

MAY 1955

TWO SHILLINGS

Wireless World

Radio · Electronics · Television

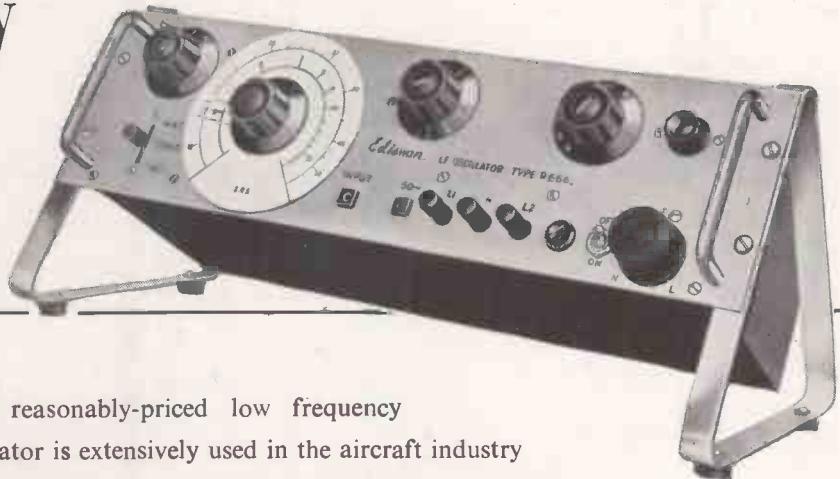


FORTY-FIFTH YEAR OF PUBLICATION

This low frequency oscillator costs only

£75

(Bench stands 1 gn. extra)



This reasonably-priced low frequency oscillator is extensively used in the aircraft industry and elsewhere as a convenient source of signals down to 1.15 c.p.s. for the testing and calibration of vibration recorders, servo systems etc. It is also widely used in medical research and clinical work for the calibration of biological amplifiers and recorders, and low frequency wave analysers.

Brief Specification:

TYPE	FREQUENCY RANGE	OUTPUT	INPUT	CONSTRUCTION
Resistance capacity, with automatic amplitude control effective over the whole frequency range.	1.15 c.p.s. to 5,500 c.p.s.	Sine wave 50 volts peak to peak push-pull, with built-in attenuator.	200-250 volts, 40-60 c.p.s.	Standard 19" rack mounting, but also suitable for bench use. Bench stands available.

NOTES. An incremental switch is fitted. Provision is made for mixing other signals with the output.

**Immediate delivery from
EDISWAN**

RADIO DIVISION · THE EDISON SWAN ELECTRIC COMPANY LIMITED

Member of the A.E.I. Group of Companies

155 Charing Cross Road, London, W.C.2. Telephone: Gerrard 8660. Telegrams: Ediswan, Wescent, London

SP 130

Wireless World

RADIO, ELECTRONICS, TELEVISION

Managing Editor:

HUGH S. POCOCK, M.I.E.E.

Editor:

H. F. SMITH

MAY 1955

In This Issue

Editorial Comment	201
Twin-Channel Tape Records	202
Books Received	202
Mobile Radio	203
World of Wireless	204
Sources of Interference	207
Wide Range Electrostatic Loudspeakers. By P. J. Walker	208
Short-wave Conditions	211
Air Traffic Control at London Airport	212
Letters to the Editor	213
Open Letter to the Postmaster General. By C. I. Orr-Ewing	215
Design for an F.M. Tuner—2. By S. W. Amos and G. G. Johnstone	216
Design for a 20-watt High Quality Amplifier. By W. A. Ferguson	223
V.H.F. and U.H.F. Reception. By J. A. Saxton and J. A. Lane	229
"Needles for Talking Machines." By S. Kelly	233
More Distortion. By "Cathode Ray"	239
Airfield Radar Developments	243
Manufacturers' Products	244
The Ratio Detector. By M. R. Murray	245
Northern Radio Show	247
May Meetings	247
Random Radiations. By "Diallist"	248
Unbiased. By "Free Grid"	250

VOLUME 61 NO. 5

PRICE: TWO SHILLINGS

FORTY-FIFTH YEAR
OF PUBLICATION



VALVES, TUBES & CIRCUITS

29. EF89 & UF89: IMPROVEMENTS IN I.F. AMPLIFIERS FOR F.M./A.M. RECEIVERS

PRELIMINARY DATA : EF89

I.F. amplifiers for f.m. reception are normally 'neutralised' in order (i) to achieve satisfactory stability and (ii) to minimise the effects of capacitive feedback from anode to signal grid in producing phase distortion and distortion of the bandpass curve. An i.f. voltage is led back on to the screen grid through a neutralising capacitor, and passes through the interelectrode capacity C_{g1-g2} to the signal grid; there it cancels out the voltage passed through the capacity C_{a-g1} , the two voltages being of equal magnitude and opposite phase. The neutralising capacitor forms the fourth arm of a bridge network, and its value is chosen to balance the bridge. Unfortunately a bridge which has been balanced for f.m. reception may not remain balanced during a.m. operation.

The Mullard EF89 is a medium slope variable-mu pentode whose introduction will tend to make neutralising requirements less critical. Unneutralised r.f. and i.f. circuits can be considered under some conditions where previously neutralising would have been required.

The maximum amplification realised with the EF89 is higher than that obtained with previously available valves such as the EF41. An indication of the maximum amplification obtainable from an r.f. and i.f. pentode is given by a quality factor defined as the ratio of slope to anode-to-grid capacitance. When designing the EF89, the small anode-to-grid capacitance of the EF41 ($C_{a-g1} < 0.002 \text{ pF}$) was used as a starting point, and the design of the EF41 modified to produce the highest practicable slope without increasing the capacitance.

Under normal operating conditions, with a 9mA anode current, the slope is 3.5mA/V for a grid bias of -2.0V.

For f.m. reception the first stage of i.f. amplification is provided by the heptode section of the ECH81 (which during a.m. reception functions as a conventional triode heptode frequency changer). The second i.f. amplifier will be the EF89, feeding into the ratio detector (diodes a''d and a'''a of the EABC80).

The EF89 has been so designed that when it follows the ECH81 connected as the a.m. frequency changer, the a.g.c. voltage can be applied to both valves if desired. (Normally of course a.g.c. is not necessary for f.m. reception.) At high input signals overcontrolling does not occur, that is, an increase in signal strength does not lead to a decrease in output, and the distortion associated with overcontrolling is avoided. The cut-off characteristics of the EF89 and ECH81 mixer heptode are so matched that, when the grid voltage is changed from -2V to -16.5V, the slope of the EF89 falls to one-tenth of its original value whilst the slope of the ECH81 heptode falls to one-twentyfourth. The cross-modulation curve is better than for the EF41, and the a.g.c. voltage therefore can be allowed to take the slope down to a small value without appreciable distortion.

The EF89 may be used also as a variable-mu r.f. amplifier. The screen grid is brought out to its own pin connection (No. 8), and the internal screening is connected to two separate pins (Nos. 1 and 6). These connections are very helpful in the design of r.f. (and, for that matter, i.f.) amplifiers, in that no additional damping is introduced by earthing the suppressor grid and screening. The suppressor grid connection to the chassis should have the lowest possible resistance ($R_{g3} \text{ max} = 10\text{k}\Omega$).

The UF89 is rated at 12.6V, 100mA and is intended for d.c./a.c. mains receivers. In all other respects it is identical with the EF89 (6.3V, 200mA), and the same operating conditions apply to the E- and U-versions.

HEATER

V_h	6.3	V
I_h	200	mA

CAPACITANCES

C_{in}	5.5	pF
C_{out}	5.1	pF
C_{a-g1}	<0.002	pF
C_{g1-h}	0.05	pF

CHARACTERISTICS

V_a	250	V
V_{g3}	0	V
V_{g2}	100	V
V_{g1}	-2.0	V
I_a	9.0	mA
I_{g2}	3.0	mA
g_m	3.6	mA/V
r_a	1.0	MΩ

TYPICAL OPERATING CONDITIONS

$V_a = V_b$	250	V
V_{g3}	0	V
R_{g2}	51	kΩ
R_k	160	Ω
I_a	9.0	mA
I_{g2}	3.0	mA
g_m	3.5	mA/V
r_a	1.0	MΩ
R_{eq}	4.2	kΩ
$g_m (V_{g1} = -20V)$	240	μA/V

LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.25	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
P_{g2} max.	0.45	W
I_k max.	16.5	mA
R_{g1-k} max.	3.0	MΩ
V_{h-k} max.	100	V

BASE

Pin:	1	2	3	4	5	6	7	8	9
	s	g ₁	k	h	h	s	a	g ₂	g ₃



Reprints of this advertisement and additional information may be obtained free of charge from

Wireless World

MAY 1955

VOL. 61 No. 5

Ineffective Regulation

ACCORDING to the summary given on p. 207 of this issue the G.P.O. has found that electric motors are now responsible for just about as much interference with broadcast reception as all other devices put together.

This being so, it is to be regretted that the Postmaster General's recently assumed powers to control interference from electric motors are unlikely to have the fullest possible effect in abating the trouble. The issue of the Regulation giving these powers, which comes into force on September 1st, was reported on p. 155 of our April issue. Briefly, all users of motors will be required to keep radiated and conducted interference within specified limits on the bands of frequencies used for television Band I and for medium- and long-wave sound broadcasting.

It must be admitted that, on the face of it, this new Regulation might be considered likely to have the desired effect. But its launching was followed by a Press statement (to which publicity was unfortunately given in the newspapers) which, we fear, will weaken the Regulation. "The new powers," said the statement, "will be used only where it is necessary for the Post Office to insist on an appliance being put right because it causes interference and the owner will not voluntarily have a suppressor fitted." That will be taken by the public to mean, "Don't go to the trouble and expense of fitting a suppressor to your motor-driven device until your neighbours complain to the Post Office."

Cloak of Security

IN drawing attention to the unsatisfactory system for controlling and administering radio matters in this country, we believe this journal is expressing opinions that are widely held among wireless people. It is encouraging to find our views are now given support by two members of Parliament. In the last issue there was a letter from Capt. L. P. S. Orr on the problems of frequency allocation and this month C. I. Orr-Ewing writes an "Open Letter to the Postmaster General," sketching in the framework for a new kind of communications commission which he proposes for regulating our affairs.

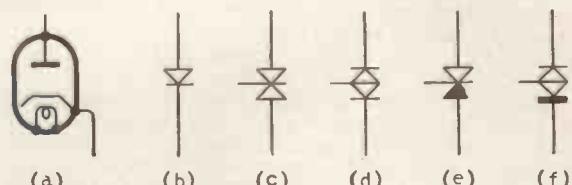
Both these legislators refer to the Defence Services in relation to frequency allocation. Possibly they feel as we do that the Services tend to get more than their necessary and proper share of the cake. Capt. Orr specifically refuses to accept the proposition that "security considerations" can automatically be accepted as a valid reason for making other than the most economical use of communication channels.

"Security" is a sadly abused word, and we would hazard a guess that its excessive use is responsible for many of the difficulties that arise in adjudicating between conflicting demands for channels between civil and military interests. Security-consciousness is infectious, too, and the word is used in relation to matters that in fact might be disclosed to anybody. Not long ago *Wireless World* was refused a list of the frequencies used for the v.h.f. section of the British Forces broadcasting network in Germany!

Transistor Symbols

IT is regretted that the diagram in the Editorial Comment of our April issue was incomplete; section (f) was cut off in making the printing block.

The full diagram is reproduced here. At (a) is shown the normal valve rectifier symbol and at (b) the conventional semi-conductor rectifier on which *Wireless World* suggests that transistor symbols may rationally and usefully be based. Diagrams (c) and (d) represent, respectively, the *p-n-p* and *n-p-n* transistor according to this system, and are similar to those



originally suggested by the Canadian Defence Research Establishment.

Finally, the modified symbols (e) and (f) for *p-n-p* and *n-p-n* junction transistors are suggested by *Wireless World* to simplify the reading of circuit diagrams by facilitating identification of the emitter element, which is thickened or blacked-in.

Twin-Channel Tape Records

H.M.V. Demonstrate "Stereosonic" System

IN addition to the single-channel high-quality tape records which were introduced by the Gramophone Company last year, twin-channel tape records are to be issued in the early autumn. Complementary recordings will be made simultaneously on parallel tracks at a speed of 7½ in/sec on a ½-in wide tape. Separate amplifiers and loudspeakers will be necessary to reproduce the two magnetic records and to establish a sound field in which it is possible to distinguish individual sources of sound when the originals were separated in space.

The system is termed "Stereosonic," which implies a difference from the conventional method of stereophonic recording and reproduction, in which omnidirectional pressure microphones are spaced some distance apart in the recording studio and more-or-less omni-directional loudspeakers are sited in similar relative positions in the auditorium. In the H.M.V. system the sound is analysed at a single point by a twin-ribbon microphone, the directional axes of which are fixed at right angles. Since there is no appreciable phase difference at the pick-up point, the outputs from the

two channels differ primarily in amplitude and also in the ratio of direct to reverberant sound. The spacing of the twin reproducing loudspeakers is not important, but they should be arranged with their axes more or less at right-angles (60° to 90° is recommended). These conditions can be met in a living room of any size with the reproducers in adjacent corners.

Best results are obtained at the junction of the loudspeaker axes, where the "wall-eyed outlook" of the special microphone is exactly compensated by the "squint" of the loudspeakers, but the "Stereosonic" effect covers a much wider area, as was evident at the inaugural demonstration given at the Abbey Road studios of the Gramophone Company. Most effective items in a varied programme were excerpts from operas in which orchestras, soloists and chorus were well spaced. But it was noticeable also, that piano reproduction had a subtle "live" quality which is not often present in single channel reproduction. The demonstrations also supported the claim that, with this method of partitioning the sound field, directional effects are sustained at much lower frequencies than in the spaced pressure microphone technique.

A "Stereosonic" reproducer for use with these tape records will be available in the autumn and will consist of two cabinets, each with elliptical moving coil units for medium and low frequencies, and electrostatic "tweeters" for 6 kc/s and above. Ten-watt power amplifiers will be housed in each cabinet and one cabinet will carry the tape mechanism and two pre-amplifiers, while the other will be fitted with a three-speed automatic disc record changer. A three-position switch will give the choice of "Stereosonic" reproduction, or single-channel through one or both loudspeakers. In addition to volume, bass and treble tone controls there will also be a balance control to give a shift of the virtual sound image between the speakers and to compensate where necessary for the acoustic characteristics of the listening room.

BOOKS RECEIVED

Department of Scientific and Industrial Research. Report for the Year 1953-54. Includes a summary of the work of the Radio Research Organisation which has covered investigations into the phase changes in low-frequency waves at a coastline, propagation at h.f., v.h.f. and u.h.f., the nature and distribution of atmospheric noise, and the use of the noise spectra of semi-conductor junctions to provide information about the physical processes involved. Pp. 326. Price 9s. Her Majesty's Stationery Office.

Schaltungstheorie und Messtechnik des Dezimeter-und Zentimeter-wellengebietes, by Albert Weissflog. Text-book of circuit theory and measurement technique in the decimetre and centimetre ranges. Pp. 308; Figs. 282. Price 33.50 Swiss francs. Verlag Birkhäuser, Basle, Switzerland.

Electric Transmission and Distribution. Edited by B. G. A. Skrotzki. Theory and practice of power supply and the equipment used in distribution systems; contributed by leading American professional engineers. Pp. 448; Figs. 292. Price 56s 6d. McGraw Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4.

Electric System Operation. Edited by G. B. A. Skrotzki. Symposium on fault protective device, load control and dispatching, and power supply economics. Pp. 370; Figs. 277. Price 49s. McGraw Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4.

Single Sideband for the Radio Amateur. Digest of articles from *QST* covering design of transmitters and

receivers. Pp. 208; Figs. 166. Published by the American Radio Relay League. Obtainable from The Modern Book Company, 19-23, Praed Street, London, W.2. Price 14s 6d by post.

Remote Control by Radio, by A. H. Briunsma. Description of an amplitude-modulation system with two independent channels, and an eight-channel pulse-modulation system, as used in the Philips radio-controlled model ships. The text includes complete circuit diagrams with component values. Pp. 97+VIII; Figs. 74. Price 8s 6d. Cleaver Hume Press, Ltd., 31, Wrights Lane, London, W.8.

Television Principles and Practice, by F. J. Camm. Description in simple terms of the technical basis of television transmission and reception, including hints on choosing a receiver, a summary of the Beveridge report and a dictionary of television terms. Pp. 215; Figs. 144. Price 25s. George Newnes, Ltd., Southampton Street, London, W.C.2.

Licence Manual for Radio Operators, by J. Richard Johnson. Model answers to questions likely to be asked in the Federal Communications Commission examinations for American commercial radio operators. Appendices give source references for questions relating to law, common communications abbreviations (including the Q code) and a bibliography. Pp. 430; Figs. 140. Price \$5.00. Rinehart & Company, 232, Madison Avenue, New York, 16.

Mobile Radio

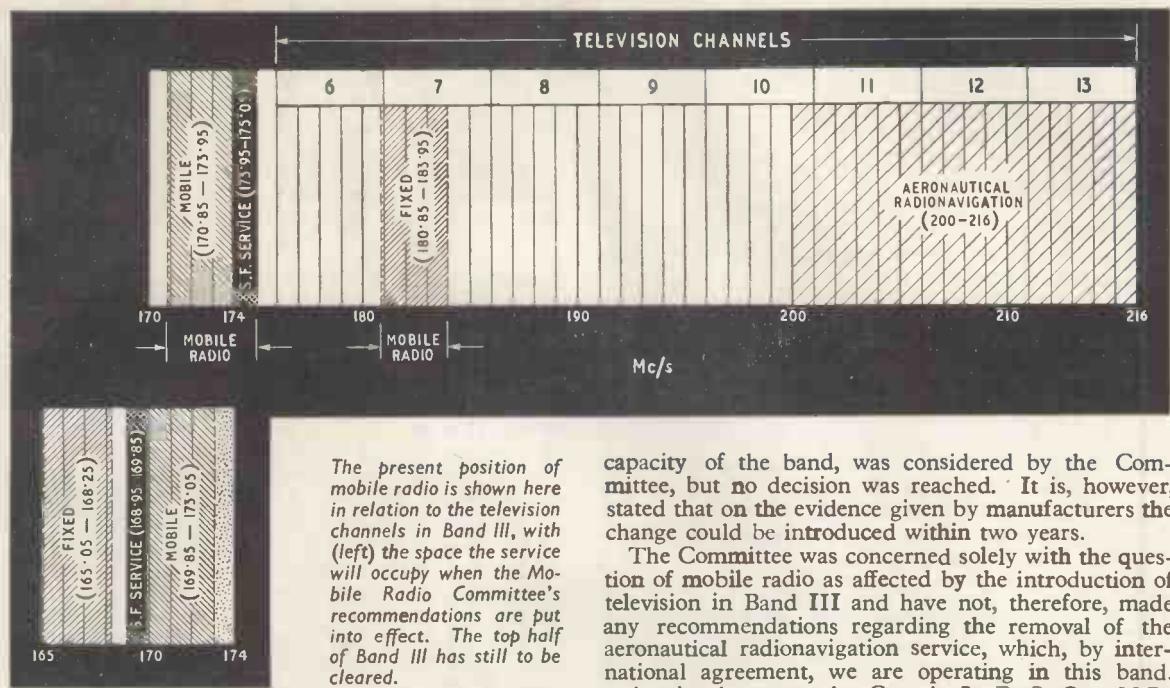
P.M.G. Accepts Plan for Clearing Band III

A YEAR ago the Postmaster General appointed a committee to examine the problems (so far as mobile radio is concerned) arising from the decision to clear Band III (174-216 Mc/s) for television. This Mobile Radio Committee—which includes representatives of the Post Office, Ministry of Transport and Civil Aviation, Mobile Radio Users' Association and the Marine Radio Advisory Service, under the chairmanship of R. J. P. Harvey (G.P.O.)—was unable to make firm recommendations by the end of the year as requested. The committee was reconstituted in January and given a further three months in which to complete the enquiry. With the reconstitution the P.M.G. added

radio users will, in future, be accommodated in the band 165-173 Mc/s. They will occupy all but 0.7 Mc/s of the band which is required for other services.

The re-arrangement provides for a guard band of 3 Mc/s between the new mobile radio band and the lower limit of television channel 6. It is, however, pointed out that it may be found possible to reduce this to 2 Mc/s so that those operators at present working between 173.05 and 173.95 Mc/s (shown dot stippled in the diagram) may not have to move.

The possibility of reducing the width of channels from 100 kc/s to 50 kc/s, thereby doubling the



The present position of mobile radio is shown here in relation to the television channels in Band III, with (left) the space the service will occupy when the Mobile Radio Committee's recommendations are put into effect. The top half of Band III has still to be cleared.

three independent members to the committee: Dr. R. L. Smith-Rose (D.S.I.R.), F. Jervis Smith (I.E.E.) and H. S. Vian-Smith (Association of British Chambers of Commerce).

The Committee's report has now been published* and was accepted in full by Earl De La Warr the day before retiring from the Government.† He pointed out, however, that it is in some ways an interim report—concentrating on the immediate problems of relieving Band III—and he has, therefore, asked the Committee to continue to advise the P.M.G. on future developments of the mobile radio service.

As will be seen from the diagram the recommended changes involve all the fixed stations, those mobile stations operating between 173.05 and 173.95 Mc/s and the single-frequency services. All private mobile

capacity of the band, was considered by the Committee, but no decision was reached. It is, however, stated that on the evidence given by manufacturers the change could be introduced within two years.

The Committee was concerned solely with the question of mobile radio as affected by the introduction of television in Band III and have not, therefore, made any recommendations regarding the removal of the aeronautical radionavigation service, which, by international agreement, we are operating in this band.

A minority report by Captain L. P. S. Orr, M.P., representing the Mobile Radio Users' Association, is appended to the Committee's report. The views expressed, which are endorsed by the M.R.U.A., are concerned mainly with compensation for the expense involved in modifying equipment, security of tenure and the P.M.G.'s "refusal to ensure that the loss of frequencies was borne equitably and not exclusively by land mobile radio services."

PUBLICATION DELAYS

WE offer apologies to readers who have been inconvenienced by the unavoidable delay, caused by difficulties in our printing works, in the publication of recent issues of *Wireless World*. These difficulties have now been overcome and it is hoped that this and future issues will be available on the correct day of publication—the fourth Tuesday of each month.

* "Report of the Mobile Radio Committee," H.M.S.O., price 9d.
† The new P.M.G. is Dr. Charles Hill.

WORLD OF WIRELESS

Wrotham Opens this Month • B.S.R.A. Exhibition • International Standards for Colour TV?

V.H.F. Service

PREPARATORY to the opening on May 2nd of the f.m. service from the Wrotham v.h.f. transmitter, test transmissions were radiated daily on one frequency from April 7th to 20th. Since then all three transmitters have daily been testing, radiating the Light Programme (89.1 Mc/s), Third Programme (91.3 Mc/s) and Home Service (93.5 Mc/s). Each transmitter will eventually have an e.r.p. of 120 kW, but during the tests and for the first few weeks of the regular service they will operate with reduced power.

The low-power transmissions from Alexandra Palace during the temporary close-down of Wrotham were discontinued on April 7th.

A further v.h.f. station—making eleven so far approved—has been sanctioned by the P.M.G. It will be at Penmon in Anglesey and, because it will be on the site of the medium-wave station, it is expected that one of the transmitters will be in use by the end of the year. The frequencies for the three-programme service are 89.6 (Light), 91.8 (Third) and 94 Mc/s (Home). Its effective radiated power permitted by the Stockholm Convention is 100 kW but initially it will operate on low power when only the Home Service transmitter will be used.

Sound Recording Show

AS already announced the seventh annual exhibition organized by the British Sound Recording Association will be held at the Waldorf Hotel, Aldwych, London, W.C.2, on May 21st and 22nd. Admission to the exhibition, which opens at 10.0 each day and closes at 6.45 on Saturday and 6.0 on Sunday, is by catalogue obtainable at the door (price 1s 6d), or by post (1s 8d) from the honorary librarian, 3, Coombe Gardens, New Malden, Surrey, after May 10th.

This year's exhibitors are: Acoustical Manufacturing Co., British Ferrograph, C. T. Chapman (Reproducers), Cosmocord, E.M.I. Factories, G.E.C., Garrard Engineering, Goodmans Industries, Grundig, H. J. Leak & Co., Leevers Rich Equipment, Lowther Manufacturing Co., M.S.S. Recording Co., Minnesota Mining & Manufacturing Co., Mullard, Reslound, Rogers Developments Co., Simon Sound Service, Sugden, Thermionic Products, Truchord, Vitavox, Wharfedale, Wireless World.

TECHNICAL WRITERS. Some of the recipients of the Radio Industry Council's premiums recently awarded for technical writing in 1954. In the back row are (left to right) D. H. Towns (British Electricity Authority), W. R. Cass and R. M. Hadfield (Pye) and H. S. Jewitt (Decca Radar). Those in the foreground are G. R. Gibbs, E. J. Kaye, Dr. J. M. M. Pinkerton and E. H. Lenaerts, all concerned with LEO (Lyons Electronic Office)

Colour Television Standardization

A STUDY GROUP of the C.C.I.R. (International Radio Consultative Committee), which met recently in Brussels, agreed that common standards for colour television should be adopted throughout Europe and urged that countries should not make any separate decisions before such standards could be worked out.

Most delegates also agreed that Bands IV and V would have to be utilized for European colour television, though the British group said that this did not exclude the possibility of colour in Bands I and III as well. In these last-mentioned bands, it was suggested by the Belgians, colour ought to be compatible whereas in Bands IV and V non-compatible systems might be introduced.

The French delegation mentioned the difficulty of standards conversion for shared programmes in colour if common standards were not adopted and also stressed the need for a colour system which would not demand expensive receivers. Existing American colour standards, said the U.S.A. group, would not be modified to conform to any C.C.I.R. standards that might be adopted in Europe.

Component Production

SOMETHING in the neighbourhood of 1,000 million parts, valued at £50M, are now produced annually by the components side of the radio industry. This is more than five times the pre-war production figure. The broad summary of the "end-uses" to which components are applied given in the twenty-second annual report of the Radio and Electronic Component Manufacturers' Federation, gives some indication of the ever-widening industrial field this side of the radio industry now serves. Whereas before the war over 90 per cent of the total component production was used in domestic sound and television receivers, the present figure is under 50 per cent. Nearly 25 per cent is now absorbed by what is generally called the "heavy" side of the radio industry—transmitters, communications equipment and navigational aids—and direct exports account for some 16 per cent.



PERSONALITIES

T. P. Douglas, M.B.E., has been appointed engineer-in-charge of the Sutton Coldfield television station in succession to R. C. Harman (see below). Mr. Douglas joined the B.B.C. in 1938 as a junior maintenance engineer at the Daventry transmitting station, to which he returned in 1946 after war service. He was transferred to Kirk o' Shotts television station in 1951 and in 1953 became assistant e.-in-c. of the Sutton Coldfield transmitter.

R. C. Harman, A.M.I.E.E., who has been engineer-in-charge of the Sutton Coldfield television station since January, 1952, has left the B.B.C. and joined I.T.A. as superintendent engineer (operations and maintenance). He joined the B.B.C. in 1935 at the Daventry short-wave station, transferring to television at Alexandra Palace late in 1937, where, after the war, he became senior engineer (transmitters). In 1949 he was transferred to Sutton Coldfield as assistant engineer-in-charge.

The I.T.A. also announces the appointment of two other ex-B.B.C. television engineers—**A. M. Beresford-Cooke**, as senior planning engineer, and **W. N. Anderson, A.M.I.E.E.**, as senior lines engineer. Mr. Beresford-Cooke joined the B.B.C. at Alexandra Palace in 1938, having been for two years in the E.M.I. Research Laboratories. During the war he served in A.A. Command on radar, becoming chief R.E.M.E. Radar Officer. Since 1946 he has been a senior member of the television section of the B.B.C.'s Planning and Installation Department. Mr. Anderson, who received his early technical training in the E.M.I. Research Laboratories where he was employed for eight years, joined the B.B.C. Designs Department in 1948 and worked on the design of test equipment for television transmission circuits. He later transferred to the Planning and Installation Department where he was responsible for the development of radio O.B. links.

H. T. Greatorex, B.Sc.(Eng.), A.M.I.E.E., has been appointed assistant head of the Engineering Information Department of the B.B.C. He joined the engineering staff of the Corporation in 1932 and after three months' service in the London Control Room transferred to Brookmans Park and later to the Daventry transmitting station as assistant maintenance engineer. Mr. Greatorex became a member of the Engineering Information Department in 1935.

Dr. A. C. B. Lovell, O.B.E., B.Sc., Ph.D., professor of radio astronomy at the University of Manchester since 1951, has been elected a Fellow of the Royal Society. Professor Lovell, whose work on the planning of the giant radio telescope, being built at the Jodrell Bank Establishment of the University, has received a good deal of publicity, was, from 1939 to 1945, at the Telecommunications Research Establishment, Malvern. Before going to T.R.E. he was for three years assistant lecturer in physics at the University, to which he returned as lecturer in 1945.

G. A. Whitfield, B.Sc., at present head of the controlled weapons division in the armament department at the Royal Aircraft Establishment, Farnborough, is to be head of the new department of aircraft electrical engineering at the College of Aeronautics, Cranfield, Beds. He takes up his appointment to the Chair of Aircraft Electrical Engineering on June 1st. It will be recalled that last year Mr. Whitfield was granted an award by the Royal Commission on Awards to Inventors for work on the development of the proximity fuze.

Sir Robert Renwick, K.B.E., has accepted the invitation of the Radar Association to become its president in succession to Air Vice-Marshal D. C. T. Bennett, C.B., C.B.E. Sir Robert, who was president of the Television Society from 1947-1954 and has been president of the R.E.C.M.F. since 1947, was controller of communications in the Air Ministry and of communication equipment in the Ministry of Aircraft Production during the war.



C. M. Benham, B.Sc., A.M.I.E.E., the new chairman of the Radio and Electronic Component Manufacturers' Federation, is chairman and managing director of Painton & Company, of Kingsthorpe, Northampton, which he joined in 1937. He was for eleven years with Standard Telephones & Cables, where he ultimately took charge of the radio engineering department at the New Southgate Works. He studied at the City & Guilds College.

The Insignia Award in Technology (C.G.I.A.) has been conferred by the City and Guilds of London Institute upon two telecommunication engineers for theses submitted. Arthur H. Watkins, who receives it for his thesis "The Setting-up and Testing of a Wideband Co-axial Telephony Line Link", joined the Post Office in 1936 and is now executive engineer-in-charge engaged on the installation and testing of wideband co-axial telephony lines. From 1943 to 1946 he was assistant engineer at the G.P.O. Central Training School. Thomas A. Lewis, B.Sc., A.M.I.E.E., receives the award for his paper "The Measurement of Radio Interference with Particular Reference to Very High Frequencies and Television." He, too, is in the Post Office, which he joined in 1937. Since 1947 he has been in the Radio Experimental Development Branch at the Backwell laboratory, working on the investigation of radio interference problems, and the design of measuring equipment and receivers for the 30-200-Mc/s frequency range. The Institute has also conferred the award on J. A. Mason, M.I.E.E., manager of the Automatic Telephone and Electric Company, which he joined on leaving school in 1911. After military service during the first world war he went into the Engineering Department, where he subsequently became assistant chief engineer.

Cable & Wireless, Ltd., announce the appointment of Ronald L. Saunders and Donald Scott as assistant engineers-in-chief in succession to W. J. Knight, M.B.E., who becomes deputy engineer-in-chief on the retirement of E. B. Dillow. Mr. Saunders joined the Pacific Cable Board in 1926 and transferred to Cable & Wireless on its formation in 1929. During recent years, as engineer-in-charge of the laboratories and workshops at Radio House, Wilson Street, London, E.C.2, he has been responsible for the company's development work. He is a B.Sc.(Eng.) of London University. Mr. Scott, after serving at twelve stations overseas, was transferred to the company's engineer-in-chief's department in 1948, where he has been responsible for the day-to-day operation of the wireless services. He was for four years seconded to the Hong Kong Government as wireless adviser.

OUR AUTHORS

Charles Ian Orr-Ewing, O.B.E., M.I.E.E., M.A., M.P., whose open letter to the Postmaster General is published in this issue, is Member of Parliament for North Hendon and parliamentary private secretary to the Minister of Labour and National Service. After obtaining an honours degree in physics at Oxford he was for three years a graduate apprentice with E.M.I. For some eighteen months before joining the R.A.F.V.R. in 1939 he was in the Television O.B. Department of the B.B.C. to which he returned in 1946 to take charge of the department. He left the B.B.C. in 1949 to join Cossor's, of which he is now a director.

J. A. Lane, joint author with Dr. J. A. Saxton of the paper in this issue on the effect of obstacles on high-frequency reception, joined in 1940 the Department of



MEMBERS of the team that designed, built, and installed the Belling-Lee television transmitter (G9AED) at Croydon for experimental transmissions in Channel 9. On the right is F. R. W. Strafford (Technical Manager). A test pattern is radiated daily from 10 a.m. to noon on 194.75 Mc/s with an e.r.p. of 1 kW and a tone (approx. 600 c/s) on 191.27 Mc/s. There is also to be an afternoon transmission from 2.0 to 4.0.

Scientific and Industrial Research where he is now a senior scientific officer in the Radio Research Organization. He is mainly concerned with investigations on various aspects of short-wave propagation and in particular with measurements of dielectric properties and power at centimetre wavelengths. Dr. Saxton, who last year contributed an article on assessing the service areas of v.h.f. and u.h.f. transmitters, needs no introduction to *Wireless World* readers.

IN BRIEF

Broadcast Receiving Licences current in the United Kingdom at the end of February totalled 13,916,246, including 4,407,393 for television and 265,468 for car sets. Television licences increased by 99,621 during the month.

Comparative Recordings (made at the same time and place with a medium-wave receiver and a v.h.f. receiver) will be used by the B.B.C. at the Manchester exhibition, which opens on May 4th, to demonstrate that interference from foreign transmitters is absent on v.h.f. and that electrical interference too is greatly reduced by the use of frequency modulation. Several examples will be given of simultaneous recordings of the same programme transmitted in both bands and the point will be made that there is no difference in the quality as transmitted but that the improved reception on v.h.f. is due to the advantages of frequency modulation.

The annual International Contest for radio-controlled model boats will be held at Saltwell Park, Gateshead-on-Tyne, on July 30th and 31st. The contest for radio-controlled model aircraft will be on August 1st at Croft Aerodrome, near Darlington. Details of the contests, which are organized by the International Radio Controlled Models Society, are obtainable from D. W. Aldridge, 1, Fowberry Crescent, Fenham, Newcastle-upon-Tyne, 4.

Four premiums, each valued at £5, have been awarded by the Television Society to the following authors for papers read at London meetings during 1954 (titles of the papers are given in parentheses): Dr. G. N. Patchett ("Problems of Interlacing"); G. B. Townsend, E. Ribchester and D. Bauer ("An Investigation of the 625-line C.C.I.R. System"); R. J. Boddy and C. D. Gardner ("An Industrial Television Channel"); and G. G. Gouriet ("Colour Television").

A three-day conference is being held at High Leigh, Hoddesdon, Herts, from May 13th to 15th by the National Federation of Gramophone Societies. Details of the fees and the programme, which will include technical and music lectures and demonstrations of high-quality reproducing equipment, are obtainable from G. E. Palmer, 106, Streatfield Road, Kenton, Harrow, Middx.

R.E.C.M.F. Council.—At the annual general meeting of the Radio and Electronic Component Manufacturers' Federation, which now has a membership of 164, the following firms were elected to form the council (the names of the companies' representatives are in parentheses): Automatic Coil Winder (R. E. Hill); British Moulded Plastics (G. F. Carnell); Garrard Engineering (H. V. Slade); A. H. Hunt (S. H. Brewell); Morganite Resistors (E. T. Treganza); Multicore Solderers (R. Arbit); N.S.F. (K. G. Smith); Painton (C. M. Benham); Plessey (P. D. Canning); Standard Telephones & Cables (E. E. Bivand); Telegraph Construction & Maintenance Co., (W. F. Randall); Truvox (K. Short). The new chairman and vice-chairman are C. M. Benham and S. H. Brewell, respectively.

Club secretaries may like to know that the latest edition of the 16-mm colour sound film "Mechanical Handling" includes sequences on some of the applications of electronics in the handling of goods. One of the sequences covers a combined conveyor and elevator system which is electronically controlled for both flow and sorting of boxes according to colour or size. Applications for the loan of the film, which lasts approximately 40 minutes, should be made to H. A. Collman, *Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1.

Isotope Instrumentation.—Radioactive isotopes are finding increasing uses in industry, medicine and research, and to facilitate the correct choice of detecting and measuring instruments, a comprehensive catalogue has been produced by the Scientific Instrument Manufacturers' Association of Great Britain, Ltd., Queen Anne Street, London, W.1. In addition to details of the products of the member firms there is a useful technical introduction and bibliography on the principles underlying radioactive isotope instrumentation. The brochure is produced under the joint editorship of Dr. Denis Taylor (A. E. R. E., Harwell) and A. G. Peacock (Mervyn Instruments).

Correction.—We tender our apologies to R. F. Gilson, the author of the article "Output Transformer Design," whose name was misspelt on p. 195 of the April issue.

BUSINESS NOTES

Wolsey Television has been acquired by the Gas Purification and Chemical Company who control, among other companies, Grundig (Great Britain), Ltd., and Grundig International, Ltd. H. S. Melly remains on the board and is joined by A. E. Johnson, G. S. Taylor and D. D. Mathieson of Grundig.

An office has been opened at 86, Holly Road, Uttoxeter, Staffs, by the Narda Corporation, of Mineola, New York, for the sale of its microwave test equipment in this country.

Demonstrations of Pye industrial and underwater television equipment will be given at the Kongresshaus in Zurich from May 11th to 13th. Examples of the company's television broadcasting equipment will also be on show.

The radio communication equipment and electronic aids to navigation on board the 20,000-ton passenger liner *Southern Cross*, which is now on her maiden voyage round the world, were installed by Marconi Marine. The sound reproducing and order system feeds a network of 200 loudspeakers and incorporates a tape recorder for recording news and other broadcast programmes received at times inconvenient for immediate diffusion over the loudspeaker system.

The B.B.C. has ordered from British Acoustic Films, Ltd., twelve combined sound and picture film cameras. Built to a B.B.C. specification, they will produce either a 35-mm picture film with a separate 35-mm magnetic sound track, or a 16-mm picture film with a separate 16-mm sound track.

V.H.F. radio-telephone equipment supplied by Hudson Electronic Devices, Ltd., has been installed by the Automobile Association on the cross-channel car ferries *Hallidale*, *Lord Warden* and *Dinard*. The A.A. staff on board are thus able to phone details to the Association's headquarters in Dover, so facilitating the rapid transit of motorists through the customs.

Sydney S. Bird & Sons, manufacturers of Cyldon capacitors, have moved their works from Enfield to Fleets Lane, Poole, Dorset (Tel.: Poole 1640). A London sales and technical liaison office has been opened at 3, Palace Mansions, Palace Gardens, Enfield, Middx (Tel.: Enfield 2071), under the direction of G. B. Francis.

Aero Research, Ltd., of Duxford, Cambridge, manufacturers of synthetic resins, have moved their northern area office to 409, Royal Exchange, Manchester, 2. (Tel.: Blackfriars 9445.)

The Plessey Company, of Ilford, Essex, announce the appointment of Thomas P. Collier, of 120, South La Salle St., Chicago, as their sole representative in the U.S.A.

A London office and show room, at 53, Victoria Street, S.W.1 (Tel.: Abbey 4704), has been opened by Atkins, Robertson & Whiteford, Ltd., of 92-100, Torrisdale Street, Glasgow, S.2, manufacturers of electronic instruments.

The telephone number of A. F. Bulgin & Co., of Bye Pass Road, Barking, Essex, has been changed to Rippleway 5588.

SOURCES OF

IN view of the recent publication of the regulations covering interference from small motors and refrigerators (see page 155, April issue), a summary of the 140,000

Sources of interference	Number of complaints	
	Sound	Television
Bedwarmers ...	578	1183
Calculating machines	342	818
Drills ...	1177	2492
External cross modulation	280	45
Faulty electrical wiring of premises	2194	494
Hair dryers	598	6954
Ignition systems of petrol engines	49	1313
Industrial and medical r.f. equipmt.	196	887
Lighting, filament type lamps	66	2569
Lighting, fluorescent tubes	1676	233
Lighting, street	712	113
Neon signs	416	1444
Power lines	814	3789
Radiation from TV time base circuits	6805	3
Radiation from superhet, local oscillators	62	1604
Refrigerators (compressor, fan, or thermo-stat)	1228	1587
Transmitters, amateurs	125	303
Transmitters, others in U.K.	142	476
Transmitters, foreign	533	146
Sewing machines	1577	8956
Smoothing irons	399	198
Vacuum cleaners	1043	3269
All other identified sources	1978	3356
{ contacts type		
commutator type	2930	7056
miscellaneous types	1468	1692
Unknown	12206	21877

OVERSEAS TRADE

Equipment for the two-way u.h.f. radio-telephone service recently introduced between Algeciras, Spain, and Ceuta, Morocco (a distance of some 20 miles) has been supplied by Standard Telephones & Cables. The installation provides for 24 simultaneous two-way conversations.

With the opening of the new Sarawak broadcasting service, the government distributed 2,600 receivers amongst the population. The General Electric Company supplied the 4-valve all-dry superhet receivers which cover both the medium-wave and short-wave bands.

Two radio manufacturers were among the 60 or more British firms who exhibited at the Lyons International Trade Fair which closed on April 25th. The two firms are Eric Resistor, Ltd., and Standard Telephones and Cables, Ltd., who were showing respectively, capacitors and valves.

Two 485-ft mast radiators, complete with r.f. transmission line of the 5-wire unbalanced type, aerial matching equipment and an earth system, are to be erected by Marconi's for the Greek broadcasting authorities on the site of a 50-kW station on the island of Corfu. The order was secured by Marconi's agents P. C. Lycourezos, Ltd., in the face of severe German competition.

Bayerische Rundfunk, the Bavarian broadcasting organization, has secured from Pye a television O.B. van which has provision for three camera chains.

Kelvin & Hughes have supplied a modified version of their "Kingfisher" echo sounder for the Sea Diver being used by the American expedition seeking the remains of Columbus' *Santa Maria*. The leader of the expedition is Edwin A. Link, the inventor of the Link aircraft trainer, who is concentrating his search off the north coast of Haiti.

Jamaican Agency.—Masterton, Ltd., P.O. Box 73, 23-25, Hanover Street, Kingston, have advised the U.K. Trade Commissioner in Kingston that they would like to act as agents for a British manufacturer of broadcast receivers not already represented in Jamaica. Full particulars should be sent direct to the company, but manufacturers are asked to notify the Trade Commissioner (Royal Mail Building, P.O. Box 393, Kingston, Jamaica, B.W.I.).

INTERFERENCE

complaints investigated by the Post Office last year is of particular interest.

By far the largest individual source of interference with television was electric sewing machines (8,956) with hair dryers (6,954) next. The table excludes the 11,495 complaints which were found to be due to defective conditions in the receiving installation. All together, 83,514 complaints of television interference were investigated.

Of the 57,324 cases of interference with sound broadcasting investigated the largest source of trouble, excluding the 19,020 complaints found to be due to "a condition or function" of the receiving installations, was radiation from television time-base circuits (6,805).

It will be seen from the table that there were large numbers of complaints investigated which are classified as "source unknown." These include those in which the interference ceased before or during the investigations, or where the interference was of such infrequent occurrence that it did not justify continual investigation "to the exclusion of more deserving complaints."

Ignition interference is generally so transient that the number of complaints in the table bears no relation to its prevalence.

To give a complete list of sources of interference is impracticable and many of the identified sources are grouped under contacts, commutator and miscellaneous types.

At the end of the year there was a backlog of 9,961 (sound) and 15,417 (television) complaints.

By P. J. WALKER*

Wide Range Electrostatic

I.—Principles of Design for Operation at Low as well as High Frequencies

A closer examination of underlying principles leads to the conclusion that the electrostatic loudspeaker may well supersede the moving coil for high-quality sound reproduction. Designs recently developed have proved to be capable of reproducing the full audio-frequency range, with harmonic distortions no higher than those of the associated amplifier.

EVERY loudspeaker designer must, at some time or other, have looked longingly at the electrostatic principle of drive as a solution to his problems of improving quality of reproduction. The movement of a diaphragm driven all over its surface is entirely predictable. The diaphragm can be as light as required. The impedances influencing performance can be predominantly acoustic and—since there are no shape restrictions—entirely under the control of the designer.

What has held it back? First, the fact that *in its generally known form* it is intrinsically non-linear and even in a push-pull construction linearity can only be approached for small amplitudes. Secondly, in order to obtain adequate sensitivity the available gap is small; the diaphragm movement limited and largely stiffness controlled, both factors restricting its use to high frequencies. Thirdly, that being essentially a capacitive electrical load, it is difficult to match to an amplifier.

The first of these objections, that of non-linearity, can be removed completely by an expedient which is spectacular in its effectiveness and simplicity. The second and third difficulties will resolve themselves, as we shall see later, when the designer makes his choice of the interdependent mechanical, acoustical and electrical variables.

Fig. 1 (a) shows diagrammatically the connection of a conventional electrostatic loudspeaker in which the polarizing voltage is applied to the centre diaphragm and the signal in push-pull to the outer perforated fixed plates. Under conditions of no signal, Fig. 1 (b), and assuming the diaphragm to be central, there will be equal and opposite attractive forces on the diaphragm. If one fixed plate is now made positive and the other negative so that the diaphragm will be deflected to the right, the effective capacitance will increase, and to satisfy the relationship $Q=CE$ the charge Q will also increase and will be supplied by a current i during the movement. The force acting on the diaphragm per unit area will, however, be pro-

portional to $\left(\frac{E+e/2}{d_2}\right)^2 - \left(\frac{E-e/2}{d_1}\right)^2$. The

relationship will be non-linear. Note that the charge Q , although varying, does not enter directly into the relation.

Suppose that after having charged the diaphragm electrode the source of polarizing potential is discon-

nected (Fig. 1(d)). The diaphragm now carries a constant charge Q which experiences a force proportional to the product of the field intensity and the charge. This force will be independent of the position of the diaphragm between the plates since both Q and the distance between plates are constants; the only variable is the applied voltage e . Note that the difference between d_1 and d_2 , although varying, does not enter into the relation.

The above is perhaps an over-simplification, but it shows that distortion is not necessarily inherent in the electrostatic principle.

The "constant Q " method of operation has another very important advantage in that it reduces the risk of collapse, which occurs at large amplitudes with the conventional method of connection, when the negative stiffness resulting from electrical attraction exceeds the positive mechanical stiffness of the diaphragm. As the diaphragm approaches one of the fixed plates the capacitance is increased, but as the charge Q has been assumed constant, E must fall since $E=Q/C$.

Professor F. V. Hunt of Harvard University has shown† that the criterion for dynamic stability under large excursions is that the time constant R_oC_o of the charging circuit (Fig. 1(e)) should be large compared with $1/2f$, the half-period of the applied frequency. This also supplies the condition for low distortion and Professor Hunt gives the results of measurements (Fig. 6.14, p. 212, loc. cit.) showing the dependence of second harmonic distortion on both the degree of unbalance due to displacement of the central electrode (in terms of $\Delta C/C$) and of the ratio of time constant to half period $2fR_oC_o$. Even when this latter parameter was reduced to unity, and the diaphragm displaced by a distance equivalent to a capacity unbalance of 25 per cent, the second harmonic did not exceed 0.5 per cent, when driven at 150 c/s by 780 V r.m.s. (plate-to-plate) with a polarizing voltage of 500. Third and higher harmonics were always less than the second.

So much for the driving mechanism; it now remains to see how it fares when coupled to the air and to an amplifier.

It will help in understanding the broad principles involved if we start by considering a loudspeaker whose diaphragm is large compared with the longest wavelength of sound to be reproduced. Under these conditions the mass reactance of the air load on both sides of the diaphragm can be neglected and the impedance per unit area $2\rho c$ offered to the motion of the diaphragm is predominantly resistive ($\rho c = 42$ mechanical ohms per cm²). With constant voltage driving the diaphragm the force will be proportional to the applied signal voltage and independent of frequency. If the load is resistive the velocity, and also the acoustic power output, will be independent of frequency.

At very high frequencies the mass reactance of the diaphragm can exceed the radiation resistance and will cause a falling off in velocity when the force remains constant; the acoustic output will then decline by

† "Electroacoustics" by F. V. Hunt, chapter 6. Published by John Wiley & Sons (Chapman & Hall).

