair in Berlin in October. The studio equipment, cameras and transmitters, which operated on a closed circuit, were supplied by Pye.

**"Engineers in the B.B.C."**—A booklet with this title, describing what the Engineering Division of the B.B.C. is doing, the types of men it wants and its conditions of service, has been prepared by the Corporation for distribution to Universities and Training Colleges as a guide to graduates and undergraduates contemplating careers as engineers.

**Decimetric Communication.**—Two-way telephony communication on 1250 Mc/s over a distance of 75 miles for approximately one hour was achieved by two British amateurs—R. Tunney, G8DD, at Worcester Beacon, nr. Great Malvern, and C. Edlin, G3QC, at Merryton Low, nr. Leek, Staffs.

**Twenty-week Courses** of lectures on electro-acoustics and pulse techniques are being held on Monday and Thursday evenings, respectively, at the Technical College, Beaconsfield Road, Southall, Middlesex. Applications for enrolment should be made immediately to the Secretary (Tel.: Southall 3448). The fee for each course is £1.

### BUSINESS NOTES

**Exporting Television Kits.**—An enquiry has been received from the Anglo-Netherland Technical Exchange, Ltd. (Antex) of 3, Tower Hill, London, E.C.3, for kits of parts for television receivers operating on 625-lines for use on the Continent.

**Television Repeaters.**—The G.E.C. is providing the four amplifiers—one working in each direction of transmission and a stand-by for each direction—required for each of the nineteen repeaters to be employed in the television cable link between Birmingham and Holme Moss. They have a gain of 52db at 4.4 Mc/s—the upper limit of the specified frequency coverage.

**Concert Hall S.R.E.**—Standard Telephones & Cables have been awarded the contract for installing the sound reproducing equipment in the Royal Festival Hall on the South Bank of the Thames. The installation, which covers the main auditorium, smaller hall and ancillary rooms, includes hearing-aid outlets fitted into the arms of seats in the main hall.

**Australian Agency** for magnetic-tape recorders and

inter-office communication equipment is required by Austral Impex to whom particulars should be sent direct. Their address is G.P.O. Box 5067, Sydney, N.S.W., Australia.

## MEETINGS

### Institution of Electrical Engineers

**Radio Section.**—Informal lecture on "The Nervous System as a Communication Network," by J. A. V. Bates, M.A., M.B., at 5.30 p.m. on November 20th.

Symposium of Papers on "Radiation Monitoring Apparatus," at 3.30 and 5.30 p.m. on November 28th.

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

**Cambridge Radio Group.**—"Frequency-Modulated Broadcasting," by W. P. Wilson, C.B.E., M.Sc.(Eng.), on November 27th (Joint Meeting with Cambridge University Wireless Society).

**North-Eastern Radio Group.**—"A New Precision A.C. Voltage Stabilizer," by G. N. Patchett, B.Sc., Ph.D., at 6.15 p.m. on November 20th at King's College, Newcastle-on-Tyne.

**North-Western Radio Group.**—"Crystal Diodes," by R. W. Douglas, B.Sc., and E. G. James, Ph.D., and "Crystal Triodes," by T. R. Scott, B.Sc., at 6.30 p.m.

on November 29th at the Engineers' Club, Albert Square, Manchester.

### Television Society

"Feedback Methods of Scan Linearization," by A. W. Keen (E.M.I.), at 7 p.m. on November 24th at the Cinema Exhibitors' Association, 164, Shaftesbury Avenue, London, W.C.2.

### British Sound Recording Association

"Some Features of Amplifier Design for Recording Equipment," by H. D. McD. Ellis, M.A., M.I.E.E., at 7 p.m. on November 24th at the Royal Society of Arts, John Adam Street, London, W.C.2.

### British Institution of Radio Engineers

**London Section.**—"Ultrasonic Generators for High Powers," by B. E. Noltingk, Ph.D., at 6.30 p.m. on November 20th at the London School of Hygiene and Tropical Medicine, Gower Street, W.C.1.

**West Midlands Section.**—Discussion on "The Quality of Electrical Reproduction and its Effect on Receiver Design," at 7 p.m. on November 22nd at the Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton.

### Radio Society of Great Britain

"Electronic Computing," by F. Aughtie, D.Sc., A.M.I.E.E., at 6.30 p.m. on November 17th at the I.E.E., Savoy Place, London, W.C.2.

# SHORT-WAVE CONDITIONS

## September in Retrospect : Forecast for November

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

THE average maximum usable frequencies for these latitudes during September decreased slightly during the daytime, and decreased considerably during the night. The latter was in accordance with the normal seasonal trend, but the daytime variation was the opposite of what would have been expected. It was probably due to the exceptional amount of ionospheric storminess which occurred during the month.

Daytime working frequencies for long-distance communication were rather low, the 28-Mc/s amateur band, for example, being seldom usable. Frequencies of the order of 21-24 Mc/s were about the highest generally usable during the day, and of the order of 10 Mc/s during the night.

There was a very considerable decrease in the rate of incidence of Sporadic E, and not much communication on high frequencies occurred by way of this medium.

Sunspot activity was, on the average, very much lower than during the previous month, and was, in fact, at its lowest level since 1946.

Some severe and prolonged ionospheric storms occurred during the month, the most disturbed periods being 3rd-12th, 18th-21st, 25th-28th and 30th. Only one Dellinger fade-out was reported; at 1715 on 19th.

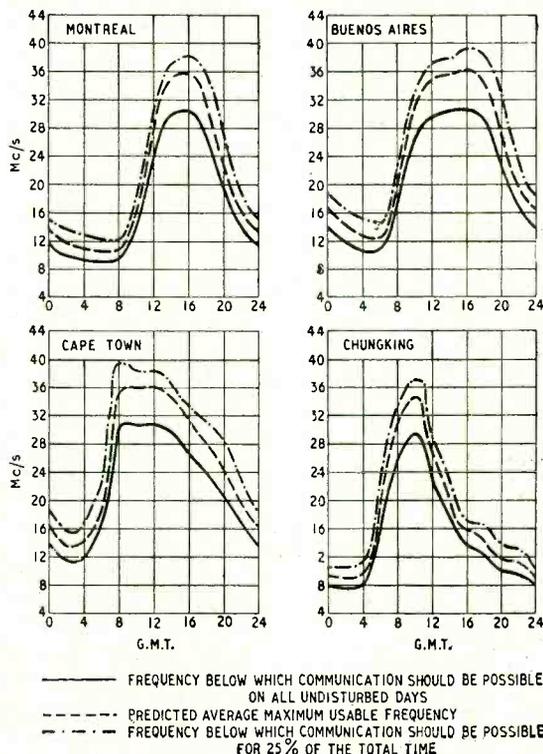
**Forecast.**—During November daytime m.u.f.s should continue to increase, and, perhaps, will reach their highest values for the present winter season. Night-time m.u.f.s should continue to decrease.

Long-distance working frequencies should therefore be high by day, and frequencies as high as 28 Mc/s should be regularly usable over most circuits at the appropriate times of day. At night frequencies as low as 7 Mc/s will almost certainly be necessary in order to maintain communication over certain long-distance circuits.

Sporadic E is unlikely to be very prevalent, and, therefore, medium-distance communication on very high frequencies is unlikely to occur. It is likely that there may be some decrease in ionospheric storminess, though

those storms which do occur are likely to be trouble some, particularly at night.

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



# Projection *versus* Direct-viewing Television

## *I.E.E. Discussion on Which is Better in the Home*

**A**T the I.E.E. on October 30th, an informal discussion on the above subject was opened by W. T. Cocking, who gave a short introductory talk to bring forward some of the relevant points at issue. The first, which occupied the meeting for a large proportion of the time, was the question of desirable picture size. Many speakers were of the opinion that we need bigger pictures than are at present given by the average television receiver, and it was suggested at the outset by a representative of the B.B.C. that the most suitable size would be about 20in by 15in. At the usual home-viewing distance of about 8ft this would subtend a viewing angle of  $10^\circ$ , corresponding to a back seat at the average cinema, and would be such that the line structure on 405-line definition would be not quite discernible. One argument put forward for this order of size by an advocate of projection television was that television producers would not be so limited to close-up shots as they are at present. Other speakers thought that the large picture was more restful to the eyes, which had freedom to move about over it, but this opinion was disputed by two supporters of direct-viewing. One of them said that because the maximum acuity of the eye existed over a very small angle, parts of the large picture could only be seen out of the corner of the eye, where vision was poor. The other speaker thought that a big picture caused eyestrain because, with the present definition, the eyes were continually trying to focus on to details which seemed to be there but actually were not.

### Viewing Distance

Apart from this, the question of size did not provoke a very sharp division of opinion, since both sides were more or less agreed on the desirability of big pictures. There was, however, some argument on the relative merits of projection and direct-viewing tubes for producing these big pictures. The opinion was expressed, for instance, that really large direct-viewing tubes could not possibly be mass-produced at low prices, and so installation and replacement costs would be too high. Moreover, although there were no official figures on the lives of projection tubes—nor on direct-viewing tubes, for that matter—there was no evidence to show that they had shorter lives. In reply to this, it was stated that manufacturers are hoping to produce 20in tubes at lower prices within a few years, and that, although projection tubes were certainly small, they could not be produced cheaply because of the large amount of precision work involved.

Several speakers referred to the use of front projection on to reflecting screens to obtain even larger pictures, but it was pointed out that the optical focus would be upset by any alteration in the position of the screen and such a system would always necessitate a darkened room.

On the subject of optimum viewing distance, several speakers agreed that this had less to do with the size of the picture than was generally thought. A representative of the B.B.C. said it was

the absolute size of the picture that was important subjectively, not its apparent size due to different viewing distances. Mr. Cocking had stated that the optimum viewing distance for a projection picture 14in wide was about 10ft, and had suggested that for this reason the public might be disappointed with projection television in the home where the convenient viewing distance was limited to about 6 or 8ft. Commenting on this, a speaker thought that figures for optimum distance could not be relied upon, as he found that it was a matter of personal preference and different people selected different distances. This opinion was supported by several others, who quoted various distances, ranging from 3ft to 9ft, taken up by people when viewing. In reply, Mr. Cocking stressed that his figure of 10ft was obtained from tests in a room without chairs, so that people were not influenced in any way by the existing seating arrangements.

### Picture Quality

Dealing with comments on comparative picture quality, a speaker said that the rough matt appearance of some projection pictures was due to the screen being too thick or having lenticular rulings which were too coarse. The fact that the line structure of the raster could not be seen was criticized by engineers. Other supporters of projection pointed out that although the high-light brightness of projection was lower than that of direct-viewing tubes, projection television gave a better contrast ratio in a lighted room because of the directional effect of the viewing screen. This resulted in a viewing angle of about  $20^\circ$  vertical and  $60^\circ$  horizontal, and light originating outside these angles had negligible effect on the picture. The use of a tinted screen on the direct-viewing tube did not, however, balance this advantage because of specular reflections from the polished surface of the screen.

Several speakers were of the opinion that although the directivity of projection television was a help towards good brightness, more could be done by improving the optical system, which was stated to be only 4 or 5 per cent efficient at the moment. In response to Mr. Cocking's suggestion that saturation effects in the fluorescent screen were perhaps responsible for limiting brightness, those supporting projection television stated that saturation effects were small, whilst the opinion of those on the other side was that saturation was important. A further speaker added that it was difficult to measure saturation anyway. It was agreed that saturation effects could be reduced by using a bigger projection tube, for this would decrease the brightness per unit area required on the tube face; this was not recommended, however, because it would increase the size of the optical system and so its cost.

Reference was made to spot wobbling as a means of obscuring the lines so that large pictures could be closely viewed, although it was pointed out that this did not help with the horizontal resolution in any way.

The **AVO** ELECTRONIC TESTMETER

An instrument of laboratory sensitivity built in a robust and portable form, for use in conjunction with electronic and other apparatus where it is imperative that the instrument should present a negligible loading factor upon the circuit under test.

The instrument consists basically of a balanced bridge valve voltmeter. It incorporates many unique features and a wide set of ranges, so that in operation it is as simple to use as a normal multi-range testmeter. Gives 56 ranges of readings:

- D.C. Volts: 2.5 mV. to 250v. Input Resistance 11 megohms. 25 mV. to 10,000v. Input Resistance 110 megohms.
- D.C. Current: 0.25  $\mu$ A. to 1 amp. 250 mV. drop on all ranges.
- A.C. Volts: 0.1 v. to 2,500v. R.M.S. up to 2 Mc/s. With diode probe external 0.1v. to 250v. R.M.S. Useful measurements can be made up to 200 Mc/s., the applied voltage being limited to 100v. above 50 Mc/s.
- A.C. Output Power: 5 mW. to 5 watts in six different load resistances from 5 to 5,000 ohms.
- Decibels: -10Db. to +20 Db. Zero level 50 mW.
- Capacitance: .0001  $\mu$ F. to 50  $\mu$ F.
- Resistance: 0.2 ohm to 10 meg-ohms.
- Insulation: 0.1 megohm to 1,000 megohms.

The thermionic circuit gives delicate galvanometer sensitivity to a robust moving-coil movement, which it is almost impossible to damage by overload. The instrument is quickly set up for any of the various tests to be undertaken, a single range selector switch automatically removing from the circuit any voltages and controls not required for the test in question.

**£35** Size: 12 $\frac{1}{2}$ " x 9" x 5 $\frac{1}{2}$ " The instrument operates on A.C. mains, 100 - 130V. and 200 - 260V. 50 - 60 c/s

Weight: 12 $\frac{1}{2}$  lbs. Fully descriptive pamphlet available on application.

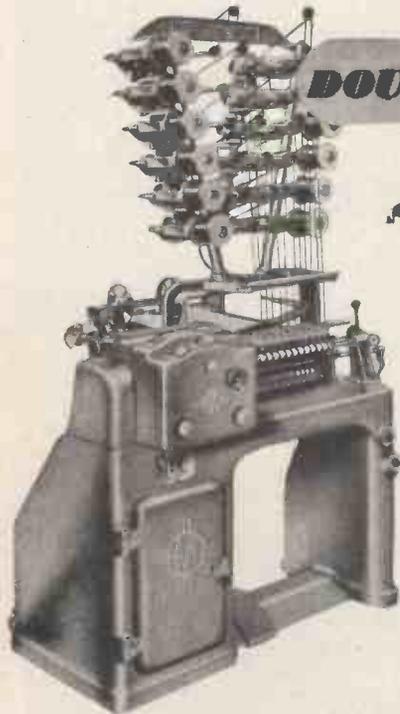


The new "AVO" VALVE DATA MANUAL is supplied free with this instrument. It is the most comprehensive quick-reference valve data book ever produced. Copies may be purchased separately, 15/-, post free.

See 'AVO' Instruments  
at  
**THE RADIO SHOW**  
Stand No. 26

**DOUGLAS AND MACADIE**

*Automatic*  
**COIL WINDERS**



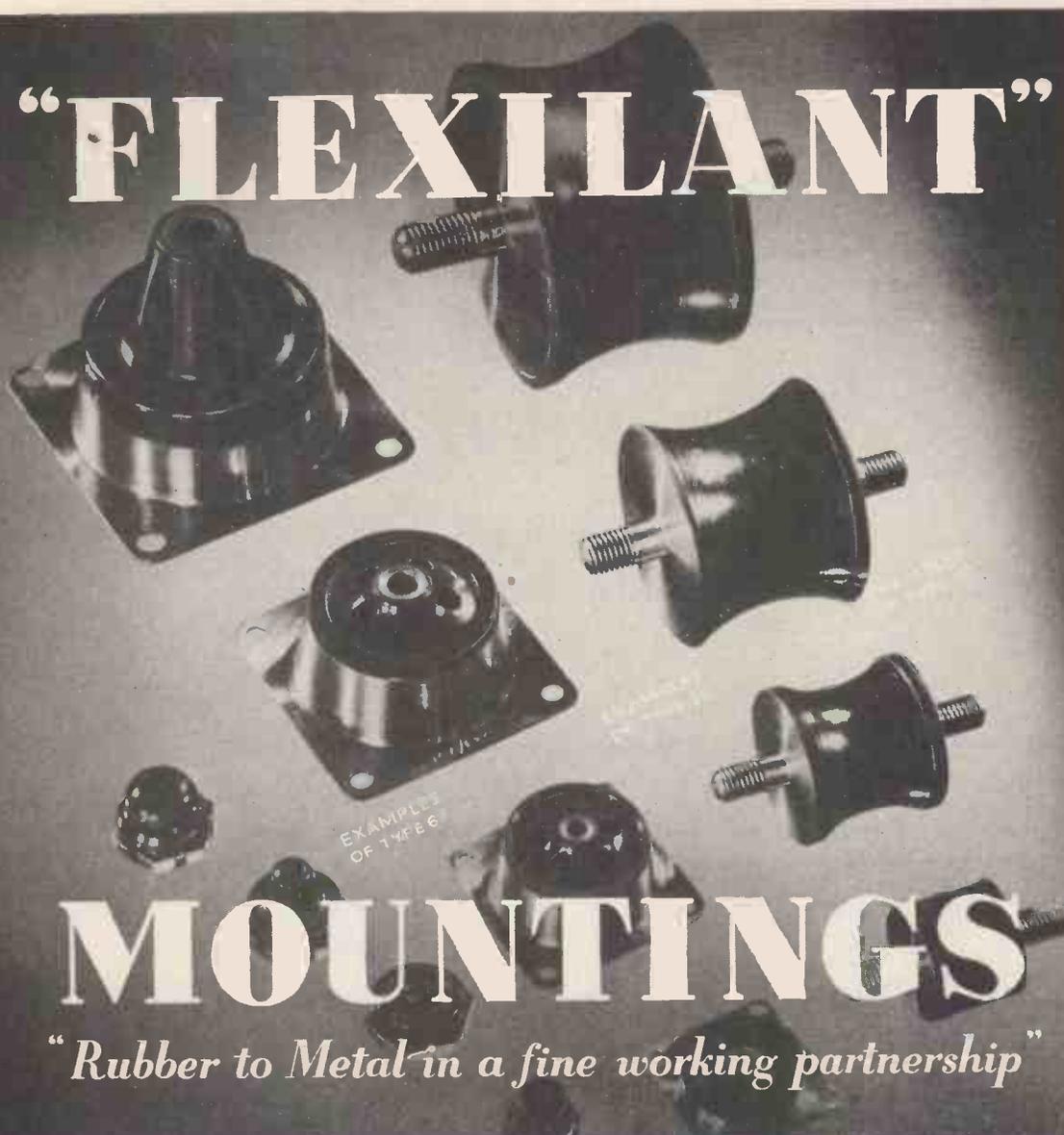
THE illustration depicts the improved "Douglas" Fully Automatic Multi-Winder, specially developed for the high-speed production of large quantities of coils with or without paper interleaving. It will produce round, square or rectangular coils up to 6in. each in length and up to 4 $\frac{1}{2}$ in. diameter. As many as 12 smaller coils can be wound simultaneously within the total available winding length of 12in. at headstock speeds of between 600 and 2,000 r.p.m.

Twenty-two different Coil Winders and Taping Machines are illustrated in our Catalogue, a copy of which will be sent to interested executives on application.

Sole Proprietors and Manufacturers:

**The AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.**  
WINDER HOUSE · DOUGLAS STREET · LONDON · S.W.1 Telephone: VICTORIA 3404/9

# "FLEXILANT"



# MOUNTINGS

*"Rubber to Metal in a fine working partnership"*

This group from our range of "FLEXILANT" general-purpose light, and instrument, mountings is backed by the good service manufacturers expect from us.

We investigate all mounting problems. May we investigate yours?

**TYPE No. 10.** Bonded Rubber Bobbins for Mountings and Couplings for use in compression and shear.

**TYPE No. 38.** Light instrument mounting.

**TYPE No. 67.** Tumbler Switch Seals.



## RUBBER BONDERS LIMITED

IN ASSOCIATION WITH EMPIRE RUBBER COMPANY  
(PROPRIETORS H.G. MILES LTD.)

## DUNSTABLE, BEDS.

# Capacitors for TELEVISION



Throughout our long association with the radio industry quality has always been the basis of Dubilier technical supremacy. This factor has also confirmed Dubilier's lead in the international Television field as it is obvious that only capacitors of tested quality and worth will satisfy designers in Television Engineering.

Experience has proved that Dubilier Capacitors, acknowledged by technicians throughout the world for their performance and reliability are best suited to manufacturers of Television apparatus.

*Comprehensive catalogues giving detailed information of capacitors and technical service are available upon request.*

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, N. ACTON, LONDON, W.3  
 'Phone: Acorn 2241 (5 lines). 'Grams: Hivoltcon, Wesphone, London.

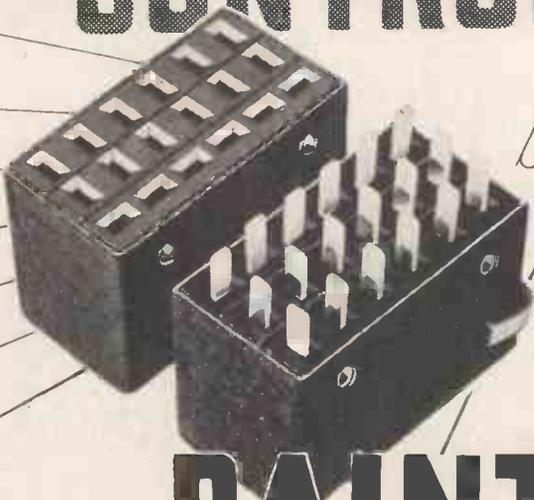
Cables: Hivoltcon, London. Marconi International Code.

# DUBILIER

CONDENSER CO. (1925) LTD.

- TYPE APPROVED COMPONENT.
- AVAILABLE IN TYPES FROM 2 TO 33 WAYS.
- CADMIUM PLATED BRACKETS AND CABLE CLAMPS.
- BERYLLIUM COPPER (SILVER PLATED) CONTACTS.
- PAPER LAMINATED RESIN BONDED INSULATORS.
- HIGH QUALITY DURABLE CRACKLE FINISH.
- SOLID DRAWN BRASS CASES.

# CONTROL



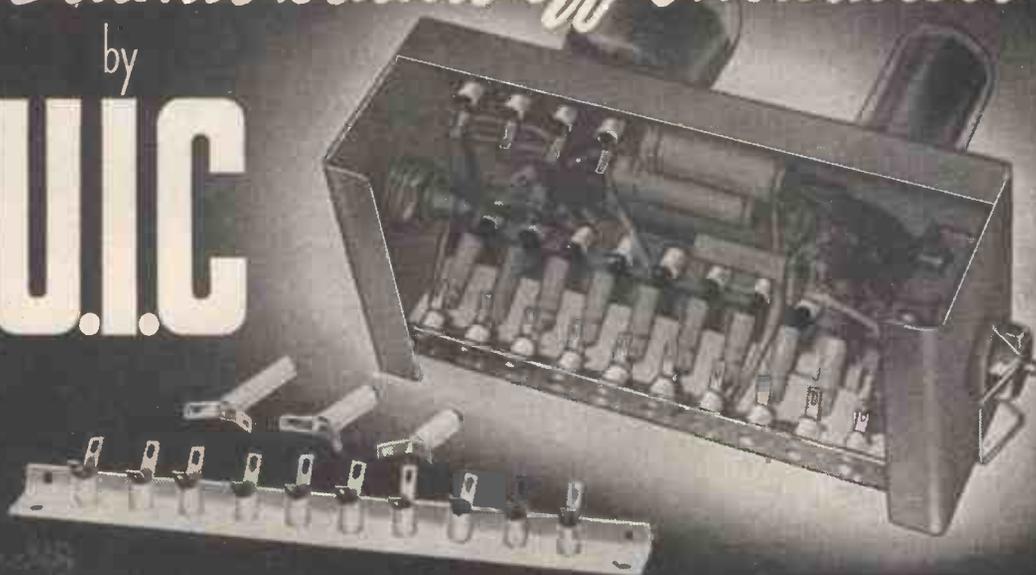
# PAINTON

PAINTON & CO LTD · KINGSTHORPE · NORTHAMPTON · PHONE 2820

## *Ceramic stand-off Insulators*

by

# UIC



UNITED INSULATOR CO. LTD. OAKCROFT RD. TOLWORTH · SURBITON · SURREY  
TELEPHONE: ELMBRIDGE 5241 CABLES: CALANEL, SURBITON

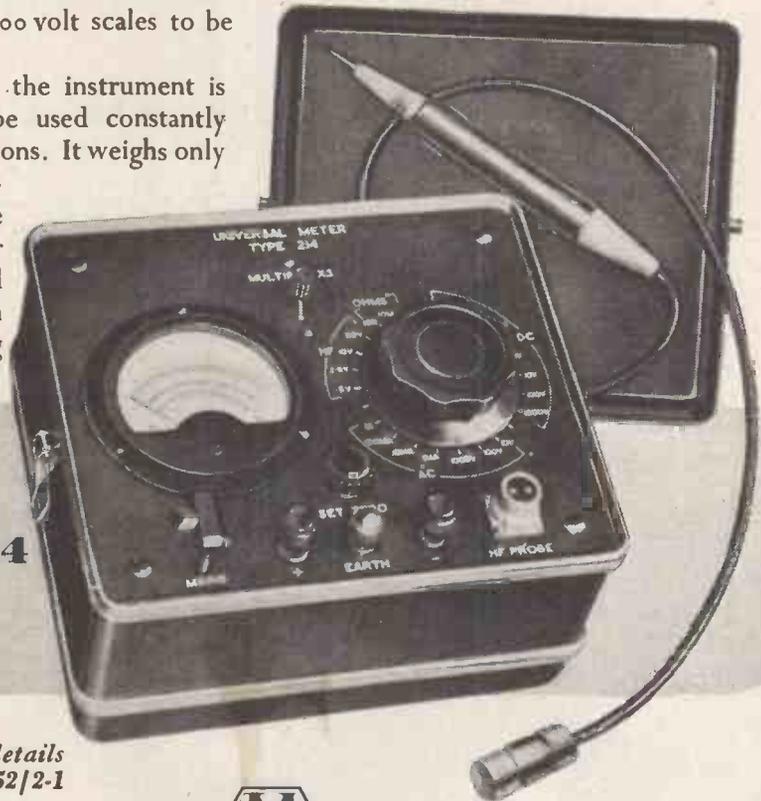
# An entirely new development...

## 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



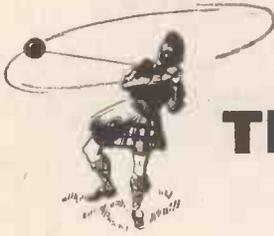
**METROPOLITAN-VICKERS ELECTRICAL CO. LTD.**

TRAFFORD PARK, MANCHESTER 17

*A member of the A.E.I. group of Companies.*

**METROVICK**

*Pioneers in radio & electronic equipment.*



## TRIAL OF STRENGTH

To try the output strength of a small or mobile transmitter at any time and at a moment's notice, all you need is the Marconi TRANSMITTER OUTPUT METER, type TF 912. Covering the frequency range 80-160 Mc/s, it is battery-operated, self-contained and portable. The scale expansion of the meter is such that low power transmitters can be checked at an open part of the scale. The basic design feature is a bolometer bridge with moving coil indicator employing a 75 ohm resistively terminated input line of novel character. Further details are freely available.

Please ask for folder SUMMARY OF COMMUNICATIONS TEST GEAR



**TRANSMITTER  
OUTPUT METER**  
Type TF 912

## Marconi Instruments Limited

ST. ALBANS, HERTFORDSHIRE · Telephone: St. Albans 6161/5

Northern Office: 30 Albion Street, Hull. Western Office: 76 Portview Road, Avonmouth. Southern Office and Showrooms: 109 Eaton Square, London, S.W.1. Midland Office: 19 The Parade, Leamington Spa



THE RADIO TELEPHONE YOU  
CAN TUCK UNDER THE DASH



**NOTE THESE  
FEATURES**

Size T/R 11 in. x 8 in. x 4 in. (30 cm. x 21 cm. x 10 cm.)  
Power Pack 8 in. x 5 in. x 3 in. (21 cm. x 14 cm. x 8 cm.)  
Weight T/R 15½ lbs. (7kg.), Power Pack 9½ lbs. (4.2kg.)

The Transceiver is easily installed below the instrument panel with the small power pack in any convenient place. The remarkably low battery drain permits connection of the set to the car batteries, obviating the cost and weight of auxiliary accumulators or larger dynamo

## B.C.C. V.H.F. RADIO TELEPHONE EQUIPMENT

The B.C.C. Mobile Radio-Telephone illustrated here will give two-way communication with the Fixed Station up to a distance of 25 miles or with the portable Pack-set up to 5 miles.

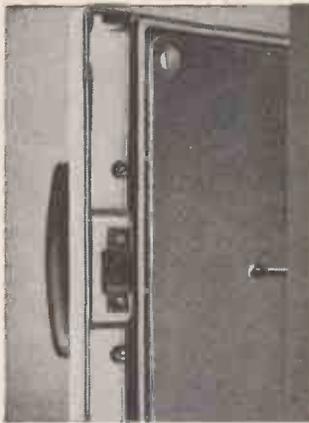
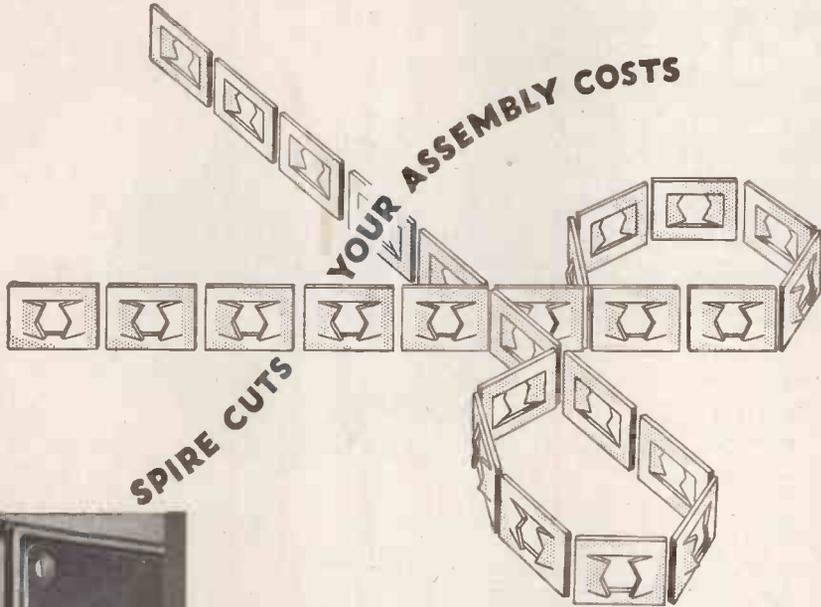
This B.C.C. equipment sets a new standard in V.H.F. Communications Technique and has been approved by the G.P.O. The complete range consists of:

Fixed Stations ... Models L111 & H111  
Mobiles ... Models L67 & H67  
Pack Sets ... Models L45V & H45V  
Hand Portables ... Models L45AV & H45AV

This equipment can be supplied to cover any spot frequency in the 75-100 Mc/s or 150-185 Mc/s bands.

All enquiries to:—  
**MARCONI'S WIRELESS  
TELEGRAPH Co. Ltd.,**  
Chelmsford, Essex.





**PROBLEM:**

To close cooker door securely on main body, and ensure that it can be opened and shut in the fastest and easiest way.

**SOLUTION:**

Spire Spring Latch Type SRV and ball stud. Just a direct pull frees the ball stud.

**THAT'S FIXED THAT—FASTER, CHEAPER, BETTER**

Here's another cost saver. SRV type Spire Speed Clips afford a simple spring latch for removable assemblies such as doors on refrigerators, cookers, cabinets, inspection covers, etc. Spire fasteners — "the fastest thing in fastenings" — are saving assembly time and cost on thousands of jobs. Why don't you find out what they can do for you? Write direct to us.

**Spire** Regd. **SPEED NUTS**

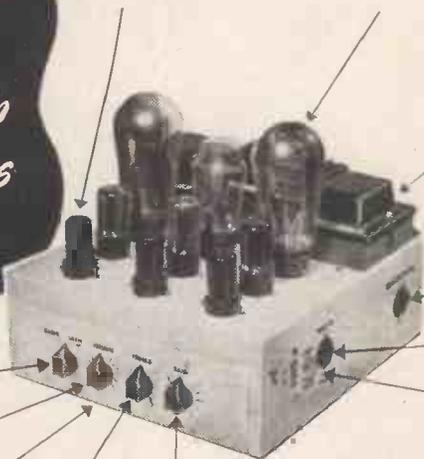
Enquiries to:  
**SIMMONDS AEROCESSORIES LTD., BYRON HOUSE, 7-8-9 ST. JAMES'S ST., LONDON. S.W.1**  
 HEAD OFFICE AND WORKS: TREForest, GLAMORGAN.  
 ALSO BIRMINGHAM, STOCKHOLM AND MELBOURNE.

**"THE CONCERT MASTER"**  
*The Amplifier with all the plus features*  
**£29.10.0**

**DISTORTION** 1/20th of 1% overall including Tone Control stages and pre-amplifier.

**TRIODE VALVES** throughout for stability and low distortion,

**FREQUENCY RANGE EXTENDED TO 20 to 30,000 c.p.s.**



Finished in Dimenso, a new rustproof finish that will last a lifetime.

A full two years' guarantee.

3,7, 15 ohms output.

Feeder Socket provides L.T. and H.T.

**MATCHING SWITCH** for low or high output pick-ups.

FOR STANDARD AND LONG PLAYING RECORDS

**MICROPHONE,** Radio, Gram Selector

**SPECIAL LOW NOISE** Volume Control.

**EXCLUSIVE** — Detachable Control Head, has 3' cable and contains no valves —all the valves are on the chassis.

**TREBLE CONTROL** cut, linear or boost positions.

**BASS CONTROL** deeper & smoother than ever before.

WRITE for 20-page Catalogue of Amplifiers, Tuning Units and other interesting items TO-DAY.

Phone: WESTERN 3350.

*Charles*  
**AMPLIFIERS**  
 SALES LTD.

181 KENSINGTON HIGH STREET, LONDON, W.8

*Difficult Problems?*



Made in Three Principal Materials

**FREQUELEX**

An insulating material of Low Di-electric Loss, for Coil Formers, Aerial Insulators, Valve Holders, etc.

**PERMALEX**

A High Permittivity Material. For the construction of Condensers of the smallest possible dimensions.

**TEMPLEX**

A Condenser material of medium permittivity. For the construction of Condensers having a constant capacity at all temperatures.



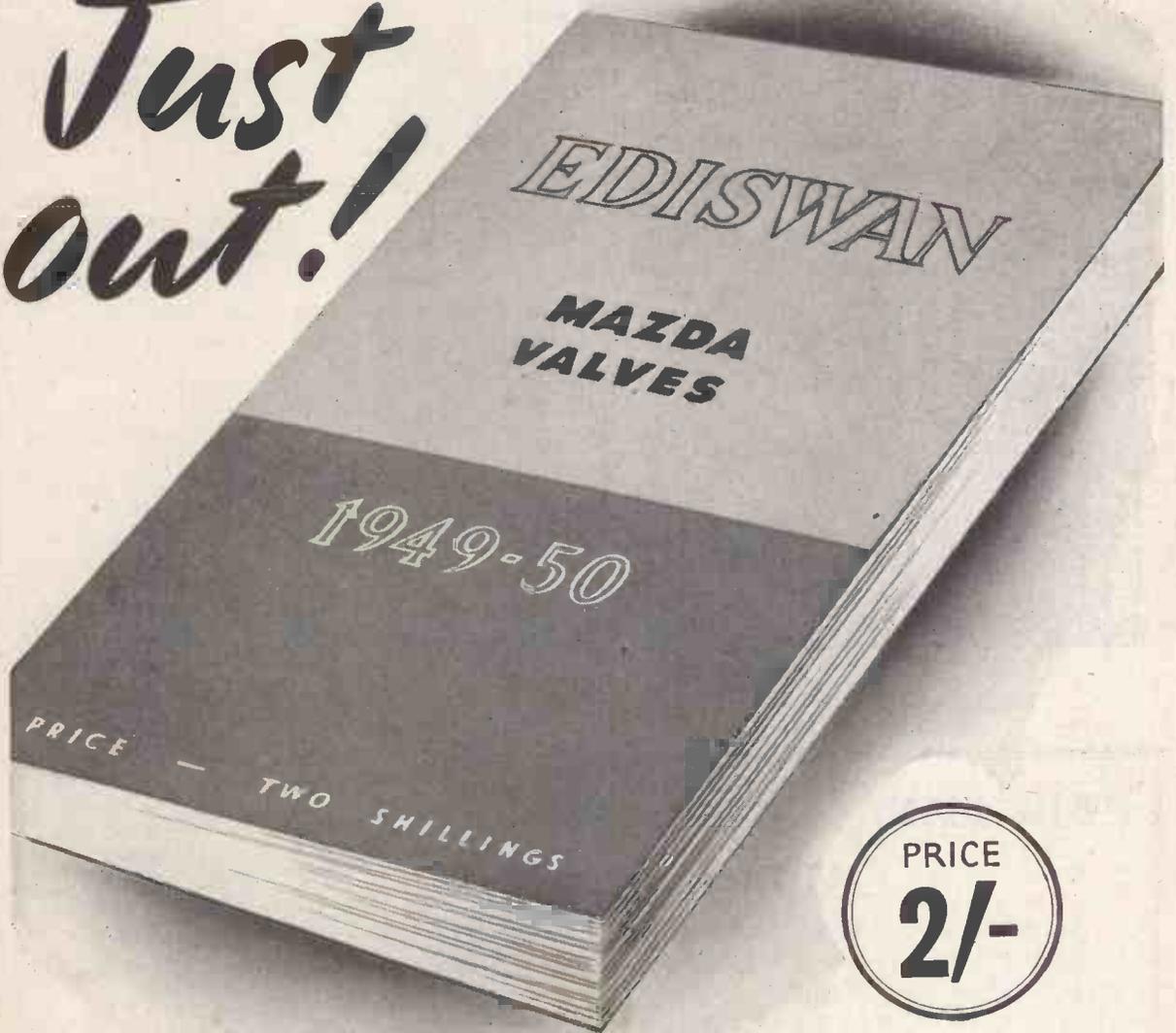
*bring them to...*

**Bullers**

**BULLERS LOW LOSS CERAMICS**

BULLERS LTD., 6, LAURENCE POUNTNEY HILL, LONDON, E.C.4  
 Telephone: Manson House 9971 (3 lines)      Telegrams: "Bullers, Cannon, London"

*Just out!*



PRICE  
**2/-**

The 1949-50 edition of the Ediswan Mazda Valve Manual is now ready for distribution. Containing 340 pages of data, characteristic curves and circuit diagrams covering a wide range of Ediswan Mazda Valves and Cathode Ray Tubes this handy pocket-sized booklet is essential to all Radio Engineers and Designers and should be on the bookshelf of every Radio man. Send for your copy now. Postal order 2/6d. (which includes postage and packing).

★ This booklet is a condensed version of the Ediswan Loose-leaf Valve Manual and supplements the 1948-49 edition. A few copies of the 1948-49 edition are still available. price 1/4d., including postage.

**EDISWAN**  
**MAZDA**

✕ Meet us at  
**THE RADIO SHOW**  
CASTLE BROMWICH  
BIRMINGHAM Sept 6-16 ✕

THE EDISON SWAN ELECTRIC CO. LTD. (Technical Publications Dept.), 155 Charing Cross Road, London, W.C.2.



*One in Ten Million!*

For efficiency and fidelity each Rola speaker is indeed "one in a million" but in a more literal sense, every Rola you receive is one in ten million speakers which are proving the superiority of Rola performance throughout the world. So let figures speak for themselves and specify Rola.

Manufacturers Enquiries to:—

**BRITISH ROLA**

FERRY WORKS, SUMMER ROAD, THAMES DITTON, SURREY (Emberbrook 3402-6)

Wholesale Enquiries to—**SOLE DISTRIBUTORS**

LONDON & NORTH:—  
CYRIL FRENCH LTD.,  
HIGH ST., HAMPTON WICK,  
MIDDX. (Kin. 2240)

SOUTH:—  
ROBSHAW BROS.,  
10, EXETER RD., THE SQUARE,  
EOURNEMOUTH. (Tel.: 5896-7)

*The Speaker You Know by Ear*

## The Murphy Television Pattern Generator at the Radio Show

Do not fail to see the Murphy TV Pattern Generator! The outstanding technical superiority of this instrument is demonstrated by its choice for testing the central TV relay network at the Show. This selection is a unique tribute to the efficiency of the Murphy TPG11 which, in practice, cuts service and repair cost by 50 per cent.

For your convenience during the period of the Show, demonstrations of this amazing instrument will be given, by appointment, on the 3rd Floor, 55, Temple Row, Birmingham (next to the Cathedral). Please contact me at the New Victoria Hotel, Corporation Street, Birmingham, or enquire at the Murphy Stand, where representatives will be pleased to put you in touch with me.

Visitors from the Holme Moss and other future television areas are advised not to

lose this opportunity of seeing how a Murphy TPG11 can be invaluable before transmissions start.

A few instruments will be available for immediate delivery in Birmingham, and members of my staff will gladly arrange demonstrations in the area.

★Remember—there is no substitute for the Murphy TPG11 Television Pattern Generator, manufactured by Murphy Radio Ltd., Welwyn Garden City, and available to all (other than Murphy Dealers) through:

### F. LIVINGSTON HOGG

Specialist in High-Grade Instruments for the  
Communications Industry

65 BARNBURY STREET, LONDON, N.1.

**CINTEL**



**WHEN IT'S A  
QUESTION OF  
CAPACITY...**

or rather, the accurate measurement of capacity, we think we can help you.

**The "CINTEL" WIDE RANGE CAPACITANCE BRIDGE**

enables capacitance in the range 0.3 picofarads to 100 microfarads to be measured to an accuracy within  $\pm 1\%$ . Capacitance can be measured *in situ* and resistance in the range 1 ohm to 30,000 Meg-ohms can also be measured. For further technical details please write for leaflet No. CBI/1.



**CINEMA - TELEVISION LIMITED**

A Company within the J. Arthur Rank Organisation

**FOREMOST IN THE MANUFACTURE OF**

- Counters & Chronometers • Metal Detectors • Oscilloscopes • Photo-Electric Cells • Cathode Ray Tubes • Geiger-Muller Tubes • Electronic Instruments

**WORSLEY BRIDGE ROAD · LONDON · S·E·26**

Telephone: **HITher Green 4600**

Northern Agents:

**F. C. ROBINSON & PARTNERS LTD.**  
287 Deansgate, Manchester 3

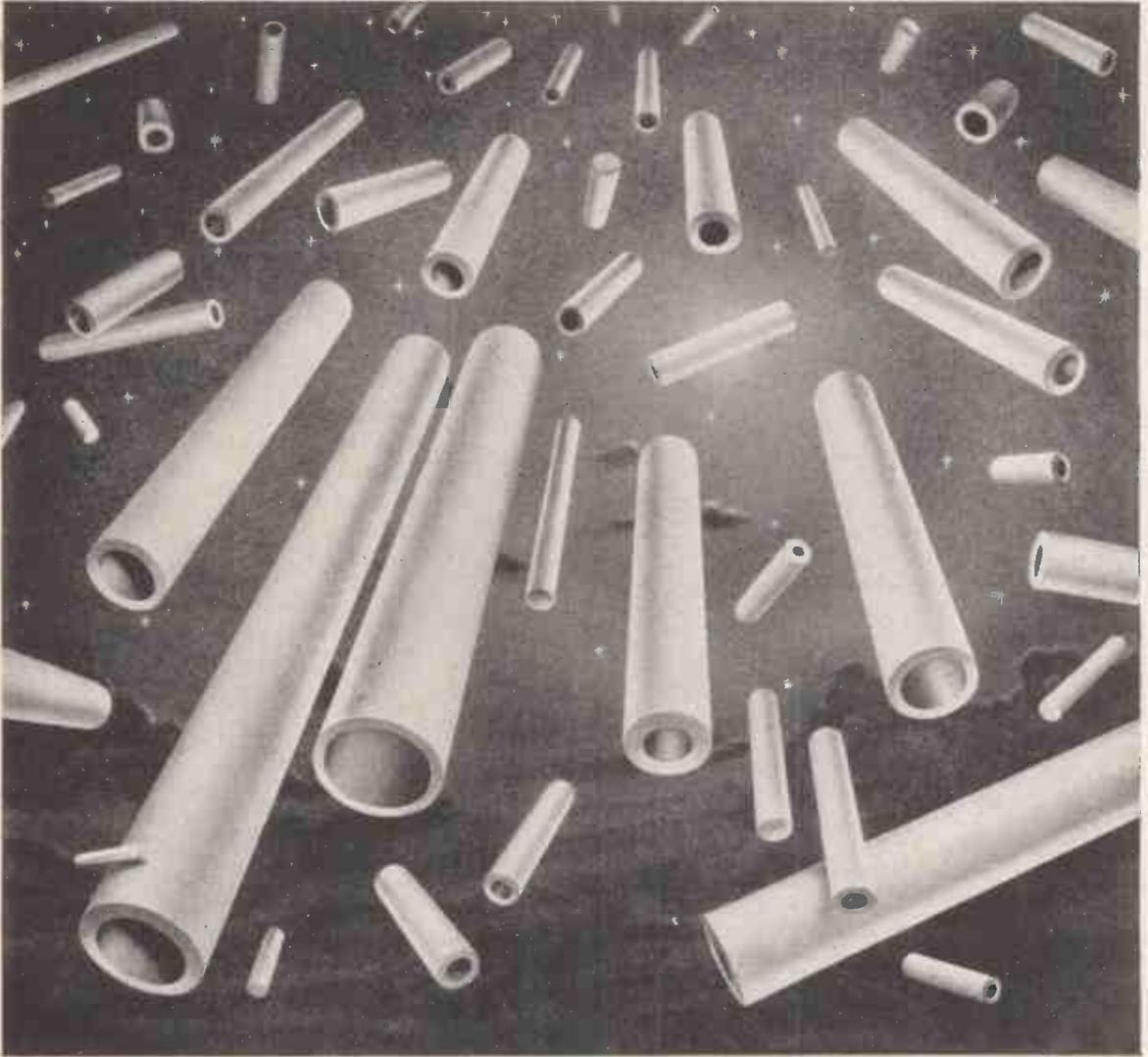
Scottish Agents:

**ATKINS, ROBERTSON & WHITEFORD LTD.**  
100 Torrissdale Street, Glasgow, S.2

**CINTEL**

REGISTERED TRADE MARK





# CERAMICS

**FOR RESISTORS**

and all radio components

FREQUENTITE — FARADEx — TEMPRADEx

**STEATITE & PORCELAIN PRODUCTS LTD.**

Stourport on Severn, Worcestershire

Telephone : Stourport 111

Telegrams : Steatite, Stourport



S.P.6

# Quality Reproduction



## The SIX-FIFTY CONSOLE

The refinements of Push - pull and a twelve-inch loud-speaker, so essential to achieve quality reproduction, are no longer confined to higher-priced instruments.

By eliminating all unnecessary gadgets and circuits, Ambassador have produced the Six-Fifty Console with these refinements for the modest price of *Thirty-Six pounds.* A.C. or AC/DC.

Obtainable from leading Radio dealers only.



PRINCESS WORKS, BRIGHOUSE, Yorks.

Telephone : BRIGHOUSE 1280 (3 lines)

DESIGNERS -  
MANUFACTURERS -  
AMATEURS -

For EFFICIENCY &  
RELIABILITY  
INSIST on -

**Cyldon**  
VARIABLE  
CAPACITORS

All standard laws,  
capacity ranges,  
& voltages up to 15kV.

AIR-SPACED TRIMMERS  
MICA DIELECTRIC  
COMPRESSION TRIMMERS  
VARIABLE  
TRANSMITTING  
CAPACITORS

Manufacturers:  
**SYDNEY S. BIRD & Sons, Ltd.**  
Cambridge Arterial Rd., Enfield, Middx.  
Phone: Enfield 2071-2

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

★

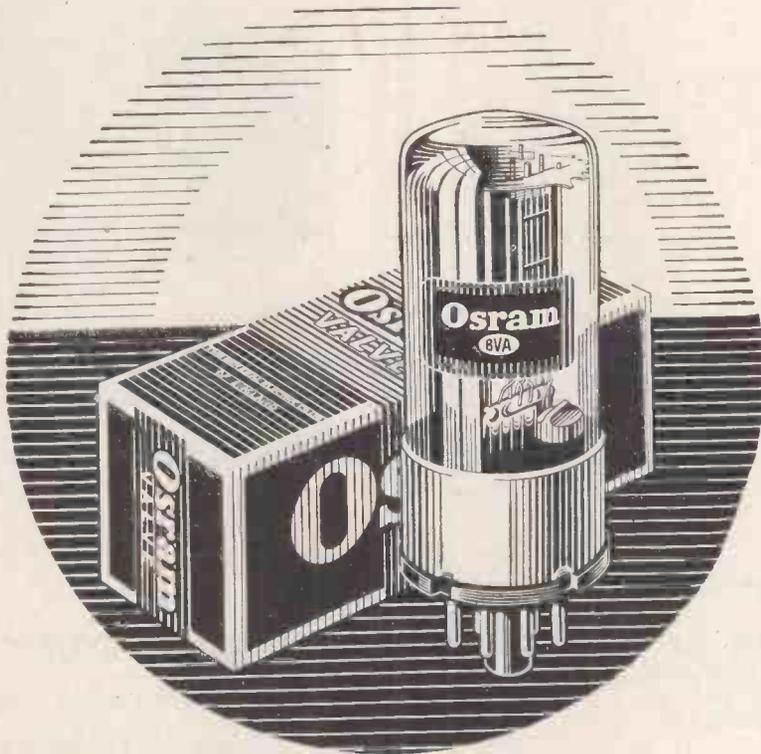
Goldring Products include:  
PICK-UPS, PICK-UP HEADS,  
SAPPHIRE JEWEL POINT  
NEEDLES, AND RADIOGRAM  
ACCESSORIES.

Write for full Descriptive Lists and Technical Information.

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

---

THE *POWER* IN THE PACKAGE



**Osram VALVES**

*A tonic to any set!*

**Osram**

PHOTO CELLS

**G.E.C.**

CATHODE RAY TUBES

**Osram**

VALVES

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, W.C.2.



• PORTABLE

• SELF CONTAINED

• EASY TO OPERATE

• HIGHLY EFFICIENT

*Brief Specification :*

- WORKING VOLTAGE** — 200/250 volts A.C. 50 c/s.  
**TAPE SPEEDS** — 7½ in./sec. and 12 in. sec.  
**RUNNING TIMES** — 30 minutes and 20 minutes  
**REWIND** — Provision for fast rewind or forward running of complete spool in one minute  
**ERASING** — Any recording may be erased. Erasure is automatic, preventing double exposure  
**OUTPUT TERMINATIONS** — 2 watts  
 — Inputs for microphone and, radio and outlet for external speaker  
**DIMENSIONS** — 18 x 13½ x 9½ in.  
**WEIGHT** — 38 lb. complete  
**ACCESSORIES** — Supplied complete with microphone, tape and spools



Recorder House, 48-50 George Street, Portman Square, London, W.1., England

Telephone : Welbeck 2371 (4 lines)

Telegrams : Simsale, Wesdo, London

Cables : Simsale, London

**Instruments for Research and Industry**

The **TWENTY MILLION**  
**MEGOHMMETER**

The modern instrument for the measurement of resistance. Covers the range from 0.3 to 20,000,000 megohms in six decades. Two test voltages, 85v and 500v are provided and a six-inch mirror scale meter enables readings to be taken accurately and quickly. The instrument is especially useful for testing cables, resistors, condensers and all insulating materials.



**ELECTRONIC INSTRUMENTS LTD**

17, PARADISE ROAD · RICHMOND · SURREY · ENGLAND



## 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**

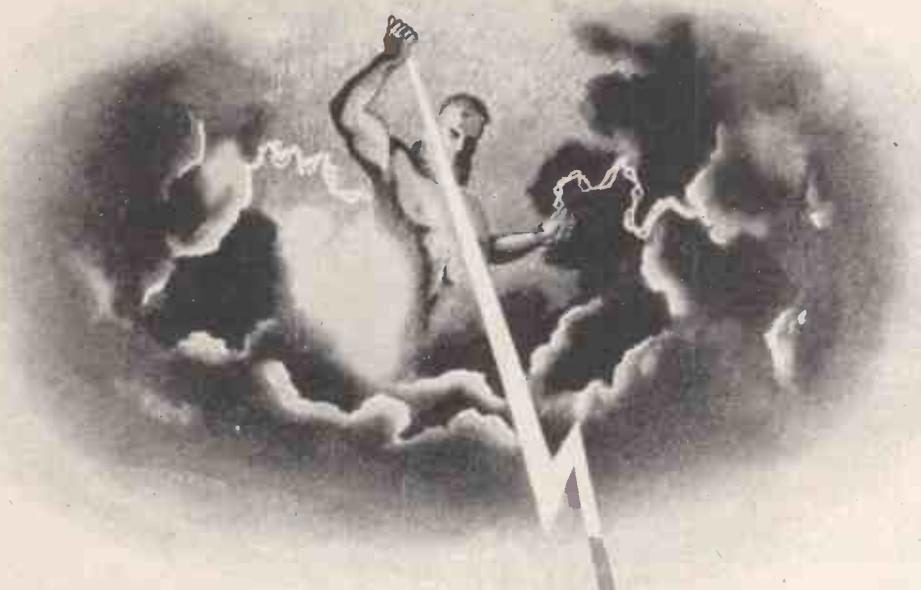
And the following Radio Examinations :

**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.14, International Buildings, Kingsway, London, W.C.2



# JOVE AND HIS LIGHTNINGS

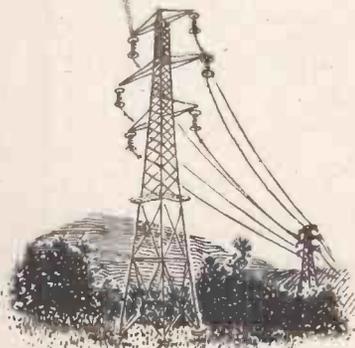
White flame flashing earthwards from the riven sky, to split the oak, and cleave the granite crag.

Olympian might made visible to mortal man, that he may know the majesty and awful wrath of gods.

In Greek mythology and Saxon song, in warlike sagas of the Norse, in mystic legends of Valhalla and northern Rhine, the lightning's flash illumines the fury of the Gods . . .

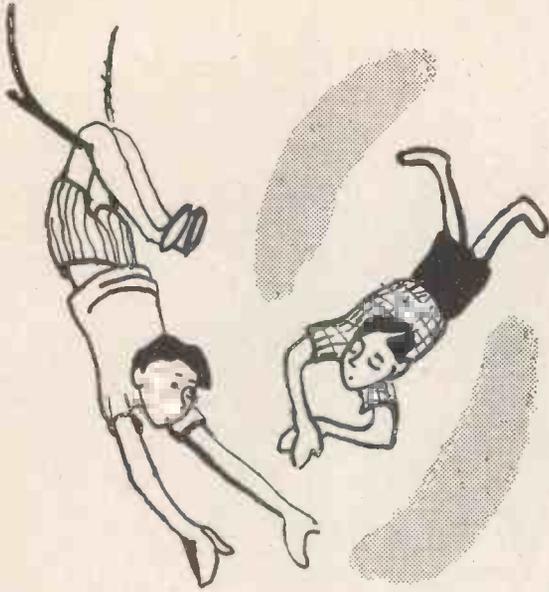
So down the ages until man, outpacing superstition through science, strikes the spark—and in the bare passage of a century, transforms titanic omnipotence to a trained servant, obsequious behind a thin wall of white porcelain.

**TAYLOR,  
TUNNICLIFF  
PORCELAIN**



TAYLOR, TUNNICLIFF & CO. LTD.      *Head Office :* EASTWOOD  
*London :* 125 HIGH HOLBORN, W.C.1.    *Holborn 1951.*

HANLEY · STAFFS · *Stoke-on-Trent 5272-4*  
*Factories at :* Hanley, Stone and Longton, Staffs.