Loudspeakers

with Negligible Distortion

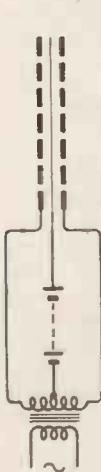
6 db/octave, but, with suitable choice of diaphragm material, not until a frequency of 20 to 25 kc/s is reached. (How different from the average moving coil in which the cut-off starts at about 1,000 c/s and must be sustained by focusing of high frequencies along the axis or by juggling with cone "break-up.")

Similarly at low frequencies a 6 db/octave falling off with reducing frequency will result when the reactance due to the stiffness (reciprocal of compliance) of the diaphragm exceeds the resistance air load. This state of affairs is shown graphically in Fig. 2. Unfortunately, it is not so easy to put the frequency at which the stiffness begins to exercise control outside the audible range. The choice of stiffness will be dictated by the necessity of constraining the diaphragm against the forces associated with the polarizing voltage. Under "static" conditions ($2fR_0C_0$ less than unity) these forces can increase as the diaphragm approaches the fixed plates and must be limited by a suitable choice of stiffness, polarizing voltage and plate spacing. The plate spacing also determines the electrical capacitance of the loudspeaker, and the impedance offered to the amplifier at the frequency chosen for "matching."

Thus the bandwidth available for constant output, under the acoustic conditions postulated, is limited at low frequencies by the diaphragm stiffness required for stability and at high frequencies by the conditions of matching to the amplifier. (The inertia cut-off will always be well above the matching frequency and can be ignored.)

The true efficiency of an electrostatic loudspeaker is

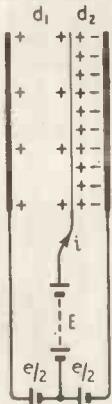
$$F \propto \left(\frac{E + e/2}{d_2} \right)^2 - \left(\frac{E - e/2}{d_1} \right)^2$$



(a)



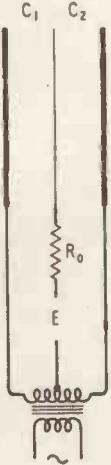
(b)



(c)



(d)



(e)

Fig. 1. Essential differences in the operation of electrostatic loudspeakers with "constant voltage" and "constant charge" on the centre diaphragm.

very high indeed, but it is difficult to realize because of the large wattless current which has to be provided due to the electrical capacity of the loudspeaker unit. Thus it is necessary to waste watts in the amplifier or in resistances associated with crossover networks of which the loudspeaker may be part. For purposes of simplification, therefore, it is convenient to use the term "apparent efficiency" the meaning of which is the ratio of the acoustic power output of the loudspeaker to the amplifier volt-ampere output necessary to provide the required voltage across the loudspeaker capacity.

The way in which the designer can trade bandwidth for "apparent efficiency" is illustrated by Figs. 3 and 4. In both cases we assume the maximum output will be available at the high-frequency matching limit, and that constant voltage will be available at this and lower frequencies.

In Fig. 3 let curve (a) represent the response with a given electrode spacing $D=1$. If we double the spacing the diaphragm stiffness required for stability

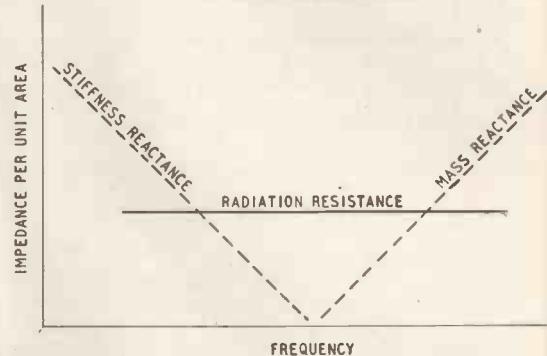
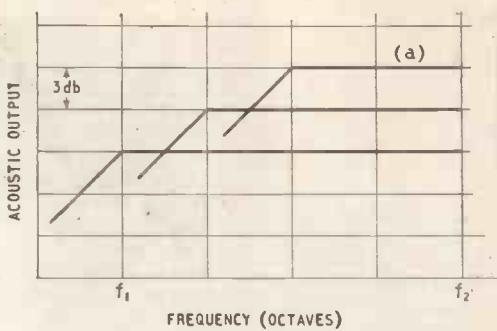


Fig. 2. Variation of acoustical and mechanical impedances with frequency in a diaphragm which is large compared with wavelength.

$$C_0 = \frac{C_1 C_2}{(C_1 + C_2)}$$

$$\Delta C = (C_2 - C_1)$$

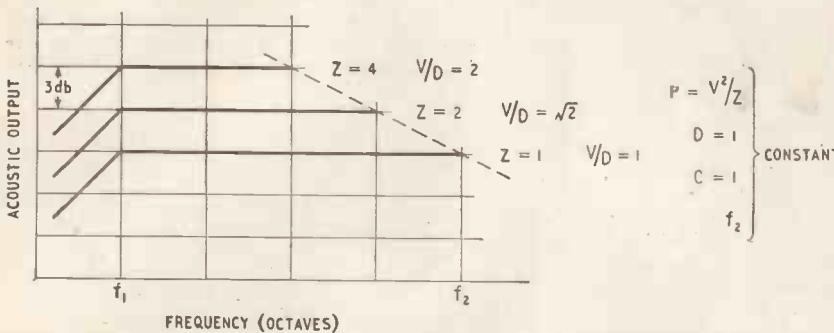
Right: Fig. 3. Low-frequency response can be extended, at the expense of "apparent efficiency," by increasing the plate spacing and re-matching to the amplifier at f_2 , the upper frequency limit.



D	C	Z	V	V/D
1	1	1	1	1
2	1/2	2	$\sqrt{2}$	$\sqrt{2}/2$
4	1/4	4	2	1/2

$$P = \frac{V^2}{Z} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{CONSTANT}$$

$$f_2$$



Left: Fig. 4. Alternatively, with constant spacing and a fixed low-frequency limit the high-frequency response can be extended, again at the expense of "apparent efficiency," by varying the frequency f_2 at which the capacitive impedance is matched to the amplifier.

can be halved and the low-frequency cut-off goes down an octave. At $D=2$ the capacitance is halved and the impedance doubled, but because the power is limited the volts rise by only $\sqrt{2}$ when the amplifier is re-matched. Thus the field strength V/D available to drive the diaphragm is reduced to $\sqrt{2}/2$ and the response falls by 3 db. We have thus gained an octave for a drop of 3 db in output, and, of course, the necessity of finding twice the polarizing voltage.

We can, if required, regain the lost efficiency by re-matching an octave lower at the top end, as shown in Fig. 4. We now keep D (and C) fixed, and with it the low-frequency cut-off. The field strength available for driving the diaphragm will be proportional only to the voltage available from the amplifier. If we re-match an octave lower Z will be doubled and V will increase to $\sqrt{2}$, so there will be a 3-db rise in acoustic power for the loss of an octave at the high-frequency end.

Since very high efficiencies are not a pre-requisite of high-quality reproduction, it is convenient to arrange the apparent efficiency to be similar to the efficiency obtained from present-day commercial moving-coil speakers. Setting the efficiency at this level and applying polarizing voltages permissible in the given air gap, we find that the available bandwidth for level response is about four to five octaves.

Below the low-frequency cut-off we have the stiffness of the diaphragm controlling response, a large proportion of it under conditions where the "apparent efficiency" is high and wasted. (At low frequencies the impedance is high, and less power is required to maintain constant voltage.) Thus, by a progressive change of "matching" in this area, one can compensate to extend the level response below the mechanical cut-off. The effect of this mechanical stiffness is best considered when we deal with possible forms of loading, since it can be lumped

in with the acoustical circuit loading the loudspeaker.

A high polarizing voltage is desirable in order to place a high value of charge Q on the diaphragm. Each small unit area of the diaphragm can be fed with a high voltage at very high impedance, thus charging up that part of the diaphragm in relation to the fixed plates. In this arrangement of the loudspeaker, where the signal is applied to the fixed plates only, there are no signal currents due to the wanted signal in the diaphragm itself, so that this arrangement of high-impedance charging of each unit area of the diaphragm is permissible, and is essential for linearity in any practical construction. Any tendency for the air to conduct between the diaphragm and the fixed plate at any point in the loudspeaker merely causes a slight drop in the voltage at that area on the diaphragm, so that in this way high voltages can be applied without any danger of sparking.

Since the charge on the diaphragm is unvarying, it follows that the force on the diaphragm is completely independent of the position of the diaphragm in the space between these electrodes and the system is linear. With this arrangement, then, it is no longer



Fig. 5. High-frequency unit with dimensions large compared with wavelength designed to cover frequencies from 1,000 c/s to the upper limit of audibility.

necessary to restrict the allowable motion of the diaphragm to a small percentage of the available gap. Again, there is no restriction to the ratio of signal voltage to polarizing voltage. The only non-linear element entering the system at all is that due to the compliance of the diaphragm, and since in most designs this is not a controlling factor in the motion of the diaphragm its importance is small. There is no difficulty in producing units on this principle, the distortion content of which is even lower than that of present-day amplifiers, and many times better than a moving-coil loudspeaker of normal efficiency.

We have seen, then, that it is now possible to design loudspeakers on the electrostatic principle for a given bandwidth, over which the forces are acting directly on to the air. We have seen that this bandwidth can be placed anywhere in the audio range and that linearity represents considerable improvement on anything hitherto produced. The design of a loudspeaker unit on such principles is therefore purely one of applying it to its acoustical load to give any required performance.

We have so far assumed the simple case of 2 pc loading on the diaphragm. Ignoring for the moment horn loading, this can only be achieved in practice at high frequencies, or for cases where the diaphragm is very large indeed.

A simple single unit construction for high frequencies is shown in Fig. 5. This loudspeaker covers the range from 1,000 c/s to the upper limits of audibility. Such a unit could, of course, be used with conventional moving-coil speakers for low frequencies, but the assumption that moving-coil units operate like distortion-less pistons at low frequencies is very far from the truth. It is obviously desirable to introduce the benefits of the electrostatic principle throughout the whole frequency range.

By way of showing what can be done, Fig. 6 shows a more complex design of electrostatic loudspeaker which, when properly loaded, covers the whole frequency range from 40 c/s up to the limits of audibility. In a future article it is proposed to discuss the operation of such loudspeakers, i.e., when size is no longer large compared to wavelength, and to

Fig. 6. Unit of more complex design which, with proper acoustic loading, covers the range from 40 c/s to the upper limit of audibility. Measurements on this and the unit of Fig. 5 indicate total harmonic distortions of less than 1 per cent.

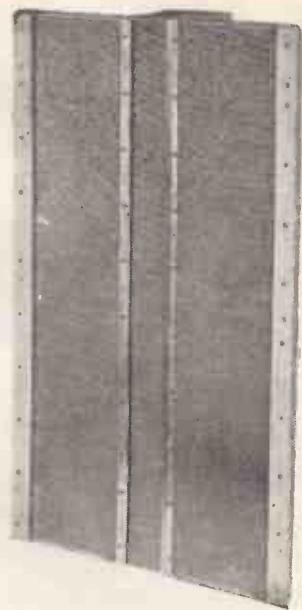
show the basis of design approach for the whole frequency range.

Distortion measurements on these units gave figures well below 1%. Measurements were made out of doors, and noise, wind, and other restrictions due to imperfect conditions made it difficult to get reliable figures below 1%. Inspection of the residual waveform indicates that the distortion due to the units is considerably lower than this figure.

Similar remarks apply to frequency response, due to the fact that it is virtually impossible to achieve perfect loading conditions. Measurements produce responses which are within 2 db of the predicted curves, but the major part of these small discrepancies may be attributed to the approximations assumed in the structures used for loading.

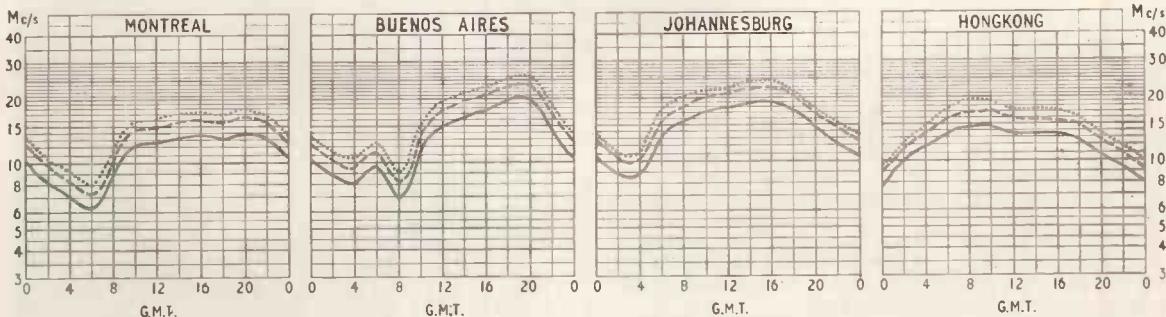
Since 1953, electrostatic loudspeakers have been the subject of joint development between Ferranti, Ltd., of Edinburgh, and The Acoustical Manufacturing Co., Ltd., of Huntingdon. Some of the techniques involved in the design of these loudspeakers are the subject of joint patent applications by P. J. Walker and D. T. N. Williamson.

(To be continued)



SHORT-WAVE CONDITIONS

Predictions for May



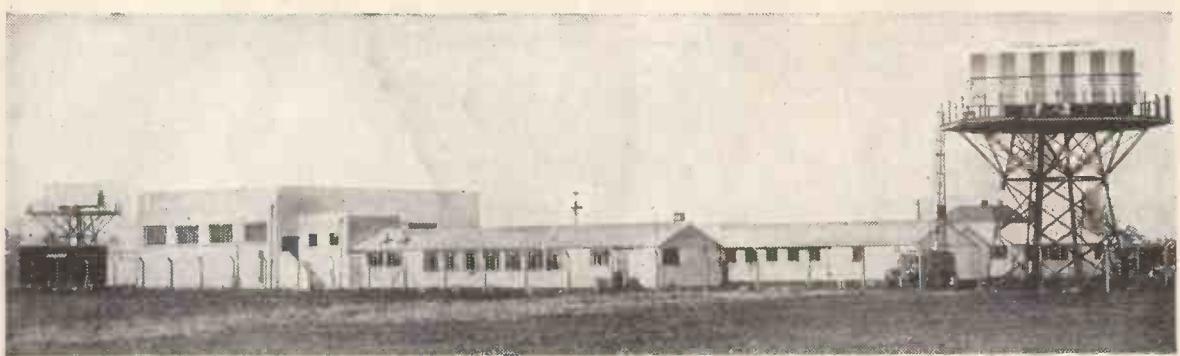
THE full-line curves given here indicate the highest frequencies likely to be usable at any time of the day or night for reliable communications over four long-distance paths from this country during May.

Broken-line curves give the highest frequencies that will sustain a partial service throughout the same period.

..... FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE FOR 25% OF THE TOTAL TIME

- - - PREDICTED AVERAGE MAXIMUM USABLE FREQUENCY

— FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE ON ALL UNDISTURBED DAYS



Air Traffic Control at London Airport

TWO new buildings were recently brought into use at London Airport for the purpose of effecting closer integration of the radio and radar aids to flying now in daily use there. One of the buildings, located on the northern boundary of the aerodrome, is the new air traffic control centre for the whole of southern England and was until recently located at Uxbridge. The main purpose of the move was to bring together in one room the radio and radar controllers who were hitherto widely separated.

No real significance attaches to London Airport as the site of this control centre since the controllers are not concerned with air traffic in and out of the airport, but it is a good radar site and the display information can be made available to the airport's control tower to reinforce data obtained from alternative aids.

The multi-channel v.h.f. area coverage radio-telephone system described in *Wireless World* of March, 1951, is operated from this building. The installation has been expanded a little since it was last described here and now provides 10 v.h.f. channels in the 118-to-132-Mc/s band.

Since both radio and radar controllers occupy the same room a major problem arose in regard to the lighting. Full daylight viewing of c.r. tubes is not yet accomplished, but it is said to be within sight. For the present purpose the lighting is provided by red, blue and green fluorescent tubes giving a mixed light having the appearance of white light, but lacking those shades responsible for strong reflections from the face of c.r. tubes. When used in conjunction with suitable amber c.r.t. filters perfect viewing is possible with an amount of light adequate for the radio personnel in the same room.

The other new building of interest at the airport is the control tower. It is located in the central terminal area and is approached by a 680-yd underground road tunnel. This building is the nerve-centre of the airport and contains the radio and radar controllers concerned with the safe and expeditious movement of aircraft into and out of the airport.

Very comprehensive radio and radar facilities are provided. There are eight radio-telephone channels, seven in the 118-to-132-Mc/s band and one in the 3-Mc/s; an interesting feature of the v.h.f. system is the provision for sharing a common aerial. Cavity resonators enable up to four transmitters (or receivers) to use the same aerial at the same time with a frequency spacing of some 400 kc/s only. Transmitting and receiving stations are widely separated and remotely controlled, but the latter is within the airport boundary.

A Marconi v.h.f. fully automatic direction finder is installed in the tower with its aerial located about half a mile away. The only aerials on the tower are those concerned with the movement of all surface vehicles which are controlled by v.h.f. radio telephones and a scanner for a Decca 8-mm (or Q-Band) radar; Airfield Surface Movement Indicator.

Movements of aircraft within 60 miles of the airport are

tracked, and when within tower control marshalled with the aid of the Cossor Airfield Control Radar Mark VI. In bad weather landing is assisted by a modified early model G.C.A. and the latest Pye Instrument Landing System.

A special feature of the new buildings is that only equipment essential for the controllers' needs is accommodated in the control rooms with the main items located in an equipment room immediately below. Here maintenance, repair and routine testing can be carried out and the whole station kept at top efficiency without in any way hindering the work of the controllers.

The need for some aid to location and movement of surface vehicles other than human vision will be appreciated when it is realized that the airport covers some six square miles of country, and some of the runways exceed two miles in length. A pool of walkie-talkie sets is maintained for communication with the control tower by personnel not normally using vehicles.

It is perhaps not surprising that London Airport has a reputation as being one of the safest in the world and the newest aids should materially strengthen this well-merited reputation.



Flying controller operating flight progress boards in control room.

LETTERS TO THE EDITOR

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

Transistor Letter Symbol

I READ with interest E. A. W. Spreadbury's letter in your March issue regarding the evolution of a suitable letter to denote the transistor.

It appears to me preferable to have a single letter symbol for what is, after all, a major element in its associated circuit. Hence I would suggest the use of the letter S to denote a transistor, on the grounds that it is a Solid-state device whereas a valve is a Vacuum device.

The existing use of the letter S to denote a switch may well be replaced by Sw, which letters are already in some use for this purpose.

South Harrow, Middlesex.

D. NAPPIN.

I LEAN towards the argument put forward by E. A. W. Spreadbury (your March issue) that some distinctive letter symbol should be adopted for a transistor in order that its different mode of operation from the thermionic valve shall be readily apparent.

Personally, I do not look with favour on the letter V to indicate a transistor; the letter is hackneyed to the extent that it denotes (a) thermionic valve, (b) voltage, (c) velocity, (d) volume, to mention a few. I also feel that Mr. Spreadbury's double-letter symbols can be improved upon, and would suggest the letter Y. This letter is not so widely used as V, and to my mind it bears some resemblance to the graphical symbol that now seems to be fairly well established. In addition, it is not unlike V in appearance, so can impart some indication of the function of the circuit element.

St. Leonards-on-Sea, Sussex. W. E. THOMPSON.

Feedback I.F. Amplifiers

WITH reference to the very interesting articles by H. S. Jewitt (February and December, 1954), we can mention that work on such amplifiers has been going on for some time at the Radio Receiver Research Laboratory of the Danish Academy of Technical Sciences and has led to the following experience.

It has been found possible to avoid the difficulties mentioned by Mr. Jewitt in obtaining the wanted selectivity curve in feedback i.f. amplifiers for television when using values for the damping and feedback resistors calculated from the measured capacitances and loss factors of the coils and circuitry.

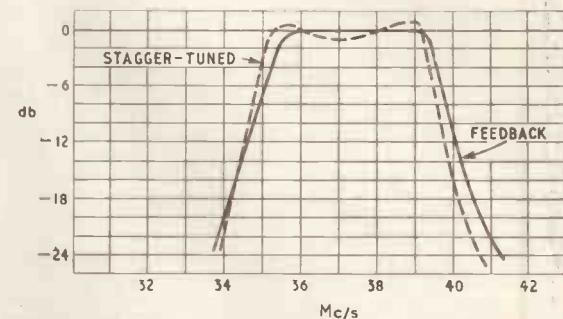
In i.f. amplifiers for television the valve and circuit losses are not negligible, and therefore the calculations should start from the formulae for the π -network. The resistances of this network are formed partly by the loss resistances of the coils and valves and partly by extra damping resistances, and it is the network formed by the latter that should be converted to the T-network used in the actual amplifier. Furthermore, it should be taken into account that the capacitances of the different stages are unequal, and that especially the capacitance in the last tuned circuit is low because this circuit is coupled to the detector. Also the loss factor of the last circuit is high because of the damping from the detector, and it may be necessary to connect the detector to a tap on the coil. On account of this, the feedback T network in the last feedback pair of an i.f. amplifier should be unsymmetrical. This fact is apparently not taken into account in the amplifier described in the later of Mr. Jewitt's two articles.

Owing to the small values of the capacitances of the circuits it is not possible to tune all circuits of the amplifier to the centre frequency by short circuiting the cross resistor in the feedback T network, as described in the articles. This is due to the mistuning developed by the self-capacitances of the resistors. The mistuning can,

however, be avoided if one circuit of a pair is damped by a suitable shunting resistor when the other circuit is being tuned.

The accompanying Figure shows a selectivity curve obtained from a feedback i.f. amplifier containing five valves arranged in two feedback pairs and one single stage, calculated to give maximum flatness. It is mounted with feedback T networks calculated for a bandwidth of 4.7Mc/s and a centre frequency of 37.12Mc/s from the measured circuit capacitances and the measured coil and valve losses. It should be mentioned that after the calculation and the tuning of all circuits to the centre frequency, no empirical change of the amplifier has been made apart from adjusting the distance of the feedback T network to the chassis in such a way that the stray capacitance gives the correct tilt of the selectivity curve. In this way it was not necessary to connect any extra capacitor across the cross resistor of the T network to give the correct tilt.

For comparison the figure shows also the selectivity curve of a stagger-tuned amplifier designed as a quintuple for same centre frequency and bandwidth and built with the calculated values of the damping resistors, the resonating



circuits being separately tuned to the calculated frequencies. It will be seen that the selectivity curve is very similar to that of the amplifier with feedback pairs, and that both curves are close to the desired curve. The curves shown are measured on an amplifier without sound-traps. The insertion of these did not present any difficulties.

JENS RASMUSSEN, P. V. IVERSEN.
Radio Receiver Research Laboratory,
Danish Academy of Technical Sciences
Copenhagen.

"As She Is Spoke"

I AM afraid I cannot agree with Mr. Briggs that the manufacture of loudspeakers should be prohibited. "But," Mr. Briggs may protest, "I never said it should!" Quite. Neither did I say, or even imply, that use of the word "recording" as a noun was wrong. On the contrary, the use I advocated was as a noun, namely, the process of making a record. I would agree with Mr. Briggs in including within that term the quality of the process, as distinct from the mechanical quality of the individual record produced, just as a photographic print may be said to show evidence of faulty printing. But he goes on to say that a record on tape must be referred to as a recording. Why? If, as may well happen, it becomes customary to print photographs on plastic materials, will Mr. Briggs insist on their being called "printings"?

It is true that, as Mr. Arnot says, the public are accustomed to records in the form of discs. But if they will now have to get used to them in the form of tapes, what of it? For many centuries they associated the word

LETTERS TO THE EDITOR

continued

"ship" with a wooden structure surmounted by sails, but seem to have experienced no insuperable difficulty in subsequently admitting metal structures, with no sails. The word "record" implies nothing about the material basis, and is equally valid for all. A cheque is usually drawn on a slip of paper, but, as Sir Alan Herbert has pointed out, there is no legal reason why it should not be on the back of a live cow.

A perfectly logical terminology is too much to expect, but please, gentlemen, do not let us go out of our way to introduce false associations.

Bromley, Kent.

M. G. SCROGGIE.

Television-To-Sound Interference

WHEN "In Town Tonight" the other evening was broadcast on both the Home and Television Services, I was amused to hear, quite distinctly, vision-channel interference in the background of the sound signal on the Home Service.

This must be very heartening to anyone who has at any time had difficulty in excluding vision interference from the sound channel of a domestic television receiver—and who has not?

London, N.10.

IAN LESLIE.

Television Quality

MAY I add my support to the points made by G. T. Clack in the January issue of *Wireless World* concerning the poor quality of television transmissions during the News and Newsreel programme. Obviously there are reasons for this deplorable state of affairs and I suspect that they are not solely concerned with technical considerations. It is, however, most regrettable that the B.B.C.—who are soon going to face strong competition—should have allowed their normally superior standards to fall to such a low level at this crucial time. I would earnestly implore the authority responsible for the nightly perpetration of this return to the magic-lantern era to think again. Even if we ignore the poor technical standards surely very few viewers prefer the present presentation of the News to the previous and more polished style of a few years ago. Mr. Bernard Hollwood has quite adequately summarized the position in a recent article in *Punch*. He suggests that the troubles of News and Newsreel are caused by misplaced enthusiasm and a misconceived notion of the function of the service.

CHARLES A. MARSHALL.

Carshalton,
Surrey.

"Telepathy by V.H.F."

I HAVE just seen "Free Grid's" reference to Maskelyne and his radio experiments in your January issue. This is of great interest to me because the Maskelyne he refers to was my father, the late Nevil Maskelyne, and there can be no doubt as to the seriousness of the work he did. It may be of interest to recall that he was a director of The Amalgamated Wireless Telegraph Co., Ltd., and one of his co-directors was Lee de Forest, whom I was privileged to meet many years later.

I remember, as a small boy, living at Seasalter, near Whitstable, and being invited to look across the Thames estuary on fine days to "see father's wireless mast," at or near Shoeburyness. About the same time he had erected other wireless stations in the country and among them was one near Porthcurno, Cornwall, and another, I think, at Cleethorpes.

I remember well hearing of the incident in which my father proved to an audience at the Royal Institute that there certainly were weaknesses in the tuning devices then in use, though my memory does not connect with

it the name of Sir Ambrose Fleming. At or about this time he visited the then St. Petersburg and was instrumental in introducing wireless to the Russian Government, who carried out experiments with a view to equipping the Russian navy.

There can be no doubt that some of his most useful work was carried out in conjunction with the Rev. J. M. Bacon's balloons. Of the two men, the one was interested in balloons as such and the other as a means of carrying wireless equipment. My father was a long-sighted man and foresaw that success in the air would come with heavier-than-air machines, and I have no doubt that he foresaw also that here lay a field for the utilization of wireless.

It may be of interest to record here that I have before me as I write a few leaves from his experimental notebook. The notes are dated July 9th, 1906, and they record, with diagrams, experiments he was then making with "diodes" connected up to produce continuous oscillation. They also show that he wasn't having a very happy time with it. Using a circuit in which there were two diodes connected, he failed to get continuous oscillation. However, he recorded that "Cossor sent in a third valve," and he repeated the experiment using all three, without success. His reasoning shows clearly that it was not more valves that he wanted, but the third electrode. But he just didn't think of it. However, a page or so later he records that he got his oscillations, but could not induce any current in his aerial. In the end he did get a current in his aerial and says that his previous failure to do so was because "The tuning proved to be so sharp that, on passing to the next turn of the helix in either direction, there was no aerial current."

I place a high value on these few pages of a great man's notebook, because they stand for me as a reminder that, but for a certain legal dispute that went against him in the House of Lords, my father might have died one of the greatest personalities of his time.

In the days immediately following my leaving college I tried to follow in his footsteps with the Mullard Radio Valve Co., Ltd., but the attempt proved only that my father was a much greater man than I.

Lurgashall,
Sussex.

NOEL MASKELYNE.

Musical Feedback

AS a Scot who used to play the bagpipes before he came to live among the unmusical English, I would like to add to the analogy which "Cathode Ray" uses in his admirable article on rectifier circuits (March issue).

Whereas a capacitor depends to a large extent on dryness for low leakage, the bag of the bagpipes depends on moisture—a minor discrepancy—and the moisture is supplied by pouring into the bag a special liquid which is distilled in the Scottish Highlands.

Also the analogy could have been extended to say that the conductor from G to C is the pipe through which the piper blows. The pipe includes a valve which, in common with other one-way devices, hasn't got infinite resistance in one direction, but "let's by."

What it lets by is the vapour from the liquid in the bag and it is the subtle aroma from the vapour entering the respiratory organs of the "intermittently breathing Scot" that inspires and stimulates him to produce the stirring music which one associates with the bagpipes. It acts, in fact, as a sort of musical positive feed-back!

Leafield, Oxford.

A. CAMPBELL.

Electronics on the Farm

I HAVE read with interest letters in your recent issues from H. G. P. Taylor and D. A. Bond on the subject of electric fences, and your readers may be interested to have a few comments from a manufacturer.

The "hoary old stager" referred to by Mr. Taylor (the inductive discharge type with a balance wheel) has many advantages from the farmer's point of view and is still very much the most popular, both here and (more impressively, perhaps) in the United States, which is the pioneer country in electric fencing and where every conceivable idea has been tried out from time to time. This balance wheel type is robust, efficient from the input-output point of view and, moreover, the audible click at each impulse provides an easy way of ensuring that the unit is working. Also, a great many farmers prefer the rechargeable accumulator to purchasing dry batteries.

I would add the following comments to the various points raised in the two letters referred to above:

- (1) A neon tube will not discharge the condenser to sufficiently low voltage due to high extinguishing voltage.
- (2) A neon tube will not carry the high peak current required.

(3) Grid-triggered neon tubes such as those used in stroboscopes, while they are capable of passing heavy peak currents, will not work at the voltage of a standard high-tension battery.

(4) Glass-enveloped tubes would not, in my view, be suitable for use under the trying practical conditions experienced on a farm.

(5) The method suggested by Mr. Taylor of permanently connecting a neon in series with a high resistance across the line and earth does not give an indication of a good line, since even with the line fouled so badly that there is only 180 volts (peak) available the neon will still give a flash, but the line at this voltage will be practically useless.

Testing with a blade of grass, as suggested by Mr. Bond, is probably more effective though again extremely inaccurate. We now manufacture a tester incorporating a variable spark gap in series with a neon light, which gives a far more accurate indication.

I think your correspondents may not have heard that there is a British Standard Specification controlling the output and frequencies of electric fencers. This does not allow an interval of less than 0.75 second between impulses.

R. S. DRAKE.

The Wolseley Sheep Shearing Machine Company,
Witton, Birmingham.

OPEN LETTER TO THE POSTMASTER GENERAL

Allocation of Frequencies : A British Communications Commission

DEAR P.M.G.,

During the last twenty years there have been a number of proposals to revise the system under which frequencies are allocated. I suggest that the time has now come when this problem needs tackling. Some of the basic arguments were well covered in the leading article of *Wireless World* for November, 1954.

I suggest it is highly desirable to have a body outside the control of the Postmaster-General responsible for allocating frequencies. It is obviously essential, however, that the Government should maintain overall control in view of the vital part played by radio and radar in the defence of this country.

In the absence of alternative proposals, may I submit the outline of a scheme which might replace that used during the last fifty years?

Need for an Early Change.—The rapid expansion of radio and radar equipments makes the allocation of suitable frequencies increasingly important and difficult. Blocks of frequencies are becoming ever more precious, and it is important that no user, be he civilian or military, should occupy more frequencies than are strictly necessary.

Possible Alternative Method.—As long as the Defence Services are large-scale users of frequencies, the Government must retain overall control. In my submission, this should be exercised, not by the P.M.G., who is himself a user, nor by the Ministry of Defence, which is the largest user; but by some authority under a Minister who is not himself an interested party. I suggest the Lord President of the Council, who controls the Government's scientific policy and therefore has suitable advisers.

I suggest he should control a British Communica-

tions Commission and that this Commission should consist of two panels:

- (a) The Civilian Radio Panel, on which the radio industry, the Board of Trade and other interested Ministries would be represented.
- (b) The Defence Radio Panel, on which the Service Departments, including the Home Office, and the Ministry of Supply would be represented.

It is important that there should be a connection between the work of these two panels. I suggest that the Secretariat should be common to both, and that the Chairman of each Panel should be a member of the sister Panel.

Proof of Occupancy.—The operational needs and radio techniques of the Defence Services are constantly changing. The same applies to the civilian radio services. It is important, therefore, that the frequency bands allocated by the British Communications Commission should be monitored to make sure that unnecessary interference is not being caused, and that the channels are being adequately used.

The responsibility for this monitoring service is a matter which could be discussed later. The G.P.O. have an obvious claim, as they have suitable equipment and personnel. The monitoring service should furnish reports direct to the British Communications Commission.

I don't pretend that this is the ideal set-up, but I would like to see some constructive alternative put forward which would ensure an independent and balanced control of the radio spectrum.

Yours sincerely,
House of Commons. C. I. ORR-EWING.

Design for an F.M. Tuner

(Concluded from p. 163
of the April issue)

2—Circuit and Constructional Details

By S. W. AMOS,* B.Sc. (Hons.), A.M.I.E.E. and G. G. JOHNSTONE,* B.Sc. (Hons.)

THE basic principles governing the design of an f.m. receiver were described in last month's issue and this article gives full details of an f.m. tuner based on these principles. The circuit comprises a pentode r.f. amplifier, a frequency-changer consisting of a pentode mixer and separate triode oscillator, followed by an i.f. amplifier employing two pentodes in cascade, the second acting as a high-level limiter. The next stage is a ratio detector with two crystal diodes feeding a triode cathode-follower output stage. The oscillator and cathode follower are the two halves of a double-triode valve and this, together with a magic-eye tuning indicator and h.t. rectifier bring the total of valves to seven (excluding crystals). There is considerable latitude in the choice of valves. The four pentodes are of the same type; the authors have successfully used B7G-pentodes of the EF91 type and B9A-pentodes of the EF80 type. The double-triode is a 12AT7 or equivalent and the rectifier can be any type delivering 40 mA at 250 V which can be operated from the general l.t. winding.

The complete circuit diagram of the tuner is given in Fig. 1. V_1 is the r.f. stage and the grid-circuit tuning is pre-set to approximately 94 Mc/s, the centre of the 12.5-Mc/s range it is intended to receive.

To keep the loss in sensitivity at the ends of the band to less than 3 db, the effective Q of the grid circuit must be less than 94/12.5, or approximately 7.5. The input transformer L_1L_2 is designed to match an 80Ω unbalanced feeder to a resistive load consisting of the input resistance of V_1 in parallel with the dynamic resistance of the secondary circuit. The dynamic resistance is approximately $2,500\Omega$ and the valve input resistance may be between $2,000\Omega$ for an EF91 and $4,000\Omega$ for an EF80. The effective secondary load may thus be between $1,100\Omega$ and $1,500\Omega$ depending on the valve type; the average may be taken as $1,300\Omega$, which is reduced to 650Ω by the addition of the connection to the feeder. To obtain a Q of 7.5 from an L-C circuit of effective dynamic resistance of 650Ω requires a reactance of $650/7.5$, or approximately 90Ω . At 94 Mc/s this implies a capacitance of 19 pF . Of this 14 pF is contributed by the valve and stray capacitance and remaining 5 pF is added in the form of a physical component.

The anode circuit of V_1 is tuned by L_3C_{15} , C_{15} being one section of the two-gang tuning capacitor. Each section of this capacitor has a capacitance range of about 7 pF and this must have in parallel a fixed capacitor to give the desired frequency range of 87.5 to 100 Mc/s. For a given inductor the reson-

* Engineering Training Department, British Broadcasting Corporation.

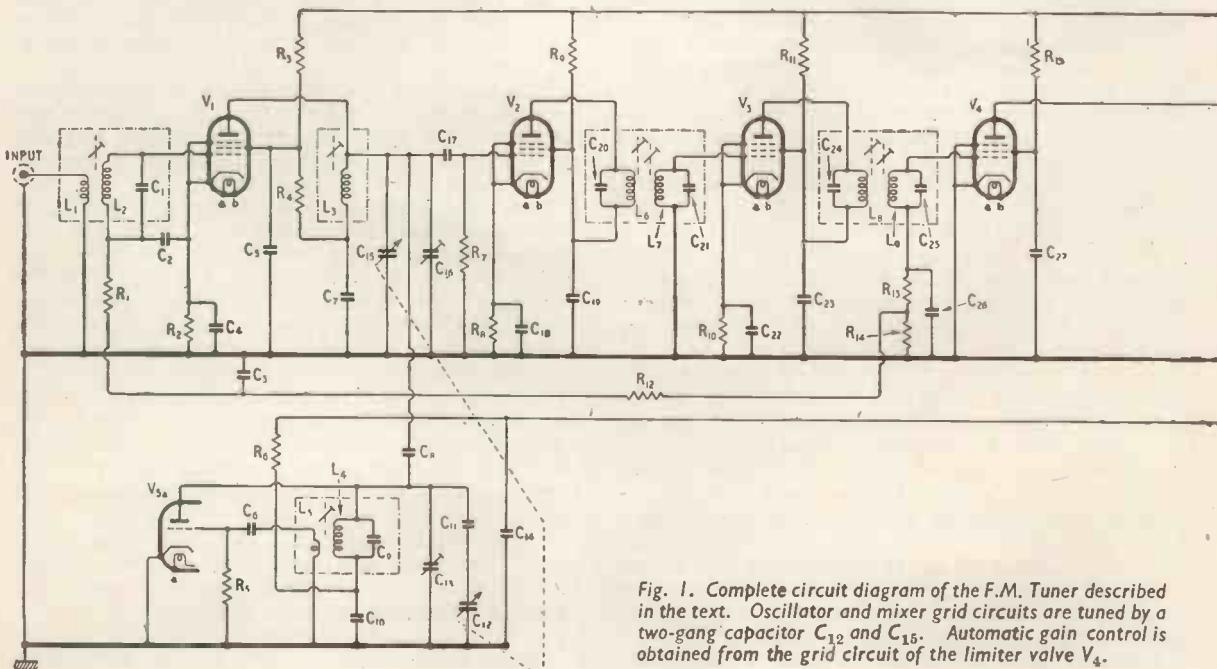


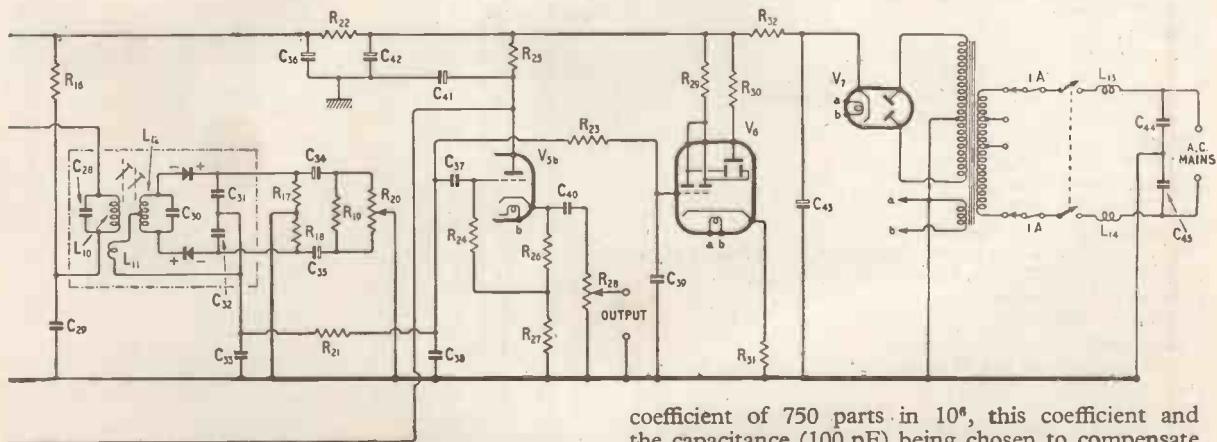
Fig. 1. Complete circuit diagram of the F.M. Tuner described in the text. Oscillator and mixer grid circuits are tuned by a two-gang capacitor C_{12} and C_{15} . Automatic gain control is obtained from the grid circuit of the limiter valve V_4 .

ance frequency depends on the square root of the capacitance and thus we have

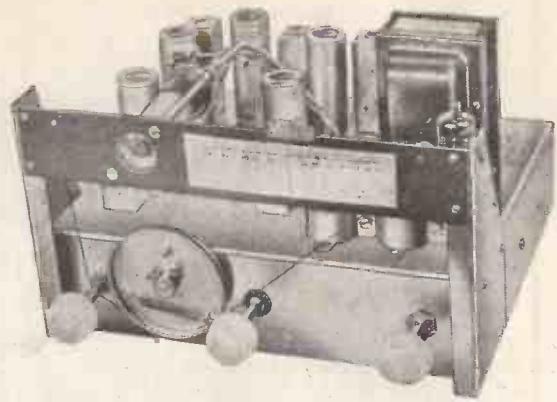
$$\frac{C + \Delta C}{C} = \left(\frac{100}{87.5} \right)^2$$

where ΔC is 7 pF and C is the fixed capacitance. This gives C as 22 pF. This is approximately the value of capacitance present in the circuit and is made up of the output capacitance of V_1 (4 pF), the input capacitance of V_2 (11 pF), the minimum capacitance of the tuning capacitor (3 pF), strays and the capacitor C_8 in the oscillator circuit. For alignment of the circuit it is necessary to have a trimmer in parallel with L_3 and, because the minimum capacitance of this component necessarily adds further fixed capacitance, the contribution from V_2 is reduced by using a 50-pF coupling capacitor C_{17} . By adjustment of the trimmer C_{18} the correct ratio of maximum to minimum frequency can be obtained and by adjustment of the inductance of L_3 operation can be secured in the correct frequency band.

The oscillator is a triode (V_{5a}) operating on the high side of the signal frequency. The intermediate frequency is 10.7 Mc/s and the oscillator frequency limits are therefore 98.2 and 110.7 Mc/s. This is achieved with the second section of the tuning capacitor C_{12} , the capacitance swing being limited to 6 pF by a series fixed capacitor. The fixed shunt capacitance required to give the correct ratio of maximum to minimum frequency is also 22 pF as for the inter-valve r.f. circuit. Of this approximately 4 pF is contributed to V_{5a} , 3 pF by the tuning capacitor, 1 pF by the coupling to the mixer grid and 2 pF by stray capacitance, leaving 12 pF to be included as a physical component. This is made up of a capacitor C_9 and a trimmer C_{13} which is adjusted, as explained in the alignment procedure, to give the desired ratio of maximum to minimum frequency.



The particular oscillator circuit employed was chosen because it enables the cathode of the valve and the moving vanes of the tuning capacitor to be earthed. In this form of oscillator the resonant circuit can be included in the anode or the grid circuit but the former arrangement was considered better because it presents the valve with a higher value of anode load and thus gives a larger output. Moreover the grid-cathode capacitance of the valve,



General layout of the front of the tuner.

being connected across a small coupling coil, has little effect on frequency of oscillation. Variations in grid-cathode capacitance can cause significant fluctuations in frequency if the resonant circuit is connected between grid and cathode. In the circuit adopted the resonant circuit is shunted by the anode-cathode and anode-grid capacitances which are more stable than the grid-cathode capacitance. It is this latter capacitance which principally controls the frequency drift in the first few minutes after switching on, the total change in this period being of the order of 25 per cent. With the particular form of oscillator circuit adopted, this warming-up shift is reduced to negligible proportions.

The components used in the oscillator circuit are chosen to minimize long-term frequency drift. For example C_{11} in series with the tuning capacitor is an N750 type, i.e. has a negative temperature

coefficient of 750 parts in 10^6 , this coefficient and the capacitance (100 pF) being chosen to compensate as far as possible for the positive temperature coefficient of the tuning capacitor. Similarly the capacitance and coefficient of C_9 are chosen to compensate for variations with temperature of the inductance of L_4 ; this capacitor is included in the screening can so as to have the same temperature as the inductor. Unless components of similar specification are used in this part of the circuit there may be an undesirable drift in tuning; the complete specification for these and all components in the tuner is given in the list

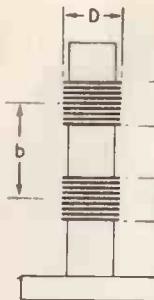


Fig. 2. The i.f. transformers used in the set take this form. As explained in the text the coupling coefficient and hence bandwidth is calculated from the dimensions a and b .

of parts. Provided the correct components are used the long-term frequency drift is very small.

The oscillator output is connected to the mixer V_2 by a small fixed capacitor C_8 , the value of which is chosen to give the correct value of oscillator drive at the mixer grid. At the oscillator frequency the mixer circuit behaves as a capacitance the value of which is given approximately by $2Cf_1/f_2$ where C is the physical capacitance present, f_1 is the intermediate frequency and f_2 the oscillator frequency. Substituting $C=25\text{ pF}$, $f_1=10.7\text{ Mc/s}$ and $f_2=105\text{ Mc/s}$ (values applying when the tuning capacitor is at its mid-setting) gives the effective capacitance as 5 pF . The oscillator output at V_{5a} anode is approximately 20 V peak and the drive required at V_2 grid for optimum conversion conductance is 3 V peak; thus the optimum value of C_8 is less than 1 pF . In practice a 1-pF capacitor is used and the

drive is about 4 V in peak value, varying slightly as the tuning setting is changed.

V_2 is an additive mixer and is biased partly by conventional cathode resistor and capacitor and partly by grid current flowing in the $1\text{-M}\Omega$ grid leak R_7 , as a result of the oscillator drive. The i.f. transformer connected in its anode circuit is of the usual double-wound type and has two similar windings on a former of 0.3 in diameter. To minimize any capacitance coupling between the windings (which might affect the shape of the response curve) the adjacent ends of the windings are arranged to be earthy. The position of the dust-iron cores can affect the mutual inductance significantly and to minimize these effects the design is such that at resonance the cores are only approximately half-embedded in the outer ends of the windings. The spacing between the windings is very critical and an error of as little as $1/16\text{ in}$ can alter the coupling factor (kQ) from 1.2 to 2.0! A formula which has proved very useful in calculating the required spacing (giving coupling factors within a few per cent of the measured values) is the following derived by one of the authors† some years ago:

$$b = 0.44D \left[\left(\frac{1 + 2.3a/D}{k} \right)^{\frac{1}{2}} - 1 \right]$$

where b = distance between coil centres
 D = overall diameter of windings
 a = length of each winding

† S. W. Amos, Calculating Coupling Coefficients; *Wireless World*, September, 1943, p. 272, 273.

LIST OF PARTS

Coils:

Aerial: Allen type FMC102; Osmor type QAFM.
R.F. inter-valve: Allen type FMC103; Osmor type QRPM.
Oscillator: Allen type FMC104; Osmor type QOFM.
I.F. transformer: Allen type FMC101; Osmor type QIFM; Denco type IFT11.
Ratio-detector transformer: Allen type FMC151; Osmor type QICD.

Valves:

Pentodes: EF91, Z77 or equivalent.
EF80, Z719 or equivalent.

Double-triode: 12AT7, B309 or equivalent.

Rectifier: EZ80, U709 or equivalent.

Magic eye: EM34.

Crystals: GEX34 or OA72.

Mains transformer:

Electro-Voice type 104E.

Tuning-drive Components:

Spindle, drum, flywheel, universal coupler, pulleys, pivots, pointer, cord, spring etc. Jackson Bros.

Mains R.F. Chokes:

Dubilier 1-amp type.

Resistors:

All resistors can be $\frac{1}{4}\text{ W}$ rating and $\pm 20\%$ per cent tolerance unless otherwise specified.

R_1	$10\text{ k}\Omega$	R_{10}	$270\Omega \pm 10\%$ for EF80 or $180\Omega \pm 10\%$ for EF91
R_2	$270\Omega \pm 10\%$ for EF80 or $180\Omega \pm 10\%$ for EF91	R_{11}	$1\text{ k}\Omega$
R_3	$1\text{ k}\Omega$	R_{12}	$1\text{ M}\Omega$
R_4	$1\text{ k}\Omega$	R_{13}	$100\text{ k}\Omega$
R_5	$47\text{ k}\Omega$	R_{14}	$100\text{ k}\Omega$
R_6	$1\text{ k}\Omega$	R_{15}	$100\text{ k}\Omega$
R_7	$1\text{ M}\Omega$	R_{16}	$1\text{ k}\Omega$
R_8	$270\Omega \pm 10\%$ for EF80 or $180\Omega \pm 10\%$ for EF91	R_{17}	$8.2\text{ k}\Omega \pm 1\%$
R_9	$1\text{ k}\Omega$	R_{18}	$8.2\text{ k}\Omega \pm 1\%$
		R_{19}	$6.8\text{ k}\Omega$
		R_{20}	$10\text{ k}\Omega$ potentiometer

Resistors (continued)

R_{21}	$100\text{ k}\Omega$	R_{27}	$47\text{ k}\Omega$
R_{22}	$1.5\text{ k}\Omega$ 3W	R_{28}	$50\text{ k}\Omega$ potentiometer
R_{23}	$1\text{ M}\Omega$	R_{29}	to be selected
R_{24}	$1\text{ M}\Omega$	R_{30}	$200\text{ k}\Omega$
R_{25}	$10\text{ k}\Omega$ $\frac{1}{2}\text{ W}$	R_{31}	$1.5\text{ k}\Omega$
R_{26}	$470\Omega \pm 10\%$	R_{32}	$1\text{ k}\Omega$ 3W

Capacitors:

Where a capacitor is specified as a particular type, or with a particular value of temperature coefficient, it is essential to use this type.

C_1	5 pF	C_{24}	50 pF silver mica
C_2	$0.005\text{ }\mu\text{F}$ ceramic	C_{25}	$\pm 5\%$
C_3	$0.1\text{ }\mu\text{F}$ 150V	C_{26}	50 pF silver mica
C_4	$0.005\text{ }\mu\text{F}$ ceramic	C_{27}	$\pm 5\%$
C_5	$0.005\text{ }\mu\text{F}$ ceramic	C_{28}	20 pF
C_6	20 pF Erie NPOK	C_{29}	$0.005\text{ }\mu\text{F}$ ceramic
C_7	$0.005\text{ }\mu\text{F}$ ceramic	C_{30}	$0.005\text{ }\mu\text{F}$ ceramic
C_8	1 pF Erie NPOK	C_{31}	39 pF Erie type N330
C_9	8.2 pF Erie N750K	C_{32}	300 pF
C_{10}	$0.001\text{ }\mu\text{F}$ silver mica	C_{33}	300 pF
C_{11}	100 pF Erie NPOK	C_{34}	$25\text{ }\mu\text{F}$ 25V electrolytic
C_{12}	$3\text{-}10\text{ pF}$ tuning capacitor, Jackson Bros. type U102	C_{35}	$25\text{ }\mu\text{F}$ 25V electrolytic
C_{13}	$1.5\text{-}7\text{ pF}$ trimmer Erie type NPO557A	C_{36}	$16\text{ }\mu\text{F}$ 350V electrolytic
C_{14}	$0.005\text{ }\mu\text{F}$ ceramic	C_{37}	$0.01\text{ }\mu\text{F}$
C_{15}	Same as C_{12}	C_{38}	500 pF
C_{16}	$1.5\text{-}7\text{ pF}$ trimmer Erie type NPO557A	C_{39}	$0.1\text{ }\mu\text{F}$ 150V
C_{17}	50 pF	C_{40}	$0.25\text{ }\mu\text{F}$ 150V
C_{18}	$0.005\text{ }\mu\text{F}$ ceramic	C_{41}	$16\text{ }\mu\text{F}$ 350V electrolytic
C_{19}	$0.005\text{ }\mu\text{F}$ ceramic	C_{42}	$16\text{ }\mu\text{F}$ 350V electrolytic
C_{20}	50 pF silver mica $\pm 5\%$	C_{43}	$16\text{ }\mu\text{F}$ 350V electrolytic
C_{21}	50 pF silver mica $\pm 5\%$	C_{44}	470 pF Erie type CD9P/101
C_{22}	$0.005\text{ }\mu\text{F}$ ceramic	C_{45}	470 pF Erie type CD9P/101
C_{23}	$0.005\text{ }\mu\text{F}$ ceramic		

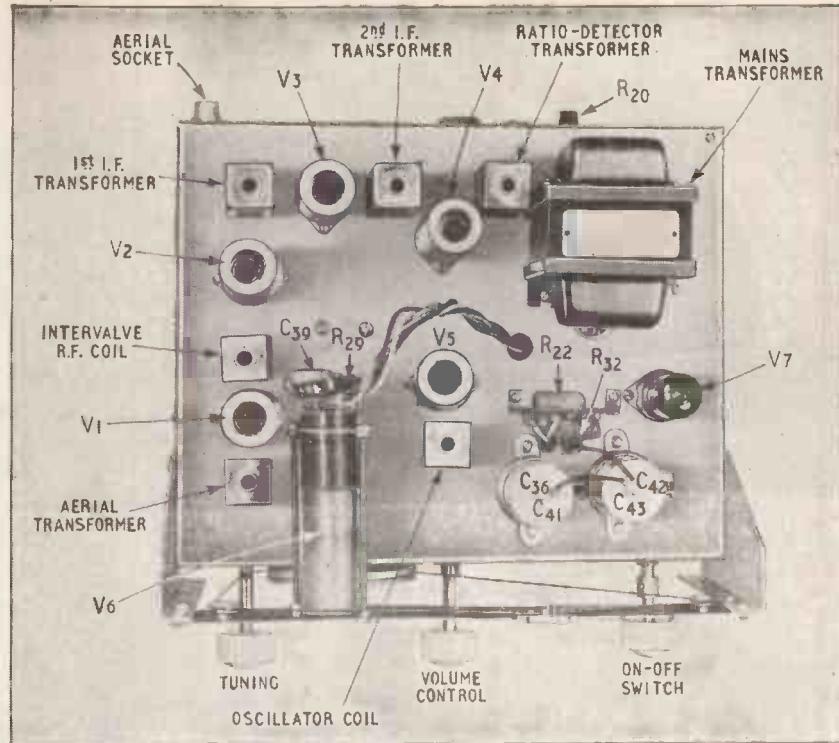
These dimensions are illustrated in Fig. 2. As an example of the use of this formula suppose $a = 0.35$ in and $D = 0.32$ in. If the working Q value is 70, and the coupling factor is required to be 1.2, the coupling coefficient must be $1.2/70 = 0.017$. Substituting in the above expression gives b as 0.68 in. The spacing between the adjacent ends of the coils must hence be $0.68 - 0.35 = 0.33$ in.

V_3 is the first i.f. stage and operates at full gain. V_4 , the second i.f. stage, is designed to work as a high-level limiter and operates with a screen-grid voltage of approximately 100. There is no cathode bias and on receipt of an input signal the valve takes grid current, developing a voltage across R_{13} and R_{14} equal to the peak value of the signal. The voltage across R_{14} is fed back to the grid of V_1 as a.g.c. V_4 acts as a leaky-grid detector and any amplitude modulation present on the input signal (due to ignition interference for example)

appears across R_{14} . R_{12} and C_3 are included in the a.g.c. line to prevent such signals from reaching V_1 . The grid base of V_1 is approximately 5 V and the a.g.c. line cannot therefore exceed 5 V no matter how strong the received signal. To give 5 V across R_{14} the input to the limiter must be 10 V peak; this is approximately 3 times the grid base of V_4 and thus ensures reasonably good limiting at high signal levels.

The decoupling used in the i.f. amplifier must be satisfactory at 10.7 Mc/s and at very much higher frequencies in order to prevent parasitic oscillation and i.f. harmonic feedback to the r.f. stages. Satisfactory operation was obtained by using 0.005- μ F ceramic capacitors for decoupling throughout the tuner. The heater current of all valves is supplied through tightly twisted twin flex. Decoupling was necessary only at the heaters of V_1 and V_5 where a 0.005- μ F capacitor is joined between each heater socket in the valve holder and chassis in order to cure a slight modulation hum.

The discriminator transformer L_{10} , L_{11} , L_{12} was wound by the authors to a specification by the General Electric Company but it is also obtainable commercially (see the list of parts). It employs two crystals which are included with the capacitors C_{31} , C_{32} in the screening can. With a ratio detector of the conventional type, such as that used in the F.M. Feeder Unit (*Wireless World*, September 1952) amplitude limitation is adjusted to a maximum by variation of the resistance in series with the electrolytic capacitors. Such adjustments upset the d.c. balance of the circuit with the result that there may be a d.c. output when the applied signal is accurately in tune. This was of no significance in the F.M. Feeder Unit but in this tuner the d.c. output is used to operate a magic-eye tuning indicator,

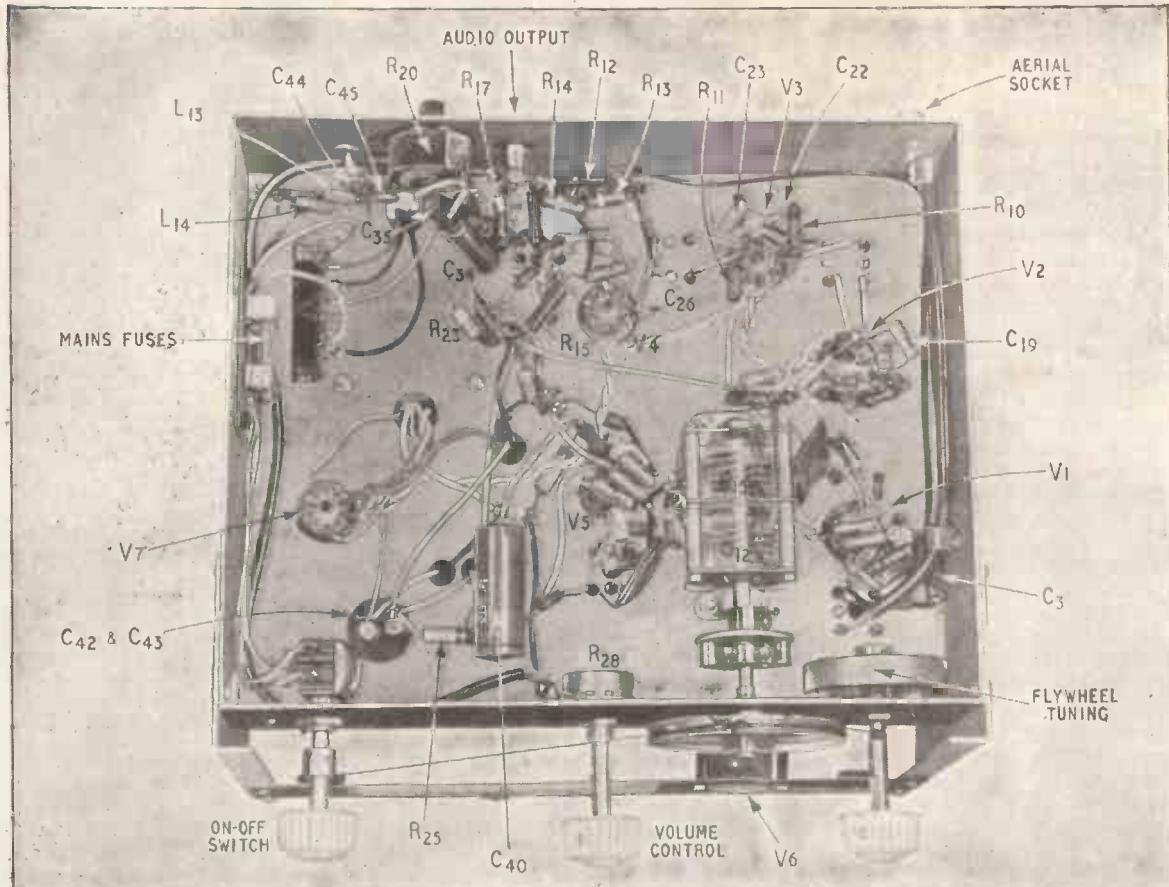


The relative position of the larger components, valves and coils is shown by this view.

and for this to be successful, it is essential that adjustment of the series resistance should not affect the d.c. balance. The circuit used meets these requirements provided the resistors R_{17} and R_{18} are equal; 1 per cent tolerance components are recommended.

The output of the discriminator passes through the de-emphasis network (of 50 μ sec time constant) R_{21} , C_{38} and then feeds the magic-eye through the network R_{23} , C_{39} which removes a.f. signals which would cause blurred tuning indication. The a.f. output is applied to the cathode follower V_{5b} .

The use of a cathode follower as output stage has the advantage that the tuner can feed amplifiers with comparatively low input resistance (such as 10 k Ω) without loss of audio signal. If such a resistance were to be connected directly across the output of the de-emphasis network there would be a loss of more than 20 db due to the series resistor R_{21} and this resistor cannot be reduced without affecting the performance of the detector. A second advantage resulting from the use of a cathode follower is that its low output resistance permits the use of comparatively long screened leads to the following amplifier without attenuation of upper audio frequencies. The highest output resistance occurs when the gain control, R_{28} , is at its mid-position and has a value of about 12.5 k Ω ; it is possible to load such a generator resistance with as much as 600 pF of shunt capacitance before the loss at 10 kc/s approaches 1 db. The cathode follower has quite a small a.f. input and can operate satisfactorily with a low anode current. The current is approximately 2 mA and is kept low to reduce the rise in temperature of the valve. The cathode follower is in the same bulb as the oscillator and it is advantageous to keep the temperature rise as small as possible in the interests of frequency stability.



The bulk of the smaller components, including the gang capacitor, are located below the chassis. The annotation enables most of them to be identified.

It is by no means easy to tune an f.m. receiver accurately to a desired transmission by ear and some form of tuning indicator was considered necessary. The obvious choice is a magic eye connected across the a.g.c. line, or across the electrolytic capacitor of the ratio detector. This is unsatisfactory if the receiver has the right shape of passband because the deflection of the eye remains substantially unaltered over a frequency range of approximately 100 kc/s on either side of the correct tuning point. If, as is common, the selectivity characteristic is asymmetric as a result of Miller effect the maximum a.g.c. voltage can give a positively misleading indication.

A precise tuning indication can be obtained from the output of the ratio detector which is zero when the receiver is correctly tuned, but is positive or negative if the receiver is mistuned. In fact the polarity and magnitude of the ratio detector output indicate respectively the sense and degree of mistuning. The tuning indicator is thus required to show accurately when the ratio detector output is zero and it was found that a magic eye operated under certain conditions could be used for this purpose.

The magic-eye circuit is so designed that the eye is closed (shadow angle zero) when there is no input to the control grid. If a positive voltage is applied to the control grid the eye opens, i.e. the shadow angle increases and if a negative voltage is applied the

sectors of luminescence overlap, corresponding to a negative shadow angle. To avoid grid current and to enable the eye to respond to positive inputs a resistor is included in the cathode circuit and the anode and target potentials are then so chosen that the eye is closed for zero input voltage. This condition can be obtained with a high value of target potential, but a low value of anode load is required and the sensitivity of the eye is poor. By using a lower target potential a higher value of anode load can be used and satisfactory sensitivity obtained, but the brightness of the eye is poor. In the compromise solution adopted the target potential is approximately 100 V and the anode load is of the order of 250 k Ω . Where a tuner is normally operated with a large input signal the maximum sensitivity of the eye is unnecessary and a brighter display could be obtained by using a higher target potential of say 170 V and a lower value of anode resistor.

The mains unit is conventional and includes a mains transformer with two secondary windings, one supplying 40 mA at 250—0—250 V and the other supplying 3 A at 6.3 V. The smoothing circuit includes three resistors R₂₂, R₂₅ and R₂₈ and four electrolytic capacitors; for convenience the capacitors are in the form of two 16 + 16- μ F components. The mains lead includes an r.f. filter L₁₃ L₁₄ C₄₄ C₄₅ which prevents radiation of r.f. energy from the lead outside the

chassis; this filter, to be effective, must be situated very close to the point where the lead leaves the chassis.

Before aligning the receiver it is advantageous to adjust the tuning indicator. To do this short-circuit C_{29} and replace R_{29} by a $1\text{-M}\Omega$ variable resistor. Adjust R_{29} to give zero shadow angle, i.e. close the eye, and then replace the variable resistor by a fixed one of the same value. Remove the short circuit.

The alignment can now be carried out and for this purpose an a.f. amplifier is required and also an a.m. signal generator capable of giving an output at 10.7 Mc/s and between 87.5 and 100 Mc/s. With the amplifier connected to the tuner output apply a modulated signal at 10.7 Mc/s to V_4 grid and adjust L_{10} for maximum audio output. Switch off the modulation and with a plain carrier input to the limiter adjust L_{12} until it is accurately tuned as indicated by the magic eye. The correct tuning is achieved when the eye is just closed and with no overlap of bright areas and no shadow showing. As the core is rotated from this position the eye either opens or the bright regions overlap and display a brighter centre segment.

Now transfer the generator output to V_3 grid and connect the amplifier input across C_{26} . With a modulated r.f. input at 10.7 Mc/s adjust the cores of the second i.f. transformer to give maximum audio output from the amplifier. Transfer the generator output to V_2 grid and repeat the adjustment for the first i.f. transformer. These adjustments should be carried out at all times with the smallest output from the generator which can be heard adequately.

With the amplifier still connected across C_{26} transfer the generator to the aerial input socket of the tuner. Adjust the generator to give a modulated output at 87.5 Mc/s and set capacitors C_{12} and C_{15} to maximum. At this setting of the tuning capacitors the pointer should indicate 87.5 Mc/s. Tune in the signal by adjustment of L_4 ; if the signal can be heard at two core settings choose that corresponding to the smaller inductance. Then adjust L_3 to give maximum output. Now set the generator to 100 Mc/s and the tuning capacitor to minimum capacitance; the pointer should now indicate 100 Mc/s. Adjust C_{13} to tune in the signal and C_{16} to give maximum output. Repeat the inductance adjustment at 87.5 Mc/s and the capacitance adjustment at 100 Mc/s until no further improvement can be effected.

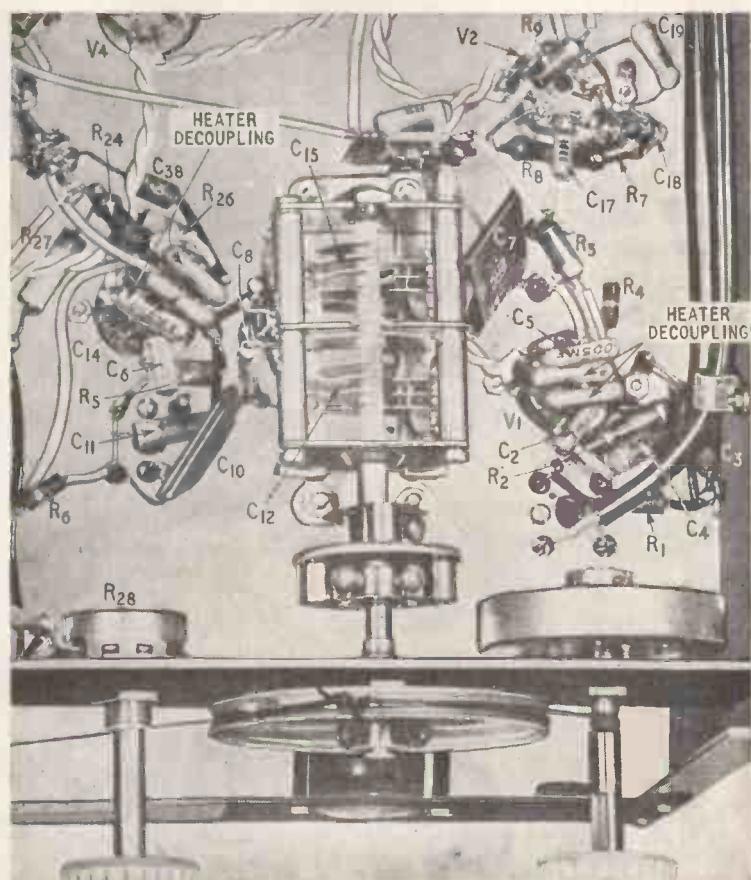
Disconnect the signal generator and reconnect the amplifier to the a.f. output socket of the tuner. Set the tuning control to approximately 94 Mc/s and adjust the inductance of L_2 to give maximum noise output.

Finally, to adjust the potentiometer R_{20} , connect an aerial to the tuner and find a weak signal. Adjust R_{20} to give minimum background noise; if the signal is frequency modulated

this setting should also give best quality of reproduction. It is possible that a different setting of R_{20} may be required for a larger input signal. The value of R_{19} was found to be optimum for the particular ratio detector transformer and crystals used and should be generally suitable for commercial versions of it. If, however, the highest degree of a.m. rejection is required the value of R_{19} should also be adjusted.

Mechanical details of the tuner can be seen from the accompanying photographs. A conventional chassis of 16 s.w.g. aluminium measuring 10 in by 8 in by $2\frac{1}{2}$ in is used. The tuning capacitor is mounted underneath the chassis and the coils above the chassis, and individually screened. The smoothing resistors dissipate approximately 4 W and are mounted above the chassis for good ventilation; if these components are located underneath there might be some frequency drift due to the increase in temperature of components near the resistors. The smoothing resistors are at h.t. potential and are placed away from the edges of the chassis to avoid, as far as possible, accidental contact with them.

The tuning spindle on the left-hand side of the front panel drives a cord which passes once round the $2\frac{1}{2}$ in diameter drum and over two pulleys riveted at the upper corners of the tuning scale, tension being applied to the cord by a spring inside the drum. The drum drives the tuning capacitor via a flexible coupling and the cord carries a pointer which slides along the top of the tuning scale, which is of 20 s.w.g.



This enlarged section of the underside of the chassis shows in greater detail the layout of the r.f. and oscillator stages.

steel. The tuning capacitor has no stops to limit its rotation to 180 deg and the necessary limitation is provided by a 6-BA cheese-headed bolt which is secured to the drum and strikes the heads of similar bolts secured to the front panel when the capacitor reaches its maximum and minimum settings. The pointer travel is nearly $4\frac{1}{2}$ in but, because of the length of the slider, a space of $5\frac{1}{2}$ in must be allowed between the magic eye and the right-hand pulley. Cord drives of this type tend to have a rather "dead" feel due to the friction present and this has been overcome by a lead flywheel secured to the tuning-spindle behind the front panel. The inertia of this wheel, though insufficient to give "spin-wheel" tuning improves the smoothness of the drive considerably.

The magic-eye holder is secured to the scale by two $3\frac{1}{2}$ -in. lengths of 4-BA studding and the target is viewed through a $\frac{7}{8}$ -in. diameter hole in the scale.

For the benefit of constructors who prefer to wind their own coils, full details are included. There are, however, commercial coils quite suitable for use in this circuit and their type numbers are given in the list of parts. The layout and pin connections for the r.f. coils are given in Fig. 3; for the sake of clarity primary and secondary windings are shown as separate coils but they are in fact overlapping as mentioned in the specification.

Coil Winding Data—Aerial Coil: Primary— $2\frac{1}{2}$ turns of 22 s.w.g. tinned copper wire in insulated sleeving inter-wound with earthy end of secondary. Secondary— $4\frac{1}{2}$ turns of 18 s.w.g. tinned copper wire spaced so as to occupy 0.5 in. Former—Aladdin type PP5938. Core—Aladdin v.h.f. grade, colour-coded purple. Can—John Dale type TV2.

R.F. Inter-valve Coil: Winding— $2\frac{1}{2}$ turns of 18 s.w.g. tinned copper wire space-wound so as to occupy a length of 0.3 in. Former, core and can as for aerial coil.

Oscillator Coil: Anode winding— $2\frac{1}{2}$ turns of 18 s.w.g. tinned copper wire spaced so as to occupy a length of 0.3 in. Grid winding— $1\frac{1}{2}$ turns of 22 s.w.g. tinned copper wire in insulated sleeving wound over

earthy end of anode winding. Former, core and can as for aerial coil.

I.F. Transformer: Primary and secondary—23 turns of 28 s.w.g. single-silk and enamelled copper wire close-wound. Spacing between adjacent ends of windings—accurately $\frac{5}{16}$ in. Former—Aladdin type PP5937. Core—Aladdin, colour-coded grey. Can—John Dale type TV1.

Ratio-detector Transformer: Primary—35 turns of 36 s.w.g. single-silk and enamelled copper wire close-wound. Secondary— $16 + 16$ turns of 28 s.w.g. single-silk and enamelled copper wire, bifilar, close-wound. Tertiary— $9\frac{1}{2}$ turns of 36 s.w.g. single-silk and enamelled copper wire close-wound over paper interlayer 0.002 in. thick over end of primary remote from secondary. Spacing between primary and secondary— $\frac{1}{16}$ in. Former, core and can as for i.f. transformer.

CLUB NEWS

Barnsley.—At the meeting of the Barnsley and District Amateur Radio Club on May 13th, H. H. Eyre (G5KM) will give a demonstration of i.f. crystal filter operation. Meetings are held at 7.0 at the King George Hotel, Peel Street, Barnsley. Sec.: P. Carbutt (G2AFV), 33, Woodstock Road, Barnsley, Yorks.

Birmingham.—The subjects for the May meetings of the Slade Radio Society are (13th) "Amateur Radio Direction Finding," by N. B. Simmonds, and (27th) "Past and Present in Amateur Radio," by E. G. H. Brown (G5BJ). The first of the season's d.f. tests for the Harcourt Trophy will be held on May 8th. The club meets on alternate Fridays at 7.45 at The Church House, High Street, Erdington, Birmingham. Sec.: C. N. Smart, 110, Woolmore Road, Erdington, Birmingham, 23.

The Birmingham and District Short Wave Society, which meets on the second Monday of each month at 7.45 at the Y.M.C.A., 20, Soho Road, Hockley, Birmingham, 19, will be addressed by T. Burton on May 9th, when his subject will be aerials. Sec.: R. Yates, 28, Daimler Road, Yardley Wood, Birmingham, 14.

Canterbury.—The East Kent Radio Society continues to meet on alternate Tuesdays at 8.0 at The Two Brothers, Northgate Street, Canterbury. Details of the programme are available from the secretary, D. Williams, Llandogo, Bridge, Canterbury, Kent.

Cleckheaton.—A member of the Leeds Post Office staff will be talking on elementary direction finding to members of the Spen Valley and District Radio and Television Society at their meeting on May 4th. The club meets on alternate Wednesdays at 7.30 at the Temperance Hall, Cleckheaton. Sec.: N. Pride, 100, Raikes Lane, Birstall, nr. Leeds.

Coventry.—In addition to the regular meetings on May 9th and 23rd the Coventry Amateur Radio Society will be holding a two-metre field day on May 1st. At the meeting on the 9th K. Barber (G3HDP) will deal with receiver servicing and on the 23rd W. Grimbaldeston (G6WH) will speak on frequency modulation. Meetings are held at 7.30 at 9, Queens Road, Coventry. Sec.: J. H. Whitby (G3HDB), 24, Thornby Avenue, Kenilworth, Warwickshire.

Two-Call Club.—The new president of the British Two-Call Club is Lt. Col. Sir Evan Y. Nepean, Bt. (G5YN, VS1YN, DL2YN), and Major K. E. S. Ellis (G5KW, DL2KE, HZ1KE) is the new vice-president. Membership of the club is open to British subjects who have held calls in two countries, or, alternatively, in two areas of the British Empire Radio Union. Sec.: G. V. Haylock (G2DHV), 63, Lewisham Hill, London, S.E.13.

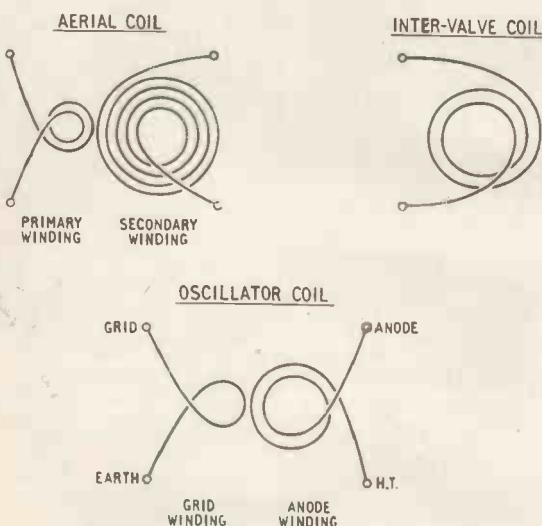


Fig.3. Winding sense and terminal connection of the r.f. and oscillator coils.

Design for a 20-Watt High Quality Amplifier

By W. A. FERGUSON, *B.Sc.(Eng.), A.C.G.I., Grad.I.E.E.

Choice of Valves and Operating Conditions

In recent years remarkable improvements have been made in the field of sound reproduction. Progress in the design of pickups, amplifiers and loudspeakers, coupled with the introduction of high-quality disc and tape recordings and v.h.f. sound broadcasting has set new standards for discriminating listeners. The amplifier and associated control circuits form the core of a sound-reproducing system and much interest has been focused on their design requirements and the manner in which high quality can be achieved.

The basic requirements of an amplifier designed for high-quality sound reproduction have previously been discussed in these pages^{1, 2}. It is proposed here to discuss further some aspects of high-quality amplifier design, with emphasis on the output stage, and it is hoped to describe in a subsequent article a design for a high-quality 20-watt amplifier using 25-watt high-slope pentodes in the output stage.

The principal features of a good amplifier can be briefly recapitulated:

1. Very low harmonic and intermodulation distortion.
2. Linear frequency response in the audible range.
3. Good response to signals of a transient nature.
4. Low phase shift in the audible frequency range.
5. Low hum and noise level.
6. Adequate power output to allow peak passages to be reproduced without overload.
7. Low output resistance to provide electrical damping for the loudspeaker system.

Output Stage.—Although the power-handling capacity of an audio amplifier is not the most important factor from the listening point of view—a low distortion level being usually judged pre-eminent—it is nevertheless of prime importance from the point of view of the designer.

It is generally considered that for realistic reproduction of orchestral music in the home a peak output power of 10-15 watts is required, assuming the efficiency of the loudspeaker system to be about 5%. Apart from loudspeaker efficiency, the required power depends on the size and acoustic nature of the room and to a lesser extent on the taste of the listener. Thus, whilst 10 watts is found to be adequate in many, perhaps, the majority of cases conditions in large rooms and small halls may merit a power reserve of at least 20 watts.

There exists a choice of two basic forms of output stage from which an effective output of 10-15 watts can be delivered to the voice coil of the loudspeaker. These two well-known forms of output stage are:

1. The Class AB push-pull pentode or tetrode stage.

2. The Class A or Class AB push-pull triode stage. The choice between these is largely a balance between economy and performance.

Pentode Output Stage.—The use of pentodes or tetrodes of the 12-watt anode dissipation class, operated in a conventional Class AB push-pull stage, enables an effective output of 12-13 watts to be obtained easily, assuming an output transformer efficiency of about 80%. This latter value is typical of present practice. The appropriate supply voltage, limited by valve ratings, is about 300-320 volts. The overall power efficiency of such a stage is fairly high, being 50% for a typical stage employing Mullard EL84 output pentodes. Harmonic distortion is, however, of the order of 3%-4% at full output, and in consequence a high degree of negative feedback is necessary to reduce distortion to low levels, say below 0.5% at rated output.

The conditions for Class AB operation normally recommended and published by the valve manufacturer are based on measurements made with continuous sine-wave drive. The bias under zero-drive conditions and the anode-to-anode load resistance are so chosen that optimum performance is achieved when the working point of the valves is displaced under drive conditions. This displacement is due to the influence of increased anode and screen-grid currents in the cathode bias circuit. For a typical output stage on a 310-volt supply using EL84 pentodes the rise in cathode current, and thus, cathode bias voltage at full drive, is about 40% with a sinusoidal input voltage.

When such a stage is used in the reproduction of speech or music, however, operating conditions are rather different. The mean amplitude of the input

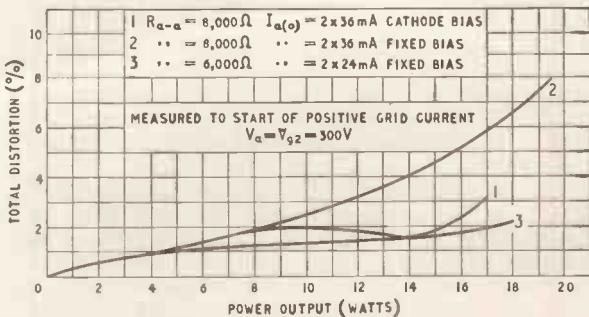


Fig. 1. Comparison of distortion curves under steady-state sinusoidal input conditions for a pair of EL84 valves in Class AB push-pull (1) with normal cathode bias, (2) with fixed bias under the same conditions, (3) load reduced for optimum fixed-bias operation.

* Mullard Valve Measurement and Application Laboratory.

signal is now very small compared with the peak values which occur from time to time and thus the mean variation of cathode current is also very small. Due to the relatively long time constant in the bias network the displacement of the working bias, even under peak signal conditions, is small enough for the stage to be considered as working with virtually fixed bias. If the normal Class AB stage (cathode biased) is measured under the corresponding fixed-bias conditions with a sine-wave input, it is found that at high output levels distortion is greater than when cathode bias is used. These two conditions are illustrated for the Mullard EL84 output pentode by curves 1 and 2 in Fig. 1. The quiescent bias is the same in both cases, curve 1 showing normal published operation with cathode bias, curve 2 operation with fixed bias. These results indicate that in practice, a cathode-biased Class AB stage designed on a sinusoidal drive basis will produce increased distortion when peak passages of speech or music are being reproduced.

One method of improving performance in practice is to adjust the quiescent operating conditions in the output stage so that they are nearly optimum for fixed bias working, although cathode bias is still used. This entails a smaller standing current and lower anode-to-anode load impedance. These changes result in larger variations in the instantaneous anode and screen-grid currents when the stage is driven, but the effect of these is at least partially compensated since the time constant in the cathode bias network has been increased at the same time. The excursion of the working bias is still kept very small under driven conditions.

It is found that good short-term regulation of the power supply is ensured by the use of large value ($50\mu F$) electrolytic capacitors for anode and screen-grid feeds. Peak currents corresponding to near overload conditions are effectively supplied by the capacitors with a reduction in line voltage of well under 0.5%, and the instantaneous power-handling capacity of the stage is not impaired.

Such a design, combined with a high degree of negative feedback (26 db), which includes the output stage and output transformer, is an alternative operating condition in the output stage of the 10-watt Mullard high-quality amplifier circuit⁵, and has proved very satisfactory in practice. A secondary feature of the use of these operating conditions is that the 12-watt output valves each run at a mean anode dissipation of only 7.5 watts. The corresponding fixed bias conditions in this case are illustrated in curve 3 of Fig. 1.

This form of operation is, however, suitable only for use in speech or music reproduction and cannot be used with a sine-wave input without excessive distortion. For this reason it is difficult to measure directly the distortion levels which obtain under practical conditions.

A second method of improving performance, described later, is to use distributed load conditions in the output stage. Depending on the precise loading used, the variation in anode and screen-grid currents can be reduced to such a level that almost identical performance is obtained under cathode and fixed bias conditions.

Triode Output Stage.—A low level of inherent distortion can be obtained in a push-pull triode stage operating under virtually Class A conditions. It is found that with 25-watt pentodes or tetrodes strapped

as triodes a power output of 12-15 watts can be obtained at harmonic distortion levels below 1% using a supply voltage of 430-450 volts.

Maximum power output and the corresponding distortion vary appreciably with the value of load impedance and Fig. 2 illustrates typical performance of the Mullard EL34 high-slope output pentode, triode-connected in a push-pull stage operating slightly below its rated anode dissipation of 25 watts.

For anode-to-anode load impedances below 7,000 Ω either a common, or separate cathode resistors (bypassed) can be used; above 7,000 Ω improved operation is obtained with an unbypassed common cathode resistor. Operating conditions approach Class A as the anode-to-anode load impedance is raised and optimum performance for high-quality output stages is obtained with a load impedance of about 10,000 Ω . An output of 14 watts is then delivered by the valves with total harmonic distortion well below 1%.

This type of output stage has found favour for a number of years in high-quality amplifiers giving about 12 watts effective output. Because of the low inherent distortion less negative feedback can be used to give acceptable linearity as compared with that required in pentode or tetrode output stages giving similar power output. Furthermore, in 3- or 4-stage amplifier designs, with most of the feedback applied over the whole amplifier, including the output transformer, it is then possible to achieve increased margins of stability for a given distortion level.

Distributed Load Conditions.—Increasing interest is being shown in various forms of distributed loading in the output stage². These involve the application of negative feedback in the output stage itself. In the simplest form, the screen grids of the output valves are fed from suitably positioned taps on the primary of the output transformer and the stage can be considered as one in which negative feedback is

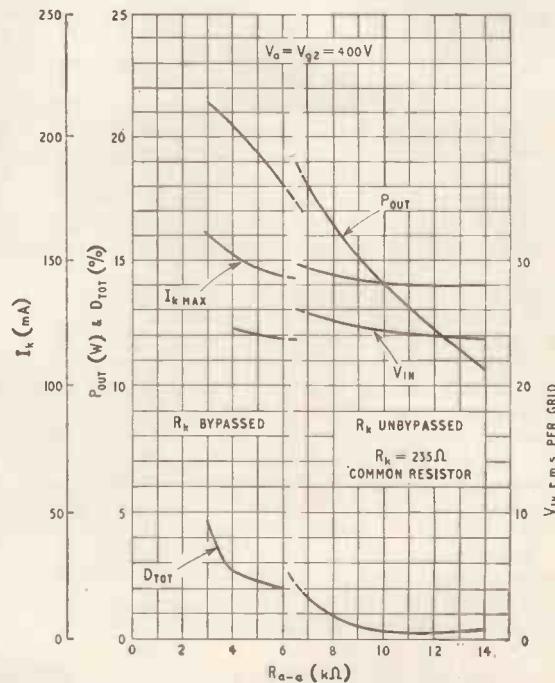


Fig. 2. Performance curves of two triode-connected EL34 valves in push-pull.

applied in a non-linear manner via the screen grids. The characteristics of the distributed load stage are intermediate between those for pentode and triode operation, approaching triode operation as the percentage of the primary winding common to anode and screen-grid circuits increases. It is found that under optimum conditions about two-thirds of the power-handling capacity of the corresponding pentode stage can be realized with much reduced distortion, whilst at power levels corresponding to triode operation, a similar order of distortion is obtained. At the same time the output impedance is reduced to a level approaching that obtained when a conventional push-pull triode stage is used.

Such a stage can thus be used with pentodes of the 25-watt class in high-quality amplifiers designed for power outputs well in excess of 15 watts, the overall power efficiency being appreciably greater than with triode operation. Conversely, the performance of 12-watt pentodes can be improved appreciably, although the power-handling capacity is somewhat reduced. However, effective power outputs of 10-12 watts can still be obtained.

A comparison is given in Table 1 of triode, pentode and distributed load operation for the Mullard EL34 and EL84 output pentodes. For valves of the EL34 type, comparison with triode operation is of most interest. It will be seen that distributed-load operation using a tapped primary output transformer enables the power-handling capacity to be more than double that possible with triode operation, whilst at the same time distortion in the stage can be held to a very low level.

Although with a common winding ratio of 0.2, i.e., with 20% of the primary winding common to anode and screen-grid circuits, the distortion level is com-

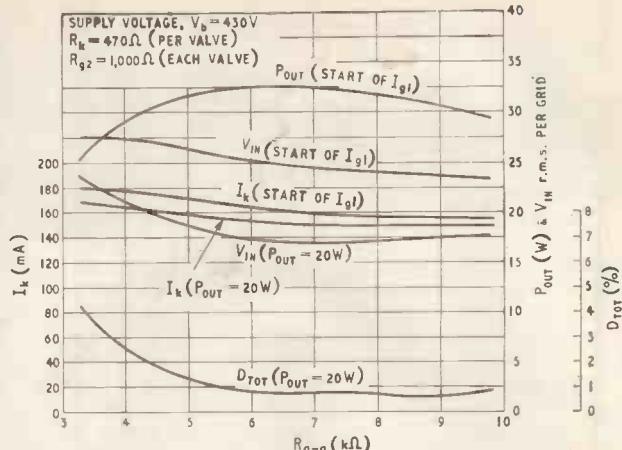


Fig. 3. Performance of EL34 push-pull pentodes under distributed-load conditions with screen tappings at 43% of primary turns.

parable with triode conditions, it has been found that appreciable improvement is obtained at higher power outputs if the common winding ratio is further increased. Progressive improvement in overall performance has been obtained with the percentage of common primary winding increased up to 40-45%. Although with this increase power-handling capacity is still further reduced, at least 35 watts output can be obtained with distortion at the onset of grid current at about 2.5%.

Performance typical of the EL34 when used with an output transformer having a primary winding tapped at 43% of the turns is shown in Fig. 3. The output transformer used for these measurements was the Partridge type UL2 and the values of power out-

TABLE 1

Valve type	Mode of operation	Operating conditions					Total distortion (per cent)			
		V_n (V)	V_{g2} (V)	R_k (Ω)	R_{a-a} ($k\Omega$)	R_{g2} (Ω)	at 10W	14W	20W	30W
Mullard EL34	Triode connection ..	400	*	470 (per valve)	10	*	0.5	0.7	—	—
	Distributed load: 43% common winding	400	400	470 (per valve)	6.6	1000 (per valve)	0.6	0.7	0.8	1.0
	Pentode connection ..	330	330	130 (common)	3.4	470 (common)	1.5	2.0	2.5	4.0
Mullard EL84	Triode connection ..	300	*	150 (common)	10	*	1.0	—	—	—
	Distributed load: 20% common winding	300	300	270 (per valve)	6.6	—	0.8	1.0	1.5†	—
	43% common winding ..	300	300	270 (per valve)	8.0	—	0.7	0.9	—	—
	Pentode connection ..	300	300	270 (per valve)	8.0	—	1.5	2.0	2.0	—

*Screen grid strapped to anode.

†See text.

put quoted are those delivered to the load in the secondary circuit.

With valves of the 12-watt dissipation class, such as the EL84, comparison with normal pentode operation is more significant. Appreciable reduction in odd harmonic distortion is again obtained under distributed load conditions and approximately 15 watts is delivered by the valves with a common winding ratio of 0.2.

From the figures in Table 1, little advantage would appear to be gained by further approaching triode conditions. There are, however, at least two advantages in using a tap at about 40% of primary turns, particularly with the EL34 where a high power output is still available. In the first place almost identical performance is obtained under cathode- and fixed-bias conditions, since with the closer approach to Class A triode working, variations in anode and screen-grid currents are reduced when the stage is driven. Secondly, as with normal triode operation, power output and distortion are less dependent on the precise value of load impedance. With a primary tap at about 40% of turns little change in performance is produced by a change in anode-to-anode load impedance of 6,000 to 9,000 Ω . In addition the output impedance of the stage is still further reduced by the use of the larger common winding ratio.

Circuit Arrangements.—The penultimate stage of the amplifier must be capable of providing a well-balanced push-pull drive of adequate amplitude and low distortion content. With 25-watt pentodes such as the EL34 the maximum drive voltage required is approximately 2×25 volts r.m.s., whilst for valves of the EL84 type the corresponding input is about 2×10 volts r.m.s. Input voltage requirements are similar for triode, pentode or distributed-load operation.

Bearing in mind the need to ensure stability when feedback is applied over the whole amplifier, the circuit should contain the minimum number of stages, in order to reduce phase shifts to the minimum. Thus if the functions of phase splitting and amplification can be combined in the penultimate stage, so much the better. This can be conveniently achieved by using the cathode-coupled form of phase splitter⁵. A high degree of balance is possible with this circuit, combined with a low distortion level at maximum drive to the output stage. By using a high-impedance double triode, an effective stage gain of about 25 times can be simultaneously obtained. This, combined with a preceding high-gain stage, enables a high overall sensitivity to be obtained, even when a high degree of negative feedback is used. A high sensitivity in the main amplifier enables the output voltage requirements of pre-amplifier and tone control circuits to be reduced; low distortion in these circuits is then more easily obtained.

It should be remembered in this connection that circuits preceding the main amplifier must be capable of handling, without appreciable distortion, voltages much greater than are necessary to load the amplifier fully.

With the use of such a valve as the Mullard EF86, which is particularly suitable for use in a high-sensitivity input stage, due to its low hum and noise levels, it is found that when feedback is applied input sensitivities of 50 to 100 mV for rated output can be achieved whilst at the same time hum and noise levels are low enough for high-quality requirements.

Negative Feedback.—In an amplifier employing

single-loop feedback from output to input, instability will occur if the loop gain—the product of amplifier gain without feedback and the attenuation of the feedback network—exceeds unity at frequencies for which the total phase shift round the loop becomes either 0 or 360° and so renders the feedback signal in phase with the input. The conditions for negative feedback imply a phase change of 180°, so that instability is approached as the additional phase shift in the amplifier and feedback network approaches 180 degrees⁶.

Since phase shifts are often difficult to measure, it is normal practice to utilize for design purposes the relationship between phase shift and attenuation characteristics. A simple CR low or high pass filter produces an ultimate phase shift of 90° and a rate of attenuation which approaches 6db/octave asymptotically. Thus an ultimate phase shift of 180° corresponds to a final rate of attenuation of 12db/octave. To preserve adequate margins of stability it is usual to design for attenuation rates not exceeding 10db/octave in the region where the loop gain varies from say 10db through unity gain (0db) to -10db.

It is thus necessary to control the amplifier characteristics over a frequency range much in excess of the designed working band. As the degree of feedback increases, this control becomes more difficult and is usually limited by the leakage inductance, self-capacitance and primary inductance of the output transformer.

It is a formidable task in practice to provide a constant and high level of feedback over the whole audible frequency range in a 3- or 4-stage amplifier where the main feedback loop includes the whole circuit and the output transformer. An adequate margin of stability in such circumstances is very difficult to obtain. Thus it is more usual to find that the effective feedback decreases towards the upper and lower audible frequencies.

Adequate feedback must, however, be available:

1. At frequencies in the region of the fundamental resonance of the loudspeaker system, to provide the low output impedance needed for efficient electrical damping.

2. Up to the highest audible frequency for which harmonics lie within the audible range, a frequency which can be taken as around 10 kc/s.

Output Transformer.—The performance of a high-quality amplifier is ultimately dependent on the quality of the output transformer. The use of distributed-load conditions does not modify the essential features of a first-class component—on the contrary the output transformer may be a more critical component, since precise balance of primary windings must be maintained.

The requirements in a very high-quality design are well known and have been previously described in some detail¹; it is not, therefore, proposed to do more than refer briefly to them. It may be said that the better the compromise effected between the requirements of high primary inductance, low leakage inductance and self-capacity, generous core size and low winding resistances, judged solely from the viewpoint of performance, the more expensive is the output transformer. This is particularly so if it is designed to handle power outputs in excess of 15 watts.

Whilst the best performance necessitates a costly component, it is possible to achieve, in amplifiers of

10-12 watts power output, a suitable compromise which results in a very high standard of amplifier performance with a transformer of moderate cost. A low value of leakage inductance is, for example, obtained more easily if the shunt inductance requirements are lessened, and appreciable negative feedback can then be used to offset the increased distortion at low frequencies due to lower primary inductance, reduced core size and less expensive core material.

Summary.—When the power handling capacity of a high-quality amplifier is not designed to exceed 10-12 watts it is possible to achieve extremely high performance with 12-watt pentodes or tetrodes. Such advantages as are possessed by 25-watt valves strapped as triodes are offset by a negligible increase in power reserve and the need for a larger and more expensive power supply.

The introduction of distributed load operation, using valves of the 25-watt class permits the design of efficient high-quality amplifiers with power-handling capacities up to 30-35 watts. Whilst it is very doubtful if such a power reserve is necessary for domestic sound reproduction—it necessitates in any case a loudspeaker system capable of handling such peak powers—amplifiers of this description find application where larger audiences are present.

It should always be remembered that the performance required of a high-quality amplifier must be judged in relation to the quality of the equipment with which it is to be used. If the use of a high-quality amplifier meriting the term is to be really justified, the pickup, pre-amplifier circuits and the loudspeaker system must themselves have a very high standard of performance.

The use of high-grade equipment in association with the power amplifier is implied in the design for the 20-watt amplifier using Mullard EL34 output pentodes under distributed load conditions, which it is hoped to describe in a subsequent article.