**confidence** *is a fine thing...*

... for the manufacturer of Electronic Equipment, no less than for the trapeze artist (the results may be less spectacular but they make far more effective balance sheets!).

Parmeko Transformers are produced by specialised production on single-purpose plant, and for 20-odd years have inspired confidence in Great Britain's manufacturers of Electronic and Electrical Equipment.

**PARMEKO of LEICESTER**

Makers of Transformers for the Electronic and Electrical Industries

**M. R. SUPPLIES Ltd**

Exclusive offers, all new and perfect. Immediate delivery. All prices nett.

**FLUXMETERS** (model WY0023. No. 1). Calibrated, in three ranges, 500/1,000, 1,000/2,000, 2,000/4,000 Gauss, with range selector plug. Complete with metered polarity indicator and probe for minimum gap of 1/16 in. Brand new, in portecase 12 x 9 x 3/16 in. £5/10/0 (despatch 2/3).

**AUTOMATIC VOLTAGE REGULATORS** (Carbon Pile). Automatically holds mains supply at any voltage between 180 and 230 v. A.C. Loading up to 500 watts. Contained in ventilated steel case 6 1/2 x 7 1/2 in. x 10 1/2 in. high, with terminal panel and pre-set voltage control knob on top. Easy to install—diagram supplied. Ideal for television, i.a.b. and dark-room work, where constant voltage is required. Brand new 57/6 (des. 4/6).

**VOLTAGE CHANGING TRANSFORMERS** (portable) 100/110v.-200/240v. (in 10v. taps) and vice versa, auto-wound, loading 1.25 KVA. In steel cabinet 9 1/2 x 7 x 6 in. with carrying handle. Just right for mobile cine work. Brand new—exceptional offer, £4/15/0 (des. 5/3).

**SELENIUM RECTIFIERS**. We have a very large stock of brand new S.T.C. Selenium Bridge Rectifiers for High Duty, all at lowest prices. Examples, 30 v. 20 amps., 72 8 (des. 1/6); 30 v. 50 amps., £2 (des. 2/6); 240 v. 10 amps., £13 (des. 5/3).

**SHADED POLE MOTORS** (Hoover). 200/250v. A.C. Suitable for wire and tape recorders, cooling and extractor fans, cine projectors, etc., 1,200 r.p.m., very silent running. Torque 400 Grm/cms. Body 3 1/2 x 3 1/2 in. Shaft each end, 29/8 (des. 1/3).

**GEARED MAINS MOTORS** (Capacitor/induction). 220/240v. A.C. Size 7 in. long by 4 in. dia., 1,500 r.p.m. with 5/1 reduction gear box attached, giving final shaft speed of 300 r.p.m. at great torque. These are substantially built to a precise standard. Reversible. Supplied with capacitor, brand new £4/10/0 (des. 1/6).

**STUART CENTRIFUGAL PUMPS** from stock. Self-contained Motor/Pump Units for 220/250v. A.C. operation. No. 10 (120 g.p.h.), £5/15/0. No. 12 (600 g.p.h.), £9/10/0. Des. No. 10 1/8. No. 12 3/8.

**HIGH DUTY VANE PUMPS**. Made to top specification in bronze throughout for Admiralty. Power required to drive approx. 1 h.p. Will pump up 3,000 g.p.h. (according to speed—200/1,000 r.p.m.) Head 75 ft. Suction lift 25ft. Industrial concerns will be supplied with photograph giving dimensions on request. Brand new £6/15/0 (des. 4/6).

**THERMO-COUPLES**. New Cambridge vacuo-junctions, 5 m/a. (10 m/a. max.) with 4-pin valve base, each with test report, 7/6 (des. 6d).

**LONDEX A.C. RELAYS**. 220/250v. A.C. coil. Type LF. With 2 C.O. and one "make" switches (4-amp.), 11/6. Also Londex Low Capacity Aerial C.O. type, operation 230v. A.C. (tapped at 110v.) with 2-pole C.O. 4-amp. switching, mounted on baseboard 6 1/2 x 4 in., 15/6 (des. either 1/3). We have a large range of miniature Londex and other relays—details on request.

**SYNCHRONOUS ELECTRIC CLOCK MOVEMENTS**. 200/250v. 50 c. Fitted spindles for hours, mins. and secs. hands, single hoie mount, silent running, supplied with plastic dust cover, 3 1/2 in. diam. and flex. ready for use 27/6 (des. 9d.). Set of three hands for 5/7 in. dial, 2/6.

**ROTARY TRANSFORMERS**. The most useful type. Input 12v. D.C., output 250v. D.C. 125 m/a. Brand new 25/6 (des. 1/3).

**STEEL TRIPODS** for P.A. Speakers. The most sturdy type under all weather conditions, extending to 11ft. and collapsing for transit to 4ft. 6 in. All steel construction, 55/- (des. England 5/3).

Further details of any item sent, if required, on receipt of stamp.

The diligent and enthusiastic service.

**M. R. SUPPLIES Ltd., 68, New Oxford Street, London, W.C.1**  
Telephone: MUSsum 2958

*Only with* **CO-AX**  
*P.F.* **CABLES**

AIR-SPACED ARTICULATED

POTENTS  
Regd Trade Mark

LOW ATTEN TYPES	IMPED OHMS	ATTEN dB/100ft or 100 m.c./ft	LOADING	O.D."
A 1	74	1.7	0.11	0.36
A 2	74	1.3	0.24	0.44
A 34	73	0.6	1.5	0.68

**THE LOWEST EVER CAPACITANCE OR ATTENUATION**

LOW CAPAC TYPES	CAPAC p.p.f./ft	IMPED OHMS	ATTEN dB/100ft 100 m.c./ft	O.D."
C 1	7.3	150	2.5	0.36
P.C.1	10.2	132	3.1	0.36
C 11	6.3	173	3.2	0.36
C 2	6.3	171	2.15	0.44
C 22	5.5	184	2.8	0.44
C 3	5.4	197	1.9	0.64
C 33	4.8	220	2.4	0.64
C 44	4.1	252	2.1	1.03

**IMMEDIATE DELIVERIES**

SPECIALISTS IN AIR-SPACED ARTICULATED CABLES SINCE 1929

**TRANSRADIO LTD.**  
CONTRACTORS TO H.M. GOVERNMENT  
138A CROMWELL ROAD, LONDON SW2  
ENGLAND

HIGH POWER FLEXIBLE  
PROTOCELL CABLE  
VERY LOW CAPACITANCE

★ NEW MODEL



**Model T24DAB.**  
A DC/AC mains/battery portable, giving good performance on two wavebands.

★ NEW MODEL WITH 12" TUBE



**Model VT55A (London Frequency)**  
**VT75A (Midlands Frequency)**  
A handsome new table receiver with figured walnut cabinet.

★ NEW MODEL



**Model ARG27A.**  
A beautiful radiogram that you'll be proud to own.



If you're going to the Show  
make a bee-line for the

**MARCONIPHONE**

THE GREATEST *Marconi* NAME IN RADIO

**STAND**

The new Marconiphone models will have much  
to interest those who appreciate technical  
excellence. We hope to have the pleasure of  
showing you the full range, some of which are  
illustrated here.

**AND SEE  
OUR NEW MODELS**

NATIONAL RADIO SHOW BIRMINGHAM  
SEPTEMBER 6th-16th

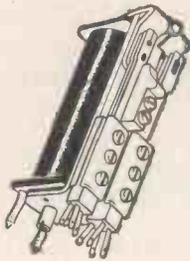
★ If you can't get to the show, your Marconiphone dealer will be pleased to give you full details.



Department W.W.  
**18, TOTTENHAM COURT ROAD,**  
 LONDON, W.1. Phone : MUSEum 2453, 4539

SHOP HOURS : Mondays to Fridays 9—5.30. Saturdays 9—1.

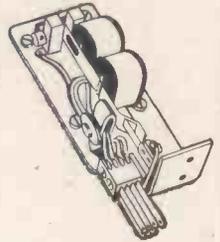
FULL MAIL ORDER FACILITIES



# RELAYS

(ex-Ministry)

P.O. 600 and 3,000 types



AS FOLLOWS

**D.C. COIL RESISTANCE :**  
 10 ohms to 42,000 ohms, also double-wound coils. Special coils wound to spec. in quantities.

**CONTACTS:** Make (M) Break (B) Change-over (C) in twin silver, heavy duty, and twin platinum in any combination to 8 sets.

ALSO AVAILABLE: SIEMENS HIGH/SPEED AND OTHER TYPES

## Drayton MOTOR UNITS

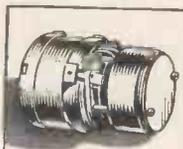
The Drayton R.Q. is a miniature capacitor induction type motor with a current consumption at 230 volts 50 cycles of 0.09 amps pf. 0.9. It is available:

**R.Q.G. GEARLESS** for running at 2700 r.p.m. continuously or intermittently in either direction or continuously reversed.

**R.Q.R. GEARED** for continuous running or reversing at speeds from 27 mins. per rev. to 600 revs. per min.

**R.Q.H. GEARED** for high final shaft speeds for continuous running, forward or reverse.

Send for List No. N800-1.



THE RQG



THE RQH

for <sup>RQ</sup> 9

THE RQR



actuators, valves, dampers, rheostats, geneva movements, rocking baths, flashing signs, illuminated models, soldering welding fixtures, rotating tables, automatic light strip feed, lubricating and other small pumps, small machines, animated displays, vibrators, developing baths, agitators, fans, aspirators and similar devices.

Drayton Regulator & Instrument Co. Ltd., West Drayton, Mdx. • W. Drayton 261

## THE VALRADIO HEAVY DUTY CONVERTER RANGE

(Famous since 1937)

Will supply A.C. at standard voltages for numerous applications from D.C. supply voltage ranging from 6-250 volts with wattage outputs from 30-300 watts.

Frequency stability at 50, 60 or 75 cycles per second  $\frac{1}{2}$  of 1 per cent. of dead frequency. Let us bring to your notice a few listed by us in popular demand, others can be considered on receipt of specification. All hereunder incorporate Radio and Low Frequency suppression from interference.

Type	D.C. Input	A.C. Output	Wattage Load	Price
230/300-A	200/250 v.	200/250 v.	200/300	£16 0 0
230/300/110-A	100/120 v.	200/250 v.	150/300	£16 0 0
230/200-A	200/250 v.	200/250 v.	100/200	£14 0 0
230/200/110-A	100/120 v.	200/250 v.	100/200	£14 0 0
230/200/50-A	50 v.	200/250 v.	100/200	£16 0 0
230/110-A	180-270 v.	200/250 v.	60/110	£10 15 0

Also similar types available to operate from D.C. input voltages of 6, 12, 24, 32 and to order.

All above prices advanced 10 per cent. from July 1st, 1950.

Literature upon request from:

**VALRADIO Limited,**  
 57, Fortess Road,  
 LONDON, N.W.5

Phone: GULLIVER 5165



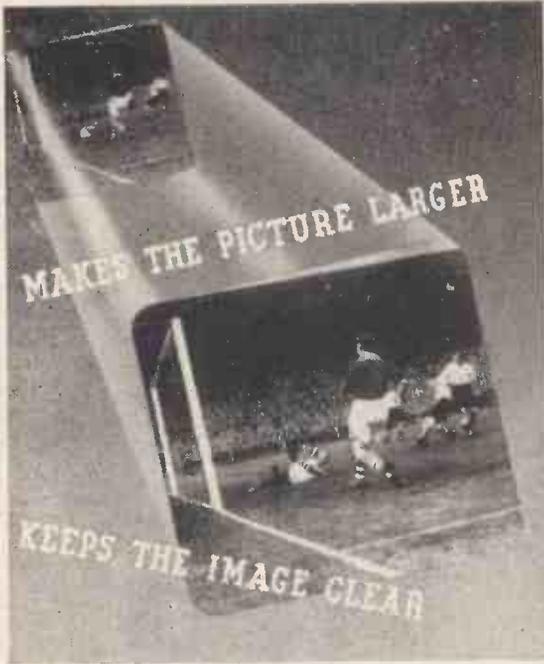
***A versatile aid  
to research***

**COSSOR**  
**MODEL 1035**  
***Double Beam***  
**OSCILLOGRAPH**

The unique Double Beam Tube enables the traces of two related phenomena to be examined simultaneously. Signals are normally fed through the Amplifiers. Calibrated Y1, Y2 and X Shifts give measurement of applied Signal Voltages and Time. The Time Base operates repetitively or by external trigger with positive or negative sync. selection. A Camera Model 1428 may be fitted for photographic recording.

*Enquiries should be addressed to:*  
**A. C. COSSOR LIMITED, INSTRUMENT DIVISION, Highbury Grove, London, N.5.**  
 Telephone: CANonbury 1234

# Make a date with **BIGGER** Television



Come to Stand 78 - see how much better good television can be—how the customer for a 9in. Receiver can be a satisfied viewer of a 12in. screen at a comparatively small extra cost.

See how a 12in. Receiver is quickly converted to a 15in. and what a magnificent picture a 15in. "Magnavista" lens presents.

See too the supreme quality of all "Magnavista" products.

There is a "Magnavista" lens for all receivers. Every lens gives unequalled magnification and clarity. Distortion is reduced to a minimum and the angle of view is large.

"Magnavista" Lenses are made in 9in., 12in. and 15in. sizes and can be attached to cabinets or used with an attractive wrought iron stand.

**METRO PEX LTD.,**

39 Great Portland Street, London, W.1.  
and King's Heath Station, Birmingham

The  
**MAGNAVISTA**  
TELEVISION LENS

## HIGH QUALITY EQUIPMENT FOR THE AMATEUR

### LOUDSPEAKER UNITS

High flux permanent magnet loudspeakers—13½in. elliptical (AR/S 1002) £4. 17. 6. 10½in. elliptical (AR/S 1001) £2. 0. 0.

### INTERMEDIATE FREQUENCY TRANSFORMERS

(<65 KC/S) suitable for communications receivers

Low Inductance	AR/T 1101 (Large)	.. ..	14/6
	AR/T 1103 (Medium)	.. ..	12/-
	AR/T 1106 (Midget)	.. ..	16/-
High Inductance	AR/T 1102 (Large)	.. ..	14/6
	AR/T 1104 (Medium)	.. ..	12/-
	AR/T 1105 (Midget)	.. ..	16/-

★ Write for full details of complete range of E.M.I. equipment for the Amateur.

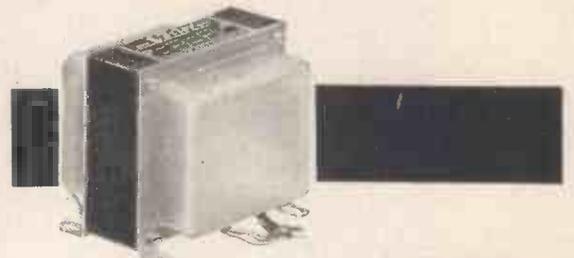
### E.M.I. SALES & SERVICE LTD.

AMATEUR DIVISION,

HEAD OFFICE: HAYES, MIDDLESEX,  
ENGLAND.



E.195



## MAINS TRANSFORMERS & CHOKES

**Varley**  
REGD. TRADE MARK

All "Varley" products are manufactured from the highest quality materials.

Transformers, etc., are individually wound and have interleaved windings with ample insulation, ensuring freedom from breakdown.

The comprehensive range of Shielded and Open type Transformers available meets the requirements of every circuit.

Write for list, etc.

MADE BY

**OLIVER PELL CONTROL LTD**  
CAMBRIDGE ROW · WOOLWICH · S·E·18  
Telephone: WOOLWICH 1422

# A Range of Industrial Photocells

58CT  
End-on-Series



90CV  
B7G Series

20CV  
B8G Series

As a result of extensive research both in material and design Mullard now make available a comprehensive range of photocells ideally suited for industrial applications.

The range falls into two main groups. The caesium-silver oxide cathode (C type) cells, with a high sensitivity to incandescent and infra-red radiation; and the caesium-antimony cathode (A type) cells, with a high sensitivity to daylight.

Brief technical details are listed below. Fuller information on these and special photocells is available on request.

Type	Base	Max. Anode Supply Voltage (V)	Max. Cathode Current ( $\mu$ A)	Dark Current ( $\mu$ A)	Sensitivity to colour temp. 2,700°K ( $\mu$ A/l)	Max. Gas Amplification Factor
20AV	B8G	150	10	0.05	45	—
20CG	B8G	90	5	0.1	150	10
20CV	B8G	250	20	0.05	25	—
90AG	B7G	90	2.5	0.1	200	7
*90AV	B7G	100	5	0.05	45	—
*90CG	B7G	90	2	0.1	125	10
*90CV	B7G	100	10	0.05	20	—
58CG	Wire-in	90	1.5	0.1	85	9
58CV	Wire-in	100	1.5	0.05	15	—

\* These valves are included in the new Government list of preferred valves for the services.

## Mullard

News Letter

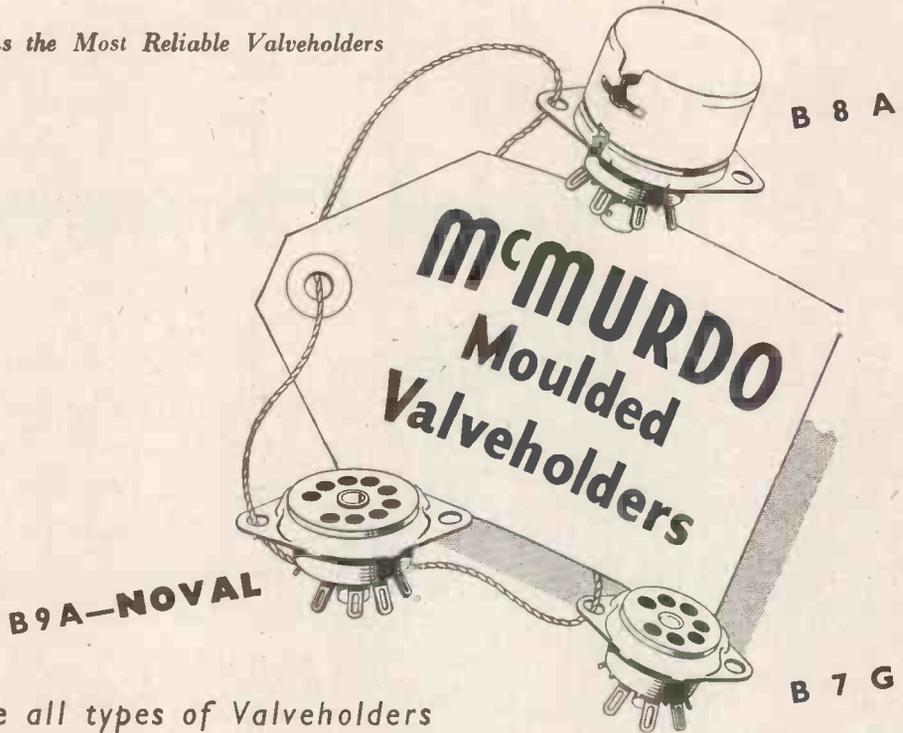
If you are not already on the mailing list for this service of advance information on new valves, please write to us for full particulars on your business letterheading.

# Mullard Thermionic Valves and Electron Tubes

INDUSTRIAL POWER VALVES · THYRATRONS · INDUSTRIAL RECTIFIERS · PHOTOCELLS  
FLASH TUBES · ACCELEROMETERS · CATHODE RAY TUBES · STABILISERS AND  
REFERENCE LEVEL TUBES · COLD CATHODE TUBES · ELECTROMETERS, ETC.



Recognised as the Most Reliable Valveholders



We make all types of Valveholders

THE McMURDO INSTRUMENT CO., LTD., VICTORIA WORKS, ASHTEAD, SURREY · ASHTEAD 3401

# HANDSOME IS AS ...



The rear of any of the sets in our range of HOME CONSTRUCTOR OUTFITS is every bit as smart as the front! (see previous ads.). Illustrated is a Radio Feeder YOU can build (to go with that Quality amp. of yours!). It is designed around our ever popular 30 Tuning Unit, which comprises the 30 Coil Pack (16-2,000 metres), 465 kc/s IF's, J.B. 2-gang and spin-wheel assembly, which we ALIGN AND SEAL AS A UNIT!! Price 75/6 incl., or 54/9 with 'standard' dial. If you want more advanced units—we have them. Model 40 (with R.F. stage, 3 gang, etc.), 107/- A. & S. or 86/3 with 'standard' 3-colour dial. 6-band Communications Pack available. Remember, our units for the Home Constructor have world-wide acclaim! Whether you are a beginner, experimenter or serious amateur you cannot do better than follow our designs.

For details, e.even circuits, full constructional data, etc., send 1/6 NOW for NEW ENLARGED EDITION (44 pp.) of "Home Constructor's Handbook." All items supplied by Mail DIRECT ONLY from:

**RODING LABORATORIES**  
70, LORD AVENUE, ILFORD, ESSEX

## VALVES!! VALVES!!

RECEIVING, TRANSMITTING,  
MAGNETRONS, KLYSTRONS,  
CATHODE-RAY TUBES, PHOTOCELLS,  
ETC.

LARGE QUANTITIES  
& GREAT VARIETIES  
IMMEDIATE DELIVERIES FROM  
STOCK

WRITE OR 'PHONE :-

*S. Szymanski*  
(pronounced SHE-MAN-SKEE)

ELECTRONIC  
ENGINEER & STOCKIST

95 STRODES CRESCENT  
STAINES - MIDDLESEX

TELEPHONE : STAINES 3971

PROBABLY THE LARGEST ACTUAL STOCKIST IN ENGLAND

WHOLESALE & EXPORT ONLY



**serves**

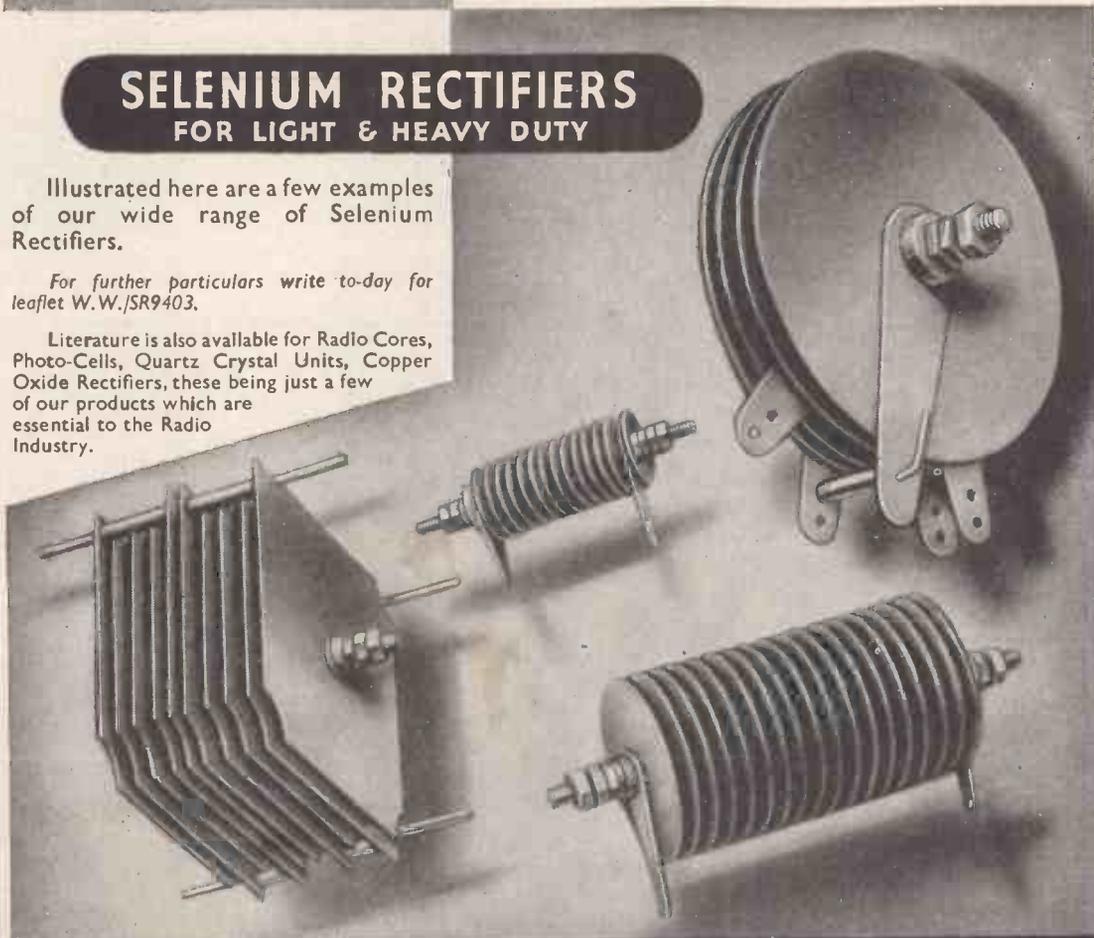
**THE RADIO AND TELEVISION INDUSTRY**

**SELENIUM RECTIFIERS FOR LIGHT & HEAVY DUTY**

Illustrated here are a few examples of our wide range of Selenium Rectifiers.

*For further particulars write to-day for leaflet W.W./SR9403.*

Literature is also available for Radio Cores, Photo-Cells, Quartz Crystal Units, Copper Oxide Rectifiers, these being just a few of our products which are essential to the Radio Industry.



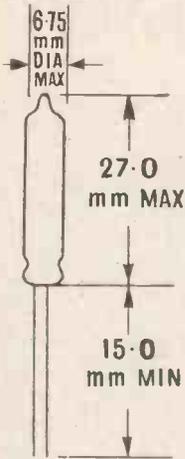
**SALFORD ELECTRICAL INSTRUMENTS LTD.**

PEEL WORKS · SILK STREET · SALFORD 3 · LANCS · ENGLAND

*A subsidiary of* THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

# Cold Cathode Diode

**NT 2**



The NT2 is a very small cold cathode diode of wide application: e.g. in counters, storage circuits, low current stabilisers and so on.

It is moreover an ideal indicator tube giving a clear bright indication with currents as low as 0.3mA.

**RATINGS**

Nominal strike voltage .. .. .	80 V.
Nominal maintaining voltage at 0.5 mA. . . . .	60 V.
Maximum power dissipation .. .	0.06 W.
Maximum current for continuous operation .. . . .	1 mA.



**GREEN HILL CRESCENT  
HARROW-ON-THE-HILL, MIDDX.**  
Telephone: HARrow 2655



## PLAN YOUR CAREER

**RADIO - TELEVISION**  
and other **INDUSTRIAL ELECTRONIC** subjects  
**ELEMENTARY & ADVANCED COURSES**

- DAYTIME** ● Principles and Practice of Radio — 1 year.  
● Telecommunication Engineering — 2 years. ● Electronic Engineering — 3 years (including one year's practical training in E.M.I. Factories)—leading to C & G full Technological Certificate.  
● Marine and Air Radio Officers' Course (for P.M.G. Licence).
- HOME STUDY** ● Radio. ● Television. ● Industrial Electronics ● Maths. ● Physics. "Courses in Radio and Television (Theory and Practice) for A.M.Brit.I.R.E., and City and Guilds Examinations." "Training also given in many other branches of engineering including A.M.I.Mech.E., A.M.I.E.E., A.M.I.P.E., etc."

Write for **FREE BOOKLET** to Dept: 10

**E.M.I. INSTITUTES**

10 PEMBRIDGE SQUARE, NOTTING HILL GATE, LONDON, W.2  
Telephone: BAYwater 5131/2.

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

E.T661

## ACCELERATION of production-line speed means economy . . . .

Wherever heat applications are specified in production lines, consult Radiant Heating Ltd. Our special gas equipment can give optimum speed together with precision and economy . . .

Write to :



for advice on heating problems

9 BARNSBURY PARK, N.I. Phone : NORth 1677/8.

W.W.2



21 candles round the cake—the family gathered round the long table—and in a corner of the room, the Soundmirror, its sensitive microphone recording on reels of inexpensive magnetic tape all the fun and laughter of a once-in-a-lifetime event.

With this remarkable new Instrument you can make your own home sound recordings—the best music—the greatest drama, speeches, sports events, etc.

# Soundmirror

MAGNETIC TAPE RECORDER

PRICE :

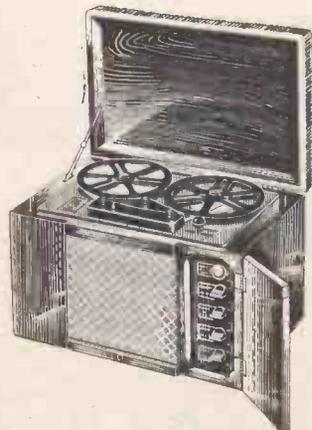
£62

Exclusive of microphone

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

- Anyone can operate the Soundmirror. One single finger-tip control provides for Play, Record, Rewind or Fast forward requirements.
- Recordings can be played back at once.
- Recordings may be permanently retained, or old items erased as new recordings are made.
- Sound Library. You can build your own Sound Library of Music, Speeches, Talks or family events—Birthdays and Weddings, etc.

Full details from the Manufacturers or Demonstrations by Appointment.



## THERMIONIC PRODUCTS LTD.

(DIVISION SM/WW), MORRIS HOUSE, JERMYN STREET, HAYMARKET, S.W.1

Telephone : Whitehall 6422 (5 lines)

Sales and Service Centres: MANCHESTER · BIRMINGHAM · BRISTOL · LEEDS · ETC.

# The EDDYSTONE

MODEL 750

## DOUBLE SUPERHETERODYNE COMMUNICATIONS RECEIVER

BUILT BY CRAFTSMEN WHO TAKE A PRIDE  
IN THEIR WORK

Well engineered, robustly constructed and possessing a specification which means top-line performance. Be sure to try this modern receiver—you will be very favourably impressed. Come and see the Eddystone range on Stand 83 at the National Radio Exhibition.



MEET US AT  
**THE RADIO SHOW**  
**CASTLE BROMWICH**  
Birmingham Sept. 6-16

## STRATTON & CO. LTD.

EDDYSTONE WORKS,

**ALVECHURCH ROAD, BIRMINGHAM, 31.**

Telephone: Priory 2231/4. Telegrams: Stratnoid, Birmingham.



## DEPENDABILITY

Reception conditions range from excellent to very poor, signal strength from strong to very weak, and to cope successfully with all such conditions you need a pair of highly sensitive and dependable headphones.



Type 'F'

For maximum reception results, insist that your local dealer supplies you with a pair of the rightly famous S. G. BROWN Type "F" headphones. Sea, land and air W/T operators, servicemen, experimenters and radio amateurs all vouch for their dependability.

TYPE "F"  
(FEATHERWEIGHT)

PRICE 30/- PER PAIR  
YOUR LOCAL DEALER CAN SUPPLY

Send for descriptive Brochure "W.W.," it gives details of full range. Prices from 30/- up to 105/- for Moving Coil Type K.

**S.G. Brown, Ltd.**

Telephone:  
Watford 7241

SHAKESPEARE STREET, WATFORD, HERTS

## B.P.L. TEST SETS

NOW AVAILABLE

### AT NET PRICES

#### B.P.L. UNIVERSAL TEST SET

£5 - 10 - 0

#### B.P.L. SUPER RANGER 1,000 $\Omega$ /v.

£12 - 5 - 0

#### B.P.L. SUPER RANGER 20,000 $\Omega$ /v.

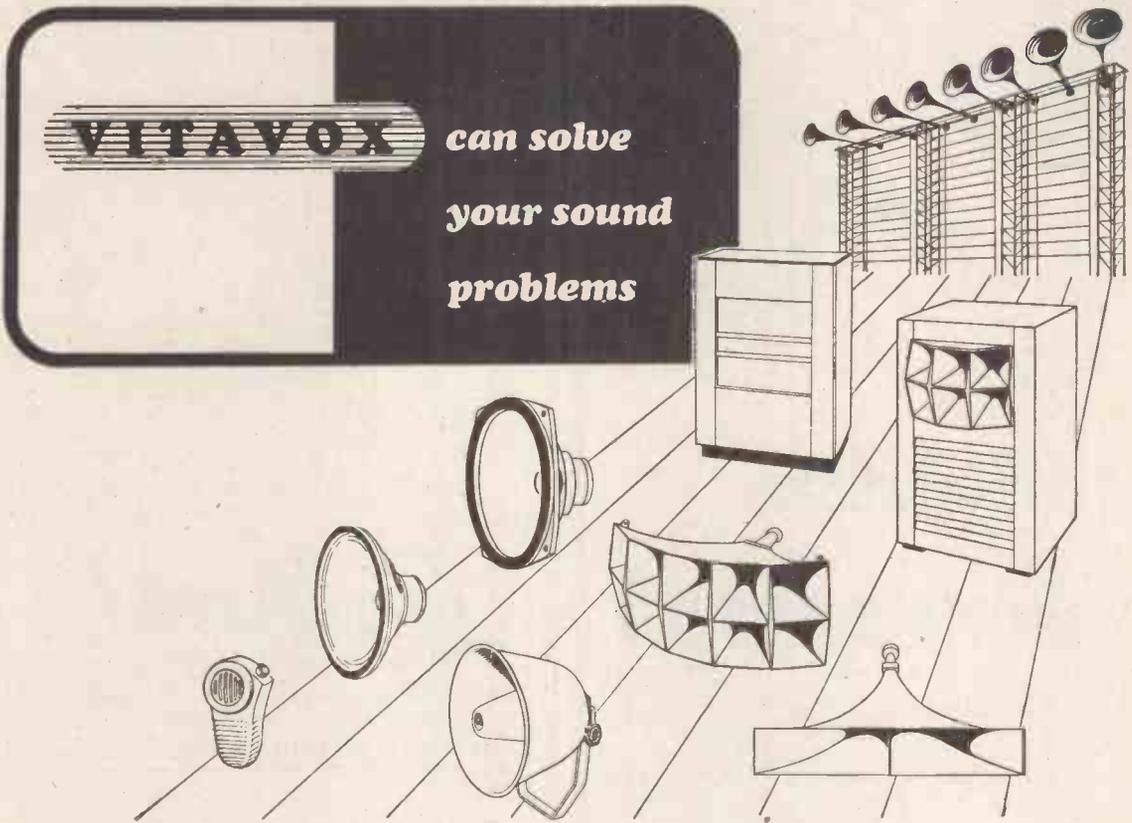
£14 - 10 - 0

Prices include postage and packing, and are applicable to Home Market only.

Send your order direct to:—

**BRITISH PHYSICAL LABORATORIES**  
HOUSEBOAT WORKS, RADLETT, HERTS

Tel: Radlett 5674-5-6



If you have a problem of sound reproduction and distribution, you will find the solution with one or a combination of the quality units in the VITAVOX range. From a 12" cone type loudspeaker to a huge industrial, theatre or stadium sound system, VITAVOX can supply your individual need. Each unit has been specially designed to solve a specific sound problem. Thousands of VITAVOX loudspeakers, microphones, units and horns are now in use in the motion picture, public address and radio industries. Remember—if your problems are sound—VITAVOX have the answer. Illustrated above are:

- A typical installation of Vitavox 75" Circular Horns.
- Console Reproducer. Model KC.10.
- Bitone Reproducer. Model 6201.
- 15" Cone Loudspeaker. Model K15/40.
- Multicell Horns: Type 220. In 3, 6, 10 and 15 cell units.
- G.P.1 Pressure Unit.
- 12" Cone Loudspeaker: Models K12/10 K12/20.
- Beam Projector Loudspeakers Model B.P.28.
- Microphone. Type B50. (Hand held model).

Write for full details of any or all the Vitavox range.

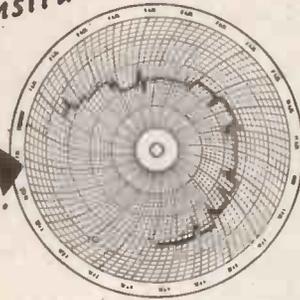
# VITAVOX LIMITED

WESTMORLAND ROAD · LONDON · N.W.9 · ENGLAND · TELEPHONE: COLINDALE 8671/3  
 TELEGRAMS: VITAVOX · HYDE · LONDON · CABLEGRAMS: VITAVOX · LONDON



*this indicating instrument accuracy*

*reproduced on this chart . . .*



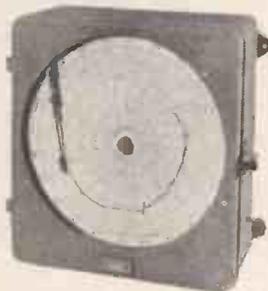
by the

**Fielden**

# Servograph

SERVOGRAPH OPERATES DIRECTLY FROM VERY LIGHT CURRENT SOURCES, consuming but a few Micro-watts for full scale deflection. Its working principle is unique and sets up a new high standard of accuracy and robustness for graphical recording meters. SERVOGRAPH's accuracy is to BSS.89 for Grade 1 Indicating Instruments—because its servo-driven pen arm removes all load from the instrument movement, admits a robust and trouble-free pen, and maintains this accuracy with full or empty ink reservoir. Needing no levelling, it operates correctly in any position and can be connected directly to tachometers, thermo-couples, resistance thermometers, CO<sub>2</sub> indicators, pH meters and so on, repeating their accuracy on the chart. Equally useful, too, as an ammeter, voltmeter, etc., it may embody a moving iron, moving coil, dynamometer or electrostatic movement.

Please write for technical leaflets 100/M.



Movements available from 50 micro-amps. or 15 millivolts upwards.

## FIELDEN (ELECTRONICS) LTD.

PASTON ROAD : WYTHENSHAW : MANCHESTER  
 FIELDEN ELECTRONICS (AUSTRALIA) PTY. LTD.  
 409 COLLINS STREET : MELBOURNE : AUSTRALIA  
 Specialists in Industrial Electronic Equipment

**"You're CERTAIN to get it at ARTHURS !"**

★ **VALVES** : We have probably the largest stock of valves in the country. Send your enquiries.

**AVO METERS IN STOCK**

Avo Model 7 .....	£19 10 0
Avo Model 7, high resistance .....	£19 10 0
Avo Model 40 .....	£17 10 0
Valve Tester .....	£16 10 0
Test Bridge .....	£11 0 0
Avo Minor, AC/DC model .....	£8 10 0
Electronic Test Meter .....	£35 0 0
Signal Generator .....	£25 0 0
Valve Characteristic Meter .....	£40 0 0

★ Demonstrations of Philips Projection Television sets in our showrooms.

**TAYLORS METERS.** List on request.

DECCA PICK-UPS .....	£3 15 5
DECCA HEAD .....	£2 19 2
ADAPTOR for Garrard .....	3 8
COSSOR DOUBLE BEAM OSCILLOSCOPE .....	£85 10 0

"Viewmaster" Television Kits in stock for Birmingham and London areas. Please state which required.

**LONDON'S OLDEST LEADING RADIO DEALERS**

**LATEST VALVE MANUALS**

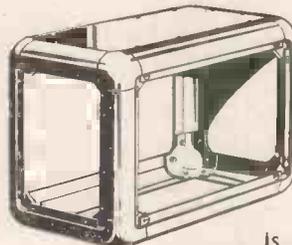
Mullard - 5/- ea.  
 Mazda - 1/- ea.  
 Brimar Teletube & Radio - 4/-  
 Post 4d. each extra

**Arthur's** EST. 1919

PROPS: ARTHUR GRAY, LTD. Terms C.O.D. or cash with order

Our Only Address : Gray House, 150/152 Charing Cross Rd., London, W.C.2 TEMple Bar 5833/4 and 4765

**ELECTRICAL, TELEVISION & RADIO ENGINEERS.**



**Widney-DORLEG**  
 REGD. CABINET SYSTEM

Is the popular method of building substantial cabinets without special tools or skill.

To meet the needs of home constructors a special department has now been opened at our London office which can supply sections machine cut to the individual lengths required, together with suitable rust-proofed panels and fixing screws. Enquiries to London Office → marked "For the attention of Dept. B."

Technical & Sales Agent

**C. H. DAVIS**  
 59, BROMPTON RD.,  
 LONDON, S.W.3  
 Telephone : KEN. 4201



MANUFACTURERS

**HALLAM, SLEIGH & CHESTON LTD**  
 WIDNEY WORKS · BIRMINGHAM · 4

Phone: Aston Cross 0914 (4 lines) · Grams: Superfine, Birmingham. 4

# PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

## PREMIER TELEVISOR KITS

FOR THE LONDON OR BIRMINGHAM FREQUENCIES

USING 9" OR 12" MAGNETIC CR TUBES

**£19. 19. 0.** including all parts, valves and loud speaker, but excluding CR TUBE  
(Carriage & Packing 15/-)

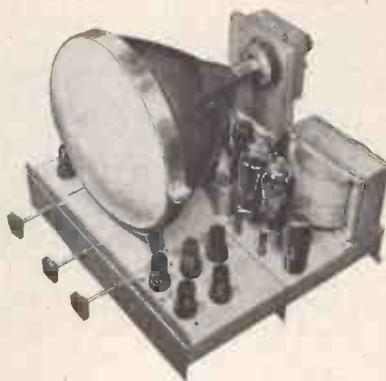
### CIRCUIT DETAILS

The Vision Receiver consists of 4 R.F. stages (EF54's) which are followed by a Diode Detector and Noise Limiter (6H6) which is directly coupled to the Video valve (EF54). Complete Kit with valves, £3/16/0. Carriage and packing 2/6.

The Sound Receiver comprises 3 R.F. stages (6SH7's) followed by a Double Diode Triode (6Q7), which acts as Detector and L.F. Amplifier. A Noise Limiter (EA50) is also incorporated. The output valve (6V6) drives a 10in. P.M. Moving Coil Speaker with closed field magnet, which is included in the Time Base Kit. Complete Kit with valves, £3/11/0. Carriage and packing 2/6.

The Time Bases employ blocking oscillators on both line (6SH7 and 807), and Frame (VR137 and 6V6). E.H.T. (non-lethal) is taken from the Line Output Transformer through a voltage doubler employing two valves (VU111). The Sync separators are 6H6 and 6V6. Permanent Magnet Focusing. Complete Kit with valves, £8/5/6. Carriage and packing 5/-.

The Power Supply is from a double wound mains transformer completely isolating the receiver from the mains. The H.T. Rectifier is a 5U4G. Complete Kit with valves, £4/16/6. Carriage and packing 5/-.



**"MAGNETIC" CONSTRUCTION BOOK 3/-**

EACH KIT OR INDIVIDUAL PART AVAILABLE SEPARATELY

FOR THE LONDON OR BIRMINGHAM FREQUENCIES  
USING VCR97 TUBE

**£17. 17. 0.**

(including Tube)

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.

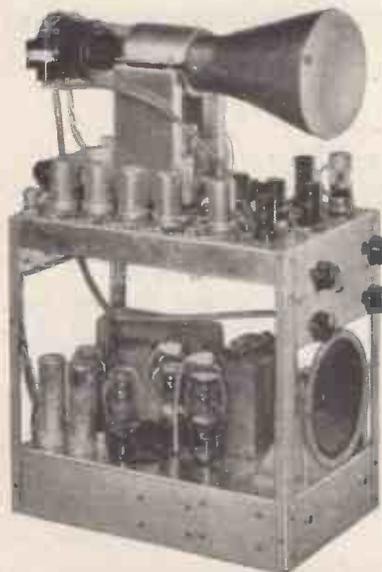
Five Easy to Assemble Kits are supplied :

VISION RECEIVER with valves, carriage 2/6 .....	£3 13 6
SOUND RECEIVER with valves, carriage 2/6 .....	£2 14 6
TIME BASE with valves, carriage 2/6 ..	£2 7 6
POWER SUPPLY UNIT with valves, carriage 5/- .....	£6 3 0
TUBE ASSEMBLY, carriage and packing 2/6 .....	£2 18 6

This unit includes the VCR97 Tube, Tube Fittings and Socket and a 6in. P.M. Moving Coil Speaker with closed field for Television. 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.



A well-made walnut finish PEDESTAL CABINET is available from stock at £5/10/0, plus 7/6 carriage and packing. Working models can be seen during transmitting hours at our Fleet Street and Edgware Road branches.

The following sensitivity figures prove that the Premier Televisor Kits are capable of reception at greater distances than any other standard commercial kit or receiver whether T.R.F. or Superhet.

VISION RECEIVER	
Sensitivity ... ..	25µv for 15 v. peak to peak measured at the Anode of the Video Valve.
Sound Rejection ... ..	Better than 40 db.
Adjacent Sound Rejection ... ..	Midland Model. Better than 50 db.
SOUND RECEIVER	
Sensitivity ... ..	20µv. Vision Relection better than 50 db.

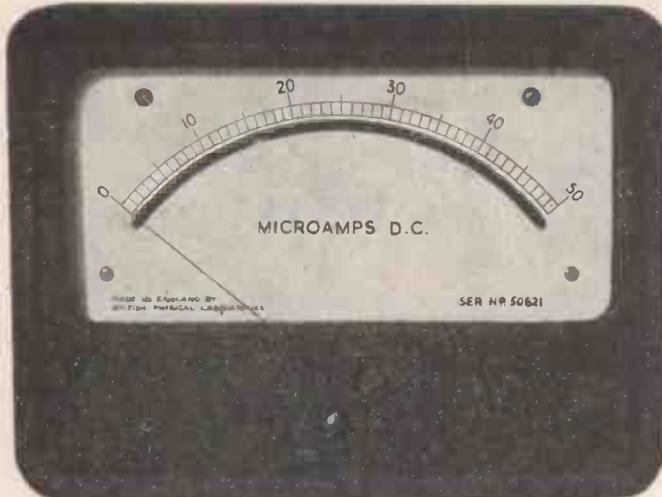
When ordering Televisor Kits

PLEASE STATE IF THE LONDON OR BIRMINGHAM MODEL IS REQUIRED

Our NEW SUMMER CATALOGUE—Now ready—Price 6d.

### BRANCHES AT

**207, EDGWARE RD., W.2** Phone : AMBassador 4033  
**AND AT 152-153, FLEET STREET, E.C.4** Phone: CENtral 2833  
 All POST ORDERS to 167, LOWER CLAPTON ROAD, LONDON, E.5 'Phone: AMHurst 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**



<b>SIZE</b>	2½"	3½"	5"
<b>RANGE</b>	25μA to 50A	10μA to 50A	10μA to 50A

<b>PRICE</b>			
50μA	55/-	61/-	93/-
200μA	45/-	51/-	83/-
1mA	35/-	41/-	73/-

(Export Prices on application)

**All sizes available with  
MIRROR SCALE**

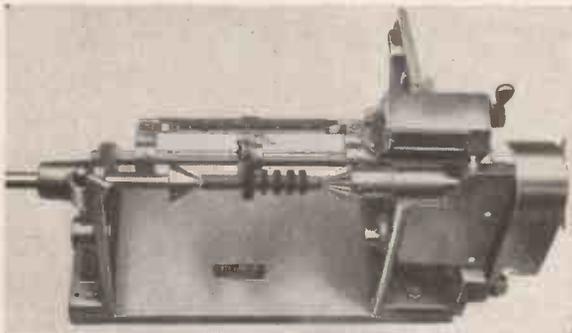
**1st Grade Accuracy**

## SENSITIVE PANEL MOUNTING METERS

For particulars of these and our full range of measuring instruments write to :—

### BRITISH PHYSICAL LABORATORIES

HOUSEBOAT WORKS · RADLETT · HERTS · Telephone: RADlett 5674-5-6



MODEL WX

## AUTOMATIC COIL WINDING MACHINES AND HAND WINDING MACHINES

Wave winding machines for single or multiple coils 1/16" to 3/4" wide for power drive.

### SOLE AGENTS ABROAD

K. G. Khosla & Co., 22 School Lane, New Delhi, India.  
Etalbis Octave Mouart, 14, Quai de l'Industrie, Sclessin-lez-Liege.  
Hefty & Frogg, Oslo, Norway, Storgaten, 15.

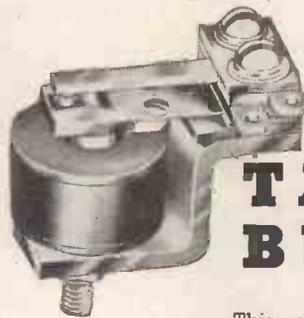
R. H. Cunningham P.T.Y. Ltd., 62 Stanhope Street, Malvern, Victoria Australia.

## ETA TOOL CO

(LEICESTER) LTD.

29a, WELFORD ROAD, LEICESTER

Phone—5386



## 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

# Frequency Shift Equipment...

Designed for conversion of any stable conventional communications receiver for frequency shift operation. Type FSR.1 is for single receiver working; other models are available for diversity reception.

**TYPE FSR 1**

*for frequency shift reception*



**TYPE FSK 2**

*for frequency shift keying*



These units can be fitted on site by station engineers, any modification of radio equipment necessitated being only of a minor nature.

RADIO & TRANSMISSION DIVISION

**AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.**



*Strowger House, Arundel Street, London, W.C.2.*

Telephone: TEMple Bar 9262. · Telegrams: Strowger, Estrand, London.

**STROWGER WORKS, LIVERPOOL, 7.**

**SOUND & VISION KIT**

21 Valves. Suitable for 9in., 10in. and 12in. Magnetic Tubes—Less Tube, tube holder and Mask. Chassis all scamped out. State whether for Sutton Coldfield or Alexandra Park. Complete with booklet, instructions, etc. £21 12s. 6d. carr. paid.  
 Pre-Amplifier for Birmingham. High gain, low noise, with built-in power pack, tunable for peak sound and vision. Completely screened. £6 19s. 6d.

**MAINS TRANSFORMERS, FULLY INTERLEAVED, SCREENED AND IMPREGNATED. ALL PRIMARIES ARE 200/250 v. Half Shrouded.**

HSM63. (Midget) Output 250/0/250v. 60 m/a. 6.3v. at 3 amps. 5v. at 2 amps. ....	15/-
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
HS75. 275/0/275v. 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	
FSM63. (Midget) Output 250/0/250v. 60 m/a. 6.3v. at 3 amps. 5v. at 2 amps. ....	15/6
FS2. 250/0/250v. 80 m/a. ....	19/6
FS30. 300/0/300v. 80 m/a. ....	19/6
FS3. 350/0/350v. 80 m/a. ....	19/6
FS2X. 250/0/250v. 100 m/a. ....	21/6
FS75. 275/0/275v. 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. 8 amps., 4v. 3 amps., 0-2-6.3v. 2 amps. Fully shrouded. ....	59/6
FS160X. Output 350/0/350v. 160 m/a., 6.3v. 6 amps. 6.3v. 3 amps., 5v. 3 amps. Fully shrouded. ....	37/6
FS43X. Output, 425/0/425v. 250 m/a. 6.3v. 6 amps. 6.3v. 6 amps. 5v. 3 amps. Fully shrouded. ....	57/6
HS6. Output, 250/0/250v. 100 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
PR1/1. Output 230v. at 30 m/a., 6.3v. at 1.5/2 amps. ....	19/6

The above have inputs of 200/250v.

**FILAMENT TRANSFORMERS**

F4. Output, 4v. 2 amps. ....	7/6
F6. Output, 6.3v. 2 amps. ....	7/6
F66. Output, 6.3v. .6 amps. ....	5/3
F6X. Output, 6.3v. .3 amps. ....	5/-
F12. Output, 12.6v. tapped 6.3v. 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. or 5v. at 10 amps. or 12.6v. at 5 amps. or 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., 6.3v. 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. ....	5/-
OPI. Midget Power Pentode, ratios 30, 60, 90-1, 40 m/a., Secondary 2/3 ohms. ....	3/2
OP2. Midget Pentode, ratios 45-1, Secondary 2/3 ohms. 40 m/a. per doz. ....	33/-
OPI0. 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	
Chokes for Williamson's Amplifier. 30H at 20 m/a., 15/6 ; 10H at 150 m/a. ....	29/6
Choke C4. 60 m/a., approx. 8 H., 350 ohms. ....	4/3
Choke C5. 40 m/a., approx. 5 H., 260 ohms. ....	3/3
Choke C6. 50 m/a., 50 H., 1,500 ohms. ....	18/6
C.W.O. (add 1/- in £ for carriage), all orders over £2 carriage paid. Trade enquiries invited.	

**H. ASHWORTH**  
 (Dept. W.W.)  
**676 GT. HORTON ROAD**  
**BRADFORD, YORKS.**

*The New*

**ACRU NEON INDICATOR LAMPS**

**SPECIAL FEATURES:—**

INCORPORATED RESISTOR

ONE HOLE FITTING

CHOICE OF CHROMIUM BAKELITE OR BRASS RINGS

IN 4 MODELS WITH SCREW TERMINALS

FOR USE ON A.C. or D.C. FROM 60 VOLTS UPWARDS



**ESSENTIAL**

ON ALL SWITCH-BOARDS, TEST PANELS, RADIO SETS, P/A SETS, TRANSMITTERS, ETC.

Send now for illustrated leaflet, prices

SOLE MAKERS

**THE ACRU ELECTRIC TOOL MFG CO. LTD.**

123, HYDE ROAD, MANCHESTER, 12

TEL.: ARDwick 4284





*are proud to have among our customers most of the leading Radio Manufacturers of Great Britain*

*We devote all our efforts to the manufacture of the finest Silver Mica Capacitors which modern scientific research can produce.*

**Stability Radio Components Ltd.**

COMMERCE ESTATE, WOODFORD AVE., LONDON, E.18.

TEL: BUCKHURST 6501/2

# THE ACOUSTICAL Q.U.A.D. AMPLIFIER

... a closer approach to the original sound



... an approach notably\* in advance of any amplifier yet offered to the public.

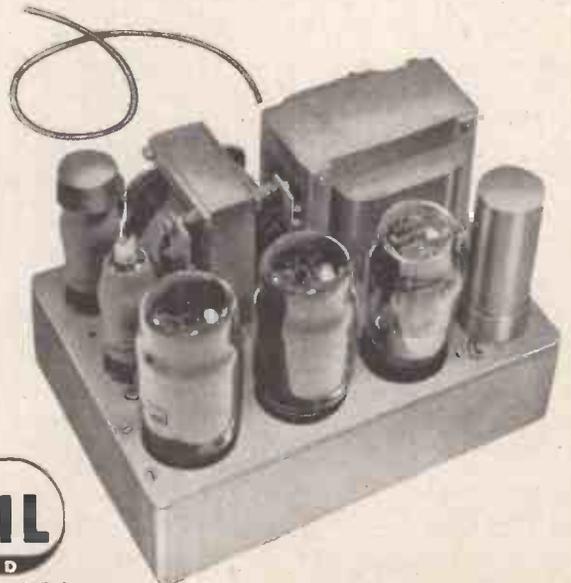
\* The word 'notably' in the above heading should be taken to mean that the advance is not one of small proportions only. It is of sufficient magnitude to be immediately apparent on a cursory listening test provided that a reasonably good loudspeaker is available. Some main factors contributing to this advance are given below.

- 1 It is the only 'Quality' amplifier which is not embarrassed by the presence of sum and difference tones, many of which inevitably fall outside the normal feedback range.
- 2 It is the only amplifier which takes into account the inherent quality of the input signal. The harmonic range is adjustable to provide an inverse characteristic of the distortion rise in the programme signal itself. (This distortion, although present in all programmes, varies with different types of programme both in slope and degree.) The range is 10db to 100db per octave with suitable rate of change of slope and two frequencies of insertion.
- 3 Because of (2) it is the only amplifier which can be used successfully with a very wide range loudspeaker if 'average' as well as 'picked' recordings are to be played.
- 4 It is the only amplifier in which the treble and bass controls can be and are designed to give the correct variations in response at all settings for the conditions under which the equipment is used. This is made possible because the treble control is no longer required to contend with variations in programme roughness etc. With the additional switch position (separate from the controls), a method of pre-setting has been achieved which is definite, simple and no longer haphazard. The controls will therefore not be mis-used other than by deliberate intent.
- 5 Day-by-day adjustments are confined to programme quality and volume controls, a procedure which is both simple and accurate.

From a 'PERFECT' input, the Q.U.A.D. will provide the most accurate reproduction yet achieved.

From a 'PRACTICAL' input, the Q.U.A.D. will provide the closest approach to the original sound obtainable.

Type Q.U.A.D. 12 watt quality amplifier for A.C mains. **£33**  
Complete in two units as illustrated.