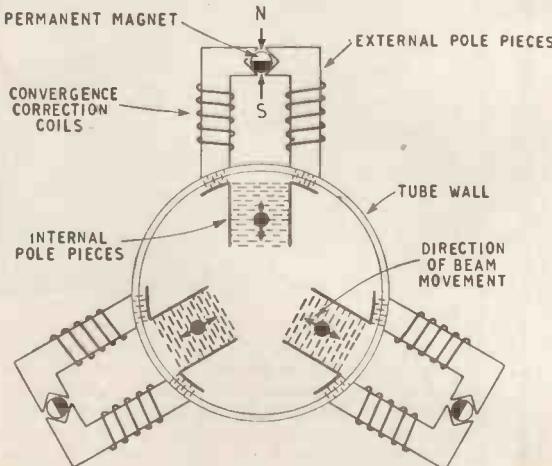
REFERENCES

- 1 "Design for a High Quality Amplifier," by D. T. N. Williamson. *Wireless World*, April, 1947.
- 2 "Amplifiers and Superlatives," by D. T. N. Williamson and P. J. Walker. *Wireless World*, Sept., 1952.
- 3 "Inexpensive 10-watt amplifier," *Wireless World*, August, 1954.
- 4 "A High-quality Ten Watt Audio Amplifier," by D. H. W. Busby and W. A. Ferguson. *Mullard Technical Communications*. Vol. 1, No. 9. Nov., 1954.
- 5 "Push-pull Input Circuits, Part 5," by W. T. Cocking. *Wireless World*, May, 1948.
- 6 "When Negative Feedback Isn't Negative," by "Cathode Ray." *Wireless World*, May, 1949.

21-in COLOUR TUBE

AN interesting feature of the new large-size tri-colour c.r. tube produced by R.C.A. is the use of a magnetic beam-convergence system with pole-pieces actually built inside the tube. The purpose of the beam-convergence system, which was electrostatic in the earlier 15-inch tube,* is to direct all three electron beams on to the particular group of three phosphor dots on the screen which is being scanned at any moment, so that one beam falls on the red phosphor dot, another on the green dot and the third on the blue dot. The convergence is helped in the first place by mechanical tilting of the electron

* "Colour Television Tube," *Wireless World*, May 1954.



Schematic of beam-convergence system, showing how the external magnets are linked to the internal pole-pieces through the glass wall of the tube.



Tri-colour cathode-ray tube, type 21AXP22.

guns. Each beam is then adjusted individually (see diagram) by the flux from an external permanent magnet, which is coupled through a pair of external ferrite pole-pieces to the pole-pieces inside the tube. The magnet is cylindrical in form and polarized as shown, so that by rotating it in the gap between the pole-pieces the component of its field which is coupled through to the internal system can be made to vary—and hence the convergence of the beam.

Coils are wound on the external ferrite pole-pieces, and these produce an additional magnetic flux which varies with the scanning angle in such a way as to maintain the correct beam convergence at all points across the screen. This is necessary because of the particular geometry of the tube, as explained in the description of the 15-inch version. The varying current to energize the coils is actually derived from the output circuits of the line and frame scanning generators. An additional facility

is a magnetic deflection system, again utilizing internal pole-pieces, which permits one of the electron beams to be adjusted laterally (at right angles to the arrows shown).

The phosphor-dot screen in this 21-inch tube is deposited on the inner surface of the glass faceplate, instead of on a separate plate inside the envelope as in the earlier model, and the picture size obtained is 19½in by 15½in. In most other respects the tube is similar to the 15-inch one, except, of course, that it has a higher final anode voltage—actually 25kV.

Commercial Literature

Electronic Picture Recording for television using television methods of studio production and standard 35-mm film. Description of the technique and apparatus in an illustrated brochure from High Definition Films, 24, Old Broad Street, London, E.C.2.

Components and Accessories; a new list (No. 194) from A. F. Bulgin & Company, Bye-Pass Road, Barking, Essex.

Electronic Computing Service for solution of research and design problems in commerce and industry. The Elliott type 402 digital computer and some typical problems described and illustrated in an outsize brochure from Elliott Brothers (London), Computing Machine Division, Elstree Way, Boreham Wood, Herts.

Magnetic Tape Erasers for ¼-in tape and spools of up to 7-in diameter. The tape is not unwound but demagnetized en bloc on the spool. Recent models are suitable for the Grundig "Stenorette" spools. Leaflet from Harvey Electronics, Farnborough Road, Farnborough, Hants.

High-Stability Resistors (Constanta) of carbon deposited on porcelain rods. Miniature resistors are now available with 5 per cent stability in 0.05-, 0.1-, 0.25-, 0.5- and 1-watt ratings while in the 0.5 per cent category 0.05-watt rating can be supplied. Folder from G. A. Stanley Palmer, Maxwell House, Arundel Street, London, W.C.2.

Voltage Stabilizer Tubes; a guide to their application, containing sections on fundamentals, interpretation of published characteristics, design formulae for associated components and data on Mullard types. From Mullard, Century House, Shaftesbury Avenue, London, W.C.2.

Intercommunication Equipment, for two-way operation, comprising a master unit and an extension unit which can be either permanently alive or only when required by the operator. Leaflet from Hifi, Derry Works, Derry Hill, Brierley Hill, Staffs.

Network Calculations, using a time-saving "potentiometer" method for steady-state and transient conditions, described in a monograph (price 1s) from Stockman Electronics Research Co., 543, Lexington Street, Waltham 54, Mass., U.S.A.

Electronic Instruments, for measurements of various physical effects, designed so that they can be used together in integrated groups for particular applications. Chart showing types of measurements with the corresponding groups of instruments needed from the Brüel & Kjær range. Also a short catalogue giving details of the instruments. From Rocke International, 59 Union Street, London, S.E.1.

List of Products of the Plessey organization accompanied by photographs showing production facilities in the various factories of the company. From the Plessey Company, Ilford, Essex.

Peak Voltmeter for measurement of transient voltages between 5V and 35kV to an accuracy of 10%. Instrument based on the firing voltage of a thyratron described briefly in a folder from Varley (Oliver Pell Control), Cambridge Row, Woolwich, London, S.E.18.

Phase Meters used for testing of production electrical and electronic equipment. Description of methods in a laboratory report from the Technology Instrument Corporation, Acton, Mass., U.S.A.

Electronic Moisture Meter, based on the measurement of the dielectric or propagation constant of the material to v.h.f. Leaflet from Shaw Electronics, 31 Market Street, Bradford, Yorks.

Current Metering Socket (the "Amp-Check") for wiring permanently in circuit to permit an ammeter to be inserted without switching off the current. Leaflet from Phillips & Bonson, Imperial House, Dominion Street, Moorgate, London, E.C.2.

Silicone Insulating Materials, notable for high thermal stability. A range consisting of silicone resins and elastomers in various combinations with glass fibre, mica and asbestos described in an illustrated brochure from Midland Silicones 19 Upper Brook Street, London, W.1.

Marine Radio Telephone and direction finder for small craft with 8 crystal-controlled transmission channels between 1.4 and 8Mc/s. Consumption is 30 watts receiving, 80 watts transmitting, with a choice of supply voltages. Leaflet from Intercommunications Equipment Co., 286-8 Leigh Road, Leigh-on-Sea, Essex.

A.M./F.M. Tuners and other associated equipments and components imported from Germany. Descriptive booklet with circuit diagrams from Technical Suppliers, Hudson House, 63 Goldhawk Road, London, W.12.

Tape Recorder, the "Editor Super," with frequency response of 40c/s-10kc/s at 7½in per second speed and mixing and monitoring facilities for separate radio/gramophone and microphone inputs. Features described in a leaflet from Tape Recorders (Electronics), 3 Fitzroy Street, London, W.1.

Vented Loudspeaker Cabinet based on the B.B.C. design described in *Wireless World* (Nov., Dec., 1950). Height 44in, width 28in and depth 18in, with speaker hole as required. Leaflet from Lockwood & Co., Lowlands Road, Harrow, Middlesex.

Loud Hailer, for use on board ship, with amplified talk-back facilities between the main control panel and up to five sub-stations. Descriptive leaflet from Easco Electrical (Holdings), Brixton, London, S.W.9.

Wafer Switches assembled to specification with any desired contact arrangement or wafer spacing. Price list of 82 "standard" arrangements and switch design chart from Specialist Switches, 24 Cranbourn Street, London, W.C.2.

Communications Receivers by Hallicrafters. Three new models covering 540-1680kc/s and three short-wave bands from 1680kc/s to 34Mc/s. Leaflets from the McElroy-Adams Manufacturing Group, 328 Lillie Road, London, S.W.6.

Band III Television Aerials, single- or multi-element arrays (including folded dipoles) for either separate mounting or on existing Band-I masts. Illustrated catalogue from Belcher (Radio Services), 59 Windsor Road, Slough, Bucks.



Ease of operation is the design keynote of this new valve-test table recently put into service at the G.E.C. Research Laboratories. All meters can be read from one position with a minimum of head movement while most of the controls are operated by the left hand, leaving the right one free for recording measurements. Knobs and keys for any particular test are arranged adjacent to one another and the range on which any meter is working is indicated by an illuminated disc. To reduce visual fatigue all non-essential markings have been removed from the meter scales, while the colour and brightness balance between scale, case and surround has been arranged so that the pointers stand out clearly.

V.H.F. and U.H.F. Reception

Effects of Trees and Other Obstacles

By J. A. SAXTON, D.Sc., Ph.D., M.I.E.E., and J. A. LANE, M.Sc.

ALTHOUGH there now exists a considerable body of literature on various characteristics of the propagation of metre and decimetre wavelengths—wavelengths of interest, for example, in television broadcasting—there is one aspect of the overall problem which has been quite inadequately treated, namely the effects of trees and other obstacles on reception at such wavelengths. It is perhaps not surprising that this should be so, for experience shows that these effects are not readily amenable to a generalized quantitative evaluation. As a consequence it is not easy to make an accurate estimation of the effects to be expected in one set of conditions on the basis of experimental observations carried out under different conditions. Nevertheless, in view of the increasing use of v.h.f. and u.h.f. for television, it is important to be able to make some assessment of the effects in so far as they may, for instance, influence the choice of a site for an aerial.

The logical conclusion of the arguments presented above is that each case of reception in circumstances where the field being sampled is influenced by local disturbances, due to trees and other obstacles, should be treated on its own merits. This, in general, is true; on the other hand, such a course may not always be really practicable, and it is clearly desirable that some attempt should be made at least to provide a guide as to the order of magnitude of the effects to be expected. It is the purpose to review the somewhat scanty experimental observations which are available, and so to try to provide such a guide.

If an opaque obstacle casts a shadow in the region of a given receiving point, the intensity of the shadow may be approximately calculated by an application of the principles of Fresnel diffraction,^{1,2} and some typical cases falling within this category will be examined. A sufficiently dense and extensive wood may approach opacity for ultra high frequencies, but with less dense woods the signal transmitted through the wood may be greater than that diffracted either over or round it when the receiving point is near to the wood: a knowledge of the attenuation of metre and decimetre waves through typical woods is therefore of interest. Although the experimental information on this point is sparse, there is enough to show in a general manner the way in which the attenuation of the received signal varies with wavelength over the range concerned.

Attenuation Through Trees:—The most extensive measurements of the attenuation due to trees along a transmission path are those described by McPetrie and Ford,¹ but their published results relate only to the frequency of 3,260 Mc/s (9.2-cm wavelength). These workers did, however, supplement the centimetre-wave observations with measurements at 540 and 1,200 Mc/s, and the present authors are indebted to them for permission to quote the results for the lower frequencies. Some observations of the attenuation produced at frequencies of 250 and 500 Mc/s by a small wood extending 150 metres along the transmission path have been published by Trevor³ and apart from this no other data appears to be recorded in the literature. Additional information relevant to the problem is that obtained some years ago by McPetrie and Saxton in measurements at a frequency of 100 Mc/s, and which has hitherto not been seen in any publication.

Attenuation at 540 and 1,200 Mc/s:—The method of procedure in the experiments carried out by McPetrie and Ford, at frequencies of 540 and 1,200 Mc/s, was to radiate a signal of known power from a suitably located transmitter and to measure the strength of the received signal at several positions behind the obstacle. In some cases it proved convenient to measure for comparison the field strength on an adjacent site for which there was an unobstructed path between the transmitter and receiver; in others it was necessary to calculate the field strength which would have existed had the trees been absent, having due regard to the ground profile between the terminal points. Observations were made using both horizontally and vertically polarized waves.

The field strengths measured at 540 Mc/s after transmission through about 85 metres of a thick, mainly deciduous, wood showed that there was hardly any significant difference between the rates of attenuation for the two types of polarization, the actual values obtained being 0.18 db/m and 0.20 db/m for horizontally and vertically polarized waves respectively. These results were obtained during the summer-time and thus refer to trees in full leaf; unfortunately no comparable observations were made for leafless trees at the same site. The rate of attenuation (db/m) naturally varies with the thickness of the wood under examination, also on the degree of undergrowth, and it cannot be expected that very close agreement will

Official communication from the D.S.I.R. Radio Research Station, Slough

always be obtained between observations in different places. Trevor's measurements³ at a frequency of 500 Mc/s in the U.S.A. also show that, for a fairly continuous wood of trees in full leaf, the attenuation is independent of wave polarization and about 0.12 db/m. For the same trees leafless, Trevor gives attenuation rates of 0.1 db/m and 0.08 db/m for vertically and horizontally polarized waves respectively.

In further experiments McPetrie and Ford investigated transmission through relatively thin screens of trees. In one case the screen consisted of a double row of beech trees about 17 m high in which the trunks were some 7.5 m apart, the spacing between the two rows being a similar distance. When the trees were leafless, individual objects in the background beyond the trees could be easily identified, but only small portions of the general background could be distinguished when the trees were in full leaf. In a second example there were four rows of lime trees about 27 m high with the trunks spaced about 6 m in both directions. Here, although some details of the background could be distinguished through the screen when the trees were leafless, this background was completely obscured at full leaf.

At a frequency of 540 Mc/s the attenuation in transmission through the beech-tree screen, even in full leaf, was too small for any definite rate per metre to be estimated; although variations of field strength over a range of 15 to 20 db were observed as the receiver was moved about in the clear ground behind the trees. The measurements through the rather more extensive lime-tree screen were also made when the trees were in full leaf, observations being made for both vertically and horizontally polarized waves at frequencies of 540 and 1,200 Mc/s. At 540 Mc/s the rate of attenuation of vertically polarized waves was found to be a little greater than for horizontally polarized waves, especially for receiving points immediately behind the trees: at 1,200 Mc/s, however, no definite difference between the rates of attenuation for the two states of polarization could be established. The average rates of attenuation through trees estimated from these measurements are as follows: at 540 Mc/s, 0.15 db/m and 0.25 db/m for horizontally and vertically polarized waves respectively: at 1,200 Mc/s, 0.35 db/m irrespective of the state of polarization. That the signals observed in the circumstances described above must have been mainly due to radiation transmitted through the trees, and could hardly have been influenced by diffraction over the top of the screen, may be shown by an application of the theory discussed later.

Attenuation at 100 Mc/s:—Just prior to the 1939-45 war a number of observations of the effects of trees on reception at a frequency of 100 Mc/s were made by McPetrie and Saxton. A variety of sites were examined, and the following examples are illustrative of the results obtained.

Measurements of field strength were made in the neighbourhood of a small clump of trees—roughly circular in shape, about 30 m in diameter, and not densely planted—first along a line passing through the centre of the clump and the transmitter, both at points in front of and behind the trees; and secondly along a line perpendicular to the first line and behind the trees. The results showed that such a short section of wooded path introduced no significant additional attenuation of the ground wave. The variations in field strength along the transverse line behind the trees, however, were considerable and

covered a range of 20 db. These variations, which were more pronounced for vertically than for horizontally polarized waves, were presumably due to multipath transmission caused by diffraction.

In another series of observations at 100 Mc/s measurements were made of the field strength of signals after transmission through several hundred metres of a thick wood, mainly deciduous in character, and in full leaf, with some undergrowth. These measurements indicated attenuations of 0.06 and 0.03 db/m respectively for vertically and horizontally polarized waves. The attenuation due to trees is thus seen to be considerably less at 100 Mc/s than at 540 and 1,200 Mc/s, whilst the relative difference between the values for the two type of polarization is more pronounced at the lowest than at the two higher frequencies.

The spatial variations in the signal obtained as the receiving aerial was moved over a distance of a few wavelengths amongst trees were, in almost every case, less for horizontally than for vertically polarized waves. The maximum difference was observed in the case of transmission through a pine wood, with no undergrowth, where there was much more vertical than horizontal growth: the field variations here were predominantly of the order of ± 2 db for horizontal polarization and ± 10 db for vertical polarization. This represented an extreme case, however, and an analysis of the whole series of observations at 100 Mc/s shows that, for horizontally polarized fields, about 80 per cent of the receiving locations had a range of variation of less than 6 db; in the case of vertical polarization the same range of variation was found at 60 per cent of the locations. The majority of the observations were made with some trees of various kinds within a range of 5 to 100 m, and, whilst the above figures can only be regarded as approximate, it is interesting to note that they are similar to those quoted by Saxton and Harden⁴ in an account of a recent field strength survey at 100 Mc/s, in which, however, trees were not always the only obstacles involved at a given receiving site.

Attenuation Through Trees as a Function of Frequency:—Although the conditions of experiment for all of the cases so far considered were by no means identical, it is obvious that the rate of attenuation through a given wood or screen of trees increases with frequency, and this general feature is illustrated in Fig. 1. Of the values of attenuation discussed above only those appropriate to trees in full leaf have been plotted, there being insufficient data to draw distinct curves for the leafless state. It might, in any case,

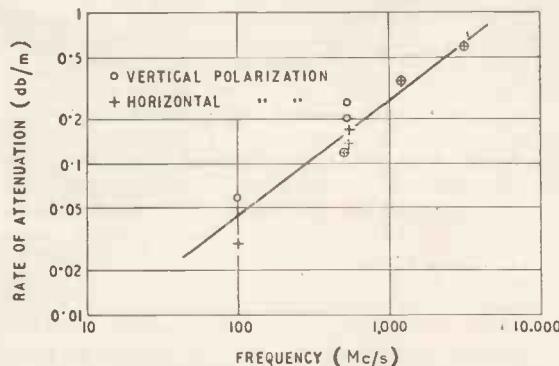


Fig. 1. Rate of attenuation in woods with trees in leaf as a function of frequency.

be argued that from the practical point of view, it is mainly important to know the worst conditions likely to arise, and these definitely correspond to trees in full leaf. (The point for 3,260 Mc/s plotted in Fig. 1 is obtained from the published work of McPetrie and Ford¹ referred to earlier.) It is also indicated in Fig. 1 how, as the frequency decreases through the u.h.f. and v.h.f. bands, there is a tendency for the attenuation to be less for horizontally than for vertically polarized waves. It must be stressed that Fig. 1 can only be used as a guide to the order of magnitude of the attenuation likely to be caused by woods, the actual value in any given case must depend on the density of the trees, and to some extent on their character, whether deciduous or otherwise.

Attenuation Produced by Other Obstacles:—In addition to trees the most important of the other obstacles affecting field strength characteristics at a given receiving location, apart from hills, are buildings. There are even fewer published measurements of the attenuation caused by buildings than there are for that due to trees; the only measurements known to the authors, in fact, being those of McPetrie and Ford¹ for 3,260 Mc/s. These experiments showed that the attenuation produced by a typical brick wall (of thickness 23 cm) is of the order of 10 db when dry, and may be considerably more when wet right through. This result indicates values for the permittivity and conductivity of such walls from which it may be deduced that attenuations of the order of 5 db are probable at 30 Mc/s in similar circumstances. To all intents and purposes, therefore, any substantial building—containing several walls—in a transmission path may be regarded as opaque to v.h.f. and u.h.f. radiation. Such a building will thus throw a shadow, inside which the field strength is mainly determined by diffraction round the sides and over the top.

Evidence has been provided by Megaw² as well as by McPetrie and Ford¹ that a useful estimate may be made of the field strength behind opaque obstacles by an application of the principles of Fresnel's diffraction theory. This method of approach should be satisfactory in the v.h.f. and u.h.f. bands, not only for the shadows produced by well-defined hills or ridges, but also for the rather more local shadows cast by buildings or by dense woods. Indeed, McPetrie and Ford have shown that the field strength distribution behind a single tree at 3,260 Mc/s is quite well accounted for by the Fresnel theory; whilst according to Megaw, to some extent the same is true for the case of diffraction by a steel mast at 600 Mc/s.

It is hardly feasible here to consider the diffraction fields behind obstacles of a wide variety of shapes, but in the following chapters calculations are made for what are probably the two most important forms of obstacle occurring in practice.

Diffraction by Opaque Obstacles:—The two classes of diffraction phenomena to be examined are (1) diffraction over an opaque obstacle of considerable extent transverse to the path of propagation (e.g., a thick screen of trees or a continuous row of buildings), and (2) diffraction round a tall opaque obstacle (e.g., a single tall building). These two classes correspond to the optical cases of diffraction by straight edges and opaque strips respectively, as treated by Fresnel. The optical theory refers to ideally sharp edges and very thin strips, and the obstacles with which this paper is concerned do not really conform to these conditions: there is, however, little doubt, in view of the fact that the distance of the source is generally

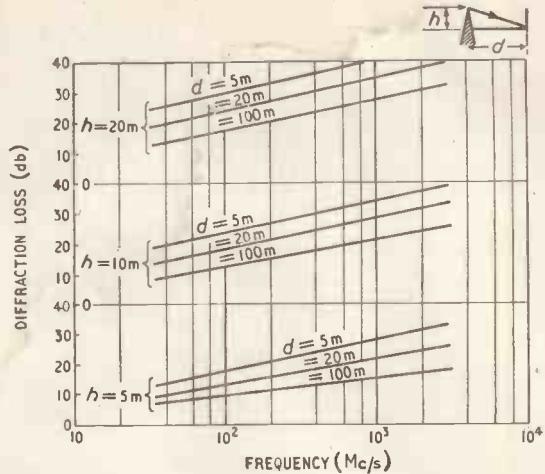


Fig. 2. Diffraction loss at a straight-edge. (Fresnel theory)

very great compared with the thickness of the obstacles, that the predictions of the simple theory are reasonably accurate.

Diffraction at a Straight Edge:—Typical examples of the diffraction loss at a straight edge are given in Fig. 2 for frequencies in the range 30 to 3,000 Mc/s. The distance of the transmitter from the obstacle is assumed to be large compared with d , the distance from the obstacle to the receiving point. The loss has been calculated for locations of the receiving aerial 5, 10 and 20 m below the line from the transmitter passing through the top of the obstacle, and is relative to the field which would have existed at the diffracting edge had the obstacle not been there. In the curves of Fig. 2 only the contribution of the direct wave from the edge of the obstacle has been considered; and in a more rigorous treatment it would be necessary to include the effect of the wave arriving at the receiver after reflection at the ground between the diffracting edge and the receiving aerial, but the neglect of this component is probably not serious for many of the cases of greatest practical interest. For example, in a typical broadcast receiving installation in the v.h.f. and u.h.f. bands the height of the aerial above ground may be expected to be about 10 m, and under these conditions, for the deep-shadow region relatively close to the diffracting obstacle, it may be shown that the angle at which the ground-reflected component is diffracted is such that the amplitude of this component is much smaller than that of the direct wave.

A further point to be borne in mind is that the loss given in Fig. 2 is relative to the undisturbed field at the height of the diffracting edge, and since, for the practical case of a distant transmitter, this field will generally be greater than that which would have existed at the receiving point had the obstacle not been present (approximately in the ratio of the heights of the obstacle and the receiving aerial) the "true" diffraction loss will be somewhat less than indicated in Fig. 2. This correction to the curves may readily be estimated from a knowledge of the heights of the obstacle and receiver. For most practical cases, however, the curves of Fig. 2 will give a direct indication of the changes in field strength to be expected for various displacements of the aerial within the shadow region; and they also give a reasonably accurate picture of the variation of diffraction effects with frequency.

The relative gain produced by increasing the height

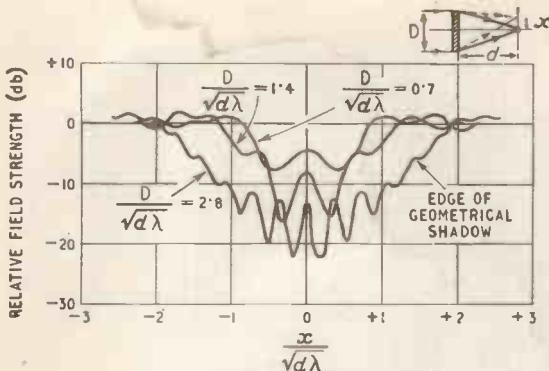


Fig. 3. Diffraction pattern behind opaque obstacles.

of an aerial situated within the shadow as compared with increasing the distance of the aerial from the diffracting edge is evident from Fig. 2. For example, at 500 Mc/s, the improvement in received signal on moving back from $d=20$ m to $d=100$ m behind an obstacle of effective height (h) of 10 m is about 6 db, whereas the same improvement could be obtained by raising the aerial by 5 m at the distance of 20 m. Provided the diffraction loss is appreciable—at least 12 db, say—the following equation may be used to calculate the loss for conditions not covered by Fig. 2:

$$E_o/E_d = 0.36 h (f/d)^{\frac{1}{2}} \quad (1)$$

where E_o is the undisturbed field at the diffracting edge, E_d is the diffracted field at a point d metres behind and h metres below the edge, and f is the frequency in Mc/s.

Diffraction by an Opaque Strip:—Typical diffraction patterns behind an opaque strip are illustrated in Fig. 3, where the variation of field strength along a line perpendicular to that from the transmitter through the centre of the obstacle is shown for various distances d metres behind the obstacle of width D metres.

The individual curves all exhibit a local maximum at a receiving point located in the symmetrical position behind the obstacle (i.e., at $x=0$, x being the displacement from the symmetrical position), a result well known in optical theory and practice. The actual signal loss, however, relative to the field which would have existed in the absence of the obstacle, and the form of the diffraction pattern both show considerable variation with wavelength for a given d . In the case of a vertical opaque strip no correction is needed to allow for the presence of the earth since, to a very close approximation, the diffraction losses associated with the direct and ground reflected waves behind the obstacle are the same. Thus, at a distance of 10 m behind an obstacle of width 10 m the diffraction pattern at 240 Mc/s is that given in Fig. 3 by the curve for which $D/\sqrt{d\lambda}=2.8$, whilst that appropriate to the frequency 60 Mc/s is the curve for $D/\sqrt{d\lambda}=1.4$. The magnitude of the diffraction loss, expressed in decibels, at the two minima on either side of the axis is approximately twice that at the symmetrical position on the axis. In general, provided the diffraction loss is appreciable (as in the case of edge diffraction) its value on the axis may be calculated from the relation:

$$E_o/E_d = 0.092 D (f/d)^{\frac{1}{2}} \quad (2)$$

E_o being the undisturbed field at the receiving point

in the absence of the obstacle (the distance of the transmitter from the obstacle being assumed to be much greater than d), E_d the field at the receiving point and f the frequency in Mc/s.

In the reception of v.h.f. and u.h.f. radiation in built-up areas, for obstacles much wider than, say, 20 m, the diffracted field over the top is likely in general to be greater than that diffracted round the sides of the obstacle. It should also be pointed out that, when the diffraction loss in a given case is very large, as indicated by equations (1) and (2), it is probable that the effect of the shadow will be alleviated as a result of energy scattered to the receiving point from other obstacles in the locality, but it is difficult to make a quantitative assessment of the importance of this factor.

Conclusions:—Whilst the attenuation caused by a few trees in a transmission path at v.h.f. and u.h.f. may not be serious, significant attenuation can be caused by thick and extensive woods. For a continuous wood the attenuation is of the order of 0.02 db/m at 30 Mc/s, whilst the corresponding figure at 3,000 Mc/s is about 0.5 db/m; and there is evidence that for frequencies less than 1,000 Mc/s the attenuation rate is slightly greater for vertically polarized than for horizontally polarized waves. On the other hand a small number of trees, or even a single tree, can cause considerable spatial variations of field strength at points within the shadow region, and when siting a receiving aerial for v.h.f. or u.h.f. transmissions this fact should be borne in mind. The same is true if the receiving aerial has of necessity to be placed behind a building, since for all practical purposes most buildings of any size may be regarded as opaque in these bands.

REFERENCES

1. McPetrie, J. S., and Ford, L. H. "Some Experiments on the Propagation of 9.2 cm Wavelength, Especially on the Effects of Obstacles." *Jour. I.E.E.*, 1946, 93, Part IIIA, p. 531.

2. Megaw, E. C. S. "Some Effects of Obstacles on the Propagation of Very Short Radio Waves." *Jour. I.E.E.*, 1948, 95, Part III, p. 97.

3. Trevor, B. "Ultra-High-Frequency Propagation Through Woods and Underbrush." *R.C.A. Review*, 1940-41, 5, p. 97.

4. Saxton, J. A., and Harden, B. N. "Ground-Wave Field-Strength Surveys at 100 and 600 Mc/s." *Proc. I.E.E.*, 1954, 101, Part III, p. 215.

I.E.E. SCHOLARSHIPS

A NUMBER of scholarships, founded in memory of eminent electrical engineers to provide for the education and training of students, are awarded each year by the Institution of Electrical Engineers. This year a new scholarship (the Arthur Fleming) is available for a student wishing to follow "a works-based sandwich diploma course in electrical engineering." It is valued at £120 p.a. and is tenable for four years. Details of this and the other scholarships available this year are given in "Scholarship Regulations" obtainable from the I.E.E., Savoy Place, London, W.C.2.

The existing scholarships include the Duddell (value £200 p.a. for three years), the Salomons and David Hughes (each valued £60 for one year). There is also the Paul scholarship (value £75 p.a. for four years) which is for instrument making.

Nominations must be submitted by May 2nd on the form available from the I.E.E.

The Institution also awards a number of research and graduate scholarships which are confined to student or graduate members of the Institution.

"Needles for Talking Machines"

Present Trends Reviewed Against
the Background of Early Invention

By S. KELLY*

DURING the fifty or sixty years which we have been blessed (?) with the gramophone, the ubiquitous needle has probably resulted in more inventive effort and original thinking than that applied to all the rest of the bits and pieces which comprise the reproducing system. During this period the needle, or stylus as we now prefer to name it, has gone the full circle. Sapphire or diamond in 1900, steel needles from about 1910 to 1935 when sapphire again made a tentative appearance; but it was not until after the war, and particularly with the advent of microgroove records that the sapphire and more recently the diamond have achieved the overwhelming popularity which they enjoyed at the turn of the century.

The original commercial stylus was that used on the Edison phonograph and was the theoretically correct shape, namely spherical. Fig. 1(a) shows a photograph of one of these early styli. Compared with present-day dimensions of 0.001in radius, they were enormous, actually 0.025in dia. Fig. 1(b) shows for comparison a "miniature" (0.030in diameter) shank with 0.001in radius sapphire. Fig. 1(c) is a mounted spherical sapphire for an early type of disc machine. The original Edison sapphires were used on "hill and dale" records and apparently, within the then prevailing limitations of the art, gave satisfactory results. According to the inventor, sapphire was necessary because it was the only material which would take the high polish required to mitigate damage to the soft wax cylinder.

At this stage it is interesting to note that the styli were made by the late Principal Alderman Fred Lee of Coventry, and during the period 1900-1910 he supplied approximately 4,000 styli per week to the U.S.A. He can rightly be named the father of the stylus industry. About 1910 the disc finally ousted the cylinder for domestic reproducers and it was from this date that the steel needle became firmly established for the next thirty odd years.

Nowadays we automatically assume that the ancients of the pre-electrical recording era were virtually savages compared with the now civilized exponents of the art of sound reproduction. An examination of the early literature reveals that if precise technical knowledge of the finer points of electromechanical analogues were missing, it was more than made up for

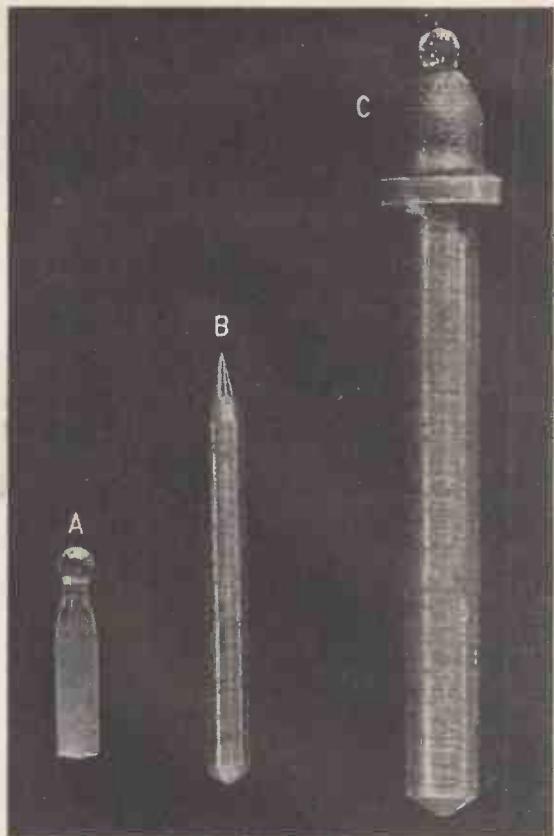


Fig. 1. (A) Edison sapphire stylus with spherical head compared with a modern microgroove stylus (B). An early spherical-tipped stylus for a disc machine is shown at (C).

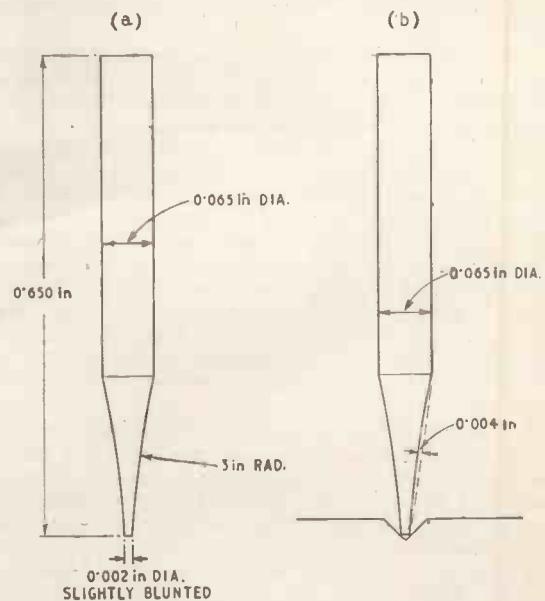


Fig. 2. Two steel needles (circa 1907) designed (a) to trace the bottom of the groove and (b) to make contact only with the walls.

* Kelly Acoustics, Ltd.

by careful experiment and acute perspicacity. Record and needle wear were already serious problems, and in 1907 it was found "that owing to the extreme nicety with which the delicately defined groove of the record must be followed by the needle of the reproducing mechanism, in order that the finest recorded vibrations may be accurately reproduced, great difficulty has been heretofore experienced. This is due to the minute but practically serious wear of the needle and groove which results from their frictional contact throughout the long and devious course of the record groove, and to the modification of the original sounds which ordinarily result from a scratchy action of the needle in following the sinuous path to which it is confined. The material preferably employed is high grade steel wire" (as shown in Fig. 2(a)).

"The improved effect of this novel shape of recordneedle tip is very marked, both in the securing of more accurate reproductions of the exact original sounds free from the unpleasing tones commonly introduced in the reproduction; and in the avoidance of wearing action upon the record whereby its usefulness is ordinarily soon destroyed or impaired. The point so rests in the bottom of the groove as to greatly reduce friction and "scratch" while at the same time accurately following the delicate deflections of the groove; and the relative diameters and lengths of the so-called "concaved" tip and round body, as indicated by the dimensions of the drawing give sufficient rigidity to the needle to prevent alteration of the tones because of undue yielding in the needle structure."

This solution of the problem was by no means the only one and another inventor about the same time had other ideas for the optimum dimensions of a needle for talking machines. He claimed:—

"My experiments indicate that the body of the needle should be 0.065in in diameter; the diameter of the point-face 0.002in; the maximum concavity of the curve forming the tapered point should be 0.004in; the length of the point 0.235in; the length of the cylindrical body 0.451in, and the total length 0.685in. (See Fig. 2(b).)

"It is believed the reason for the increased efficiency of the improved needle is largely due to the form of the point and the position it occupies in the groove. Its concavity insures contact on the sides of the groove at two points only, and the flat face at the termination of the point lies always above and out of contact with the bottom of the groove, thus the area of contact is extremely limited resulting in greatly lessening the objectionable 'scratch' ordinarily very noticeable. The form of the point permits it to penetrate to sufficient depth in the groove to insure perfect engagement therewith, and the attenuation of the point permits the latter to follow accurately slight sinuosities in the lateral bends or convolutions of the groove, by which the sound vibrations are reproduced, thus avoiding 'slurring'.

"Whether the above theoretical reasoning be correct or not, the fact remains that a needle formed as shown and described produces results far in advance of those produced by any other needle known to me. The improvement is especially marked in the reproduction of instrumental music and the tones of the singing or speaking voice. The clearness of detail, accentuation and the tone qualities of the human voice are distinguishable to the faintest inflection and intonation. In band music the broad tones of the bass horns are reproduced with softness and true tonal value, preserving all the effect of their great sound volumes. On

the middle register and high notes there is a clearness of tone and distinctness of sound identical with actual playing.

"The improved needle by reason of its form and peculiar engagement with the groove, wears but little and apparently reproduces the last notes of the record as clearly and distinctly as the first, and also acts less destructively on the record, thus prolonging its term of usefulness."

How long during the playing of a record this ideal was maintained is a matter for conjecture. Both gentlemen used approximately the same material and almost the same dimensions, but it would appear that the latter experimenter's explanation is more nearly in accord with our present-day ideas on the correct functioning of the stylus and the record groove.

Needle Replacement

The trouble of having to change needles after every record soon became apparent.

"The mechanism (shown in Fig. 3) relates to machines of the character known as 'talking machines,' more particularly those employing disc recordings, and the object is to provide a multiple needle holder which may be mounted upon a suitable supporting arm whereby attachment may be made to the recording or reproducing element of the talking machine.

"The multiple structure is rotatable and operates in such a way as to permit the needles carried thereby to be used consecutively and afterward removed at one time and others set in their places, and it may be made of any suitable material, preferably metal."

One imagines that the mass of moving parts was not of paramount importance!

Until the advent of electrical recording, with almost limitless amplification of energy, numerous attempts were made at improving the transmission of energy from the record to the sound box, and 1909 saw the production of collar type loud-tone needles. Although it functioned somewhat differently from later types, it "consisted of a round rod carrying at a short distance from its lower extremity, which is cut to a point, a metallic collar of which the upper surface is destined to lean against the head of the needle carrier which is bound to the diaphragm of the sound-box of the machine. This arrangement considerably augments the surface of contact of the needle with the carrier and in consequence the amplitude of the sound waves

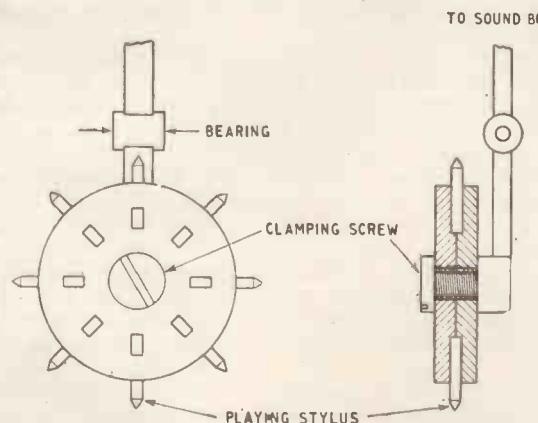
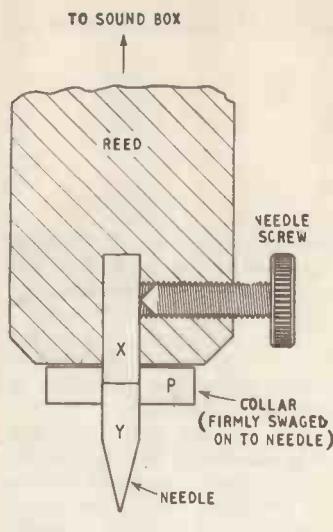
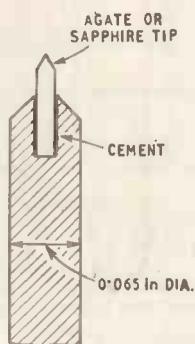


Fig. 3. Rotatable magazine for rapid stylus replacement.



Left: Fig. 4. Use of a collar to give rigidity to the needle.

Below: Fig. 5. Hard tip with shank of different material, chosen for good acoustic properties (1915).



- M₁ TONE ARM + HEAD MASS
- M₂ ARMATURE MASS
- M₃ STYLUS MASS
- Cm₁ ARMATURE RESTORING MEDIUM
- Cm₂ STYLUS COMPLIANCE
- Cm₃ RECORD/TIP COMPLIANCE

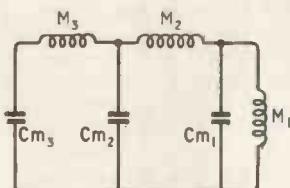


Fig. 6. Electrical analogue of the mechanical parameters of a pickup.

engendered by the movement of the disc or cylinder. The diagram (Fig. 4) shows the general arrangement and provision is made for a sapphire or like point to be constructed on the same principle. A shank X is inserted in the round metallic piece P and on the opposite side is inserted a sapphire (or other suitable precious stone) Y of which the point is slightly blunted or rounded.

"Numerous experiences have proved that in order to arrive at an improvement and an augmentation of the force of the sounds emitted by the machine, the thickness of the round metallic piece P must have a certain relation with the diameter of the shank A, that is to say the said thickness must be equal or very nearly equal to the diameter of the shank. The lower surface must further be fixed to the shank at the beginning of the reduced part."

Needle scratch was an ever-present problem, and by 1915 the whole of the animal, vegetable and mineral kingdoms had been explored in order to produce a needle or stylus for talking machines in which "the sound produced would be improved and purified, and also be capable of operating upon sound records formed of relatively hard materials without wearing away or otherwise deteriorating such records.

"With these ends in view a stylus was produced for talking machines having a body of relatively hard, slightly elastic, insulating material, a cylindrical recess in one end of the body, and an agate point cemented in the socket, said agate having a smooth conical or rounded end projecting from the body. (See Fig. 5.)

"One of the many advantages is that no shrill tones are produced, the always present scratch is minimized, and a very mellow rendering of the sound is obtained as the improved stylus softens the sound and gives a full and natural tone. A needle may be used about four hundred times without requiring substitution. Furthermore, it reduces the wear on the record and also tends to eliminate imperfections in the record."

It can be said that generally design of steel needles more or less stagnated after this period. Improved materials in the special chrome steels, and later tungsten wire in a copper sheath were produced but all metallic needles suffered from the defect of a rapid and untimely end, usually about four grooves from the inside of the record when a final crescendo had roused one's emotions almost to a frenzy only to be shattered by the raucous sounds which were suddenly emitted; then a lively dash to the talking machine to disengage the offending sound box and needle before one's precious records were irretrievably ruined!

It is often said that nothing is new, and skipping many years we come to 1948 when a new stylus was announced for sound reproduction, "more particularly a sapphire stylus (sic) for reproducing sound on all records. The object was to produce a form of stylus which gives high quality reproduction with minimum wear, and consequently long life to the record."

The sapphire stylus consisted of "a tapered conical portion flat ground on the point of a diameter of from 0.001 to 0.005 inches so that the point enters a standard record sound groove and only makes substantially point contact with the inclined side walls of the sound groove."

One of the important advantages of the disc-type record over the cylinder was the much higher modulation which could be engraved upon it. With few pre-war (1939-1945) exceptions, all reproducing heads, whether acoustic or electric, suffered from a very high inherent stiffness with the result that the playing weight had to be relatively enormous, 4oz being common. Under these circumstances the force exerted at the point of contact between the stylus and the record was such as to tend to shatter any sapphire stylus, or at the best to reduce the life of the stylus to only a relatively short time, and out of all proportion to its cost, with the attendant risk that if the stylus did chip records could be ruined.

During the 1930's the needle armature, with its attendant reduction in mass and hence extended high-frequency response, made its appearance. At a somewhat later date miniature steel needles with a still lower mass, and miniature thorn needles made their debut.

Record Wear

Up to this time the only stylus available with these medium and heavyweight pickups which offered some degree of protection to the record was the thorn type, and this protection was more apparent than real unless the records were kept meticulously clean and no pieces of abrasive material became embedded in the thorn during the sharpening process. By virtue of the very compliant nature of the material (about twenty times that of steel) the forces existing between the record and the stylus are considerably reduced, and it is to this fact that we owe the continued existence of many precious old records which would have been irretrievably ruined had they been reproduced by the blunt

steel instrument now mercifully relegated to the museum.

With the concept of high-compliance, low-mass pickups a sapphire stylus of small radius became feasible. A comparison of the heavyweight pickup using a steel needle stylus and a modern lightweight unit may not be inappropriate. Fig. 6 shows the basic analogue for the two pickups. Their constants are tabulated below, together with the approximate forces involved for standard 78 r.p.m. records.

Stylus	M_1	M_2	M_3	Cm_1	Cm_2	Cm_3	Playing Weight (grams)
Loud tone ..	112	0.600	0.235	10^{-7}	1.35×10^{-9}	10^{-9}	112
Soft tone ..	112	0.600	0.060	10^{-7}	8.5×10^{-7}	5×10^{-9}	85
Cantilever ..	30	0.020	0.013	2×10^{-6}	2×10^{-7}	1.5×10^{-8}	8

M_1, M_2, M_3 in grams; Cm_1, Cm_2, Cm_3 in cm/dyne. All values refer to needle tip.

From the table it will be seen why the soft tone needle did in fact give a "softer tone" than the loud-tone "blunderbuss," namely that the shunt effect of Cm_2 was very much greater.

During the 1930s serious investigations were undertaken, notably by Pierce and Hunt, into the various forms of distortion which were inherent in disc recording and reproducing systems, these various distortions being due solely to the physical dimensions of the stylus and record, and assuming the rest of the system to be linear. It was shown that one of the most serious forms of distortion was due to pinch-effect at high frequencies resulting in harmonic and intermodulation distortion, and they suggested that a method to overcome this would be the use of a stylus which would not only transmit lateral vibrations to the transducer but also decouple effectively the vertical vibrations. This was the genesis of the cantilever stylus.

The cantilever stylus can be made with an effective mass at 10 kc/s as low as 3 milligrams, although the more usual type (see Fig. 7) used in commercial units

had a mass of approximately 13 milligrams, made up as follows:

Sapphire	1.00
Bush	0.75
Arm (effective)	6.00
Head	5.50
<hr/>	
	13.25

An effective stylus mass of approximately 13 mgm appears to be somewhat excessive in view of present-day recordings using high velocities at the upper end of the frequency band, and some effort should be expended in reducing this mass.

It will be seen from the dimensions of Fig. 7 that the stylus uses a rondel of 0.020 in diameter. If the rondel is reduced to 0.015 in diameter the stylus weight is halved, and if the bush is eliminated a total 1.25 mg is saved. This saving of 1.25 mg would be thrown away if the stylus arm of Fig. 8 were used, because the 0.035 in diameter blank removed from the end weighs approximately 1.55 mgm. Fig. 8 shows a method of exploiting this reduction in mass. An undersized punch is used to pierce the hole for the stylus and the "rag" thus thrown up is used in place of the bush as the rondel support. No material is blanked out from the hole, all of it being used to form the approximately cylindrical projection used for supporting the stylus. The "rag" on the underside is tightly swaged round the stylus and sometimes a cement such as shellac or one of the artificial resins is used as an additional safeguard. The arm shown in Fig. 8 is completely satisfactory and gives an effective mass as shown above:

Sapphire	0.50
Arm (effective)	6.00
Head	3.00
<hr/>	
Total	9.50 milligrams

showing a saving of 4 mgm over Fig. 7. A simplification in tooling would be to increase the width of the arm to 0.035 in and reduce the thickness to 0.009 in. The effective mass of the stylus arm will be the same, the lateral compliance will be reduced by 50% and the vertical compliance will be approximately

Fig. 8. Alternative construction without aluminium bush.

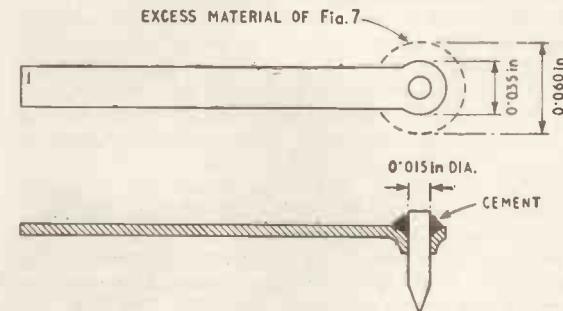


Fig. 7. Construction of a typical cantilever stylus.

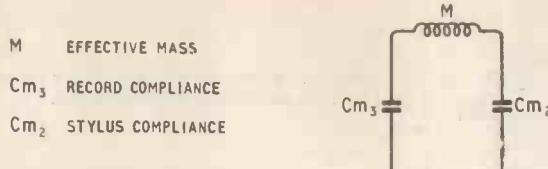


Fig. 9. Electrical analogue of cantilever stylus. Typical values of Cm₃ are 2.5 × 10⁻⁸ for plastic microgroove records and 1.1 × 10⁻⁸ for standard shellac.

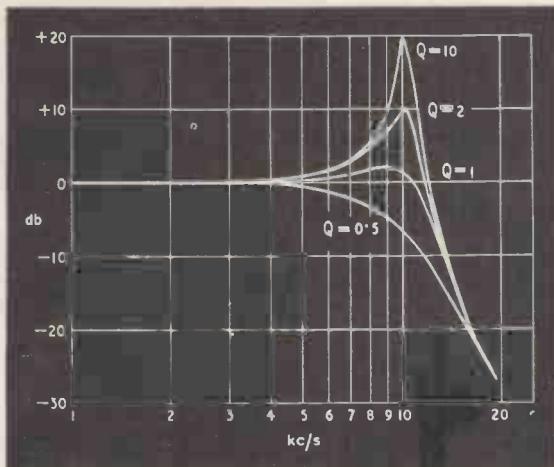


Fig. 10. Effect of load resistance on the response of the low-pass analogue of Fig. 9.

doubled; this can result in an improved high-frequency transmission characteristic, because of the 20% increase in resonant frequency.

The ultimate will probably be a rondel of 0.007in to 0.010in in diameter, 0.020in long in a pure beryllium arm.

The analogue of Fig. 9 shows the cantilever behaving virtually as a low-pass filter, while the effective mass M is given by $\frac{dLWT}{3}$ and the compliance Cm₂ by $\frac{4L^3}{EWT^3}$, where: L= length, W= width, T= thickness, d=density, E=Young's modulus.

From these equations it is seen that for maximum high-frequency transmission the Young's modulus should be at a maximum and the density a minimum. The table below shows Young's modulus (E), density (d), and a goodness factor G = $\frac{E}{d}K$, where K is any convenient constant, in this case 10⁻¹¹.

Substance	Young's Modulus	Density	G
Beryllium copper	12.5 × 10 ¹¹	8.2	1.53
Phosphor bronze	12.0 × 10 ¹¹	8.8	1.36
Steel C.08	19.0 × 10 ¹¹	7.7	2.46
Steel C.38	20.0 × 10 ¹¹	7.7	2.60
Monel	18.0 × 10 ¹¹	8.8	2.05
Aluminium	7.3 × 10 ¹¹	2.7	2.70
Beryllium	12.7 × 10 ¹¹	1.8	7.05

From the above figures it will be seen that pure

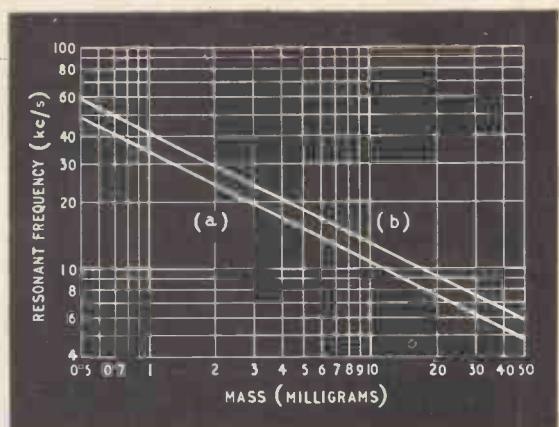


Fig. 11. Relationship between stylus resonance and effective stylus mass under the conditions specified in the text. (a) microgroove, (b) standard shellac records.

beryllium is by far the best, but unfortunately it is not commercially available. Using currently available materials, and provided that the dimensions of the stylus are modified accordingly, there is not a great deal to choose between the other metals, although steel will probably be the general commercial choice.

Fig. 10 shows the effect of varying load resistance of the low-pass analogue shown in Fig. 9. Under normal working conditions the resistive component of the terminating impedance is extremely small, so the system behaves as a resonant circuit comprising the effective mass of the stylus assembly and the record compliance in series with the stylus compliance (the reactance of the rest of the pickup moving system which is in parallel with this latter compliance is usually sufficiently great to be neglected). Fig. 11 shows the relation between "stylus resonance" and effective stylus mass (a) when applied on a standard vinyl microgroove record, at a playing weight of 8-10 gm, and stylus radius of 0.001in; and (b) when applied on a 78 r.p.m. shellac record and 0.0025in radius stylus at a playing weight of 8-10 gm. It will be found that reducing the playing weight will often reduce this resonant frequency on vinyl records due to the smaller area of contact between the stylus and the groove walls and hence an increased value of compliance.

The resonance can result in an increase in output of 10-15 db in a lightly damped system (this also means the needle tip impedance has increased by ×3 to ×6 at this frequency). The obvious method of reducing this resonance is to apply additional damping. Unfortunately all semi-solid materials have a high reactance to resistance ratio, with the result that if sufficient damping is applied to make the system aperiodic at this frequency, the overall compliance of the pickup is reduced considerably. In one case the low frequency compliance of the system was 4.5 × 10⁻⁶ cm/dyne and application of a piece of plasticized cellulose 0.020in in diameter by 0.060in long, cemented between the stylus head and the case of the pickup, reduced the resonance from +12 db to +2 db, the resonant frequency remaining at about 15 kc/s, but the low-frequency compliance was reduced to 1.1 × 10⁻⁶ cm/dyne. In other words, the low-frequency impedance, and hence the playing weight was considerably increased. Fig. 12 shows the reason-

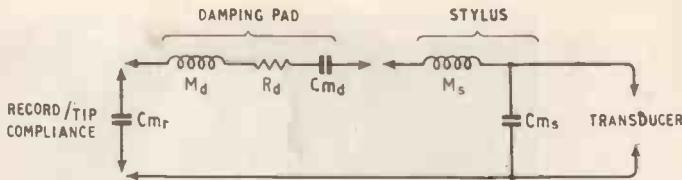


Fig. 12. Electrical analogue of the stylus with the addition of a damping pad.

ing behind this statement, where C_{m4} is about 1.5×10^{-6} cm/dyne.

If the damping material is cemented only to the stylus tip and the other end left free, the high frequency resonance can be damped by virtue of the inertia of the damping material effectively clamping the remote end and as the frequency is progressively increased. The effective mass referred to the stylus tip will be increased by approximately 1.25 mgm, the low-frequency compliance will not be affected and the resonant peak can be reduced to +2 db or less. The actual frequency or resonance will be reduced, but the overall response will be improved because of the "flattening" of the resonance curve.

Cantilever Cross-sections

The majority of cantilever arms at present used are of rectangular cross-section with the idea of obtaining a maximum lateral stiffness to prevent undue high-frequency loss; and at the same time allowing for adjustment of the vertical thickness to give the correct ratio of overall transducer lateral compliance to vertical compliance (which latter should be confined entirely to the cantilever arm). In practice this ratio is between 5 and 10. If the ratio is reduced to much less than 5 considerable attenuation will take place, especially at high frequencies, and if the vertical stiffness is too great a subsidiary difficulty may be experienced in that the vertical resonance of the complete pickup and tone arm may be moved up into the lower audio band, say 100-300 c/s, with disastrous results to reproduction if the transducer is sensitive to vertical impulses. By suitably proportioning the dynamic constants of the rest of the pickup the cantilever arm may be made of circular cross-section, which can materially reduce the production costs of the complete stylus assembly. It also leads the way to a reduction in effective mass of the cantilever arm for a given stiffness. The compliance (reciprocal of stiffness) for a cantilever or rectangular cross-section is given by the

formula $\frac{4L^3}{EWT^3}$ and for a cantilever or circular cross-section by $\frac{4L^3}{3ER^4}$. The effective mass referred to the

stylus tip of each of these cantilevers is $\frac{dLA}{3}$, where

A = cross-sectional area. As before stated, we wish to reduce the effective mass by the greatest possible amount for a given value of compliance. In the case of the rectangular cantilever there is not a lot we can do, except possibly make it of channel section. In the case of the circular material, however, it can be made in the form of a tube, and if the value of the outside and inside diameters are in the ratio of 1.125 and 0.875 to the diameter of the solid rod the effective mass will be reduced by half for the same stiffness. The logical development from that is to form the tube into an elliptical cross-section in order that the correct ratio of vertical and lateral compliance be obtained.

This novel form of producing a headache for the stylus manufacturers is offered to pickup designers "for free."

The quantities of styli produced at all times during this era have mounted to prodigious proportions. An article in the *Talking Machine World*, dated 15th August 1911, describes one manufacturer as producing "needles for talking-machines" at a rate of 6,500,000 per day. This, of course, was in America. However, to-day there is at least one company in the United Kingdom producing sapphire styli at a rate of 140,000 per week and the capacity of other individual production units is probably not far short of 100,000. Possibly some statistician will produce figures giving the number of miles (in light years?) travelled by all the "needles for talking-machines" in their devious convolutions produced to date.

As is well-known, the average velocity on a 78 r.p.m. record is of the order of 3 cm/sec and in the case of the best acoustic reproducers (playing weight 100 grams) the sound pressure was of the order of 10 dynes/cm² at a distance of one metre. The available power at the stylus point at 1 kc/s under the above conditions is about 1.5×10^{-3} watt and the acoustic output power is about 10^{-4} watts, giving an efficiency of 6 per cent. In the case of an electrical reproducer the available mechanical power is the same, and the acoustic level is approximately the same. However, the total power consumed from the supply mains is usually of the order of 60/100 watts, giving an overall efficiency of an electrical reproducer of 0.0001 per cent or, in other words, the efficiency is 60,000 times worse than the acoustic reproducer. It is a sad commentary on our so-called technological advances that in our pursuit of "high fidelity," we use not a sledge hammer to crack the walnut but almost the whole resources of the Battersea Power Station; and it is suggested that possibly the correct approach to this art of sound reproduction is to learn again our first principles of acoustics and develop the art to its logical conclusion without any playing about with electrons and such new-fangled notions.

Grateful acknowledgement is made to Fred Lee & Co. (Coventry), Ltd., Technifon, Ltd., and Sapphire Bearings, Ltd., for information and samples.

REFERENCES

U.S. Patent Numbers 866,950, 918,389, 1,034,387.
British Patent Numbers 8562/1909, 2502/1915, 579,738, 603,606.

J. A. Pierce and F. V. Hunt, *J.S.M.P.E.*, Vol. 31, August, 1938.

"Two-valve Superhet" ; Modifications

AN improvement in performance of the above receiver (described in our March, 1955, issue) can be effected by connecting the 1-MΩ triode section grid leak of the ECL80 valve to the cathode of this valve instead of to the chassis and by reducing the value of the 3.3-kΩ smoothing resistor to 1.5 kΩ. Incidentally, C_s should be between 1 and 2 pF.

MORE DISTORTION

What Causes Musical Unpleasantness?

By "CATHODE RAY"

LAST month we dismissed frequency distortion as no longer a problem,* and concentrated on non-linearity distortion. The object was to decide, if possible, what the distortion figures given nowadays by makers of sound-reproducing equipment mean. They are usually "percentage harmonic distortion," but there is often a strong undercurrent of suggestion that they ought to be intermodulation. If they were, would we be any the wiser?

Well, after reviewing the elementary facts of harmonic production by non-linear equipment, I referred to an experiment I described in 1938 to demonstrate that the unpleasantness of non-linearity distortion is due not so much to the harmonics as to intermodulation products. These only occur when there are at least two frequencies present in the original signal, and the experiment was to apply two different frequencies and note that at an amplitude great enough for considerable harmonic distortion they sound quite clear when heard separately, but perfectly horrible when together, even if the total amplitude is then no greater. On the other hand they sound clear together if the amplitude is substantially reduced so that the distortion is slight. I mentioned that some doubt had been expressed whether it was safe to conclude from this one experiment that most of the unpleasantness of distortion is due to intermodulation. Even though at this much later date that is generally accepted, it seemed to me there would be no harm in looking into the matter more closely. And so (limiting our enquiry to musical programmes) we considered what it is that makes some combinations of sound frequencies blend smoothly and harmoniously and others harshly. Generally speaking, the smaller the numbers in which the frequency ratio can be expressed, the less conspicuous is the addition of the second frequency (assumed to be the higher one). The simplest of all (not counting 1 : 1) is of course the 2 : 1, or octave, and the higher frequency is then so concordant with the lower as to form a new starting point for the musical scale; for example, if the two frequencies are 100 c/s and 600 c/s (fundamental and sixth harmonic) the 600 can be reckoned in relation to the nearest octave above 100, namely 400, and the ratio of frequencies can be regarded as 600 : 400, or 3 : 2, a basic musical harmony. For this reason the even harmonics have to be higher than the odd before they are noticeably discordant; the lowest odd harmonic that sounds definitely discordant is the 7th, but the lowest discordant even harmonic is the 14th. After considering the relationship between the shapes of equipment transfer (input/output) characteristic curves and the resulting harmonics, we concluded that with properly designed and operated equipment, in which only second and/or third harmonics are appreciable, the harmonics alone wouldn't cause any harshness of

tone, though they might perhaps shift the balance of tone upwards in frequency and also make it sound richer or thicker (according to personal reactions). In arriving at this conclusion we considered only the harmonics in relation to their own fundamentals. But how about the harmonic frequencies of different notes played at the same time? For instance, two of the notes in the common chord are in the frequency ratio 5 : 8 and the third harmonic of one and the second harmonic of the other are therefore in the ratio 15 : 16, roughly a semitone apart, and that is not a pleasant musical sound. But unless both second and third harmonics are comparable in strength with the fundamentals (which, if due to distortion, would not be typical of properly designed and operated equipment!) this discordant tone would be relatively very weak. I am told that musical composers are aware of the inadvisability of prescribing chords for strongly harmonic-producing instruments if they want to obtain a smooth-sounding result.

Experiment Repeated

And now we are ready to compare the results of purely harmonic distortion with what the same knowledge of musical harmony would lead us to expect the effects of intermodulation to be. Anybody who may have been so painstaking as to compare the account of my experiment given last month with the original in 1938 has no doubt been itching to accuse me of cheating. The original frequencies were given as 50 and 400; last month's, as 100 and 533. Well, perhaps I did cheat. Having recently repeated the experiment, I believe that if my original frequencies had been exactly as stated, in 8 : 1 ratio, they wouldn't have made such an unpleasant noise as they did. Using an exact frequency ratio, the two reproduced together by a distorting triode or pentode do not lose all trace of their individual character, as in the pre-war experiment, though they do sound much more distorted than simply their separately distorted selves added together. But if the ratio is not exact—say 50 c/s and 410 c/s—the result fully deserves my earlier description. As the upper frequency is varied, the unpleasantness goes through marked fluctuations, being sometimes very bad indeed and sometimes by comparison almost tolerable (though of course not by "hi fi" standards!).

This fits in perfectly with our musical ideas. With exactly 50 and 400 c/s, the second-order intermodulation products (as they are called), $f_1 \pm f_2$, are 350 and 450. These, of course, are the 7th and 9th harmonics of 50 c/s, and 400 c/s is the 8th, so the only difference as compared with harmonic distortion of 50 c/s alone is that these three harmonics are abnormally strong. In fact, this seems to be quite a good way of finding out what exaggerated upper-harmonic distortion sounds like. If the intermodulation were mainly

* Don't take that too literally, of course!

third-order, $f_1 \pm 2f_2$, the frequencies created would be 300 and 500, the 6th and 10th harmonics, which ought to sound smoother than the musically discordant 7th and 9th. Fig. 1 shows the frequency pattern.

A critic complained that frequencies such as 50 c/s and 400 c/s are an unlikely basis for musical programmes. Had they been, say, 200 and 600 or even 150 and 400 the intermodulation products would have been the same frequencies as non-discordant harmonics. If, in order to demonstrate the objectionability of intermodulation I deliberately chose frequencies such as 50 and 410, or 200 and 410, I would be wide open to the criticism that such ratios do not occur in music at all, except perhaps the kind of music in which the worst discords could pass unnoticed. So this time I chose 100 c/s and the rather odd figure of 533, because although these actual frequencies do not come on musical instruments with standard tuning, they are in the ratio (which is what mainly counts) of notes G and C, which very frequently do occur together in music, being the so-called dominant and tonic of the scale of C major. Unless both second and third harmonic distortions are grossly excessive, any jarring tone is almost or quite negligible. But the corresponding intermodulation product frequencies are 433 and 633, and 333 and 733, respectively (Fig. 2). These are out of tune with any notes on the musical scale, harmonious or discordant, so the unmusicalness of the sound is hardly surprising.

Here, then, we have two frequencies which are harmonious with one another and with one another's lower harmonics, but whose intermodulation frequencies are altogether unmusical by any standard. The listening test confirms these expectations. On the other hand frequencies could be chosen for the two input tones that would yield concordant intermodulation products, and this too is confirmed by one's ears. I don't know whether it would be practicable to compose music using only notes that could not, when sounded together, be distorted into discordant intermodulation tones, but I fancy composers would find it rather a serious restriction. And not only are the intermodulation tones introduced by distortion into typical musical programmes likely to be more discordant than the harmonics, but they are far more numerous. One has only to try to reckon the number superimposed on orchestral music to guess how the confused "muddy" sound of non-linear reproduction is caused. The doctrine that most of the audible unpleasantness of non-linearity distortion is due to intermodulation tones rather than harmonics is, I conclude, in general justified, at least for the lower-order distortion that is normal in reasonable apparatus.

Distorted Discords

One criticism that has been voiced is that modern composers like nothing better than a good hearty discord, and so discordant distortion products are not so serious as I made out. But (1) the amount of listening to music by that kind of composer is a small fraction of the whole, (2) even that kind of composer does not (except for a few obscure experimenters) write music for notes outside all recognized musical scales, and (3) in spite of what such music may sound like to some, the occurrence and nature of the discords is intended to be as composed and not as it may happen to result from chance distortion. A similar reply can be made to the criticism that intermodulation tones are generated in our ears because they are non-

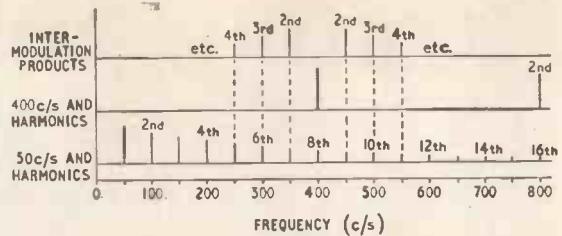


Fig. 1. This diagram shows, above a frequency scale, the harmonic frequencies of a 50-c/s signal, the same for a 400-c/s signal (only fundamental and second are within range), and the frequencies of the products of intermodulation between the two.

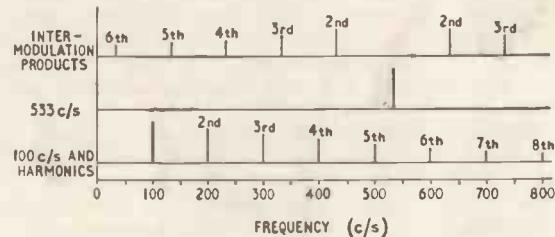


Fig. 2. Similar to Fig. 1, but with fundamental frequencies of 100 c/s and 533 c/s.

linear, and therefore distortion doesn't matter. But this ear distortion becomes prominent only when the sound is loud, so the distortion coming from reproducers, which doesn't disappear when we walk away and hear it more distantly, sounds unnatural.

Very well then, let us take the relative unpleasantness of intermodulation as established, and pass on to measurement of the distortion. And here there seems to be a tendency to argue that because intermodulation is the cause of the unpleasantness it is the thing that should be measured, rather than harmonics. It may quite possibly be true that it is better to measure intermodulation than harmonics, but this is not the argument to prove it. Remember, we can't measure unpleasantness as such; we can only look for something to which unpleasantness seems to be more or less proportional. If we find that unpleasantness is proportional to the percentage of intermodulation products, then it may seem natural to measure that. But it could be equally appropriate to measure percentage harmonics, even if they themselves contributed nothing to the unpleasantness, provided that they were directly proportional to the intermodulation. It is rather like voltage measurement. A difference of potential causes mutual electrostatic attraction, whereas it does not directly cause a magnetic field, but nevertheless voltmeters actuated by magnetic fields are far commoner than electrostatic voltmeters. The magnetic voltmeters are worked by current, which (according to Ohm's law) happens to be directly proportional to a voltage.

The relationship between harmonics and intermodulation is even closer than that between voltage and magnetic field, because harmonics are actually a particular kind of the same thing as intermodulation. This is a suitable moment for clearing up the numbering of these things. At one time it was quite usual to call the double-frequency harmonic the first harmonic. I believe musicians still do (they also often use the word "partial" for "harmonic.")

It was quite reasonable. But it was also rather awkward that the n th harmonic should be $n+1$ times the frequency, so to make the n th harmonic n times the fundamental frequency the fundamental is now reckoned as the first harmonic. Similarly the simple sum and difference intermodulation products, of frequency $f_1 \pm f_2$, were (and are) sometimes called the first-order intermodulation products; and this too was awkward because the kind of distortion causing them also caused what we now call second harmonic. So the rule is that the order number of the general intermodulation product $p f_1 \pm q f_2$ is $p+q$. With $f_1 \pm f_2$, p and q are both 1, so the order is 2. In this way the order of intermodulation is always the same as that of the harmonic produced by the same kind of distortion. If you didn't at first see my point about the vast number of intermodulation products compared with harmonics, it should be clearer now. Seventh-order distortion of two frequencies comprises only two seventh harmonics— $7f_1$ and $7f_2$ —but all these intermodulation products: $6f_1 + f_2$, $5f_1 + 2f_2$, $4f_1 + 3f_2$, $3f_1 + 4f_2$, $2f_1 + 5f_2$, $f_1 + 6f_2$, $6f_1 - f_2$, $5f_1 - 2f_2$, $4f_1 - 3f_2$, $3f_1 - 4f_2$, $2f_1 - 5f_2$ and $f_1 - 6f_2$. Both mathematical calculation and practical test show that this distortion also produces fifth, third and first harmonics and intermodulation products. So imagine the result with a full orchestra playing!

Next, see what happens to the distortion products just listed when f_2 becomes equal to f_1 . The only harmonic frequency, of course, is $7f_1$ (because $7f_2$ is the same). All the sum intermodulation products also boil down to $7f_1$. The difference products are $5f_1$, $3f_1$ and f_1 , which also were there before. So harmonic distortion is not an entirely separate subject from intermodulation, but can be regarded as a special case of it. No wonder then if there is a close numerical relationship between figures for harmonic distortion and those for intermodulation.

It would take too long to go through all the calculations here and now to show what the relationship is, because it depends on the kind of distortion. But the data have been clearly tabulated in the article by Callendar and Matthews I mentioned last month. There are also some very interesting comparisons between calculations and experimental results in a paper by W. J. Warren and W. R. Hewlett*. All I can do in the space left is to outline some of the main principles.

We have already seen that the relative strength of each harmonic produced by distortion depends

on the shape of the transfer characteristic of whatever is causing the distortion. The same goes for intermodulation products. And I have mentioned that the shape that generates, say, second harmonics, is also the shape that generates second-order intermodulation. Conveniently enough for the memory, it is the second-power (or square-law) shape. What does that mean? Well, suppose we take first of all a linear device, say a resistor. The equation stating the relationship between the voltage applied and the current flowing through it is commonly known as Ohm's law: $I = E/R$. In algebra, however, it is a custom to use small letters for variables and capitals for constants. The whole meaning of Ohm's law is that however the current and voltage may vary, the ratio of the two—the resistance—is constant. So we can write the same thing

$$i = \frac{1}{R} e$$

and because $1/R$ is the conductance, for which the usual symbol is G , we can make a neater job:

$$i = Ge$$

If we plot a graph of i against e , by choosing some fixed value of G and then choosing various values for e to give corresponding values for i , giving points to join up into a line, we find that the line is always a straight one. That is what we mean when we say that the resistor is *linear*. We can alter the slope of the line by choosing a different value for G ; that would mean a different, but still linear, resistor. We could also shift the line bodily (which would be useful for approximately imitating the nearly-linear part of a valve characteristic) by adding another constant, say I_o , to stand for the current flowing when there is no voltage:

$$i = I_o + Ge$$

Our e stands for any value of input voltage varying in any way at all, but supposing we use a definite kind of input voltage, with a sine waveform, we can substitute for e the equation of that waveform, usually written $e = E \sin \omega t$, where E is the peak voltage and ω is 2π times the frequency. The result of the substitution is

$$i = I_o + GE \sin \omega t$$

from which we see that the current also has the same sine wave form and frequency. What we have done is to prove that a linear device—resistor, valve, amplifier or what not—is distortionless (as if we didn't know!).

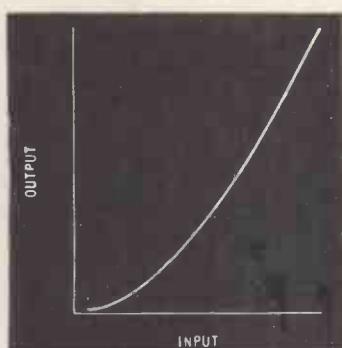
To study non-linear devices we try to find an equation which, when graphed, closely imitates the characteristic curve of the device. One of the commonest shapes, especially where valves are used, is the one that bends increasingly in one direction, as in Fig. 3. This can be imitated by adding a square or second-power term to the equation, with its own constant to decide the amount of curvature:

$$i = I_o + G_1 e + G_2 e^2$$

When the signal waveform is substituted for e the new term becomes $G_2 (E \sin \omega t)^2$, and this is equal to $\frac{1}{2} G_2 (1 - \cos 2\omega t)$, which shows that a signal of twice the frequency (i.e., the second harmonic) is produced. To imitate the device's curve more accurately it is usually necessary to add some higher even-number terms, and each brings in its own harmonic and also harmonics of all the lower even numbers.

If the curve bends over equally at both ends it

Fig. 3. Type of transfer characteristic giving rise to even-number distortion.



can be shown in a similar way that odd-number terms are needed in the equation, and odd harmonics are produced.

The same procedure is adopted in studying intermodulation, except that e must be (at least) two sine (or cosine) waves of different frequencies. The algebra and trigonometry needed to reckon up all the frequencies in the output, and the amplitudes of each, becomes really formidable, and that is why it was very kind of Messrs. Callendar and Matthews to go through it all and present the results in convenient tables. They show that the relationship between the powers of e in the characteristic equation and the harmonic frequencies produced by the corresponding distortion holds good for intermodulation products—that an even power causes intermodulation products of that order and all lower even orders, and similarly for odd powers.

Distortion Measurement

The fact I have been leading up to in all this is that if the equation of a distorting device's transfer characteristic is known, the amplitude of every harmonic and intermodulation product follows (provided, of course, that we have the skill and patience to deal with all the necessary calculation!). So there is, corresponding to any combination of harmonics resulting from a given combination of input signals, one particular combination of intermodulation products. And vice versa. Theoretically at least, if either harmonics or intermodulation are known, both are known. So theoretically at least it doesn't matter which is measured. There is a fixed rate of equivalence between the two.

But that doesn't mean that for every 1% harmonic distortion the intermodulation distortion is some fixed number of %. It isn't nearly as simple as that. In general, there is a different ratio between harmonics and intermodulation for every order (second, third, etc.), and that number is not fixed but depends on the respective amplitudes of the two or more input frequencies, and on the amount of distortion of other orders. The reason for this last is that the amount of second-order distortion (say) depends not only on the second-power term in the equation but also all higher even-power terms. This complication drops out if the distortion is exclusively second or third, as approximately it often is. Another complication can be avoided by always using the same ratio of signal amplitudes for intermodulation testing; a commonly-used ratio is 4 : 1. If the single signal used for harmonic testing has the same peak value as these two combined (i.e., 5 times the amplitude of the weaker) then with second-order distortion alone each of the two intermodulation products, reckoned as a percentage of the weaker signal forming its "carrier wave," is 1.6 times the percentage harmonic distortion. With third-order distortion alone, the corresponding ratio is 1.92. And if both "sidebands" are counted, these two figures are doubled. Fortunately these ratios are not very much affected by reasonable amounts of higher-order distortion, and practical tests with the 5 : 4 : 1 signal ratio show that the intermodulation product percentage of any order is usually 1.5-2 times the same-numbered harmonic percentage. Because the carrier wave is only one-fifth of the amplitude used for harmonic testing, however, the intermodulation product itself is smaller than the corresponding harmonic, so it is not really correct to

say (as American writers do) that intermodulation measurement is more sensitive.

All this is on the assumption that there is no frequency distortion. Of course if the various frequencies are amplified by different amounts in the "device," that upsets the calculations accordingly.

For the sake of simplicity, everybody wants to sum up the distortion in a single number. But looking at Figs. 1 and 2 again we may well ask how this can be done. Even single-signal harmonic measurement is liable to produce a considerable number of harmonics of assorted amplitudes, and intermodulation measurement yields vastly more. Is there any way of combining those groups of percentages into one, in such a way that it gives a fair indication of the unpleasantness of the distortion?

It would be very nice if there were, and several ways have been proposed, but I am afraid that the answer is, if not an outright negative, at least doubtful. One of the most popular schemes of measurement is to apply a single tone at the input, measure the total output (fundamental plus harmonics due to distortion), and then insert a bridge filter between output and meter to stop the fundamental completely, so that what is measured is the total harmonics. The ratio of 100 times the second reading to the first is "percentage total harmonics." This scheme is popular because it can be worked with comparatively simple apparatus and gives a single figure. But unfortunately that figure is not a fair measure of unpleasantness. Although the subject is full of controversy, one thing universally agreed is that a given amount of third harmonic distortion is worse than the same amount of second, and that the high harmonics are worse still. To make the "total" figure take this into account it was proposed in 1936 that harmonics should be measured separately and each multiplied by $n/2$ before being combined. For the second harmonic n is 2, so its reading is unaffected; the third is multiplied by $3/2$; the fourth 2; and so on. By the way, whether the individual harmonics are "weighted" like this or not, they must not be just added together to give the total; as I explained in "Total Power" (March, 1952) when adding up a number of simultaneous voltages or currents it is necessary to square each, add them all together, and take the square root of the result.

According to D.E.L. Shorter of the B.B.C.* this system still doesn't give enough weight to the unpleasantness of the high-order distortion, and he reckons that multiplying each harmonic reading by $n^2/4$ lines up better with listening tests. You can see, of course, how difficult it is to discover exactly how much worse one kind of distortion sounds than another; for one thing it probably depends a good deal on the kind of programme being heard. So any weighting system is rather arbitrary. I doubt whether anyone would be prepared to swear that fourth harmonic is either $4/3$ or $16/9$ times as bad as third, or even that it is equally bad. And besides the extra calculation, measuring all the harmonics separately necessitates much more expensive apparatus, especially for the Shorter weighting, in which the very high harmonics are multiplied so much that one has to be able to measure accurately very small percentages of them.

How about intermodulation measurements? They

* "The Influence of High-Order Products in Non-Linear Distortion," *Electronic Engineering*, April 1950, p. 152.

are even more controversial. The most popular method (again, because it requires simple apparatus and gives a single reading) applies a strong low-frequency signal and a quarter-strength high frequency signal, and measures the total of the "sidebands" around the latter; e.g., those shown on the top line in Fig. 1. The procedure has been described in *Wireless World* by Thomas Roddam (April 1950) and E. W. Berth-Jones (June 1951). It comes under the same criticism as the total harmonic distortion method, over which it seems to have no very obvious advantages.

Another system, called the C.C.I.F. method, varies the frequencies of both input signals in such a way that one signal is always a certain number of c/s (say 1,000) more than the other. The frequency of the second-order intermodulation product $f_1 - f_2$ is therefore constant and hence relatively easily measured. This method is very highly spoken of in some circles, but since it indicates only second-order distortion, it presumably pronounces a push-pull amplifier having strong third-order distortion as absolutely perfect. To my mind this is a fatal objection.

The simpler methods have their uses (e.g., pro-

duction tests of units having possibly varying amounts of similar distortion), so long as one doesn't regard them as unpleasantness meters. For thorough investigation it seems to be necessary to have a wave analyser for separately measuring every distortion product, and preferably to supplement it by visual examination of the transfer characteristic and of the output when the fundamental has been removed. For most purposes I should say that harmonics are enough, but there is an exception if one wants to know what the distortion is like near the upper frequency limit, because then the harmonics are all "off the map," but two signals inside the limit can still intermodulate to give a distortion product right inside the audible range.

Nobody would be more pleased than I to be able to hand out a simple cut-and-dried solution to this problem of distortion measurement. Perhaps some painstaking and well-provided organization will give a team of research workers a year or two to find out what reasonable conditions and method of test take into fair account every cause of unpleasantness of distortion.

AIRFIELD RADAR DEVELOPMENTS

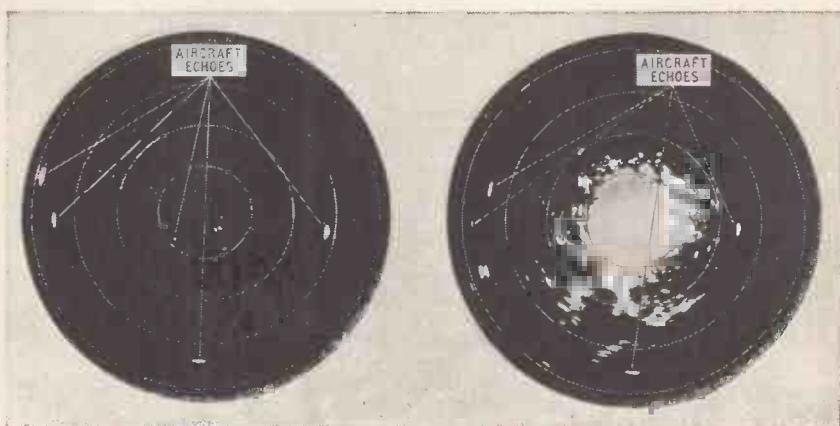
Crystal-controlled and with Permanent-Echo Suppression

THE clutter of permanent echoes (p.e.'s) familiar to all operators of radar equipment, and which is particularly troublesome on airfield radar screens, can now be successfully eliminated by an ingenious cancellation system embodied in the latest Type S232 airfield radar introduced by Marconi Wireless Telegraph Company. Known as "Moving Target Indicator" (MTI) it provides permanent-echo suppression better than 46 db. Another unusual feature is that it is crystal-controlled throughout, which to a large extent accounts for the good p.e.-suppression.

Briefly, the operation of the equipment is as follows:—the output from a crystal-controlled reference oscillator on 5.625 Mc/s is mixed with an harmonic of another crystal-controlled oscillator and the beat frequency amplified and multiplied to give the final output frequency, which in this case is in the frequency range 500 to 610 Mc/s (50 cms). The output power is between 50 and 60 kW at a pulse length of 2 to 4 μ sec as required and at a pulse repetition frequency of 500 to 800 c/s.

The received (echo) signals after conversion to an intermediate frequency of 45 Mc/s together with the eighth harmonic of the 5.625-Mc/s reference oscillator (also 45 Mc/s), are fed to a homodyne detector. The output from this detector is therefore proportional to the difference in phase of the two input signals. As the phase

of the reference oscillator is fixed, echoes from stationary objects will have the same phase difference on all successive echoes, but those from a moving target will have a continuously changing phase. It is only necessary to compare the homodyne output produced by successive echoes in order to determine whether an echo is moving or not. A special liquid delay line is used for this purpose and in this device identical signals resulting from permanent echoes cancel out and only those whose phases have changed between successive echoes appear in the output circuit. Here they are rectified and fed through a video amplifier to separate cathode followers and thence by coaxial cables to p.p.i. display consoles. Up to eight p.p.i. display units can be used with one aerial head so that the equipment can be used for long-range, short-range or segmental viewing simultaneously in several different places. As demonstrated by an experimental equipment installed at London Airport, this radar is capable of detecting aircraft at ranges of from $\frac{1}{2}$ to 100 miles.



P.p.i. displays showing permanent-echo suppression (MTI system) with the Marconi Type S232 airfield radar. On the left MTI switched on, on the right, switched off. Range markers at intervals of 5 nautical miles.

Manufacturers' Products

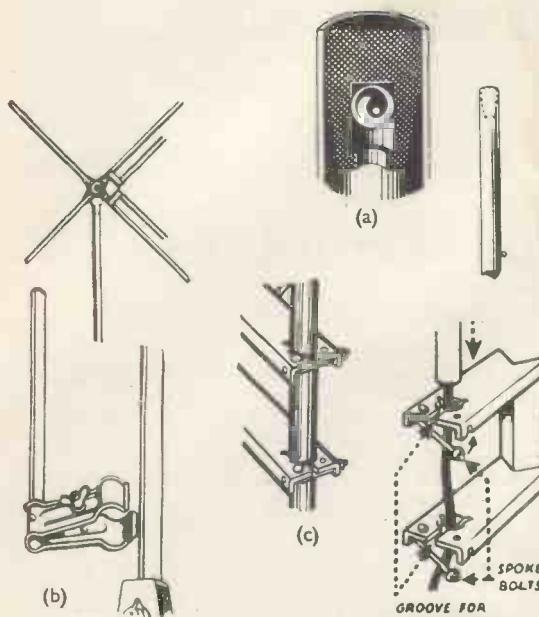
NEW EQUIPMENT AND ACCESSORIES FOR RADIO AND ELECTRONICS

Television Aerials

IMPROVEMENTS to existing models and the introduction of Band III add-on elements comprise some of the latest changes made in the television aerials produced by Antiference.

One of the most interesting is a vibration damper to alleviate the audible howl sometimes produced by wind causing vibration of the elements. When transmitted down a chimney shaft it can be most annoying.

The damper consists of a hollow plastic plug containing



Antiference aerial damper (a), new harness bolts (c) and "Addex" Band III units (b).

a small weight having a slight lateral movement and inserted in the end of each aerial rod. The movements of this weight oppose the vibrations of the rod and silence the aerial. It is also claimed that a further advantage of the new device is that it tends to alleviate signal "flutter" caused by vibration of the aerial. It is shown at (a) in the drawing above.

Another improvement concerns the mast clamps on the chimney harness. Captive "spoke-bolts" are fitted in place of loose bolts and greatly simplify the erection of the mast when complete with aerial and feeder; (c) in the drawing.

The Antiference "Snapacitor" fitting, which relies on a capacitance in place of the usual electrical connection between feeder and the aerial elements, has been improved by employing a more effective type of anodizing of the contiguous surfaces. The capacitance of the coupling is by this means raised to 1,000 pF or more.

The same type of coupling is used for the new add-on elements which have been brought out to convert a Band-I aerial for Band-III reception.

These are known as "Addex" units and are available for plain dipoles, "H" or "X" aerials. Where the high-and low-band stations are not co-sited reception from opposite directions can be effected by fitting a suitable Addex kit to an Antex (X) aerial. It is not applicable to other types. Prices range from 7s 6d to 15s for a set.

The address of the maker is Bicester Road, Aylesbury, Bucks.

Four-Band Coil Pack

THE majority of coil packs cover the three recognized broadcasting wavebands only; i.e., short, medium and long, but in the latest addition to the Denco range of packs a fourth band is included with a coverage of 50 to 160 metres. The other three bands have coverages of 16 to 50 metres, 194 to 550 metres and 800 to 2,000 metres respectively when tuned by a 500-pF gang capacitor using an i.f. of 465 kc/s. The additional waverange takes in the 80- and 160-metre amateur bands and the wavelengths employed by trawlers and coastwise shipping.

Known as the model CP3F it comprises a small chassis of $2\frac{1}{2} \times 4\frac{1}{4}$ in with an overall depth of 1 in, excluding the switch spindle, carrying 4 oscillator and 4 signal circuit coils with adjustable dust iron cores, 8 trimming capacitors, oscillator tracking capacitors and a 2-pole 4-way switch.

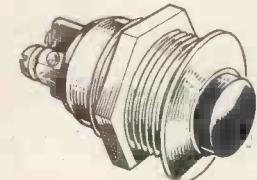
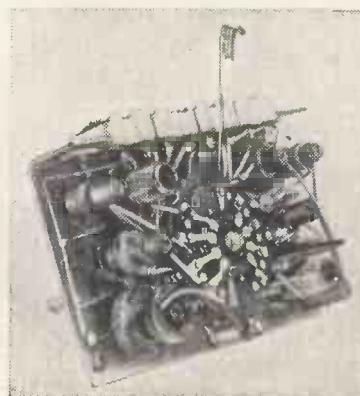
The makers are Denco (Clacton) Ltd., 357-359 Old Road, Clacton-on-Sea, Essex, and the price is 49s plus 16s 4d U.K. purchase tax.

Light-Action Push Switch

A RECENT addition to the range of Bulgin switches is a spring-loaded push-to-make, single-pole switch for use in test equipment and apparatus where temporary excitation only of the circuit is required. It is a single-hole fixing type with a large screwed bush, forming also the main body of the switch, measuring $\frac{1}{4}$ in in diameter. It measures 1 in deep behind the bezel rim and will take panels up to $\frac{1}{2}$ in thick. The case is completely insulated from the contacts.

The switch is rated at 110 V, 1 A or 30 V, 2 A in a.c. circuits with some derating for d.c. over 12 V. The push-button is of generous size, measuring $\frac{1}{4}$ in in diameter and operates without undue pressure. Self-aligning and self-cleaning internal contacts undoubtedly contribute to the very light action. The finish is chromium and black.

Known as the Type MP12 the new switch costs 3s 9d and the makers are A. F. Bulgin & Co., Ltd., Bye Pass Road, Barking, Essex.



Above: Bulgin new push-switch type MP12.

Left: Denco Model CP3F four-range coil pack.

The Ratio Detector

By M. R. MURRAY*

Principle of Operation in F.M. Receivers

RATIO detectors are so called because they produce two voltages whose ratio varies with the frequency swings of the incoming f.m. signal. The difference between these two voltages provides the audio output. A ratio detector circuit can easily be distinguished from other double-diode discriminators because its diodes are connected back-to-back (see Fig. 1), that is, the tuned secondary circuit L_2C_8 of the transformer is connected from the cathode of one diode to the anode of the other. The main advantage of the circuit, which will be decisive in set design, is that it reduces the number of i.f. stages required. Other detectors do not remove unwanted amplitude modulation superimposed on the f.m. signal by impulsive noise or gain variations in the receiver, and a separate i.f. stage has to be provided solely for this purpose.

How is the amplitude modulation removed? The two voltages mentioned above are added together in the circuit, but although their ratio varies the sum of the two is held constant. At low audio frequencies this sum is prevented from varying by the "flywheel" action of a 5- or 8- μ F stabilizing capacitor, C_3 in Fig. 1. When amplitude modulation on the f.m. input to the ratio detector makes the signal rise momentarily, both diodes are driven harder and the extra current flows into C_3 ; current is drawn out from C_3 when the signal falls on the downward half-cycle of the amplitude modulation, so that successive half-cycles of the a.m. cancel each other out. At higher unwanted audio frequencies the damping effect of the diodes on the L_2C_8 tuned secondary circuit varies during the a.m. cycle and compensates for the a.m. variations.

The circuit can be arranged in a symmetrical or balanced form in which the voltages are produced across two equal capacitors connected in series across the diode load (Fig. 2), but preference may be given to the unbalanced circuit (Fig. 1) in which only the lower of the two capacitors is retained. Removing

* Mullard Technical Service Department. This article is based on one which originally appeared in *Mullard Outlook*.

one capacitor makes for economy and leaves the circuit sufficiently capable of suppressing unwanted amplitude modulation. However, a difference voltage can no longer be taken from the common connection of two capacitors, and by the time the circuit has been rearranged it is not at all obvious how the audio output arises. This article therefore is concerned chiefly with the unbalanced circuit, since the explanations can readily be adapted to include the Fig. 2 circuit where both capacitors are present.

The internal impedances of the ratio detector diodes must be small and at least approximately equal, and one diode must have its own cathode pin connection. Suitable diodes are a''_d and a'''_d of the Mullard EABC80. Subscript has been used to indicate voltages applied to k''_d and a'''_d , and in this way to make it quite clear that the a'_d diode is not

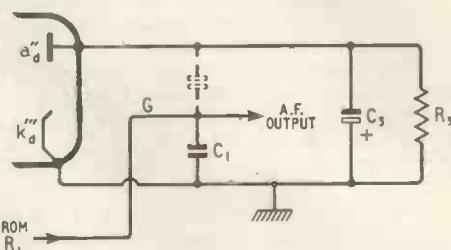


Fig. 2. Part of a balanced ratio detector circuit, showing how it is related to the unbalanced version. C , here corresponds to C , in Fig. 1.

used in the ratio detector. Actually, the a'_d diode is the a.m. detector and rectifier for a.g.c. voltages.

The transformer, or ratio filter, is similar to that required for other discriminators, and only a brief description of the effect of frequency swing upon phase need be given here.¹

The L_1C_P and L_2C_8 circuits are retuned to a central intermediate frequency of, say, 10.7 Mc/s. Current and voltage in the tuned circuits will only be in phase

at the central intermediate frequency. Primary L_1 has a current which lags (or leads) the f.m. input voltage as the signal frequency is swung higher (or lower) than the intermediate frequency. Secondary L_2 picks up the flux generated by the primary current and produces voltages in its two halves whose phase θ varies at the same audio frequency as the phase of the primary current. Tertiary winding L_3 is not tuned, and injects an i.f. reference voltage from the primary into the secondary. This voltage

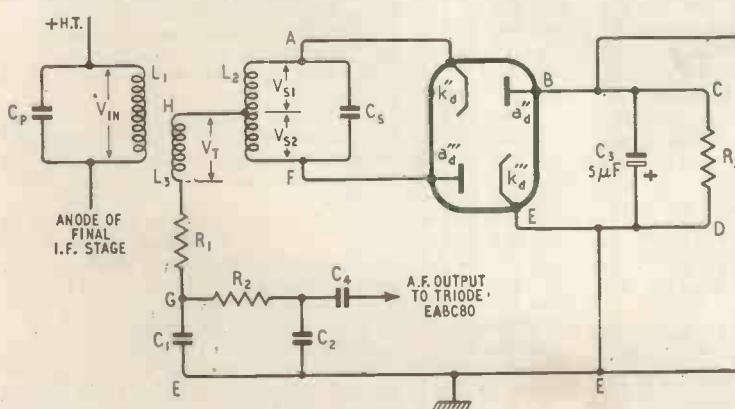


Fig. 1. Typical ratio detector circuit of the unbalanced type.

combines vectorially with the "phase swinging" i.f. voltage across each half of the secondary and makes the ratio of the voltages taken off to the diodes vary at audio frequency.

To interpret the vector diagram (Fig. 3) it is sufficient to know that the lengths of the arrows have not been drawn to scale as they usually are to represent the number of volts, etc.; while the angles between the arrows can be read off as phase differences in degrees. Start, then, by picking out the input voltage V_{IN} ; the phases of all the other quantities are measured with reference to it. In the secondary the induced current I_s lags (or leads) V_{IN} when the signal frequency is higher (or lower) than the intermediate frequency. The voltages across the two halves of the secondary are V_{S1} , V_{S2} . They respectively lag and lead I_s , whatever the position of I_s , by 90° . Because the secondary is centre-tapped V_{S1} and V_{S2} are equal and 180° out of phase with each other, so on the diagram they are drawn with equal and opposite arrows. The phase angle between I_s and V_{IN} ($= \theta$) varies with the frequency swing, so that I_s is wagging to left and right of V_{IN} , while V_{S1} and V_{S2} are seesawing up and down, at the audio (modulating) frequency.

Next pick out V_T on the diagram; it is the tertiary voltage injected into the secondary from the primary, and is in series with the voltage across each half of the secondary. Now the tertiary consists of a few turns wound closely over the anode end of the primary. So V_T does not waggle; it is fixed and can be drawn 180° out of phase with V_{IN} .

The voltage $V_{k'd}$ applied to cathode $k'd$ is the vector sum of voltages V_{S1} and V_T in series. This vector sum is formed on the vector diagram by the "parallelogram law," that is, the sum $V_{k'd}$ is the diagonal of a parallelogram whose sides are V_{S1} and V_T . Similarly, the voltage $V_{a''d}$ applied to $a''d$ is found by drawing a parallelogram using V_{S2} and V_T as the two sides.

If V_T had not been injected into the secondary, the voltages taken off from the secondary would be V_{S1} and V_{S2} whose lengths on the diagram remain constant as I_s is wagged to and fro. By combining V_{S1} and V_{S2} with V_T , however, two voltages $V_{k'd}$ and $V_{a''d}$ are obtained which are equal only at the intermediate frequency when I_s is in phase with V_{IN} ($\theta = 0$). But when I_s lags V_{IN} , then $V_{k'd}$ is greater than $V_{a''d}$ (as in the diagram), and diode $a''d$ passes more current than diode $a''d$; or when I_s leads V_{IN} the position is reversed and $V_{a''d}$ is greater than $V_{k'd}$. With a suitably designed circuit the ratio $V_{k'd}/V_{a''d}$ follows faithfully the original audio modulation as I_s is made to waggle to left and right of V_{IN} by the frequency swings contained in the signal.