# Simple and Reliable



**I**N areas where the cost of installation and maintenance of line communications is prohibitive, the Redifon GR. 49D comes into its own. Many hundreds have already been supplied for small communities, oilfields, forestry workings and similar assignments. Equally suitable for static or mobile installations, the set is a complete transmitting and receiving station and can be used for point-to-point or ground-to-air services with both C.W. and R.T. facilities. Radio Telephony operation is as simple as using an ordinary dial telephone, and the fully tropicalised design ensures low operating costs and complete reliability under the most adverse climatic conditions. Contact Redifon for full details.

COMMUNICATIONS  
**Redifon**  
Radio

Radio Communications Division

**REDIFON LIMITED, BROOMHILL ROAD, WANDSWORTH, S.W.18**  
DESIGNERS & MANUFACTURERS OF RADIO COMMUNICATIONS & INDUSTRIAL ELECTRONIC EQUIPMENT. Phone: VANdyke 5691

## LONG PLAYING RECORDS AND THE WILLIAMSON AMPLIFIER

Microgroove recordings require special bass and treble compensation for faithful and pleasing reproduction.

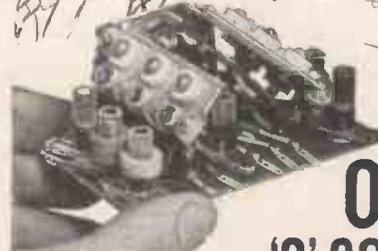
To enable users of the Williamson Amplifier to reproduce these records at their best, we have produced a tone compensating unit which provides the necessary degree of correction.

The main feature of this unit is its compact size which enables it to be mounted on the motor board. Other features include specially tailored networks to suit most recording characteristics, and the use of the latest Mullard B8A Valves.

Full details of this and other high fidelity equipment on application.

**GOODSELL LTD.,**  
40, GARDNER STREET, BRIGHTON, SUSSEX

Demonstrations at:—  
**HOLLEY'S RADIO STORES, CAMBERWELL**  
H.P. Terms Available



As specified for conversion of the Type 25 unit of the TR.1196, and for modernization of war-time utility receivers and others.

NO WHISTLES!  
WITH  
THE  
**OSMOR**  
**'Q' COILPACKS**  
SUPERHET and T.R.F.

The OSMOR "Q" Coilpack does not "whistle while it works" but gives you perfect performance in every way. And

it saves time, money and hours of wasted effort puzzling over complicated wiring circuits. Just 5 connections, 5 minutes work and the job is done—and well done!

Send stamp for **FREE** new circuits, lists of Coils, Coilpacks, Dials and all Radio Components, etc.

★ New wavelength scales for Type A dials 8/- each.

**OSMOR RADIO PRODUCTS LTD., (Dept. W.10)**  
BRIDGE VIEW WORKS, BROUGH HILL, CROYDON, SURREY.  
Telephone: Croydon 1220.

# LONDON CENTRAL RADIO STORES

*Government Surplus - Immediate Delivery from Stock*

**EX-R.A.F. RECEIVER TYPE 81B**



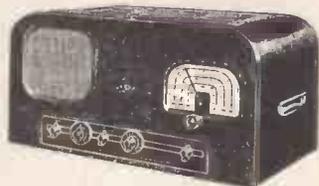
A channel checking receiver of 49 to 100 metres range. 8 valves: four EF50, one EF39, one EBC33, one 6K8, one Diode EI50. No Service manual or other information available. Price with metal cover

**47/6**

1/30th H.P. MOTORS. Constant speed. Double-ended spindles. 220-250v. These motors are new, not surplus conversions and are suitable for 16 mm. projectors and many other purposes. **37/6** AC/DC, without feet  
**VISION UNIT, Type 162.** Complete with 6in. 517 C.R. Tube, 2in. 139 C.R. Tube, one 807, three VR65, one 6J5 valves. 0.5 milliammeter, condensers, etc. Suitable for Television **55/-**  
**PHOTO ELECTRIC CELLS, Type CV143.** Small infra-red image, glass converter tube, 50-100v. Suitable for all purposes. Guaranteed New. N.B.—We cannot enter into correspondence **10/-** regarding these cells  
**10-VALVE COMMUNICATIONS RECEIVERS, Type 1155.** Guaranteed equal to new. Freq. range 7.5 mc/s. 75 kc/s. in five wavebands. Complete with 10 valves including magic eye. Enclosed in metal case. Every receiver is aerial tested. Complete with Power Pack and Loudspeaker for A.C. mains **£16.10.0**  
 220/250v

**BRAND NEW ACCUMULATORS.** Complete in strong case, as illustrated. British made. 6v. 85 a. Size 12x9x7in. Weight, 45lb. Carriage and **£3.10.0** packing 5/-  
**NEW OLDHAM'S GLASS CELL ACCUMULATORS.** 2-volt, 41 x 1 1/2in. square. Weight, 14 oz., each **2/3** In lots of six 12/-  
**MAP READING TORCH.** Powerful magnifying lens, 3in. diam. In bakelite case. Fitted with dimmer switch Takes 2U2 cells. With **22/6** bulb, less batteries  
**SMALL FRACTIONAL H.P. MOTORS.** 24v. A.C./D.C. Double-ended spindle. **7/6** Size 2in. square  
**MOVING COIL HAND MICROPHONE.** 30 ohm voice coil. Complete **5/6**  
**PHOTO-ELECTRIC CELLS, Type GS16.** These cells are the gas-filled type with caesium Cathode. Made by Cintel. Minimum sensitivity 100µA/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

**MAGNETA 6-VALVE A.C. RECEIVER**



3 wavebands, L., M. and S. Push-pull amplifier output 15 watts, using two 6V6 valves. Connections for Gramophone and microphone. In black metal cabinet, crackle finish. Size 21 x 12 x 10in. Built-in speaker. Suitable for concert halls, works, etc. Thoroughly overhauled by our experienced staff. Carr. pd. **£15.0.0**

**MOVING COIL SPEAKERS** by Film Industries Ltd., with metal flare. Unit 4 1/2in. dia. Weight 7 1/2 lb. **£5.10.0**

**WALKIE-TALKIE (Transmitter and Receiver) CHASSIS, type 38 Mk. II**

**NEW EXIDE ACCUMULATORS**



2-volt in black bakelite case, 15-20 amps. Size 6in. x 1 1/2 in. square. Weight 26 ozs. Brand new **5/6** Carr. paid. or in lots of six **30/-**

**4-VALVE USED SUPERHET UTILITY RECEIVER**



Every one guaranteed to be in working order. Medium Waveband only. Four valves, P.M. Speaker, complete in pine-wood cabinet size 13 1/2 x 12 x 6 1/2in. A.C. mains 200/250 volts. In good condition. Plus 5/- carr. and **£3.19.6** pkg.

**PHILIPS 6-VALVE COMMUNICATIONS RECEIVER**



16-50, 200-550 and 800-2,500 metres. R/F, F/C, 2 I.F.s D.D.F. Pentode Output. Spin-wheel tuning. In black metal case with built-in speaker. Complete with power pack, AC 200-250v. Can also be supplied with 12v. D.C. power pack if required. BRAND NEW **£16.10.0** EX-GOVT

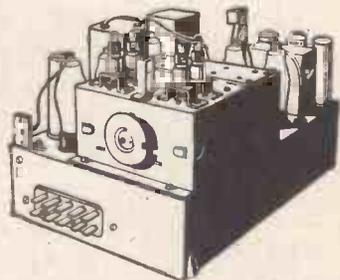
**RECEIVER ONLY.** Equal to new. (Carr. and **£10** pkg. 10/6). (See July issue for illustration.) FREE with each receiver! Complete circuit, description and modifications for civil use, reprinted from "W.W." July, 1946.  
**BALL MICROPHONE.** Manufactured by Standard Electric. All in perfect condition. Suitable for broadcasting and recording. Moving Coil (Dynamic). Omnidirectional. No energising necessary. High Fidelity. Coil Impedance 15 ohm and will work very well in conjunction with an ordinary speaker transformer. Is of the type used by many leading bodies, such as the B.B.C. and G.P.O. for high fidelity **£4.17.6** reproduction (See illustration, July issue.)

Matching, Burglar Alarms, Automatic Counting, Door Opening, etc. Brand new. In original cartons. **42/6**

**2-VOLT VIBRATORS, Type R76C.** 7-pin self-rectifying. Output 200v. at 60 m/A. Made by Electronic Laboratories Inc. **7/6**  
**Mallory Type 650, 6v. 7/6** 4-pin American base  
**FIVE-WAY RUBBER COVERED CABLE.** Suitable for lighting and other purposes. Per doz. yds. **6/-**  
**CO-AXIAL CABLE for TV.,** 75 ohms, 12 yard lengths **8/-**  
**HEADPHONES.** American lightweight. 200 ohms. Suitable for Deaf Aid, **7/6** Pair.  
**UNI-SELECTOR SWITCHES.** With complete wipers, 4-bank, 37/6; 6-bank, 37/6; 3-bank, 22/6.

In perfect working order. Complete with four ARP12, one ATP4 valves, one pair throat mikes, pair headphones and aerial. In metal case. Free wiring diagram. Less batteries. Carr. and pkg. **£38.8.6** 2/6.

**R.A.F. 6-VALVE SUPERHET RECEIVING UNIT NO. 25**



Easily adapted for short wave reception for home use. Contains two EF36, two EF39, one EK32, one EBC33 valves, condensers, resistances, etc. Free circuit diagram, 9in. x 19in., showing all components, supplied with each set. In new condition. All valves guaranteed. **22/6**

**PLEASE NOTE**

- We do not issue lists or catalogues.
- Carriage charges relate to British Isles only.

**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.

# TAYLOR

# TELEVISION

## MODEL 240A

**TELEVISION PATTERN GENERATOR** Frequency coverage from 40 - 70 Mc/s. Suitable for London & Midlands. A.C. mains operated.

£14 . 0 . 0 List Price

## MODEL 170A

**ELECTRONIC TEST METER** A 40 range instrument fitted with 4" Moving Coil Meter. A.C. mains operated.

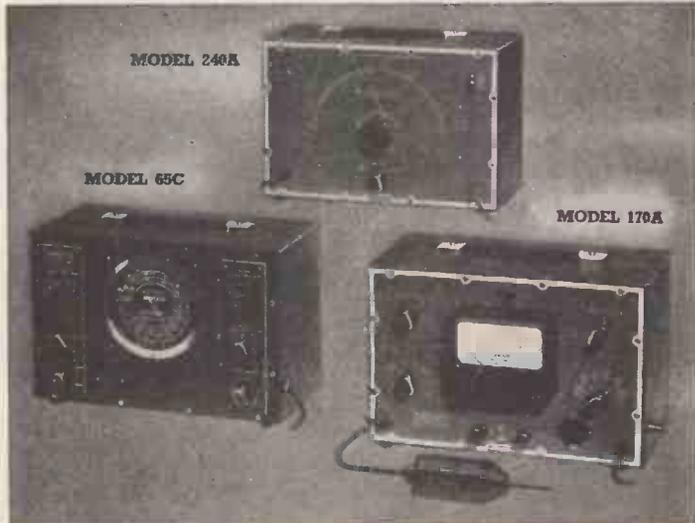
£22 . 10 . 0 List Price

## MODEL 65C

**WIDE-RANGE SIGNAL GENERATOR** 7 ranges from 100 Kc/s - 160 Mc/s. A.C. mains operated

£17 . 15 . 0 List Price

ALL WINDSOR & TAYLOR TEST EQUIPMENT IS AVAILABLE ON H.P. SEND FOR DETAILS AND CATALOGUES.



## TEST GEAR

### TAYLOR ELECTRICAL INSTRUMENTS LTD

419-424 MONTROSE AVENUE, SLOUGH, BUCKS, ENG.

Telephone Slough: 21381 (4 lines) Grams & Cables: Taylins, Slough

Other products include: Multirange A.C.D.C. Test Meters Signal Generators • Valve Testers • A.C. Bridges Circuit Analysers • Cathode Ray Oscillographs High and Low Range Ohmmeters • Output Meters Insulation Testers • Moving Coil Instruments

## T.V. in the FRINGE AREAS



★

### A Superior PRE-AMPLIFIER By 'RAINBOW'

For use with CO-AX or BALANCED FEEDER

Built-in Power Pack, with Metal Rectifier, E.F.91 valve, exclusive Rainbow Coils. Complete with all Plugs. Crackle Finish, Steel Case  
8 $\frac{3}{8}$ " x 4 $\frac{3}{4}$ " x 2 $\frac{1}{8}$ ".

Price £5 17 6

Alexandra Palace or Sutton Coldfield Model

Is giving excellent results with Receivers by Bush, Pye, H.M.V., Marconi, Philips, etc. It's to your advantage to write for fuller details.

**RAINBOW RADIO MANUFACTURING CO. LTD.**

Mincing Lane, Blackburn, Lancs., England

Quality  Television  
Sets, Chassis and Components

NEW

## PM FOCUSING UNIT

Rear operated shift controls.

Remote focussing control, worked through gears by key extending beyond cap of CR tube.

Alcomax III magnet.

Tube supporting plate for solid fixing concentric with neck of tube.

Type PM15A for tetrodes and PM20A for triodes. Price 36/-

For further details ask for Technical Publication No. 44.

SCANNING UNITS for aluminised CR tubes, for circuit see Technical Publication No. 38A

10KV. RF. E.H.T. UNITS:

TELEVISION RECEIVERS and COMPLETE SETS in SINGLE CHASSIS FORM, all with ALUMINISED CR TUBES. Circuit booklet 1/6 post free.

**HAYNES RADIO LTD.** Queensway, Enfield, Middx.

new valves



for **AIRBORNE** and **MOBILE**  
V.H.F. Communication Equipment



Recently added to the *Standard* range are two Grounded Grid Triode Valves types 3B/240M and 3B/241M, which have been specially developed to meet the need for reliable, low priced transmitter output valves capable of giving an output of at least 12 watts at frequencies up to 200 M/cs.

**CHARACTERISTICS**

	3B/240M	3B/241M
Heater	6.3 V	19 V
	1.1 A.	0.37 A.

**CAPACITANCES**

Anode to grid	4.3 pF
Anode to cathode	0.15 pF
Grid to cathode	11.0 pF

**RATINGS**

V <sub>a</sub> (max.)	325 V
I <sub>a</sub> (max.)	120 mA
W <sub>a</sub> (max.)	15 W (without cooling)
	24 W (with cooling)

Amplification factor	Measured at	90
Mutual conductance	I <sub>a</sub> = 50 mA	27 mA/V

**DIMENSIONS**

Maximum overall length	3.5/32 inches
Maximum seated height	2.5/8 inches
Maximum diameter	1.3/16 inches
Base	B8B

**Standard Telephones and Cables Limited**

Registered Office: Connaught House, Aldwych, London WC2

RADIO DIVISION Oakleigh Road, New Southgate, London N.11



## A Portable Amplifier of Established Merit

**PA30/B PORTABLE AMPLIFIER.** A 30-watt Amplifier for public address men. Inputs for moving coil or ribbon microphones and gramophone. Tone control. Illuminated panel and output signal level indicator.

Outputs: 7.5, 15 ohms and 100-volt line. Operates from 200/250 volts, or 12-volt battery when used with battery adaptor unit type LT30.

Supplied in handsome portable case. An ideal equipment for P.A. vans, general installations and outdoor requirements.

**List Price : PA30/B Portable Amplifier, £35.**

**LT30 Battery Adaptor, £12 10s. od.**

*Manufacturers of Industrial, Portable and Mobile Amplifiers to suit every possible need. You are invited to write for further details of our range of products.*



### LEADERS IN THEIR FIELD

**Birmingham Sound Reproducers Ltd. Claremont Works, Old Hill, Staffs. Tel: Cradley Heath 6212/3**

40th YEAR OF PUBLICATION

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

Editor: H. F. SMITH

PUBLISHED MONTHLY Price 2/- (last Thursday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford St., London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Ethaworld, Sedist, London."

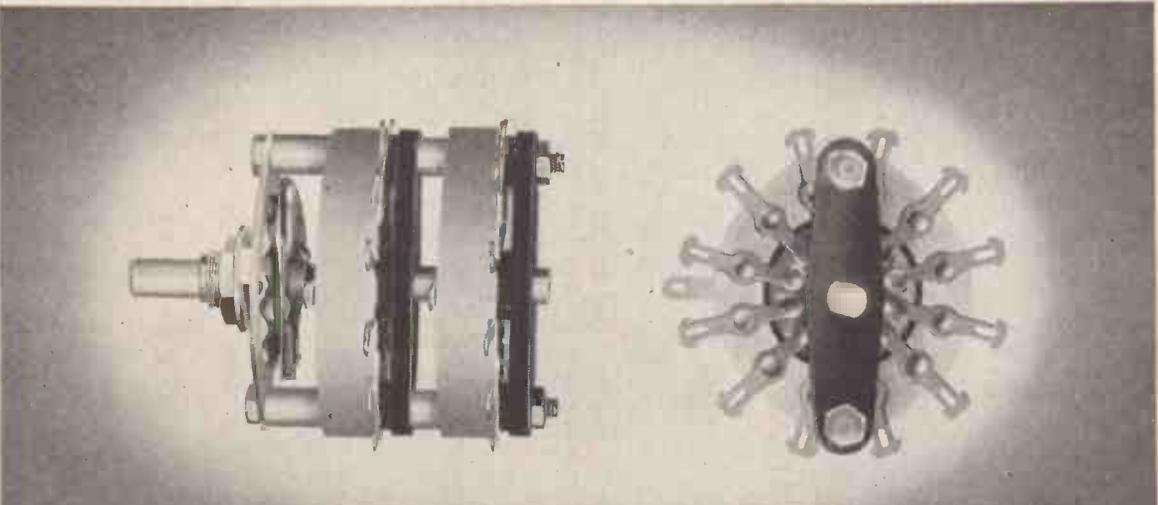
ANNUAL SUBSCRIPTION: Home and Overseas, £1 6s. 0d.; U.S.A. and Canada, \$4.50

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

EDITORIAL COMMENT .. .. .	305
17th NATIONAL RADIO EXHIBITION .. .. .	306
FLYBACK E.H.T.—2. By <i>W. T. Cocking</i> .. .. .	313
WORLD OF WIRELESS .. .. .	316
MEASUREMENTS WITH SIMPLE APPARATUS. By <i>Donald Robinson</i> .. .. .	320
AIR TRAFFIC CONTROL .. .. .	323
NEW BOOKS .. .. .	324
GRAMOPHONE SPEED CONVERSION. By <i>R. L. West</i> .. .. .	325
IMPROVED STEREOPHONY. By <i>E. Aisberg</i> .. .. .	327
SHORT-WAVE CONDITIONS. By <i>T. W. Bennington</i> .. .. .	330
R.C. OSCILLATORS. By " <i>Cathode Ray</i> " .. .. .	331
MONITORING AIRWAYS RADIO .. .. .	335
UNBIASED. By " <i>Free Grid</i> " .. .. .	336
LETTERS TO THE EDITOR .. .. .	337
RANDOM RADIATIONS. By " <i>Diallist</i> " .. .. .	340



### CERAMIC SWITCHES

For applications where only the best is good enough. Stators and rotors of Frequentite "R" ceramic. All contact members of silver alloy.

# Wright and Weaire Limited

138, SLOANE ST. · LONDON · S.W.1 TEL SLOANE 221415 FACTORY: SOUTH SHIELDS, CO. DURHAM



# Important trends in VALVE DESIGN

## MULLARD TELEVISION H.F. PENTODE TYPE EF80

The main application of the EF80 is as R.F. or I.F. amplifier in television receivers. It is, however, suitable for use also as a video output valve, as a synchronising pulse separator and as a frequency changer. In order to meet the requirements of the latest trends in receiver practice, and particularly the trend to use the transformerless technique for D.C./A.C. operation, the valve has been designed to give adequate performance when operated from a 170 V high tension line. The EF80 is a miniature R.F. pentode of all-glass construction. The adoption of the Noval (B9A) base with its extra pin connection permits the use of two cathode leads, as a result of which the input conductance is greatly reduced—a point of considerable importance at the higher television frequencies. In the radio frequency stages of receivers for use in the 41.5-65 Mc/s band, and also in the I.F. amplifying stages of superhet receivers operating on the higher television frequencies where intermediate frequencies of the order of 45 Mc/s, are commonly employed, the damping due to the input conductance of the valve is a limiting factor in performance. The low value of input conductance of the EF80 (330  $\mu$ mhos

at 100 Mc/s) renders the valve superior to previous types in this respect. The following table gives the gains obtainable in a 4-valve amplifier for the following conditions:—

- (a) Bandwidth 6 Mc/s centred on 45 Mc/s.
- (b) Bandwidth 3.5 Mc/s centred on 65 Mc/s.

These conditions correspond to Channels 1 and 5 in the British television frequency band, and also represent the most severe conditions under which the valve is likely to be used, either as R.F. amplifier in T.R.F. receivers for the 41.5 to 68 Mc/s band, or as an I.F. amplifier in superhet receivers for higher carrier frequencies.

	Gain (decibels)	
	Amplifier (a)	Amplifier (b)
Staggered tuned circuits	100	84
Transformer coupled circuits	114	135

For direct-view receivers a gain of 90 db from the aerial terminal to the detector is necessary. It is therefore seen that the EF80 gives ample gain in a 4-valve amplifier at 45 Mc/s using either staggered-tuned single circuits or transformer coupling. At 65 Mc/s, however, transformer coupling must be employed.

### RATINGS AND CHARACTERISTICS

HEATER			
$V_h$	....	....	6.3 V
$I_h$	....	....	0.3 A
CAPACITANCES			
$c_{in}$	....	....	7.5 $\mu$ F
$c_{out}$	....	....	3.3 $\mu$ F
$c_{a-g1}$	....	....	< 0.007 $\mu$ F
$c_{a-k}$	....	....	< 0.01 $\mu$ F
$c_{g1-h}$	....	....	< 0.15 $\mu$ F
CHARACTERISTICS			
$V_a$	....	....	170 V
$V_{g2}$	....	....	170 V
$V_{g3}$	....	....	0 V
$I_a$	....	....	10 mA
$I_{g2}$	....	....	2.5 mA
$V_{g1}$	....	....	-2.0 V
$g_m$	....	....	7.4 mA/V
$r_a$	....	....	0.5 M $\Omega$
$\mu_{g1-g2}$	....	....	50
$R_{eq}$	....	....	1,000 $\Omega$
Input damping (at 50 Mc/s)	....	....	12,000 $\Omega$



Reprints of this article together with additional data may be obtained free of charge from the address below.

MULLARD ELECTRONIC PRODUCTS LTD.,  
TECHNICAL PUBLICATIONS DEPARTMENT,  
CENTURY HSE, SHAFTESBURY AVE., W.C.2  
MVM 139

# These Valves make News!

## MINIATURE AMERICAN TYPES

### for AC/DC EQUIPMENT

A complete range of miniature B7G valves is now available for 110 volt or 240 volt AC/DC equipment. All these valves bear American type numbers.

#### TYPE 50C5

##### OUTPUT TETRODE for 110v. Supply

Heater Rating ... ..	50.0 volts 0.15 amp.
Mutual Conductance ... ..	7.5 mA/V
Power Output ... ..	1.9 watts

#### TYPE 19AQ5

##### OUTPUT TETRODE for 240v. Supply

Heater Rating ... ..	19 volts 0.15 amp.
Mutual Conductance ... ..	4.1 mA/V
Power Output ... ..	4.5 watts

#### TYPE 35W4

##### HALF WAVE RECTIFIER

Heater Rating ... ..	35 volts 0.15 amp.
R.M.S. Input ... ..	240 volts max.
Rectified Current ... ..	100 mA. max.

DIMENSIONS:—Seated Height 2½" max.  
Diameter ½" max.

#### TYPE 12BE6

##### SPECIAL HEPTODE

Supply Voltage ... ..	110 volts	250 volts
Heater Rating ... ..	12.6 volts 0.15 amp.	
Anode Impedance ... ..	0.5	1.0 meg.
Osc. Mutual Conductance ... ..	7.5	7.5 mA/V
Conversion Conductance ... ..	0.40	0.48 mA/V

#### TYPE 12BA6

##### VARI Mu R.F. PENTODE

Heater Rating ... ..	12.6 volts 0.15 amp.	
Anode Impedance ... ..	0.25	1.5 meg.
Mutual Conductance ... ..	4.3	4.4 mA/V

#### TYPE 12AT6

##### DOUBLE DIODE TRIODE

Heater Rating ... ..	12.6 volts 0.15 amp.	
Voltage Gain ... ..	33	42

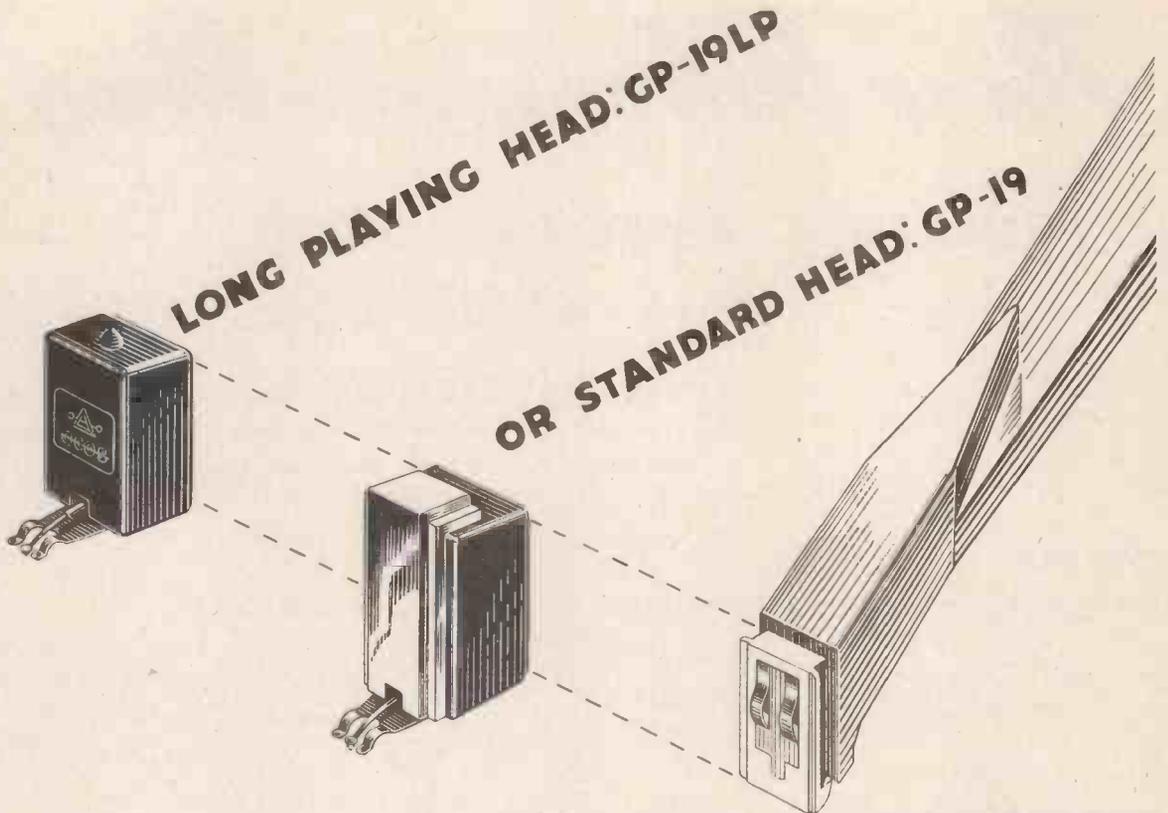
DIMENSIONS:—Seated Height 1½" max.  
Diameter ½" max.

# BRIMAR

TECHNICAL ADVICE SERVICE

WRITE NOW TO DEPT. 4530  
for data sheet on the above valves

STANDARD TELEPHONES AND CABLES LIMITED, FOOTSCRAY, SIDCUP, KENT.



**INTERCHANGEABLE ON THE GP20 NEW TRUE FIDELITY PICK-UP**

Long-playing micro-groove records are here. And so is the GP.19LP Head, specially made for them. It is interchangeable with the Standard GP.19 Head on the famous GP.20 Pick-Up. The man with a GP.20 and these two heads is equipped for the finest possible reproduction from any record—standard or micro-groove, 78 or 33 $\frac{1}{3}$  r.p.m.

**SOME CHARACTERISTICS**

**GP-19 HEAD**

Output  $\frac{1}{2}$  v. at 1,000 c.p.s.—5 to 20 times greater than comparable magnetic types.

Range 30-10,000 c.p.s.

Low needle pressure—14 grms.—virtually eliminates record wear.

**GP-19LP HEAD**

Output  $\frac{1}{2}$  v. at 1,000 c.p.s.

Response is flat from 30 c.p.s. to 3,000 c.p.s. with a rising characteristic above this frequency.

Needle pressure 7 grams.

**BOTH HEADS**

Automatic bass-boost without additional equalisers.

Can be fitted to domestic radios. Needle talk and motor rumble negligible.

Unbreakable and non-hygroscopic crystal element.

Permanent sapphire stylus eliminates needle change.

GP-20	Complete pick-up with Standard Head .. ..	£2 10 0
		(plus 21/5 P.T.)
GP-20LP	Complete pick-up with Long Playing Head .. ..	£2 10 0
		(plus 21/5 P.T.)
GP-19	Standard Head as fitted to GP-20 .. ..	£1 10 0
		(plus 13/4 P.T.)
GP-19LP	Long Playing Head as fitted to GP-20LP .. ..	£1 10 0
		(plus 13/4 P.T.)



# THE "BELLING-LEE" PAGE

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

## The National Radio Exhibition Number

In under a fortnight many readers of this page will be visiting the Radio Exhibition at Castle Bromwich. We are confident that a fair proportion of them will visit us on stand No. 71. Right hand side, the stand surmounted by a "Sky-tower" bearing a "Multirod," the whole erected as high as the hall will allow.

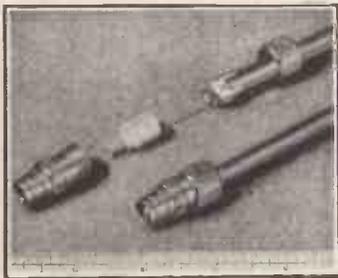
In general our efforts will be directed towards selling aerials, television aerials in particular, for the manufacture of which we have recently purchased an additional factory. By the time the exhibition opens we will have approximately 50,000 square feet of floor space devoted to aerial manufacture.

## Television Aerial Conversion Kits

These will be made available just as soon as the frequencies of new transmitters have been confirmed by the B.B.C. It should be remembered that the frequencies of Sutton Coldfield were changed about a fortnight before it opened. The prices of aerial conversion kits will be kept as low as possible, and we hope to be able to show visitors to our stand, just what the kits will look like.

## Television Demonstration Aerials

In view of the rapid expansion in the B.B.C. building programme and the hope of two new stations within a year, many visitors will be interested in the new "Belling-Lee" kit to enable television demonstration aerials to be erected temporarily and quickly.



## Universal Coaxial Plug

It is expected that "Wireless World" readers will be more interested in our better quality components, and we hope they will all like our new universal coaxial plug L.734/P. This fits all "Belling-Lee" coaxial sockets and



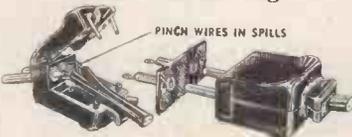
termination boxes, and accepts coaxial cables from 5/32 to 5/16, covering television feeders for domestic purposes with impedances from 50 ohms and including 72 ohm semi-air-spaced.

It is the first "Belling-Lee" plug that, when the writer took it apart for the first time, half of its "innards" didn't find their way under the desk and into trouser turn-ups.

It is easy to load, as the soldering is done before assembly.

This plug replaces three others, which we feel to be a really useful contribution towards standardisation. There may be a new socket and there certainly will be a new aerial termination box incorporating novel ideas.

## Twin Feeder Plug



We are conscious that although we have, for long enough, advocated the use of 80 ohm balanced feeder, we have been dilatory in offering a really suitable twin plug at a competitive price. At last we believe we have something that will appeal to most users. Something cheap, easy to load, and suitable for the purpose. A termination box to take this plug will also be shown for the first time.

## Electrical Interference with Television

It is generally appreciated that the most troublesome form of interference is that caused by motor cars, but there are cases of interference from small electric motors, and this can be very annoying when it does occur. The suppression

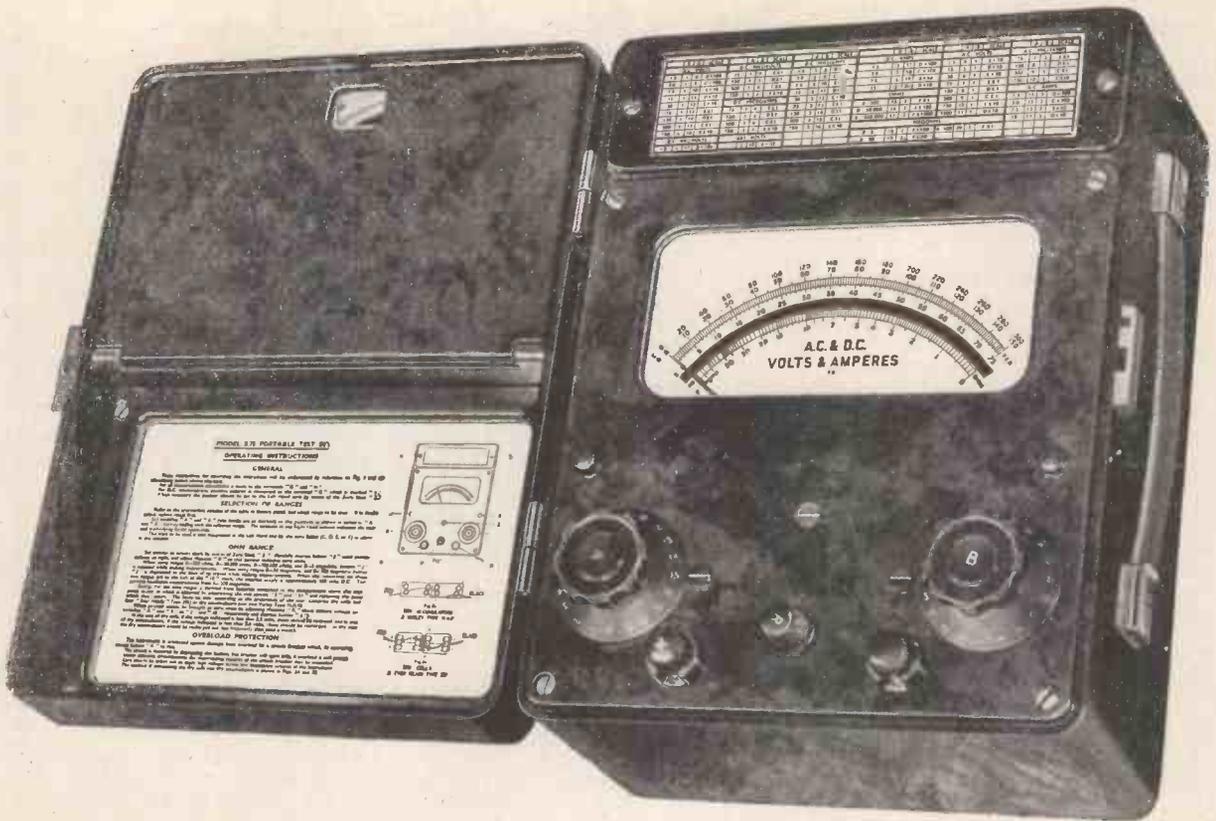
of such interference at the source does not present much difficulty, but there is little that can be done at the television receiver. Once the interference gets out on the line, it is quickly radiated and re-radiated, and may be picked up by some receivers even when the aerial is well outside the normal interference field, and correctly balanced.

We do want to emphasise that, so far as we know, there is at present no suitable set lead suppressor of any make which will be of much practical use at television frequencies.

We have said this before, but we still have cases where radio dealers have sold the well-known L.300 set lead suppressor, most efficient on broadcast frequencies but really not worth while for television. There may have been some confusion because we claim the L.300 suppressor to be useful from 10 to 2,000 metres. Readers will appreciate that there is a big difference between 10 metres (i.e., 30 Mc/s) and 41.5 Mc/s, the lowest frequency used for television. It should be realised that the usual flex lead suppressors L.301 and L.1174 are normally not effective at television frequencies. "Belling-Lee" are continuously working on this problem and hope to produce a range of suppressors effective at these frequencies.

Where interference is really serious the most sound advice is to erect the best possible aerial as high as practicable, no matter how close the site may be to the transmitter. This may involve the use of attenuators but the signal-to-noise ratio may be greatly improved.





**The**  
**WESTON**  
**S.75**  
**Multi-Range**  
**Test Set**

**53 Ranges with Rotary Switch Selection**

This uniquely comprehensive Test Set has 53 ranges for measuring A.C. and D.C. current and voltage, resistance and insulation. It is completely self-contained, with internal batteries to provide power for the ohms ranges and self-contained power pack for insulation measurement at 500v. Selection is carried out by two 20-position switches. A fully-protective safety device is fitted and is operative for forward or reverse overload. The 150-division 6in. scale is uniformly divided and is fitted with an anti-parallax mirror. The set is enclosed in a handsome bakelite case and fully complies with B.S.S. No. 89 covering first-grade instruments. Full details of the ranges covered, and of the complete specification, will gladly be supplied on request.

**SANGAMO WESTON LIMITED**  
**ENFIELD, MIDDLESEX**

TELEPHONE: ENFIELD 8434 (6 LINES) AND 1242 (4 LINES)  
 TELEGRAMS: SANWEST, ENFIELD

DEPOTS AT  
 Glasgow, Newcastle-on-Tyne, Leeds, Manchester, Wolverhampton, Bristol, Liverpool, Nottingham, Southampton, Ipswich and Brighton.



# HIGH QUALITY REPRODUCTION

"FIFTY and THIRTY WATT" CINEMA AMPLIFIERS as illustrated for single or double P.E.C. input with separate adjustable bias. Full range of tone controls to suit all needs with built-in Exciter Supply if required.

PRICES range from **34½ gns.** to **42½ gns.**



### TYPE C.P. 20A AMPLIFIER

For AC Mains and 12 volt working giving 15 watts output, has switch change-over from AC to DC and "Stand-by" positions. Consumes only 5½ amperes from 12 volt battery. Fitted with mu-metal shielded microphone transformer for 15 ohm microphone, provision for crystal or moving iron pick-up with tone control for bass and top. Outputs for 7.5 and 15 ohms. Complete in steel case with valves.

PRICE **£28 0 0.**

### FOUR-WAY ELECTRONIC MIXER

This unit has 4 built-in balanced and screened microphone transformers, normally of 50-30 ohms impedance. It has 5 valves and selenium rectifier supplied by its own built-in screened power pack consumption 20 watts. Suitable for recording and dubbing, or large P.A. Installations since it will drive up to six of our 50 watts amplifiers whose base dimensions it matches. The standard model has an output impedance of 20,000 ohms or less, and any impedance can be supplied to order.



PRICE **£24 0 0.**

### OTHER MODELS IN OUR RANGE OF AMPLIFIERS

- "SUPER-FIFTY WATT" . . . . . PRICE **36½ gns.**
- "THIRTY WATT" . . . . . " **30½ gns.**
- "10-15 WATT RECORD REPRODUCER" " **25½ gns.**



These are fitted in well ventilated steel cases with recessed controls, as illustrated.

*Full details upon request.*  
**EXPORT ENQUIRIES INVITED!**

**VORTEXION LIMITED, 257-261 THE BROADWAY, WIMBLEDON, LONDON, S.W.19**

Telephones: LIB 2814 and 6242-3

Telegrams: "Vortexion, Wimble, London."



MEET US AT  
**THE RADIO SHOW**  
**CASTLE BROMWICH**  
 Birmingham Sept. 6-16

**STAND**  
**No. 62**

THEY SANG THE PRAISES OF THE 10 INCH ★

*NOW we present a*  
**12" Stentorian**  
**Concentric Duplex**  
**HIGH FIDELITY REPRODUCER**

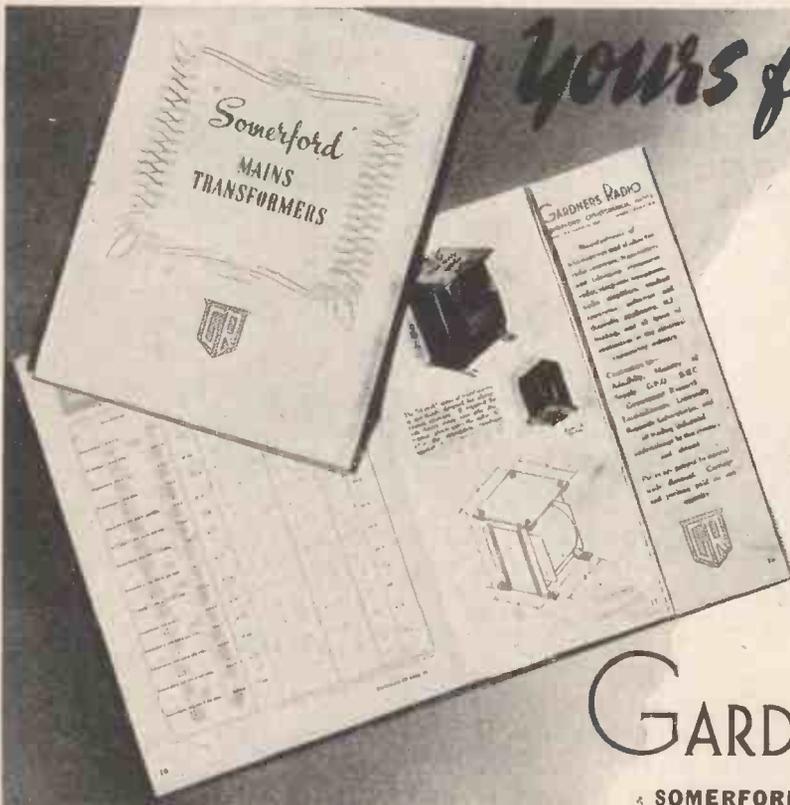
Similar in construction to our highly successful 10" Concentric Duplex, it combines the same high quality with large power handling capacity, achieved by a very high flux density magnet, and special cone material (made from newly-developed long fibre pulp) which enables a resonant point of below 50 c.p.s. to be obtained. The all-metal high frequency diaphragm and speech coil gives rigidity of construction and maximum driving efficiency. This rear assembly is totally protected by a bakelite and perspex housing.

Full details of both 10" and 12" models on request.

**SPECIFICATION** Serles Gap magnet of Alcomax 3.  
 OF 12": Flux in LF gap 14,000 gauss on 1½" pole  
 " HF " 17,000 gauss " " "  
 Power handling capacity, 15 watts. Frequency range  
 30-17,000 c.p.s. Fundamental bass resonance, 45 c.p.s.

**PRICE** Complete with cross-over network and transformer, **£15 - 15 - 0**  
 " Without transformer, **£14 - 14 - 0**

WHITELEY ELECTRICAL RADIO CO. LIMITED · MANSFIELD · NOTTS



*Yours for the asking!*

All you need to know about the "SOMERFORD" range of Mains Transformers

You are invited to write for this new 28-page booklet. Specifications, dimensions, fixing centres, weight, price, etc., all the information relating to the Somerford Mains Transformers including the Avon, Hengist, and Burley types is contained in this latest publication. You will find it an invaluable work of reference.

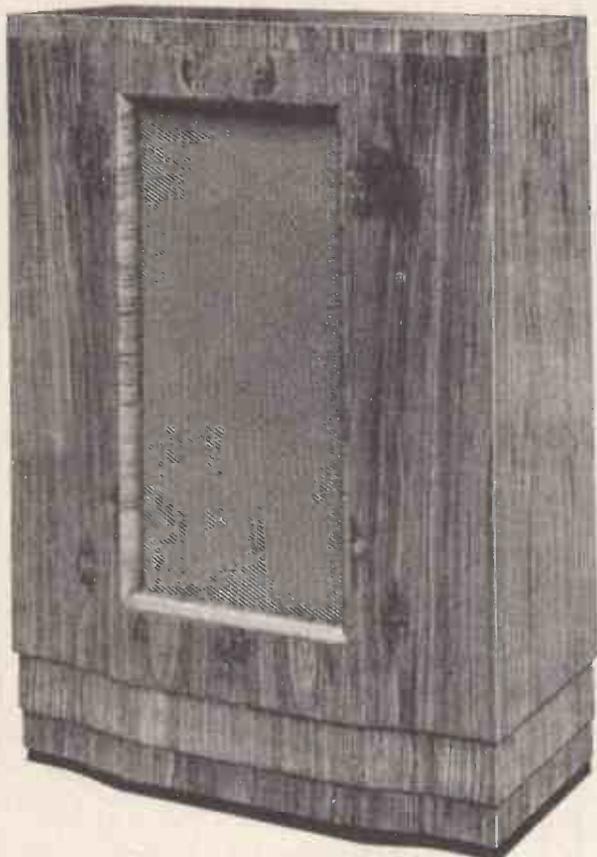
Somerford Transformers are designed to meet the standard requirements of the Radio, Television and Electronic Industries.

Obtainable direct from the manufacturers.

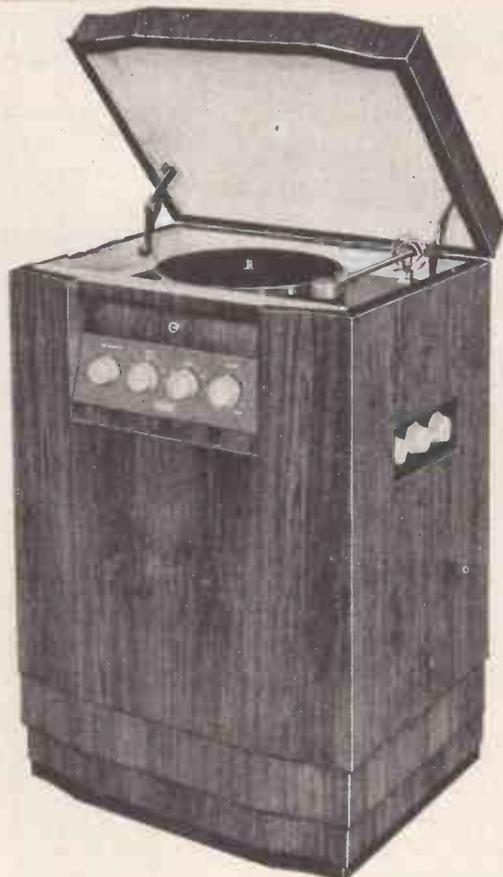
**GARDNERS RADIO** Ltd

5 SOMERFORD, CHRISTCHURCH, HANTS.

Tel.: CHRISTCHURCH 1025

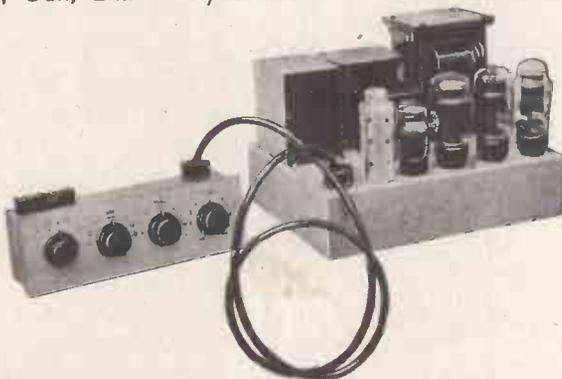


LEAK "550" CABINET LOUDSPEAKER, using separate bass and treble loudspeakers with cross-over filter. Finished to customers' requirements in Walnut, Mahogany, Oak, Elm or Sycamore.



CONSOLE CABINET, housing the LEAK TL/12 and RC/PA amplifiers, LEAK radio unit, and gramophone unit using the LEAK Dynamic pick-up.

RC/PA Remote Control pre-amplifier. £6-15-0



*These amplifiers are the choice of many distinguished audio engineers for high quality reproduction in their own homes.*

TL/12. 12 - Watt Triple Loop Feedback Amplifier. £25-15-0

Used with the RC/PA pre-amplifier and the best complementary equipment the TL/12 power amplifier gives to the music-lover a quality of reproduction unsurpassed by any equipment at any price. It is designed in a form so that the power amplifier can be housed in the base of a cabinet and the small pre-amplifier mounted in a position best suited to the user.

★ BEFORE PURCHASING YOUR NEW REPRODUCER ASK YOUR DEALER FOR A DEMONSTRATION OF LEAK EQUIPMENT ★

**H. J. LEAK & CO. LTD. (Est. 1934), Brunel Rd., Westway Factory Estate, Acton, W.3**

Phone : SHEpherds Bush 1173/4

Telegrams : Sinusoidal, Ealux, London

Foreign : Sinusoidal, London

*From the comprehensive  
range of*

# ANTIFERENCE *Aerials* FOR TELEVISION & RADIO

From the inception of television Antiference have devoted the whole of their activities solely to the design and production of aerials and aerial equipment. Antiference pioneer work has produced a range of aerials—both television and radio—from which can be selected a model to meet the most critical individual conditions. Below are briefly described typical Antiference products.

## 1 The "D6" THREE ELEMENT Television Aerial

A high-gain model for fringe areas. Provides maximum signal and sharply directional reception.

## 2 The "ANTEX" Television Aerial

Revolutionary in design and performance this aerial provides stronger signals and greater reduction of interference than the standard "H" array. Complete with 7ft. mast and chimney or wall mounting, or with pole mounting fitting.

## 3 The COMBINED Television and "EXSTAT" Aerial

Provides interference-free reception of both television and radio.

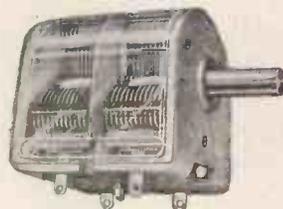
## 4 The "FOURWAY" Television Aerial

A versatile aerial for strong signal areas primarily designed for indoor use, but can be mounted outdoors where signal strength is not adequate for indoor mounting.

See them on  
**STAND No. 18**  
National Radio Exhibition

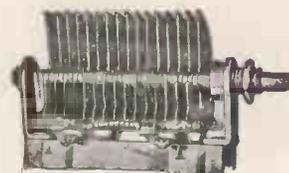
ANTIFERENCE LIMITED · 67 BRYANSTON STREET · LONDON · W·1

**SO SMALL—  
IT DOES  
A BIG JOB**



Miniature in Size, but big in performance. The M.M. 2 Gang Condenser has frame dimensions of only  $1\frac{7}{16}$ " x  $1\frac{11}{32}$ " x  $1\frac{11}{16}$ ". Complete with dust cover. Cat. No. 4702.

PRICE 10/6



TYPE 604 (illustrated) is a low-loss short-wave condenser suitable for Chassis or one-hole fixing. Brass vanes are soldered to supports and electroplated.

TYPE 603 is a split stator condenser of similar construction.

The S.1 series in both types are particularly suitable for low power transmitters.

PRICES: Type 604 .. 15/3—17/0  
Type 603 .. 16/0—17/6

Replacement Scales calibrated to Copenhagen Plan now available for:—

Airplane Drive .. .. 2/3 retail  
Squareplane Drive .. .. 2/6 retail  
Full Vision Drive .. .. 2/9 retail  
S.L.8 or S.L.5 Drive .. .. 4/6 retail

PRECISION COMPONENTS BY

# JACKSON

BROS (LONDON) LIMITED

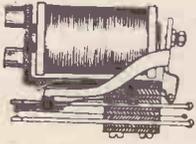
KINGSWAY · WADDON · SURREY

Tel.: Croydon 2754-5

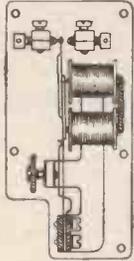
Grams: Walfilco, Souphone, London

# DON'T MISS THESE BARGAINS

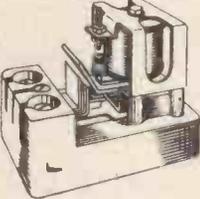
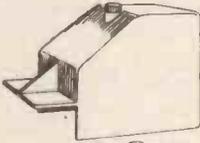
## RELAYS.



**A**merican made with heavy duty contacts. Sensitive type which closes at approximately 4 m.A., 12/6. Non-sensitive type for closing on 12-24v., 4/6.

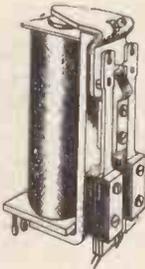


**E**xtra light weight, extra sensitive for high speed or radio control work, weight only 1 1/4 oz., closes on 2 m.A., solid, platinum change-over contacts, adjustable pressure. Price 13/6.

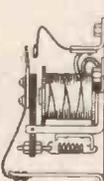


**T**otally enclosed, in bakelite, this relay has a 24v. coil but can, of course be re-wound for mains operation. Its contacts are suitable for breaking 20 amps. Price, 4/6, 48/- doz.

**P**ost Office types. Upright mounting, prices as follows: sensitive types with coil resistances of 2,000 ohms and over with 1 pr. of contacts 7/6, with 2 pr. of contacts, 8/6, then 6d. extra per pair of contacts. Medium sensitivity type 1,000 ohms and over with 1 pr. of contacts, 4/6 extra contact as above. Low voltage types coil resistances of 100 ohms and over with 1 pr. of contacts, 3/6 extra contacts as above.



**C**ontactor for breaking 25 amps., coil voltage is 24v. D.C., but with a re-wind or a small rectifier these will close off A.C. mains. Very heavy duty solid silver contacts. Price 1/6, 15/- doz.



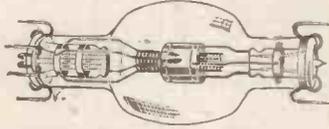
## IMPULSE OPERATED RELAYS.

**T**his is sometimes known as Selector Switch 10B. It consists of a solenoid, the armature of which is connected to a ratchet wheel so that each time the solenoid is energised the ratchet wheel moves round one notch. Secondary switches are built-in which permit: continuous running, inching, following a four position switch and undoubtedly a host of other operations. Articles have appeared in Journals showing how these may be operated by radio impulses and thus control models. Price 3/9 each, 36/- per dozen.

## LIQUIDATOR'S STOCK

Polished walnut radio cabinet size 20x12x7 3/8 in. complete with L., M. and S. dial, size 7x6 1/2 in. and backplate with magic eye cutout, also with drilled chassis and hardboard back. You will find it quite a simple matter to complete this into a very handsome receiver of the £15 class. Limited quantity, price 32/6, plus 2/6 carriage for the 5 items.

## TRANSMITTING VALVES.



**T**he valve illustrated is the VT31, a transmitting tetrode with an R.F. output of 250 watts. The overall size of this valve is 1 1/4 in. long by 6 1/8 in. across the bulb. We are able to offer this American made valve at 18/6, which is only a fraction of original cost. So this is your chance to do some experimenting or to make that special piece of equipment. Its heater is rated at 12v. 8a. We have many other transmitting valves in stock at equally interesting prices, we list a few below and invite your enquiries for any not listed:—  
803 Tetrode 125 watts, htr. 10v. 5a., 10/-  
805 Triode 125 watts, htr. 10v. 3 1/2a., 10/-  
813 Tetrode 100 watts, htr. 10v. 5a., 35/-  
DET5 Triode 25 watts, htr. 4v. 2a., 12/6  
RK28A. See 803 above.  
TZ40 Triode 40 watts, htr. 7.5v. 2.5a., 27/6  
DET5 Triode 36 watts, htr. 6v. 1.25a., 15/-  
TZ05/20 Triode 40 watts, htr. 6v. 1.1a., 15/-  
807 Tetrode, 30 watts, htr. 6.3v. .9a., 5/6  
6L6 Tetrode 12.5 watts, htr. 6.3v. .9a., 8/9  
6J6 dbl. Triode 3.5 watts, htr. 6.3v. .45a., 10/6  
35T Triode 50 watts, htr. 5v. 4a., 25/-.  
**PLEASE INQUIRE ABOUT OTHER TYPES.**

## RECTIFYING VALVES (MERCURY).

VU29 600 m.A. @ 4,000v., htr. 4v. 9a., 7/6  
866A 240 m.A. @ 10,000v., htr. 2.5v. 5a., 10/6  
872 1250 m.A. @ 10,000v., htr. 5v. 7.5a., 17/6  
RZ11 150 150 m.A. @ 1,000 v., htr. 4v. 4a., 15/-  
VU508 1,000 m.A. @ 8,000v., htr. 4v. 3a., 15/-  
GDU21 3,500 m.A. @ 11,000v., htr. 4v. 11a., 45/-.  
**OTHER TYPES WITH OUTPUTS UP TO 5 AMPS.**

## RECEIVING VALVES.

**W**e carry a full range of all types ancient and modern, send for special list, or if in a hurry ask us to send your valves C.O.D. We also stock Tungar Rectifiers, Voltage Regulators, Photo Cells, Magnetrons, Clystrons, Thyratrons, etc., etc. Send us your enquiries.

## COMMUNICATIONS RECEIVER.

**T**his is the communications receiver type No. R.1155 which is one of the finest communication sets ever made. Designed by leading engineers and made by one of our famous Companies, this receiver will undoubtedly give you years of good listening. Most readers will know it fairly well. The receiver covers the broadcast bands, long waves and medium waves, and short waves up to 20 mc/s. It contains 10 valves and really brings the stations in. August prices: £6/10s. for a good complete receiver; £7/10s. for same grade receiver tested and re-aligned; £8/15s. for unused receiver; or £9/15s. for unused receiver tested and re-aligned. All plus partly returnable packing case deposit and carriage charge of 10/-.

## SERVICE DATA.

**100** service sheets, covering British receivers which have been sold in big quantities, and which every service engineer is ultimately bound to meet. The following makers are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster Brandes, Lissen, McMichael, Marconi, Mul-lard, Murphy, Philco, Phillips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.

**O**ur folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers "all dry" etc., which have been imported into this Country. Names include Sparton, Emmerson, Admiral, Crossley, R.C.A. Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc., etc. Price for the folder of 100 sheets is £1. Post free.

## PLUG AND SOCKET.



**T**his brass cased plug and socket is extremely robust and ideal for P.A. or outside work. Ideal also for taking power to units as it insulates the ends of the wires. Contacts are quite suitable for carrying up to 10 amps. so this can be used for lighting or power. Price 2/6 per pair.

## THIS MONTH'S SNIP

**Lowest priced TV. parcel yet offered!** This comprises an ex-Govt. unit which among a host of other parts contains 11 6.3v. valves and an excellent wide bandpass I.F. strip. With this we give without extra charge all the data showing how a really good TV. receiver can be made using this unit. Extra parts are needed of course but with the main unit at this low price the total cost should not exceed £10. Price for the unit complete with the 11 valves and the data is only 22/6, plus 2/6. Send today or you may miss this bargain.

Orders under £2 add 1/6, under £1 add 1/- . Postable items can be sent C.O.D. additional charge approx. 1/- . Good stock of all items at time of going to press. List 6d. Telephone: Ruislip 5780



**PRECISION EQUIPMENT**

(2) ELECTRON HOUSE, Windmill Hill, RUISLIP MANOR, MIDDX.

# UNIVERSITY RADIO

**Offer Guaranteed Used Equipment at Attractive Prices**

Hallcrafters SX28 Commu-  
nication Receiver, Perfect ..... £37 10 0  
BC348, Complete with all valves,  
converted for mains 200/250 AC.  
New condition ..... £15 0 0  
BC348, Complete and perfect,  
converted for mains 200/250 AC.  
Casework damaged ..... £10 10 0  
"P. Int One" Leak Amplifier,  
Leak crossover network, Leak  
pre-amp with tone control, Con-  
noisseur single speed motor and  
Leak pickup. Fitted in oak cabi-  
net, absolutely as new ..... £52 10 0  
Collaro, single player Microgram,  
complete and as new ..... £10 0 0

RI155, brand new in transit cases,  
air tested ..... £7 15 0  
Avo Meters, Model 7, as new... £13 0 0  
Avo Meters, Model 40, as new... £11 10 0  
Hallcrafters S27, complete and  
perfect ..... £22 0 0  
Eddystone 640 Communication  
Receivers, as new ..... £18 10 0  
Hambander Communication  
Receivers, in new condition... £12 0 0  
Deccalcan Record Player, port-  
able and as new ..... £19 0 0  
Advance Signal Generator,  
Model EI, as new ..... £14 10 0  
Taylor Model 65b, Signal Gen-  
erator, in new condition ..... £10 10 0

Avo Mains Signal Generator,  
perfect ..... £11 10 0  
Taylor Meter, Model 90a,  
universal, as new ..... £10 10 0  
Decca Record Player, latest  
model, as new ..... £8 0 0  
Axiom 22, 12in. speaker by Good-  
mans, as new ..... £8 0 0  
Connoisseur Pickup, with trans-  
former ..... £2 15 6  
National HRO Seniors, with-  
out coils or power pack, perfect  
order and condition ..... £12 0 0  
12v. Mobile Amplifiers, by  
Parmeko, complete with hand  
mike ..... £11 0 0

**WE NEED GOOD USED EQUIPMENT URGENTLY. PLEASE SEND, BRING OR PHONE FOR OFFER**

Hunt's Resistance Capacity  
Bridge, model CRB, as new ..... £10 10 0  
Taylor Valve Tester Model 45,  
complete with charts, as new ... £10 10 0  
B.P.L. Signal Generator, model  
RS 600, as new ..... £10 0 0  
M.C.R.I., complete with all coils,  
AC/DC, perfect ..... £8 0 0  
Magnavox 12in. Model 66  
Speaker, mains energised 15  
ohms speech coil ..... £5 10 0  
G.E.C. 6 volt Overseas Model  
Radio, 3 waveband, as new ..... £14 0 0  
10 watt Quality Gram. Ampli-  
fiers, 200/250 v. AC. New ..... £8 15 0

Evershed 500v. Bridge Megger,  
with built-in resistance box.  
Perfect ..... £15 0 0  
Wilkins and Wright Moving  
Coil Pickup, with transformer,  
as new ..... £4 0 0  
Universal Avomitor, as new ... £6 0 0  
Pye Workshop Test Rack, model  
940020, complete and as new... £27 10 0  
Gaumont British Projectors,  
Model LS16, sound or silent,  
overhauled by makers, complete  
with speakers and resistance.  
Perfect ..... £67 10 0

Floor Console Radiogram  
Cabinets, walnut finish, a really  
beautiful job. New, three only  
at, each ..... £21 0 0  
Taylor Universal Test Meter,  
Model 75a, as new ..... £9 10 0  
Goodmans Axiom 150, 12in.  
speaker. Twin cone, as new..... £6 0 0  
Goodmans Audiom 60, latest  
model, as new ..... £5 0 0  
Connoisseur Gram. Motor, with  
turntable. Single speed, as new £13 0 0

**WE HAVE OTHER EQUIPMENT ARRIVING DAILY!**

**ALL S.A.E. INQUIRIES WELCOMED**

CASH OR CHEQUE WITH ORDERS. ALL ITEMS LISTED ARE CARRIAGE PAID UP TO 50 MILES.

**22 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2**

'Phone GERrard 4447 and 8582. Hours 9 to 6. Thursdays 9 to 1.

## INEXPENSIVE TELEVISION

is the title of the latest 48-page illustrated publication showing how a variety of ex-Govt. Radar Units can be converted readily and cheaply into efficient Television Receivers. Send only 2/9 for your copy, and a price list of the specified items.

**RECEIVERS R.1355.** As specified for above, complete with all valves. ONLY 55/- (carriage, etc., 7/6).

**R.F. UNITS TYPE 25.** For use with R.1355 for London reception. ONLY 17/6 (postage 1/6).

**R.F. UNITS TYPE 26** for use on Sutton Coldfield frequency are all sold, but we can supply one of the other R.F. Units with full details of modification, which has been fully tested some 70 miles from the transmitter. BRAND NEW IN CARTONS ONLY 25/-; or slightly used 17/6 (postage on either, 1/6).

**I.F. STRIP TYPE 194.** Another of the units specified for Inexpensive Television. A first class strip giving tremendous amplification, and well recommended for constructors who have built a Televisor but have come "unstuck" in the vision or sound receiver. Contains six valves VR65, and one each VR53 and VR92. Size 18 x 5 x 5in. ONLY 45/- (postage, etc., 2/6).

**INDICATOR UNITS TYPE 6.** As specified for above TV. Complete with valves and VCR97 C.R. Tube. BRAND NEW IN MAKER'S CRATES. ONLY 90/- (carriage, etc., 7/6).

**INDICATOR UNITS TYPE 62.** Contains 16 valves VR65, 2 of EB34, 2 of EA50, and a VCR97 Tube. ONLY 75/- (carriage, etc., 12/6).

**TRANSFORMERS FOR "INEXPENSIVE TV"** can be supplied as follows: Time Bases and Vision Transformer 350-0-350v. 160 m/a., 5v. 3 a., 6.3v. 6 a., 6.3v. 3 a., ONLY 36/-. Sound Receiver Transformer 250-0-250v. 100 m/a., 5v. 3 a., 6.3v. 6 a., ONLY 27/6. E.H.T. Transformer for VCR97 Tube, 2-0-2v. 1.1 a., 2-0-2v. 2 a., 2,500v. 5 m/a., ONLY 30/-. POSTAGE 1/6 per transformer please.

**MAGNIFYING LENS** for 6In. Tube. First grade oil filled ONLY 25/- (postage 1/6). Also available in 9in. size, ONLY 65/- (postage, etc., 2/6).

**TV PRE-AMPLIFIER** for weak areas can be made with the minimum of conversion from the ex-R.A.F. Amplifier 6046/6050. A most efficient job. Supplied complete with 2 valves EF50 and full modification data for both stations. ONLY 22/6 (postage 1/-).

*Cash with order please, and print name and address clearly*

**U.E.I. CORPORATION**

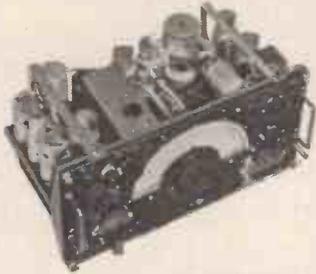
Radio Corner, 138 Grays Inn Road,  
London, W.C.I. Phone: TERMINUS 7937

(Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross)

# CLYDESDALE

Bargains in Ex-Service Radio and Electronic Equipment

## STILL A FIRST LINE COMMUNICATIONS SET



Probably the most widely used set in the world, operated by the active amateur and SWL alike. The R.1155, 7 valve communications superhet with an I.F. of 465 K/cs, and 5 wavebands. Covers "80," "40," and "20" metre bands, plus broadcast bands. Full vision dial, graduated in M/cs and K/cs. Requires only 200 v. H.T., 35 m/a. and 6.3 v. L.T. 3A.

**CLYDESDALE'S PRICE ONLY £12/12/0 POST PAID**

Complete with A.C. Mains Power Pack, mounted in a metal speaker cabinet and complete with 6V6 Output Stage, Connecting cables, and Bin. speaker.

**CLYDESDALE'S PRICE ONLY £18/12/0 POST PAID**

## THAT "SHARP CHANNEL" Q5'ER

46129 (equivalent BC453) Command Receiver is quite effective and justifiably popular as a sharp channel I.F. system to follow any conventional communications receiver having an I.F. of 190 to 550 k/cs. The receiver operates with an I.F. of 85 k/cs. Except for rewiring the heater circuit (24 volts as is) to conform with the supply available, no further major modifications need to be done. The BC453 makes an excellent car radio for M.W. reception, and can be readily modified by installing the M.W. COIL UNIT, price 10/-, from us, and correcting the valve heater circuit to conform with supply available, and installing a speaker and H.T. Vibropack.

**CLYDESDALE'S PRICE ONLY 63/-** CARRIAGE PAID



### R.F. 27 UNITS.

These 1st Class converter units cover a frequency of 65 to 80 Mc/s with variable tuning over the entire range. This converter has an oscillator tuned to an output of approx. 7 Mc/s which can be fed into practically any Receiver which tunes the "40" metre band. Valves include VR136/EF54 (R.F.), VR136/EF54 (Mixer) and VR137/EC52 (Oscillator). Requires only 6.3 v. 9A. L.T. and 300 v. 20 m/a. H.T.

**CLYDESDALE'S PRICE ONLY 35/-** POST PAID

### NOT ON MAINS SUPPLY ?

The R1224 provides the answer to that. This is a 5 valve battery driven communications receiver employing one R.F. stage and a 465 Kc/s I.F.—with excellent selectivity and sensitivity. Frequency coverage is 1 to 9 Mc/s (300 to 33.3M) in three switched wavebands. Tuning is effected by a slow motion drive. Requires only a 120 v. H.T. battery, a 2 v. accumulator and a G.B. Enclosed in wooden cabinet.

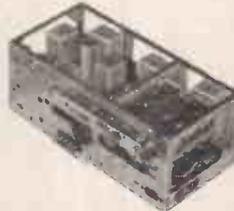
**CLYDESDALE'S PRICE ONLY £5/19/6** POST PAID

## WHY MISS THAT DX ON 2-METRES

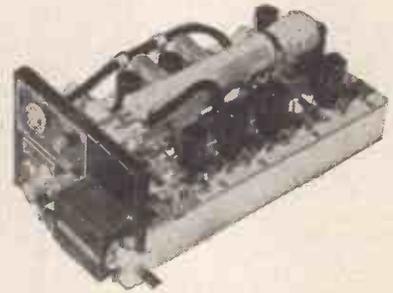
BC-624 (SCR-522) Receiver chassis provides the basis for the new 2 metre receiver. A coverage of 100 to 156 mc/s covers the "144" band. Spot frequencies may be "Locked" by using the local oscillator as it is at present or modifications to this stage provides variable tuning. 12 mc/s I.F. stages.

Complete with all valves, including 1/9002, 3/9003 B7G Based types. Requires only 300 v. D.C. HT at 75 m/a. and 28 v. L.T. (valves can be rewired for 12 v. heater supply). FREE, BC-625 Transmitter chassis, partly dissembled, but including a host of VHF components, including 2 valve bases for 832/829 tubes FREE.

**CLYDESDALE'S PRICE ONLY 37/6** each POST PAID



## CALLING CQ 70 CENTIMETRES



The A.S.B.8 will provide the receiver with which to hear those 70 cm. calls.

This is a 12 valve double superhet originally designed for use on 515 M/cs. Simple modifications and re-tuning will bring this receiver onto 420 M/cs. Employing a 446A Lighthouse Triode as the R.F. stage, the following stages include :

- 955 1 st. Oscillator—460 M/cs.
- 955 Mixer.
- 2/6AC7 1 st. and 2 cd. I.F., 55 M/cs.
- 6J5 2 cd. Oscillator, 39 M/cs difference.
- 6AC7 2 cd. Mixer.
- 2/6AC7 1 st. and 2 cd. I.F., 16 M/cs.
- 6H6 Diode Detector.
- 6AC7 Video Amplifier.
- 6AC7 Cathode Follower.

Details can be supplied for modifications to the last three stages to provide A.N.I., "S" Meter and Audio Stages, tuning instructions and constructional details for A.C. Mains Power Pack. Unit Dimensions : 13½ x 5½ x 7½ in.

**CLYDESDALE'S PRICE ONLY £4/10/0** each POST PAID

**A.C. Mains Power Unit with Built-In Modulator for W/S 36 Transmitter.** Cat. No. H.43

A complete 110 to 250 volt cycle A.C. Mains Power Unit, consisting of one L.T. supply transformer—4 v. 4A. (3 windings) for the rectifier, etc., at 3.25-0.3.25 v. 8A. winding supplying the 6.3 v. circuit of a built-in modulator, suitable for swinging a transmitter carrier of 100W. input, plus an outlet for the supply of an external transmitter. A 200-0-200 v. 50 m/a. fully smoothed supply for bias needs a second transformer (H.T.) 500-0-500 v. 200 m/a. (twice) rectified and smoothed, one supply for the internal modulator, the second supply is carried to an outlet for external use.

Valves include : 3/6C5, 2/807 and 2/AV1 (FW4/5/800). Controls are located on the steel front panel. Unit complete in varnished wooden cabinet with carrying handles.

**CLYDESDALE'S PRICE ONLY £12/10/0** CARRIAGE PAID

### AVAILABLE NOW

Illustrated List No. 7. Send 6d. to cover cost. Print Name and Address.

Order direct from :—

**CLYDESDALE SUPPLY 2 BRIDGE STREET CO. LTD. GLASGOW - C.5**

Phone : South 2706/9

Branches in Scotland, England and Northern Ireland.



## APOLOGIES

We apologise for an error which occurred in the details given for our Output transformer type 2B36 in the Williamson Amplifier booklet. There is a choice of seven output impedances by series parallel connection. These are:— 1.25, 2.8, 5, 7.8, 11.3, 15.3 and 20 ohms.

This incidentally is the component that has aroused so much interest in the U.S.A.

By the way, there is now an improved version type 2B36B leakage reactance under 15m/hys. Primary inductance is still 100 hys minimum, price 90/-.



SAVAGE TRANSFORMERS LTD. • NURSTEED ROAD, DEVIZES, WILTS. TELEPHONE DEVIZES 536.

## "ADCOLA" SOLDERING INSTRUMENTS

Reg. Trade Mark



Reg. Design 860302

Designed for Wireless Assembly and Maintenance. SUPPLIED FOR ALL VOLT RANGES FROM 67v. TO 230/50v.

The three Adcola Models cover the requirements of the Television, Telecommunication and Radar Engineers and assure thorough jointing.

- ¾ in. dia. Bit. Standard Model — 22/6
- ½ in. dia. Bit. Standard Model — 25/-
- ⅜ in. dia. Detachable Bit — — 30/-

Patented in England and Abroad.

Sole Manufacturers :

**ADCOLA PRODUCTS LIMITED**  
ALLIANCE HOUSE, CAXTON STREET, WESTMINSTER,  
LONDON, S.W.1. Tele. MA CAulay 4272.

## THE "EASYBUILT" TELEVISOR

Full constructional data in book form now available. It comprises what is in our opinion the most practical, economical and reliable method for the construction—by the amateur—of a full-size magnetic television.

The instructions given are detailed, precise and remarkably easy to follow. Both theoretical and practical (point-to-point) wiring diagrams are given. Our technical experts have carefully examined the circuit and are most enthusiastic; we can find no inherent snags of a practical nature which are likely to occur.

The "EASYBUILT" is particularly suited for the home constructor as the designers have taken exceptional care to specify only those components which are readily available at reasonable prices. **IN FACT THE TOTAL COST (LESS C.R. TUBE) SHOULD BE WELL UNDER £20.** We are making a special point of stocking all the specified parts for the "EASYBUILT," and will have a demonstration model on view early in September. As usual, our prices are extremely competitive.

**ORDER YOUR COPY OF THE "EASYBUILT" TELEVISOR MANUAL NOW. THE PRICE IS ONLY 2/6 POST FREE.**

We shall include with each copy a priced parts list. All components will be separately listed and available individually. Don't forget that those of you who buy the major portion of your gear from us will be given every assistance during AND after construction. London and Home Counties viewers will be able to bring the completed television to us for service and alignment should this prove necessary.

### 3 NEW RELEASES—3 OUTSTANDING BARGAINS.

**Amplifier Unit Type 3562.** Brand-new in cartons. Complete in case size 12 x 9 x 8 in. Valve line-up: one of 5U4, two of 807, one of EF50 and an EA50; many high-voltage condensers and resistors included. Easily converted to a high-output amplifier or modulator unit. The useful chassis lends itself to amplifier construction, etc., 19/6, plus 3/- carr. and pkg. Don't miss this superb offer.

**Receiver Type R1147B.** A 7-valve UHF receiver, range approx. 200 Mc/s. PARTICULARLY SUITABLE FOR EASY CONVERSION TO 144 Mc/s. Valve line-up: two of EF50, 2 of EF36, and one each of EB33, RL7, RL16. The receiver is beautifully constructed and fitted with micro-condenser drive. Contained in black metal case size 8 x 7 x 6 in. BRAND-NEW IN USEFUL TRANSIT CASE which might have been designed as a tool box! ONLY 30/-, carriage paid.

**Receiver Unit Type 6A.** Housed in case size 10 x 8 x 7 in. Frequency range 3-7 Mc/s. Valve line-up: 5 of EF50 and one each EB33, EF36, and 6K8. The dial is exceptionally well geared and calibrated. Slightly soiled condition externally but perfect inside. 29/6, plus 2/6 carr. and pkg.

### STILL GOING STRONG.

**Medium-wave Command Receiver.** Frequency range 200-600 metres. Valve line-up: three of 12SK7, one of 12SR7, one of 12K8 and a 12A6—all miniature types. Will readily convert into a car radio or domestic receiver of outstanding performance. Unused and in excellent condition. We provide circuit diagrams. £3/19/6, plus 2/6 carr. and pkg.

**Receiver Unit 25/73 (TRI 136).** Valve line-up: two of EF36, two of EF39, one of EK32 and an EBC33. Easily and rapidly converted to a very fine superhet receiver (see "Practical Wireless" August, 1949). Supplied complete with circuit and conversion data. In very good condition indeed and offered at 22/6, post free.

**Receiver Type 1B.** Complete with four battery valves. Frequency range 6-9 Mc/s. Circuit diagram provided. 17/6, plus 1/- post and pkg. 45-Mc/s. "Pye" Strips. New. Less valves, 39/6; complete with all valves 62/6, carriage paid.

**Indicator Unit Type 62A.** Contains 12 EF50, four of SP61 (CV118), two of EB34, three of EA50, 13 pots and one VCR97 tube. This is the finest indicator Unit of them all. Unused condition, but chassis slightly soiled. Offered to callers only. Price £4/19/6.

**Amplifier Unit 18/165.** A neat and compact equipment incorporating the following valves: two of EF36, one of EBC33, and two EL32; and microphone transformers, inter-valve transformers, numerous condensers and resistances, etc. Are you looking for something to "break down"? Then here is your chance! An experimenter's gold-mine for only 17/6, post paid.

Have you visited our easily accessible London premises? A treasure house for the enthusiast. Come along and see! A very competent technical staff always at your service. Huge stocks of valves, components and TV/Radio equipment at attractive prices. Many, many bargains for the caller.

Best Buy at Britain's



**CHARLES BRITAIN (Radio) Ltd.**

11, UPPER SAINT MARTIN'S LANE  
LONDON, W.C.2 TEM. OS45

3 minutes from Leicester Square Station (up Cranbourne Street)  
Shop Hours: 9-6 p.m. (9-1 p.m. Thursday). Open all day Saturday

## LAWRENCES

**STANDARD PANEL MOUNTING RACKS.** Type 10A/9591. Height 5.5ft. For 19in. panels. Drilled every inch. Supplied with panels total 3ft., which carry terminal strips, etc. Suitable for transmitters, amplifiers, commercial eqvt., £2 each.

**DIEHL LOW INERTIA A.C. SERVO MOTORS.** CDA 211052. New, 17/6.

**RADAR EQUIPMENT AND COMPONENTS.** Type SA2 Transmitter Receivers, 10 cm. Employs 2J22 Magnetron, 721A ATR, 726B Klystron, etc. Type SA2 Antenna Duplexers, SO No. 12283. Type SA2 Servo Control Units CNM-55ALB1. Type APN9935. Cavity Tuning Units. Westinghouse Model VE Type CAY-55ADV Plan Position Indicator Repeaters, Electronic Range Marking, 7in. tube presentation. General Electric Model VG Type CG-55AEB Projection Plan Position Indicator Repeaters, Electronic Range Marking, 24in. screen presentation. Type TS-13/AP "X" 3 cm. Band Radar Test Sets. Western Type CW60-ABM Wavemeters "S" 10 cm. Band for use with SL1 Radar, etc. Type R54, APR4 Radar Receivers, 300-1000 Mc/s. R.C.A. Type CRV-46ACG "S" Band Radar Receiver Indicators Type CRV-50AEE Deflection Amplifiers. Type SA2 Modulator-PPI Indicators. Type APS3/MD-5B Radar Modulators. Type APS3 Antenna Scanning Units. Type CMM55-AB1 Slewing Train Indicator. Reflector Klystrons: Type 723A/B 75/-, Radar Gaps Type 1B24, 15/-, 721A, 15/-, 724B with cavity holder, 15/-, Valves Type 715B, 35/-, Waveguides: "H" 1 cm. Band Launching Sections, 35/-, "X" 3 cm. Band Launching Sections, 25/-, "S" 10 cm. Launching Sections, 35/-, 1 cm. 90 deg. Angle, 10/-, 3 cm. Receiver Section, with 723A/B Holders, mounted in unit with I.F. Amplifier stages, 15/-, 3 cm. Section 90 deg. bend, 90 deg. twist, length 14in., 15/-, Rotating Joint; 3 cm., 45/-, 3 cm. Antenna Radiator Section, 25/-, Details of the above available on request.

**NEW AMERICAN AUTO-DRY-AIRE Model 2200 DEHYDRATORS.** For the conditioning of coaxial transmission lines and waveguides. Designed for continuous operation with totally automatic cycle governed by programme timer. With 100 per cent. relative humidity intake, an output of 860 cu. in. per min. at nil per cent. maximum relative humidity is obtainable, with a maximum pressure of 40lb. per sq. in. For 115-230 v. A.C. operation, 640 watts, £45. Also Portable Model with similar performance, £27.

**MICRO-WAVE LIGHTHOUSE ASSEMBLY.** P/o RT39/APG5. Osc and TR cavities. Type N coupling. Uses 2C43, 2C40 and 1B27 valves. Tunes 24-2700 Mc/s, £7.

**NEW MINIATURE LEACH RELAYS.** SPCO.280 ohms. Dim: 1.25 x 1 x .6in. 3/- each.

**NEW METERS.** 500 microamps scaled 0-15 v., 0-600 v. Ohms 2in., 6/6 each. Also 0-150 mA 2in. flush, 6/6; 0-10 mA 2in. flush, 7/6; 0-15 v. A.C. 25-125 c/s, 2in. flush, 8/6.

**NEW TX CHOKES.** 10H,200 mA. Resistance 77 ohms. Potted. 12/6.

**BENDIX COMPASS RECEIVER TYPE MN26Y.** Complete with all valves and circuit diagrams, in good condition. £5.

**CONNECTING CABLES.** 12 point, with plugs, for Walkie Talkie Sets. ZA 10608. 2/6 each.

**BUTTERFLY TUNING ASSEMBLIES.** Contain crystal mixer and RL18 triode, osc. Tunes 300-600 Mc/s. With worm drive and tuning dial. 36/-.

**RADIO RECEIVERS TYPE BC624.** A VHF set which operates around 2 metres. Employs button and octal valves. Supplied less valves, only 6/-, carr. 2/6.

**AMERICAN TRANSMITTERS TYPE BC778.** An automatic life-boat equipment, with hand generator, fully waterproof and submersible. Emits distress or manually keyed signals on 500 Kc/s. Complete with Antenna Reel and Kite, 47/6.

**RECEIVERS TYPE 161.** Employs 4 B9G valves. Fitted with 4-band rotary turret U.H.F. coils which are electrically rotated. Less valves, 7/6 each.

**RADIO ALTIMETER TEST SETS TYPE 6.** Complete in instrument case with test leads. In new condition. £7.

**CONTROL UNITS TYPE RM-7-B.** 115-230 v. A.C. Made by Federal Telegraph Co., for use with BC342 Receiver installations. Simplex Keying Channels. Interphone Magneto and Telephone unit integral. Milliwatt Audio Level Indicator. In black crackle instrument cases. £6/7/6.

**TRANSMITTING CRYSTALS.** 3,500 Kc/s. In evacuated holder on octal base. 10/- each.

**WESTINGHOUSE I.H.P. 230 v. CIRCUIT BREAKERS.** With reset switch. 15/- each.

**DESYNN CONTROL UNITS.** 12 v. A selsyn type of remotely controlled tuning capacitor, in oil filled container mounted on octal base. 5/- each.

**NEW METAL STORAGE CABINETS.** Of improved design, fitted with 12 sliding drawers. Overall dimensions: 10 1/2 in. x 7 1/2 in. x 6 in. Extremely useful for segregation and neat storage of small parts. 17/6 each.

Experienced Export Shippers.

ALL PRICES INCLUDE U.K. CARR. TERMS C.W.O.  
SATISFACTION GUARANTEED OR MONEY IMMEDIATELY  
REFUNDED.

## LAWRENCES

61, BYROM STREET, LIVERPOOL, 3.

Telephone: CENtral 4430.

# FIRST AGAIN! TELEVISION SCOOP

FIRST TIME OFFERED

T.V. CHASSIS • LONDON OR BIRMINGHAM • BEST VALUE EVER

15 VALVES. LARGE 10" BLACK AND WHITE PICTURE. BRAND NEW AND UNUSED.

This is not a kit, but a factory-built job. Fully assembled and tested, made by a well-known manufacturer. Sound and vision R.F. unit uses latest type miniature valves, 8 of 6AM6 and 2 of 6AL5. Permanent magnet focussing. Complete with all valves and 10in. cathode ray tube type 108K, fitted with a special ion trap to prevent screen burn. High quality sound with Elac 8in. p.m. speaker. Closed field. Hard valve time bases on frame and line, uses 2 7C5 and 1 62BT. Line fly back E.H.T. 6-7 Kv., non-lethal using FY51.



LASKY'S PRICE	£25-0-0	COMPLETE WITH 10" C.R. TUBE, 15 VALVES AND 8" SPEAKER NO EXTRAS REQUIRED.
------------------	---------	---

CARRIAGE & INSURANCE 37/6

Power supplies 200-250 volts, 50 c.p.s. input. Auto wound mains transformer, with two 6 volt and one 5 volt windings for valve heaters. 53KU rectifier.

Dimensions: 15½in. wide, 15½in. deep, 14½in. high including C.R. tube.

Make no mistake, this is no Ex.-Government lash-up, but a new television receiver, complete in every detail, ready to function. Mount it in a cabinet of your own choosing, in a wall or any location that meets your requirements. Complete working instructions and circuit diagrams, for future reference, supplied with each receiver. If you need any further details please write for them, or better still call and view.

SOLD ONLY AT **LASKY'S RADIO** 370, HARROW ROAD, PADDINGTON, LONDON, W.9  
Phone: CUNNINGHAM 1979.

Send also for a copy of our current Bulletin giving full details of our stocks of new manufacturers surplus components, valves, transformers, etc., also Ex.-Government equipment. Enclose a 2½d. stamp with your name and address, for a copy by return.

## RADIOMENDERS LIMITED

FOR SPECIAL TRANSFORMERS AND REWINDS

*We specialise in*

AMATEURS' WINDINGS, TRANSFORMERS  
ALL TYPES, CHOKES, PICK-UP COILS,  
INSTRUMENT COILS, Etc.

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.

## NEON TEST PROD

★ FOR 200-250v. MAINS.  
HAS A 1,001 USES  
CONSUMES ONLY HALF A MILLIAMPS,  
FULLY SHROUDED WATERPROOF.

Tests on A.C. & D.C.



**NEW**

A.F. BULGIN & CO., LTD.  
BYE PASS RD., BARKING, ESSEX

# Connoisseur Products

**TWO SPEED-MOTOR.** At the turn of a switch you have two speeds, 33.1/3 or 78 r.p.m. The Turntable is a full 12" diameter; its main spindle precision ground and lapped, runs in phosphor bronze bearings. The synchronous motor is virtually vibrationless and is suitable for playing standard, transcription and microgroove recordings.

Retail price without pickup - - - - - £13 15 0  
Purchase Tax. - - - - - £5 19 2

**SUPER LIGHTWEIGHT PICKUP** for standard and microgroove recordings. The interchangeable heads are fitted with an easily replaceable armature system complete with a semi-permanent sapphire. Armature mass 20 milligrams. Extremely low mass at needle point (4/5 m.g. only) allowing for reduction in downward pressure to 10/12 grams for standard recordings, and 5/7 grams for microgroove recordings.  
Prices: With one Head - £4 0 0, plus £1 14 8 Purchase Tax  
Extra Heads, each - - £2 10 0, plus £1 1 8 Purchase Tax  
Spare armature System with Sapphire, 14/8 including Tax.

**THE CONNOISSEUR** Varigroove Recording Unit. 33.1/3 and 78 r.p.m. 100 to 300 GROOVES PER INCH continuously variable. MOVING COIL CUTTER HEAD of entirely new design. Patented method of suspension allowing use of large magnet system, producing sensitivity and response hitherto unobtainable. All patterning effects eliminated, allowing microgroove recordings to be made with ease.  
15 ohms impedance. Frequency response 30 - 15,000 c.p.s.  
LESS THAN 5 WATTS required to fully modulate.  
Price £130 0 0

**ALSO HIGH AMPLIFYING EQUIPMENT**

**A.R.SUCDEN AND CO. (ENGINEERS) LTD., BRIGHOUSE, YORKSHIRE.**



## YOUR EQUIPMENT CAN HAVE THE PROFESSIONAL LOOK



THE EQUIPMENT SHOWN IS THE TOP BAND CABINET TRANSMITTER AS DESCRIBED IN THE "SHORT WAVE MAGAZINE."

SEND FOR ILLUSTRATED LITERATURE AND PRICE LISTS OF OUR COMPLETE RANGE.

### BY USING WODEN POTTED COMPONENTS

Woden Potted Transformers and Chokes ensure a clean layout with uniform smart appearance. They are used by many leading Radio and Television Manufacturers and this is sufficient testimony to the high standard of efficiency which characterize these components. Available for "Wireless World" Williamson Amplifier, "Electronic Engineering" Home Built Televisor and other popular circuits.



**MOXLEY ROAD BILSTON STAFFS**

P H O N E : B I L S T O N 4 1 9 5 9

# M.O.S. — SETTING NEW STANDARDS in MINIATURE COIL PACKS

This new M.O.S. coil pack of the smallest possible physical dimensions sets a new high standard in performance. It is of exceptionally high gain, and particular care has been taken in the design of the short wave range, which gives a performance equal to that normally obtained only on a communications receiver.

Winding of coils gives extremely high magnification in aerial circuit. Iron dust cores also ensure increased efficiency. While the coil packs are supplied pre-aligned and in this condition give excellent results, since stray capacities of the various circuits in which it is used will vary, the trimmers and cores have been arranged to be readily accessible for small final adjustments to ensure maximum performance. Overall size: 2 1/2 in. deep x 2 1/2 in. wide x 1 1/4 in. high.

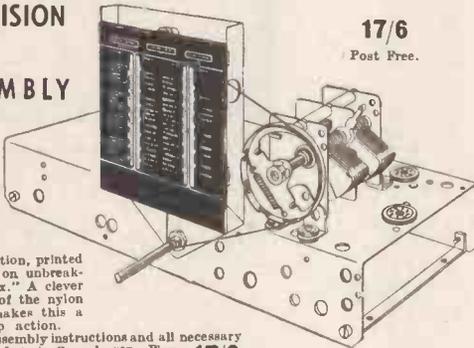
**TRADE & WHOLESALE TERMS AVAILABLE on APPLICATION**

## FULL VISION DIAL ASSEMBLY

A brand new full vision dial with 3 wavebands (L. M. S.) Positive in action and non-slip.

The dial is arranged for back illumination, printed three colours on unbreakable "Perspex." A clever arrangement of the nylon cord drive makes this a truly non-slip action.

Boxed with assembly instructions and all necessary components. Latest Copenhagen Plan Engravings. Post Free. **17/6**



**TRADE & WHOLESALE TERMS AVAILABLE on APPLICATION**

## 5-VALVE SUPERHET CHASSIS

A five-valve chassis as illustrated above, in heavy gauge steel, cadmium plated. Complete with cabinet fixing brackets, valve holders riveted in position, and A.E.-GRAM sockets. Correctly drilled for the Full Vision dial previously described. Chassis designed to be used for either A.C. or D.C. circuits. Post free. **11/-**

## PLESSEY 2-GANG 0.0005 mfd.

For use with above coil pack and chassis. Chassis correctly drilled to accommodate this tuning condenser. Pitted with rotor grounding brush and ball bearing race, this condenser gives noiseless tuning on the Short Wave bands. **5/-**

## COLLARO AC 504 PLAYERS

Collaro playing desks are well known for their reliability and strong mechanical design. We can offer the A.C. 504 series on H.P. terms according to the following scale: AC504 with magnetic pick-up. Cash price £5/2/6. Deposit 30/-; 8/6 monthly payments of 12/2. AC504 with crystal pick-up. Cash Price £5/17/7. Deposit £2: 8/6 monthly payments of 13/-.

NOTE: NO H.P. INTEREST CHARGED.

**TRADE & WHOLESALE TERMS AVAILABLE on APPLICATION**

## RELAYS AND KEY SWITCHES

LARGEST EX-GOVT. STOCK IN G.T. BRITAIN

Types 600-3000 Relays — Siemens High Speed Also A. C. 250 volts 50 cycles

Uniselector Switches, Carbon Insets, Telephone Components, Plugs, Jacks, Handsets, Co-Axial Cables — Government Contractors

**JACK DAVIS (RELAYS) LTD. (Dept. W.)**  
30 PERCY STREET, LONDON, W. 1  
Phones: MUSEum 7960, LANgham 4821

## VIEWMASTER COMPONENTS ON HIRE - PURCHASE.

**EXCLUSIVE M.O.S. OFFER.** This first class receiver sponsored by the leading component manufacturers needs no detailed description by us. From our many friends who have constructed the receiver we know that its performance has not been overrated, and we have no hesitation in giving it our full recommendation.

### OUR HIRE PURCHASE TERMS ARE SET OUT IN THE ACCOMPANYING TABLE.

We regret that we can supply tubes on these terms only when ordered with, or after the supply of, other Viewmaster components. Tubes can be supplied on H.P. terms only on the understanding that in the event of failure during the H.P. term, the tubes are covered only by the manufacturer's guarantee, and their decision must be accepted as final. **MINIMUM DEPOSIT £5.**

Ref.	Components	Deposit	12 Monthly Payments of
A.	W.B. Chassis, tube supports, speaker, valveholders, etc.	£2	8/2
B.	T.C.C. condensers LONDON	£2	9/1
C.	T.C.C. condensers MIDLAND	£2	9/6
D.	Westinghouse Rectifiers ..	£1	4/6
E.	Plessey focusing etc. ..	£2	7/-
	Morganite resistors Q pots, Colverp pots, Wearle coils, Belling connector G.E.C. neon, Bulgin panels and switch etc.:		
	LONDON	£2	5/11
	MIDLAND ..	£2	8/5
G.	Set of valves .. ..	£2/2/2	7/10
H.	9 inch Tube, including tax	£3/0/-	15/-
I.	Mullard 12 inch Tube, incl. tax .. ..	£4/12/6	£1
J.	Ferranti or Brimar tube, including tax .. ..	£4/12/6	£1/1/-

## 500 YARDS OF LIGHT!

This torch, Type H, is the latest addition to our range of American Type long beam focusing torches. It uses five U2 batteries and has an adjustable ring focusing head.

Head of torch 3 1/4 in. in diameter. Torch is 15 in. long. Torch fully guaranteed.

Torch uses standard batteries and bulbs. Constructed of heavily nickel plated brass and has pull-out carrying loop in base. Base also contains spare bulb clip.



## TORCH COMPLETE WITH BATTERIES

**AND ONE BULB. 22/6**

Spare Batteries 5d. each. Post free

Spare Bulbs 6d each.

**SPECIALLY SUITABLE FOR PROTECTIVE PURPOSES.**

### OTHER AMERICAN TYPE LONG BEAM TORCHES IN STOCK ARE:

Type	Beam	Batteries	Focussing	Head	Incl. post.
A	700ft.	Three U2	Ring	3 1/4 in. dia.	15/11
C	300ft.	Two U2	Ring	2 in. dia.	8/11
D	300ft.	Two U2	Slot and pin	2 in. dia.	4/6
E	200ft.	Two U11	Slot and pin	1 1/4 in. dia.	3/3
F	100ft.	One No. 8	Slot and pin	1 1/4 in. dia.	2/3
G	600ft.	Three U2	Ring	2 in. dia.	13/11

All torches dispatched complete with batteries and fitted bulb.

**WHY WORRY about the winter. Get your torch NOW!**

We can still supply the famous **BURGOYNE SOLDER GUN** backed by our 2-YEAR GUARANTEE at only **52/6** cash  
20/- down and 7/- monthly for 6 months

## R. 1355 RECEIVERS FOR T.V. CONVERSION.

Brand new 52/6, while they last!

**Terms: Cash with Order**

## M.O.S.

## MAIL ORDER SUPPLY CO.,

The Radio Centre,  
33 Tottenham Court Road, W.1. MUSEum 6667-8-9.

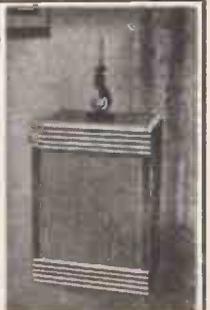
## VENTEX CABINETS

have become the accepted standard for first quality 12 in. loudspeakers.

Type 1275 ... 12 gns. Type 1255 ... 14 gns.

Fit our FULLY COMPENSATED VOLUME CONTROL. Essential for high quality reproduction at low volume levels.

A range of HIGH QUALITY TUNERS and AMPLIFIERS with an advanced specification will shortly be available. S.A.E. for details.

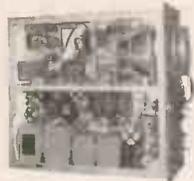


**C. T. CHAPMAN (Reproducers) Ltd.** FLAXman 3217  
RILEY WORKS, RILEY STREET, CHELSEA, S.W.10  
Daily demonstrations at Webb's Radio.



**TELEVISION PRE-AMPLIFIER.** This Ex-Govt. 1 valve pre-amplifier is extremely sensitive and stable. It makes an amazing improvement in both vision and sound reception in all fringe areas. Now available for both London (type A) and Birmingham (type B). Very small dimensions. Length 4in. Width 3½in. Chassis depth 1½in. Overall depth to top of valve 4½in.

Fitted with EF50 valve. Ready for use. Power requirements 6.3 v. LT 200/275 v. HT. Coax Input and Output sockets. Ideal for "The Viewmaster," "The Inexpensive Television Set," Electronic Engineering Television and any commercial set with suitable power supply. Unique value, 15/-. (Post 1/-). Tested and Guaranteed.



chassis which slides in and out of outer case. Brand New and unused. Ideal for conversion to transmitter or TV. An outstanding bargain, £12/10, carriage, paid.

**RADAR INDICATORS.** Type VE. Grey Enamel case. L., 24in. D., 23in. W., 11in. Contains 16 valves, 6SN7 (7), 807 (3), VR150 (2), 2X2, 5U4G, 6AG7, 6SL7. Oil filled condensers 10 mfd. 600 v. (3), 6 mfd. (2), .1 5,000 v. (2), Potmeters (16), Small Electric Motors (2). Transformer Input 115 v. 60 c. Output 3,890 v. .0023 a. Another ditto Output 6.3 v. 10 a. 6.3 v. 0.6 a. 5 v. CT. 3 a. 850 v. CT. 0.142 a. Filter chokes (2), 10 h. 2 a. 77 ohms also a very large quantity of precision resistors and condensers. 7in. CR tube mounting and focussing coils (no tube). Double deck



**RADIO SET SCR 291 A COM-PRISING:** Federal U.S.A. 110 v. 50/60 cycles Communication Receiver. BC1147A. 13 valves, comprising 6SK7 (4), 6SH7, 6SA7, 6I5, 6H6, 6SJ7, 6SQ7, 6K6, or 6V6, 5U4G, VR150. 4 wavebands 1.5-3.1 mcs., 3.1-6.6 mcs., 6.6-14 mcs., 14-30 mcs. I.F. frequency 455 kcs. Front panel 19in. x 14in., rack mounted. CONTROLS.—Waveband switch, matching, tuning, A.F. gain, I.F. selectivity (band width), BFO, BFO On/Off, sensitivity, power on/off, AVC—manual. Built-in loudspeaker. Receiver section is entirely self-powered. A supersensitive receiver of the highest class. Auxiliary Power Pack Control, Panel PN-31A, 110 v. 50/60 cycles. 4 valves and stabiliser. 2X2, 5U4G, 6L6, 6AC7, VR150. 6 Potmeters, 6 toggle switches, 3 indicator lights. All circuits fully fused. 0-50 ma. meter. Unit self-contained. Rack mounted. Size 19in. x 10½in. Ideal for operating your transmitter. Magneto Operated Telephone Circuit PN32A. Handset and mag-handle on front panel. Size 19in. x 5½in. (The XYL can call you for meals with the phone). Whole equipment in magnificent cabinet type rack 32in. high, 20in. deep, 22in. wide. 218-page instruction book included. Brand new, unused. In original unopened packing. Securely packed in wooden container with fall-away front and rear, making set very quickly operative. Make your Ham Shack a real radio station with one of these magnificent equipments. (ORIGINAL COST APPROX. £250. 17 only available. Our price, £30 each, carr. paid.)

**Q-MAX B4/40 40 w. TRANSMITTER.** Shop soiled. Full guarantee. List price £75. 2 only to clear, £50 each. Full details on application.

**R.F. UNITS, TYPE 24.** New condition. Complete with 3 valves. 20-30 mcs. Tunes to 5 spot frequencies, 14/-. Carriage 1/4.

**TYPE 87 POWER UNIT.** Input 12 v. Output 265 v. 65 ma. 6.5 v. 2.5 a. Incorporates beautiful rotary generator in neat case 8½in. L. 6½in. H. 4½in. W., 5/- each. Post 1/4.

**PAMPHONIC PA SPEAKERS.** 10in. in handsome maroon metal cabinet. Original packing (not surplus), 55/- each. Less than cost.

**1155 AC POWER PACK AND OUTPUT STAGE.** As per "Wireless World" Specification. Brand New in neat crackle case 12in. x 8in. x 5in. Handle and PVC feet. Built-in L.S. Just plug into 1155 and set is all AC operated. Special value, £5/19/6. Carr. 3/6.

**COMMAND POWER PACK for BC453/4/5 or 26 and 27/ARCS sets.** No Alterations to receiver. 230 v. AC Input. Fitted 6X5 Rectifier. Not Surplus. Beautifully made, 50/-, carr. paid.

**BC458A COMMAND TRANSMITTERS.** Brand New. No valves. (Wire removed from Ceramic formers otherwise perfect). Unique value 7/6 each, carr. 1/4.

PROMPT DELIVERY AND SATISFACTION GUARANTEED AS ALWAYS.  
2½d. stamped envelope must accompany all enquiries.

**H.P. RADIO SERVICES LTD.**

Britain's Leading Radio Mail Order House  
Estd. 1935

55 COUNTY ROAD, WALTON, LIVERPOOL, 4

Tel. Alntree 1445 Staff Call Signs, G3DGL, G3DLV

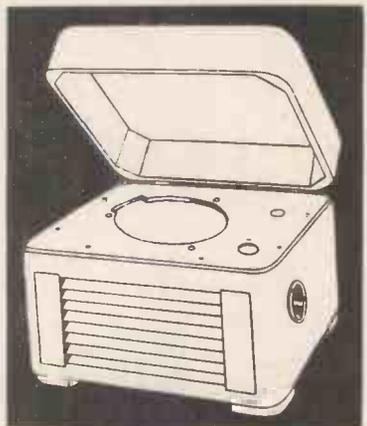
**IDEAL BARGAINS FOR CONSTRUCTORS**

Assemble your own

Table Electric Gramophone or Record Player

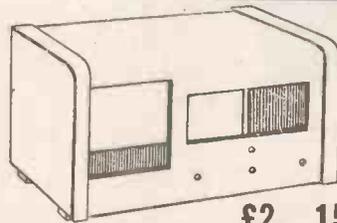
**CABINETS**

Beautifully polished Walnut with Rumanian Birch grille and feet. Lid interior felted. Top plate cut out for gramophone unit. Recessed escutcheon plate fitted in side for volume control. Access trap-door in base. Rubber non-scratch feet. Sub-baffle for 6½in. loud-speaker. External 16 x 14 x 12in. deep. Internal 15 x 13 x 7in. below top plate, 3in. above to lid. Solid and finely built.



£3. 10. 0.

each, incl. Purchase Tax.  
Packing and carriage 7/-.



Similar quality Walnut

**TABLE RADIO CABINETS**

23 x 9 x 13in. high. Speaker opening 7½in. square. Dial opening 8½ x 4½in. Four 3in. holes for controls.

£2. 15. 0. each Packing and Carriage 5/-

**N. MIERS & CO. LTD.,** Telephone: EUSTON, 7515.  
115, Gower Street, London, W.C.1.

T.A. 3285

**THE THREE 'R'S**

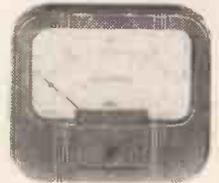
3", 3½", 6"  
**RECTANGULAR INSTRUMENTS**

by

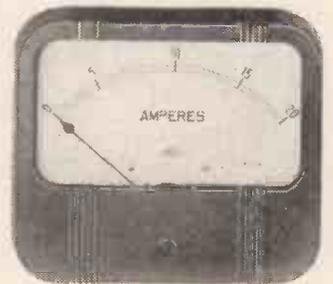
**PULLIN**



Series 30



Series 35



Series 65

These three rectangular instruments are designed on symmetrical lines, thus giving a distinctive clear open scale and pleasing appearance. Each size available in all standard ranges. The Series 65 and 35 can be fitted with dial illumination.



**MEASURING INSTRUMENTS (PULLIN) LTD.**

Electr'n Works, Winchester Street, Acton, London, W.3.

Telephone ACORN 4651/3 & 4995

# D. COHEN

## RADIO & TELEVISION COMPONENTS

Purchased from the Liquidator of Miniradio :-

### MAINS TRANSFORMERS

Primary 200-250 v. P. & P. on each 1/6 extra.  
 Drop thro' 350-0-350 v. 70 mA, 6 v. 2.5 amp., 5 v. 2 amp., 13/6.  
 Semi-shrouded, drop-thro' 280-0-280 v. 3 amp., 5 v. 2 amp. 15/-.  
 Semi-shrouded, drop-thro' or upright mounting 280-0-290 80 mA, 4 v. 6 amp., 4 v. 2 amp., 12/6.  
 Auto-wound HT. 280 volts at 360 mA, 4 v. 3 amp. 2 v. 3 amp., or 6 v. 3 amp. Separate 4 v. 3 amp., rectifier winding (upright or drop-thro') 10/6.  
 Heater Transformers Pri. 200-250 v. 6 v. 1 1/2 amp. 6/6; 2, 4 or 6 v. 2 amp., 7/6. P. & P., each 9d.

### ELECTROLYTIC CONDENSERS

50 mfd. 50 work. 1/9.  
 16-24 mfd. 350 work. 2/11.  
 100 mfd. 12 v. work. 1/3.  
 16-16 mfd. 450 work. 3/6.  
 50 mfd. 12 v. work. 1/-.  
 25 mfd. 25 v. work. 1/-.  
 8 x 32 mfd. 450 work. 4/-.  
 16 x 8 mfd. 450 work. 3/9.  
 8 mfd. 450 v. work. 1/11.  
 250 mfd. 12 v. work. 1/3.  
 16 x 32 mfd. 450 v. work. 4/6.  
 8 mfd. 500 v. 2/6.  
 16 mfd. 500 v. 3/6.  
 8 x 8 mfd. 450 work. 3/3.  
 30 x 30 mfd. 350 work. 3/9.

### P.M. SPEAKERS

Size	with trans.	less trans.
3 1/2 in.	—	8/6
5 in.	12/6	—
6 1/2 in.	12/6	8/9
8 in.	14/3	11/9
10 in.	17/6	14/6

Post and packing on above items 1/- each extra.

**MIDGET BAKELITE CABINET** 7 1/2 in. x 5 1/2 in. x 5 in. c/w. 5-valve S/H chassis med./long wave scale and back (Takes std. twin gang condenser and 3 1/2 in. speaker), 15/-.  
**EXTENSION SPEAKER** 4 in. wide x 4 1/2 in. high x 3 in. deep at base tapering to 2 1/2 in. c/w. 3 1/2 in. speaker. 15/-.  
 Colours of both the above: Cream, walnut, black and maroon. State second choice when ordering.

**LINE AND FRAME COIL ASSEMBLY.** Frame coils wound but not fitted (full instructions supplied). High impedance frame; low impedance line, matching 5-1. 7/6.  
**PERMANENT MAGNET FOCUS ASSEMBLY** with variable adjustment, 8/-.  
 6 1/2 in. SPEAKER (P.M.) specially made for Television with closed field, complete with O.P. transformer. 11/6.  
**CONSTRUCTOR'S PARCEL** Comprising 5-valve superhet chassis with transformer cut-out, size 13 1/2 in. x 6 in. x 2 in., with L.M. & S. scale, size 7 in. x 5 in. Back plate two supporting brackets, drive drum, pointer, two-speed spindle, twin gang condenser. Mains transformer 250-0-250 v. 60 mA, 6 v. 4 amp Pri. 200/250 6 1/2 in. ROLA energised speaker and 6 x 5 Rect.

**28/-** Plus 2/- post and packing.

**6-STATION SWITCHED SUPERHET COIL UNIT,** by famous manufacturer. Ideal for Car Radio or radio set. Range coverage Pos. 1, 200-300 m.; 2, 250-360 m.; 3, 250-360 m.; 4, 320-460 m.; 5, 400-550 m.; 6, 1100-1850 m.; no oscillator required for lining up, complete with Circuit and medium and long wave frame aerial. 21/-. post and packing, 1/-.  
**PRE-ALIGNED MIDGET 465 Kc. Q.120,** made for the above Coil Unit, 8/6 per pair, post 6d.  
**CHASSIS TO FIT COIL UNITS AND IFs,** size 11 1/2 in. x 5 1/2 in. x 1 1/2 in., 2/6.  
**MAINS TRANS. TO FIT ABOVE CHASSIS.** Pri. 200/250 volt. Sec. 250-0-250 v. 60 mA, 6 v. 4 amp., 13/6, post and packing, 1/-.  
**CONSTRUCTOR'S PARCEL,** comprising chassis 10 1/2 in. x 5 1/2 in. x 2 in. with speaker and valve holder cut-outs; ROLA 5 in. P.M. with O.P. trans.; twin gang with trimmers; pair of TRF coils; 4 international Octal valve holders; wave change switch and Erie 20k pot with switch, 17/6 plus 1/6 post and packing.  
**CONSTRUCTOR'S PARCEL,** comprising Midget twin gang with slow-motion drive; Pair Midget 465 Kc. IFs.; frame aerial; medium wave osc. coil and layer type H.T. and L.T. Battery, 90 v. + 1 1/2 v. 21/-. plus 2/- P. & P.  
**STANDARD 465 KC. I.F.s.** Iron cored Q.120, 7/- per pair.  
**MINIATURE 465 KC. I.F.s.** Type M400B. 12/6, plus 6d. post and packing.  
**MINIATURE 465 KC I.F.s** (slightly larger than the above item), Q.120. Per pair 10/-.  
**VALVE HOLDERS.** Paxolin International octal. 4d. each. Moulded International octal, 6d. each. EF50 ceramic 7d. each. Moulded B7G slightly soiled 6d. each.  
**LINE CORD.** 3-way 0.3 amp. 180 ohm per yard. 10d. per yard.  
**CERAMIC PFS.** 3 each of the following: 330, 220, 180 & 82, 2/6.  
**VOLUME CONTROLS,** by famous Manufacturer. Long spindle and switch. 1, 1 and 2 meg., 3/3 each. 20, 25 and 50 k., 3/- each.  
**VOLUME CONTROLS,** by famous Manufacturer. Long spindle less switch, 5 k., 50 k., 500 k., 1 meg., 1/6 each.

### ENERGISED SPEAKERS

8 in. 2,000 ohm field with O.P. trans. 5,000 ohm imp. .... 15/6  
 5 in. 1,000 ohm field with O.P. trans. 5,000 ohm imp. 12/6.  
 10 in. 1,000 ohm field with 5,000 ohm impedance O.P. trans., or push-pull trans. 6 v. 6 match-ing. 17/6.  
 P. & P. 1/- each extra.

### TUNING CONDENSERS

.0005 twin gang with feet, 4/-.  
 .0005 twin gang, fitted feet, trimmers and drum, 4/7.  
 Post on the above items, 6d. extra.

### MAINS DROPPERS

.2 amp. 1,000 ohms tapped 900 ohms. 1/9.  
 .2 amp. 717 ohms tapped 100 ohms. 1/6.  
 .3 amp. 520 ohms tapped. 2/6 ea.