The current through each diode has two paths in the secondary system; those for $a''d$ are (i) BCDEFA and (ii) BCDEGHA, while for $a''d$ they are (i) FABCDE and (ii) FHGE. The paths numbered (ii) have a common section $L_3R_1C_1$, and because of the

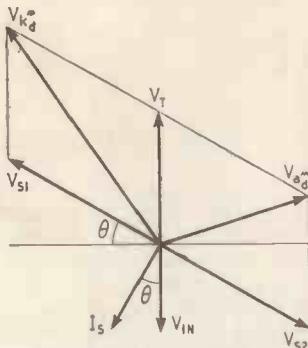


Fig. 3. Vector diagram illustrating the mechanism of the ratio detector.

way the diodes are connected their currents through $L_3R_1C_1$ oppose each other. At the intermediate frequency, when $V_{k'd} = V_{a''d}$, there is no audio output voltage at G; above the intermediate frequency current flows in the direction HGE (when $V_{k'd}$ is greater than $V_{a''d}$) or in the direction EGH below the intermediate frequency ($V_{a''d}$ greater than $V_{k'd}$). Thus the a.f. voltage taken off at G depends on the frequency swing of the incoming signal; it follows the ratio $V_{k'd}/V_{a''d}$, and therefore reproduces the waveform of the original studio sounds.

There is also an "i.f." variation in the vectors shown in Fig. 3. They can be imagined as contracting to zero length then, expanding out again but in the opposite direction, contracting back to zero again, and finally returning to their original length in their original direction; and they complete this cycle the same number of times per second as the frequency of the signal after it has passed through the frequency changer. In actual fact, the vectors do not return exactly to their original direction, for in the meantime their i.f. frequency will be changing and θ will have changed too—but the to-and-fro waggle of I_s , of course, is at audio frequency. These i.f. variations in $V_{k'd}$ and $V_{a''d}$ are rectified by the two diodes, the secondary system being by-passed to earth at the i.f. by C_1 . Further filtering out of the i.f. is performed by the C_2R_2 de-emphasis network usually placed at this point; but the main function of the de-emphasis network is to compensate for treble boost applied at the transmitter. In f.m./a.m. receivers the "pure" a.f. output is passed via a d.c. blocking capacitor C_4 and a volume control to the triode grid of the EABC80. In a line-up designed solely for f.m. reception a double diode such as the EB91 could be used in the ratio detector.

REFERENCES

- 1 "Cathode Ray." "Frequency Modulation, Part 3," *Wireless World*, July, 1951; with corrections, August, 1951.
- 2 Seeley, S. W., and Avins, J. "The Ratio Detector," *RCA Review*, June, 1947.

1955 A.R.R.L. HANDBOOK

A CONSIDERABLE quantity of new material is included in this, the 32nd, edition of the Radio Amateur's Handbook, which is compiled by the American Radio Relay League, the U.S. equivalent of our R.S.G.B. Almost all its 27 chapters are affected, but by omitting outmoded designs of equipment and techniques the very latest in amateur practice is included without any increase in the size of the volume. It remains the same at 608 pages, of which 67 are given over to valve and transistor data, two more than last year.

The mobile radio chapter has been almost entirely revised and contains descriptions of the most up-to-date equipment extant in amateur circles. These are applicable to this country, and for that matter everywhere where amateur radio flourishes.

It is often the little things that give the final polish to amateur work; for instance, the handbook explains the correct way to lash a bunch of wires in a receiver, how to operate a break-in system to the best advantage, how to get the most out of DX working and such-like. Information of this kind is not easily found elsewhere.

Copies of the handbook are obtainable from the Modern Book Co., 19-23, Praed Street, London, W.2, or ordered from the Radio Society of Great Britain, New Ruskin House, Little Russell Street, London, W.C.1, for delivery from the U.S.A. The price is 30s (31s 6d by post).

NORTHERN RADIO SHOW

AS already announced, the second post-war Northern Radio Show, organized by the Radio Industry Council, will be held in the City Hall, Manchester, from May 4th to 14th. The show will open daily from 11.0 to 10.0, except on the 10th when it will close at 11.0. Admission to the exhibition, which will be officially opened at 3.30 on the 4th by Her Royal Highness the Princess Royal, will be 2s (children 1s). There will be special rates for parties of 25 and over, and trade season tickets will be available, price 5s.

As will be seen from the following list of 53 exhibitors the majority are domestic receiver manufacturers, although some accessory and component manufacturers are also participating. As at the London Show the exhibition will include a studio from which the B.B.C. will broadcast sound and television programmes. The B.B.C. is providing a demonstration comparing broadcast reception on medium waves with frequency-modulated v.h.f.

	Stand No.		Stand No.
Aerialite	46	McMichael Radio	28
Antiference	6	Marconiphone Co.	38
Ambassador Radio & Television	15	Mercantile Credit Co.	40
Arrell Electrical Accessories	25	Mullard	8, 20
B.B.C.	56	Multicore Solder	50
Balcombe, A. J.	11, 13	Murphy Radio	55
Belling & Lee	54		
British Radio and Television	39	National Provincial Bank	1
British Railways	10	Pam Radio & Television	31
Bush Radio	36, 103	Permanoid	25
Cole, E. K.	53	Philips Electrical	34, 48
Co-operative Wholesale Society	51	Pilot Radio	21
Cossor, A. C.	4, 17	Practical Wireless	5
Decca Record Co.	9, 23	Pye	18
E.M.I. Sales & Service	49	Radio Gramophone Dev. Co.	27
Edison Swan Electric Co.	47	Regentone Radio & Television	52
English Electric Co.	22	Slingsby, H. C.	100
Ferguson Radio Corp.	16	Sobell Industries	30
Ferranti	29	Stella Radio & Television	24
Garrard Engineering Co.	3	Taylor Electrical Instruments	12
General Electric Co.	37, 43	Telerection	44
Grampian Reproducers	26	Ultra Electric	32
Gramophone Co.	35	Vidor	33, 102
Granada Theatres	41	Waveforms	45
Invicta Radio	19	Whiteley Electrical Radio Co.	7
Kemsley Newspapers	104	Wildbore, J. E.	42
Kolster-Brandes	14	Wireless & Electrical Trader	2

MAY MEETINGS

Institution of Electrical Engineers

London.—May 2nd. "A Simple Introduction to Telegraph Codes" by H. V. Higgitt.

May 5th. "The Electrical Activity of the Brain" by Dr. W. Grey Walter.

May 11th. Group of papers on "Transistors and other Semi-conductor Devices" including "Junction Transistor Noise in the Frequency Range 7-50 kc/s" by W. L. Stephenson and "Noise in Silicon Microwave Diodes" by G. R. Nicoll.

The meetings will be held at 5.30 at Savoy Place, W.C.2.

Physical Society

Acoustics Group.—May 12th. "Measurement of Equal Loudness Contours" by R. S. Dadson and D. W. Robinson at 5.30 at Imperial College, London, S.W.7.

Institute of Physics

Non-Destructive Testing Group.—May 6th. "Xeroradiography" by R. L. Durant (Ministry of Supply) at 6.30 at 47, Belgrave Square, London, S.W.1.

British Institution of Radio Engineers

London Section.—May 18th. "The Development of the Underwater Television Camera" by D. R. Coleman, D. A. Allanson and B. A. Horlock, at 6.30 at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

British Sound Recording Association

London.—May 20th. Annual convention at 7.0 at the Waldorf Hotel, Aldwych, W.C.2.

Electroencephalographic Society

There will be a meeting of the above society on May 21st at the Maudsley Hospital, London, S.E.5.

Incorporated Practical Radio Engineers

South Coast Section.—May 12th. "Band III Aerial Equipment" (Antiference) at 7.30 at the Kings Arms Hotel, Castle Street, Christchurch.

Midlands Section.—May 4th. "Philco Television Receivers" at 7.30 at the Crown Hotel, Broad Street, Birmingham.



You may well ask—no one has so far clearly defined just what is this High Fidelity we hear so much about.

Is price the criterion? If so, the sky's the limit!

What about power output? Do you really need 15 or even 10 watts? Or is it possible that to operate one good speaker in your home, 3 or 4 watts may be ample if the quality is right? That's the secret.

To come down to earth, here is a High Quality Amplifier that has everything you need. The TRIX model T41, with Bass and Treble boost, separate Control Panel, High and Low gain inputs to suit every pick-up, inverse feed-back, is also compact and convenient. And the price—£16.10.0.

Small wonder that the TRIX T41 is already highly successful in world-wide export markets including the U.S.A., Canada and New Zealand. It will prove to you too that the name TRIX is synonymous with Peak Performance in record reproduction.



Model T41

Send for full technical details.

STOP PRESS!

Extract from MONTREAL STAR, February 5, 1955. Review of MONTREAL RADIO FAIR

"For pure musical enjoyment three particular sets of equipment attracted my attention. The first, in the economy class for both size and price, was the . . . TRIX . . . combination."

The TRIX ELECTRICAL Co. Ltd.

1-5 MAPLE PLACE, TOTTENHAM CT. ROAD, LONDON, W.I. Phone: MUSEUM 5817

Telegrams and Cables: TRIXADIO WESDO, LONDON



RANDOM RADIATIONS

By "DIALLIST"

The Achilles Heel

ACHILLES, if you remember, was dipped as a baby into a certain sacred spring, whose waters had the power of rendering invulnerable any part of the human frame wetted by them. By an oversight Aphrodite, his mamma, omitted to push under the one heel by which she was holding him. When he grew up and became in due course a fully fledged hero spears and arrows and things just bounced off him without doing the slightest harm. But one day a javelin got him in his one vulnerable spot—that unwetted heel—and that was the end of him. And ever since then the expression "the heel of Achilles" has been used to signify the weak spot in otherwise robust beings or things. Now, I wonder what you'd pick out as the Achilles heel in the television receiver of to-day. My own experience is necessarily limited; but I've discussed the matter with a good few dealers and servicemen and most of them, after hearing the Achilles story are of the opinion that whoever mothered the television set must have held on to both heels during the ducking process. There are in fact two far-too-frequent sources of trouble. The first is the e.h.t. winding of the line output transformer and the second, the e.h.t. rectifier.

Kicks in the Neck

USING the flyback to induce from 4 to 25 kV by shock-excitation is pretty well universally accepted practice nowadays. But the winding in which that shock-excitation takes place gets 10,125 kicks in the neck during every second that the TV set is in use and it should always be so designed and made that it has an ample factor of safety. Too often this is not the case, as many viewers know from sad experience. The e.h.t. rectifier, again, is not always of a type fully up to the work in hand and can cause a lot of trouble if it isn't. I wonder sometimes that valve manufacturers are not more conservative in the limits that they lay down, or don't stick their toes in harder when set makers propose to use a particular e.h.t. rectifier of theirs in what might be called borderline

conditions. It doesn't do their reputation much good when such a valve needs frequent renewal—and matters are made still worse when replacements are in such short supply that the unfortunate viewer has to wait for weeks before his dealer can put his TV receiver into action again.

Band III Service Areas

ONE'S FIRST impression on examining the I.T.A.'s expected-service-area map of the London district was that it perhaps erred a *leettle* on the optimistic side. I hope I'm wrong; and I've no doubt that as time goes on and as experience is gained an even larger area will be well served from Croydon. But as to the immediate future two recent statements make one think a bit. The first, by Bellings & Lee, is that owing to the small size of its elements the Band III aerial will have to be more elaborate than that for Band I if it is going to be an equally efficient collector at a given range. Various factors limit the number of elements that can be usefully employed in a Yagi array. The second statement

(from Ekco this time) is that the amplitude of the Band III signal fed to sets of theirs fitted with converters will need to be twice as great as that of the Band I signal to give the same results on the screen. Both B. & L. and Ekco know what they're talking about. Adding up, one is forced to the conclusion (if one hadn't arrived at it already!) that if it is going to cover adequately the area served by a Band I transmitter, a Band III transmitter will need to have a power output many times greater. That, I think I'm right in saying, has been found in America, where Band III stations are authorized to use considerably larger outputs than their opposite numbers on Band I. There must, I suppose, be some particular reason why we decided to use vertical polarization for our Band III system; but it was surely something of a leap in the dark. Had we chosen horizontal polarization, a mass of data, culled from some years of American experience, would have been at our disposal. As it is, we are launching out into an entirely unexplored TV field. Perhaps it's another instance of our legendary national predilection for being different.

Sorting Things Out

WHAT a business it is to pull up one's roots and move from a house in which one has lived for many years! I speak from vivid experi-



"WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition	25/-	26/3
STUDIO ENGINEERING FOR SOUND BROADCASTING. B.B.C. Engineering Training Manual by members of the B.B.C. Engineering Division. General Editor J. W. Godfrey.	25/-	25/6
SHORT-WAVE RADIO AND THE IONOSPHERE. T. W. Bennington, Engineering Division, B.B.C. Second Edition	10/6	10/10
INTRODUCTION TO VALVES. R. W. Hallows, M.A. (Cantab.), M.I.E.E., and H. K. Millward, B.Sc. (Lond.), A.M.I.E.E.	8/6	8/10
WIRELESS WORLD TELEVISION RECEIVER MODEL II: Complete constructional details with notes on modernizing the original design	3/6	3/9
RADIO INTERFERENCE SUPPRESSION as Applied to Radio and Television Reception. G. L. Stephens, A.M.I.E.E.	10/6	10/11
SOUND RECORDING AND REPRODUCTION. A B.B.C. Engineering Training Manual. J. W. Godfrey and S. W. Amos, B.Sc. (Hons.), A.M.I.E.E.	30/-	30/8
ADVANCED THEORY OF WAVEGUIDES. L. Lewin	30/-	30/7
FOUNDATIONS OF WIRELESS. M. G. Scroggie, B.Sc., M.I.E.E. 5th Edition	12/6	13/-
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 3rd Edition	18/-	18/8

A complete list of books is available on application.

Obtainable from all leading booksellers or from

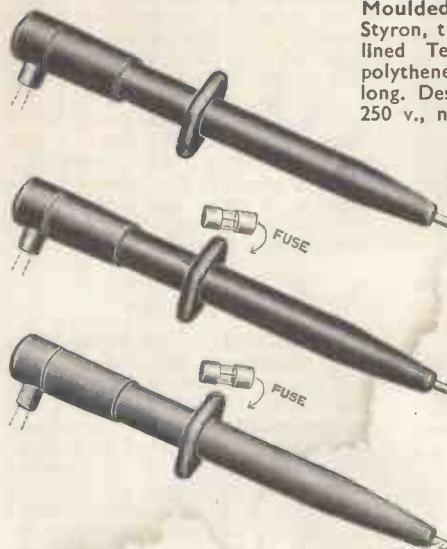
ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1.

ence, for that's what I did less than a week before I sat down to write these notes. Like, I suspect, most folk who are fond of making up and trying out new things for sound and television as they come along, I had amassed a vast and varied collection of bits and pieces; I could never bear to throw anything away for fear that I should need it. The result was that shelves, cupboards, drawers and boxes, crammed higgledy-piggledy with gear ranging from toroidal tuning coils to tweeters, from odd lengths of wire to obsolete valves, occupied every available part of my own particular stamping ground. Weeks before the move I kept telling myself that it was high time to make a start on sorting out what I really wanted from what could be dispensed with. Being by nature, however, a confirmed putter-off I didn't get down to it till only a few days were left and I've a haunting fear that I'll find myself saying sadly: "If only I'd kept *that*, it would have been just the thing for this job."

Radiating at Random

Going through stacks of files and making a bonfire of old and useless letters and papers was one of the worst parts of the job. But it was not without its rewards. One letter was, to me, particularly interesting. Written over 20 years ago, it was from the Editor of *Wireless World*, confirming his acceptance for a trial run of a new feature to be called "Random Radiations" and signed "Dialist." *Wireless World* was then a weekly and remained such up to the outbreak of the last war. As "R.R." has appeared in every issue since January 18th, 1935, this present set of notes must be somewhere about the four hundred-and-thirtieth of the series! "Free Grid" can, I believe, beat that hollow, if he can be induced to work out his figures. "R.R." has brought me over the years a vast amount of correspondence from people in almost every part of the world. And it has led to the formation of not a few close and valued friendships. One letter I shall never forget. It came early in those lean and rather ghastly years which immediately followed the war from a generous-hearted New Zealand reader who "hoped I wouldn't mind if he sent along some food parcels." I'm not an emotional person but I was nearly moved to tears. We've never met, and probably we never shall; but his family and mine have written to one another ever since and it's a very real friendship.

BULGIN TEST-PRODS FOR SERVICING



Moulded in glossy Red or Black Styron, these fully insulated streamlined Test-Prods are fitted with polythene terminal cover. Six inches long. Designed for max. 500 volt use, 250 v., normal max.

Plain Test-Prods,
non-retracting
points. No fuses.
LIST NOS.
TP.1 (Black)
TP.3 (Red)

Retracting point.
1A fuse (unless otherwise stated).
LIST NOS.
TP.2 (Black)
TP.4 (Red)

As TP.2 and 4, but
with slotted prod
to grip wires 18
S.W.G.
LIST NOS.
TP.12 (Black)
TP.14 (Red)

TWIST-GRIP TEST PROD

The New Bulgin Test-prod with the unique "Twist-Grip" wire ends. Prods or clips onto stiff wires, etc., of 0.020-0.0625in Ø. Ideal for use in inaccessible places. Easy cable connection. 6½in. long. Red (TP.16) and Black (TP.17).

& THE 'NEON' MODEL

List No. TP.9. Suitable for testing up to 250 v. supplies. Will indicate polarity and detect leakage. Housed in moulded rubber case with sleeved semi-flexible leads. Totally shock-proof and safe. The gadget of 1,000 uses. Internal lampholder and safety resistor fully enclosed in plastic moulded core.

Full information is available in 144 page Catalogue (Ref. 194/WW) Price 1/- post free.



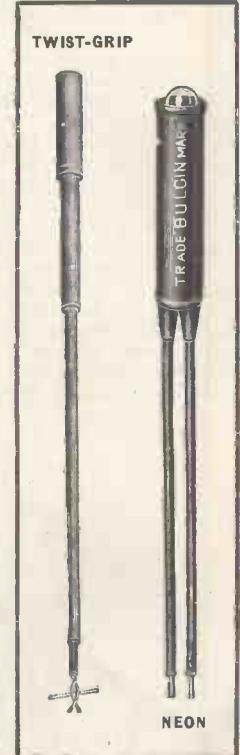
BULGIN

REGD. TRADE MARK

A. F. BULGIN & CO., LTD.
BYE-PASS Rd., BARKING, ESSEX

Telephone : RIPPleway 5588 (5 lines)

MANUFACTURERS OF RADIO & ELECTRONIC COMPONENTS



UNBIASED

By FREE GRID

Base Uses

"DO right and fear no man; don't write and fear no woman" is an old and true maxim. Through ignoring this advice many a man has been mulcted of a tidy sum in a breach of promise action. Modern invention has, however, rendered it completely out of date as a South American court has awarded exemplary damages against a man despite the fact that he did right and didn't write.

"Cuddles can be costly if accompanied by the whispering of sweet nothings in the shell-like ear of a girl who is a Bachelor of Science," as the learned judge remarked, in giving judgment. It appeared that the lady had a tiny microphone concealed in her hair and a pocket tape recorder hidden "elsewhere about her person." I don't know what this latter expression means, but presumably a female B.Sc. would conceal it in the top of her blue stocking.

Another application of a tape recorder has been brought to my notice by the makers of a well-known instrument on this side of the herring-pond. Tape recordings were recently used by an anaesthetist to provide what is called "distraction-anaesthesia" for a patient in the dentist's chair.

I have no wish to detract from the merits of this idea, but I am compelled to point out that there is nothing new in it. Thousands of years ago Chinese teeth extractors used thumbscrews to distract the patients' attention from the comparatively minor pain of manhandling a molar. Even the idea of using music as a "distractor" is not entirely new, for the original purpose of a military band was to drown the cries of the dying on the battlefield and thereby distract the attention of the hale and hearty from sounds which might undermine their morale.

Music has always been held to be

of great psychological value, as we know from the old saying "Music hath charms to soothe the savage breast. . ." But it must be the right kind of music, as every snake charmer knows, and the tape recorder is the only instrument suitable for providing it. If you switch on a wireless set you don't know what you are going to get and gramophone records—even L.P. ones—are too short for a major operation. There must be no break while a record changer does its stuff.

Planned Listening

IN these days of ubiquitous planning, system is being applied to almost every human activity. I see that in the U.S.A. there is even a society making plans for rebuilding the world in the event of its destruction in an atomic war. But amidst all this activity people still seem to listen and view haphazardly instead of planning their radio enjoyment for a week ahead after studying the programmes as I do.

Now to a large extent I blame this on the set makers for, so far as I know, there are still only two sets on the market with a built-in programme time-switch. Even in these two sets, the programme clocks are only capable of being set for twelve hours ahead. So far as I know there is not even a 24-hour programme clock on the market. What is really wanted, of course, is an instrument whereby programmes could be preset for the whole week.

Presumably there is no great demand for programme clock sets, and there are, I believe, two reasons for this. In the first place the public has the good sense to agree with me that it is a seven-day clock that is wanted, and in the second place no great effort has been made to put over the idea of planned listening.

My demand for planned listening and looking may seem a trumpery idea; so was the idea of railways before 1825. Indeed, the old Duke of Wellington called the idea "damned dangerous."

Eros or Cupid

A READER who wrote to approve of my condemning the B.B.C. announcers for their incorrect pronunciation of "polio" suggested that I should castigate them for their manhandling of Eros, the little god on the fountain in Piccadilly Circus. There is not

From my scrapbook



much that slips past my observant eye or ear, and I actually dealt with the pronunciation of Eros over 23 years ago, and I reproduce here the sketch I used then. The lapse of time is vividly illustrated by the fact that I likened the B.B.C.'s pronunciation to a Piccadilly cabby's references to his steed ("This 'ere 'oss"). Horse cabs certainly don't ply in Piccadilly now, and I believe there were only two in 1932.

I notice that I also referred to the seven-metre broadcasting experiments which the B.B.C. was then conducting with a view to supplementing the m.w. service with metre-wave transmissions.

To conclude, the correct pronunciation of Eros should, of course, be Cupid. I defy even the B.B.C. to make a hash of that.

W.W. Diary 1980

AS I sat the other evening entering up the events of the day in my W.W. Diary I fell to wondering how much longer it will continue to be published in its present form. The only grouse I have against the present diary is that, although it undoubtedly suits the needs of many of its buyers, it is not a great deal of use to Mrs. Dale or me as the daily events of our lives are far too numerous to be recorded in the small space provided unless resort is made to the truncated staccato method of self-expression used by Mr. Jingle.

By 1980 all our wireless receivers will be for sight as well as sound and all will be provided with tape decks for recording voice or vision. The W.W. Diary will then consist of a self-contained magazine slipped into a special tape-deck chamber of its own enabling us to record our daily thoughts which can be played back through the loudspeaker at will.

I also make bold to say that all the technical information will be available on a separate tape and will be reproduced, not as the spoken word but as the printed word on the TV screen.



Cuddles can be costly

ALL-ROUND DEPENDABILITY



Avo
**Precision ELECTRICAL
MEASURING INSTRUMENTS**

Dependability is an essential quality in any good electrical testing instrument. Absolute dependability is the outcome of good design, suitability for purpose, and a high standard of accuracy. These indispensable factors are exemplified in all "Avo" Instruments, which are also noteworthy for their compact portability and robust construction.

You can depend on "Avo." When choosing instruments, consult our complete catalogue, a copy of which may be had free on application.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
WINDER HOUSE (' DOUGLAS STREET ') LONDON S.W.1

Telephone: VICTORIA 3404-9



ELAC closed field...



... LOUDSPEAKERS

These loudspeakers have been designed to provide minimum magnetic interference together with high acoustic efficiency. ELAC Elliptical and round loudspeakers are used in most of the leading Television and Radio receivers.

PRICES INCLUDING P.T. FOR LOUDSPEAKERS LESS TRANSFORMER AS FROM NOV. 1st, 1954.

7" x 4" Elliptical	Flux 6,500 Gauss	21/10	6 1/2" PM. 6G	Flux 6,500 Gauss	21/10
3 1/2" PM. 3G	Flux 6,500 Gauss	19/10	8" PM. 8D	Flux 7,500 Gauss	29/1
5" PM. 5G	Flux 6,500 Gauss	20/6	10" PM. 10D	Flux 7,500 Gauss	34/4



ELECTRO ACOUSTIC INDUSTRIES LTD.

Stamford Works, Broad Lane, Tottenham, N.15

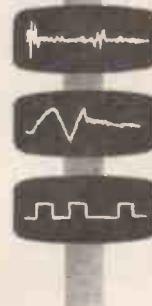
FLAT TUBES

 SAVE SPACE

DG 16-21

FOR 'A' SCAN RADAR
AND INSTRUMENT
APPLICATIONS

The screen of the DG16-21 cathode ray tube is a rectangle measuring $5\frac{1}{2} \times 1\frac{1}{2}$ inches — the logical shape for radar 'A' scan and many instrument applications. A number of these tubes can be stacked vertically to provide multiple displays within a confined space . . . they are the answer to those problems in design where circular tubes make equipments excessively bulky.



easily stacked

for multiple trace
comparison

Deflection : Electrostatic,
symetric or assymetric.
 V_h : 6.3 volts.
 I_h : 0.3 amp.
Base : B14A.

TYPICAL OPERATING CONDITIONS

V_{a3}	V_{a2}	V_{a1}	V_g	Deflection Sensitivity
5,000V	600 to 700V	1,800V	-25 to -70V	S_x
				0.19mm/V

The DG16-21 has a green luminescent medium persistence screen. Versions with other screens are contemplated and your comments are invited.

Mullard

They say
we make a perfect
pair...



...with
excellent
connections

To be exact, this is the 12 pin version of the Multi-Way Plug and Socket range, which covers 4, 8, 12, 20 and 28 ways. The range features unusually low insertion pressures, and embodies considerable experience in meeting humid conditions. Designed to overcome as far as possible the difficulties encountered when using this type of connector in rack mounting applications, they have greater latitude in matching up than any comparable product, and are in use throughout the world in Radio, Television and Telecommunications equipment by such renowned firms as:—Messrs. Marconi's Wireless Telegraph Co. Ltd., The English Electric Co. Ltd. and Messrs. Standard Telephones & Cables Ltd.

A.I.D & A.R.B - APPROVED

POWER CONTROLS
LIMITED

EXNING RD., NEWMARKET

P.C. 2

PHONE: NEW 3181/2/3

Response is not all the story



Dealerships in several of the principal towns are still open and applications are invited.

WRIGHT & WEAIRe LTD

131 SLOANE STREET · LONDON · SW1 Tel: SLOane 2214/5 & 1510

THE FERROGRAPH was the first portable Tape Recorder to be designed and wholly manufactured in Britain. To-day the bewildered buyer may well hesitate when confronted with a choice of so many makes offered. But if he is serious—and not lightly choosing something for his casual enjoyment—he would do well to ponder the following fact.

Frequency response is often popularly quoted in advertisements as 50-12,000 c.p.s. This, of itself, means nothing in evaluating the excellence or otherwise of a recorder. Two other interdependent factors must be regarded, viz.—signal/noise ratio and distortion, if the true worth of the instrument is to be gauged.

Furthermore, the limits in which the response is held must be given or the statement is again valueless. The Ferrograph frequency response is guaranteed to be within ± 3 db up to 10,000 c.p.s. at $7\frac{1}{2}$ i.p.s., although the response does, of course, extend much beyond this.

No exaggerated claims are made for the Ferrograph since its established reputation makes such claims unnecessary. Simple conservatism has always been a feature of Ferrograph publications and advertisements, and experience has shown the discerning user prefers it that way.

MODEL 2A/N

$3\frac{3}{4}$ and $7\frac{1}{2}$ i.p.s.
76 gns.

MODEL 2A/NH

$7\frac{1}{2}$ and 15 i.p.s.
86 gns.

Ferrograph

BRIEF SPECIFICATION

Twin Track (to International standards)
Playing British and American pre-recorded tapes

Playing Time with 1,750 ft. Reel
45 minutes per track at $7\frac{1}{2}$ i.p.s. (others speeds pro rata)

Quick Rewind
in less than 60 seconds

Signal Level Meter
giving positive reading

Frequency Response
 ± 3 db 50/10,000 c.p.s. at $7\frac{1}{2}$ i.p.s.

"Wow" and Flutter
Less than 0.2% at $7\frac{1}{2}$ i.p.s.

Signal to Noise Ratio
Better than 50 db, 200/12,000 c.p.s. Unweighted, including hum, 45 db.

Longterm Speed Stability
Less than 5% variation

Output Power
2½ watts into 15 ohms



NORTHERN RADIO SHOW

*The World's finest record
playing equipment will
be exhibited in full on*

STAND

3

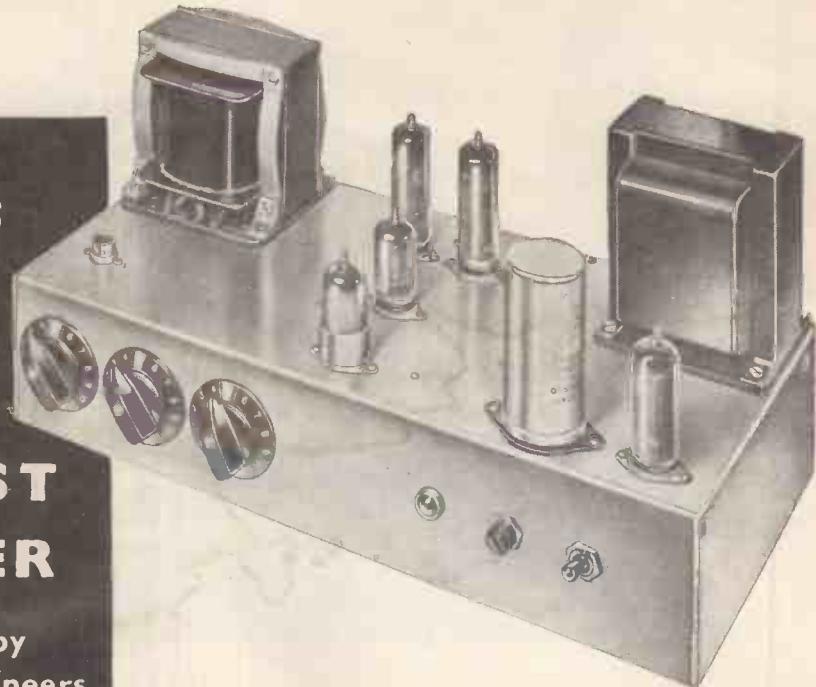
Garrard
record playing units

THE GARRARD ENGINEERING AND MANUFACTURING CO. LTD.



Build this HIGH QUALITY LOW COST AMPLIFIER

- ★ Circuit designed by Mullard research engineers.
- ★ Specified components available from most radio dealers.



Here's an entirely new amplifier circuit which brings high quality sound reproduction within the reach of thousands more enthusiasts. It has been designed by Mullard research engineers with special regard for easy construction

and low cost. Full details of the circuit are included in the 2s. 6d. book which is obtainable from radio dealers, or direct from Mullard Ltd. Valve Sales Department—2s. 10d. post free. Get your copy now.

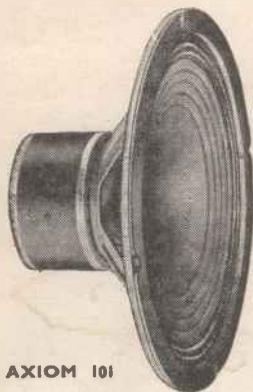


EASY TO BUILD AT LOW COST	GOOD TRANSIENT RESPONSE	LOW OUTPUT RESISTANCE	LOW HUM AND NOISE
NEGLIGIBLE DISTORTION AT ALL OUTPUT LEVELS	DESIGNED ROUND FIVE MULLARD MASTER VALVES EF86 ECC83 2 x EL84 GZ30 or EZ80		UNIFORM FREQUENCY RESPONSE IN AUDIBLE RANGE

Mullard



MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2

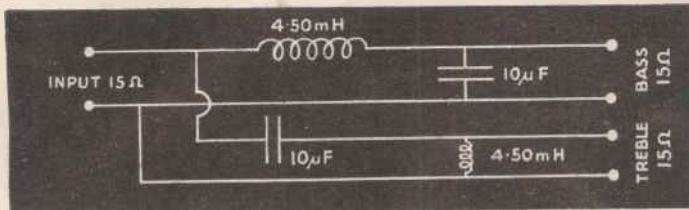


AXIOM 101

An **inexpensive** twin unit

HIGH FIDELITY

CROSSOVER SYSTEM



AXIOM 101, 5 watts.

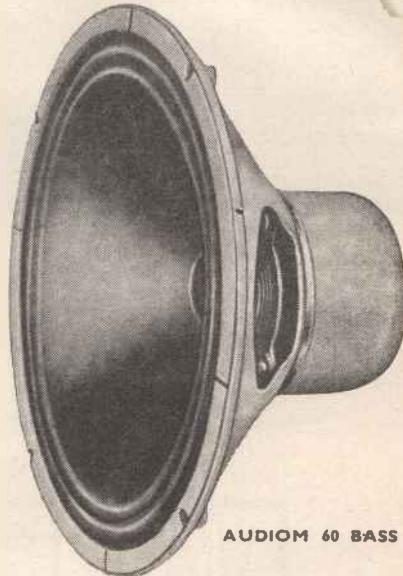
Frequency coverage	40/15,000 c.p.s.
Fundamental Resonance	65 c.p.s.
Flux density	13,500 gauss
Nett Weight	3½ lb.
Price.....	£6/12/1 (inc. Tax)

AUDIOM 60 BASS, 15 watts.

Fundamental Resonance	35, 55 or 75 c.p.s.
Flux density	14,000 gauss
Nett weight	12 lb. 3 oz.
Price.....	£8/12/6 (Tax Free)

4.50 mH CHOKES, Type "1005," price 37/- pair

We shall be pleased to forward full details of this crossover system on request.



AUDIOM 60 BASS

Goodmans

LOUDSPEAKERS WITH A MESSAGE OF PERFECTION

POST THE COUPON for details of the Axiom 101, Audiom 60, and our other High Fidelity Loudspeakers, details of crossover systems, bass reflex chambers, etc.

GOODMANS INDUSTRIES LTD.

AXIOM WORKS · WEMBLEY · MIDDX. · WEMBLEY 120.

U.S.A. AGENTS : ROCKBAR CORPORATION INC.
215, East 37th Street New York 16

To : GOODMANS INDUSTRIES LTD.
AXIOM WORKS WEMBLEY, MIDDX.

I am interested in.

Name

Address:

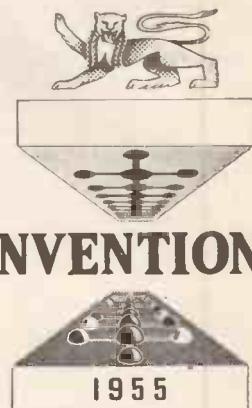
WW/5/55 Please write in block capitals

THE ASTONISHING ACHIEVEMENTS OF PLASTICS IN INDUSTRY

Plastics in electricity, in textiles, transport, commerce and cars, and a host of new fields

Learn what plastics can do for you in your business
by visiting the 3rd British Plastics **Exhibition** and Convention—
at Olympia, London, from June 1-11.

There you will see, in colourful and all-embracing array, everything the British plastics industry has to offer—the latest materials, machines and moulding presses—the whole range of finished articles from curtains to car bodies.



BRITISH PLASTICS EXHIBITION & CONVENTION

This will be the biggest, the most comprehensive, the most valuable Exhibition of British plastics ever staged.

A Convention, held simultaneously, provides for a discussion on technical advances throughout this ever-growing industry. This is an **Exhibition** you **MUST** see. Mail the enquiry form to-day for full information and free season ticket.

*The biggest and most practical
exhibition of British plastics ever presented.
Plan your visit NOW!*

Exhibition staged every second year by the journal "BRITISH PLASTICS".

- Please send me the 1955 Exhibition Brochure, Convention details, free season ticket, etc.

DATE

MAIL THIS TO-DAY!

TO:
EXHIBITION MANAGER
BRITISH PLASTICS
DORSET HOUSE
STAMFORD STREET
LONDON. S.E.1

TRANSFORMER PROBLEMS WE HAVE TO SOLVE

THESE 4 CERTIFICATES are YOUR Safeguard



Joint Services
Approval Certificate No 9471
TRANSFORMERS & CHOKES:
OPEN TYPE WITH C-CORES

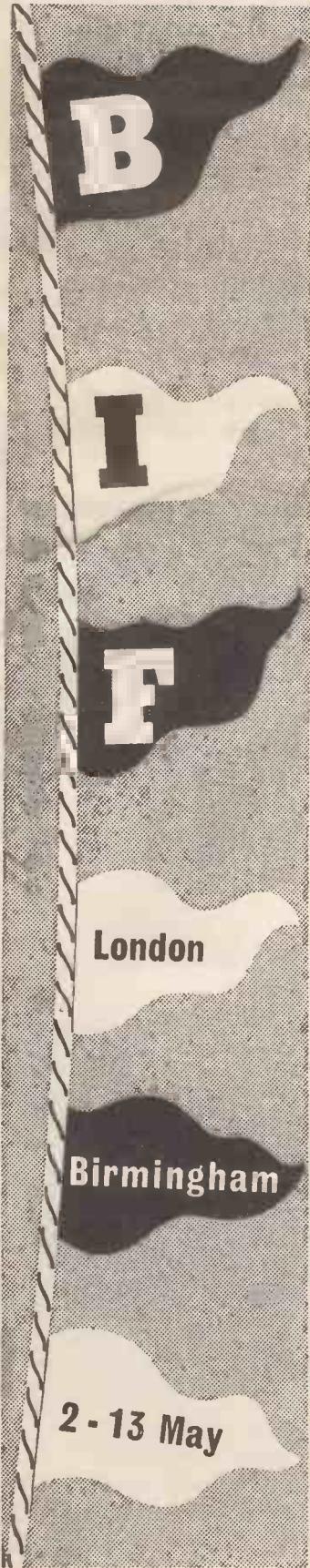
HANWORTH

GRESHAM
TRANSFORMERS LTD

MIDDLESEX

The Electronics Division of Gresham Transformers Ltd., offers a choice of transformers and chokes which are not only made to the highest standards of quality, but have been independently tested and awarded —

CERTIFICATES OF APPROVAL FOR JOINT SERVICE USE



*We've put out
the flags for your*

BIF of 1955

British industry has good reason to put out the flags. Controls have disappeared. The challenge of foreign competition is being vigorously met. There is once again a healthy home trade.

The BIF of 1955 is one aspect of the new confident outlook of British industry.

Go to it . . .

Just once a year British industry goes on display. You have this one chance of doing business in ideal conditions.

In an hour or two you can compare all the work of many different industries. You can see for yourself which new developments are likely to affect your business. You can discuss your needs with manufacturers who want to help you.

These are the opportunities that only the BIF provides.

BRITISH INDUSTRIES FAIR

*Open 9.30 a.m. to 6.0 p.m. daily except Sunday, 8th May.
Public admitted daily after 2 p.m. (all day Saturday).
Olympia only open until 9.0 p.m. Friday, 6th May
and Wednesday, 11th May.*



VALVE VOLTMETERS

Millivoltmeter Type 784



**(Wide-band Amplifier and
Oscilloscope Pre-Amplifier)**

- Frequency range from 30 c/s to 10 Mc/s
- Voltage ranges 0-10, 0-100, 0-1,000 millivolts
- Excellent Stability
- Can be used as an amplifier up to 15 Mc/s
- Quick delivery. Price £75

Valve Voltmeter Type 712

- Frequency range from 30 c/s to 200 Mc/s
- Balanced, unbalanced and differential inputs
- Measures both positive and negative D.C. voltages
- 0-1.5, 0-5, 0-15, 0-50, 0-150 volts A.C. 0-5, 0-50, 0-500 volts D.C.
- Six resistance ranges reading up to 100 megohms
- Balanced circuitry ensures exceptional stability
- Very low probe input capacity
- Immediate delivery. Price £50.



Full details of these or any other Airmec instruments will be forwarded gladly upon request.

AIRMEC
L I M I T E D

HIGH WYCOMBE

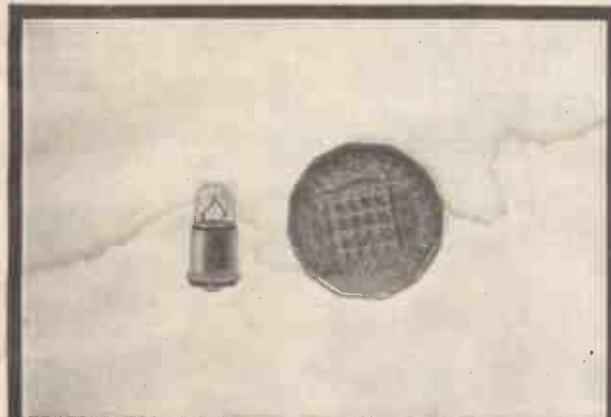
Telephone : High Wycombe 2060

BUCKINGHAMSHIRE

ENGLAND

Cables : Airmec, High Wycombe

THORN CONTRIBUTIONS TO space & weight saving IN EQUIPMENT DESIGN

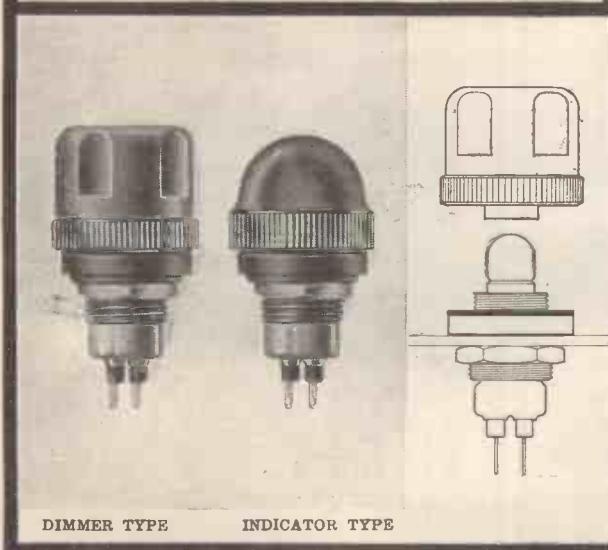


ATLAS MIDGET PANEL BULB Overall length: 14.6 mm. Bulb diameter: 6.3 mm. Rating: 28v., 1 watt, 0.04 amp. Also available in 12v., 6v. R.A.E. and S.R.D.E. type approval. Flanged cap and single centre contact for easy replacement.

The need for saving space and weight in modern electronic and panel control equipment is an ever present problem. The Atlas Midget panel bulb was designed with these difficulties particularly in mind. Tiny in size, simply and robustly constructed, its success is confirmed by type approval from the R.A.E., Farnborough, and S.R.D.E., Christchurch.

The development of the Atlas Midget panel bulb made possible the production of the Thorn Miniature Sealed Panel Lampholder, which has been developed specifically for the Armed Services. It is available with dimmer or indicator cap, and will withstand conditions of constant vibration and shock.

Brief details are given below, but further enquiries are invited.



DIMMER TYPE

INDICATOR TYPE

THORN MINIATURE SEALED PANEL LAMP HOLDERS

Overall length including contacts: 1.43 ins. Dia.: .75". Weights: with Indicator Cap 0.276 ozs., with Dimmer Cap 0.644 ozs. Conform to Radio Components Specs. (Prov.) 201, Humidity Class. H.1. Temperature category 40/100 (-40°C. to +100°C.). Pressure sealed to 20 lbs./square inch.

Completely weatherproof and will withstand conditions of constant vibration and shock. Rotation of the dimmer cap controls the light output from bright to dim by means of an internal metal shutter. Developed originally for A.F.V.'s, Thorn Miniature Sealed Lampholders have many other obvious applications.

The holders are insulated from the panel which can vary from $\frac{5}{8}$ " to $\frac{1}{8}$ " thick. Thicker panels may be counterbored. Single hole mounting facilitates fitting. Rotation is prevented by flats on the body. The lamp can be replaced without breaking seals, by unscrewing cap.

THORN ELECTRICAL INDUSTRIES LTD

Thorn

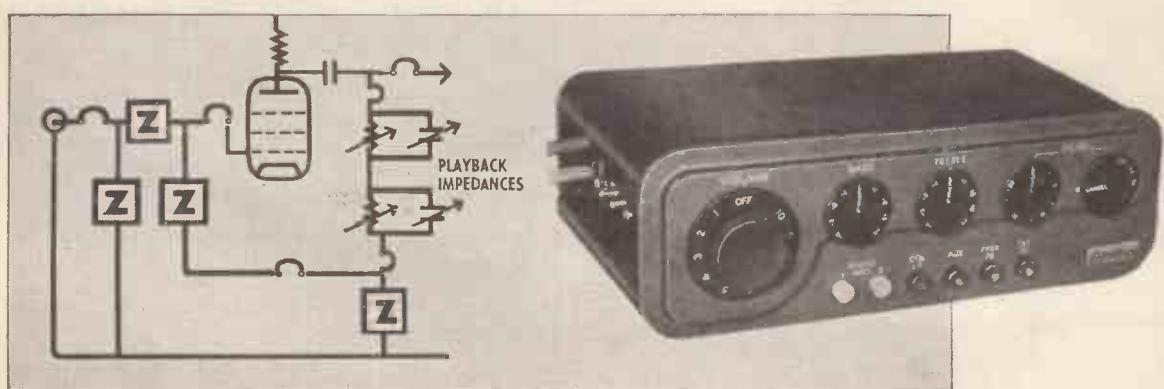
AIRCRAFT COMPONENTS DIVISION, 105-109 JUDD STREET, LONDON, W.C.1

Independently Variable Impedances

When a designer contemplates the input stage from a gramophone pickup he can (a) amplify and then compensate, (b) compensate before amplification, (c) compensate over the first stage by feedback.

No single method is acceptable over a wide range of impedances if the requirement is low distortion and low noise. His choice and the circuit impedances used will depend upon the output level of the pickup, its source impedance, its load impedance and its characteristic.

In the QUAD 11, the first stage circuit connections and their impedances are contained within a detachable plug unit. A range of units covers optimum design requirements for all types of pickups.



ONLY THE QUAD 11 GIVES PERFECT MATCHING AND OPTIMUM INPUT CIRCUIT ARRANGEMENTS. ONE OF THE REASONS WHY THE QUAD 11 GIVES THE CLOSEST APPROACH TO THE ORIGINAL SOUND



The Acoustical
Manufacturing Co. Ltd
Huntingdon, England

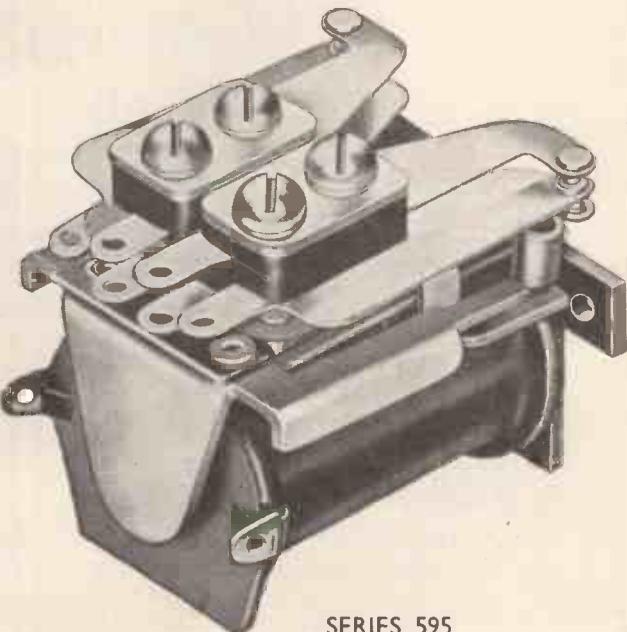
RELAYS



HERMETICALLY SEALED SERIES 595 H

This is a hermetically sealed version of our series 595 Relay, which is already well known to the aircraft industry.

The armature design reduces the effects of shock, vibration and acceleration; a spring type armature hinge eliminates backlash, friction and risk of displacement.



COIL: In all standard voltages up to 110 V. D.C. Working range between plus 10% and minus 20% of rating.