### WAVE CHANGE SWITCHES

3 pole 2-way..... 1/2  
 4 pole 4-way..... 1/9  
 1 pole 12-way ..... 2/6  
 2 pole 12 way ..... 3/6  
 P. & P. 3d. each.

### TELEVISION MASKS

White Rubber. 9 in. with glass, 10/6. 12 in. with glass. 15/-.

### POST ORDERS ONLY

67 RALEIGH AVENUE, HAYES, MIDDLESEX

### AMPLIFIERS KIT for HOME CONSTRUCTORS

A complete set of components to construct a 10 watt amplifier including Woden potted mains transformer. 5 valves, 10 in. speaker with transformer. Components of the highest quality. No Govt. surplus. Three switched inputs, negative lead back, push-pull output, cone control, steel chassis. Suitable home or small hall. CASH WITH ORDER

Price Complete to the last screw

£8 0 0

(Subject)

### BEETHOVEN LTD

ELECTRIC EQUIPMENT  
 Chape. Lane, Sands, High Wycomb. Tel: 1152/3

## 25 YEARS OLD TO-DAY!

SEND FOR OUR 25th BIRTHDAY RADIO AND TELEVISION COMPONENT CATALOGUE 6d. post paid

Contains details of thousands of quality new components with full data. The most comprehensive catalogue available. SEND NOW TO THE FIRM YOU CAN RELY UPON.

COVENTRY RADIO, Dept. "W," 189, Dunstable Rd., Luton.

## ENGINEERS!

Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES". Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., CITY & GUILDS (Electrical, etc.), MATRIC., etc., on "NO PASS—NO FEE" terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto., Aero., Radio, etc., Building, etc. If you're earning less than £10 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE!

## B.I.E.T.

287 Shakespeare Ho., 17-19, Stratford Place, London, W.1.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

# PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

## PREMIER MIDGET RADIO KIT



Redesigned and easier than ever to build. Includes an attractive walnut or cream plastic cabinet 12in. x 6in. x 6in. The valve line-up is 6K7, 6BH7 and beam power output (CV1510) in the A.C. model and 6K7, 6BH7 and 12A6 in the A.C./D.C. model. Both use metal rectifiers and are for use on 200-250 volt mains. The dial is illuminated and the receiver presents an attractive appearance. Medium and long waveband coverage. Complete kit of parts with valves, speaker, cabinet and point-to-point diagrams. Please state if A.C. or A.C./D.C. is required.

**£4.19.6** inc. P.T.

## NEW 3-BAND MIDGET SUPERHET KIT

Redesigned to cover the short, medium and long wavebands (16-50, 190-540, 1,000-2,000 metres) A.C. valve line-up, 6K8, 6K7, 6Q7, CV1510 (Beam power output). A.C./D.C. valve line-up is the same excepting output valve is 12A6. Both use metal rectifiers and are for use on 200-250v. mains. In cream or walnut cabinet as illustrated. Illuminated dial. An attractive and powerful receiver. Complete kit of parts with Valves, Speaker, Cabinet and point-to-point diagrams. Please state if A.C. or A.C./D.C. is required.

**£6.19.6** inc. P.T.

## CATHODE RAY TUBES. ALL NEW AND PERFECT.

CV. No.	Civil No.	Dia. in Inches	Focus	Defin.	E.H.T.	O.K. for T.V.	Price	Rat. pkg. and Insc.
254	—	—	E.S.	Mag.	8kv.	Exptml.	40/-	10/-
279	—	2.75	E.S.	E.S.	1450	Exptml.	10/-	2/6
600	5CP1	5	E.S.	E.S.	2kv.	Yes	25/-	2/6
601	5BP1	5	E.S.	E.S.	2kv.	Yes	27/6	2/6
602	3AP1	3	E.S.	E.S.	1.5kv.	Yes	15/-	2/6
718	5FP7	5	E.S.	Mag.	7kv.	Exptml.	20/-	2/6
741	5LP1	5	E.S.	E.S.	2kv.	Yes	27/6	2/6
790	2AP1	3	E.S.	E.S.	1kv.	Yes	15/-	2/6
817	3EP1	3	E.S.	E.S.	2kv.	Yes	15/-	2/6
915	12FP7	12	Mag.	Mag.	—	No	60/-	12/6
1112	VCR112	5.25	E.S.	E.S.	3kv.	Yes	15/-	1/6
1131	VCR131	12	E.S.	E.S.	4kv.	Yes	80/-	12/6
1138	VCR138	3.5	E.S.	E.S.	1200v.	Yes	10/-	2/6
1140	VCR140	12	Mag.	Mag.	3kv.	Yes	90/-	12/6
1379	ACR2	5	E.S.	E.S.	3kv.	Yes	15/-	2/6
1381	AOR8	5.25	E.S.	E.S.	2kv.	Yes	15/-	1/6
1384	—	11.5	E.S.	E.S.	4kv.	Exptml.	40/-	2/6
1395	—	6.25	E.S.	E.S.	3kv.	No	17/6	10/-
1511	VCR511	11.75	E.S.	E.S.	4kv.	Exptml.	60/-	10/-
1516	VCR516A	9	Mag.	Mag.	5kv.	No	40/-	10/-
1521	VCR521	3.5	E.S.	E.S.	4kv.	No	5/-	1/6
1522	VCR522	1.75	E.S.	E.S.	800v.	Yes	15/-	1/6
1593	VCR517	6	E.S.	E.S.	2kv.	Yes	20/-	2/6
1791	5FP1	5	E.S.	E.S.	2kv.	Yes	27/6	2/6
2880	EM14/1	3	E.S.	E.S.	800v.	Yes	17/6	1/6
3776	—	5.25	E.S.	E.S. Mag.	4kv.	Exptml.	20/-	2/6

## TRANSMITTING AND SPECIAL PURPOSE VALVES

846A	10/-	843	5/-	3B24	7/6	EHTT(CV19)	20/-	MR300E(CV3558)	15/6
837	10/-	1625	5/-	V869	7/6	V868(CV1068)	6/6	U19(CV187)	6/6
860	5/-	713A	6/6	GDT4C	6/6	EL266(CV15)	40/-	N82(CV1199)	5/-
872A	10/-	XH1.5	6/6	DET5	10/-	VT30(CV1030)	7/6	CV67(Klystron)	5/-
830B	10/-	807	6/6	282A	10/-	U13(CV1113)	5/-	GU50(CV1072)	7/6
878	10/-	100TH	20/-	RK7A	12/6	PT25H(CV1046)	5/-	1828(CV1755)	3/6
881	10/-	4C27	10/-	307A	10/-	VU133A(CV54)	6/6	BL63(CV1102)	6/6
832	10/-	2X2	2/6	327A	15/-	ADI(CV1814)	6/6	GU1(CV1262)	6/6
805	10/-	9003	3/6	958A	2/6	DDQ(CV1141)	6/6	V1908(CV29)	6/6
803	10/-	9003	3/6	956	3/6	717A(CV3584)	6/6	EL359(CV76)	40/-
705A	10/-	9004	3/6	CV1810	6/6	BL18(CV1197)	5/-	831A	3/6
1816	5/-	703A	10/-	3T	6/6	HY114B(CV3505)	6/6	Base	2/6
8012	10/-	2E22	7/6						

152-153, FLEET STREET, E.C.4. Phone: CENTRAL 2833—and at—207 EDGWARE RD., W.2. Phone: AMBASSADOR 4033  
 207, Edgware Road is open until 6 p.m. on Saturdays. 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.

## TELE-RADIO (1943) LTD.

177, EDGWARE ROAD, LONDON, W.2

Wharfedale W10/CS 10in. cloth suspension	£7 5 0
Wharfedale Golden 10in. 2/3 or 15 ohms	£4 0 0
Wharfedale Super 8/CS 2/3 or 15 ohms	£4 0 0
Goodmans Single Cone Audiom 60	£6 15 0
Goodmans Double Cone Axiom 150	£8 8 0
Vitavox K12/10	£7 0 0
Partridge PPO/0 6K to 3.75 and 15 ohms	£2 12 6
Partridge PPO/1 8K to 3.75 and 15 ohms	£2 12 6
Partridge PPO/2 10K to 3.75 and 15 ohms	£2 12 6

### MATCHED VALVES

KT66's	£1 16 6	6V6's	£1 5 8
6F6's	£1 5 8	PX4's	£1 13 0
PX25's	£2 14 10	6B4's	18 4

### WILLIAMSON AMPLIFIER COMPONENTS

Chassis punched and drilled	£1 7 6
Partridge mains trans. 425/150mA	£2 17 0
Partridge mains trans. 425/200mA	£4 8 0
Partridge choke 25H 60mA	16 0
Partridge choke 13H 200mA	£1 11 0
Partridge output trans. wire ended	£5 0 0
Partridge output trans. tag board	£5 13 0

Full detailed price list available.

"The Williamson Amplifier" booklet as reprinted from "Wireless World," post free, 3s. 9d.

The Williamson quality amplifier can be seen and heard at our premises in Edgware Road. When ordering please include sufficient for postage and packing. Shop Hours: Monday-Saturday 9 a.m.-6 p.m. Thursday, 9 a.m.-1 p.m. Phone: PAD 6116 or 5606.

## G2AK

## This Month's Bargains

## G2AK

**POWER TRANSFORMERS.** 620/550/375/0/375/550/620 v. at 200 mA. plus 250 mA at the 375 v. taps. Two separate windings for rectifiers of 5 v. at 3A. each. Primary 230 v. 50 c. Rated at 278 watts. Our price, 39/6, carriage paid.

**HEAVY DUTY L.F. CHOKES.** Fully potted. 30 Hy. 100 ma. 150 ohms (Weight 14lb.). Price 13/6. 20 Hy. 126 ma. 100 ohms (Weight 14 lb.). Price 15/6. 30 Hy. 150 ma. 150 ohms (Weight 18lb.). Price 17/6. All transformers are carriage paid except to Eire for which we must ask for 5/- extra.

**G.P.O. STANDARD DESK MICROPHONES** with screened lead and plug, 9/6 each, plus postage 1/6.

**VIBRATOR PACKS.** 6 v. input. Output 180 v. 40 ma., fully smoothed. Price 19/6 plus postage 1/6. 12 v. input. Output 300 v. 100 ma., fully smoothed. 19/6 plus postage 1/6. All packs are tested and sent-out in working order.

**H.T. BATTERIES.** Heavy duty 157 v. plus 5.2 v., in sealed metal cases, 10 1/2 in. x 4 1/2 in. x 4 in.; Wt. 11lb. These are a special mercury type and are excellent at 8/6, plus postage 1/6.

**AMERICAN TELESCOPIC PLYWOOD MASTS.** These excellent 30ft. masts can be erected by two people in half-an-hour on tripod support. Please write for photographs. Only £4/10/- each. Packing and carriage 10/-.

**SMALL FILAMENT TRANSFORMERS.** Input 230 v. Output 6.3 v. Tapped at 4 v. 1.5 amps. Price 7/6. Postage 9d.

**SPECIAL METER OFFER.** 100 microamps. Scaled 0-100 2 1/2 in. Only 22/6 each. 500 microamps. Scaled 0-500 2 1/2 in. dia. Each 7 6

500 microamps. Scaled 0-15-600. Each 6 3

Ditto, but ex-equipment. Each 5 0

5 amp. Thermo 2in. dia., 2/6 each or 5 for 10/-.

0-5 mA. 2in. dia., 5/- each. 0-100 mA. and 0-500 mA. 2 1/2 in. Flush mounting, 7/6 each.

0-20 volt 2in. dia., 5/- each. 20-0-20amps. 2in. dia., 5/- each. 0-3,500v. Moving Coil 3 1/2 in. dia., 25/- each. 0-9 amps. Hot Wire Ammeters (by removing external shunt, full scale deflection is 4 amps.), 1/6 each.

Radiator Thermometers 2in. dia. Movements 2.5 mA. Backwards reading. Ideal for "S" Meters, 1/6 each.

Postage on single meters, 6d. Three or more post free. PLEASE PRINT YOUR NAME AND ADDRESS.

## CHAS. H. YOUNG, G2AK

All Callers to 110 DALE END, BIRMINGHAM

Phone: CENTRAL 1635.

Mail Orders to 102 HOLLOWAY HEAD, BIRMINGHAM

Phone: MIDLAND 3254.

1850 **TELCON** 1950  
 CELEBRATES ITS  
**CENTENARY**

1950 marks the anniversary of 100 years of manufacturing enterprise since the formation of The Gutta Percha Company, which in 1850 made the first submarine telegraph cable laid between England and France and which became the nucleus of The Telegraph Construction and Maintenance Company Ltd. From this small beginning as merchant adventurers in a new commodity, grew the Telcon organisation, whose activities have steadily multiplied until today they cover a wide field of industry.

**CABLES** Power distribution cables; land communication cables; radio frequency and television cables; instrument wires.

**METALS** Magnetic alloys; glass sealing alloys; resistance alloys; thermostatic bimetals; beryllium copper; etc

**THERMOPLASTICS** Gutta Percha and Telcothene; sheet, tube, mouldings, tape, coated papers, etc.

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD  
 TELCON WORKS GREENWICH S.E.10  
 Telephone :— GREENWICH 3291  
 Telegrams :— MOORINGS GREEN, LONDON



# Wharfedale

STOCKISTS OF  
 WHARFEDALE HIGH  
 FIDELITY SPEAKERS

## HIGH FIDELITY EQUIPMENT

including loudspeakers, transformers, crossover networks, special tone and volume controls, micro-groove equalizers, and

## TECHNICAL PUBLICATIONS

**LOUDSPEAKERS:** The Why and How of Good Reproduction 5s., **SOUND REPRODUCTION:** Greatly enlarged 2nd Edition 10/6, are stocked and sold in the London area by these Traders.

\* Many can give demonstrations of Wharfedale High Fidelity Equipment.

### STOCKIST

- E. P. Fox, 109, Walton Road, East Molesey
- Holley's Radio Stores, 285, Camberwell Road, S.E.5.
- Holt & Crompton, 6, Station Parade, Sutton
- R. A. Minter, 2, East Street, Bromley.
- M. Richards, The Crescent, Leatherhead
- Rogers Development Co., 116, Blackheath Road, Greenwich, S.E.10.
- Silcocks & Co., High Street, Romford, Essex
- C. Wright, 432, Hoe Street, Walthamstow, E.17

### ALL DISTRICTS—

- Alec Davis Supplies, Ltd., 18, Tottenham Court Road, W.1.
- The Gramophone Exchange Ltd., 121, 123 Shaftesbury Ave., W.C.2.
- Premier Radio Co., 152/153, Fleet Street, E.C.4.

Webb's Radio, 14, Soho Street, Oxford Street, W.1.

### ALL DISTRICTS ESPECIALLY WEST & N. WEST

- Premier Radio Co., 207, Edgware Road, W.2.
- H. L. Smith & Co., Ltd., 289, Edgware Road, W.2.
- Tele-Radio, Ltd., 177 Edgware Road, W.2.

### DISTRICTS SERVED

- Molesey, Kingston and Malden.
- All South and S.E.
- Sutton, Carshalton, Cheam.
- Bromley, Beckenham, Chislehurst, Petts Wood and Orpington.
- Leatherhead, Dorking, Epsom, Ashstead, Ewell and Surbiton.
- All South and S.E. London.
- Ilford, Romford,
- Walthamstow, Leyton, Leytonstone.
- Charles Britain Radio Co., Ltd., 11, Upper St. Martin's Lane, W.C.2
- Modern Electrics, Ltd., 164, Charing Cross Road, W.C.2.
- Stern Radio Ltd., 115, Fleet Street, E.C.4.

WHARFEDALE WIRELESS WORKS, BRADFORD RD., IDLE, BRADFORD, YORKS.

# Henry's

RADIO COMPONENTS  
ELECTRONIC & TELEPHONE EQUIPMENT

**MIDGET .0005 mfd. TWO-GANG TUNING CONDENSER.** Size only 2½ in. x 1½ in. x 1½ in. Capacity guaranteed, standard length ½ in. spindle, complete with mounting bracket, less trimmers, 6/6, or complete with "built-in" trimmers, 7/6. Each plus 6d. post.

"**CLEAREX**" very latest T/V Enlarging Lens, complete with attractive plastic fixing straps (does not damage cabinet). 50/- only, or the new Filter type at only 55/- For 9 in. or 10 in. Tubes.

**ALUMINIUM SHEET.** Size 2½ in. x 10½ in. x 16 s.w.g., 3 sheets, 10/-; also 17½ in. x 8½ in. x 18 s.w.g., 3 sheets, 7/- Please add 9d. postage.

"**DENCO**" ALIGNMENT OSCILLATOR D.A.O.I. This unit provides a modulated signal for the alignment of I.F. amplifiers and associated circuits.

The two standard frequencies of 465 Kc/s and 1,600 Kc/s are selected at the turn of a switch.

All supplies are derived from one U.10 cell and one 1289 battery inside the unit. Consumption of 50 m.a. single valve type DL92 is used. Dimensions of case: width 3½ in., depth 2½ in., height 4½ in. Price only 39/6, post free.

**R.1355 RECEIVERS.** We have been fortunate in securing a further limited quantity of these receivers. These are brand new and unused. Price 55/- (plus 5/- carriage).

**R.1355 MAINS TRANSFORMER.** 200/250 v. input. Outputs 250-0-250, at 120 m.a., 6.3 v. at 6 a., 5 v. at 3 a. Fully shrouded top chassis mounting and guaranteed 100 per cent. Only 28/6.

## R.3515 I.F. STIP

A complete I.F. Unit, comprising 6 SP61 I.F. Stages, tuned to 13.5 Mc/s., 1 EA50 diode detector, and 1 EF36 or EF39 output or video stage. A few modifications only are required to adapt this unit, which will give pictures of extremely good quality. Price, complete with valves, and foolproof modification instructions, is 45/-, plus 5/- packing and carriage. Limited quantity only.

**INDICATOR UNIT TYPE 193.** Containing VCR 138A 3½ in. tube 3 VR65, 1 VR54, 1 VR92, 2 high-speed relays, volume controls and 101 res. and condensers. Absolutely brand new. Carriage paid, £2.

**BAKELITE RECEIVER CABINETS.** An extremely advantageous purchase, enables us to offer the following:—Attractive brown bakelite cabinet, size 15 in. x 8½ in. high x 7½ in. deep, complete with chassis drilled for standard five-valve superhet, back, 3-way glass dial and back plate. Chassis and cabinet are designed for 6½ in. speaker, and all standard components. Price complete is 25/- only. Limited quantity.

**TYPE 6C INDICATOR UNITS.** Comprising 3½ in. VCR138 C.R.T. with mu-metal screen, 2EF50, 2 EB34, plus high voltage condensers and resistors. In good condition, price 45/- only.

**RECEIVER TYPE 25.** The receiver portion of the T/R 1196. Covers 4.3-6.7 Mc/s and makes an ideal basis for an all-wave receiver, as per "Practical Wireless," August issue. Complete with valves type EF36 (2), EF39 (2), EK32 and EBC33. Supplied complete with necessary conversion data for home use. Only 22/6. Chassis only, 8/6.

**E.H.T. TRANSFORMERS.** Output 2,500 v., 5 m.a., 4 v. 1.1 amp., 2-0-2 v., 2 a. (for VCR97), 35/- only. Output 3,250 v., 5 m.a., 6.3 v. 1 a., 2-0-2 v., 2 a. (for 5CPI), 39/6. Output 4,000 v., 10 m.a., 2-0-2 v., 2 a., 48/-, Output 5,000 v., 16 m.a., 2-0-2 v., only 60/- All input 230 v. and fully guaranteed.

**WAVE-FORM GENERATOR TYPE 34.** Ex. A.M. Including 6 SP61, 4 EF36, 2 EB34 and one CV116. Also relays, transformers, pots., condensers and resistors. The whole contained in metal box size 11½ x 11 x 8 in. In clean condition, an absolute bargain at 25/-, plus 3/6 packing and carriage.

**A.M. RECEIVER UNIT TYPE 161.** Comprising RL37, 2 EF54 and EC52. Coils, relay and many condensers and resistors. The whole in metal box, size 8½ in. x 6½ in. x 3½ in. New, a bargain at only 15/-, carriage paid.

**SPECIAL PURCHASE.** Brand new H 4/200 E.H.T. pencil rectifiers, 2,400 v., 3 m.a., only 15/- each. Also RECTIFIERS, J50 (new, ex-Govt.), 7/6 each. Westinghouse 36 EHT 35, 17/4; 36 EHT 100, 26/6.

**SLIDER POTS.** As used in all the latest T/V sets. A bank of four, comprising 2 of 10K, 100 ohm and 500 ohm. Only 6/- the set. Easily split up.

**DUAL PURPOSE MAINS-TRANSFORMERS.** Special 350-0-350 v., 80 m.a., 6.3 v. tapped 4 v., at 3 a., 5 v. tapped 4 v. at 2 a. Top chassis mounting and fully guaranteed. 18/6 only, plus 9d. post.

WE ARE PLEASED TO ANNOUNCE THAT WE ARE ONCE AGAIN ABLE TO OFFER A RETURN OF POST SERVICE.

Send stamp for current Component List—  
Probably the most comprehensive in the trade

**5, HARROW ROAD, LONDON, W.2**

PAddington 1008/9 and 0401



And a  
Richard Allan  
speaker to go  
with it Sir?

● It gives radio in any other room. It saves moving the main set about with its attendant risks. It enables you to listen in another room without

having to leave the door open.

In case of sickness it relieves boredom and keeps the patient cheerful.

● Every Richard Allan speaker is a baffle speaker.

● Richard Allan made the first popular modern baffle type speakers and still leads the way.

● Richard Allan gives higher value at lower prices.

● There is a Richard Allan speaker to suit every room and every pocket.

Consider these advantages and buy a Richard Allan extension speaker.

Baby 39/6

Minor 52/6

Major 65/-

Bafflette 44 4 0

De-Luxe

£4 15 0

Console

£6 15 0

Prestage

£12 19 6

**Richard Allan**

RADIO LTD., BAFFLETTE HOUSE, BATLEY, YORKSHIRE.

## GARLAND RADIO

**MOTORIZED SWITCH ASSEMBLY,** Type 10FB/556, with 24 v. miniature motor, 2½ in. x 1½ in. x 1½ in., gearing, switch contacts, etc., 10/-.

**D.C. SOURCE:** Comprising mains transformer, primary 0-200-230-250 v., secondary 0-18-24-31 v. @ 1.5A, and selenium bridge rectifier, max. input 31 v., max. output 24 v., 1.2 a., ideal for motors, etc., 27/6.

**ROTARY TRANSFORMERS:** Input 24 v. Outputs 300 v. @ 150 m.a. and 150 v. @ 30 m.a. Wound field. 12/6.

**TOROIDAL CERAMIC POTENTIOMETERS,** Type 10 w./1681. 17 kΩ @ 100 watts. Ideal for HT variation. 6/- each.

**DE JUR AMSCO PRECISION POTENTIOMETERS:** 20 kΩ @ 100 watts. 4/- each.

**SPLIT-STATOR CONDENSERS:** 100 pF. As used in I.F.F.'s. 1/3 each. 250 pF with slow motion and switch, 2/- each.

**PUSH-PULL OUTPUT TRANSFORMERS:** Maximum 6 watts. Matching 6V6G's to 2.5Ω or 4Ω speakers. 6/6 each.

**ROTARY WAFER SWITCHES:** SP 3-way, 9d.; SP 4-way, 10d.; 6-way Paralleling, 6d.; 3-pole 2-way, 1/-; 5-pole 3-way, 1/3; 4-pole 4-way, 1/6; SP 10-way, 1/9; 2-pole 10-way (wired), 1/6; 2-pole 4-way (wired), 9d.

**VOLUME CONTROLS:** With S.P. switch, 1K, 2K, 2.5K, 5K, 15K, 20K, 75K, 100K, 150K, 500K, 1M @ 4/-. With D.P. Switch, 20K, 25K, 100K, @ 4/6.

**OILFILLED CONDENSERS:** 4 mfd. 600 v. D.C. wkg.s., 3/6 each. L.F. CHOKES: 20H @ 80 mA, D.C. Tropicalised. 8/6 each.

**100Ω W/P POTS:** Preset miniature (1 watt), 1/6.

**15A 3 p SWITCH PLUGS:** Metal cast industrial type, takes standard 3 pin plug top. 4/-.

**DESK TYPE PUSHES:** Baize-backed. 2-way, 1/3; 3-way, 1/6; 4-way, 1/9; 6-way, 2/-.

**TX and SP VALVES:** 803, 805 @ 10/-; 8012, CV296 @ 7/6; VU111 @ 5/-; VU113, VU133, CV54 @ 3/6; Stabilivolt NS1 @ 10/-.

**BRAND NEW METAL CONDENSERS:** .02/350 v. Type CP33N, 1/- each, 10/- per doz.; .002/500 v. Type CP30s, 1/- each, 10/- per doz.; .01/350 v. CP32N, 1/- each, 10/- doz.; 1/350 v. CP37N, 1/- each, 10/- doz.; .05/500 v. CP36s, 1/- each, 10/- doz.; 1/200 v. CP36H, 1/- each, 10/- per doz.; .05/200 CP34H, 1/- each, 10/- doz.

**HEATER TRANSFORMERS:** Suitable well-known T/V kit. Pri: 200 v./250 v. by 10 v. steps; Sec. 0-6.3 v. @ 7A, 0-2-6.3 v. @ 2A. 15/-.

**MUIRHEAD S.M. DRIVES:** As used on G-units and R1224A. 6/6 each.

All goods new unless otherwise stated. Postage extra all items.

**GARLAND BROS.**

Chesham House, Deptford Broadway, London, S.E.8.

Telephone: TIDeway 4412/3.



Measurements can be made from  
1mV to 100V with the Furzehill  
**SENSITIVE VALVE VOLTMETER**  
over the range 10c/s to 500 Kc/s.  
Logarithmic scale shape and  
high input impedance are  
other features.

by *Furzehill*

**FURZEHILL LABORATORIES LIMITED**  
Boreham Wood, Herts. Te: ELStree 1137

Visit S.I.M.A. Exhibition and Symposium 4th to 8th September, 1950

## QUALITY SUPERHET

By courtesy of the General Electric Co. Ltd., Kingsway, London, we have pleasure in introducing a new pre-tuned superhet, as described in their technical publication TP4. This receiver is the ideal unit for use with amplifiers such as the "Williamson," where reception conditions are unfavourable to a "straight" type of receiver.

### OUTSTANDING FEATURES:—

- Four pre-selected wavelengths. 3 medium. 1 long.
- Two positions of selectivity. Bandwidth 6 kc/s and 16 kc/s.
- Very efficient 9 kc. whistle rejector, giving approximately 40DB rejection.
- Variable switched bass and treble controls.
- Ample gain for lightweight pick-ups.
- Very low overall distortion.

Price : **£16. 0. 0.**

Purchase Tax : **£3. 15. 0.**

DELIVERY 7 - 14 DAYS.

TRADE ENQUIRIES INVITED.

## ROGERS DEVELOPMENTS CO.,

"RODEVCO HOUSE,"

116 BLACKHEATH ROAD, GREENWICH, S.E.10.

Telegrams: RODEVCO, GREEN, LONDON.

# BALDWIN



**MOVING-COIL**  
for d.c.

**RECTIFIER**  
for a.f.

**THERMAL**  
for h.f.

Leaflets 101 &  
101-A.

**2½ & 3½-in. ROUND PATTERN**

Also 4-inch square flush mounting, 6-inch Portables, Galvanometers, etc.

A wide range of instruments for  
Laboratory and Industrial use.

**BALDWIN INSTRUMENT CO. LTD.**  
**DARTFORD, KENT**      Dartford 2989 & 2980

## Stars for Sale!

- ★ 3 SPEEDS — 33½ - 45 - 78 rpm.
- ★ INTERCHANGEABLE HEADS  
for Microgroove or Standard Records
- ★ AUTOCHANGE UNITS  
for 10" or 12" Mixed Records

Interested in the **NEW**  
Long-Playing, Unbreakable  
**MICROGROOVE RECORDS** ?  
Send for details of the new motors  
—record players & auto changers  
now becoming available.

**7th**  
**RADIOCRAFT** Ltd.  
60-71 CHURCH GATE, LONDON E.C.4  
PHONE 58927  
G3CQ5 C38Y1 G2R1

## PRATTS RADIO

**1070 Harrow Road, London, N.W.10**  
(Nr. SCRUBBS LANE)      Tel. LADBroke 1734



**MODEL AC10E £8/18/6**

**AMPLIFIERS.** College general purpose units. Model AC10E 10 watt 4 valve unit. Neg. feedback. Separate mike stage, separate inputs for mike and gram. with twin faders. Tone control. Complete in case with chrome handle, £8/18/6. (Carriage 5/- extra.)

Model AC18E, 6 valve unit with output of 18½ watts. Push-pull output with feedback over 3 stages. Separate mike stage. Inputs as AC10E. Complete with case and chrome handles, £13/19/6 (carr. pd.). Model U10E, 6 valve unit for DC/AC mains. Spec. as AC18E. 10 watts output with feedback over 3 stages. Separate mike stage, £11/11/0 (carr. 5/- ex.). All above have outputs to match 3, 8 or 15 ohms speaker, and are ready for immediate use. Finish blue stove enamel. Input volts average, mike .003 v., gram. .3 v. No pre-amplifier required. Model AC8C record/radio amplifier. Chassis model. 5 valves P.P. output with feedback over 3 stages. Output 8-10 watts. Supplies H.T. and L.T. for tuning unit. Output to 3, 8 and 15 ohm speaker, £9/18/6 (carr. pd.). Model AC4C, AC or U4C AC/DC. 3 valve chassis units. 4 watts (output to 3 ohms, £4/19/6 (carr. 2/6). 3 waveband superhet tuning unit available. Price £9/13/10 tax paid. Stamp for amplifier list. Above are as supplied to clubs, schools, hospitals, etc.



**MODEL AC4C 99/6**

**SPEAKERS.** Truvox 2½in., 17/6; 12in., 37/6; Scentorian, 2½in., 15/6; 5in., 17/6; Plessey, 5in., 9/6; 8in., 11/9; 10in., 17/6; Rola mains en., 6½in., 700 ohm field, 10/-; Goodmans 8in., 16/6; 12in., 130/- (all less o/transfr.).

**TRANSFORMERS.** E.H.T. 2.5 Kv, 4 v., 4 v. C.T. Input 200/20/40 v. (for VCR97), 27/6 (tested 15 Kv.). 2 x 350 v. 80 mA., 0, 4, 5 v.; 0-4, 6.3 v., 21/6. Filament, input 230 v., output 6.3 v. 1½ A., 5/6. Output 6V6 to 3 ohms, 3/11; Ultra midget 154/354, 3/11; 6V6 P/P. to 3, 8, 15 ohms, 18/-.

**VARIABLE CONDENSERS.** 2 gang .0005, 4/3; 3 gang, 6/9, with ft. and shaft 2½in. Presets. Ceramic 50 pf., 4d.; 100 + 500 pf., 1/3.

**CONDENSERS.** B.1. 500/550 v. C'b'd. Blocks, 8 mfd., 3/3; 8 + 8, 4/9; 8 + 16, 6/-; Huns 8 mfd., 2/3; 16 mfd., 3/6; 16 + 8, 3/9 (all 450 v.). T.C.C. 25 mfd. 25 v., 1/-; 25 mfd. 12 v., 8d. Open 10-6. Callers welcome. Nearest Tube Kensal Green. All Goods New and Unused. C.O.D. or C.W.O. Post free over £1.

## WEYRAD

Components for all users. If you are interested in these or any other items please write for further details.

**BANDSPREAD UNITS**—Ranges to suit all requirements—9 Wavebands—with or without R.F. stage.

**TUNING SCALES NOW AVAILABLE.** Size 9in. x 9in.

**COIL PACKS**—3 and 4 Waveband with R.F. stage. 3-Wave packs—Special versions for battery operation.

**COILS**—12.5 to 2,000 Metres. Air cored, Iron cored midget and Screened types available.

**I.F. TRANSFORMERS**—Miniature, Midget and Standard types, all of high performance.

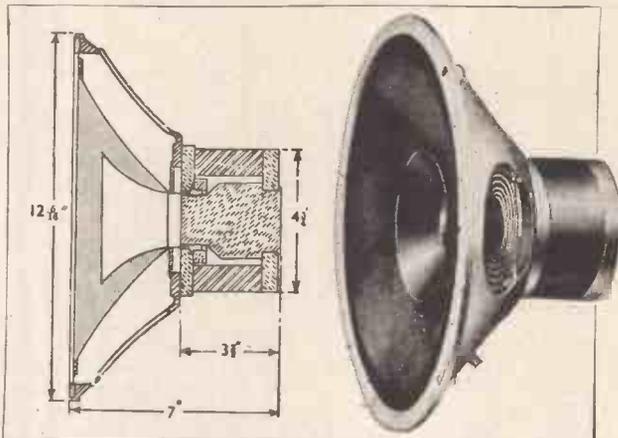
**FILTERS, CHOKES AND SPECIAL COILS** to order. We are coil winding and assembly Contractors to well known manufacturers at home and overseas. Your enquiries, large or small, are invited.

**WEYMOUTH RADIO MANUFACTURING CO., LTD.,**

**CRESCENT STREET, WEYMOUTH**



# GOODMANS AXIOM 22



The Axiom 22 12" — 20 watt twin-cone high fidelity P.M. loudspeaker (dustproof).

“THE TREND towards the use of higher flux densities in loudspeakers designed for high-quality reproduction is well exemplified by the new Axiom 22 made by Goodmans Industries, Lancelot Road, Wembley. So far as the diaphragm is concerned, it is the same as the Axiom 12 and has twin curved-sided cones with a reinforced edge to the high-frequency cone. The back centring device consists of a porous bakelized linen diaphragm with concentric corrugations. The ring type magnet makes use of one of the new high-performance alloys, and by careful design of the poles the flux density has been raised

to 17,500 gauss. This is in a gap 1.15 mm. wide, 7.8 mm. deep, with a nominal pole diameter of 44 mm. We have had an opportunity of hearing the Axiom 22 with an Axiom 12 as reference standard, and there can be no doubt of the improvement conferred by the increased flux density. Sensitivity is, of course, higher but the outstanding impression is one of tautness and the grip the Axiom 22 has on transients.

The increased magnetic damping is no doubt also responsible for an apparent reduction in intermodulation from self-generated transients, and a consequent improvement in “presence” and the segregation of the instruments of the orchestra. The price is £12 13s.”

*From the "Wireless World," June, 1949*

**GOODMANS INDUSTRIES LTD : LANCELOT ROAD WEMBLEY · MIDDLESEX. WEMBLEY 1200**

*Meet us at the Radio Show, Castle Bromwich — STAND 85*

## YOU CAN MAGNETICALLY RECORD using your Gramophone Motor as a Drive



Necessary parts, also usable later for a more ambitious job, plans available, 1 Spool Diamond Magnetic Recording Tape and 1 take-up spool, 2 Corner Brackets, 1 Roller, 1 Record-playback Head Kit, 1 Friction Clutch, 1 Dual-purpose Supersonic Oscillator and Two-stage Preamplifier and your Radio Chassis. Set of parts £7.15.0, or items supplied separately.

Also Constructional Data for Wire and Tape Recorders 5s.

**PARK RADIO OF MANOR PARK, 676/8, 783 Romford Road, London, E.12**

Speaking  
of  
Operations



Speaking of operations, a delicate but highly successful one has been carried out in striking the balance of correctly matched voice coil and curvilinear cone for our new 12" loud speaker. By carefully

suiting the weight of coil to cone we have reduced the peaks and secured a freedom from break-up, while the very high flux density of the large Alcomax magnet considerably increases the sensitivity, especially in the higher frequencies. All very worth while as you may see, or rather hear.

## GRAMPIAN 12" SPEAKER TYPE 3512/15

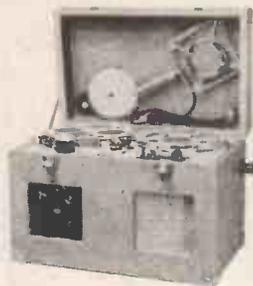


Overall diam. 12½". Depth 6". Weight 7lb. 15 ozs. Voice Coil Impedance 15 ohms. Fundamental resonance 60 cycles. Flux density 14,000 lines per. sq. cm. Frequency range 50-7,000 c.p.s. Fixing holes 4 holes ½" diam. spaced 90° on P.C.D. 12½".

DELIVERY FROM STOCK  
LIST PRICE £6-10-0

**GRAMPIAN REPRODUCERS LTD**  
Hampton Road, Hanworth, Middx. Phone: Feltham 2657

## The SOUND MAGNET RECORDERS



Programme continuous for ¼, ½ and 1 hr.  
Radio Quality at medium speed 30 mins. without pause.

Twin tracks double programme time on one spool.  
Powerful 12 watt playback.

MODEL 50

Portable Recorder  
£50

(Available shortly—S.M.  
Tape Converter for use with existing amplifiers, price £30.)

The Sound Magnet will record any sound, from a whisper to full orchestra, and playback faithfully.

See and hear them at:—

Modern Electrics, 164 Charing X Road, W.C.2 ;

Geo. Brown, George 4th Bridge, Edinburgh ;

Walters, 396 High St., Lincoln.

There is an agent in every town in the U.K. Call on your local radio-man, or write us direct for full particulars of these wonder machines.

**GENERAL LAMINATION PRODUCTS LTD.**

(Dept. W)

294 BROADWAY, BEXLEYHEATH, KENT

(Bexleyheath 3021).

**1 kW TELEGRAPH TRANSMITTERS.** Two HF 300's output. Operation 3.5 Mc to 16 Mc.

**HALLICRAFTERS BC 610** (or HT-48) operating over 2 Mc to 18 Mc and modified for 21 and 28 Mc. Crystal and VFO on all bands. Complete with speech amplifier, antenna tuning unit, exciter units and coils for all bands, set of x-tals specially made for BC 610 and new valves.

**RCA TRANSMITTERS.** Type ET4332B. 2 Mc to 20 Mc. Two 813's output. Crystal controlled and modified for VFO. With separate speech amplifier.

**60 W. TRANSCIVERS.** Very compact, weight 13 lbs. 829 output, 2 Mc to 8 Mc or 4 Mc to 16 Mc. Phone and key. High-class superhet. receiver. Complete with power pack for 110/220 v. AC. and two rotary converters for 12 v. battery supply. Two sets of aerials, microphone, headphones and set of spare valves.

**AUTOMATIC HIGH SPEED TELEGRAPH EQUIPMENT "BOEHME"** (U.S.A.). Up to 400 signs per minute on line or wireless.

**AR-88-D's, AR-77-E's, S-27's, HRO's** with 5 or 9 coils.

**SKYRIDER DIVERSITY HALLICRAFTERS RECEIVERS,** complete with console, power units and loudspeaker.

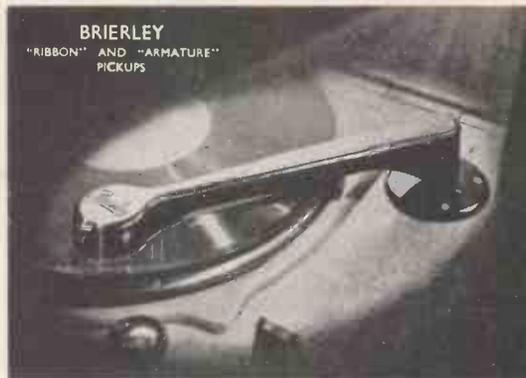
All above items in excellent working condition. Working demonstration upon request.

**TX VALVES** 803, 805, 807, 813, 814, 832, 861, 866A, 100TH, DET-16, 6L6 Met. and many others.

Large stock of Tx condensers, crystals and other components. Alignment and repair of communication receivers and all other short wave equipment undertaken.

## P.C.A. RADIO

Transmitter Division:— Receiver Division:—  
The Arches, Cambridge Grove, 170 Goldhawk Road,  
London, W.6. Tel. RIV 3279 London, W.12  
Tel. SHE 4946



## BRIERLEY RIBBON CARTRIDGE PICKUP

Type JB/P/R/3 for 78s  
Type JB/P/R/3/M for LP.

## BRIERLEY 2-SPEED TRANSCRIPTION TURNTABLE CHASSIS

These products are the ultimate of what is possible and are incomparable with any other existing equipment. If you have not received full details, write for them now.

**Postscript.** Since the preparation of the above announcement, plans for supplying the Transcription Turntable Chassis for 33½, 45 and 78 r.p.m. speeds have materialised and it is available now only as a Three-Speed Transcription Turntable Chassis.

**J. H. BRIERLEY (GRAMOPHONES & RECORDINGS) LTD.**  
46, TITHEBARN STREET, LIVERPOOL, 2

**Two outstanding advantages . .**



- This bridge not only measures balanced or unbalanced impedances with equal facility, but also has the merit of extremely low impedances looking back into the terminals and from the terminals to ground. It provides, at radio frequencies, the range, flexibility and stability of an audio-frequency impedance bridge and, having a neutral terminal available, it permits the measurement of three-terminal networks. A high degree of accuracy is maintained throughout the full frequency range.

**R.F. BRIDGE B 601 — 15 Kc/s. to 5 Mc/s.**  
 Capacity: 0.01 pf. to 20,000 pf. in five ranges.  
 Resistance: 10 ohms to 10 megohms—6 ranges.  
 Inductance values which will resonate the above capacities between 15 Kc/s and 5 Mc/s.  
 Direct reading accuracy is constant to within 1% up to 3 Mc/s and may fall to 2% at 5 Mc/s.



THE WAYNE KERR LABORATORIES LTD., NEW MALDEN, SURREY · MALDEN 2202



**WITH A VIEW**

to

obtaining

**E.H.T. SUPPLY**

for your television receiver, easily and economically,

**VISIT STAND N° 16**

CASTLE BROMWICH,  
 SEPTEMBER 6-16th,

NATIONAL RADIO EXHIBITION

1950.



**METAL RECTIFIERS**

will be demonstrated in the "VIEW MASTER" television receiver in which a "Westalite" rectifier type 36EHT100 provides the E.H.T. supply from the line flyback.

Methods of obtaining an E.H.T. supply of 5, 3 and 1.7 kV from the standard mains transformer, and 6 kV from a pulse-driven multiplier, together with valuable information on H.T. and L.T. units and "Westectors" for H.F. duty are described in

**"THE ALL METAL WAY"**

*Obtain a copy at the Stand, or send 6d. to Dept. W.W.9,*

**WESTINGHOUSE BRAKE & SIGNAL Co., Ltd., 82 York Way, King's Cross, London, N.1**

### THE FIDELIA

Features include variable selectivity, infinite impedance detector, electronic bass and treble controls, triode output stage; 3 wave-bands 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. Price £17/2/6. Also 9-valve luxury model, £21/5/-. "Precision" 5 valve chassis, £12/17/6. & 7-8 watt amplifier £16/16/-



Guaranteed 12 months  
Data sheets on request

### 7 VALVE RADIO- GRAM CHASSIS



**ELECTRO  
Acoustic  
-DEVELOPMENTS-**  
18 Broad Rd., Willingdon,  
Eastbourne, Sussex

## THE IDEAL MICROPHONE FOR TELE-COMMUNICATION

MODEL  
**C 51**  
MOVING-COIL  
MICROPHONE  
BY

Designed and developed essentially for G.P.O. hand-sets, with mobile tele-communication and P.A. work in view, LUSTRAPHONE Model C.51 is fast establishing itself wherever a good microphone is called for. It provides maximum intelligibility at extreme range and under adverse conditions, and is used extensively by Broadcast Engineers and others needing quality and dependability. Available as insert unit, or complete hand instrument. Data sheet on request.

**LUSTRAPHONE** LUSTRAPHONE LTD.  
84, BELSIZE LANE, N.W.3

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  $\mu$ F to 8  $\mu$ F. Also STOCKS of small, genuine MICA Condensers from .00001 (10 pf) to .01  $\mu$ F (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.



**THE "FLUXITE QUINS" AT WORK**  
"Our aerial's wired right" frowned EE,  
"And all fixed with FLUXITE you see  
We've tested it well  
It's as sound as a bell,  
Yet this picture looks sooty to me!"

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 iron-mongers—in tins, 10d., 1/6 and 3/-.  
**TO CYCLISTS!** For stronger wheels that will remain round and true, here's a time tested tip. Tie the spokes where they cross with fine wire **AND SOLDER**. 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.

## FLUXITE SIMPLIFIES ALL SOLDERING

Write for Book on the Art of "SOFT" Soldering and for Leaflet on **CASE-HARDENING STEEL** and **TEMPERING TOOLS** with **FLUXITE**. Price 1d each  
**FLUXITE LTD.** (Dept. WW), **BERMONDSEY STREET, LONDON, S.E.1.**

## SOUTHERN RADIO'S WIRELESS BARGAINS

**R.3515 TELEVISION UNITS.** 21 valves with 6-stage 14 Mc. I.P. STRIP. Recommended for ideal TV conversion by all experts. **BRAND NEW** in original wooden cases, £3/10/0.

**R.1355 RECEIVERS.** Brand New and unused as specified for inexpensive television, £3/5/0.

**T.R.1196 6-valve Superhet Receivers.** Perfect and guaranteed. With circuit, 22/6, plus 1/4.

**BENDIX COMMAND RECEIVERS.** B.C. 454 (49-100 metres), B.C. 455 (39-49 metres). Complete with 6 valves. Perfect condition, 35/- each, plus 1/4.

**CONTROL BOXES** for B.C. 453 4/5 Command Receivers, 13/6.

**CONTROL CABLES, 14ft.,** with adaptors for B.C. 453/4/5, 9/6 each.

**R.A.F. BOMBSIGHT COMPUTERS.** Complete, brand new, with motors, gyro gears, blowers, etc., etc. Ideal for model makers, etc. The best component value ever offered, 55/-, each plus 5/-.

**LUBRA HOLE CUTTERS.** Adjustable from  $\frac{1}{8}$  in. to  $\frac{3}{16}$  in. for use on wood, metal, plastic, etc., 5/6.

**CONTACTOR TIME SWITCHES** by Smith or Venner. 10-hour movement with thermostatic control, 2 impulses per second. Complete in sound-proof case, 10/-, plus 1/4.

**HAND GENERATORS, 6 volts** at 5 amps. Complete with crank, 20/-.  
**Lucas GENERATORS, 12 volts** input, 480 volts output, at 40 ma., 10/-.

**RADIO COMPASS INDICATORS** with internal Selsyn motor, 3in. dial, 13/6; 5in. dial, 15/6.

**RESISTANCES, 100 assorted** capacities. All useful sizes from  $\frac{1}{4}$  to 3 watts, 9/- per 100.

**CONDENSERS, 100 assorted.** All useful sizes up to 2 microfarad. Tubular and mica, 15/- per 100.

**ALL GOODS PREVIOUSLY ADVERTISED STILL AVAILABLE**

Full list of RADIO PUBLICATIONS, 21d.

Please Note New Address:

**SOUTHERN RADIO SUPPLY LTD.**  
11 Little Newport St., London, W.C.2  
GERard 6653

### TWIN TEST METER PANEL

comprising

M/coil 0-5 ma and M/coil 0-40 v metres. Variable resistance stud (control), 5-way Yaxley switch, 8P/8T Toggle switch, 3 Potentiometers etc.

Outstanding value at  
12/6 post free

### MAKE YOURSELF HEARD

**MOBILE (6 volt) P.A. EQUIPMENT** comprising 4 valve, 7 watt amplifier, housed in metal carrying case 12" x 6 1/2" x 6 1/2" fitted with control panel. Supplied complete with Vibrator power supply

Offered at 9 Gns. Oarr. Paid

**RADIO UNLIMITED,**  
ELM ROAD, LONDON, E.17  
Tel.: KEY 4813



## TAMSA

**HIGH QUALITY TAPE  
RECORDING HEADS  
NOW AVAILABLE FROM STOCK**

WHEN VISITING BIRMINGHAM FOR THE NATIONAL RADIO EXHIBITION Phone **NORthern 2084** AND CALL ON US FOR A DEMONSTRATION OF **QUALITY RECORDING**

Let us know your requirements

### AUDIGRAPH LTD.

Dept. MR3, 74, Great Hampton Street,  
HOCKLEY, BIRMINGHAM, 18

## ★ 'Radiospares' Quality Parts

The  
**Service Engineer's  
First Choice**



# Wireless World Classified Advertisements

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/-. (Address replies: Box 0000 c/o "Wireless World," Dorset House, Stamford St., London, S.E.1.) Trade discount details available on application. Press Day: October 1950 issue, Monday September 4th. 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

**R**ADIO amplifiers for schools, hotels, clubs, etc.; from £18/18.  
**AEROTRON** 4-station superhet feeder units; £7/7, with valves; agents required in all areas.  
**AEROTRON RADIO CO.**, Peel St., Chadderton, Lancs. [5745]  
**UNIVERSAL ELECTRONIC PRODUCTS**, 36, Marylebone High St., London, W.1. Welbeck 4058.  
**SPECIALISTS** in the design and manufacture of high fidelity reproducing equipment from 5-100 watts for domestic or industrial purposes. Our new twin channel amplifier (type U.E.57) with independent bass and treble outputs, provides the most satisfying standard of reproduction we have yet experienced. It is now being demonstrated in our showrooms daily (we close Thursday 1 p.m., Saturday 4.30 p.m.), and we invite those who seek perfection from recorded music to hear this superb instrument. We also offer tuning units or complete chassis designed and constructed to individual requirements. [0126]

**HALLICRAFTERS** dual diversity receivers, complete with power units and loudspeakers; few only available.

**McELROY ADAMS MFG. GROUP, Ltd.** (Hallcrafters), 46, Greyhound Rd., London, W.6.

**12** treble boost; £12/10; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0065]

**BERNARDS**, makers of television radio, 20 amplifier equipment available for early delivery; television time-base chassis and E.H.T. supply combined, 5 valves, completely wired, tested, only new components used; £7/12/8.

**BERNARDS**, 12, Chelverton Rd., Putney, London, S.W.15. Put. 7526.

**CHARLES AMPLIFIERS, Ltd.**, are now able to produce amplifiers, radio units and electronic equipment to specification; enquiries invited for development work and for short production runs.—Charles Amplifiers, Ltd., 40, Ken-sal Rd., W.10. [0173]

**THE Spencer-West type AC/4 converter unit** permits reception of the Birmingham transmitter when employing a London type receiver; specification includes 5 valves, self-contained power unit and a low noise pre-amplifier; full particulars available on request.

**SPENCER-WEST, Quay Works, Gt. Yarmouth.** [5834]

**THE Spencer-West type AC/3 television pre-amplifier** will give a performance superior in every way, but in particular superior so far as "noise" is concerned; provision is made for connection to all types of commercial receivers; available for trial if desired; leaflet, etc., available on request.

**SPENCER-WEST, Quay Works, Gt. Yarmouth.** [5835]

**BROUGHTON** quality amplifiers, 10-12watts for 3, 9, 15ohm speakers, p.p. output, couples to pre-amp by extension cable for a full range of bass and treble control, complete with top cover, £26/10, packing case £12.5 returnable carriage paid.—C. Steward, The Glen, Broughton Rd., Hadleigh, Essex. [5799]

**NEW** amplifier by Midland Radio Coil Products: The Symphonie Seven High Fidelity portable, seven watts of high fidelity reproduction in highly portable form full bass and treble tone controls, 2-stage N.F.B., high gain; price £10/15/6.—For full details of this and other amplifiers and radio feeders address a post card to 19, Newcomen Rd., Wellingborough. [5618]

**BY** direct from manufacturers; our radio gram chassis are truly remarkable value; 5-valve all-wave superhet, large fully illuminated glass dial, complete with valves and speaker aerial tested ready for installation; price £12 inclusive, carriage paid; 2d stamp for illustrated leaflets; trade enquiries invited.—Bayly Bros., 46, Pavilion Drive, Leigh-on-Sea, Essex. [5573]

**C.J.R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd.**, Hubert St., Birmingham, 6 (Aston Cross 2440), the Midlands specialist manufacturers of high fidelity sound reproduction equipment for the world-famous Williamson amplifier and associated accessories including tone control stages, loudspeaker crossover units, distortionless contrast expanders and radio feeders; send for details and prices. [5470]



## - for the WILLIAMSON AMPLIFIER

**THE** widest possible audio range — the lowest possible distortion and an output of 20 watts . . . these critical demands of the designer of this now famous Amplifier implied the finest that technical skill and craftsmanship could provide for every component. From the inception of the Williamson Amplifier in 1947 Partridge have specialised in the transformers and chokes. The all-important output transformer was the special care of Partridge, and this "Williamson specification" component is now available for a varied range of impedance. Secondary windings are brought out as eight separate sections of equal impedance. Stock types comprise 0.95 ohm, 1.7 ohm, 3.6 ohm and 7.5 ohm sections.

*The Partridge "Williamson" Output Transformer is acknowledged the most efficient of its type*

FULL DATA ON REQUEST



**ROEBUCK ROAD, KINGSTON UP-PASS TOLWORTH SURREY**  
 Telephone: ELmbridge 6737-8

## NEW RECEIVERS AND AMPLIFIERS

**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-prx 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 or 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. Lab. 5303.  
**T**ELRAD ELECTRONICS, 70, Church Rd., Upper Norwood, London, S.E.19.—Designers and manufacturers of Telrad quality amplifiers; established as the most outstanding value in high-quality amplifiers, thanks to faithful reproduction at unrivalled price, these unique amplifiers are the first choice of the enthusiast; 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]

**TECHNICALLY** far ahead of any other reproducer is the Williamson amplifier; a satisfied customer says: "After searching for 3 months and listening to many other so-called quality amplifiers, I have at last found what I want. The R.T.M.C. version of the Williamson is the finest product of the kind, and workmanship and parts used are unsurpassed. This goes for quality of reproduction, too; I have many other letters in similar strain. There is no doubt the Williamson amplifier will satisfy the most critical quality enthusiast. It is the ultimate choice if you want trouble-free reproduction with super quality. Price £23/10 7-valve model; £28/10, 9-valve model (with built-in pre-amplifier). See previous adverts. Also "W.W." booklet on this famous amplifier. We are open all day Saturday for demonstrations. Send for details, photos (3d stamp) to R.T.M.C. (Ealing) Ltd., Laurel House, 141, Little Ealing Lane, W.8 (Ealing 6962). [0139]

## RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

**H.R.O.** Senior, speaker, 8 coils, power pack.—Offers to Box 5804. [5789]

**SX** 28, an immaculate model, in perfect showroom order; £100.—Box 5800. [5780]

**EDDYSTONE** 680, as new, makers' guarantee expires December, 1950; offers.—Box 5799. [5766]

**R**1155 receiver, power pack speaker, in neat cabinet, new condition, perfect order, 10phones; £10; London.—Box 5862. [5821]

**8-VALVE** a.c./d.c. radio gram, chassis, 3" b. illuminated glass dial, 10 watt P.P. output, perfect condition, £12/12.—Box 6116. [5841]

**MURPHY** radiogram A.136R in perfect condition, £70; seen by appointment.—Ashley, 11, Heath Villas, Vale Health, N.W.3. [5850]

**I**NEXPENSIVE television sets, R55, R56, R57, R58, VCR97, power packs, assembled; offers.—Swinburne, 1, Doric Ave., Frodsham, Cheshire. [5758]

**HALLICRAFTER** S-41W tuning 500kc/30mc, handsread, B.F.O., separate speaker, 230volt a.c./d.c.; price £14.—Lewenz, Kennes House, Kintbury, Newbury, Berks. [5788]

**COMMUNICATIONS** receivers.—H.R.O. Senior 'x's, in good condition, complete from £12/10, plus carr.; also A77, AR8, CR100, etc.—State requirements to R.T. & I. Service, 254, Grove Green Rd., London, E.11. [0053]

**WILLIAMSON** amplifier with pre-amp (2 inputs), T.V. sound, O.P. meter (with bias and h.t. ranges, etc.), switched O.P. for 6L6's as beam test; basis of t.r.t. with inf. imp. detector.—£25 or nearest offer to Ollington, 4, Glebe Hyatt, Sanderstead, Surrey. [5763]

**WILLIAMSON** amplifier, Goodman Axiom 12in. Collaro mixed autochange, fitted coil pick-up head, pre-amplifier with bass, treble and midrange lift, radiogram cabinet, all virtually new; nearest; £60 the lot; reason for sale, matrimonial.—Vennard, Coombe Ridge, Bourne Lane, Brimscombe, Glos. [5806]

**HALLICRAFTER (U.S.A.)** SX28 15-valve H communication receiver for sale, world-wide reception, television sound, gram input, 8watts high fidelity push-pull output, privately purchased (not ex-W.D.), in perfect unsoiled mint condition; details on request and offers considered.—K. Blackwell, 41, Meadoway, Old Southgate, London, N.14. [5762]

**HAMMELUND** Super-Pro for sale, new in 1941 and little used, in perfect order and complete with universal mains unit and loudspeaker, 540kc/s to 20mc/s continuous coverage, offers wanted; also BC348/R receiver, as new and unused and not converted, purchased 2 years ago and never used, offers wanted.—Frazz Groom, 2, Gordon Terrace, Edinburgh, 9. [5817]

**NEW DYNAMOS, MOTORS, ETC.**  
**BATTERY** chargers, 4 models 2-6-12v, 1-2-4 amp D.C.; any mains voltage; also larger type special transformers, chokes, test gear, interior car heaters, etc.—The Banner Electric Co., Ltd., Hoddesdon, Herts. [0122]



## COMPLETE L.P. RECORD SERVICE

Our 18 months' experience of solving the problems associated with L.P. records here and in the U.S.A. is now crystallised into a comprehensive service for you.

We are now stocking the complete range of L.P. records of serious music, and the associated playing desks. Over and above that is the quite unequalled range of Hartley-Turner high-fidelity equipment for reproducing these epoch-making discs with a degree of realism which is quite startling.

You are invited to come and hear what can be got from these discs when they are reproduced with real fidelity; and we shall be happy to supply your needs from a single record to a complete installation.

We are preparing "The reproduction of L.P. records" and this, together with a year's supply of critical reviews of records, will be sent to you for a subscription of 5/-. This is included as a free supplement to our "Selected Record Catalogue," price 25/-, and existing subscribers to the catalogue will get their copy in due course.

This complete service is extended to all our overseas friends. L.P. records can safely be sent by post, and we guarantee complete satisfaction in the farthest corner of the Empire.

Send today for free catalogues and literature, and don't forget "New Notes in Radio," price 2/6, a pocket guide to high-fidelity.

**H. A. HARTLEY CO. LTD.**  
152 HAMMERSMITH ROAD  
LONDON, W.6. RIVerside 7387

**LONG PLAYING RECORDS AND RECORD PLAYERS** by Decca now available from stock. Send 2/6 for list of first release records and Record Players (33 1/3 r.p.m.) with pickup. Price £8/18/-. Records available from us by post. G.P. 20 Pickups, 7/15.

**SENSATIONAL NEW AMPLIFIER** by N.R.S. The Symphony No. 1 is the most flexible on the market to-day! Three separate channels giving entirely independent control of bass, middle and top, also scratch cut for records. Gram. and Tuner inputs, 5 watts undistorted output matched to 3 or 15 ohms. Price £8/19/6.

**SYMPHONY NO. 2.** Same theme as No. 1, but having 10 watts push-pull output, superb quality. 3, 7.5 and 15 ohms. Inputs for magnetic, crystal and hi-fi pickups, full provision for Tuner, built on handsome black-crackle chassis, Woden mains and output transformers. Price 13 gns.

**NO. 1 HIGH QUALITY TUNER**, specially recommended for above amplifiers and Leak, Williamson, Charles, Rogers and other quality amplifiers. L. & M. wave T.R.F. with infinite impedance detector, illuminated "Airplane" dial with escutcheon and glass, virtually distortionless. Price of complete kit, £4/10/-, or ready built £5/10/-.

**NO. 2 QUALITY SUPERHET TUNER** L.M. & S. WAVE, large full-vision dial assembly, spin-wheel tuning. As kit, £7/10/-, built, £8/10/-.

**COLLARO STANDARD MICROGRAMS**, new in original cartons, £13/10/-. Case with motor-board only, 47/6.

**BASS REFLEX CABINET**, 2ft. 6in. high x 1ft. 3in. wide x 1ft. deep for 8in. speaker, superb acoustic results. Complete kit of timber, etc., with instructions, 75/-, ready built, 85/-, carriage 5/-.

**FULL BARGAIN CATALOGUE** 2/6. DEMONSTRATIONS DAILY. Terms c.w.o. or c.o.d.

**NORTHERN RADIO SERVICES**,  
16 Kings College Road, London, N.W.3  
Phone: PR11mrose 8314

### NEW DYNAMOS, MOTORS, ETC.

**JANETTE** d.c. to a.c. rotary converters, 200/250 volts d.c. input, 200/250 volts, 50 cycles, 1-phase, a.c. output at 300 watts, new, £20; 500 watts, £23; complete with smoothing for television and radio—Johnson, 19, Kennington Rd., London, S.E.11. Reliance 1412-3.

**ALL** types of rotating electrical machinery up to 20kva available, including rotary converters, rotary transformers, motors, petrol and diesel-engined generating plants, 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.

**DIESEL** Electric generating plants, 3kva, 230v with push-button remote control, starting equipment, ready for use, £195.

**ROTARY** transformers, input 20v d.c., outputs 6.5v d.c. and 300v d.c., permanent magnet field, 20/-; ditto, input 28v d.c. and 1,200v, 70ma d.c. output, energised field, 35/-; ditto, input 12v d.c., output 500v, 90ma d.c., energised field, 35/-.

**PETROL** electric generator plants, comprising a J.A.P. No. 2a single cyl. engine coupled by vee rope drive to an alternator, giving an output of 230v, 50 cycles, 400 v.a., with screened lamination and filtering on generator, entirely suitable for operating television and radio on farms, etc., price £40; such plants can be supplied with various outputs, a.c. or d.c., for other applications.

**CHAS. F. WARD**, Lordcroft Works Haverhill, Suffolk. Tel. 253. [0039]

### DYNAMOS, MOTORS, ETC.—SURPLUS

**ENGINE-DRIVEN** starters, water cooled, foot started alternator, 230/150 watt and 7.5v, 10a d.c. self energised, a.c. voltage, automatic regulation, mounted on light portable frame, alternator completely removed and serviced by makers, E.D.C.C., £25, delivered and tested; 12 and 24v lighting plants, petrol or T.V.C. (1/3 per gall.), petrol engines, 6v, 72, 85, 120 amp hour batts, see "W. World" July, page 74, also August's; no lists; please state exact requirements; see displayed advert. page 76. for S.T.C. rectifiers.

**PEARCE**, 66, Great Percy St., London, W.C.1.

### NEW LOUDSPEAKERS

**BASS** Reflex cabinets, beautiful walnut finish, for all good speakers; stamp leaflets—Cabinetware, 13a, Hayes St., Blackburn, [0090]

### LOUDSPEAKERS—SURPLUS AND SECONDHAND

**AXIOM** 22, makers' carton, £9; pressure unit, 30/-—113, Hazel Rd., Huyton, Lancs.

**BARKER**, 148A, brand new £9/10.—Raymond, 306, London Rd., Slough, Bucks.

**LOWTHER-VOIGT** PMI unit, PWI corner reflector speaker in mahogany and white filter, £50.—Box 5793. [5756]

**VOIGT** domestic corner horn, white, as new, unmarked, twin diaphragm unit and power pack, £55.—48, Swanage Rd., S.W.18. [5767]

**WHAFFLEDALE** W.15C.S., unused, £9/10; Rola G.12, mains, £3/10; Garrard 202, motor and turntable, £2/10, little used.—Sculley, 52, Ridgeway, Hayes, Kent. [5845]

**GOODMANS** 12in P.M. speaker, standard G model, 70/-; also Goodmans Axiom 12in twin cone, 95/-; both as new and 15 ohms; carriage pack.—Rowell, 14, Market Hill, St. Ives, Huntingdonshire. [5858]

**COMPLETE** Lowther Voigt equipment, including two Voigt speakers, L.C. twins in corner horns, tuner, amplifier, M.C. P.V., correction units, filters, etc., by Lowther, Decca quality recordinals, all as new.—13, St. Augustine's Av., Margate. [5807]

### TRANSMITTING EQUIPMENT

**TR9** transmitter-receivers; these were formerly sold at £6 each, the remaining few to be cleared at 25/-, carriage paid.

**THE STAMFORD** Radio Co., 199, Stamford St., Ashton-under-Lyme, Lancs. [4795]

**HALLICRAFTER** transmitters, Type HT4E (BC610), complete to makers' latest specification, covering all frequencies from 1mc to 30mc, 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.

**HALLICRAFTER** official sole agents in U.K. including service and spares.  
**McELROY ADAMS MFG. GROUP**, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1802. Cables, Hallicrafter, London. [5212]

### NEW TEST EQUIPMENT

**AVAILABLE** for early delivery, two-beam switch unit, 6 valves, self-contained power pack, variable switching frequency, provisional price, £10/14/6, enables two separate traces to be displayed on standard oscilloscope.

**BERNARDS**, 12, Chelverton Rd., Putney, London, S.W.15. Put. 7538. [0098]

**LABORATORY** test equipment.—Signal J generators, oscilloscopes, freq. meters, valve voltmeters, valve testers, output meters, meggers, etc., by Marconi, Ferris, Clough-Brengle, Collins, Cossor, Ultra, Taylor, etc.; list available.—Please state requirements to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0052]

**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. [0180]

## MAGNETIC TAPE

### Recording Equipments and Components

**OSCILLATOR UNIT.** Constructed on small chassis suitable for sub-assembly, provides r.f. for erase and bias at 45 kc/s. Requires 250v. h.t. and 6.3v. for operation. Complete with 6V6 valve, £3/1/-.

**OSCILLATOR COIL ASSEMBLY.** Comprises high "Q" coil and condenser tuned to 45 kc/s. Specially designed to provide highly symmetrical sine wave output for low tape noise, 10/6.

**RECORD/REPRODUCE HEAD.** High or low impedance. High quality response. Totally enclosed. Gap length 1 mil. £2/2/-.

**REPRODUCE HEAD.** As above but gap length 0.5 mil, (suitable for 2-head systems). £2/2/-.

**ERASE HEAD.** Capable of erasing new high coercive force tape when used with oscillator unit above. £2/2/-.

**TAPE.** New high coercive force tape suitable for high fidelity recording at slow speeds. 7in. (1,200ft.) reels. £1/10/-.

11in. (1,000 metre) reels also available.

**RECORDING** and reproducing amplifiers, desks, and complete machines available shortly.

TRADE ENQUIRIES INVITED.

## CABOT RADIO COMPANY LIMITED

Electronic Equipment Manufacturers,  
28 BEDMINSTER PARADE, BRISTOL 3.  
Telephone 6/314.

SUCCESSFUL SALES! SATISFIED CUSTOMERS!

## Pennine RADIO

THE ALL SEASON SENSATION. ACCLAIMED THE COUNTRY OVER. THE INTIMATE RECEIVER WHICH COMBINES APPEARANCE AND PERFORMANCE. HOUSED IN A BEAUTIFUL WALNUT CABINET. EACH SET FULLY GUARANTEED.

HEIGHT 10", WIDTH 12½", DEPTH 5½"  
4 Valve SUPERHET

THE SET THAT SELLS ITSELF!

UNBEATABLE VALUE  
£11 9 7  
INC. TAX



### "THE ROVER"

SUPPLIED ONLY THROUGH SELECTED WHOLESALERS. ILLUSTRATED LEAFLETS AND ATTRACTIVE DISPLAY CARDS.

**PENNINE AMPLIFIERS**  
ELLAND YORKS ENGLAND  
TEL. ELLAND 2107

TEST EQUIPMENT—SURPLUS AND SECONDHAND

AVO model 7, £14.—Hill, 38, West End Ave. Harrogate. [5813]
AVO 7 £12. Avo signal generator £8; little used, as new.—Box 5794. [5757]
AVO valve tester and Hunts test bridge, as new, best offer.—139, Goldhurst Terrace, N.W.6. Mal 6155. [5849]

M.I. type QD101 oscilloscope and V.T.M. used only a few hours, £25.—Bartholomew Chapel by Kirkcaldy, Fifeshire. [5779]

TAYLOR 65B sig. gen., as new, £10; Taylor 45a valve tester, perfect, £11/10; Davenport Garage charger £7/10.—50, Mile Oak Rd., Southwick, Sussex. [5765]

OSCILLOSCOPE, Taylor Model 30A. almost unused, 3 1/2 in. tube, t.b. and amp. max. sensitivity 60 mv per cm, guaranteed, £19/10 or nearest offer.—Crossfield, 43, Crossland Rd., N.W.1. [5846]

METERS, all 2 1/2 in. dials, 0/2,000 electrostatic, £25.—Osmor moving coil 6V/0.2 amp thermo 5V; 5mA inst. rectx, 2/11; 6.2 volt, 5 amp, M.E.S. bulbs, 4/6 dozen.—Passingham, 95, North St., Kewghley. [0092]

AUTOMATIC voltage regulators for a.c. mains. Ferranti 7.5kva, moving coil, frequency compensated, undistorted output wave form, varied to suit any nominal supply between 200 and 250V. 1ph. 45 to 60cps. input voltage may vary from 88% to 108% of nominal. output 100%±14%. complete with voltmeter, spares, handbook, brand new, in original oiled paper wrappers and export packing cases. Govt. surplus; offered at a fraction of normal cost; overplus enquiries to P. B. Crawshaw 166, Pixmore Way, Letchworth, Herts. [5136]

VALVES

UNUSED valves, 815 50/-, 832 10/-, 805 30/-, 845 30/-, 837 7/6, 12 40 15/-, 1625 5/-, 12C8 2/6; also 2.4kv 30ma mains transformer, 30/-; post extra.—Harris, 10, Kingsley Av., W.13. [5861]

NEW GRAMOPHONE AND SOUND EQUIPMENT

MAGNETIC tape. Emittape type 65 on 1,200ft spool, 25/-; paper tape, 25/-; blank recording discs, 12in dia./sueca, 4/6; all from stock; full trade terms available.

SOUND DISCS (SUPPLIES). Ltd., 178, Bishopsgate, Southp'ry, Lancs. Tel. 815. [5335]

WIRELESS valve corner detectors, scientifically designed acoustic chambers for 8 to 15in speakers; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0054]

TRANSFORMERS, tone control and loud speaker filter cores for normal, W.W. "C" circuits; special designs promptly made.—R. Clarke, 30, Langland Crescent, S. Stanmore, Middx. Wor. 5521. [5976]

TAPE recorders amplifier can be used independently, £50; portable amplifiers, complete with speaker and crystal microphone, p.p. output, in leatherette carrying case, £20; sound and light recording equipment, p.c.—A. Clark, 112, Carnoustie St., Glasgow. [5848]

TAPE recording panels; a precision panel comprising two motors, high fidelity sound and erase head, high speed capstan of unique design giving tape speeds of 7 1/2 in and 15 in per sec, suspended between hall races with heavy fly wheel to ensure freedom from wow; no unclamping of tape is necessary for rewind; panel finished in black crackle, size 14in x 12in; £20.

HIGH fidelity tape heads as fitted on our panels; record-p/ playback, £10; erase heads, £4/10; standard record/p/ playback, £1/10; erase head, £1/10; o.c. coil, 15/-; head to grid transformers, 7/6; circuits supplied with orders; trade enquiries invited.

MORECAMBE SOUND SERVICE, Sealand Works, Cross Cop, Morecambe, Tel. Heysham 570. [0078]

GRAMOPHONE AND SOUND EQUIPMENT—SURPLUS AND SECONDHAND

RECORDING wire, stainless steel, .0036in dia. 3,600ft reels 5/6.—16, Catherine Rd., Swinton, Manchester. [5728]

PORTABLE M.S.S. disc recorder, excellent condition, £27 or near offer; details.—Tel. Forest Hill 8387, Box 5785. [5751]

WEBSTER-CHICAGO portable recorder, one-hour spools; nearest £60; hardly used.—Dr. Badham, Botleys Park Hospital, Chertsey, Surrey. [5800]

M.S.S. recorder, amplifier, mike, stand, M monitor and phones, all transportable, seldom used, cost £150; offers to Wordsworth 3874, or would hire. [5755]

MAGNETIC sound recording wire, stainless steel, temporary wood spools, approx. 1 1/2 hours' running time at 2ft per sec.; 14/- per spool.—A. Smart, 40, Grange Rd., Halesowen. [5776]

Portable 15 watt amplifier in steel cabinet; 2 moving coil microphones, complete with floor stands and 1 banquet stand, complete in wood case; 1 portable playing desk (electric) complete with p.c.k-up, in steel case; 2 Goodman loud speakers, 12in; suitable for social club or similar organisation; £50 the lot; can be inspected.—Apply, M.E.M. Co., Ltd., Reddings Lane, Birmingham, 11. [5776]

NEW COMPONENTS

CRYSTAL microphone inserts (Cosmocord Mic-6), guaranteed brand new, 15/6, post free.

RADIO-AID, Ltd., 29, Market St., Watford, Tel. Watford 5988. [0036]

YOU are bound to try an Osmor "Q" Coil-pack eventually and be delighted with the results; why not save time and money now? Get a stamp for free circuits and latest lists of coils, coilpacks, dials, etc. etc.

OSMOR RADIO PRODUCTS, Ltd. (Dept. W.C.A.), Borough Hill, Croydon, Surrey. (Tel. Croydon 1220.) [0046]

Advertisement for STERN'S featuring the slogan 'You're SURE to get it at STERN'S' and 'ESTABLISHED 25 YEARS'. The ad lists various electronic components and their prices.

Deco 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 1 1/2 in. x 1 1/2 in. dia., Iron Core, Aerial H.F. or Osc., 3/6 each. Electrolytic Condensers... B.E.C. Midget Can Tubular, 8 mfd. 450 v. (1 1/2 in. x 1 1/2 in. dia.); 2/6; 8-8 mfd. 450 v. (1 1/2 in. x 1 1/2 in. dia.); 4/-; 16-8 mfd. 450 v. (1 1/2 in. x 1 1/2 in. dia.); 9/6; 32 mfd. 450 v. 5/-; 16-16 mfd. 450 v. (1 1/2 in. x 1 1/2 in. dia.); 4/6; 4/6; "Dubbler" "Drillite" 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. Deco 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 42/- (incl. P.T.T.). Osmor Midget Coil Pack. Size 3/4 in. x 1 1/2 in. x 1 1/2 in. covering S.M. and L. Waves. Coils wound on Polystyrene Formers with adjustable Iron Core, ensures efficient performance. Factory wired and aligned. Price, including fullcircuits 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 1 1/2 in. x 1 1/2 in. ratio 60-1, 3/6 (or ratio 90-1, 3/6). Stern's Multi-ratio (over 12 ratios, some O.T.), 6/6 watts, 7/6. Stern's Heavy Duty Multi-ratio, all C.T./Tapped handles 13 watts and suits P.X. 4s, 6L6s, etc., 25/6. Roia Multi-ratio, 5/6 watts, 10/6. L.F. Chokes, Midget 10 Henry 250 ohm 40 mA., 3/6; 20 Henry 250 ohm 60 mA., 5/6; 20 Henry 300 ohm 120 mA., 10/6; 5 Henry 50 ohm 250 mA., 18/6; 20 Henry 250 ohm 120 mA., 18/6; 9 Henry 250 ohm 120 mA., 8/6. Aluminium Chassis. Substantially made of gauge 16 S.W.G. with four sides, 7 in. x 4 in. x 2 in., 3/6; 9 in. x 5 in. x 2 in. 4/-; 10 in. x 6 in. x 2 in., 4/11; 13 in. x 8 in. x 2 1/2 in., 5/6; 12 in. x 9 in. x 2 1/2 in., 6/8; 14 in. x 9 in. x 2 1/2 in., 6/11; 16 in. x 8 in. x 2 1/2 in., 7/3; 16 in. x 8 in. x 3 1/2 in., 8/6. I.F. Transformer, 465 k/c. New well-known manufacturer's surplus I.F. x 1 1/2 in. x 1 1/2 in. Iron Core, 9/- each. Deco Iron Core, 465 k/c. or 1.6 m/c., 1 1/2 in. x 1 1/2 in. x 3/4 in., 18/6 pair. Wearite Stand Cap, Tuned, 465 k/c., 20/- pr. Meter Rectifiers. Westinghouse 250 micro/amp., 1/16, 1 mA., 10/6, 5 mA., 4/6. Selenium Rectifiers. H.T.L. Wave, 250 v. 50 mA., 5/-; 200 v. 100 mA., 5/9; 250 v. 100 mA., 7/6. Bridge Rectifier 12 v. 1 amp., 12/6; 12 v. 3 amp., 19/6; 12 v. 5 amp., 25/-; 24 v. 3 amp., 23/6; 6 v. 1 amp., 7/6. Charger Transformers. Each has input of 230 volts. Output (a) 24 volts tapped 15 v., 9 v. and 4 v. at 3 amps., 21/6; (b) 30 volts tapped 15 v. and 9 v. at 3 amps., 22/-; (c) 15 volts tapped 9 v. at 3 amps., 14/3; (d) 12 volts, 1 1/2 amps., 11/3; (e) 10 volts tapped 9 v. at 6 amps., 19/9; 15 volts tapped 9 v. at 1 1/2 amp., 11/9. Valve Heater Auto Transformer. Step-up or down, 2 v., 4 v., 5 v., 6.3 v. at 3 amp., 9/6. Filament Transformer. Inputs 230 volts, outputs 6.3 v. 1 amp., 7/6; 4 v. 1 amp., 7/6; Input 200/250 v., output 4 v. (C.T.) 1 amp., 4 v. 2 amp., 6.3 v. 2 amp., 19/6. Deco Chassis Cutter. Adjustable between 1/2 in. and 2 1/2 in. dia., used with Hand Brace, 7/6.

"MAINS or BATTERY PERSONAL KIT"

A complete KIT of PARTS to build our new MIDGET 4-VALVE SUPERHET PERSONAL SET, covering MEDIUM and LONG WAVES and designed for MAINS or BATTERY operation is now available. This 2 Waveband Superhet Receiver is designed to operate on A.C. mains 200/240 volts, or by an "All-Dry" Battery, either method being selected by means of a Rotary Switch. It is so designed that the Mains Section (size 4 1/2 in. x 1 1/2 in. x 3 1/2 in.) is supplied as a separate Kit, which may be added at any time. The kit therefore can be supplied either as an "All Dry" Battery Personal Set, or as a Midget Receiver for Combined Battery/Mains operation. The circuit incorporates Delayed A.V.C. and Preselective Audio Feedback. A Roia 4in. P.M. Speaker with generous size Output Transformer ensures excellent quality reproduction. Ready Wound Form Aerial, Fully aligned I.F. Transformers, and a Drilled Midget Chassis are included. Valve line up—1.R.5 (F.C.), 1.T.4 (I.F. Amp.), 1.R.5 (Diode Det. and Audio Amp) and 3.S.4 (Output Tet). The Set is quite easily built from the very detailed assembly instructions supplied, which includes a practical component layout, with point to point wiring, and a circuit diagram for both the Set and the Mains Unit. Price of COMPLETE KIT (less Mains Unit), 28/13/9. Price of COMPLETE MAINS UNIT KIT, £11/7/6. EVER READY TYPE B114 BATTERY, 9/7. An attractive Walnut Finished Cabinet, size 9 in. x 5 1/2 in. x 5 1/2 in., of the hinged lid type and suitable to house the complete set is available for 19/9.

THE COMPLETE ASSEMBLY INSTRUCTIONS mentioned above can be supplied separately for 1/6.

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 Deco Iron Dust Core'd Coil, thereby ensuring maximum gain for Single-Tuned Stage covering medium Waveband.

Valve Line-up: 1T4 (R.F. Ampl), 1T4 (Detector), 185 (1st A.F.), and 384 (output). Includes latest Roia 3in. Moving Coil Speaker, and a Chassis already drilled and etched. A consumption of only 7 mA. ensures long battery life. The Kit is designed for a cabinet, minimum size 6 in. x 4 1/2 in. x 3 in. 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.T.). Suitable unpolished Cabinet 6 1/2 in. x 4 1/2 in. x 3 in., 12/9. Ever Ready B114 Battery, 9/7. Building Instructions, Circuit, etc., supplied separately, 1/-.

A Complete Kit of Parts to build a Midget "All Dry" Battery Eliminator, giving approx. 69 volts H.T. and 1.4 volts L.T. This Eliminator is suitable for any Personal Set requiring H.T. and L.T. voltages indicated above. The Kit is quite easily and quickly assembled and is housed in a Light Aluminium Case, size 4 1/2 in. x 1 1/2 in. x 3 1/2 in.; it can therefore be accommodated inside most makes of Personal Sets. Price of Complete Kit, £1/17/6.

"Wireless World" Midget A.C. Mains 2-Valve Receiver. We can supply all the components, including valves and M/Coll 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.

"Wireless World" Midget A.C. Mains 3-Valve Receiver, covering Long and Medium Wavebands. We can supply all the components, including Drilled Chassis, Valves, Moving Coil Speaker, etc., to build this set, as specified in the Feb. issue, at a total cost of £4/5/- including a reprint of the complete Assembly Instructions and Circuit (this is available separately for 9d.).

An attractive Walnut Finished Cabinet is now available for this W/World 3-Valve Set at 21/-, or it can be supplied with a complete Dial and Drive Assembly which includes the latest Station Name Dial and Dial Mechanism, and a Combined Switch/Volume Control to effect very slight modification. Inclusive price, 35/- (Dial and Drive Assembly with Switch/V. Control supplied separately for 14/-).

We can supply all the Components, including Valves, M/Coll Speaker, etc., to build a Midge's A.C./D.C. Mains T.R.F. 3-Valve (plus Metal Rectifier) Receiver as designed and specified by a popular Technica 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 6in. Moving Coil Speaker is supplied. Price, including Wiring Diagrams, 75/- (or less M/Coll Speaker, 65/-).

"ELECTRONIC" VALVE VOLTMETER. We can supply the COMPLETE KIT OF PARTS, including the Valve, Diode and Meter, etc., to build this instrument, as published in the January issue of "Electronic Engineering," complete with a reprint of the wiring diagram and assembly instructions (supplied separately for 5d.) at a total cost of £3/15/-.

TELEVISION !! The "Viewmaster" Television assembly instructions (showing Wiring Diagram and Practical Component layout now available for 5/-). We have the specified Components, including the T.O.O.—Hulgin—Morganite—W.B.—Westinghouse—Plessey—Colverson, etc., outfits in stock. Separate Components also available.

"Electronic" 2/6. Complete range of specified Components in Stock, instruction and explainer booklet available for 2/6.

\*Send 3d. 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



**RACK MOUNTING CABINET FOR 19" PANEL**

CABINET to accommodate one 19" x 10 1/2" x 14G. Steel Rack Panel with 17" x 12" x 2 1/2" Chassis and Angle Brackets in 18G Steel. Panel secured by four Chromium Plated Screws. Approximate overall dimensions 21" x 12 1/2" x 11 1/2" high, Louvred on Back, having radiused front corners and Rubber feet ..... £3 15 0

Two Carrying Handles, extra..... 6 0  
Recessed Lid, 14" x 8" in top, extra 10 0  
Pack-Flat Export Version, extra... 12 6

FINISHES: Black, Grey or Brown Wrinkle Enamel.

CARRIAGE: Paid to towns in the United Kingdom.

ILLUSTRATED LISTS AND TRADE TERMS ON APPLICATION.

REOSOUND ENGINEERING & ELECTRICAL COMPANY, "REOSOUND WORKS," COLESHILL ROAD, SUTTON COLDFIELD

Tel.: SUT. 4685. Grams: Reosound, Sutton Coldfield

**WE DON'T**

supply anything Ex-Government  
ALL BRAND NEW GOODS  
—fully guaranteed—

**AUTOCHANGERS IN STOCK**

GARRARD RC65A. A.C./D.C. Mixed Records. Standard lightweight magnetic head, £20/15/-.

GARRARD RC65A. A.C. Mixed Records. Standard lightweight head, £15/13/6.

GARRARD RC70A. A.C. Non-mixed. £10/9/1.

INTERCHANGEABLE GARRARD plug-in heads for the above. Lightweight, £2/6/8. High fidelity, £3/5/-. Adaptor for RC65 and 70, 6/6.

E.M.I./MARCONI. A.C. Auto-changer, Non-mixed, Hi-Fi head. Complete with transformer, £10/10/8.

COLLARO RC500. A.C. Auto-changer. Non-mixed. Crystal or Hi-Fi head, £10/15/-.

CABINETS. Unpolished for all the above changers. Motor boards ready cut to fit, £3/10/- 33d and 78 r.p.m. GRAM. MOTORS are now becoming available, and we are booking orders in STRICT ROTATION.

**TAYLOR TEST GEAR**

The entire range by this famous maker is now available on hire purchase. S.A.E. for catalogue and terms.

ALL AVO TEST GEAR NOW IN STOCK. Leather cases for AVO 7, £2/2/6, post free. 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 15lb. 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.

**NEW COMPONENTS**

EHT Transformers, mains transformers, output transformers and chokes; open or bolted types; transformers designed to individual specification; singles or in quantity. WILLESDEN TRANSFORMER COMPANY, Ltd., 781, Harrow Rd., N.W.10, Ladbroke 2846. [0075]  
RADIO hardware in 1/- packets: 3-pt tag strips; mounting boards; fuse holders; spindle couplings; eye bolts; 2, 4 or 6BA bolts; shakeproof nuts; 2, 4 or 6BA studding; Gromets; solder tags; pin tags; spade tags; tinned copper wire 16, 18, 20 or 22swg; sleeving 1, 1 1/4 or 2mm; resin cored solder; 1/4/36 single flex (6 colours); single or twin screened flex; Ae/E socket panels; voltage panels\*; indicator lamps ruby\*; jack plugs\*; jack sockets; Sump plugs; BC adaptors; flex connectors; flexible couplers; grid caps; ocal or standard; insulated tape; insulated staples; co-ax wiring cleats 4in; pointer knobs; plain knobs. All packed in generous 1/- packets (\*these items 1/- each), 12 packets 10/6 inc. post; 25 packets £1 post free. Any type or assorted as you wish. See our lists free on request for many other items. FRITH RADIOCRAFT, Ltd., 69-71, Church Gate, Leicester. [0026]

TELEVISION.—"Wireless World" superhet. A very sensitive set, fully illustrated set of reprints, 5/-; construction simple with the following parts: RF chassis in copper fully dried and assembled with cans and valveholders, 52/6; VF box, 10/-; complete chassis sets, 98/-; coil sets, complete, 52/6; scanning coils, 35/-; focus coils, 37/6; PM rings, 22/6 and 25/-; line transformers, 62/6 and 42/-; mains transformers (14lb), 77/6; chokes, 50/-; block trans., 15/-; Westalite 25, 4kv rectifiers, 31/-. Above totals £22 and represents two-thirds of the price if completed with surplus parts, or half price if completed with new components—a low price for a quality set. Coils: Midland TRF, EE, View/M, FW, all line video chokes, 18/6; speaker types to order, inc. 3in canned; oscillator coil sets, broadcast IF trans. 15/- pr., LMS coils 2/6 ea.; Williamson tuner coils, 7/6 pair; sub-miniature s/het, 2/6. Chassis: EE, TB and PP, 20/- pair; F/Wess., complete s/het, 50/-; line/EHT trans., 44/-; 5kv, 60/-; switch button, 50/-; osc. unit, 30/- trade enquiries invited.—Bel Sound Products Co., Marlborough Yard, London, Ardway, N.18. Arc. 5078. [0183]

**COMPONENTS—SURPLUS AND SECONDHAND**

B7G ceramic valveholders, 10/- doz (1/- each), post free.—Hendreys, Ltd., 1, Westgate, Chichester, Sussex. [5803]

WALTON'S OF WOLVERHAMPTON [5803]  
Outstanding value in ex-Government mains and other transformers.

MT.1 standard tapped input 25 volt 2 amps output, ideal for small motors, chargers, etc., price 12/6.

MT.2 experimental E.H.T. transformer, condenser input from mains, output variable, up to 4kV, price, including full instructions and input condenser, 17/6.

INTER valve transformers, ratio 3 1/2-1, list price 17/6, our special price 5/6 only.

SEND s.a.e. envelope today for our special clearance lists; you will be amazed at the value we offer.

WALTON'S WIRELESS STORES, 203, Staveley Rd., Wolverhampton. [0061]

ELECTRONIC flash condensers, 6 microfarads, £2,000/-; 6 for £ carriage paid.—Middlehurst, Higher Parr St., St. Helens. [5831]

SOUTHERN RADIO SUPPLY Ltd., 11, Little S Newport Street, London, W.C.2. See our displayed advertisements, page 68.

ALLEN & GOULD, 5, Obelisk Parade, Lewisham, S.E.13 offer the following goods, new and unused, unless otherwise stated:—

MAT resistors, 100ohm, 250w, 1/9; 350ohm, 250w, 1/6; SBC neoms, 200-220v, resistor in cap, 2/-; SBC holders (cond-grid), 6d; 6d; head slow-motion dials (as on R1224), 6/-; mains transformers, PRI 0-200-220-240sec, 250-0-250v at 80ma, 6.3v at 3amp, 5v at 2amp, 11/6; .01 MFD 5kv wkr., 1/6; Jones P and S, 6w 1/6, 3w 1/3, 10w 2/-, 15w 2/6; B & L P & S, 7-p 1/9, 10-p 2/-; Pye co-axial P, S, L straight 1/3, angled 1/-; Pye co-axial connections 6d; Pye T pieces, 6d; rotary transformers, 24v in, 300v 150ma and 150v 20ma out, 12/6; rotary transformers, 14v in, 600v at 140ma out, 17/6; switches (oak, Yaxley type, etc.), SP 3w 6d, SP 10w 1/6, 6w parallel 6d, SP 3w 1/-; toggle switches, laminated bakelite, stripped from unused equipment, SP on-off 1/-, DP on-off 1/3, DP DT 2/-; toggle switches, black bakelite, new, SP DP 1/-, DP on-off 1/6; 2in FCD 500ua cal 0-15, 0-600v, used, tested, surplus, 4/4/-, 2in 0-300v d.c. 5/6, 2in 0-500v d.c. 5/6, 2 1/4in 0-25a d.c. MI 5/-; selenium rectifiers, heavy duty, 160v 600ma, 9/-; low-resistance phones with headband, lead and plug, 3/3 per pair; deaf aid type phones with two spare insets, 7/6 per pair; magnetic throat mikes, 1/9 per pair; dimmer switches for lamps or as extension speaker volume controls, 9d; crystal diodes, CV 102, 12, 2/3; volume controls w/w 50hm 50hm, 500ohm, 1k, 5k, 8k, 10k, 15k, 20k, 25k, 35k, 50k; carbon 500ohm, 3k, 10k, 20k, 50k, 100k, 150k, 250k, 500k, 1m, 2m, 3m, at 1/3; double carbon 50k, 150k, 500k, 2/6; double w/w, 2.2k+2.5k, 3/-; ceramic air space trimmers, 3/30 pF, 4d each, 3/6 per doz, 24/- per 100. Special offer to hams: P.O. racks, 19in wide x 5ft 6in high, only 20/- each, carriage forward; limited number, so order now.

ALLEN & GOULD, 5, Obelisk Parade, Lewisham, S.E.13. Tel. 433 4333. [5849]

LITTLEWOODS, North London's best selection of radio and television components; pay us a visit or post or phone your enquiries; no lists. LITTLEWOOD & GRUNER, Ltd., 27, Ballards Lane, Finchley, N.3. Fin. 3060. [0055]

**A REMARKABLE ACHIEVEMENT IN FILTER DESIGN**



**E.M.G. STEEP-CUTTING INFINITELY VARIABLE FILTER**

- Cuts at any selected frequency between 4,000 and 8,000 c.p.s.
- Average steepness of cut 30 db. per octave.
- Connects between secondary of output transformer and speaker (15 ohms, rated impedance).
- Specially valuable for use with new micro-groove records.
- Greatly reduces needle-hiss on ordinary records with minimum high note loss, and suppresses high pitched interferences on radio.
- No distortion, and no appreciable loss of volume.
- Leaflet available from the manufacturers.
- Novel circuit, patents pending.

**£4 - 10 - 0**

Trade Enquiries invited.

**E.M.G. HANDMADE GRAMOPHONES, LTD.,**  
6, Newman St., Oxford St., W.1.  
Telephone: Museum 9971-2-3.

**LOWTHER PRODUCTS**

for  
**UNFAILING DEPENDABILITY!**

The choice of both Professional & Amateur for audio or electronic equipment

Full details:  
**THE LOWTHER MANUFACTURING CO.**  
(The Laboratory Production Unit)  
Lowther House, St. Mark's Rd., BROMLEY, KENT. Rav. 5225.

# Surplus Bargains!

**RECEIVER 18.** Covering 6-9 mcs., and complete with 4 battery valves, circuit, connecting data, and batteries, 25/- Post 2/6.



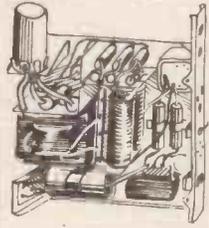
**WIDGET ACCUMULATORS.** Made by famous manufacturers, 3AH capacity. ONLY 2/6 each or £1 dozen.

**MERCURY BATTERIES,** as reviewed in "Wireless World" May 1948 94v. H.T., 1.3v. L.T., 5/6 each; 94v.-63v. H.T.s, 5.2v. L.T., 7/6 each. Post 1/-.

**MIDGET MOTORS,** 2 1/2 in. long, 1 1/2 in. dia., 1/135 H.P. on 27v., these will operate from a 12v. D.C. from 110v. A.C., or from the mains with a suitable dropper, 9/6.

**TRANSFORMERS.** Modulation transformers which may be used as mains auto-transformers (230-110v.) handling some 75 watts, 5/-. Input transformers, with 3 very heavy windings (one tapped low resistance) which may be used as small mains transformers or heavy duty output transformers, 3/9. Post 1/3.

**FIELD TELEPHONES.** Of American manufacture, with bell ringing generator, and standard type handset, in first-class condition. Webbing cases, 37/6. Solid leather cases, 45/-.



**VIBRATOR UNIT**  
21. Store soiled, but containing electrolytics, resistors, condensers, chokes, metal rectifiers, transformer and vibrator, etc., 7/6. Post 1/6.

**RECEIVER 21.** Covering 4.2-7.5 and 18-31 mcs., and complete with 9 battery valves, circuit, connecting data and super capacity all-dry battery, 42/6.

**AMPLIFIER TYPE 1135A,** a small unit, measuring 9 x 2 1/2 x 6 in., and containing 3 (6.3v.) valves (6B3, 6X3 and EL32), which requires very little conversion for P.A. ONLY 18/6. Circuit 1/3.

**PANELS,** containing two 17, 450v., one 01 350v., one 1 600v., one 8 micro f. 150v. condensers, one L.F. choke, one valveholder, etc.: these are new and individually boxed. ONLY 1/9.

**CONDENSERS** (new—not stripped). Tubular: 75 micro/f., 12v., 12/6 doz.; .05 750v., 1/8 doz.; .25 350v., 1/8 doz.; Mica: .00003 3,000v., 2/- doz.; .001 2,000v., 2/- doz.; .0002 2,250v., 2/6 doz. Electrolytic: 25 micro/f., 25v., 12/6 doz.

**BRAND NEW 1355's.** The ideal Television conversion unit, with 11 valves. These are in original maker's crates, but may have discoloured metalwork due to long storage. OUR PRICE, 55/-, plus 7/6 carr.



**CASED SPEAKERS.** In attractive 9 in. dia. metal cases, with transformer for 3.5 or 15 ohm input. ONLY 10/6. Post 1/6.

**RECEIVER TYPE 25.** One of the best known sets for converting into a domestic receiver. With six valves (6.3v.), pair 400 k/cv. I.F.T.s and a host of resistors, condensers, etc. Complete with circuit ONLY 22/6.

## RADIO EXCHANGE CO., 9, Caldwell Street, BEDFORD. Phone 5568.

All goods sold as used unless otherwise stated.

### COMPONENTS—SURPLUS AND SECONDHAND

**RADIO CLEARANCE Ltd.,** 27, Tottenham Court Rd., London, W.1.

**COMMUNICATION receivers B21B,** made by Marconi Wireless Telegraph Co., coverage 1/20mc/s (300-15 mtes.) in 4 bands, turret switched coils, 104in roller dial calibrated all bands, a 9-valve super with 2-RF's (KTW63's), mixer (X65), 3-IF's (KTW63's), DET and LF (DH63), B.F.O. (KTW63), output KT63, all stages metered, by switching, fitted 230v 50c/s L.T. transformer, but H.T. is required, precision job, size 2 1/4 x 2 1/2 x 1 1/4 in., supplied brand new complete with circuit diagram and individual test reports, but less valves, at £9/19/6, plus 10/- carr.

**50W MODULATORS,** complete with power supplies, 0-110v-200/250v, 50c/s, 8 valves, 6C5 into 6C5's push-pull, into push-pull 807's, 3 rectifiers, paper smoothing condensers throughout, jacks for key, mike and line, the power unit gives 500v 200ma (d.c. smoothed) and 6.3v 5a in addition to supplying the modulator, complete outfit, with circuit diagram, in metal case (21in rack mounting panel), containing 18 solid state case, with carrying handles, no mod. transformer; £12/10, carr. paid.

**SUPER mains transformers, 620-550-375-0-375-550-620v,** 250ma may be drawn from inner (375v) taps, and 200ma from other of the outer taps, simultaneously, 5v 3a, twice is available for the rectifiers, enclosed job, 6 1/2 x 6 1/2 x 5 1/4 in, weight 24lb, by Parmeko, primary 230v 50c/s, 39/6, carr. paid.

**PERSONAL receivers, 3-valve T.R.F. receivers,** using 10T4's, contained in a handsome bakelite case, with lift-up lid, size 7x6 1/2 x 5 1/2 in, with lid closed, plastic carrying handle, frame aerial in lid; these receivers cover the medium waveband and operate from self-contained dry batts.; standard types, W1435 and U2, output to a pair of high impedance headphones, controls 5 S.M. tuning and reaction; opening lid switches on; supplied brand new, with valves, batteries, phones, an ideal set for many purposes, invalids, hosp. patients, etc.; these receivers are not Govt. surplus and are offered ready to play, £3/19/6, (carr. paid), chassis, 5 x 5 1/2 x 5 1/2 in, drilled 4-button base holes, 1/9, 5 x 9 x 1 1/4 in, drilled 7-button base holes, 2/3; All, 17 x 9 1/2 x 2 1/2 in, drilled 7 int. oct. and square, open ends, 3/5; E.H.T. trans. 4kv, 1ma, 2v 2a, secs, Pri. 230v, 50c/s, gives approx. 5,500v with usual smoothing, 29/6; smoothing chokes, 5H 200ma 1000/4 1/1, 6H 200ma 1000/5 5/6; electrolytics, 8mf 450v 2/3, 16+8 350v Can 3/-, 15+15 450v+20mf 25v Can 4/6, 32 mf 350v Card 2/-, 32 450v Card 3/6, 100 mf 350v Can 3/6, 16+8 8 double-ended Can 450v 3/-, 25 25v 1/3, 25 50v 1/3, 50 25v 1/6, 100mf 12v 1/-, 50/12v 9d.

**P.M. SPEAKERS;** 5in, less trans., 9/11; 6 1/2 in, less trans., 10/11; 10in, with trans. P.P. 4,500/1, 21/-; outputs trans, 2,000/20, 2,500/20, 2,750/20, 3,000/20, 5,000/20, 7,000/40, all at 3/-; heavy duty, 7,000/20 3/6; 3 ratios, 7,000-3,500-1,750/40 4/-; switches, standard size, 2P 4W, 3B 2/6, 1.P. 10W2B 2/6, 2P 4W2B 2/6, 2P4W1B plus additional wafer with shorting plate, 2/3, all have 5in spindles; resistors, 100 assorted, 4/7 valves, ranging 190d 1/4 down to 100k, 3w; all standard sizes; best makes 10/6, post 6d; air-spaced variables, ceramic bases, 1/4in spindles, 1in long, straight, 25PF 9d, 100PF 1/3; preset 50PF 6d; meters, metal cased, 2in circular, 0/500 micro 7/6, 0/15-60v, ren. ext. res. 6/6; 0/20v or 0/40v, with shunt, 5/-; bakelite cased, 2 1/4 square, 0/1ma 7/6, 0/5ma 6/-, 0/50ma 7/-; 0/300v series res. supplied, 7/-, 0/20v 5/-; bakelite cased, 2 1/4 in circular, 05c micro 16/6, 0/30ma 7/-, 0/50ma, 0/100ma, 0/200ma 8/6; all meters flush mounting, visual indicators, type 1, crossover needle 2-60 microa, with common magnet, 3/-; S.M. dials, as on R.F. 26, less cursor, 3/11; rotary power units type 104, 12v D.C. input, output 250v 60ma, 6.5v 2.5a, 20v rotary, mounted on chassis with subp., 6/11; type 37, 24v input, output as 104, 5/11; 2-rank condensers, .0005, cer. ins. 1in spindle, 4/6; superhet coils 1 1/2 x 1 1/4 in formers, M.W. H.F., A.E. or Osc., L.W. H.F., A.E. or Osc., 1/6 per coil; 1.F. tra' 465kc/s, iron-cored, 1/9; set of 6 coils and rap, 9/6; 10-pin plugs and sockets, with keyway, 1/6 pr.; telescopic aerials, all, 15in closed, 7ft 6in extended, 3/6; bakelite cases, with lid, inside meas. 6 x 6 1/4 x 3 1/4 in with out lid, lid 1 1/2 in, formers, for 10c aerial lid recs fixing, ideal for personal sets, meters, etc., 8/6, post paid; aircraft radio rec., type CRV 46151 6-valve receivers, covering 195kc/s-9,050kc/s, in 4 bands, 195-500-1,600kc/s, 1.6-5mc/s, 4.5-9.05mc/s, switched R.F. mixer, 3-1 F. det. output, using 4-12SPT's, 1-12EA7, 1-12A6, S.M. dial calibrated in kc/s, size 8 1/4 x 7 x 1 1/2 in, provision for aerial or loop, powered from 28v, self-contained dynamotor supplied with valves and dynamotor, used at £5/19/6, carr. paid; mains trans., PRI 230/250v, 50c/s, secs. 460v, 200ma, 210v, 15ma, 6.3v, 5a 14/-.

**SMOOTHING chokes 20H, 8ma, 350ohm, size 2 1/2 in x 2 1/2 in x 3 1/2 in, 6/11; 8H, 250 ma, 50 ohm size, 4in x 5in x 5in, 10/6; post paid.**  
**RADIO CLEARANCE Ltd.,** 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015  
**F**OR disposal, several mains trans. by Bryce, Portminster, Radiospares, etc.; all unused; accept half list price; stamp detail.—Strange, 2a, Eastern Rd., London, E.17. [0073  
**S**ERVO-CONTROL equipment, Magslits, Servo syns, Velocodes, etc.—Hopton Radio, 1, Hopton Parade, Streatham High Rd., London, S.W.16. Tel. Streatham 6165. [0049  
**Y**OU'LL probably get it at Smith's, Edgware Rd.; from a 1/10 watt resistor to a radiogram cabinet, lowest prices, biggest variety.—New Metropolitan Music Hall, Pad. 5891. [0114



## DEMOBBED VALVES 2/8

Service Valves and their Commercial Equivalents—  
Complete Lists FREE

02A	6V6	AC2PENDD	KT35
1C5	6X5	AC5PEN	U52
1LA4	7A7	FW4/500	DH63
1R5	7A8	FC13C	KT61
1S5	7B6	FC13	U50
1T4	7C7	VP13C	U17
184	12A6	VP13	R63
1V	12H6	TDD13	KT61
2A3	12K7	EL13	X65
2X2	12L3	SP13C	U51
354	12M7	PEN3520	EP50
905	128H7	PEN40DD	EL33
6U4	12SK7	U4020	ECC31
5V4	12SQ7	UR3C	EP39
12B7	12SR7	ACTP	EL32
524	14R6	TP2820	EP56
6A3	18	VP13	EK32
6A7	19	TH23	EM34
6AC7	2516GT	TP22	EL50
6AG5	25T5	PEN453DD	CC35
6AG7	25Z4	ME41	DL2
6B4	25Z5	PEN383	DL35
6B7	25Z6GT	U23	41MPT
6B8	32	EL133DD	CI
6C5	35Z4GT	EL42DD	CI
6C8	39/44	PEN45	XP
6D6	41	PEN45DD	XH
6E5	42	PEND2C	ECH35
6E8	43	VP1332	AR4101
6F7	75	ACVP1	EP6
6F8	78	TP23	EK32
6G6G	80	EL41	KP1018
6H6	84/8Z4	PE25	RP4101
6I6	85	TP25	ME41
6J6	813	VP23	ME41
6K7	866A	HL32D	MSFen
6L7	954	PENDD2530	Y63
6K7GT	955	U74	6A8
6K8	9001	KTW74	G87
6L8G	9002	DL74	U74
6L7	9003	U71	58
6N7	ACTH1	DH73	1628
6Q7	SP4 (7)	X73	1904
6S7	SP4 (5)	KTW73	210VPT
6H7	VP4B	KT72	SP2
6SK7	M4	KT74	210F
6SL7	ACHL	DH76	TDD2
6S7	D41	KT76	PM12E
6N7	AC.Pen (5)	U76	M2AFA
6T7	AC.Pen (7)	W76	LP2
6U7	U10	KT33C	QF21
6SA7	MU18	KT32	FD220

# HIVAC THE SCIENTIFIC VALVE

Midget and Sub-Miniature Valves

	Midget	Sub-Miniature	Each
XSG, 1.5 v. & 2 v.	15/6	XWO.75B ...	17/6
XW, 1.5 v.	15/6	XY1.4B ...	17/6
XH, 1.5 v.	10/6	XY1.4C ...	17/6
XD, 1.5 v.	10/6	XFW10 ...	17/6
XL, 1.5 v.	10/6	XFY 10 ...	17/6
XLO, 1.5 v.	10/6	XFY 11 ...	17/6
XP, 1.5 v.	12/6	XFY 12 ...	17/6
XY, 1.5 v.	15/6	XFG 1 ...	17/6
XVS only 2 v.	15/6		

## TAYLOR

EASY TERMS up to 10 months—near cash price on all Taylor Meters.  
FREE Catalogue, Payment Plan form.

Order C.O.D. or remit with order. Post 1/-.  
When writing please mark envelope (WW).

## RADIO BULLS VALVES

246 HIGHEST HARLES ROAD  
Telephone: ELGar 4444

# MICROGROOVE IS HERE!

Not "shortly" and not "in the near future"; no waiting lists but IMMEDIATE DESPATCH (if you order promptly) of excellent Microgroove Gramophone Units made by famous British manufacturer, and despatched ready to plug in. For 50-cycle A.C. mains of 100/130 and 200/250 volts; consumption approx. 12 watts. 10in. turntable revolving evenly at 33 $\frac{1}{3}$  r.p.m. Auto stop and start. Lightweight High-Fidelity Magnetic Pickup giving delightfully clean quality. Output approx. 0.3 volt at 1,000 c/s., requiring no pre-amplifier or input transformer with normal amplifier or radio set. Frequency range 30-14,000 c/s. For use with Miniature steel or sapphire stylus. Complete with mounting accessories, tax paid, carriage paid, £7/5/- nett. Limited quantity available, so order now. Also the same model but 78 r.p.m. Mount the two side by side in one cabinet for the ideal playing desk; costs less than a single two-speed job, saves changing styli, etc., and supplied tax paid, carriage paid, for £13/19/6 the two. Talk to us also if you would like a Microgroove Automatic Record Changer; and, of course, for ALL the high-quality equipment by Hartley-Turner, Wharfedale, Goodmans, A. C. Barker, Vortexion, Decra, Marconiphone, etc., etc. Meanwhile, get organised TODAY for Microgroove—WE'RE ready!

## WIRELESS SUPPLIES UNLIMITED

264-266 Old Christchurch Road, Bournemouth, Hants

## SELENIUM RECTIFIERS, CHARGER KITS, CHARGERS

New Goods with Full Guarantee

S.T.C. SELENIUM L.T. RECTIFIERS, up to 300 watts, bridge, h.w. or c. tap, 200 m/a to 10 amp, with or without transformer. A few of our large stock—2 v./6 v., 4 amp, 4/10; 2 v., 0.5 amp, with transformer, 12/6; 6 v., 1 amp., 7/2; 6 v., 2 amp., 9/-; 6 v., 4 amp., 16/6; 6 v., 10 amp., 22/6; 12 v., 1 amp., 9/6; 12 v., 2 amp., 12/6; 12 v., 4 amp., 19/6; 12 v., 6 amp., 25/-; 12 v., 10 amp., 42/6. Higher voltages in stock. Add postage 8d. up to 12/6, 1/- above.



**FOOLPROOF CHARGERS AND KITS.** New Minor Charger as illustrated, 6 v. to 12 v., 1 amp., large selenium rectifier, stabilising barretter, 46/-, 18 months' guarantee, or in kit form 42/-, post 1/8. Kit less case 32/6. New 2 amp. kit for 2 v., 6 v., 12 v. transformer, ballast bulb, 4in. diam. rectifier, 38/6, or with case as illus., 52/-, "Automat" 2 amp. 6 v.,

12 v. charger ready for use, 65/-, with 18 months' guarantee. "Automat" 2 v., 6 v., 12 v., 4 amp. slider charger, weight 22lb., 86/5/0, plus 12/6 crate and carr. **HEAVY DUTY KITS.** 8.T.C. 12/15 v. 4 amp. rectifier, 70 watt transformer, barretter for 2 v., 6 v., 12 v. charger, foolproof operation, full instructions, 52/6; ditto but for 2 v., 6 v., 4 amps., 48/6, post 1/4. Slider Kit, 100 watt trans., 4 amp. rectifier, slider resistance, high grade ammeter for 6 v., 12 v. charger, £3/15/0; ditto but 120 watt trans. and giant 8in. 6 amp. rectifier, slider res., ammeter, 25. weight 18 lb. For small radio store 1 to 20 cell 1.5 amp. kit, transformer 150 watts, 2 amp. rectifier, barretter bulb, for continuous running, £4/15/0, post 1/8. **ELIMINATOR KIT** for 120 v. 20/30 m/a eliminator, 20 watt trans., 130 v. 30 m/a h.t. rect., 2 v. 0.5 amp. trickle rect., 2 x 8 mids. condensers, case, etc., 42/- or without case 35/-, post 1/2. **SELENIUM SMALL SPACE H.T. RECTIFIERS;** 250 v. 60 m/a h.w. for c.d.c. sets, 7/-; 310 v. 80 m/a, 6/-; 250 v. 100 m/a bridge, 13/6; 350 v.-0.350 v. 80 m/a c.t., 13/6, post 6d. extra.

**NEWBAT.** Accumulator cell desulphator and conditioner, 1/6, post 4d.

## CHAMPION PRODUCTS

43 Uplands Way, London, N.21. Phone LAB 457

## COMPONENTS—SURPLUS AND SECONDHAND

**PERFORMANCE** meters, type No. 2, fitted standard mains 230v a.c., 50 cycle power pack, 2 V.R.91, 1 V.R.137, 1 5Z4G, 1 C.V.51, 1 V.R.92 and other useful components; £2/5 each, carriage 5/6.

**SOLENOIDS,** fitted cantilever action, operating voltage 10-12 volts d.c., new, dimensions 3in long, 1in diam.; price 5/6 each, post paid. **NEW G.E.C. ammeters,** complete with external shunt and connecting links, centre zero, 15-0-15 amps, dimensions 3 $\frac{1}{2}$ in x 3in x 2in; price 21/- each, post paid.

**SIEMENS** high-speed relays, 75ohms, double bobbin, 5/- each post paid; we have a large stock of 3,000 and 600 type P.O. relays; ohmmeters ranging from 100 to 10,000ohms, assorted contacts; prices on application.