CONTACT COMBINATIONS: up to 2 pole changeover.

BASE: International octal.

WEIGHT: 3 $\frac{1}{4}$ ozs.

DIMENSIONS :

Diameter—1 $\frac{11}{16}$ " overall.

Height — 2 $\frac{5}{8}$ " overall.



MAGNETIC DEVICES LTD
NEWMARKET

MD4A



Operating in the decimetre wave region, this Signal Generator has been designed to meet the increasing requirements of the development laboratory at Ultra High Frequencies. Besides a wide frequency range and reliable attenuator system, provision is made in the L.1 for both internal and external sinewave and pulse modulation. Full technical details are available on request.

Write for Folder W.25.

Advance

U.H.F. SIGNAL GENERATOR

Nett price in U.K. £375

ADVANCE COMPONENTS LTD., MARLOWE ROAD, WALTHAMSTOW, LONDON, E.17

Telephone : LARKWOOD 4366/7/8

Tested Tried and Proven

Our PERSONAL CREDIT PLAN is used by all discerning and careful buyers—it provides easy repayment terms coupled with very low deposits and low service charges. We are authorised Distributors for most high grade Electronic Equipments, and we detail below a selection of merchandise available. If your particular requirement is not mentioned, please let us know and we will quote details by return. Send your deposit with your order, allowing sufficient for carriage and packing extra, in order to secure your needs. Please specify over what period, up to a maximum of 18 months, you wish to repay, and the necessary forms will be sent to you immediately.

AMPLIFIERS AND TONE CONTROLS

	Cash Price	Deposit
Leak TL/12 "Point One"	£28 7 0	£4 4 9
" Varislope Mk. I	£12 12 0	£1 17 6
" Varislope Mk. II	£16 16 0	£2 10 3
" TL/10 (complete)	£28 7 0	£4 4 9
Acoustical QUAD Mk.-II (complete)	£24 0 0	£6 6 0
Rogers Junior and Control Unit	£25 0 0	£3 15 0

CATHODE RAY TUBES

9in. Mullard, Mazda	£12 10 0	£1 17 6
12in. G.E.C., etc.	£16 13 8	£2 10 0
16in.	£22 4 10	£3 6 9
17in.	£23 12 8	£3 10 11
17in. Aluminised	£24 13 8	£3 14 0
12in.	£17 14 6	£2 13 3
10in. E.M.I."	£14 18 11	£2 5 0
M.W. 6-2 Projection Tube	£8 6 10	£1 5 0

CONVERTERS DC/AC

Valradio 230/200A	£15 8 0	£2 6 2
" 230/110A	£11 16 6	£1 15 5

GRAMOPHONE UNITS

Collaro 2000 Transcription	£13 9 6	£2 0 6
" 2010 Transcription (complete)	£18 5 3	£2 14 9
" RC54 3-speed with Pickup	£13 4 2	£1 19 8
" AC8/554 3-speed and heads	£18 18 4	£1 6 9
Connoisseur Variable 3-speed	£25 15 5	£3 17 5
B.S.R. Monarch Mixer Auto	£13 10 0	£2 0 6

LOUDSPEAKERS

Wharfedale W15CS	£17 10 0	£2 12 6
" Super 12CS	£17 10 0	£2 12 6
" W15	£15 10 0	£2 6 6
" W12CS	£19 15 0	£1 9 3
" W10CSB	£12 6 6	£1 16 11
" Golden 10	£7 13 3	£1 3 0
" Bronze 10	£4 12 8	£1 11
" Super 8 CSAL	£6 13 3	£1 0 0
" Bronze 8	£3 3 11	£1 9 6
Plessey 15in.	£27 0 0	£4 1 0
G.E.C. Metal Cone	£8 16 7	£1 6 6

MICROPHONES

Ronette 088 Ball Filtercell	£4 10 0	13 6
" HM7 Hand	£4 7 8	13 2
" G210 Streamlined	£4 19 6	15 0
" R474	£15 15 0	£2 7 3
" R572	£9 19 6	£1 10 0
" S742	£9 5 0	£1 8 6
" RFC	£8 15 0	£1 6 3
" Burgoyne	£2 15 0	£1 8 3
" Coronation	£2 12 0	£1 7 9
Acos Mic 18-2	£12 12 0	£1 17 9
Reslo Ribbon	£9 0 0	£1 7 0

RADIO CHASSIS AND TUNERS

Burgoyne RG1 8-valve 8-watt	£23 2 0	£3 9 5
Leak VS Tuner	£35 0 0	£5 5 0
Lowther AM/FM	£29 6 4	£4 8 0
Chapman S5/FM combined tuner	£22 10 0	£4 17 6
Rogers Junior VS	£24 16 1	£3 14 6
Chapman FM81 Tuner	£21 0 0	£3 3 0

TEST EQUIPMENT

	Cash Price	Deposit
Advance Signal Generator P1	£19 19 0	£3 0 0
Advance Signal Generator J1	£35 12 0	£5 6 9
Advance Signal Generator H1	£25 0 0	£3 15 0
AVO Model 8 Meter	£23 10 0	£3 10 6
" Model 7 Meter	£19 10 0	£2 18 8
" Electronic Test Meter	£40 0 0	£6 0 0
" Universal Bridge	£34 0 0	£5 2 0
" Signal Generator	£30 0 0	£4 10 0
" Universal Avominator	£10 10 0	£1 11 6
" D.C. Avominator	£5 5 0	15 9
" Heavy Duty Meter	£15 0 0	£2 5 0
" Valve Characteristic Meter	£60 0 0	£9 0 0
" Valve Tester type 160	£92 0 0	£13 16 0
" Leather Cases for 7, 8, 40 and Heavy Duty Meter	£3 0 0	9 0
Taylor 45B Valve Tester	£25 10 0	£3 16 6
" 66A Signal Generator	£22 10 0	£3 7 6
" 77A Multirange Meter	£15 0 0	£2 5 0
" 88A Multirange Meter	£22 0 0	£3 6 0
92A T.V. Oscillator 0-250 Mc/s	£27 0 0	£4 1 0
110C Capacity-Resistance Bridge	£14 10 0	£2 3 8
120A Universal Meter	£9 10 0	£1 8 8
Taylor 130A Insulation Tester	£15 0 0	£2 5 0
171A Electronic Valve Voltmeter	£26 10 0	£3 19 6
240A Pattern Generator	£14 0 0	£2 2 0
260A T.V. Wobbulator	£36 15 0	£5 10 3
Cossor 1039M Portable Oscillograph	£29 10 0	£4 8 6
" Telecheck Wobbulator	£27 0 0	£4 1 0
Pullin Universal Series 100 Meter	£11 11 0	£1 14 8

RECORD PLAYERS

E.A.R. P750	£27 6 0	£4 1 11
" A750	£31 10 0	£4 14 6
" Bantam Auto	£22 1 0	£3 6 0
" Bantam Non-Auto	£16 16 0	£2 10 5
Regentone 3-speed-amplifier HG2	£15 15 0	£2 7 3
" 3-speed mixer auto AHG2	£21 0 0	£3 3 0

PICK-UPS

Ronette Miniweight with 2 heads	£3 9 6	10 6
" Minilight super hifi	£3 16 3	12 0
Acos HGP 39-1/GP20 Arm	£3 8 4	10 6
Connoisseur with diamond stylus	£10 1 9	£1 10 3
Connoisseur extra heads	£7 8 11	£1 2 3
Leak arm with diamond stylus	£11 9 6	£1 14 6
" extra heads	£7 15 3	£1 3 3

TAPE RECORDERS AND DECKS

Editor Super	£57 15 0	£8 13 3
" Standard	£47 5 0	£7 1 9
Vortexion 2A	£84 0 0	£12 12 0
" 2B	£99 0 0	£14 17 0
Ferrograph 2A	£79 16 0	£11 19 5
Grundig TK9	£68 5 0	£10 4 9
" TK12	£73 10 0	£11 0 6
" TK819	£99 15 0	£15 0 0
Playtime with microphone and tape	£31 4 6	£4 13 9
Lane Mk. VI Deck	£18 10 0	£2 15 8
Burgoyne 2-speed Deck	£13 19 6	£2 2 0
Truvox Deck Mk. IIIU	£23 2 0	£3 9 5
Wearite 2A Deck	£35 0 0	£5 5 0
" 2B Deck	£40 0 0	£6 0 0

E. & G. MAIL ORDER SUPPLY CO.

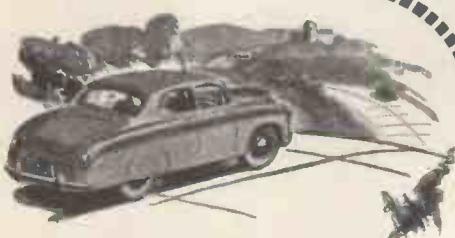
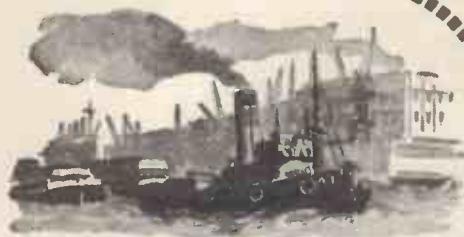
The Radio Centre

33 Tottenham Court Road • London • W.I • Tel: MUS 6667





REPORTER



**LOW COST—SMALL SIZE
LOW BATTERY DRAIN
MOBILE RADIO TELEPHONE**

On airfields, in dockyards, in civil engineering and industry, operations reach their peak of speed and efficiency with the Pye "Reporter". All mobile personnel over a wide area can be contacted instantly through this compact and economical equipment which is quickly fitted to any vehicle. Control is simpler and swifter because wasted time and misunderstandings are eliminated. The Reporter enables four vehicles to do the work of five. Pye Telecommunications are the largest suppliers of commercial 2-way radio in Europe and supply over 75% of British requirements.



Telecommunications

CAMBRIDGE

ENGLAND



Pye (New Zealand) Ltd.
Auckland C.I., New Zealand

Pye Radio & Television (Pty.) Ltd.
Johannesburg
South Africa

PYE LIMITED

Pye Canada Ltd.
Ajax, Canada

Pye Limited
Mexico City

CAMBRIDGE

Pye-Electronic Pty., Ltd.
Melbourne, Australia

Pye Limited
Tucuman 829
Buenos Aires

ENGLAND

Pye (Ireland), Ltd.
Dublin, Eire

Pye Corporation of America
5th Avenue Building
200, 5th Avenue, New York

Whatever the recorder Choose—



— A NEW
LOW COST HIGH QUALITY

MAGNETIC RECORDING PAPER BASED TAPE

- MANUFACTURED BY ONE OF THE COUNTRY'S LEADING POWDER METALLURGICAL LABORATORIES
- MIRROR SMOOTH FINISH DESIGNED TO REDUCE FRICTION AND WEAR ON HEADS
- EMBODYING QUALITIES FOUND IN THE MORE EXPENSIVE TAPES
- 7" DIA. IMPROVED UNIVERSAL SPOOL CONTAINING 1,200 FEET
- LET THIS NEW TAPE "SPEAK FOR ITSELF"

RETAIL PRICE £1 WITH FULL TRADE DISCOUNT

Enquiries to:—

SALFORD ELECTRICAL INSTRUMENTS LTD.

PEEL WORKS • SILK STREET • SALFORD 3 • LANCS
LONDON OFFICE: MAGNET HOUSE • KINGSWAY • WC2 • Tel: Temple Bar 4669

A Subsidiary of THE GENERAL ELECTRIC COMPANY LTD OF ENGLAND

SenTerCel H.T. rectifiers

from 125V 30mA
to 250V 300mA

Specially designed for use in domestic Radio & Television receivers, these miniature rectifier stacks have an established position with manufacturers to whom reliability, small dimensions and low costs are important.

FEATURES

- Instant starting — no warming-up period
- Unlimited instantaneous overload
- No limit to size of reservoir capacitor
- Simple mounting—no valve holder
- Withstand overloads such as charging current of de-formed electrolytic capacitors
- Low heat dissipation
- Practically indestructible in service
- Simple wiring—two connectors only
- Small size . . . low weight
- LOW COST

TYPE	RM0	RM1	RM2	RM3	RM4	*RM5
Maximum ambient temperature	35°C	35°C	35°C	35°C	40°C	55°C
Maximum output current (mean)	30mA	35mA	60mA	90mA	120mA	150mA
Maximum peak inverse voltage	125V	150V	300V	350V	350V	350V
Max. instantaneous peak current	... Weight .....	... 0.82 oz.	... 1 oz.	... 1.4 oz.	... 2 oz.	... 4.75 oz.
* For use in voltage doubler circuits the peak inverse and maximum input voltages are halved. Current output being as for half wave operation.						

SELENIUM
SenTerCel
RECTIFIERS

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2
RECTIFIER DIVISION: Edinburgh Way, Harlow, Essex.

Telephone: Harlow 26811

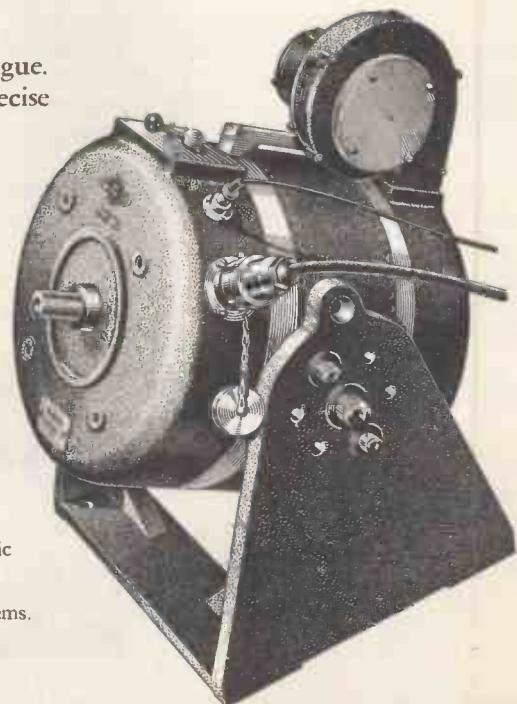


The part played by **GOODMANS** in VIBRATION INVESTIGATION

It is acknowledged that vibration causes metal fatigue. Authoritative opinion is divided as regards the precise investigating approach to fatigue failure—whether the frequency of reversals should be high or low, and the amplitude large or small.

To simulate a particular vibration mode under controlled conditions is to go a long way to discover the critical failure point. And Goodmans Vibration Generators do just that. For certain types of specimen, the standard range of models can be applied to obtain the S.N. Curve. Should this range not offer a solution to your particular problem or method of investigation, a modified arrangement might prove the answer.

Our wide experience in the design and production of electrodynamic generators is at the service of Industry, and we welcome enquiries for specialised applications, with particular emphasis on fatigue testing problems.



GOODMANS

VIBRATION
GENERATORS

The present Goodmans range of Vibrators extends from a model developing ± 300 lb to a midget with a force output of approximately ± 2 lb.

Full details on request to "Vibrator Dept. W"

GOODMANS INDUSTRIES LTD., AXIOM WORKS, WEMBLEY, MIDDX.

Telephone : WEMbley 1200 (8 lines)



NEW 5-MEGACYCLE OSCILLOSCOPE joins the Tektronix Type 530 Series

TYPE 532 the most *Versatile oscilloscope* in its class!

This new oscilloscope offers the advantages of all six Type 53 Plug-In Units now available — plus those yet to come. Only the wide-band units are limited by its dc-to-5 mc response. Wide sweep range (0.2 μ sec/cm to 12 sec/cm) and 4-kv accelerating potential complement the signal-handling versatility of the Type 532 . . . resulting in performance characteristics desirable for a great many laboratory applications.

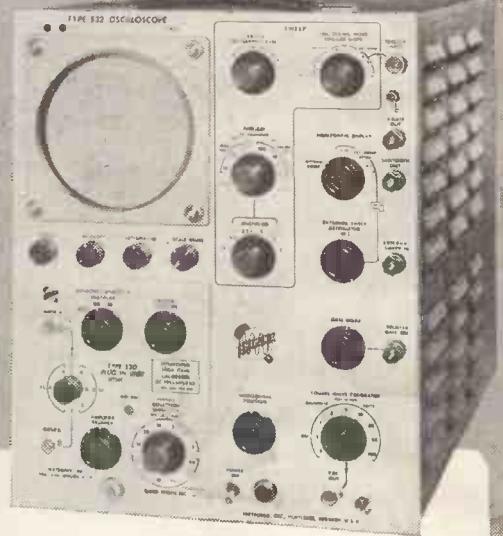
Extra dependability is designed into the Type 532, mainly through circuit simplicity and conservative tube loading. Yet it retains all the precision and stability you've come to expect in Tektronix oscilloscopes. It is an instrument that will give lasting satisfaction in all applications within its capabilities.

Vertical Characteristics of the Type 532 with these Plug-in Units

TYPE 53A—DC to 5 mc, 0.07- μ sec risetime. Sensitivity 0.05 v/cm to 50 v/cm, ac or dc, continuously variable, with 9 calibrated steps from 0.05 v/cm to 20 v/cm, \$85.00

TYPE 53B—Same as Type 53A with additional calibrated ac-sensitivity to 5 mv/cm \$125.00

TYPE 53C—Dual-Trace Unit. Two identical amplifier channels, dc to 5 mc, 0.05 v/cm to 50 v/cm. Electronic switching triggered by oscilloscope sweep...or free running at about 100 kc \$275.00



BASIC CHARACTERISTICS

Wide Sweep Range
21 calibrated sweeps from 1 μ sec/cm to 5 sec/cm, accurate within 3%. 5x magnifier, accurate and valid on all sweep speeds, extends calibrated range to 0.2 μ sec/cm. Full range — 0.2 μ sec/cm to 12 sec/cm, continuously variable.

DC-Coupled Output Amplifier

Less than 3 db down at 5 mc. Adjusted for optimum transient response with wide-band units plugged in.

Advanced Cathode-Ray Tube

Tektronix 5" flat-faced precision crt with 4-kv accelerating potential provides 8 centi-

meters of linear vertical deflection.

Sensitive Horizontal Amplifier

0.2 v/cm to 20 v/cm sensitivity.

Versatile Triggering

Internal or external, with amplitude level selection or automatic triggering.

Accurate Amplitude Calibrator

Square wave, 0.2 mv to 100 v in 18 steps, accurate within 3%.

DC-Coupled Unblanking

Vertical Beam Position Indicators

Electronic Voltage Regulation

TYPE 532 — \$825.00 plus price of desired plug-in units.
Prices f.o.b. Portland (Beaverton), Oregon

TYPE 53D — Differential-input high-gain unit, DC to 350 kc at 1 mv/cm; passband increasing to 2 mc at 50 mv/cm. Full range — 1 mv/cm to 125 v/cm \$145.00

TYPE 53E — Low-level differential-input unit. 50 microvolt/cm to 10 millivolt/cm, calibrated. Passband 0.06 cycles to 60 kc. Maximum combined noise and hum, 7 μ v rms, with input grids grounded \$165.00

TYPE 53G — Differential wide-band unit. DC to 5 mc, 0.07 μ sec risetime. 0.05 v/cm to 20 v/cm calibrated, with separate attenuators for both inputs. Better than 100-to-1 common-mode rejection for the entire passband \$175.00

REPRESENTED IN LONDON BY
LIVINGSTON LABORATORIES LTD.
- ARCHWAY 6251

Tektronix, Inc.

P. O. BOX 831 D, PORTLAND 7, OREGON, U. S. A.
CYPRESS 2-2611 • CABLE: TEKTRONIX



Simon is Sound recording

When you listen to a Simon Portable you're hearing Sound Recording at its lively best. Ask your dealer for a demonstration. Try its simple controls. Hear its faultless reproduction of speech and music—remember that for P.A. or record reproduction you can use the high quality amplifier independently of the recorder

THE ONLY PORTABLE RECORDER

with a 10-watt High Fidelity push-pull amplifier, with less than 1% distortion at full output and incorporating Bass and Treble tone controls.

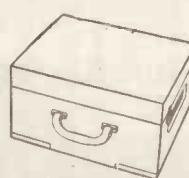
THE ONLY PORTABLE RECORDER

which becomes at the turn of a switch a

Tape Recorder
Record Player
10-watt P.A. Amplifier

The SP/1 is precision built to top standards. All electronic components are of the highest quality. All mechanical parts are plated.

- ★ Fast rewind and wind-on.
- ★ Monomaster Finger-tip control.
- ★ Servo self-energising brakes provide very rapid stop from full speed.
- ★ 2-stage capstan.
- ★ Three motor drive.
- ★ 10 watts push-pull output.
- ★ Simple loading.



PORTABLE TAPE RECORDER MODEL SP/1 79 GNS.

DELIVERY EX-STOCK
H.P. FACILITIES WITH PLEASURE

Ask for illustrated literature on Information Sheet TI/6.

SIMON SOUND SERVICE LTD. (Dept. W.)

48-50 GEORGE ST., LONDON W.I.
Phone: WELbeck 2371 (5 lines)

RELAYS

AMERICAN

RELAYS

FOR

OFFSHORE

CONTRACTS

We are already tooled to manufacture many types of these relays, and through our association with the Guardian Electric Manufacturing Company of Chicago, we have access to full information on other types.

ENQUIRIES ARE INVITED.

TELEPHONE: NEWMARKET 3181-2-3

TELEGRAMS: MAGNETIC, NEWMARKET



MAGNETIC DEVICES LTD
EXNING ROAD, NEWMARKET

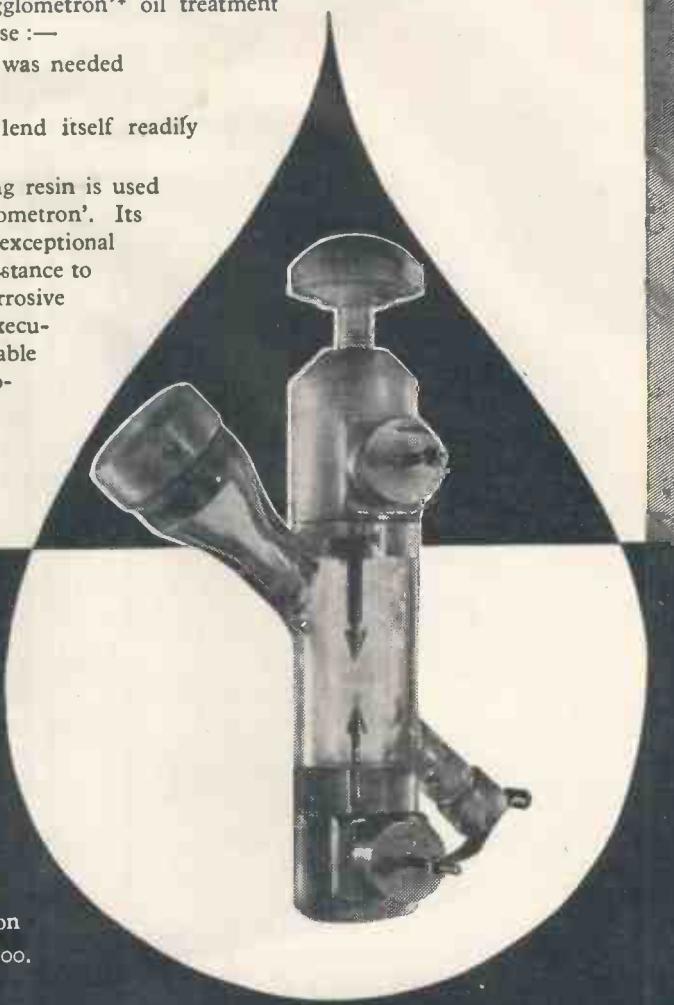
MD.7.

Cast in ARALDITE

This component is a part of the 'Agglometron'* oil treatment chamber. It was cast in 'Araldite' because :—

- * An outstanding electrical insulator was needed
- * It had also to be oil-resistant
- * It was important that it should lend itself readily to casting and machining.

'Araldite' as a casting and as a bonding resin is used in many components of the 'Agglometron'. Its electrical and mechanical properties, its exceptional adhesion to metals and ceramics, its resistance to high temperatures, humidity and corrosive agents suggest other uses in which the execution of new designs can be made practicable and the production of electrical components greatly simplified. May we send you full descriptive literature ?



An electrical device developed by Mr. O. E. Nekolla of Messrs. Menrow Ltd. (a subsidiary company of J. & E. Arnfield Ltd.) for agglomerating impurity particles in circulating oil to facilitate filtering. The name 'Agglometron' is a registered trade mark for the high voltage treatment chamber included in the filtration plant and is covered by B.P. 698,900.

THESE ARE THE NEW EPOXIES!

'Araldite' (regd.) epoxy resins are obtainable in the following forms :—

- Hot and cold setting adhesives for metals and most other materials in common use.
- Casting Resins for the electrical, mechanical and chemical engineering industries.
- Surface Coating Resins for the paint industry and for the protection of metal surfaces.

'Araldite'

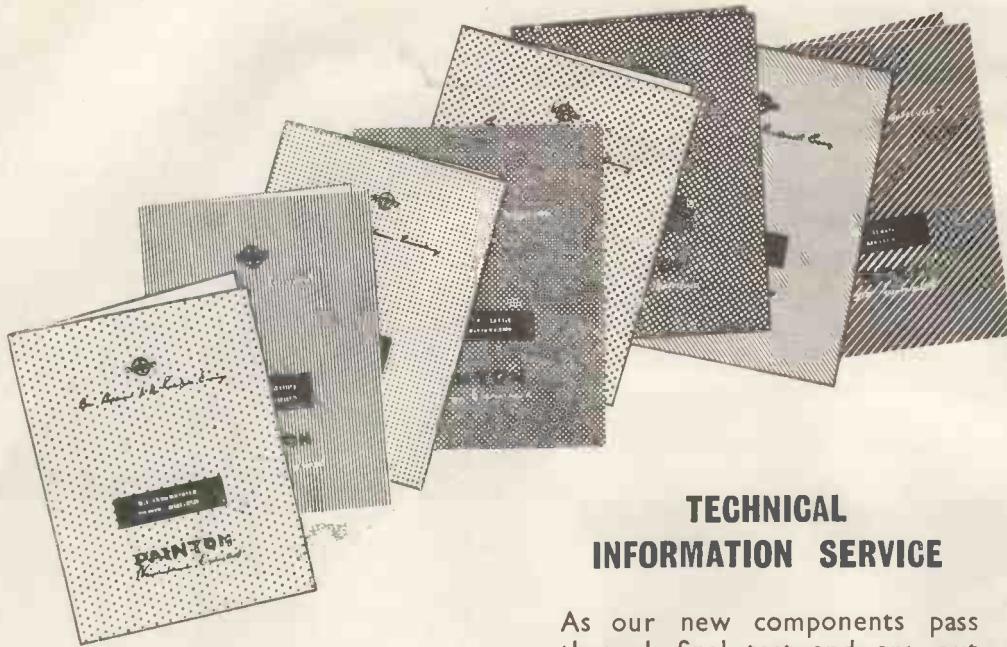
Araldite is a Registered Trade Name

epoxy casting resins

Aero Research Limited, DUXFORD, CAMBRIDGE. Telephone: Sawston 187. A Ciba Company



By Appointment to the Professional Engineer



Leaflets supplementary
to main catalogue available

HIGH STABILITY CARBON RESISTORS
INSTRUMENT 'TYPE M'
PAINTON WINKLER SWITCH
PUSH BUTTON SWITCHES
EDGEWISE MINIATURE FADER
TOGGLE SWITCHES 6 AMP. RANGE
'METLOHM' METAL FILM RESISTORS
CO-AXIAL/MULTI CONTACT
PLUG AND SOCKET
CONTACT MAINTENANCE
THE 'BEMBRIDGE SERIES' KNOBS

TECHNICAL INFORMATION SERVICE

As our new components pass through final test and are put into production, supplementary technical leaflets are printed and mailed to Painton customers, so that they may be fully informed about all Painton Components. If you are not already receiving this service will you kindly write to us, giving particulars of your Department and Company, and the person or persons to whom you would like this mailing directed. The literature you request will be despatched by return.

PAINTON
Northampton England

MANUFACTURERS OF : ATTENUATORS AND FADERS · STUD SWITCHES · TOGGLE SWITCHES
PUSH BUTTON SWITCHES · FIXED AND ADJUSTABLE WIREWOUND RESISTORS · HIGH
STABILITY CARBON RESISTORS · "METLOHM" STABILITY RESISTORS · WIREWOUND
POTENTIOMETERS · MIDGET R.F. CHOKES · KNOBS, DIALS & POINTERS · TERMINALS
PLUGS AND SOCKETS



THYRATRONS for Industrial Purposes

XENON-FILLED TRIODES

These valves are suitable for a wide variety of control applications. The inert gas filling ensures stable operation over a wide range of ambient temperatures.

HYDROGEN-FILLED PULSE MODULATOR TRIODES

Designed to discharge pulse-forming networks in high power, high voltage pulse generators. Short deionization time and low time jitter provide for precise triggering at high repetition frequencies.

Technical data sheets are available on request.

Type	Filling	Max. Dimensions		Filament or Heater		Max. Peak-Inverse Voltage (Volts)	Max. Peak-Forward Voltage (Volts)	Max. Peak Current (Amps)	Max. Mean Current (Amps)	Approx. Tube Drop (Volts)	Peak Power Level (a)	American Equiv.	C.V. Number
		Length (MM)	Dia. (MM)	Volts	Amps (Approx.)								
AFX.212	Xe	54	19	6.3	0.25	350	350	0.11	0.025	11	—	6D4	1949
AFX.203	Xe	176	57	2.5	4.0	300	280	1.7	0.40	11	—	C1A	2868
FX.215	H ₂	286	97	2.5	27.5	16,000	16,000	200	0.20	100(b)	2.0 x 10 ⁹	—	2203
FX.219	H ₂	222	65	6.3	10.6	16,000	16,000	325	0.20	100(b)	3.2 x 10 ⁹	5C22	2520
FX.225	H ₂	175	65	6.3	6.1	8,000	8,000	90	0.10	100(b)	2.0 x 10 ⁹	4C35	1787
FX.227	H ₂	132	40	6.3	2.25	3,000	3,000	35	0.045	100(b)	0.3 x 10 ⁹	3C45	372

Xe — Xenon

H₂ — Hydrogen

(a) — Product of Peak forward Voltage, Peak Current and pulse repetition frequency.

(b) — Under conditions of pulse operation.

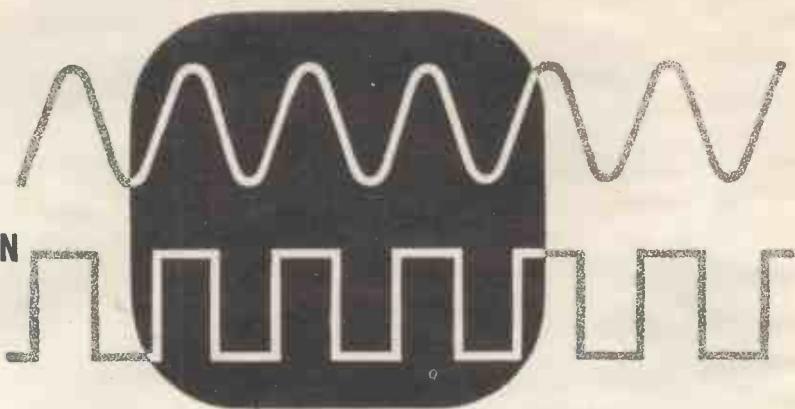
ENGLISH ELECTRIC

ENGLISH ELECTRIC VALVE CO. LTD.

Waterhouse Lane, Chelmsford
Telephone : Chelmsford 3491

NO INTERACTION

*Identical Amplifiers
20 mV/cm at 4 Mc/s*



dual-trace oscilloscope

BY MULLARD

After considerable research and development Mullard introduce the L.101 oscilloscope—a well-engineered and reliable instrument with dual trace facilities, and accurate time and voltage calibration.

Two separate amplifiers and a high speed electronic switch operating during the fly-back cycle are used to display two input signals on a conventional cathode ray tube. This arrangement provides a complete uninterrupted sweep on each channel alternately, and ensures freedom from interaction between the two amplifier channels.

The two amplifiers are identical and have a constant bandwidth of 4 Mc/s irrespective of sensitivity. They are aligned for good transient response and have a rise time of 0.1 μ sec. Each amplifier has a maximum sensitivity of 20 mV peak-to-peak/centimetre.

A Miller time base is employed, which may be free-running, synchronised or triggered. Its velocity is continuously variable between 0.1 μ sec/cm and 10 msec/cm. Both time and voltage may be measured by the nul method and a well-regulated power supply preserves calibration accuracy.

Further information on the operation and performance of this new oscilloscope and other Mullard instruments is readily obtainable from the address below.



Mullard



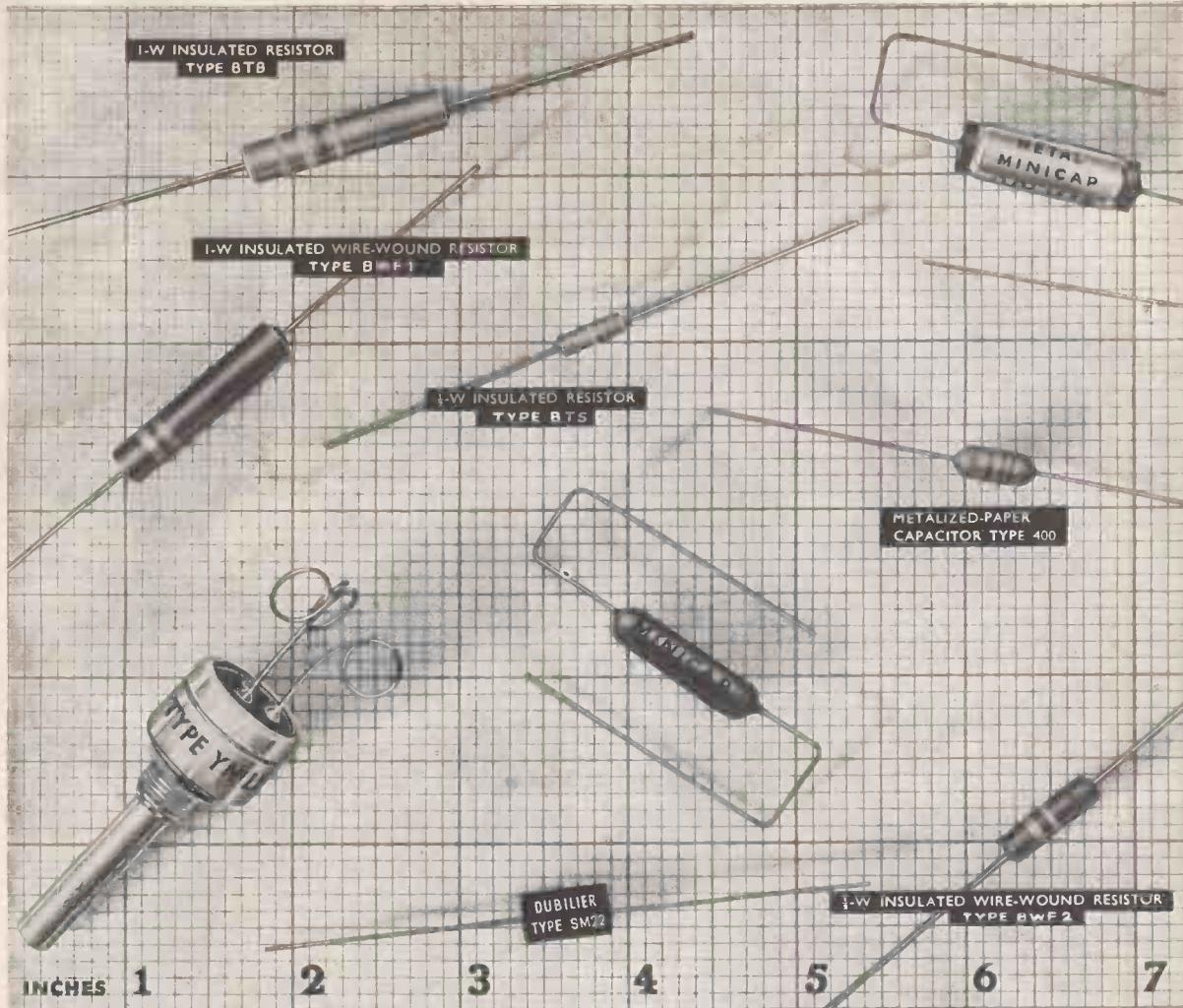
SPECIALISED ELECTRONIC EQUIPMENT

MULLARD LIMITED · EQUIPMENT DIVISION

CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON · W.C.2

(M1456)

MINIATURIZATION



Tiny valves and transistors demand tiny components to accompany them. Whether you are working on television for Bands III and IV, Band II Radio, computers, industrial electronics or test gear, these components will undoubtedly interest you. Deserving of special mention are the tiny BTS type ½-W. resistor measuring only $\frac{3}{16}$ " \times $\frac{1}{8}$ " and the type 400 metallised paper capacitor in its melt-proof cover. For those of you concerned with tropicalization, BTS, BTB and BWF2 resistors, YN-potentiometers and metal 'minicap' capacitors will be of special interest. To those of you engaged on Government contracts we should like to mention that the metal 'minicap' capacitor and the type BTS and BTB resistors are type-approved. Send for samples and catalogues by dropping us a line on your company's letter-heading.

DUBILIER

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3
Telephone: ACORN 2241. Telegrams: Hivoltcon, Wesphone, London. Marconi Int. Code.

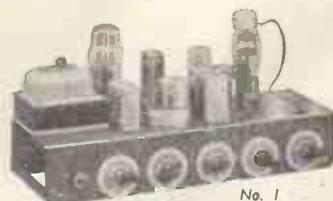
REAL HIGH FIDELITY at modest cost . . .

*Manufacturer-to-Consumer policy saves you at least one-third cost!

We are now specialising in the supply of units for making up high-fidelity Radio and Record-reproducing Equipments for use in the Home, Small Halls, Schools and Gramophone Societies and single items for replacing in existing equipments and radiograms.

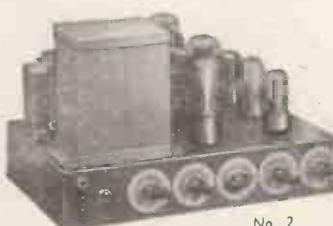
Our Chief Engineer, who is operating a Technical

Guidance Service, is available daily, including Saturdays, from 10 a.m. to 6 p.m., or will deal with enquiries by return of post. Our new illustrated Catalogue and Supplement will be a great boon to those desiring high quality equipment for modest expenditure. Send two 2½d. stamps for your copy now. It may well save you pounds.



No. 1

No. 1 "SYMPHONY" AMPLIFIER is a 3-channel 5-watt Gram/Radio Amplifier with astonishingly flexible tone control. You can tilt the treble, the bass, or—and here is the unique feature—the middle frequencies to suit your own ear characteristics and the record or radio programme being heard. It is thus possible to arrange the frequency-response of the amplifier to a curve equal and opposite to the resultant curve of the other items in the chain so that what finally registers in the brain is as per original. This flexibility of control is far more important than mere nominal linear response of the amplifier, as the pick-up, speaker, etc., are not linear. Independent Scratch-Cut is also fitted and special negative-feedback circuit employed. The Amplifier can accommodate a wide variety of records from old 78's to new L.P.'s. Input is for all types of pick-up of 0.1 v. output or more and there is full provision (and power) for Radio Tuner. It is available to match 2/3 or 15 ohms speakers. Price: 10 gns. (carriage 5/-). Fitted in portable Steel Cabinet, 35/- extra.



No. 2

No. 2 "SYMPHONY" AMPLIFIER as No. 1 but with 10-watt Push-pull triode output and triodes throughout. Woden mains and output transformers and choke. Full provision and power for Tuner. Output tapped 3, 7.5 and 15 ohms. Competes with the most expensive amplifiers on the market yet costs only 15 gns. (carriage 5/-). Fitted in portable Steel Cabinet 2 gns. extra.



"SYMPHONY" AMPLIFIERS with REMOTE CONTROL. Both the above model Amplifiers are available with all controls on a separate Control Panel with up to 4 feet flexible cable which simply plugs into the amplifier. Enables the Amplifier proper to be sat in the bottom of a cabinet whilst the controls are mounted conveniently higher up. Extra cost 2 gns.

"STUDIO SYMPHONY" AMPLIFIERS, Models 1 and 2, new models specially designed to get the maximum out of the revolutionary new Collaro Studio pick-ups and heads type "P" or Transcription. Specification as per our Standard Symphony models but with high-gain, low-noise, built-in Pre-amplifier stage with separate switched correctors for Std. and L.P. Third position on switch provides input matching for Acos and similar output pick-ups. These remarkable new models thus provide all the facilities and matching of our Standard Symphony Amplifiers PLUS the specialised Collaro matchings. Send for copy of "The Gramophone" review of these instruments. Price: No. 1, 12 gns.; No. 2, 17 gns. Carriage 5/-.

CURRENT GARRARD PRODUCTS AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK AT PRESENT.

MODEL TA 3-speed unit, with plug-in turnover head Type G.C.2, £10/16/-, or with Acos HGP 33 or 37 heads, £10/14/-, or with two separate high fidelity Acos HGP35 heads, £12/17/-. Unit less heads, £8/11/-, post 2/6. Heads, 42/3 each, post 1/-.

MODEL TB as above, but with long pickup arm. Less heads, £8/11/-, post 2/6.

Heads to fit this unit: Decca XMS, 54/6, Decca Crystal, 33/-, Garrard Standard Magnetic, 28/-, miniature magnetic low impedance, 28/-, miniature magnetic high impedance, 38/-. Post on heads 1/-. Unit can be supplied with any combination of above heads and is carefully adjusted for stylus pressure on despatch.

MODEL RC80M, less heads, £15/5/-, with new turnover head, £17/9/6, with two separate Acos HGP35 heads £19/9/-, carriage 5/-.

COLLARO PICKUPS AND HEADS. Studio Pickup Arm, 13/10. Studio Pickup head type "O" or "P," £3/0/9. Pickup complete £3/14/7. Studio Transcription Pickup Arm with Studio "P" head, £4/15/9. Ditto with Transcription head, £5/2/5.

TRANSCRIPTION MOTORS IN STOCK.

COLLARO TRANSCRIPTION MOTOR, Model 2000, Mk. II, £13/9/6. Model 2010, including Transcription Pickup and PX cartridge, £18/12/-. Carriage 5/- in either case.

NEW CONNOISSEUR variable speed on all 3 speeds £25/15/5.

GARRARD Model 301, £25/3/6.

Cabinets available to house any of the above motors together with pick-up, price £3/7/6. Carriage 5/-.



"SYMPHONY" BASS REFLEX CABINETS, fully finished in figured walnut, oak or mahogany to our own design and to match our Console Amplifier Cabinet, enabling the housing of a whole equipment in a two piece suite; cost: 12in. speaker model, £11/10/-; 10in., £11/-; 8in. £10/10/-. Carriage according to area. The 10in. model is ideal for the WB HF 1012 (see "The Gramophone" review March).

TREBLE BAFFLE veneered to match, optional extra 50/-.

SNIP NO. 1
GARRARD LATEST MODEL RC80M AUTO-CHANGER. Fitted with full-length Pick-up Arm to take 3-pin plug-in heads, manufactured end of Oct. 1954. PRICE LESS HEADS, £15/5/-, carriage paid. These extraordinarily versatile units can be supplied fitted with the following combinations of Pickup Heads at the following prices:
With two Decca XMS f/r Magnetic Heads, £20/15/-.
With two Decca Crystal Heads, £18/10/-.
With Decca Crystal for L.P. and Garrard Miniature Mag. for Std. Takes miniature fibre or steel needles. £18/13/-.
With adaptor and two Acos HGP39-I Heads, £20/5/-.
With adaptor and one Acos HGP39-I Head for L.P. and Garrard Miniature Mag. High Impedance for Std. Takes miniature fibre or steel needles, £19/17/-.
The above combinations of heads are matched for output and the stylus pressure is carefully adjusted before despatch. Carriage paid.
Above mounted in Portable Cabinet 90/- extra,
IMMEDIATE DELIVERY from STOCK guaranteed.

MONARCH latest model, 3 speed AUTO CHANGER with ACOS HGP37 head, price £13/10/-. Carriage 5/-. Leaflet 2½d. Mounted in Portable Cabinet 70/- extra.

"SYMPHONY" BASS REFLEX CABINET KITS. 30in. high, consist of fully-cut 2in. thick, heavy, inert, non-resonant patent acoustic board, deflector plate, felt, all screws, etc., and full instructions. 8in. speaker model, 85/-; 10in. speaker model, 97/6; 12in. speaker model, £5/7/6. The design is the final result of extensive research in our own laboratory and is your safeguard of optimum acoustic results. Carriage 7/6. Ready built, 10/6 extra.

HIRE PURCHASE FACILITIES
NOW AVAILABLE on orders of £15 or over.
Send one-third deposit with order, balance over 6 or 12 monthly instalments. State which required.

NORTHERN RADIO SERVICES

11, KINGS COLLEGE RD., ADELAIDE RD
LONDON, N.W.3. Phone : PRImrose 8314
Tubés: Swiss Cottage and Chalk Farm.

Buses: 2, 13, 31, 113, 187.

CONSOLE AMPLIFIER CABINETS (above), 33in. high, lift-up lid with piano hinge, take Tape Deck, Gram Unit or Auto-changer, Amplifier, Pre-Amplifier and Radio Feeder Unit finished medium walnut veneer. De Luxe version, price 10 gns. Oak or Mahogany veneers 10/- extra. Special finishes to order. Carriage according to area, we will quote.



Northern Radio Services (CONTD.)

"SYMPHONY" RADIO FEEDER UNITS

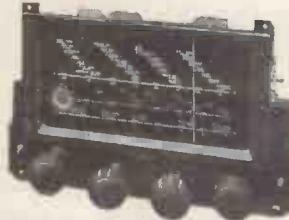


NO. 1 "SYMPHONY" TUNER. A T.R.F. model designed for the quality reception of local stations. Quality is adequate for amplifiers of the highest fidelity. Choice of definite frequency selection. Controls: gain, wave bands, and radio/gram switch. Illuminated engraved glass dial. Latest miniature valves. Overall dimensions: 9in. wide x 8in. deep x 8in. high. Power required: 6.3 v. at 1 amp, and 250/300 v. at 15 mA. Price £7·7·0. Carr. & pkg. 5/-.

NO. 2 "SYMPHONY" SUPERHET TUNER. Three wave-bands, advanced circuit, very newest valve types, floodlit glass dial with bronze escutcheon provided. Suitable for use with the best amplifiers. Overall dimensions: 12in. wide x 8in. high x 7in. deep. Controls: on/off switch, radio/gram wave-change and tuning. Dial cut-out: 8in. x 4½in. reading horizontally or vertically (state which required). Tuner can be readily mounted at any angle. Requires 6.3 v. at 1.5 amp, and 250/300 v. at 20 mA. Price £11·11·0. Carr. & pkg. 5/-.

NO. 2 VS "SYMPHONY" SUPERHET TUNER. As No. 2 but incorporating on the wave-change switch an extra position for radio, thus making two radio positions. One is the standard one with 9 kc. separation and the extra one providing virtually T.R.F. band-width and quality on local stations. Price £13·13·0. Carr. & pkg. 5/-.

All above tuners are made to plug in to any of our "Symphony" Amplifiers in a matter of seconds by means of the octal plug fitted at the end of a flexible multi-cable. They are ideal for providing in conjunction with our "Symphony" Amplifiers, the same high quality in radio as is obtained from these amplifiers on gramophone, but they are equally suitable for use with other high fidelity amplifiers, and where the output circuit requires modification to match a given amplifier this can be carried out free of charge. Either of the two Superhet models can be fitted with a magic eye tuning indicator for £2·2·0 extra. Furthermore, they can be fitted with a pre-amplifying stage to match the Decca Magnetic Pickups or the Collaro Studio type "P" pickup head for use with amplifiers which would not otherwise have enough gain for these comparatively low output pickup heads. In these cases, two separate correction circuits—one for standard and one for LP as recommended by the pickup manufacturers—are incorporated in the radio/gram switch. Please send for our catalogue giving further details.



TAPE DECKS AND AMPLIFIERS

TRUVOX TAPE DECK MARK III. TR2/U. Latest version to take pre-recorded tapes. Price 22 gns. Illustrated leaflet 2½d.

TAPE AMPLIFIER TYPE C, expressly designed by Truvox to work perfectly with their Deck, 3 valves plus rectifier and Magic Eye level indicator. Price 16 gns.