**G.E.C. 20hfd condensers;** for power factor correction, with internal safety leak, rating 275 volts, 50 cycles; price 8/- each; special quotation for quantities.

**INDICATOR** units, type 184a, fitted 3in and 6in cathode ray tubes type ACR.10 and V.C.R. 517B, and 17 valves, viz., 6 V.R.92, 5 V.R.91, 3 V.R.54, 3 V.R.65, metal rectifiers, chokes, transformers, potentiometers, resistances, condensers, etc.; £3/10 each, carriage 10/-.

**GRABER** rotary switches, 250v 10amp d.c. single pole 3-way series, parallel, ideal for photo floods, etc.; price 4/- each or 40/- per doz, post paid. **15-AMP Mercury switches,** fitted with saddle and clip; 4/- each, postage paid.

**A LARGE** quantity of single items which we do not list, which are 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.

**SALE,** Haynes TV equipment, high impedance scanning coils, blocking transformers, output chokes, £4 set; focus coil, 8,000 ohms, 30/-; RF EHT unit, 5-8kV, £3/10; Woden potted choke, 20E, 250ma, £2 all as each, P.O. 1784. [57/9]

**SURPLUS,** unused, 1 350v 2/doz., .01 200v 3/- doz., .05 500v 3/- doz., 1 500v 3/- doz., .01 mica 3/- doz., 4pf, 20pf 2/- doz., 2mfd 500v 9d each; TRF coils 4/9 pair, etc.—Bargain list from: T. G. Howell & Co., 29, McWilliam Rd., Brighton, 7/-.

**600** watt auto transformers, new but soiled, 45/- plus 3/- carr., up to 16 lb, 230/110v; Lustraphone m/c mikes, new 52/6, post 1/-; Rola 8in p.m. speakers, less trans., new 13/6, post 1/3; crystal diodes, capsuled, new 3/6; 2v 0.4a sperkle rectifier, 6/6; 6.6, 6.3v 1 amp heater trans. 7/-, post 8d.

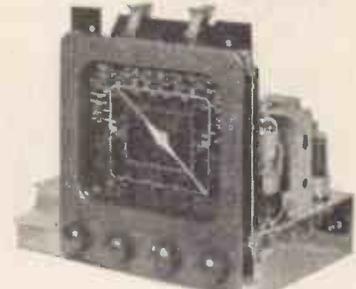
**CHAMPION PRODUCTS,** 43, Uplands Way, London, N.21. Lab. 4457. [10100]

**USED** Surplus—Midget power motors, 25-110 volt dc/ac 8/6, small panels, with 20, .17 450v, one .01 350v, one 1 600v, one 8mfd 150v tubular, one LF choke, 2,000 ohms resistance, valve holder, etc., boxed, 1/6 each, 12/- doz., .0005 tuning condensers 1/9, 15/- doz., 25x 25mfd tub, bias 1/- each, 9/- doz., 75mfd 15v working, 1/- each, 9/- doz., .05mfd 750v 8d per doz, wanted tape or wire recorder—Hayson, 14, St. Mary's, Bedford. Tel. Bedford 5568.

**RADIO UNLIMITED,** Elm Rd., Walthamstow, E.17, for guaranteed spotless surplus components. Speakers: 3in 10/-, 3 $\frac{1}{2}$ in 11/-, 5in 10/-, 6in 11/-, 8in 12/6, 10in 14/6; output trans. std. pent. 3/6, Heavly dty, P. capped, 2, 5, 8, 15ohm 12/6; condensers, all fresh stock, 1 350v 6d., 1 500v 1/-, 8mfd 500v 2/-, 15mfd 500v 3/3, 8x16 450v 3/9, 16x16 450v 3/9, 25mfd 25v 1/6, 50X50 1/9; all types in stock; order c.o.d.; m/coil 0-40 ammeter new/boxed, 3/9; TX valve 807, 6/7; V/control, 10K to 2 meg, long spindle, less switch, 2/6; with sw. 3/9; m/coil headphones, 4/6; bal/arm type with throat microphones, 4/6; throat mics., 1/6 pair; 100ft aerial with 40ft cord, 4/6; Midget 465 1 i.t.s., 11/- pair; hundreds other lines; s.a.e. list, 0/1062, Secy. 4813.

**SUPREME RADIO,** 746b, Romford Rd., Manor, Pk. London, E.12. Tel. Hf. 1260. Est. 16 yrs. P.M. focus units from 15/- ea.; ret. rings for same, 8d ea.; E.F.50 valve holders, ceramic type, 6d ea.; Aladdin coil formers, with cores, 8mm 8d ea., 6mm 6d ea.; 5meg carbon vol. cont., 7/6d ea.; 100K $\Omega$  vol. cont., long spindle, with S.P. switch, 2/6 ea.; 25m $\Omega$  vol. cont., long spindle, less switch, 2/- ea.; noise suppressor units, consisting of 2.1mfd cond. and iron-core choke, 6d ea.; co-ax. cable 80ft 8d yd., 60ft type, 6d yd.; twin balanced feeder 5d yd., 6/6 doz. yds.; C.V.22 crystal diodes, 2/6 ass.; 1-watt resistors: 10 $\Omega$ , 22 $\Omega$ , 27 $\Omega$ , 47 $\Omega$ , 82 $\Omega$ , 120 $\Omega$ , 180 $\Omega$ , 330 $\Omega$ , 390 $\Omega$ , 820 $\Omega$ , 1k $\Omega$ , 3.9k $\Omega$ , 11k $\Omega$ , 47k $\Omega$  and 10meg/1/9 doz., 18/6 gross or ass.; 1/2-watt resistors: 2/2k 6.8k $\Omega$ , 16k $\Omega$ , 18k $\Omega$ , 3.3k $\Omega$ , 100k $\Omega$ , 220k $\Omega$  2/- doz., 21/- gross or ass.; 1 watt res.: 270 $\Omega$ , 470 $\Omega$ , 1k $\Omega$ , 3.3k $\Omega$ , 8.2k $\Omega$ , 18k $\Omega$ , 33k $\Omega$ , 56k $\Omega$ , 68k $\Omega$ , 1 meg and 2 meg, 4/- doz.; midget mica cond., .0005mfd, .0003mfd and .001mfd, 6d ea., 5/6 doz. or ass.; metalmine cond., .01mfd 350v and .002mfd 500v, 9d ea., 7/6 doz.; P.F. cond., 40pf, 50pf, 60pf, 65pf, 305pf, 307pf, 50pf, 530pf, 570pf, 590pf, 700pf, 1,800pf, and 4.5pf, 10 and 2 1/2 doz. each; fly-back type line trans., with provision for EY51 valve, 22/6 ea.; 16mfd 350v dryvite cond., small can type, 1/9 ea.; 8mfd 500v wire end tub cardboard cond., 1/6 ea.; 16+16mfd 450v cardboard cond., 2/9 ea.; 16+8mfd 450v metal can cond., 1/6mfd 50v or 25mfd 25v tub, wire end cardboard conds., 1/- ea.; 12mfd 50v metal screw base cond., 6d ea.; 4mfd 450v metal or cardboard cond., 6d ea.; 2mfd 350v tub cardboard cond., 6d ea.; component parts for constructor television and radio circuits our speciality; terms c.w.o., no c.o.d.; send s.a.e. extra for postage orders under £5; 2/6d s.a.e. all enquiries and lists. [0021]

# CHASSIS



**HAYES RG/120 CHASSIS.** An outstanding 5-valve chassis with high sensitivity and selectivity. Octal valves 6K8, 6K7, 6V6, 6Q7, 5Z4, 16-50, 195-550, 900-2000 metres. Iron-cored high "Q" coils. Illuminated glass dial 8in.x6in., variable tone control, switched P.U. sockets, and high quality 4-watt output. Chassis size 11" wide, 7 $\frac{1}{2}$ " deep, 9 $\frac{1}{2}$ " high. Beautiful bronze escutcheon is supplied, and gives a professional appearance to the chassis when mounted in a cabinet. Heavy duty mains transformer, 200/250 A.C. mains. Special voltages and frequencies to order. These chassis are not surplus or bankrupt stock, but are brand new and fully guaranteed. Price £13/7/6 carriage paid.

**ARMSTRONG CHASSIS.** Messrs. Armstrong will not be exhibiting at Castle Bromwich this year, but we shall be demonstrating the full range of Armstrong chassis in our showroom. Open from 10 a.m. to 10 p.m. from 6th to 16th September inclusive. How to get there: Bus 50 from Paradise St., or bus 49 from Carrs Lane (both in centre of city), alight at Trafalgar Rd. Showroom is in corner building almost opposite. Come along and see these amazing Armstrong chassis, you will be able to try all chassis from 7-14 valves under actual operating conditions.

**THE HAYES COMPANY**  
1 ALCESTER RD., MOSELEY, BIRMINGHAM, 13  
Phone: SOUTH 0202

## SOLONS FOR YOUR SOLDERING JOBS!

Types available—65 watt oval

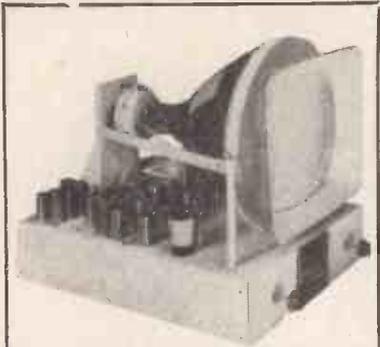


- tapered bit,
- 65 watt round pencil bit,
- 125 watt oval tapered bit,
- 125 watt round pencil bit,
- 240 watt oval tapered bit.

**HENLEY SOLON**  
ELECTRIC SOLDERING IRONS

These five models will satisfy practically every soldering demand whether for the occasional household job or continuous soldering under workshop or factory conditions. With the Solon the heat is in the bit itself... continuously... hour after hour; all connections housed at end of handle away from heat. Each model complete with 6 feet Henley 3-core flexible. Now available from stock. Write for folder Y.10.

**W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.**  
51-53 Hatton Garden, London, E.C.1



# T.V.20

## for DISTANCE RECEPTION

12in. tube 21 valves  
200/250 A.C. etc.

Price **50 Guineas** plus tax

# N.B. Radio Exhibition

During the Castle Bromwich Radio Exhibition (Sept. 6-16) all **ARMSTRONG RADIO** and **TELEVISION** receivers will be on view from 10 a.m. to 10 p.m. each week-day. See them in our Agents'—Hayes Co.—showrooms.

1, Alcester Road,  
Moseley,  
Birmingham, 13.  
Telephone: South 0202

Demonstrations can be arranged by appointment outside these times.

Chassis despatched by passenger train within 24 hours of order.

*Armstrong*

**The CHASSIS PEOPLE**  
Armstrong Wireless and  
Television Co. Ltd.  
Walters Road, Holloway,  
London, N.7.

Telephone: **NORTH 3213.**

### COMPONENTS—SURPLUS AND SECONDHAND

**.01** mfd. 250v tubulars, 3d.; 8mfd. 500v oil-filled, 4/-; 3 toggle panel, 1/-; 12v 1ga rectifiers, 1/-; 5v 1/2a mains transformers, 2/6; morse keys, 9d.; 0.01mfd, 5kv, 9d.; many other bargains; post extra; money-back guarantee; no c.o.d.; s.a.e. lists.

**ANNAKIN 25, Ashfield Place, Otley, Yorks** [5815  
**EX-GOVT.** tropicalised chokes, 90ma 15h 3/9, 250ma 15h potted 9/9; ex-Govt. receivers, type B1124C, less valves, 8/6 ea. to clear (condition good), cart. 2/6; drive drums, 2 1/2in. 6/6 doz; sel. recls. 12v 1/2a 10/6 doz; ex-Govt. meters, 0-1ma 5/9; c.w.o., post extra.—Post orders only to Powell & Lynnwood Cresc., Leeds, 12. [5859

**H.R.O.** receivers, complete with 7 coils and power pack, £28; Hallicrafters, S27, SX24, AR88LF and Hammerlund Super Pro receivers from stock at reduced prices, rotary converters, all voltages and wattage: 20-watt rack mounting amplifiers, complete with heavy duty a.c. power pack, 200-250v, £225 d.p. output, less valves, new, 90/- each; i.t. transformers, 6v-50v, all current ratings special types to order at competitive prices we invite your enquiries; S meters for AR88, H.R.O. Hammerlund, etc., available; mag slips in prs boxed, 3in, new, £3/7/6 pair; special offer of new meters, 5 m.a. 6/6 100 m.a. 7/6; 5 thermo amp meters 5/6, all 2in scale; ex Government S.T.C. ball microphones, perfect, £4/17/6; 12in and 15in energised and p.m. speakers, Rola G12, Magnavox 66, etc.; low resistance phones 3/6 or high resistance, 7/6 pr; U.S.A. m/coil, 7/6 pr; special offer of first grade m/coil meters, 500 m.a., 2 1/2in scale, flush mounting, 7/6 each; 500 micro amps, with 2in scale 8/6 each; 200 micro amps, 3 1/2in scale, flush mounting, 65/- each; 50 micro amps, 2in, projecting type, 30/- each; 1 m.a. meter rectifiers, 5/- each; telescopic aerial masts, approx. 18ft. 25/- each; new hand bearing compass, with battery compartment in handle, new 45/- each; transmitting valves, 807 2/6, 813 45/-, 723 A/B 50/-, 35T 27/6, 832 22/6, 805 25/-, 829B 30/-, 721A, 931A 724A; also available, h.t. rectifiers, type H 176, 8/- each; 20-way rotary stud switch, 5 1/2in X 5 1/2in 5/6 each; a.c./d.c. 1-20hp motors 200-250v, suitable for sewing machines, 40/-; auto transformers from 100v up to 7kv in stock; large and comprehensive stock of relays, types 600-3000, and Siemens high speed uniselectors, telephone handsets, plugs, jacks, switches etc., co-axial cable; special offer of mains transformers, 200-250v a.c., tapped 250-0-250, 100 m.a., 6v 4amp, 5v 3amp, £1 each; special offer of new syn. induction electric motors (reversible), suitable for recording mechanism, etc., 200/250v A.C., 1/80hp, 1500 r.p.m., 55/- each. New powerful Garrard double-spring clockwork motors, complete with 10in turntable, 35/- each. New 3 1/2in diam. A.C. 200/250v induction motors, 1/100hp, suitable for models, etc., 30/- each; postage extra on all goods.

**SERVICE RADIO SPARES:** 4 Lisle St., London, W.C.2. Tel. Ger. 1754. [5452

### NOTICES

**BRITISH SOUND RECORDING ASSOCIATION**—  
THE lecture season opens on September 29th at the Royal Society of Arts. Membership of the Association is essential to everyone actively engaged or interested in high quality reproduction. Papers and lectures on all aspects of electro-acoustics are given at the meetings and later published in the Journal. The current issue may be obtained by non-members, price 2/9 p.f.; Manual of Equipment and Accessories, 1/2 p.f.—Write for brochure and membership application form to the Membership Secretary, Harle J. King, 48, Mount View Rd., North Chingford, London, E.4. [0119

### WANTED, EXCHANGE, ETC.

**WANTED,** Magnetophon Tons B, with spares (amplifier not required).—Box 2665. [5074  
**WANTED,** dynamometer a.c. test set, also oscilloscope type 339A, also L050A oscillator. [0176  
**LESLIE DIXON & Co.,** 214, Queenstown Rd., Battersea, S.W.8. Macaulay 2159. [0176  
**D**ISC recorder wanted, or 2-speed turntable and motor.—51, Manchester St., Cleethorpes. [5808  
**WANTED,** tape or wire recorder, preferably portable.—D. O. French, BM/JRZL, London, W.C.1. [5856  
**WANTED,** general radio standard signal generator, type 605B, state price and condition.—Box 5811. [5816  
**WANTED,** circuit details, etc., for Moreton Cheney "Silver Dragon" tuning unit and amplifier.—Box 5797. [5773  
**WANTED,** junction boxes JB-70-A and T-50 microphones.—P.C.A. Radio, Cambridge Grove, London, W.6. Tel. Riv 3279. [0081  
**WANTED,** Wireless Worlds, June, '42; July, '42; Oct., '43; Nov., '44; Feb., '45; May, '48; June, '48; July, '48.—Box 5861. [5820  
**WANTED,** AR88s, SX26s, EC348 (not modified), S-27s.—P.C.A. Radio, Cambridge Grove, London, W.6. Tel. Riv 3279. [0080  
**WANTED,** quantities of new, surplus valves, types EF39, EF36, EL32, 6SN7GT.—N.R.S., 16, Kings College Rd., London, N.W.3. [5755  
**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  
**WANTED,** all types of radio equipment, test instruments, radio receivers, personal sets, television, components, etc., etc.; call, write, send or 'phone.  
**MILLER'S RADIO,** 38a, Newport Court, Charing Cross Rd., London. [5221

# STANDARD ENCLOSED RACK



Registered Design No. 858451

The 1mho 6ft. and 4ft. enclosed racks are standard articles, available from stock. They embody several unique features in their design. For example, both sides as well as back door are swung on lift-off hinges, and multiple units may be formed using only two end doors. Panels, chassis, chassis runners—telescopic and fixed, desk unit, gram unit and mobile base are all standard accessories.

Write for leaflet giving full details or catalogue of our complete range of standard cases, chassis, handles, etc.



112/116 NEW OXFORD ST., LONDON, W.C.1  
TELEPHONE MUS. 7878 (20 lines)

**ELECTRADIX BARGAINS**

**RECEIVERS I132 A and 1526.** V.H.F., 11 valves, superhet receivers 2 models, identical, 100/126 Mc/s. or 65/85 Mc/s., grey cabinet (19" x 11" x 10"). Price with valves, 65/-. Carriage and packing 7/6 extra.

**PRECISION Temperature Control Ovens** for quartz crystals, etc., 230v. 50 cycles will give a stability with suitable crystals of better than two parts in a million. Fitted precision thermostat and thermometer. Temp. adjustable 40/60 degrees. £4/17/6.

**RESISTANCES**, wire wound, 152 ohms 2 amps. double tube, new geared movement, 30/-; 4.6 ohms 16 amps, twin slider with geared movement, 35/-; 20 ohms 2.5 amps., single slider, 15/-; 300 ohms 1/2 amp., 15/-; 5 ohms 10 amps., 21/-.

**MICROPHONES**, Tannoy Multi-carbon hand mike in metal case, with switch in handle, 5/-, post 1/-; special transformer, 10/6 extra. G.P.O. hand mike in bakelite case, 3/6; transformer, 2/6, post 6d.

**HAND MAGNETO GENERATORS**, new condition, ex-G.P.O. 4 Horseshoe magnet type, wound armature driven by gearing in handle, output approx. 75v. 25 m/a. A.C., in hardwood box with external terminals, 10/6. Postage 2/- extra.

G.P.O. magneto bell in polished wood box with switch hook and contacts, condenser, transformer and connection strip, 5/-. Post 1/-.

**TRANSFORMERS**, Foster double wound 230/50v. 2 amps. 100 watts, 15/-. Post 2/-.

**CONSTANT PRESSURE TRANSFORMERS** input 190-260v., output 230v., plus and minus 15v., 150 watts, £6/10/-. 60 watts, £4/10/-. Carriage extra.

**PARCELS**.—10 lb. useful odds for the junk box. All clean, dismantled from Government and other surplus apparatus, 7/6 post free. (For home buyers only.)

**MERCURY SOLENOID SWITCHES**, new and boxed, 15 amp. size, 5/-, post 1/-.

**GALVOS**, 500 ohm, by leading instrument makers, mirror reflecting, 7 mm. micro-amps, with lamp and scale fitted in polished wood box. For A.C., 230v. mains. £8/10/-.

**ELECTRADIX RADIOS**

214 Queenstown Road, London, S.W.8

Telephone: MACaulay 2159



**A work of outstanding importance**

## Antenna Theory and Design

By H. Paul Williams,

Ph.D., A.M.I.E.E., Sen.M.I.R.E.;  
Head of Electronics Dept., The Fairey Aviation Co., Ltd.; formerly Antenna and Propagation Specialist with Standard Telephones and Cables, Ltd., New Southgate.

An important two-volume work giving a complete account of the theoretical basis of antenna design followed by comprehensive guidance on the practical aspects of the work. Both volumes are profusely illustrated.

**VOL. I. FOUNDATIONS OF ANTENNA THEORY.** 142 pages. 21/- net

**VOL. II. THE ELECTRICAL DESIGN OF ANTENNAE.** 522 pages. 63/- net

**Pitman**

Parker Street, Kingsway, London, W.C.2

**WANTED, EXCHANGE, ETC.**  
WANTED, surplus relays, impulse switches, sparking plugs, 5-way, push-button units; any condition; large or small quantities; highest prices paid.—Box 4660. [5579]

**REPAIRS AND SERVICE**  
M A I N S transformers rewound, new transformers to any specification  
MOTOR rewinds and complete overhauls; first-class workmanship, fully guaranteed.  
F.M. ELECTRIC Co., Ltd., Potters Bldgs., Warsler Gate, Nottingham. Est. 1917. Tel. 36555. [0113]

M A I N S transformers rewound promptly, usual guarantee.—Radio Rewind Service, Blith-dir, nr. Dolgellau, N. Wales. [5243]  
L O U D S P E A K E R S rewound and cones fitted, any make, prompt service.—Model Loud-speaker Service, 54a, Bullington Rd., Oxford.

M A I N S transformers rewound or constructed to any specification; prompt delivery.—Bede Transformer Co., Ltd., Bedesway, Bede Trading Estate, Jarrow. [3198]

T E L E V I S I O N, radio and amplifier repairs or modifications; home-built receivers aligned and tested; quotations by return; any type transformer or coil supplied.  
B E R N A R D S, 12 Chelverton Rd., Putney, London, S.W.15. Put. 7538. [0099]

R E P A I R S to moving coil speakers, cones, 10 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. [0110]

A L L types of ammeters, voltmeters, Avos, etc., repaired; quick, efficient service, estimates free.—Donvin Instrument Co., 91, Princesdale Rd., London, W.11. Tel. Park 4469. [0059]

E L E C T R I C A L measuring instruments of every make repaired and standardised.—The Electrical Instrument Repair Service, 329, Kilburn Lane, London, W.9. Tel. Lad. 4168. [3715]

A R E W I N D service which duplicates or modifies as required; transformers, loudspeakers, etc.; prompt returns.—Raidel Services, 49, Lr. Addison Rd., Croydon, Gro. 6537

T E L E V I S I O N, radio receivers and transmitters, amplifiers and electronic apparatus repairs, or modifications; complete service for high fidelity construction and maintenance.

A V I N A S H E L E C T R O N I C, Ltd., 63, Kensal Rd., London, W.10. Lad. 1598. [5811]

R E P A I R S.—E.M.T. mains and O.P. transformers, field coils and chokes; also armatures and motors; new transformers designed to any specification; all work fully guaranteed.

W I L L E S D E N T R A N S F O R M E R C O., Ltd., 781, Harrow Rd., N.W.10. Tel. No. Ladbroke 2846.

"S E R V I C E" with a smile.—Repairs 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. [0112]

R A D I O MAINTENANCE SERVICE for guaranteed rewinds and repairs; armatures, P.H.T. motors, vac. units, portable tools, etc.; good deliveries.—139, Goldhurst Terrace, N.W.6. Mal. 6133. [9925]

"S T U R D Y" rewinds, mains transformers, chokes and fields, first-class work, prompt deliveries and satisfaction guaranteed.—Sturdy Electric Co., Ltd., Sturdy Works, Burnopfield, Newcastle-on-Tyne. [0125]

A S E C O N D - t o - n o n e rewind service, reliable, neat, return of post service; your television requirements printed and executed, E.H.T., L.E.T. and heater transformers; stamp for quotations.—R. E. F., 137a, Ashton Rd., Oldham. [3519]

R E W I N D S and conversions to mains and output trans. pick-ups, fields, clock coils, car vibrator units, etc.—from 6/6 p.p. equipment a speciality; all work guaranteed.—N. L. Rewinds, 4, Brecknock Rd., N.7. Tel. Wordsworth 7791. [5795]

A L I G N M E N T and repair of communication receivers and all other short wave equipment; receivers and amplifiers built to specification; experimental and design work executed.—P.C.A. Radio, Cambridge Grove, London, W.6. Tel. Riv. 3279. [0093]

24 - H O U R service, 6 months' guarantee, any transformer rewound, 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.

M E T R O P O L I T A N R A D I O S E R V I C E for rewinds, mains and field 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 3000. [0130]

**WORK WANTED**  
DESIGN, assembly work on amplifiers, radio receivers and transmitters, television and electronic apparatus.

A V I N A S H E L E C T R O N I C, Ltd., 63, Kensal Rd., London, W.10. Tel. Lad. 1598. [5810]

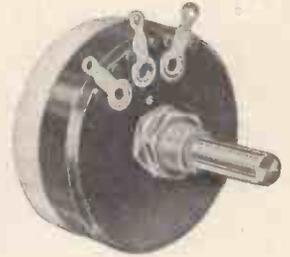
D R A U G H T I N G, tracing and photoprinting services; estimates free; contractors to the Ministry of Supply and the Admiralty for drawing and tracing work to their requirements and specifications, sub-contracting work of this nature undertaken.

D R A W I N G & T R A C I N G, Ltd., 456a, Ewell Rd., Tolworth, Surbiton, Tel. Elmbridge 7406. [4163]

M O R T, B.Sc., A.M.I.E.E., offers to the J. trade and amateur a service of technical advice, design and construction of special test gear, receivers and other apparatus, including correction of faults in home-built apparatus.—Write to BCM/HIFIDEL, W.C.1. [5752]

M I S C E L L A N E O U S  
P I R E: 1946 April Sept. missing; 1947, 1948 complete; offers.—Box 6118. [5852]

W A L N U T radiogram cabinets; stamp leaflets.—Cabinetware, 1a, Heyes St., Blackburn.

**POTENTIOMETERS**

by  
**RELIANCE**

Wire wound and Composition types, Single, Ganged, Tandem Units.

Characteristics: linear, log, semi-log, non-inductive, etc.

Full details from

**RELIANCE**

Manufacturing Co. (Southwark) Ltd.

Sutherland Rd., Higham Hill, Walthamstow E.17

Telephone: LARKSWOOD 3245

**NEW S.T.C. SELENIUM RECTIFIERS.** Largest L.T. range in Great Britain. Current products, NOT surplus. E.H.T. H4/200, W.W. Telesor, 29/6, H4/100 VR97, 19/6, post free.

**HALF-WAVE RECTIFIERS.**  
16v. 2a, 7/-; 1a, 8/6; 2a, 9/10; 3a, 17/-; all post 6d. 4a, 18/-; 6a, 22/6, post 10d. 30v. 1a, 12/6; 2a, 14/8; 4a, 26/-; 6a, 38/6; 40v. 1a, 16/6; 2a, 21/-; 4a, 37/6; 6a, 54/-; 100v. 2a, 36/6; 4a, 69/-; 6a, 100/-, all p. 1/-.

**HALF-WAVE HEAVY DUTY, 7 1/2 in. SQUARE COOLING FINES.**  
16v. 5a, 22/6; 10a, 24/6; 30v. 5a, 37/-; 8a, 40/6; 48v. 2.5a, 27/6; 5a, 50/6; 8a, 57/-, all post 1/-.

**BRIDGE CONNECTED FULL WAVE.** Special price, 230v. 1a, D.C., 90/-, 2.5-3a, D.C., 105/-, 17v. 1.25a, 12/9; 2a, 16/4; 2.5a, 21/3; 3a, 23/-; 4a, 26/-; 5a, 27/6; all post free. 33v. 2a, 19/6; 1a, 22/6; 1.5a, 29/6; 2a, 32/6; 3a, 37/6; 4a, 45/6; 5a, 46/6; all post 10d. 52v. 1.5a, 41/-; 2a, 50/-; 3a, 57/-; 5a, 70/-; 7v. 1.5a, 53/-; 2a, 64/-; 100v. 1.5a, 76/-, all p. 1/-.

**BRIDGE CONNECTED HEAVY DUTY 7 1/2 in. SQUARE COOLING FINES.**  
17v. 6a, 36/2; 10a, 44/-; 12a, 76/-; 20a, 84/-; 33v. 6a, 68/-; 10a, 75/-; 12a, 132/-; 20a, 148/-; 54v. 6a, 95/-; 10a, 106/-; 72v. 6a, 122/-; 10a, 138/-; 100v. 10a, 200/-, all p. 1/-.

**BRIDGE INDUSTRIAL FUNNEL COOL.** 17v. 12a, 80/-; 20a, 92/-; 30a, 130/-; 50a, 198/-; 33v. 6a, 73/-; 10a, 84/-; 12a, 132/-; 20a, 152/-; 54v. 6a, 97/-; 10a, 114/-; 72v. 6a, 120/-; 10a, 144/-; 100v. 6a, 168/-; 10a, 202/6, all post 1/6.

**VALVE CHARGER REPLACEMENTS.** No wiring alterations. Philips & Tungar. 2-12v. 4-5a. Charger Kit, 230 A.C. Vent. Case, Ammeter, wt. 22lb. £5/10/-, del.

Wholesale & Retail

**T. W. PEARCE** (Est. 18 yrs.)  
66 GREAT PERCY STREET, LONDON, W.C.1

Off Pentonville Rd. Between King's Cross and Angel

# GALPINS

ELECTRICAL STORES

408 HIGH ST., LEWISHAM, LONDON, S.E.13  
Tel.: Lee Green 0309 Near Lewisham Hospital.  
TERMS: CASH WITH ORDER. NO C.O.P.  
THURSDAY EARLY CLOSING

**EXTENSION P.M. SPEAKERS**, 3½in. by Johnson & Phillips, will handle 1½ watts. New boxed, 7/6 each. Post 9d.

**EX R.A.F. MICROPHONE TESTERS**. These contain a 2½in. scale 0 to 450 Microamp meter shunted to 1 m/amp. calibrated 0 to 10 volts moving coil, complete with 1 mA. rectifier, "Mike transformer," etc., all contained in polished wood box, as new, 17/6 each.

**MAINS TRANSFORMERS**, 200/250 volts input in steps of 10 volts, output 350/0/350 volts 180 m/amps., 4 volts 4 amp., 5 volts 3 amps., 6.3 volts 4 amp., 37/6 each, ditto 500/0/500 volts 150 m/amps. 4 volts 4 amp., 5 volts 3 amp., 6.3 volts 4 amp., 42/6 each; ditto 425/0 425 volts 180 m/amps. 6.3 volts 3 amp. twice, 5 volts 3 amps. (Williamson Amplifier), 39/6 each; ditto 350/0/350 volts 180 m/amps. 6.3 volts 8 amps. 5 volts tapped 4 volts 3 amps. 39/6 each.

**EX R.A.F. D.C. TO D.C. MOTOR GENERATORS**, 24/28 volts input 1,200 volts 72 m/amps. output, as new, 7/6 each, post 1/6.

**MAINS TRANSFORMERS**, 230 volts A.C. 50 cys. input 17½ volts 50 amps. output, 52/6 each, carriage 5/-; another auto wound, output 14 and 17 volts output at 30 amps., 35/- each, carriage 3/6; another with 2 x 4 volt 20 amp. windings, 25/- each, P/f.

**PRE-PAYMENT 1/- SLOT ELECTRIC LIGHT CHECK METERS**, all electrically guaranteed, 200/550 volts 50 cys. 1 ph., A.C. input, 2½ amp. load, 27/6 each; 5 amp. load, 35/- each; 10 amp. load, 42/6 each; 20 amp. load, 50/- each, carriage 2/- extra; in quantities of one dozen or more a special discount of 10%.

**POWER TRANSFORMER AUTO WOUND** voltage changer tapped 0, 110, 150, 190 and 230 volts at 1,600 watts, £5/5/- each, carriage 3/6; ditto, 2,000 watts, £6/5/- each, carriage 3/6; another tapped 0, 110, 200, 230 volts at 350 watts, at 47/6 each, carriage 2/-.

**ELECTRIC LIGHT CHECK METERS**, quarterly type, for sub-letting garages, apartments, etc., all fully guaranteed electrically for 200/250 volts A.C. mains 50 cys. 1 phase, 5 amp. load, 17/6 each; 10 amp. load, 20/-; 20 amp. load, 25/- each; 50 amp. load, 37/6 each; 100 amp. load, 45/- each; carriage 2/- extra on each; special discount of 10% on quantities of one dozen or more.

**MAINS TRANSFORMERS** input 200/250 volts, 000/1 in steps of 10 volts, output tapped 0, 6, 12 a 24 volts at 10/12 amps., 47/- each; ditto as above but at 25/30 amps. output, 68/6 each.

**MAINS TRANSFORMERS**, 200/250 volts 50/1 ph., in steps of 10 volts. Output 500/0/500 volts 300 m/amps., 0.3 v. 8 a., 6.3 v. 8 a., 6.3 v. 4 a., 5 v. 4 a., 4 v. 4 a., at 67/6 each; another same input, outputs, 450/0/450 volts 300 m/amps., 0.3 v. 8 a., 6.3 v. 8 a., 4 v. 5 a., 5 v. 4 a., at 62/6 each.

**CELL TESTING VOLT-METERS**, moving coil, reading 3/0/3 volts by well-known makers, complete with test leads, 7/6 each.

**MAINS TRANSFORMERS**, 200/250 volts, input in steps of 10 volts, output 350/0/350 volts 300 m/amps. 4 volts 4 amp., 5 volts 4 amp., 6.3 volts 8 amp., 6.3 volts 8 amp., 62/6 each. Smoothing chokes 10 Henry 100 m/amps. 200 ohms D.C. resistance, 5/- each.

**MAINS VARIABLE SLIDER RESISTANCES**, protected type, by well-known makers, 450 ohms, 9 amps., 22/6 each; ditto, 1,500 ohms to carry 45 amps., 22/6 each, not protected, 0.4 ohms, to carry 25 amps., 10/- each; 14 ohms to carry 1/4 amps., 12/6 each.

**EX GOVERNMENT AUTO WOUND TRANSFORMERS** (as new), 1,000 watts output 115/230 volts or vice versa, £4/10/- each, carriage 5/-; another 1,000 watts from 5 to 230 volts with various tappings inclusive of 110, 150, 60, 90, etc., etc., all tapping at 1,000 watts, £5/10/- each, carriage paid.

**MAINS TRANSFORMERS**, input 200/250 volts in steps of 10 volts output 350/0/350 volts. 300 m/amps. 4 volt 8 amp., 4 volt 4 amp., 6.3 volts 6 amp., 3.6 volts 2 amp., tapped at 2 volts (electronic) at 57/6 each; another same input as above, output 500/350/0/350/500 volts 250 m/amps. 5 volts tapped at 4 volts 4 amps. twice, 6.3 volts tapped at 2 volts 2 amps., 67/6 each.

**EX NAVAL CATHODE RAY INDICATOR UNITS**, as new, containing loads or very useful components, condensers, resistances, transformers, chokes, etc., etc., weight 90lb. last few to clear, 25/- each, carriage paid.

**ALL GOODS SENT ON 7 DAYS' APPROVAL AGAINST CASH**, all letters answered. We regret we have no lists available at present. We would be pleased to quote

## MISCELLANEOUS

**A**UTOMATIC coil winding machine with reel carrier and wire tensioner, £35.—Box 5783.

**E**LECTRONICS, April, 1948, to March, 1950. £5/10.—Raymond, 306, London Rd., Slough, Bucks. 5830

**2**KVA "New Process" P2 spot welder, 440V a.c., good condition: £35.—Allen, 104, Vallance Rd., London, N.22. 5851

**T**RANSFORMER laminations No. 4 at 10 lb. delivery ex stock.—Charles F. Ward, Lordscroft Works, Haverhill, Suffolk. Tel. Haverhill 253. 5814

**C**OPPER wire for sale, 32 gauge E.D.W.S., 36/-; .0076 P.D.S.C., 31 gauge and 35 gauge E.D.W.S., as new.—App. Monitor Radio & Communications Co., Stechford, Birmingham, 9.

**A**.C. gen.: 230v 100w 50cs, 12v inpt, £4; H.M.V. a.c. record player, £6; 9ft dural TV masts, 1½in 14g, 15/-; quantity quotes; all goods carr. pd.—B.C.R. Television. Ltd., Horsham, Sussex. 5772

**E**NGRAVING, 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, enameled, perspex, dials; one knob or repetition equally entertained. 10034

**A**LLSCREWS, Ltd., for B.A. screws, nuts, washers, studding, grub-screws, bolts, soldering tags, woodscrews, etc., plain or nickel or cadmium plated.—Type-gross packets or large quantities, standard for lists.—270a, King St., Hammersmith, W.6. Riv. 7762. 5426

**E**X-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, 30/- each. Engraving hand sets, making and carriage England and Wales.—Weatherhead's, Bletchley, Bucks. 5793

**F**LUORESCENT lighting, 80 watt Ballast 210-240 a.c. wired with tube holders and glow starter lamp, tested, ready for use less 5ft tube, 42/6, carr. paid, purchase your tube locally, trade supplied, send for list.—Malden Transformer Supplies, Opposite G.P.O. George Street, Richmond, Surrey. 10038

**C**OPPER wires enamelled, tinned, Litz, cotton, silk covered, etc., BA screws, nuts, washers, soldering tags, eyelets, ebonite and laminated bakelite panels, tubes, coil formers; Tunol rod; headphones, flexes, etc.; latest radio publications, full range available; list, s.a.e.; trade supplied.—Post Radio Supplies 35 Bourne Gardens, London, E.4. 10138

**T**HE Spencer-West chassis set permits all types of chassis to be manufactured in a few minutes. No holes to drill. Holes of any diameter and irregularly shaped holes; squares, rectangles, transformer cut-outs can be punched. Expensive punch sets are not required and the tool is suitable both in price and performance for amateur constructors, small manufacturers, laboratories, etc. Illustrated leaflet on request. SPENCER-WEST, Quay Works, Gt. Yarmouth. 5833

**A**LUMI chassis, plain or punched, 8in x 4½in x 2in, four sided, 2/9 post paid; 9in x 7in x 2¼in, four sided, 3/9 post paid; 12in x 7in x 2¼in, four sided, 4/9 post paid; 12in x 9¼in x 2¼in, four sided, 5/6 post paid; 14in x 10in x 2¼in, four sided, 6/9 post paid; 16in x 9¼in x 2¼in, four sided, 7/9 post paid; 18in x 9in x 3in, four sided, 8/6 post paid; open ends with rear fixing flange, 8in x 4in x 2½in, 2/-; 9in x 6in x 2½in, 2/9; 10in x 7in x 2½in, 3/6; 12in x 6in x 2½in, 3/9; all post paid; valve holes, AE and E. P.U. sockets and 1in sq. 2½ holes, 3d; control spindle holes, etc., 2d; transformer cut-outs (any size), 6d; just send rough sketch and cash with order; s.a.e. please, enquiry.

**TAYLOR & TOY, Dog & Duck Ferry, Worcester. 5836**

## SITUATIONS VACANT

### LONDON COUNTY COUNCIL.

**SOUTH-east London Technical College.**—Applications are invited for the post of lecturer in radio communication to commence duties in September, 1950. Applicants should have a University Degree or the equivalent and have had industrial experience.

**SALARY** in accordance with the London Burnham Technical scale, which would be in the range of from £336—£15—£603 a year, plus graduate and training allowance where applicable. To a suitably qualified candidate an addition to the scale of up to £150 may be paid. Initial increments will be paid for suitable previous teaching and/or industrial experience.

**APPLICATION** forms may be obtained by forwarding a stamped addressed foolscap envelope to the Secretary, South-East London Technical College, Lewisham Way, S.E.4, and should be returned not later than fourteen days after the appearance of this notice. (1047). 5825

**S**ERVICE engineers, long established dealer looking for good men, Bromley.—Box 5792. 5750

**R**ADIO and television service engineer required; good pay, good prospects; S.W. London.—Box 5805. 5790

**T**ELEVISION engineers for East London districts; write, stating experience, salary required, driving ability, etc.—Box 4702. 5591

**F**REE lance service engineers required, P.A. and intercom equipment in all principal towns, generous remuneration.—Box 5769. 5744

**E**LECTRICAL wireman and assembler, production training experience essential; salary £6-7 according to experience.—Ring Mansion House 6744. 5768

**S**ENIOR electronic draughtsman required by large light engineering company in East London area.—Write giving age, experience and salary required, to Box 5787. 5742

# BARKER AUTUMN PROGRAMME

Our plans are simple. No major change in our speakers, and the release of a limited number of a very interesting new cabinet.

For those who want to enjoy the most satisfying season of NATURAL sound, and many more to follow, early action is really essential. Don't put it off until just before Xmas, or you may be left waiting. We stick to making the finest speakers for home use, limited in number because not mass produced. We get with our patent dual drive and patent graded cone a wider frequency range than any single and most twin speakers, PLUS the fundamental and exclusive drive feed-back effect, so vital for that beautifully smooth top and clean bass, that firm handling of transients, which are the hall marks of

## BARKER NATURAL SOUND

We offer you:

### BARKER 150

The supreme 12in. unit with 17,500 g. magnet, 40-15,000 cps, 15 ohms coil, weight 17 lb. price 18 gns. This is the connoisseurs speaker for use with the highest grade amplifiers and associated equipment.

### BARKER 148a

The well tried and favourite speaker for more general high quality use. 12in., 40-15,000 cps., 15 ohms, 9 lb., price 15 gns. The 148a has smaller magnet and a shade more upper middle, which many people like.

### BARKER 501

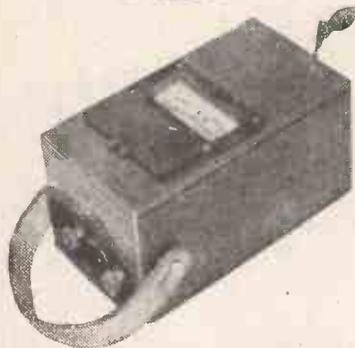
Several new ideas in cabinet design very pleasing to look at and hear. All round sound distribution just at armchair listening level, for corner or mid-wall positioning. Supplies strictly limited. Oak, walnut, polished or plain, at 24 gns. plus carriage.

Send a card now for details, to:

# BARKER NATURAL REPRODUCERS

BCM/AADU

LONDON, W.C.1.



The "MAJOR" Insulation Test Sets Outstanding in the famous "Record" family, this Test Set has a constant pressure generator of patent design. Ranges are available up to 500 volts 50 megohms, with or without continuity range of 0/30 ohms. Our engineers will be pleased to discuss your problems. Write for folder D/b.

**THE RECORD ELECTRICAL CO. LTD.**  
 BROADHEATH, ALTRINCHAM, CHESHIRE  
 Telephones: Altrincham 3221-2-3  
 Telegrams: 'Circscale', Altrincham  
 Cables: 'Circscale', Altrincham  
 23, VICTORIA STREET, LONDON, S.W.1  
 Telephones: ABhey 5148  
 Telegrams: 'Circscale', Soveast, London  
 Cables: 'Circscale', London

Improved 'High Fidelity'  
 Results. Obtainable at

### HOLLEY'S RADIO STORES

285, CAMBERWELL ROAD,  
 S.E.5 Phone RODNEY 4988

By the new MICROGROOVE  
 EQUIPMENT

DECCA L.P. UNITS & PICK-UPS  
 ACOUSTICAL new "QUAD"

special AMPLIFIER  
 LEAK AMPLIFIER PICK-UP and  
 TUNER

VORTEXION "STEREO-  
 PHONIC" & ACOS "GP20"  
 PICK-UP

WILLIAMSON AMPLIFIERS &  
 TUNERS by GOODSSELL

SOUND SALES "TONEMAS-  
 TER AMPLIFIER" & DX TUNERS

CORNER SPEAKERS by  
 WHARFEDALE, TANNON and  
 DECCA

GOODMANS "AXIOM," W. B.  
 "STENTORIAN" and BARKER  
 SPEAKER UNITS

ARMSTRONG R.F. 103/3 and  
 EXP 83/3 CHASSIS

TWO-SPEED ELECTRIC  
 MOTORS, also

BRIGGS new Edition of "SOUND  
 REPRODUCTION"

Demonstrations every evening  
 until 6 p.m. except Thursday.

### SITUATIONS VACANT CROWN AGENTS FOR THE COLONIES.

RADIO officer required by the East Africa High Commission for the Directorate of Civil Aviation for one tour of 48 months in the first instance. Commencing salary according to age and experience in scale £550 rising to £715 a year. Gratuity of 13½ per cent of total salary received is payable on satisfactory termination of contract. Outfit allowance £50. Free passages. Candidates under 40, should hold a First Class Air Operator's Licence and have had not less than 1,000 hours flying experience on civil aircraft. They should have had considerable experience in the operation of medium and high frequency radio stations. Experience in the operation of modern radio and/or radar navigational aids, and the day to day maintenance of modern radio equipment, and experience as a Signals Officer in Civil Aviation or the Services, would be an advantage. Apply at once by letter, stating age, full names in block letters, 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/25107(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. [5855]

ESTIMATOR required, accustomed to working on own initiative on production radio equipment; only experienced men need apply; S.W. London area.—Box 5238. [5668]

EXPERIENCED television service engineers required immediately North West London district, five-day week, good salary and prospects to suitable men.—Box 5875. [5826]

A MALGAMATED WIRELESS (AUSTRALASIA), Ltd., invite applications for positions in its Research Laboratories and Works, Sydney, Australia, in Electrical Engineering categories—

(1) SENIOR engineers and physicists with about 7 years' personal experience in research development or design work in telecommunications, followed by experience in the supervision of a small group engaged in such work; men with University degree in Electrical Engineering or Science, or Corporate Membership of I.E.E. preferred.

(2) ENGINEERS or physicists with about 3 years' personal experience in research development or design work in telecommunications; men with University degree in Electrical Engineering or Science, or Corporate Membership of I.E.E., preferred.

(3) RADIO engineers, City and Guilds standard or equivalent, with about 5 years' experience in the development and preparation of prototype models for the production of electronic equipment.

(4) VALVE production engineers with 3 to 5 years' experience in the production of (a) receiving valves and (b) power valves; this type of work will be in connection with the overall manufacturing phases in one or other of these categories.

APPLICATIONS, giving particulars of training, should be addressed to Box 5906. [5792]

MAN required for small radio transformer and coil-winding department, able to take charge, technical and practical experience essential; South London area.—Box 5809. [5812]

JUNIOR required to assist engineer in expanding firm of audio amplifier manufacturers, permanent post, excellent prospects.—Write, N. R. S., 16, King's College Rd., London, N.W.3.

ELECTRONICS.—Lab. assistant for interesting project, inter B.Sc. or equivalent, radio/electronic experience needed, S.W. London; write fully, age, experience, education, etc.—Box 5788.

GRADUATE engineers required for high-frequency cable testing.—Apply giving age, experience and salary required, to Ref. 423, Semens Brothers & Co., Ltd., Woolwich, S.E.18.

EXPERIENCED radio and television engineer required; permanent position, good wages; Edmonton and Tottenham district.—Apply Supreme Radio, Ltd., 26, Silver St., Edmonton, N.18. [5791]

RADIO-TELEVISION mechanics required; R must be C. & G. standard and able to drive.—Apply, with copies references, Wireless Instruments (Leeds), Ltd., 54-56, The Headrow, Leeds, 1. [5771]

EXPERIENCED design and development engineer required for audio and small power transformers.—Apply, giving full particulars and salary required, to Woden Transformer Co., Ltd., Moxley Rd., Birston, Staffs. [5760]

DRAZIN, Ltd., require a radio and television service engineer, (b) improver; good opportunity for skilled men keen on high-grade work.—Write, stating age and details of experience, 59, Heath St., Hampstead, N.W.3. [5801]

BERRY'S (SHORT WAVE), Ltd., have vacancies for counter sales staff, a senior and junior, engineers.—Applications should be in writing, and state past experience, age and salary required: 25, High Holborn, W.C.1. [5781]

THE BRITISH THOMSON-HOUSTON Co., Ltd., has a few vacancies on the design staff for electronic engineers experienced in development work on audio-frequency, radio-frequency, or radar display equipment, age 25-30.

QUALIFICATIONS: Hons. degree or equivalent in engineering, with subsequent experience in circuit development work; salary according to qualifications, age and experience.

APPLY, giving full particulars, to: Manager, Electronic Engineering Dept., The British Thomson-Houston Co., Ltd., Rugby. [5673]

DRAUGHTSMEN, senior, required in S.W. London district, experienced in electronic engineering, light mechanical design and knowledge of workshop practice an advantage.—Write, giving full details, past experience, age and salary required to Box 5247. [5896]

## THE BRITISH NATIONAL RADIO SCHOOL ESTD. 1940

NOW IN OUR ELEVENTH  
 YEAR AND STILL  
**NO B.N.R.S. STUDENT  
 HAS EVER FAILED**

To pass his examination(s) after completing our appropriate study course!  
**NOTHING SUCCEEDS LIKE SUCCESS**  
 and what we have done a thousand times already, for others, we can do again, for YOU!

A.M.I.E.E.,† A.M.Brit.I.R.E. and  
 CITY and GUILDS Radio and  
 Telecommunications Exams., etc., etc.

† in specially approved cases  
 Six months' trial period without obligation to continue.

Please mention this advt. and send for free booklet and sample lesson to:—

STUDIES DIRECTOR  
 BRITISH NATIONAL RADIO SCHOOL  
 66, ADDISCOMBE ROAD, CROYDON  
 Phone: Addiscombe 3341

# Amc

## TELEVISION

### F. V. D.

#### FULL VISION DRIVE TUNING SCALE

New 3 colour scale Copenhagen plan now available for immediate delivery.

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.

9in. C.R. TUBE SUPPORT for mounting on top of Gantry Assembly.

9in. CREAM MASKS.

5, SHAKESPEARE RD., FINCHLEY, N.3

Phone: FINchley 2188

STAND NO. 97



STAND NO. 97

MEET US AT  
**THE RADIO SHOW**  
CASTLE BROMWICH  
Birmingham Sept. 6-16

**MAINS TRANSFORMERS**  
(Postage Extra under £2)

As supplied by us to the Ministry of Supply, B.R.C. Education Authorities, Admiralty, etc. Interleaved and impregnated. Screened primaries tapped 200/250 v.

(Also built to your specification—prompt deliveries—quotation per "Return of Post.")

**DROP THROUGH TYPE. TOP SHROUDED**

(a) 250-0-250 v. 60 mA., 6.3 v. 3 a., 5 v. 2 a. ....	15/6
(b) 250-0-250 v. 60 mA., 4 v. 4 a., 4 v. 2 a. ....	15/6

Following types have Universal L.T. windings.

6.3-4-0 v. 4 a. C.T., 6-4-0 v. 2 a. ....	17/6
(c) 250-0-250 v. 80 mA. ....	17/6
(d) 320-0-320 v. 80 mA. ....	17/6
(e) 320-0-320 v. 100 mA. ....	19/6
(f) 300-0-300 v. 100 mA. ....	19/6
(g) 300-0-300 v. 100 mA. ....	19/6

**FULLY SHROUDED UPRIGHT TYPES**

(l) 350-0-350 v. 150 mA., 6.3 4.0 v. 6 a. C.T., 5-4-0 v. 3 a. ....	39/-
(m) 425-0-425 v. 180 mA., 6.3 v. 4 a. C.T., 6.3 v. 4 a. C.T., 6 v. 3 a. ....	42/6
(n) 425-0-425 v. 180 mA., 4 v. 8 a. C.T., 4 v. 4 a. C.T., 4 v. 4 a. ....	44/6
(o) 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/-

Note.—Model (l) above is suitable for Williamson Amplifier.

**Williamson Pre-Amp Mains Transformer**  
325-0-325 v. 20 mA., 6.3 v. 6 a., 6.3 v. 1.5 a. .... 19/6

**WILLIAMSON AMPLIFIER REPRINT**  
36-page booklet published by "Wireless World" ..... 3/6

**WILLIAMSON OUTPUT TRANSFORMER**  
Built to Author's specification 1/32  
secondaries. Approved type ..... £3 12 6

**WILLIAMSON SMOOTHING CHOKES**  
Choke No. 2 £1 2 6. Choke No. 1. 12/6  
PRE-AMP. CHOKES, 50H. 20 mA., 1.500Ω .. 15/6

**FEDER UNITS**  
High class radio feeder units with R.H. stage. Switched pick-up sockets. Glass scales. Completely aligned.

**MODEL A.** Covers 16/50, 100/0, 4 a and 900/2,000 metres. Price, including Purchase Tax ..... £10 8 6

**MODEL B DE LUXE.** Covers 45/145, 130/450, 900/2,000 metres and six ranges of band spread. Price, including Purchase Tax ..... £18 7 6

**MODEL E.** Model A, but with Variable Selectivity and infinite impedance detector. Price, including Purchase Tax £12 15 0

**"VIEW MASTER" TELEVISION RECEIVER**  
All as individual partstocked as well as complete kits CONSTRUCTOR'S ENVELOPE, containing full instructions, layouts, diagrams, etc., 5/-, post free.

**POLISHED ALUMINIUM CHASSIS, 16 S.W.G., 4 SIDES, 3 in. DEEP**  
10 1/2 x 6 in., 10 in. x 8 in., 8/6; 12 in. x 9 in., 10/6; 14 in. x 9 in., 16 in. x 8 in., 11/6; 20 in. x 8 in., 12/6

**EDDYSTONE SHORT-WAVE COMPONENTS**  
Full range stocked. Eddystone illustrated catalogue 6d

**SPECIAL OFFERS**

0005 2-gang T. Condensers	6 6
Coil Packs 3 W.B. Miniature	£1 9 6
485 K.C.I.F. Transformers, pair	12 6
T.M.C. 1 mfd. 7 Kv. Condensers, with clip	12 6

**INSTRUMENT WIRES**  
Comprehensive range in enamelled cotton and silk covered copper wires from 16 S.W.G. to 40 S.W.G.

500 V. A. Auto Transformers, 115/230 ..... £2 2 0

**PACKARD BELL PUSH-PULL PRE-AMPS.** In sealed cartons with accessories and two valves, 6SL7 and 25D7

**TRANSMITTING VALVES**  
807, 6/-; 805, 23/6; 813, 27/6; 6L6, 9/6; 6J6, 9/6.  
VCR97 C.R.T.s in maker's transit cases £1 12 6

Quantity discounts on Ex-Govt. Valves.

SEND NOW 6d. P.O. for 64-PAGE CATALOGUE

Terms C.W.O. or C.O.D.

**COULPHONE RADIO**  
"The Return of Post Mail Order Service"  
53 BURSCOUGH STREET  
ORMSKIRK, LANCS.  
Phone 987

**SITUATIONS VACANT**

**MINISTRY OF SUPPLY** invites applications from Physicists and Electronic Engineers for unestablished appointments in the Experimental Officer Class at Research and Development Establishments in and near London.

MAJORITY of qualifications: Higher Schools Certificate; applications also invited from candidates holding Higher National Certificate in light electrical engineering, including electronics or higher qualifications; experience in the following fields is desirable: electronic measurements in connection with field trials; radio and electronic circuitry; high-speed electrical transients; electronic development; general experimental research requiring some mathematical facility.

SALARY according to age, qualifications, experience, etc., within ranges: Experimental Officer (minimum age 28), £525-£675 (London), £495-£645 (Provincial), Assistant Experimental Officer, £230-£490 (London), £220-£460 (Provincial). Rates for women somewhat lower.

APPLICATION forms obtainable from Ministry of Labour and National Service, Technical and Scientific Register (R.K. York House, Kingsway, W.C.2 quoting A214/50A. Closing date, September 14, 1950. [5761

**INTERNATIONAL** company require radio mechanic for ground duties overseas, single candidates preferred with City & Guilds Certificate and experience airfield installations; inclusive salary approximately £475 to £630, free quarters, pensions fund.—Write Box 5786. [5741

**E. K. COLE, Ltd.**, have vacancies for testers at their Electronics Division: experience in the testing of radar, communications or electronic equipments, to electrical specifications essential.—Full details in writing to the Personnel Manager, Malmesbury, Wilts. [5805

**RADIO** testers for television; Midland manufacturers require men with experience of radio gear to train as testmen; testees, good rates of pay and opportunities for advancement.—Write, stating age and experience, to the Personnel Manager, Box 5801. [5782

**RADIO** and television testers and trouble shooters required by large manufacturer in East London area; applicants should have previous experience with manufacturer and adequate technical knowledge.—Please state age and full details of experience to Box 6119. [5853

**MINISTRY OF SUPPLY** invites applications from Physicists and Electronic Engineers for the following unestablished appointments in the grade of Principal Scientific Officer. (1) at London Headquarters, (2 & 3) at the Royal Aircraft Establishment, Farnborough, Hants.

1. **PHYSICIST** or Electrical Engineer for co-ordination, guidance, and control of research and development in one of the following fields: (a) Radio components: development of new components for new radio equipments and assessment of fundamental requirements to meet the equipment needs. (b) Radio navigation and radar: development and research to meet operational requirements for radar and radio navigation devices, aircraft approach and landing aids, etc. (c) Radio communications: development and research to meet operational requirements for communication systems (airborne and associated ground equipment), special test equipment, etc.

2. **PHYSICIST** for work on radar, display, digital and analogue computers, and radio and line communications equipment.

3. **PHYSICIST** for research and development in connection with electronic valves and cathode ray tubes. Candidates should be at least 31, and possess a good honours degree in physics or electrical engineering, with considerable experience, including research, in the appropriate field of work. Salary assessed on age, qualifications and experience within ranges £950-£1,250 (London), £910-£1,177 (Farnborough). Rates for women somewhat lower than for men. S.D. benefits. Application forms obtainable from Ministry of Labour and National Service, Technical and Scientific Register (R.K. York House, Kingsway, W.C.2 quoting A 215/50A. Closing date 14 September, 1950. [5767

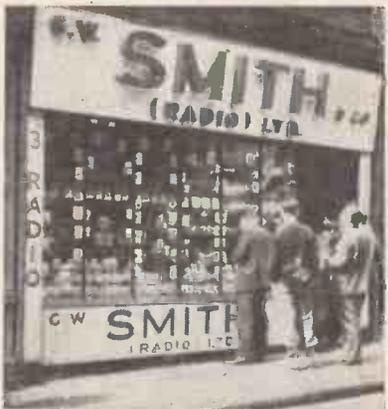
**ELECTRICAL** engineer required for technical duties in Australia with a firm of capacitor manufacturers; general experience in the manufacture of capacitors or research on dielectrics is desirable; good prospects for suitable applicant.—Reply, giving all pertinent information, to Box 5810. [5813

**RADIO RENTALS, Ltd.**, expanding business calls for expert wireless and television engineers in London area and Southern Counties; ownership of saloon car essential, excellent prospects.—Apply by letter only in the first instance to Service Manager, 33/41, Westbourne Grove, London, W.2. [6877

**ELECTRONIC** test engineer required, primarily for tests and experimental work on development projects and special products, salary £250-£500 p.a. according to ability and experience.—Apply in writing to All-Power Transformers, Ltd. (Instrument Department), Chertsey Road, Byfleet, Surrey. [5840

**CHIEF** engineer required to take charge of small laboratory at radio manufacturers in N.E. London; must have good technical ability in design of R.F. test equipment and radio components; write, giving full particulars of qualifications and experience, stating age and salary required.—Box 5069. [5649

**WANTED** for employment in various parts of the United Kingdom, personnel experienced in the maintenance and repair of radar and electrical fire control equipment, salary scale £380 p.a. rising to £495, good opportunities for advancement; applicants should furnish full details of age, practical experience, technical qualifications held and in which part of the U.K. they would like to be employed.—Replies should be addressed to D.D.M.E., H.Q., A.A. Command, Stanmore, Middlesex. [5843



**A WINDOW WORTH LOOKING INTO**

**Television.** Receivers Type 3585 complete with 45 mc/s. strip using 5 EF50's Diode and Cathode follower, together with a further 2 EA 50's, 1 EF 50, 4 SP 61's, 5VR 56, 3VR 55, 1 VR 3, 1 VR 54, also stacks of resistors condensers, 2 5,000 ohm relays and 2 1,000 ditto. These units are brand new in sealed cases and cost only £510/-.

**Television. I.F. strips** only. Ex the above Units, complete with 6 EF 50's, 1 EA 50, also brand new and unused, 62/6 each. Ditto less valves, £2. Limited number only.

**Television. Units** type 208a, 2 stage as above with 2 EF 50's, ideal as sound or vision units, 15/6 each.

**Television.** Brand New R 1355 Receivers, complete with valves as used in the "Inexpensive Television" suitable for London or Sutton Coldfield, 59/6 each.

**Television. Power Packs.** Ex-Admiralty. 230 volt 50 cycle input, output 2,500 volt 5 m/a. 350 x 350 volt 200 m/a. 6.3 volt 15 amps. Fully smoothed and supplied complete with all valves 92/6 each.

**Television.** Coils wound on lin. x jin. polystyrene with slugs single hole fixing. 6d. each.

**Television. Condensers, 1,000 pf. and 500 pf. midget moulded mica** 4d. each. High voltage types, 1,000 pf. moulded mica 5 kv., 1/3 each. 1,000 pf. ceramic, 9 kv. 1/3 each.

**Television. Diode Holders,** 3d. each. High Voltage Valve tops fully insulated, 6d. each. High voltage Sleeving 3d. per length. High voltage Cable 1/9, 12 yards.

**Television. High Voltage 1 mfd. Condensers,** oil filled Mansbridge type "Trouble Free", 1 mfd. 3kv. 2/- each. 1 mfd. 4kv. 3/- each. 1 mfd. 5kv. 3/3 each.

**Television. Iron cored slugs** for Aladdin formers, also for 1355 receivers, type 24, 25, 26, 27, U.H.F. units and 1155 receivers, 2d. each.

**Television, or 'Scope Transformers.** Input 230 volt, 50 cycle. Output 700 volt, 20 m/a. 4 volt 1 1/2 amp. twice with 5,000 volt insulation test ideal for voltage doubling. Ex-Admiralty brand new and boxed 17/6 each.

**Chokes. L.F. 200 m/a. 5 henry, D.C. resistance 100 ohm., 3/6 each. 40 ma. 25 henry resistance 1000 ohm, 4/6 each. 100 m/a. 1 henry 12 ohm resistance, 3/- each. 20 henry, 80 m/a. 350 ohm, 6/6 each.**

**25/73 Receivers,** brand new complete with valves, 22/6 each.

**Special Offer. 6 Mfd. 1000 volt Mansbridge condensers, 2/6 each. Belling Twin panel mounting fuse holders, 1/- each. Bias Condensers, 25 mfd, 50 volt 6d. each. Ceramic condensers, 3.3PF, 22PF, 33PF, 1d. each. 10K carbon pots 6d. each. 10K heavy Duty Wire—Wound pots 2/6 each. 3K Heavy duty Wire Wound pots 3/6 each.**

Open all day Saturday

**G. W. SMITH & CO.**  
(RADIO) LTD.  
3, LISLE STREET, LONDON, W.C.2  
Phone: GERrard 8204.

## SPECIAL BARGAINS

Govt. Surplus, Manufacturers' Surplus & Bankrupt Stocks.

We can offer for immediate delivery

Resistors 1/8, 1/4, 1/2, 1 & 3 Watt.  
ALL VALUES

16 Foot Sectional Aerial in Canvas Carrying Bag

Magnifying Lens.  
Rubber Mask.  
Burgoyne Solder Guns.  
Bakelite Accumulators. Ex Govt. S.W.  
Condensers. All Types.  
Meters.  
Switches. Toggle and Yakley.  
Headphones. L/R and H/R.  
Vibrators, 6 and 12V.  
Speakers. All Types.  
Volume Controls.  
Output Transformers.  
Chokes.

Receivers. R1155, I355 and I84 brand new in original cases. Dinghy Radio Transmitter SCR 578

Your enquiries are invited.

Wholesale and Export only

Please enquire for our 12-Page Bulletin.

## RADIO MERCHANDISE Co. Ltd.

65, Farringdon Road, London, E.C.1.

Telephone: Holborn 6377

The Voigt Loudspeaker is still ahead of all others. P.M. Unit with 22,000 line gap flux £40 ex works. Corner Horns (in the white) £19 10 0 or £47 10 0 ex works.

Home demonstrations arranged in London area.

Order from

VOIGT PATENTS LTD.,

Sydenham, S.E.26 Tel: Syd 6666

## 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  
FORMERS AND TUBES, ALL DIAMETERS.

Latest Radio Publications.

## THE CRYSTAL VALVE

as used in radar receivers.

These Crystal Valves or Diodes are not Government Surplus but brand new goods manufactured by one of the largest and most famous Radar Equipment Manufacturers in the country.

3/6 each, postage 2½d.

Protective Tube and Fixing Brackets, 3d. extra. Send stamped addressed envelope for comprehensive lists. Trade supplied.

## POST RADIO SUPPLIES

33, Bourne Gardens, London, E.4.  
Phone: Clissold 4688

## SITUATIONS VACANT

**E**XPERIENCED television and radio service engineer required; must have first-class knowledge and experience of radio, television and telecommunications; driving ability essential; only fully experienced men need apply.—Valance & Davison, Ltd., Service Department, 34-36, Dock St., Leeds, 10. [5775]

**T**ECHNICAL sales assistant (male) required for the communications and special products sales division of large, well-known radio manufacturer's export department; aged about 24 years; write, giving particulars of previous experience and salary required; good prospects; interesting work.—Box 5802. [5784]

**R**ADIO testers required for work on communication receivers of advanced design, capable of alignment, fault-finding and taking of all necessary measurements.—Write, stating age, experience and salary required, to Box No. 222, S. T. Garland Advertising Service, Ltd., 52, Mount St., London, W.1. [5759]

**R**ADIO television engineer, technically sound, first-rate repairer, directorship offered, car if possible, grand opportunity for right engineer with enterprise, able to take over and develop radar sub-contract and other engineering; small capital reqd., also another fair of keen as above, by well-known engineers.—Box 6120. [5854]

**R**ADIO Engineer required by manufacturer's service departments in North London area; applicants should give full details of education, which should not be below General Certificate standard, technical training and experience, age and salary required to Box 423, c/o Era Publicity, Ltd., 7, Fitzroy Square, London, W.1. [5798]

**A** NUMBER of senior and junior vacancies for radio, radar, electronic, television, etc., development service engineers, draughtsmen, wiremen, testers, inspectors, etc., urgently required 30 television service engineers.—Write in confidence, Technical Employment Agency, 179, Clapham Rd., S.W.9. (Brixton 5487). [10103]

**E**LECTRICAL inspectors of radio type constructors, education equipment and of television transmission equipment required, East London district; starting pay yielding £5 15s to £7 per 44 hours 5-day week according to experience and ability; good promotion prospects for capable men.—Write stating age and experience to Box 61 [5847]

**D**EVELOPMENT department of instrument making firm in London area requires graduate in physics or engineering with good communications experience, particularly in acoustics and electronics, including the design of amplifiers for outputs.—Write, stating age, experience and salary required, to Box 5796. [5770]

**D**EVELOPMENT engineer required for work on a wide range of electronic equipment; applicants must have Degree in electrical engineering (communications) or physics, and preferably some industrial experience.—Write stating qualifications and experience to Southern Instruments Ltd., Fernhill, Hawley, Camberley, Surrey. [5754]

**J**UNIOR engineers for development work in a wide range of electronic work excluding television and radio; applicants should have a good grasp of basic principles of electronic circuitry and some experience of similar work.—Write, stating age, experience and salary required to Cinema-Television Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26. [5844]

**D**RAGHTSMEN with electronic experience required for senior positions in the electronic drawing office of large manufacturer of radio communication and other electronic equipment, applicants should have several years' drawing office experience on similar equipment and a practical background.—Please state full details, including age and salary required, to Box 5878. [5927]

**R**ADIO and Television service engineers required in various parts of the country, particularly Coventry, Nottingham and Stratford-on-Avon; payment by salary, expenses and bonus; own transport an advantage; applicants must be keen, responsible and experienced engineers.—Apply in writing to Service Manager, Sobell Industries, Ltd., Langley Park, Slough, Bucks. [5809]

**T**HE DE HAVILLAND AIRCRAFT Co., Ltd., have vacancies for electrical draughtsmen, aircraft experience preferred but consideration will be given to those experienced in switchgear and associated component design who could readily adapt themselves to aircraft installation technique.—Apply in writing to Chief Draughtsman, The De Havilland Aircraft Co., Ltd., Hatfield Aerodrome, Herts. [5663]

**T**HE Plessey Company have vacancies in their development division, Ilford, for senior and junior electronic engineers with experience in servo-mechanism design; candidates should be British-born subjects and should possess a good honours degree in physics or electrical engineering.—Write with full details of age, experience and salary required to The Plessey Co., Ltd., Vicarage Lane, Ilford. [5842]

**P**HYSICISTS, with university degrees, preferably aged 21-28, are required for work in connection with (a) crystal valves, (b) wave guides, (c) microwave circuits, (d) high frequency heating; applications giving details of age, experience and qualifications should be sent to the Personnel Officer, (Ref. GE10), Research Laboratories of The General Electric Co., North Wembley, Middlesex. [5804]

**D**ECCA RADAR, Ltd., require a radar circuit engineer for research and development work on receivers; the position offers good opportunities to a man of sound training and experience who wishes to join a firm in which individual ability and energy will be appreciated.—Write only in first instance giving full details age, experience and salary required to REF. EF3, Decca Radar, Ltd., 1-3, Brixton Rd., S.W.9. [15759]

## "You can rely on us"

FOR CLEAN COMPONENTS AT COMPETITIVE PRICES

IMMEDIATE DISPATCH

## MIDGET COIL-PACKS

These are an ideal miniature Coil-Pack especially suited where space is limited. They consist of iron-cored miniature coils for both Aerial and Oscillator stages, built-in Wavechange switch and midget trimmers. They are intended for an I.F. of 465 Kc/s and I.F. Transformers type RS/GB 465 (12/6d. per pair) are the ideal companions for a trouble-free superhet.

### TYPE "R"

MW/LW/GRAM Ranges 200-550 metres, 300-2,000 metres.  
SIZE: Length 2½in. Width 1½in. Depth 1¼in.

### TYPE "S"

MW/SW/GRAM Ranges 200-550 metres, 17-50 metres.  
SIZE: As Type "R."

### TYPE "C"

LW/MW/SW Ranges 800-2,000 metres, 200-550 metres, 17-50 metres.  
SIZE: Length 3½in. Width 1½in. Depth 1¼in.

TYPE "R" and "S" each 25/-. TYPE "C" each 28/6. Post 6d.

All coils enclosed—All iron-core, cores adjustable. Completely wired, only five connections needed to external circuit.

Catalogue with Data, 3d.

## 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.

## \*"Globe-King" MARVEL IN MINIATURE (REGD.) 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" . . . wide testimonials British Isles and Abroad. Built and designed to precision standards, complete kit costs only 49/6d.—write today for descriptive catalogue.

JOHNSONS (SPECIALISTS) MACCLESFIELD CESHIRE (ENG)

## 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. Liverpool: 6, Chesham Place S.W.1. Kirkby Estate. SLOane 3463 SIMONSWOOD 3271/3

## YOUR METER DAMAGED ?



Repairs by skilled craftsmen to all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, Synchronous Clocks, etc. Quick deliveries—for speedy estimate send defective instrument by registered post to:

**L. GLASER**  
Electrical Instrument Repairers  
341 CITY ROAD, E.C.1.  
Tel. Terminus 2489

# NUSOUND PRODUCTS

136 WARDOUR ST., LONDON, W.1

Tel.: GERrad 8845

HOME BUILT TELEVISION AND AMPLIFIER SPECIALISTS

Full Mail Order Facilities (Add Postage)

Mon./Fri. 9-5.30 p.m. Sat., 9-1 p.m.

**A QUALITY TRF RADIO FEEDER UNIT.** The feeder unit is a 3-stage wide band TRF preset to the three main stations with single switch control and including a gram position. Using two B7G miniature valves and a diode output stage this makes a compact unit, size 7in-6in-2 1/2in. Cost, £6 10s. 8d. inc. Constructional booklet available. Price 1s. 8d. post free. Cost to build, approximately £3 10s. 0d.

**A PRESET S/HET RADIO FEEDER UNIT.** This is also a very compact unit designed for those who are beyond the range of the TRF. Choice of three programmes on the M.W. or L.W. bands. Single switch control and inc. gram position. Size 7in-6in-2 1/2in. Price £6 10s. 8d. inc.

**A 81-WATT QUALITY AMPLIFIER.** 6 valves, inc. matched 6V6 output—3 stages treble boost and bass boost—2-stage treble cut—20db neg. feedback—provision for radio feeder unit. A real Hi Fi amplifier at the reasonable price of 14 gns. complete.

**A 41-WATT QUALITY AMPLIFIER.** Despite its low cost this is a real quality instrument. Includes 3-stage neg. feedback, separate bass and treble boost controls, treble cut, pre-amp stage, provision radio feeder. Price, 10 gns. complete. Constructional booklet for A.C. or A.C./D.C. model, 1s. 8d. post free. Complete kit, 28.

(Please send stamp for leaflet on all our products.)

**GRAMOPHONE EQUIPMENT.** Connoisseurs' pickups: Standard, £3/10/-; Trans., 13/-; Lightweight, one head, £5/14/8; Trans., 15/-; Abre pickup, £4/3/-; special trans., 25/-; Acos GP20, 7/13; Goldring lightweight, 6/14. Garrard Plug-in Heads: Standard, 28/8; Miniature, 43/-; Hi Fi 72/4; Adapter, 4/6. We stock all the well-known makes of Speakers and quality components.

**NUSOUND TRANSFORMERS.** (Tapped pri. unless otherwise stated.)

A few selections from our wide range, and we can wind to your own spec, delivery 4 days. Estimates free. 350-0-350 v., 150 m/a., 6.3 v. 4 a., 5 v. 3 a., £2. 350-0-350 v., 100 m/a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, £1/8/3. 350-0-350 v. 75 m/a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, £1/1/9. 300-0-300 v., 60 m/a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, £1/0/3. 250-0-250 v., 60 m/a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, 18/9. 700 v. 10 m/a., 6.3 v. 1.5 a., 4 v. 1 a., 18/6. 250-0-500 10 m/a., 6.3 v. 9 a., 4 v. 1 a., 18/6. 6.3 v. 1 1/2 a. Heatertrans. 230 pri. only, 6/9. 4 v. 2 a. Heatertrans. 230 pri. only, 6/9. 6 v. 6 a. C.T. Heatertrans. 230 pri. only, 15/6. 6.3 v. 3 a. C.T. Heatertrans. 230 pri. only, 12/6. 12 v. 1 a. C.T. Heatertrans. 230 pri. only, 8/6.

**NUSOUND CHOKES.**  
CH4, 10 H., 150 ohms, 75 m/a., 4/6.  
CH5, 10 H., 300 ohms, 60 m/a., 4/6.  
CH10, 15 H., 250 ohms, 60 m/a., shrouded, 10/9  
CH8, 10 H., 300 ohms, 100 m/a., shrouded, 9/6.  
CH9, 10 H., 200 ohms, 150 m/a., shrouded, 12/9.  
CE2, 5 H., 80 ohms, 250 m/a., shrouded, 19/6.  
Our comprehensive list of TV—Radio and Gramophone equipment, etc., is now available. Price 4d. post free.

## SITUATIONS VACANT

**DRAUGHTSMAN** required in the development laboratory of large radio manufacturer in East London area; applicants should have practical background and some years' drawing office experience; a knowledge of wafer switches would be an advantage. Kindly state full details, including age and salary required, to Box 5798.

**DESIGNER** draughtsman required for a design and development laboratory; applicants must possess Higher National Certificate or equivalent qualifications, and have a practical experience of plastic moulds, small special purpose machinery, press tool work and general machine tool knowledge.—Apply, stating age, qualifications and experience, to the Employment Officer, Hoover, Ltd., Perivale, Greenford, Middx. [5737]

**APPLICATIONS** are invited for testers and selectors, preferably with experience of such work on multiquad cables, for the electrical testing department of a telecommunications cable factory in S.E. London; applicants must be prepared to participate in installation contracts abroad; suitable ages 19-30; salary according to age and experience.—Applications, giving qualifications and training, to be addressed to Box 5799.

**ELECTRONIC** engineers are required by a large aircraft company for experimental work on a new and interesting project; applicants, who should preferably be under 35 years of age, must have received technical education up to a degree standard and should be experienced either in G.H.F. design and measuring techniques or in instrumentation work.—Apply, stating age, experience, and salary required, to Box 5061 [5627]

**MURPHY RADIO, Ltd.** require a television service engineer for their Midland Service Depot in Wednesbury, Staffs; duties include answering technical queries and carrying out testing and fault-finding on television receivers; the successful applicant will be required to undergo a period of training in Murphy receivers in Welwyn Garden City.—Applications to Personnel Manager, Murphy Radio, Ltd., Welwyn Garden City, Herts. [5747]

**TELEVISION** service engineers are required by The English Electric Co., Ltd., for London and Birmingham areas; applicants should be qualified service engineers of several years' standing capable of installation, fault finding and maintenance of television receivers.—Write, giving details of age and previous experience, quoting reference 468 to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5764]

**APPLICATIONS** invited from technicians (max. age 29) for shore service at W/T stations overseas; technical and practical experience radio communications essential; applicants should possess either a P.M.G. or C. and G. Radio II Certificates; good salary and allowances; permanency after probation.—Apply in writing, giving full qualifications, experience, to Staff Manager, Cable & Wireless, Ltd., Electra House, Victoria Embankment, London, W.C.2. [5787]

**RADIO** Engineer with experience in technical sales work required by a large company in North London; applicants must have thorough knowledge of modern radio practice with some experience in the aviation field; since the work involves negotiating with all grades of personnel in Government Departments, and aviation companies, a university degree is desirable but not essential; applications will be treated in strict confidence, and must state full particulars of experience and salary required.—Box 5790. [5788]

**ATTRACTIVE** staff vacancies for draughtsmen exist at Chelmsford and in London with Marconi's Wireless Telegraph Co., Ltd.; continued expansion of the company's work calls for increased R.O. output and electrical or mechanical draughtsmen are invited to apply for these permanent staff positions on the design and development of radio and radar equipment.—Write, giving full details, quoting reference 142A, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5769]

**DECCA RADAR, Ltd.** require a senior engineer for work on new radar projects of an important and interesting nature; the position offers excellent opportunities to a man who can show proof of outstanding ability as a development engineer; applicant should have received a sound training in electrical engineering and have extensive experience in the development and design of complete radar systems.—Write only in first instance giving full details age, experience, and salary required, to REF. EF2, Decca Radar, Ltd., 1-3, Brixton Rd., S.W.9. [5738]

**CENTRAL MIDDLESEX HOSPITAL, Park Royal, N.W.10.**—Technician/Recordist, Electroencephalographic Department, applicants should be 22 years of age, with matriculation or equivalent examination, and possess some technical training in electronics and experience in servicing amplifiers. Previous electroencephalographic experience an asset but not essential. Salary on scales £370X£15 to £435 or £450X£20 to £530 (plus London Weighting) according to experience. Applications to Medical Director. Closing date two weeks after appearance of advertisement. [5828]

**ENGLISH ELECTRIC VALVE Co., Ltd.**, Chelmsford, require two junior engineers for radio wave work. Previous experience not necessary, but applicants must hold physics or engineering degree or exempting qualifications from Graduate I.E.E. Also senior engineer for work on Klystron and travelling wave tubes. Qualifications: Engineering or physics degree or exempting qualification from A.M.I.E.E. and several years' experience.—Write, giving full particulars, quoting reference 440A, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5680]

# L.R.S.

FOR

PROMPT & EFFICIENT SERVICE

CASH OR EASY TERMS

ARMSTRONG

ALL WAVE CHASSIS

(incl. speaker and output transformer)

Model EXP 83/3. Cash £18/17/1, or £5 with order and 10 monthly instalments of 30/-.  
Model RF 103/3. Cash £25/12/6, or £5/10/- with order and 11 mon. inst. of 40/-.

Model EXP 125/2. Cash £47/16/-, or £11/10/- with order and 10 mon. inst. of £4.

Model EXP 119 (less speaker). Cash £43/19/7, or £10 with order and 12 mon. inst. of 62/-.

We specialise in Armstrong Chassis. See our maker's advert. on page 75.

LEAK & GOODSSELL AMPLIFIERS AND TUNERS SUPPLIED ON EASY TERMS

LOUDSPEAKERS

Wharfedale W.12/CS 12in. less transf. Cash £43/10/-, or £4 with order and 6 mon. inst. of 20/-.

Goodmans, the new Axiom 150 (less trans.). Cash £8/8/-, or £2 with order and 7 mon. inst. of 20/-.

Other models supplied on similar terms, including Hartley Turner.

COLLARO

RECORD CHANGER

R.C. 500 with crystal pick-up. Cash £10/15/-, or £3/12/- with order and eight mon. inst. of £1. All other Collaro R.C. units and Record changers available on similar terms.

RADIOGRAM UNITS

A.C. 505 M.B. Cash price £7/5/3 or £2/2/- with order and six monthly inst. of £1.

Full particulars with leaflet of any of the above on request. Kindly enclose stamp.

We shall be able to supply much of the New Equipment shown at the National Radio Exhibition.

ON EASY TERMS

THE LONDON RADIO SUPPLY CO.

Est. 1925

BALCOMBE, SUSSEX

# MORSE CODE TRAINING



There are Candler Morse Code Courses for BEGINNERS AND OPERATORS

Send for this Free "BOOK OF FACTS" It gives full details concerning all Courses.

THE CANDLER SYSTEM CO. (Room 55W), 121 Kingsway, London, W.C.2  
Candler System Co., Denver, Colorado, U.S.A.

## TELEVISION

### CONSISTENT LONG DISTANCE RECEPTION

Two units designed and manufactured with great care to ensure the best results.

#### (1) The type AC/3 Pre-Amplifier.

A new Unit employing a most efficient circuit. Specification includes two triode valves to ensure low noise. Self contained noise filter and power supply unit. As used for demonstration purposes in securing 'low noise' amplification by Technical Schools and Colleges, etc. A trial will convince the most sceptical of its many advantages.

Full particulars, circuit, etc., on request.

#### (2) The type AC/4 Birmingham/London Converter Unit.

Permits correct reception of the Birmingham transmitter on a London type receiver. Birmingham is a single side band transmitter and thus a double converter arrangement is essential for correct reception. This refinement is incorporated in our Converter Unit.

Full particulars, etc., on request.

**SPENCER-WEST,  
QUAY WORKS, GT. YARMOUTH**

## Cutofeed SOLDERING IRON

Simple self-feed speeds up soldering. Better work. Saves solder. Write for leaflet 30J.



**RUNBAKEN-MANCHESTER 1**

## RADIO G200 OFFERS

100-156 Mc/s RADIO RECEIVERS. Type R28/ARC-5. Complete with 10 Valves and 4 Crystals. 4-717A, 3-125H7, 2-125L7, 1-12A6. Crystal controlled, motor tuned, as new 47/6. Post 1/6. Trade and Overseas enquiries invited.

**ARTHUR HOILE**

55 UNION ST. MAIDSTONE, KENT. Phone: 3155

100 kcs.  
QUARTZ  
CRYSTAL  
UNIT  
Type  
Q5/100



### for Secondary Frequency Standards

- ★ Accuracy better than 0.01%.
- ★ Temperature coefficient 2 parts in a million per degree Centigrade temperature change.
- ★ Gold electrodes applied by cathodic sputtering direct to the faces of the crystal, giving permanence of calibration.
- ★ Simple single valve circuit gives strong harmonics at 100 kcs. intervals up to 20 Mcs.
- ★ Octal based mount of compact dimensions. PRICE 45/- Post Free

Full details of the Q5/100 including circuit are contained in our leaflet Q1. Send stamp today for your copy.

### THE QUARTZ CRYSTAL Co., Ltd.

63-71 Kingston Road,  
NEW MALDEN, SURREY

Telephone: MALden 0334

### SITUATIONS VACANT

APPLICATIONS are invited for the position of technical design engineer in the F.H.P. motor laboratory at a large electrical engineering company in the West London area; experience of F.H.P. motor design and performance, and ability to accept full responsibility of a project from the initial design stage to factory production is essential; applicants should possess engineering degree or equivalent qualifications; salary in the £1,000 region of £1,000 per annum according to qualifications.—Apply giving details of age, education and job history to the Employment Officer, Hoover, Ltd., Perivale, Greenford, Middx. [5736]

MARCONI'S WIRELESS TELEGRAPH Co., Ltd., require staff for their modern development laboratories at Chelmsford, Essex, to undertake important development work on interesting radar projects; qualified electrical engineers and physicists, with experience of radar, are required at various levels; there is also scope for young men without experience, including those who possess the highest academic attainments; where necessary a period of training will be given at the Marconi College.—Please send full details, indicating present salary level, quoting Ref. 474, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5783]

A NUMBER of vacancies will arise this summer for draughtsmen at the Bradford works of the English Electric Company; this is due to further expansion, and stable employment under excellent conditions is offered to suitably experienced men; the new drawing office will be concerned with control gear for rolling mills and mining equipment to be manufactured at Bradford; applications are invited from switchgear and control gear draughtsmen; electrical and mechanical draughtsmen who have not had previous experience in this field but who have had sound electrical or mechanical D.O. experience will also be selected; junior or intermediate grade draughtsmen who wish to gain experience of this interesting electro-mechanical work are also invited to apply.—Write, giving full details, quoting reference 138, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1

B.C. invites applications from engineers or physicists of recognised professional standing for a post in the Television Section, Research Department, Kingswood Warren, Surrey. They must have sound knowledge of telecommunications theory and have had practical experience of modern television. Knowledge of up-to-date methods in colour television is essential and experience in the field of vacuum physics would be an advantage; the successful applicant would be required to show considerable initiative and take a leading part in research work in television especially that concerning high definition and colour; the work will include development of experimental monochrome and colour television apparatus and ancillary equipment; salary in grade with annual increments of £50 and maximum of £1,100 per annum.—Applications, stating age, qualifications and experience, to reach Engineering Establishment Officer, Broadcasting House, London, W.1, within seven days. [5860]

B.C. invites applications for three posts in research departments in the audio frequency, recording and acoustics sections respectively, present at Balham, London, later to be transferred to Kingswood, Surrey. Salaries in grade with annual increments £40, and max. £890 p.a. Applicants must possess a university degree in electrical engineering or physics, or equivalent qualification, and knowledge of music advantageous. Audio frequency section: Experience in electrical measurements is essential and knowledge of acoustic measurements highly desirable. The work includes research in microphones and loud speakers, and embraces all other aspects of audio frequency research and development; preference given to applicants with ability to guide development work in drawing office and workshops. Acoustics Section: Sound knowledge of physics and electronics is essential and applicants should have had experience in acoustics or an allied field. Duties consist of research on acoustic design of studios and involve investigation of acoustic properties of materials and structures. Recording Section: Duties will include research and development work on all aspects of sound recording; familiarity with low frequency electronic technique and design of light electrical mechanical equipment, and ability to organise development work in drawing office and workshops desirable. Applications, stating age, qualifications, details of past and present employment, and stating for which post application is made, should reach the Engineering Establishment Officer, Broadcasting House, London, W.1, within seven days of the appearance of this advertisement. [5797]

### SITUATIONS WANTED

RADIO engineer, Associate Brit. I.R.E., ten years' experience, seeks position in central or southern England.—Box 5803.

BUYER, 16 years' experience radio and television manufacturers, knowledge all departments seeks similar administrative position.—Box 5874. [5824]

GRADE I (A.M.) wireless operator (26), receiving speed 25 w.p.m., familiar with point to point and D/F workings, requires progressive post.—Box 5875. [5825]

DEVELOPMENT engineer requires responsible position in North England or Scotland; at present responsible for electrical and mechanical development of audio equipment for recording company of high repute; excellent references from present employers.—Box 5807. [5794]

## B. & H. RADIO EAST STREET, DARLINGTON

### BASS & TREBLE SEPARATOR

Enables the use of separate speakers for bass and treble. Permits adjustment of amount of treble relative to bass and also allows speakers of different impedance to be used. Kit of parts £1 9 6

### SCRATCH FILTERS

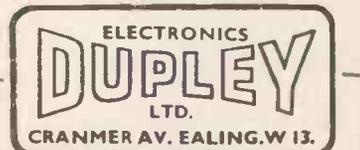
Give marked reduction of scratch level without serious effect on treble response. 15 0

### VARIABLE SELECTIVITY I.F. TRANSFORMERS. 465 k/c.

Give 3 degrees of selectivity. Per pair £1 0

### WHISTLE FILTER

Completely eliminates that annoying 9 k/c inter-station whistle. Easily inserted in speaker leads and suitable for any impedance 2 to 30 ohms. Gives a very sharp, narrow cut, guaranteed better than 40 db, with negligible insertion loss. £1 13 6



Transformer and Coil Manufacturers to the Trade  
Telephone: EALing 6698

BULLANCO. 66 QUEENS R? S.E.15 TEL. NEW CROSS 1092

**ALUMINIUM** SHEET EXPANDED TUBES; ANGLES, BARS, RODS, MOULDINGS, RIVETS

S.A.E. LIST ANY SIZES CUT OR FOLDED

## LYONS RADIO LTD.

RECEIVERS TYPE R132A. High grade 11 valve superhet. Frequency range 100 to 125 Mc/s. Fitted with precision slow-motion drive, tuning meter R.F. and L.F. gain controls etc. Convertible for 2 metre band reception. (Details in R.S.G.B. Bulln. Aug. 49), etc. For callers only, priced according to condition, with valves from 30/- and less valves from £1. Also some unused condition supplied in makers transit case. PRICE £4 19/6, carriage free.

AMERICAN I.F.T.'s TYPE B968. A useful piece of equipment fitted with 12 v. D.C. input motor gear, having an output of 450 v. D.C. at 60 mA. (These are easily convertible into an efficient AC/DC fractional H.P. motor). Contains 12 valves: 7 6BH7's, 2-6H6's and 3-719's, several relays, reduction gears, carbon pile voltage regulator etc. PRICE 29/6, carriage 4/6.

HAND GENERATOR Mk. 2. A manually operated generator, originally designed to provide the operating voltages for the American Trans./Recvr. types 38 Mk. 3, and 48 but of course suitable for a variety of purposes. Nominal ratings H.T. 102 v. D.C. at 60 mA. and L.T. 3.1 v. D.C. at 0.2A. Conditions in brand new and perfect, supplied with instruction book, size 5 1/2 x 5 1/2 in. PRICE 25/-, carriage 2/6.

R.F. UNITS, TYPE 27. A few more of these well-known converters in stock. Condition is good and they are complete with valves. PRICE 27/6. Post 1/6.

ORAMIO ROTARY SWITCHES. 4 wafers, each 2-pole 4-way. PRICE 4/6. Post free.

NEW ILLUSTRATED CATALOGUE of Govt. Surplus Bargains now ready 3d. in stamps please.

3, GOLDHAWK ROAD, (Dept. M.W.)  
SHEPHERDS BUSH, LONDON, W.12

Telephone: Shepherds Bush 1729

**THE MODERN BOOK CO.**

Testing Radio Sets. By J. H. Reyner 22s. 6d. Postage 9d.  
 The Radio Amateur's Handbook 1950 Edition. By A. R. R. L. 20s. Postage 9d.  
 Sound Reproduction. By G. A. Briggs. 10s. 6d. Postage 6d.  
 Reproduction of Records. By J. H. Brierley. 3s. 6d. Postage 2d.  
 Television Servicing. By Heller & Shulman. 47s. Postage 9d.  
 Recent Advances in Radio Receivers. By L. A. Moxon. 18s. Postage 6d.  
 The Theory and Design of Inductance Coils. By V. G. Welsby. 18s. Postage 9d.  
 Radio Valve Data—compiled by "Wireless World." 3s. 6d. Postage 3d.  
 Radio Servicing Equipment. By E. J. G. Lewis. 25s. Postage 9d.  
 Radio Engineering Handbook. Ed. Keith Henney. 85s. Postage 9d.  
 The Amplification and Distribution of Sound. By A. E. Greenlees. 16s. Postage 6d.  
 Television Explained. By W. E. Miller. 5s. Postage 4d.  
 Basic Mathematics for Radio Students. By F. M. Colebrook. 10s. 6d. Postage 4d.  
 Amateur Radio Receivers. By S. K. Lewer. 3s. 6d. Postage 2d.  
 Radio Handbook, 12th Edition. By Editors and Engineers. 25s. Postage 9d.  
 We have the finest selection of British and American radio books in the Country. Complete list on application.

**19-23 PRAED STREET**

(Dept. W.9)  
**LONDON W.2**  
 PADDINGTON, 4185

**DUKE & CO.**

RESISTORS, NEW. Assorted sizes and wattage, 25 3/-; 50 5/6; 100 10/-.  
 H.T. BATTERIES. 180v. tapped 90v., 21v. bias, 1 1/2 L.T. New, sealed case, tested, 5/6, plus 1/- post.  
 WALNUT CABINET EXTENSION SPEAKER, for 10in. speaker, metal grill, volume control position, 25/-. Short Wave 18 Set, superhet, with free headset, 17/6 (for medium wave change to P. coils.)  
 FURTHER SUPPLIES OF DUNLOPILLO SEATS, moquette covered, plywood backed, 12/6, plus 2/- post. DUNLOPILLO CUSHIONS, 34 x 15 x 3in. tapering to 2in. also 32 x 18 x 2in. flat, both types, 12/6, each post free.  
 GOOD SUPPLIES OF PLYWOOD, 2ft. x 3ft. x 3/16in., 3/6; 3ft. x 17in., 2/6.  
 WALKIE TALKIES. A few left at only 17/6. Only one valve (ATP) and switch (send-receive) short, set of drawings supplied with each one.  
 SPEAKERS. 2 1/2in. 10/- (special super midget transformer, 6/6); 5in. speaker 10/-; 5in. with trans., 12/6; 6in. 12/6; 6in. with trans., 15/6; 8in. 15/6; with trans., 18/-; 10in., 19/6; 12in., 35/6.  
 DOMESTIC RADIO KIT. In bakelite cabinet, 4 valve T.R.F., universal or A.C. only, for £4/15/6; or in ivory cabinet, 6/- extra. Assembled, 30/- extra.  
 CONDENSERS (electrolytic). 32+32, 450 v. 3/6; 16+16, 350v. 3/6; 8+8, 450v. 3/6; 8+8, 350 v. 2/6; single 8, 450v. 3/6; 8, 350v. 2/6; 16, 450v. 3/6.  
 SPEAKER. New in extension cabinet, only 14/6.

Cash with order, please, and allow sufficient to cover postage. Stamps ONLY for lists.

**219 ILFORD LANE, ILFORD, ESSEX. Ilford 0295**

**TECHNICAL TRAINING**  
 CITY & Guilds (Electrical, etc.), on "No Pass—No Fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 176-page handbook, free and post free.—B.I.E.T. (Dept. 388A), 17, Stratford Place, London, W.1. [0117]

**TUITION**  
**TELEVISION.**  
 The only school in Great Britain devoted solely to training in television.—Write, Principal, Gothic Television School, 13, North Avenue, London, W.13. [0051]  
 RADIO training.—P.M.G. exams and I.E.E. Diploma; prospectus free.—Technical College, Hull. [0111]

**CAREERS** in radio, television and electronics; write for free brochures giving details of 1 year, 2 year and 3 year day courses; E.M.I. INSTITUTES, Dept. W.W., 10, Pembroke Square, London, W.2. Bayswater 5131/2 (Associated with "His Master's Voice") [0001]

**WIRELESS** officer's attendance and "Radio-certs" postal course.—Apply Manager, The Wireless School, Manor Gdns., London, N.7.

**NOTHING** succeeds like success! What we have done a thousand times we can do again, for you.—See the B.N.R.S. Advt. on page 78. [6811]

**A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc.**, on "no pass—no fee" terms; over 95% successes. For details of exams and courses in all branches of engineering, building, etc., write for 176-page handbook—free.—B.I.E.T. (Dept. 387B), 17, Stratford Place, London, W.1. [0118]

**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 Telegraphy, Ltd., 179, Clapham Rd., London, S.W.8. 40 years experience in coaching students in wireless telegraphy and allied subjects. [0124]

**THE** Institute of Practical Radio Engineers have available home study courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade; enrolments limited, fees moderate.—The Syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End London, N.8. [0088]

**BUSINESSES FOR SALE AND WANTED**  
**M**AIL order radio supply service for sale, specialising in midget radio and radio service spares, large stock of valves and components available; price asked £100; please write for further particulars.—Box 5822

**A**N old-est. radio and electrical, Rochdale, a d.f. shop, excel. liv. acc., bathrm., large out-bldgs., P.Y. price for property, G.W. tools, plant, F. & F., £1,850; real opportunity for ambitious man; write—BM/AZG, London, W.C.1. [5732]

**FOR** domestic reasons, working director wishes dispose 51 per cent holding in limited company of flourishing North London radio retailers, fully furnished flat in modern block nearby if needed, £1,385 for quick sale.—Page, Moore & Page, 30, Ely Place, E.C.1. [5746]

**TELEVISION**, radio, cycles and electrical, real opportunity for T.V. enthusiast, shop with living accommodation in centre of busy town of 40,000, 40 miles Sutton Coldfield; Takings last year £11,000, audited accounts; 7 good agencies; long lease; rent and rates, £120 p.a.; £5,000; stock approx. £2,000.—Box 5808. [5796]

**BOOKS INSTRUCTIONS, ETC.**  
**B**ERNARDS Radio Publication. Send 1d stamp for catalogue now.  
**MASON & SON, Ltd.**, Wivenhoe, nr. Colchester, Essex. [0094]

**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. [0115]

**"RADIO Servicing"** by Abraham Marcus: a complete handbook which covers theory and practice and shows how to deal with all radio faults; write for free descriptive leaflet to—Allen & Unwin, 40 Museum St., London, W.C.1. [5786A]

**I.P.R.E.** Technical Publications; 5,000 alignment peaks for superheterodynes, 4/9 post free; The Practical Radio Engineer, quarterly publication of the Institute, sample copy 2/- post free; membership and examination data, 6/- post free.—Secretary, I.P.R.E., 20, Fairfield Rd., London, N.8. [0089]

**A. W. FELDMAN** (formerly A.W.F. Radio Products) announces a new comprehensive list of T.C.C. capacitors, Tungram valves, Eric resistors and volume controls A.W.F. Transformers for all needs, and hundreds of other lines to traders and service-men only; send for a copy now to—11, Park View Rd., Bradford, Tel. 41854. [5755]

**HOME** constructors interested in securing high-quality picture definition from their receivers will find publication Ref. A430/11 most useful. This circuit diagram gives details of a high-quality vision unit for use with existing ancillary equipment. Response level to 3mc/s with sharp cut off and corrected phase shift. The highest definition possible from 405 lines is secured. Circuit diagram available on request price 2/-.  
**SPENCER-WEST**, Quay Works, Gt. Yarmouth. [5832]

**SUPACOILS**  
**OFFER**  
 THE LATEST EDITION OF THE  
**HOME**  
**CONSTRUCTOR'S**  
**HANDBOOK**

No keen radio enthusiast should be without this invaluable booklet which is of equal use to beginner, amateur or professional radio engineer. It contains, among other things:—  
 ● Circuits of feeder units, superhet receivers, test equipment, amplifiers and power packs, etc.  
 ● Pages of servicing and constructional information which will assist you in YOUR radio problem.  
 ● Complete resistance colour code.  
 ● A considerable amount of invaluable general Radio information.  
 ● A comprehensive catalogue.  
 ● Above all it is profusely illustrated with half tone blocks and costs 1/6 only or a copy will be given FREE with every order for £1 or more.

We also offer the following selection from our stocks of quality components.

- **COILS.** A complete series of High Q variable iron dust cored coils in wave-lengths 10-30, 16-50, 30-75, 75-200, 190-550 and 800-2000 metres; Aerial, H.F. or Oscillator at the remarkable price of..... 3/- each
  - **MODEL 30** famous 3 waveband superhet Coil Packs, aligned..... 29/9 inc. Full connection details and instructions given with every pack.
  - **MODEL 40** Coil Packs—similar, with R.F. stage aligned..... 57/6 inc.
  - **MODEL 30 TUNING UNIT** consisting of 30 Coil Pack, pair of "M.M." I.F. Transformers, matched 2-gang and attractive Dial. Components aligned together as a unit and sealed..... 54/9 inc.
  - **MODEL 40 TUNING UNIT**, similar, with R.F. stage..... 86/3 inc.
  - **6 BAND COMMUNICATIONS** coil pack..... £8 11 10
- Or supplied with J.B. Caliband Drive which incorporates a dual pointer mechanical band-spread drive at..... £9 11 4
- **RECORD CHANGERS** and Micrograms by all leading manufacturers—we specially recommend the Plessey entirely automatic changer which plays mixed 10in. and 12in. records. Price 12 gns, plus £5/14/8 P.T.
  - **PICKUPS**, dial drives, chassis, loud-speakers, soldering equipment, valves and all components. Also a comprehensive range of instructional Books at reasonable prices.

**SUPACOILS MAIL ORDER OFFICE**  
 98, Greenway Ave., London, E.17

**CRYSTALS**  
 of OUTSTANDING QUALITY  
 TYPE "S"  
 Frequency range : 100 Kc/s to 15 Mc/s. Black bakelite case, 1 1/2" high, 1 1/8" wide, 3/4" thick, with two 1/4" diameter pins spaced 3/4" apart.



**BROOKES CRYSTALS**  
 10, Stockwell St., Greenwich, London, S.E.10  
 Phone : GREenwich 1828, Cables : Xtals London.  
 Grams : Xtals Green London.

## LABORATORY TEST EQUIPMENT

High Grade test equipment GUARANTEED equal in every way to the maker's specification. We offer only New or rebuilt instruments, recalibrated if and where necessary.

**WAVEMETERS** by R.C.A., Type TE.149. Frequency range 200 Kc/s. to 30 Mc/s., by harmonics. Directly calibrated dial from 2.5 to 5 Mc/s. Scale length 9 feet. Absolute accuracy 0.02 per cent. Crystal accuracy 0.005 per cent. Supplied with instruction book, spare valves and components in a well fitted transit case. Battery operated. NEW. £14.

**CONSTANT VOLTAGE TRANSFORMERS** by Advance. Type MT140 input 190-260 v. Output 230 v.  $\pm 1$  per cent at 150 W. Also MT161 as above, except that output is 60 W. These transformers are in new condition.

**TINSLEY GALVANOMETERS.** Complete with light source. Various sensitivities from  $\pm 2 - 7\mu A$ , in polished wood cases. Condition as new.

**BEAT FREQUENCY OSCILLATOR.** Type 195L by Marconi Instruments. Condition absolutely as new.

**UNIVERSAL IMPEDANCE BRIDGE.** Type TF373D by Marconi Instruments. Condition as new.

Also in stock we have valve voltmeters, wavemeters up to 1000 Mc/s. Precision attenuators, Signal generators type TF.144G, & TF.390F Oscilloscopes type Ultra Mk. II. Send for lists.

## HATFIELD INSTRUMENTS

175, UXBRIDGE RD., HANWELL, LONDON, W.7.

Telephone : EAL. 0779

## TO DEALERS

We can offer a limited number of Dealers a reliable and quick **RADIO & TELEVISION REPAIR SERVICE**

### REGO-FRASER

TELE-RADIO ENGINEERS

62, Hare Street, Woolwich, S.E.18

Tel. WOO. 1804

## WILCO ELECTRONICS

**RECEIVERS R.1132A.** Brand new, in perfect condition, range 100 to 124 mc/s, standard 19in. rack mounting, fitted tone control, manual and A.V.C., large calibrated slow motion dial tuning meter etc., a really first class receiver. Our price £4/19/6.

**POWER PACK, Type 3,** for above receiver. Brand new, in perfect condition, input switched 200 to 250 volts, A.C. 50 cycle, with two smoothing chokes, fitted D.C. voltmeter 0-300, milliampere meter 0-150, fuses, etc. A superb job. £4/19/6.

**SPECIAL OFFER.** For above receiver and pack, £8/17/6 the pair. Pack & cge. 10/-.

**WIRELESS FILM RECORDERS,** for 35 mm. film. With cutting head etc. Incorporating a 230 v. Mains motor, £20.

**TEST SET Type 205.** 5 to 3.5 centimetres with 9 valves including Magic eye. Klystron. 100 Microampmeter. Blower motor, etc., in good condition £20.

**TEST SET Type 28.** Incorporating a 50 Microamp. meter, in steel case 6in. x 3½in. x 3in. with carrying handle, 50/-.

**P.M. SPEAKERS.** 8in. Goodmans in wall case 21/-.

**CRYSTAL PICK-UP.** Rothermel Senior, 35/- each.

**TRIMMING TOOLS,** in Holder, 15/- set. **CUTTERS STYLII,** 6/- per doz.

204 LOWER ADDISCOMBE ROAD, CROYDON ADD. 2027

## HILL & CHURCHILL LTD.

BOOKSELLERS

SWANAGE : DORSET

Available from stock :

Fink " Radar Engineering " .....	59/6
Chaffee "Theory of Thermionic Vacuum Tubes" .....	55/6
Pierce "Electric Oscillations and Electric Waves" .....	33/-
King and others "Transmission Lines, Antennas and Wave Guides" .....	36/6
Zworykin and Morton "Television" .....	56/-
Glasgow "Principles of Radio Engineering" .....	42/6
Maloff and Epstein "Electron Optics in Television" .....	34/-
Lee "Electronic Transformers and Circuits" .....	36/-
Elven and others "Outline of Radio" .....	21/-
Yarwood "High Vacuum Technique" .....	12/6

(Postage extra)

CATALOGUE ON APPLICATION

## TRANSFORMERS, COILS, ETC.

TO ANY SPECIFICATION

LOW VOLTAGE LIGHTING A SPECIALITY

SPECIAL. 6.3 @ 7A. & 0-2-6.3 @ 2A, 24/6

CHO J. E. THORNER & SONS EST. 3849 3, DEAN AV., MANCHESTER, 16 1925

## LOCKWOOD

makers of

### Fine Cabinets

and woodwork of every description for the Radio and allied trades

LOCKWOOD & COMPANY

Lowlands Road, Harrow, Middlesex. Byron 3704

## SAMSONS SURPLUS STORES

**CRYSTAL LAPEL MIKES** 1½in. diameter, extremely sensitive. 12/6, post 9d.

**CO-AXIAL CABLE,** 30ft. lengths, complete with Pye female plug each end. 80 ohms. Brand new. 7/6, post 1/3.

**HEAVY DUTY AUTO TRANSFORMERS,** tapped at 110v., 150v., 190v., 230v., 1.6 K.V.A. £4/10/0. Carr. 5/-.

**L.T. TRANSFORMERS,** 6.3 v. 15 amps. 15/-, brand new. Post 1/6.

**AERIAL MASTS,** 36ft. R.A.F. Type 50. Complete kit consists of nine tubular sections 2in. diameter, set of pickets. Box plate, guy and all fittings. Brand new in canvas carrying bag. £3/15/0. Carr. 7/6.

**BRAND NEW TRANS-RECEIVERS.** Type 58. Freq. range 33-50 metres, complete with 'phones, mike, power supply unit, spare valves, and instrn. book. £17/10/0. Carr. 5/-.

**BRAND NEW 12 V. VIBRATOR PACKS,** Completely smoothed and rectified, output 210v. D.C. 70 m/a. 19/6, post 1/6.

**"NIFE" ALKALI BATTERIES.** 2.5v./2v., 10 A.H. As new, made by Britannia Batteries, Ltd., 12/6, post 1/-.

**HEAVY DUTY SLIDE REGISTER.** 152 ohms 2 amps. Twin coils with wheel control. Brand new, 32/6, post 1/6.

169/171 Edgware Road, London, W2. Pad 7851

125 Tottenham Court Rd., W.1. Eus 4982

All orders and enquiries to our Edgware Road branch, please.

## 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., 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, W1



## TESTSCOPE Mains Tester

For high & low voltage testing:—

1/30 & 100/850 volts A.C. or D.C. Write for interesting leaflet 30F.



RUNBAKEN · MANCHESTER I

## U.H.F.

### TRANSMITTER-RECEIVER

Of Special Interest to all enthusiasts on 420 Mc/s.

We have been fortunate to obtain a very limited number of complete Transmitter-Receiver, type RT-3A/ARN-1. These consist of an F.M. Transmitter and Receiver (a total of 13 valves are included) each containing a built-in Power Pack for direct operation from a 24-volt supply. Black Crackle Cases, slightly store soiled.

SPECIAL PRICE, 79/6.

Carriage and Packing Paid Send S.A.E. to-day for our Special Summer Clearance list which includes valves.

WALTON'S WIRELESS STORES 203, STAVELEY ROAD WOLVERHAMPTON

# Condenser leadership —from the inside!

I am Mr. Quest—my task is to ensure that the materials stand up to their jobs, and—by constant experiment—to improve both materials and methods.



Solid foil and paper : non-inductive assembly

Non-hygroscopic processing for high performance

Hermetic sealing by rubber bung : max. creepage path

Rigid outer aluminium casing

Vice-like grip of bung on wire prevents disconnections



I am Mr. Test—my eagle eye makes certain that every condenser maintains the T.C.C. reputation for high quality, faultless performance and long life.

The 'Metalmite' construction shown here is a typical example of T.C.C. design : it has set a new standard both for compactness and ability to withstand extreme tropical conditions. Details of any T.C.C. range are available on request.



## “METALMITE” TUBULAR PAPER CONDENSERS

THE TELEGRAPH CONDENSER CO. LTD · RADIO DIVISION · LONDON · W.3 · Tel : ACORN 0061 (9 lines)



*The Finest Cored Solder in the World*

AGAIN AT THE NATIONAL RADIO EXHIBITION

# Ersin Multicore Solder

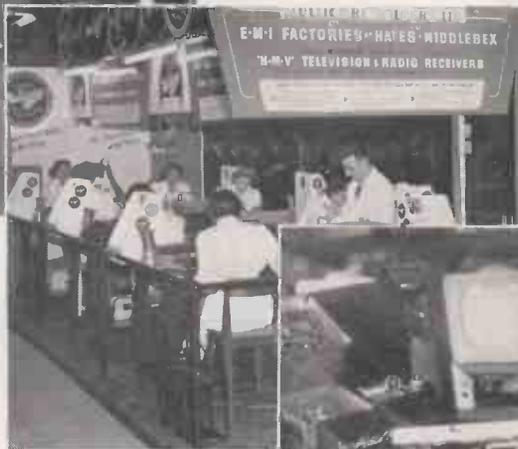


**1947 BUSH**—At Radiolympia, 1947, 38,500 Ersin Multicore soldered joints were made by Bush operatives in the assembly of radio sets on the Ersin Multicore stand.

(Below)—7 lb. reels supplied to Manufacturers, prices upon application.

(On right)—Size 1 carton for Service Engineers & Workshops

Once again, we will be the only solder manufacturers supporting the National Radio and Television Show. In 1947, we displayed a typical Bush Radio assembly line, in 1949, a model E.M.I. Factory, and in 1950 we are very happy to announce that G.E.C. have agreed to co-operate with us at Birmingham in once again providing a very interesting insight into modern Radio and Television manufacture.



**1949 E.M.I.-H.M.V.**—

Visitors at one of the Ersin Multicore Stands at the 1949 Radiolympia saw the precision soldering of R.F. units of 'H.M.V.' television receivers by operatives from E.M.I. Factories Ltd.



**1950 G.E.C.**—Ersin Multicore Solder being used in the assembly of the main deck of the new G.E.C. Table Television Receiver No. BT. 2147.



SIZE 1 CARTONS—  
5/- RETAIL

Catalogue Ref. No.	Alloy Tin/Lead	S.W.G.	Approx. Length per carton
C16014	60/40	14	26 feet
C16018	60/40	18	60 feet
C14013	40/60	13	22 feet
C14016	40/60	16	42 feet

Leading manufacturers in all parts of the world know that the efficiency of their equipment depends on the quality of the solder they use—that is why they use only Ersin Multicore, the Finest Cored Solder in the World.



MEET US AT  
**THE RADIO SHOW**  
CASTLE BROMWICH  
Birmingham Sept. 6-16

**MULTICORE SOLDERS LTD.**

MELLIER HOUSE, ALBEMARLE ST., LONDON, W.1 • REGent 1411

**STAND  
NO 86**