NEW MODEL PORTABLE RECORD PLAYERS



NON-AUTO
MODEL



AUTO MODEL

We are pleased to announce the entry on to the market of two "Symphony" Record Players designed to represent the greatest value in this line ever offered. Model No. 1 contains the Collaro 3-speed single record playing unit AC3/554 and model No. 2 contains the Collaro Autochanger RCS54. They are available with either Type "O" insert, "P" insert or transcription insert. Prices (in attractive rexine case), No. 1 £10·19·6, No. 2 £14·19·6. Carr. 7/6. Transcription insert 6/9 extra.

GOODMAN'S CORNER CABINETS (right) for the AXIOM 150 Mark 2 manufactured by us to Messrs. Goodmans' specification and approved by Messrs. Goodmans. Height, 44in. Price: complete kit in plain board with 1in. thick felt, 8 gns. Price: ready built, 10 gns. Finished in figured walnut, 16 gns. Other veneers to order. Carriage extra according to area.



GARDNERS RADIO



There are 399 Standard types
of 'SOMERFORD' Transformers
and Chokes IN STOCK



GARDNERS RADIO LTD., SOMERFORD, CHRISTCHURCH, Hants. Tel. 1024



ANNOUNCEMENT FM RECEIVER ALIGNMENT GENERATOR MODEL 1324

This Alignment Generator will be available later this year to provide the Service Engineer with a compact test set with which all essential alignment procedures on FM Broadcast Receivers may be undertaken.

Accurate trimming for correct overall and IF response curves is easily carried out and facilities will be provided for discriminator alignment and checks on its sensitivity and distortion. Watch for the release date and price.

COSSOR Model 1322

Model 1322 — used in conjunction with a cathode ray oscilloscope — provides equipment for the display, measurement and correct adjustment of RF and IF response curves of television receivers. This entirely new instrument comprises a swept oscillator covering the Television BANDS I and III (5-75 Mc/s. and 155-255 Mc/s.) and a frequency marker oscillator so that precise calibration of the oscilloscope display may be made; accuracy of the frequency of the marker pips being verified by reference to an internal crystal. The

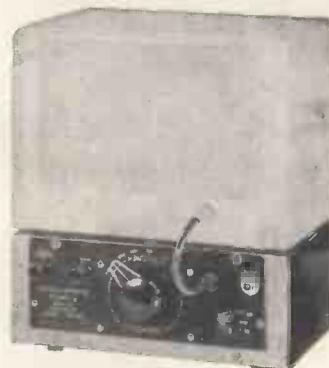
Telecheck and Marker Generator for Bands I and III

alignment oscillator is set to the video carrier to which the receiver is tuned and the sweep (either 1 Mc/s. or 10 Mc/s.) is automatically derived from the time base voltage of the display oscilloscope. The response of the "strip" under test to the frequency band applied is then presented on the screen of the cathode ray tube. The RF output of Model 1322 is available at 75 ohms and is adjustable from a maximum of 40 millivolts to a minimum of 10 microvolts through a coarse and fine attenuator.

TELECHECK CONVERTER FOR BAND III

Model 1321

This adaptor provides owners of Model 1320 "Telecheck" with an extension of the frequency range of the original instrument into the BAND III television channel. Thus, alignment procedures adopted for BAND I RF/IF "strips" are available also for BAND III receivers. A selection of the desired BAND is made by means of a switch. Pattern generator facilities for picture time base linearity checks have been retained. Model 1321 Adaptor is designed for permanent attachment to the standard "Telecheck" providing a neat, light and compact unit. Mounting is effected by four screws and the inter-connecting wiring is carried in a single insulating sleeve.



COSSOR

ELECTRONIC INSTRUMENTS

Write for illustrated leaflets about both these instruments :

COSSOR INSTRUMENTS LIMITED (Dept. 1) Highbury Grove . . . LONDON N.5
Telephone: CANterbury 1234 (33 lines) Telegrams: Cossor, Norphone, London

01.60
N.5

Cables: Cossor, London

ACCLAIMED



HIGH FIDELITY

THE
Concertone
Tape Recorder

48 GNS COMPLETE

THERE ARE ACCREDITED DEALERS IN MOST OF THE PRINCIPAL TOWNS THROUGHOUT THE COUNTRY WHO WILL BE PLEASED TO DEMONSTRATE THIS EXCEPTIONAL MACHINE TO YOU. WHY NOT SEND FOR A SIX PAGE COLOUR LEAFLET AND THE NAME OF YOUR NEAREST DEALER?

Meticulously recording every tonal facet with complete mastery, the "Concertone" tape recorder will give you the ultimate listening pleasure that comes from superb music faultlessly recorded and reproduced.

The "Concertone" will re-create, in the home, the true image of the original performance. Whether it be Solo Violin, or Oboe, or a Full Organ with its demanding power and range, the "Concertone" with its wide frequency response, and extended dynamic range, will satisfy the connoisseur of fine music.

Simple, absolutely reliable, rugged, compact, lightweight, and easily portable, the "Concertone" will, wherever there are sounds to be recorded, serve faithfully, earning, justly, unqualified praise for its faultless performance.

Manufactured by the company in its own precision machine shop, the tape mechanism employs three motors and a special design servomatic brake. The brake not only locks the spools securely during transit, but of greater importance, it is completely free from fade, being self-compensating for wear. Unique is the provision of a mechanical interlock which prevents faulty operation.

Mr. Dealer!! Are you making the most of the Tape Recorder Sales? The "Concertone" is an instrument that is free from trouble and easy to sell. Why not write today for details?



FISHER ELECTRONICS COMPANY LTD.
70, BREWER ST., LONDON, W.1. Phone: GER 3376



EXPORT ENQUIRIES TO:— THE BARNETT SHIPPING & EXPORT CO. LTD., 25 MONUMENT ST., LONDON, E.C.3

NEW!

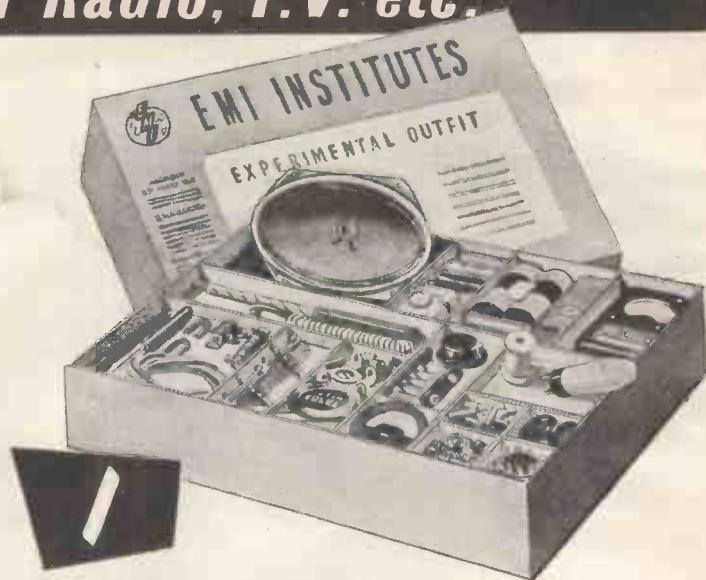
LEARN THE PRACTICAL WAY

Specially prepared sets of radio parts with which we teach you, in your own home, the working of fundamental electronic circuits and bring you easily to the point when you can construct and service radio sets. Whether you are a student for an examination; starting a new hobby; Intent upon a career in industry; or running your own business—these Practical Courses are intended for YOU—and may be yours at very moderate cost.

EASY TERMS FROM 15/- A MONTH

With these outfits, which you receive upon enrolment, you are instructed how to build basic Electronic Circuits (Amplifiers, Oscillators, Power Units, etc.) leading to complete Radio and Television Receiver Testing and Servicing.

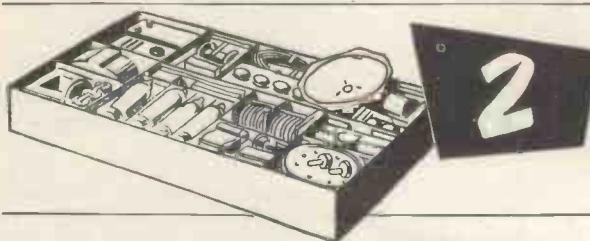
EXPERIMENTAL KITS in Radio, T.V. etc.



BEGINNER'S RADIO

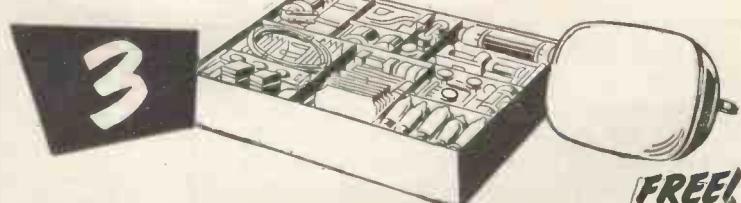
OUTFITS — For carrying out basic practical work in Radio and Electronics, from first principles and leading to the design and building of simple Receivers.

**ALL EQUIPMENT SUPPLIED
IMMEDIATELY AND REMAINS
YOUR PROPERTY**



ADVANCED RADIO OUTFITS

— With this equipment, you are instructed in the design, construction, testing and servicing of complete modern TRS. Superhet Radio Receivers.



TELEVISION Outfit No. 3 — With this equipment you are instructed in the design, construction, servicing and testing of a modern high-quality 15" Television Receiver.

OTHER COURSES WITH EQUIPMENT INCLUDE:

**MECHANICS • ELECTRICITY
CHEMISTRY • PHOTOGRAPHY
CARPENTRY**

**ALSO DRAUGHTSMANSHIP • COMMERCIAL ART
AMATEUR S.W. RADIO • LANGUAGES • ETC.**

POST THIS COUPON TODAY

Please send me your FREE book on Practical Courses.

Subjects of interest _____

To: E.M.I. INSTITUTES, Dept. 127x, Grove Park Road, London, W.4.

NAME _____

ADDRESS _____



MAY

E.M.I. INSTITUTES

The only Postal College which is part of a world-wide Industrial Organisation

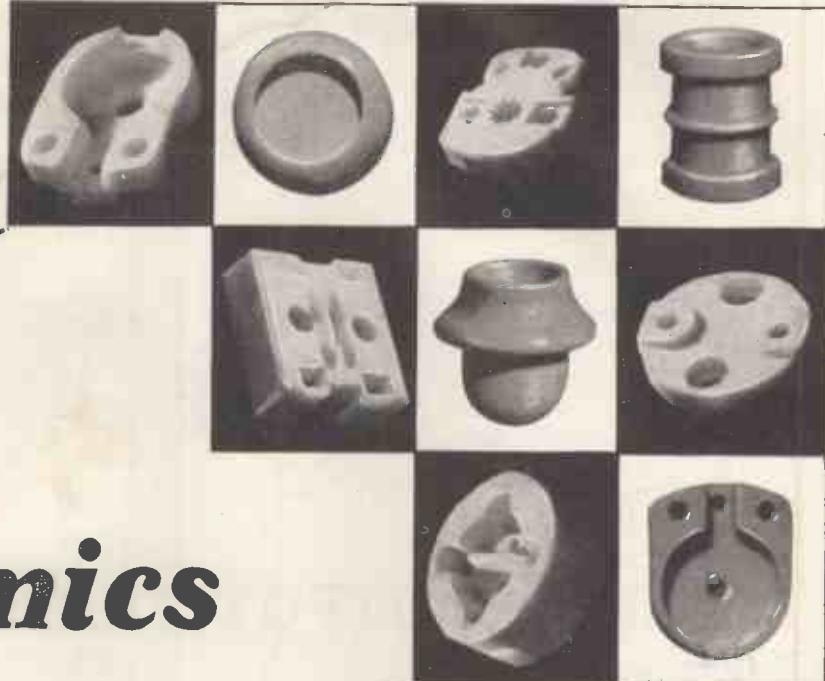
TAYLOR TUNNICLIFF

Makers of Porcelain Insulation

Low

Loss

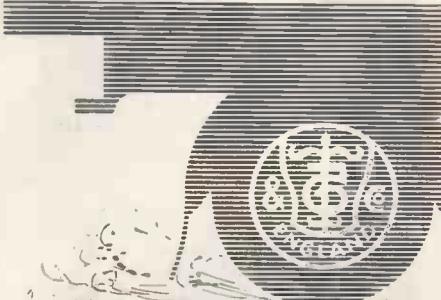
Ceramics



ANOTHER BATCH OF THE FINEST
QUALITY CERAMIC INSULATORS . . .

A SERVICE WHICH TT HAVE DEVELOPED
AFTER YEARS OF CONTINUOUS EXHAUSTIVE
RESEARCH.

THESE TT INSULATORS PLAY AN
IMPORTANT ROLE IN ELECTRONIC
DEVELOPMENT.

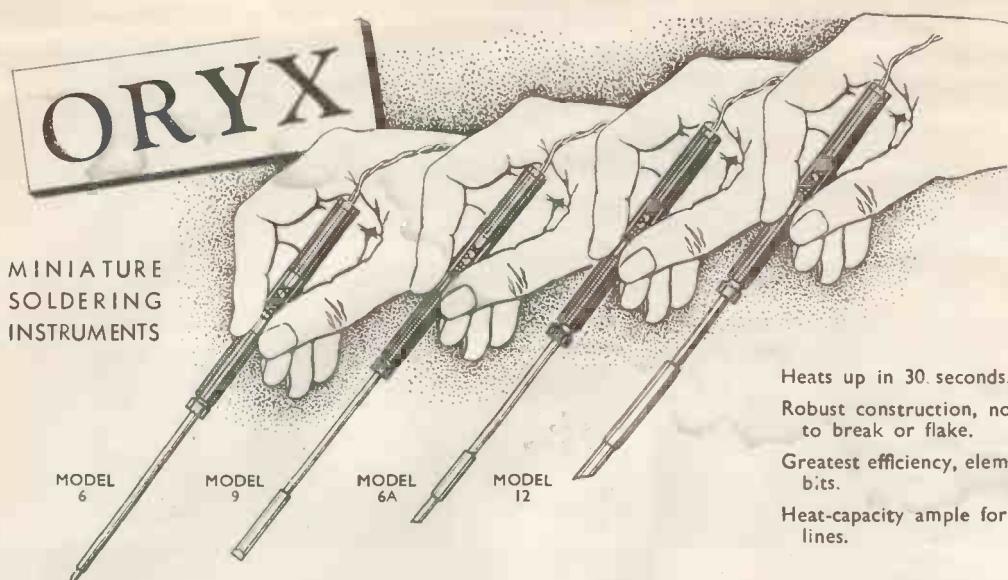


TAYLOR TUNNICLIFF (REFRACTORIES) LTD.

ALBION WORKS · LONGTON · STOKE-ON-TRENT

Telephone : Longton 33122

London Office: 125 HIGH HOLBORN, LONDON, W.C.1. Tel. Holborn 1951/2

MINIATURE
SOLDERING
INSTRUMENTSMODEL
6MODEL
9MODEL
6AMODEL
12

Heats up in 30 seconds.

Robust construction, no ceramics or mica to break or flake.

Greatest efficiency, elements situated under bits.

Heat-capacity ample for use on production lines.

Sole Distributors

ANTEX 3, TOWER HILL,
LONDON, E.C.3.

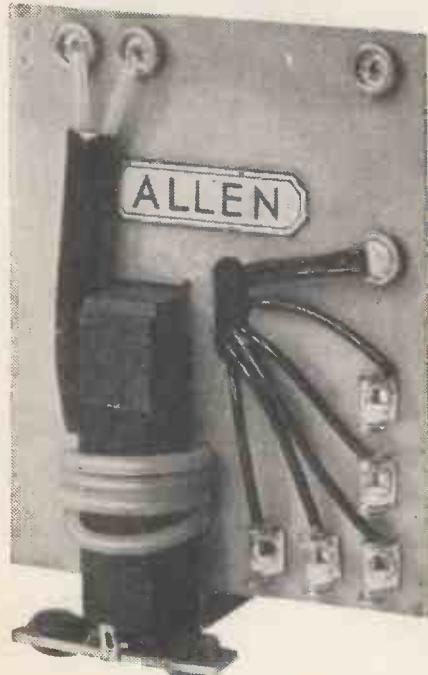
Phone: ROYal 4439. Grams: (Overseas) "Antexlim London"

SUPPLIERS TO H.M. & FOREIGN GOVERNMENTS, LEADING ELECTRONIC, HEARING AID, INSTRUMENT, RADAR, RADIO, T.V. & ELECTRO MEDICAL MANUFACTURERS, HOSPITALS & UNIVERSITIES THROUGHOUT THE WORLD

Model	Consumption	Voltage	Bit Diameter	Weight	Length	Price	Spare Bits
12	12 watts	6, 12, 24 or 50	3/16" (4.8 mm)	0.5 oz	6 1/2"	25/-	2/-
11*	10 watts	6 only	5/32" (4 mm)	0.5 oz.	6"	35/-	7/6
9	8.3 watts	6, 12 & 24	5/32" (4 mm)	0.25 oz.	6"	25/-	1/8
6A	6 watts	6 only	3/32" (2.4 mm)	0.25 oz.	6"	25/-	1/8
6	6 watts	6 only	1/16" (1.6 mm)	0.25 oz.	6"	25/-	fixed bit

* Model 11—Special High Temperature Model.

LINE OUTPUT TRANSFORMER TYPE L.O. 352



"L.O. 352" IS THE TYPE NUMBER OF AN ENTIRELY NEW ALLEN LINE OUTPUT AUTO-TRANSFORMER NOW AVAILABLE.

Note the following "Star" features:

- ★ E.H.T.: 14 to 18 KV.
- ★ E.H.T. Regulation: Better than 5 M.Ω
- ★ Audible Whistle: Negligible.
- ★ Application: Self-running, Square-wave or Sawtooth driven.
- ★ Associated Valves: PL81, PY81.
- ★ Associated Yoke: Allen Type DC605/C.
- ★ H.T. Rail: 190 volts for 14KV.
- ★ Core Material: Mullard Ferroxcube (earthed).
- ★ Scanning Angle: 72 degrees.
- ★ Suitable C.R.T.s: Any "wide-angle" tube, from 14 to 21in.

Manufacturers are invited to write for further details and prices.
Home-Constructors: Please send S.A.E. for recommended circuit diagram and details.

ALLEN COMPONENTS LTD.

(Specialists in high-grade television components)

197, LOWER RICHMOND ROAD, RICHMOND, SURREY

V.H.F. AND COMMERCIAL TV

mean
new
interest
for
you

There will be two new reasons, at Britain's 1955 National Radio Show, why your visit will have special importance. New V.H.F. Radio Sets using Frequency Modulation will be on display . . . also there will be a range of Multi-Channel Sets designed to receive commercial TV.

Throughout the Show—in Radio, Television, Telecommunications and Electronics—you will find features which will arouse tremendous interest. *It will be a truly valuable visit—make your arrangements for it NOW.*

AT THE BRITISH NATIONAL

radio show

L O N D O N

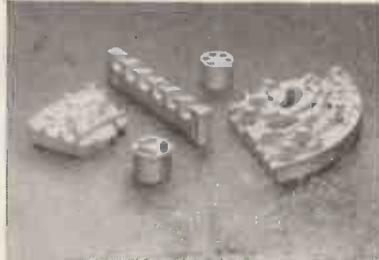
AUGUST 23 — SEPTEMBER 3



*Overseas visitors may obtain full information from
THE RADIO INDUSTRY COUNCIL, 59 RUSSELL SQ., LONDON, W.C.1, ENGLAND
Telegrams: Oldarion, Westcent, London.
Apply to your local B.O.A.C. or B.E.A. Agent for travel information.*

Bullers CERAMICS FOR INDUSTRY

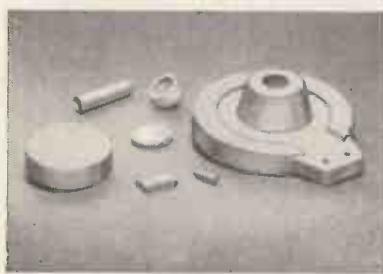
High quality material and dimensional precision are attributes of Bullers die-pressed products. Prompt delivery at competitive prices.



We specialise in the manufacture of—**PORCELAIN**
for general insulation

REFRACTORIES
for high-temperature insulation

FREQUELEX
for high-frequency insulation
PERMALEX & TEMPLEX
for capacitors



BULLERS LIMITED

MILTON • STOKE-ON-TRENT • STAFFS

Phone: Stoke-on-Trent 21381 (5 lines) • Telegrams & Cables: Bullers, Stoke-on-Trent
Ironworks: TIPTON, STAFFS London Office: 6 LAURENCE POUNTNEY HILL, E.C.4
Phone: Tipton 1691 Phone: MANSion House 9971

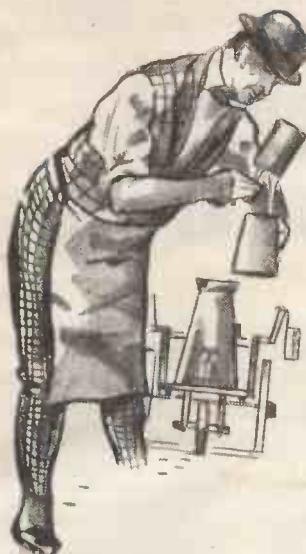
A SOUND TIE UP



A.I.D APPROVED

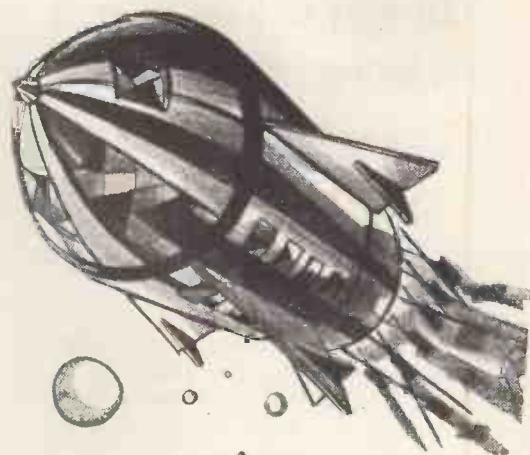
"WILLESDEN" TRANSFORMERS
for all
ELECTRONIC & TELECOMMUNICATION REQUIREMENTS

WILLESDEN TRANSFORMER CO. LTD., 2a, FRITHVILLE GARDENS, SHEPHERDS BUSH, LONDON, W.12. Telephone: SHE 5819, 2714.



Local Colour

It isn't so very long since this form of delivery ceased to satisfy the increasing demand. In fact, there are still some people who were sorry to see the old milk float superseded by the horse-drawn cart—and now there are not so many of these either.



Wide Range

But deliveries must keep up with the times, and already there have been experiments with long-range rockets to deliver postal packets at speeds which would make airmail look as if it were at a standstill.

International Coverage

We at Classic have the importance of safe, speedy delivery well in mind. We don't actually use rockets, but we do use all the best methods, and our export despatch department rather prides itself on the safe delivery of orders. They get plenty of practice, too. We find that the demand for Hi-Fi equipment is world wide, and more and more people are turning to Classic, where they can choose from a *completely* comprehensive selection of TR, Hi-Fi, or FM equipment—a selection that is right up to date.

Send for our 16-page illustrated catalogue (U.K. 6d. Special Export Edition 1/- Airmail Extra) and you'll see just how comprehensive our selection is.

CLASSIC ELECTRICAL
COMPANY LIMITED
THE HI-FI SPECIALISTS



HARTLEY-TURNER SOUND EQUIPMENT

All that is Best in High Fidelity. The Hartley-Turner True Bass Baffle

It is a well-known fact that to reproduce the lower frequencies a large baffle or equivalent is essential.

The Hartley-Turner True Bass Baffle achieves the effect of a large baffle board but due to the unique design it does this with a size of only 18in. cube.

Designed primarily for the Hartley 215 speaker but equally suitable for any other high quality 10in. or 12in. speaker this enclosure is an essential part of a distortion-free sound reproduction system.

Price complete is £8.

Details sent free and post free on application to:

**H. A. HARTLEY CO. LTD.
152, HAMMERSMITH ROAD,
HAMMERSMITH, LONDON, W.6.**

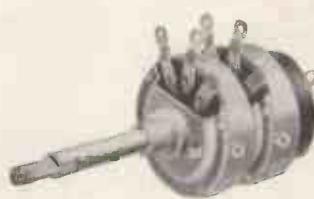
Telephone: RIVerside 7387

Special Note for Overseas Dealers:

If you require supplies of any items of communication equipment and are not already served, our Purchasing and Export Departments can help you. Let us know your requirements.

WHY ENGINEERS SPECIFY **EGEN** potentiometers—

Egen Potentiometers are based on long experience of requirements of television and electronic equipment manufacturers. In design, dependability, accuracy and freedom from wear they are outstanding, but, above all, they are completely NOISELESS.



DUAL POTENTIOMETERS with concentric operating spindles. The new Egen Dual Potentiometers incorporate all these outstanding design features — multiple contact rotors, smooth easy movement, thorough screening between sections, plus a convenient soldering tag for earth-ing screened connec-

tions on each metal case. Switch and Potentiometer soldering tags are of high-grade brass heavily silver plated for easy soldering; they are positively located and withstand soldering heat and bending without loss of rigidity. Control spindles can be supplied to suit customers' requirements.

PRE-SET POTENTIOMETERS. Completely enclosed in high-grade phenolic mouldings. Solder tags heavily silver plated for quick soldering. Fully insulated spindles with integral control knobs. Tapped for 2-hole 6 B.A. fixing on $\frac{1}{2}$ " centres. Type 126, wire-wound. Type 127, carbon.



STANDARD CARBON POTENTIOMETERS. Made by an entirely new method ensuring a highly stable resistance element, which is also very durable. Silent and smooth in operation, these controls offer both mechanical and electrical reliability. Soldering tags are heavily silver plated to resist oxidisation, and the mains switch has an efficient quick make-and-break action.

PRE-SET RESISTOR. This has a wire-wound resistance element, traversed by a nickel-silver slider. Adjustment is effected by a worm drive spindle fitted with a knurled and slotted knob. This component is smooth and noiseless in action and is designed to meet the many and varied requirements of the Electronic Industry. Egen pre-set resistors can be supplied in multi-bank assemblies to suit individual requirements. There are also twin-track models, and types with an electrically divided slider, giving adjustment on two resistors with one operation.



EGEN ELECTRIC LTD. Charfleet Industrial Estate, Canvey Island, Essex • Phone: Canvey Island 691/2

RADIO**TUBES**

Part of our service is to anticipate the forward demand for radio tubes, and especially new types. You will be well aware that during the last year many new types have appeared and the demand for these has exceeded all estimates, with the result that great shortages of many types have arisen.

Thanks to considerable foresight and careful planning we are in the enviable position of being able to offer ex stock those types that are in short supply.

From our unique and comprehensive stocks of over 2,000,000 tubes of British, American and European types we can satisfy your immediate demands.

For even better service we have installed the Telex System, the number being 2-2573.

Let us have your enquiries which will receive our immediate attention.

HALL ELECTRIC LTD
HALTRON HOUSE, 49-55 LISSON GROVE,
LONDON N.W.1.

Tel.: Ambassador 1041 (5 lines) Cables: Hialectric, London



Make the most of F.M. with

Armstrong Equipment

Specialists in High Quality Reproduction for over 20 years



**AMPLIFIER £19.15.0
CONTROL UNIT £9.15.0**

Demonstrations at your local High Fidelity specialists, or at our showrooms in Holloway. Special High Fidelity demonstrations each Thursday evening from 7 p.m.

THE A.10 AMPLIFIER

Output: 10-12 watts.
Distortion: 0.1% total harmonic at 8 watts.
Frequency Response: within 1 db 15-30,000 cps.
Input: 250 millivolts for 10 watts output.

CONTROLS

1. Input—4 position.
2. Equaliser—4 position.
3. Filter—6 position with built-in "rumble" filter.
4. Treble Lift and cut giving ± 15 db.
5. Bass J db—continuously variable

THE F.M. 56 TUNER

Coverage: 85-95 mc/s.
Image Rejection: 26 db.
I.F. Rejection: 60 db.
Output: 3 volts r.m.s.

Circuit: a low noise triode. R.F. stage is coupled to a high stability frequency changer. This is followed by two I.F. stages and a triple diode triode ratio detector and A.F. stage.

Valves: The latest type Mullard. ECC 85, EF 86, EABC 80, EM 34.



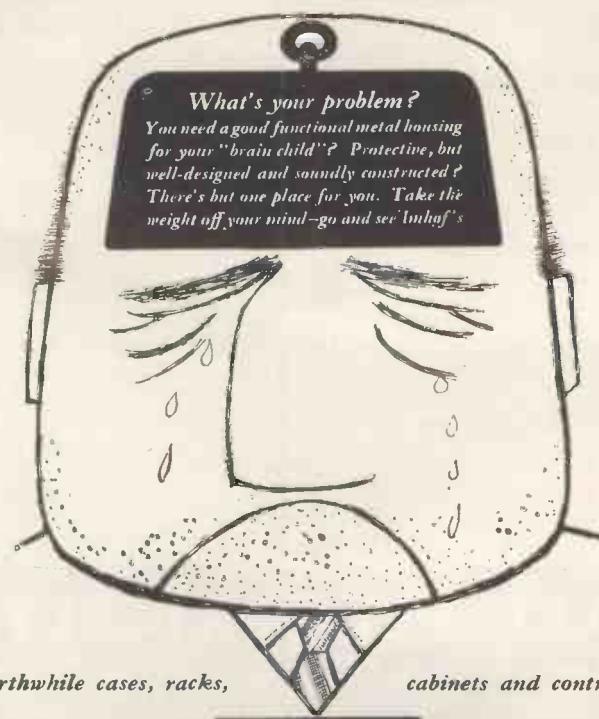
PRICE £21.0.0

All our models are sold under full and unconditional money-back guarantee of satisfaction. Prices include Purchase Tax, Hire Purchase facilities are available.

ARMSTRONG WIRELESS & TELEVISION CO. LTD., WARLTERS RD., LONDON, N.7 Telephone: NORth 3213

At Imhofs you get the best of both worlds. A Standard Range of metal housings (racks, cases, consoles, and cabinets) : all sizes, all shapes : in fact, infinite in variety.

Delivery ? Excellent !



for worthwhile cases, racks,

cabinets and control consoles

Then there's the Imhof Design Service. Tell us your needs. We do the rest. Design, test and produce—in quantity.

Come and see for yourself — you'll probably find exactly what you want !

ALFRED IMHOFF LIMITED Dept P2

IMHOFFS

112-116 New Oxford Street London WC2

MUSEUM 7878

ANTIFERENCE

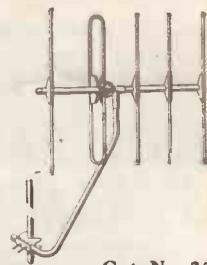
BAND 3 AERIALS

*...A comprehensive new range
for every requirement*

A complete new range is now available for the reception of Band 3 transmissions in Channels 8 or 9 and at prices that reflect the careful planning and thought that has gone into their construction. We illustrate only 5 of the 11 models available. Our wide experience gained from Antiference factories on the American continent has played a large part in the development of this completely new range of aerials designed for efficiency—with economy. All the fine features of the Antiference Band 1 range are incorporated in these models; they are easy to install and are fully pre-assembled and aligned for peak performance on the Band 3 frequencies.

When ordering please quote Channel for which aerials are required, e.g. CAT. NO. 120/4E/.... (quote Channel reference here).

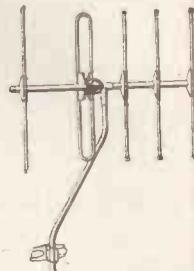
The ANTIFERENCE Band 3 range will be on display on Stand No. 6 Northern Radio Show, City Hall, Manchester, from May 4th-14th.



Cat. No. 350/1C

Five element array with swan-neck mast and "U" bolt grip for fitting to existing masts from $\frac{3}{8}$ in. up to 2in.

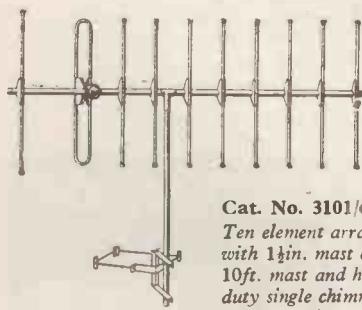
List Price 52/6.



Cat. No. 350/2D

Five element array with cranked mast and universal mounting bracket.

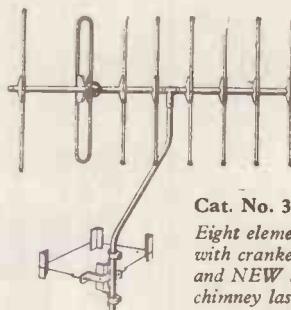
List Price 53/6.



Cat. No. 3101/6G

Ten element array with 1½in. mast cap 10ft. mast and heavy duty single chimney lashing equipment type G.

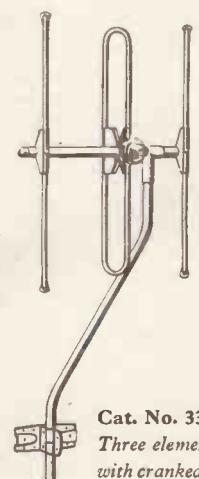
List Price 145/-.



Cat. No. 380/5D

Eight element array with cranked mast and NEW type chimney lashing equipment.

List Price 83/6.



Cat. No. 3302/D

Three element array with cranked mast and universal surface mounting bracket.

List price 42/6.

ANTIFERENCE LIMITED, BICESTER ROAD, AYLESBURY, BUCKS. Tel.: AYLESBURY 1467/8/9

"WEYRAD"

COIL PACKS AND I.F. TRANSFORMERS

**FOR HIGH PERFORMANCE
THE B.30 SERIES**

These packs have been developed to provide an answer to the problem of reliable operation on overcrowded broadcast bands. The use of an R.F. stage results in much improved sensitivity and selectivity.



UP TO 4 WAVE BANDS — GRAM. SWITCHING

Fully tropicalised, iron-cored coils wound on moulded bakelite formers. Ceramic based, compression-type trimmers. Close tolerance silvered mica padders.

B30/G	TUNING CAPACITY	483-532 pF.
B31/G	"	354-399 pF.

Coverage 12.5-550 m. in 4 bands.

B32/G	TUNING CAPACITY	483-532 pF.
B33/G	"	354-399 pF.

Coverage 12.5-37, 33-100, 190-550 & 300-2,000 m.

B34/G	TUNING CAPACITY	483-532 pF.
B35/G	"	354-399 pF.

Coverage 16-50, 190-550, & 800-2,000 m.

PRICES: B30-33 93/9 + 30/6 P.T.
B34-35 84/5 + 27/5 P.T.

FOR USE WITH THESE I.F. TRANSFORMERS

**WEYRAD
TYPES
P.3, P.4,
P.5 or P.6.**
Operating at
465-470 Kc/S.



A very wide choice of I.F. stage arrangements is possible. The types listed cover transformers of the highest possible electrical and mechanical quality, low cost versions for manufacturers and special types providing variable selectivity characteristics.

P.3.A & P.3.B.	.....	9/10 each
P.4	.....	7/6 each
P.5	.....	8/6 each
P.5.A	.....	10/- each

WEYMOUTH RADIO MFG. CO., LTD.
CRESCENT STREET, WEYMOUTH, DORSET

Specify AERIALITE

for

AERIALS

The wide range of Aerialite aerials includes types for television, radio and f.m. reception. Our long experience in this specialist field enables us to market aerials of extra high efficiency which give years of trouble-free service. For example, there is no equal to the Dublex T/V aerial in terms of forward gain (6dB) and broad bandwidth at the low price of £4/8/6. There are many other unique aerials in the range—send for details. Retail prices are from 13/6.

ACCESSORIES

Two valuable additions to the accessory range are the Part No. 168 coaxial plug and the Part No. 169 In-line attenuator. The plug is of three-piece construction and is easily fitted to the semi-airspaced and standard types of coaxial cables. The In-line attenuator is available in five types, 6dB, 12dB, 18dB, 24dB, and 36dB and carries plug and socket ends. It may be instantly inserted in aerial down-lead. Other accessories include plugs, sockets, lightning arrestors, brackets, etc.

HF. CABLES

A new type of T/V down lead has recently been introduced under the trade mark of "Aerialite." This cable has lower attenuation than solid types and yet is available at the same price (£8/4d. per yd. retail price). Other cables available include twin feeders (screened and unscreened) for 75 ohm and 300 ohm applications, as well as 50 ohm and 75 ohm coaxials with solid and semi-airspaced insulation. A special low capacity cable for car radio aerial connections, etc., is also manufactured.

CONNECTING WIRES

Aerialite connecting wires are being increasingly used in the radio, T/V and electronics industry due to their flexibility, wide colour range and low cost. Thermoplastic insulation ensures a higher dielectric plus the advantages of greater mechanical strength, fire resistance, and permanence. Aerialite connecting wires are easy to handle and easy to strip and save valuable time on the production floor. Please send for leadlet and prices.

RELAY CABLES

Aerialite relay cables have been designed and manufactured to provide efficient and permanent installations for sound and broadcast relay networks. To meet these exacting requirements these cables have the minimum of attenuation combined with high mechanical strength. The range includes single and double star quad, single polythene insulated, flat twin Fig. 8 and single star quad copper taped relay cables. Television relay cables are also available.

T/V AERIAL AMPLIFIERS

Types DAI and PAI-8 meet the need for both multiple outlet and individual aerial distribution and amplification. Model DAI will provide unity gain with at least 30 T/V receivers operating and the specification includes heavy duty power pack, neon indicator, two stage, gain control, two independent coaxial outputs. The size is 18½in. x 6in. x 7½in. Type PAI is available with up to eight coaxial outlets and is suitable for showroom or demonstration purposes.

* We shall be at the
NORTHERN
RADIO SHOW
CITY HALL
MANCHESTER
MAY 4-14
STAND 46.

YOUR ENQUIRIES INVITED

**COMPLETE SATISFACTION
WITH
AERIALITE
PRODUCTS**

AERIALITE LTD . CASTLE WORKS . STALYBRIDGE . CHESHIRE

a new T.D.M.S.

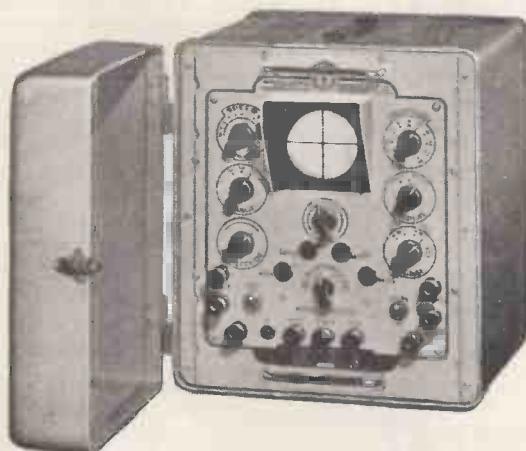
The T.D.M.S. 5 & 6 are portable sets designed to measure distortion at any point in a radio teleprinter or line telegraph circuit without interfering with normal transmission.

The equipment consists of two units each $16\frac{1}{2}'' \times 10\frac{1}{2}'' \times 12''$ both mains driven and electronically controlled ; either may be used independently for certain tests or both may be used in combination to cover a comprehensive range of testing operations.



T.D.M.S. 5

Sends an automatic test message or characters or reversals at any desired speed and/or percentage of distortion. The CRO has a circular time base for distortion measurements or relay adjustment.



T.D.M.S. 6

For distortion measurements on working circuits without interrupting service. Each element of a start-stop signal appears separately on the spiral time base display. Adjustable speeds from 20-160 bauds.

You are invited to apply for a copy of a descriptive leaflet which describes the equipment in detail

Automatic Telephone & Electric Co. Ltd.

Radio and Transmission Division, Strowger House,
Arundel Street, London, W.C.2. Telephone : TEMple Bar 9262. Cablegrams : Strowgerex London.



NEW ARCOLECTRIC SIGNAL LAMPS

For Low Voltage or Mains

Illustrated are a few signal lamps taken from our wide range. The insulation of every Arcolectric signal lamp will resist a flash test of 1,500 volts A.C.

The SL.90 illustrated here is a typical Arcolectric low voltage signal lampholder. It is designed to accept popular M.E.S. bulbs. The bulb is accessible from front or rear of panel. The domed plastic lens surrounded by a polished chrome bezel gives a most attractive panel appearance. This holder can be fixed in a single $\frac{3}{4}$ " hole.

The mains voltage signal lamp S.L.88/N is supplied complete with an M.E.S. neon tube and a suitable series resistance.

Write for Catalogue No. 128

ARCOLECTRIC
SWITCHES LTD

CENTRAL AVENUE, WEST MOLESEY, SURREY. TELEPHONE: MOLESEY 4336 (3 LINES)



MAXI-Q
REGD.

AND NOW THERE ARE NINE
THE CP.3F/G BEING THE LATEST ADDITION AND AGAIN IN RESPONSE
TO POPULAR REQUESTS.

This 4 waveband Coil Pack complete with Gram position is for use with a 500pF. 2-Gang Condenser. It covers the standard Long, Medium and Short wavebands with the addition of the Band 50/160 metres, 1.85/6 Mc/s. This covers the Trawler Band, 105/160 metres, Shipping 68/74 metres, Aeronautical 52/55 and 95/105 metres, and the 80 and 160 metres Amateur Bands.

The CP.3F/G comprises of Aerial and Oscillator coils complete with iron dust tuning cores, Wavechange switch and Mica Compression Trimmers mounted on an aluminium plate. Fixing is effected by an additional nut on the Wavechange switch. The I.F. is 465 Kc/s. For use with any standard frequency changer.

Retail Price: 57/- plus 19/- P.T.—Total 76/-.
The following Coil Packs are also available:

CP.3F. As above less the Gram position.

Retail Price: 49/- plus 16/4 P.T.—Total 65/4.

CP.3/370 and 500pF. Three Waveband Coil Packs for use with either 370 or 500pF. tuning condensers.

Retail Prices: 32/- plus 10/8 P.T.—Total 42/8.

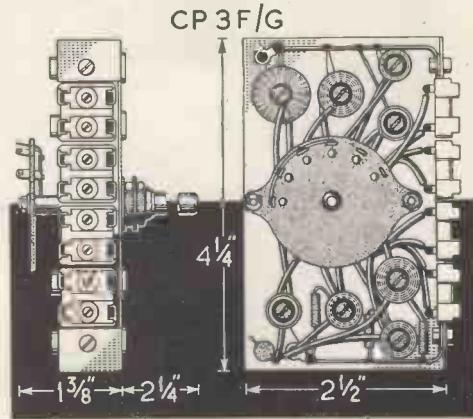
CP.3/G. Three Waveband Coil Pack for 500pF. tuning condensers with provision on the Wavechange switch for gramophone position.

Retail Price: 39/- plus 13/- P.T.—Total 52/-.

CP.4/L and CP.4/M. These compact 4-station Coil Packs are available for either 1 Long and 3 Medium wave stations (CP.4/L) or 4 Medium wave stations (CP.4/M). Retail Price: 25/- plus 8/4 P.T.—Total 33/4.

CP.4L/G and CP.4M/G. As above but with provision for gramophone pick-up on the Wavechange switch. Retail Price: 31/- plus 10/4 P.T.—Total 41/4. See Technical Bulletin DBT.9 for details of all coil packs. 1/6.

Obtainable from all reputable stockists or in case of difficulty direct from works. Send 1/- in stamps for General Catalogue.



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

Stop Press: "Osram" "912" and "Mullard" "5-10" Amplifier Chassis and Bronze finished Front Panel—21/- each. The "Practical Wireless" "Fury Four" uses the "Maxi-Q" Yellow (3/11) and Green Chassis Mounting Coils (4/9) (please state frequency range when ordering). Also available are the "Fury Four" Chassis and Paxolin Front Panel—19/6. Long and Medium wave T.R.F. Coils, wound on Polystyrene Formers—9/- per pair. IFF.1, Improved 465 Kc/s. I.F. Filter, wound on Polystyrene Former—4/1.

FOR T.V., RADIO SERVICING and General Laboratory Use.

TAYLOR OSCILLOSCOPE

Model 31A

An Oscilloscope of advanced design and reliable performance intended primarily to meet the requirements of T.V. and Radio Service work, but its versatile features make it ideally suitable for general Laboratory work.

Tube: Flat faced C.R. tube 4in. diameter. Electrostatic deflection.

Hard Time Base covers frequencies from 10 c/s to 500 Mc/s—free running or triggered.

Amplifiers: Both horizontal and vertical with push-pull output are provided. Amplifier high gain band width 10 c/s to 6 Mc/s.

Flyback Suppression Circuit fitted with tube modulator.

Cash Price £60

Prompt delivery



TAYLOR MULTIRANGE UNIVERSAL METER

Model 88A

A robust and accurate Multirange Meter is of special value to the Radio and Television Service Engineer. It has a sensitivity of 20,000 o.p.v. D.C. and 2,000 o.p.v. A.C.

Ranges: D.C. volt ranges from .1 to 5,000-V (25 Kv by an external adaptor). 11 A.C. volt ranges from 1 to 5,000-V. 15 D.C./A.C. current ranges from 50 uA-10 amps.

Resistance 1 ohm-5 megohms (50 megohms with external battery).

Automatic overload protection.

Cash Price £22

Prompt delivery

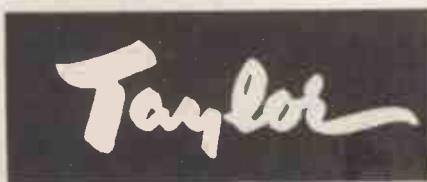


JUST Released!

Model 92A T.V. Sweep Oscillator Covering Band III. Write for illustrated leaflet and details.

NEW! Model 67A T.V.

Signal Generator 100 K/C. 240 m/c. Write for illustrated leaflet and details.



● All Taylor instruments available on H.P.
Write for catalogue and details of H.P. terms.

ELECTRICAL INSTRUMENTS LTD.

MONTROSE AVENUE, SLOUGH, BUCKS. Telephone: Slough 21381. Cables: Taylins, Slough

an open
Invitation
 to all manufacturers
 of

Photo Flash Equipment

Deaf Aids

**Private Telephone
Installations**

Amplifiers

D.C. Power Units

Spot Welding Equipment

Test Gear

Magnetisation Equipment

You are invited to regard the TECHNICIANS at DALY as a part of your own technical staff. Non-standard components are invariably a source of worry, therefore the Electrical Industry find the DALY "made-to-measure" service for individual requirements specially helpful and a great time-saver.

For URGENT problems a telephone request will bring us post haste to your factory for consultation without obligation—and you will find our readiness to help both valuable and economic.

DALY ELECTROLYTICS for ELECTRONICS and COMMUNICATIONS . . . MOTOR START . . . RADIO and T.V. . . are in great demand throughout the world ; send for appropriate pamphlet.

DALY
ELECTROLYTIC CAPACITORS

CONDENSER SPECIALISTS FOR OVER 20 YEARS

**DALY (CONDENSERS) LTD., WEST LODGE WORKS,
THE GREEN, EALING, LONDON, W.5**

Phone : EALing 3127-8-9. Cables : DALYCON, LONDON

MAINS TRANSFORMERS

FULLY INTERLEAVED
SCREENED AND IMPREGNATED. ALL GUARANTEED

ALL PRIMARIES ARE 200/250 v. Half Shrouded.

HSM 63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps.	16/3
HS63: Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps.	16/6
HS40. Windings as above. 4 v. at 4 amps., 4 v. at 2 amps. Output.	16/6
H32. 250-0-250 v. 80 m/a.	19/-
HS3. 350-0-350 v. 80 m/a., 19/- HS30. 300-0-300 v. 80 m/a.	19/-
HS2X. 250-0-250 v. 100 m/a., 21/- HS75. 275-0-275 v. 100 m/a.	21/-
HS30X. 300-0-300 v. 100 m/a., 21/- HS3X. 350-0-350 v. 100 m/a.	21/-

Fully Shrouded

FSM63 (Midget). Output 250-0-250 v. 6 m/a., 6.3 v. at 3 amps., 5 v. 2 amps. Output	16/9
FS2. 250-0-250 v. 80 m/a.	21/-
FS30. 300-0-300 v. 80 m/a., 21/- FS3. 350-0-350 v. 80 m/a.	21/-
FS2X. 250-0-250 v. 100 m/a., 23/- FS75. 275-0-275 v. 100 m/a.	23/-
FS30X. 300-0-300 v. 100 m/a., 23/- FS3X. 350-0-350 v. 100 m/a.	23/-
All the above have 6.3-4.0 v. at 4 amps., 5.4-0 at 2 amps.	
FS43. Output 425-0-425 v. 200 m/a., 6.3 v. 4 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded	47/6
FS50. Output 450-0-450 v. 250 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded	67/6
F35X. Output 350-0-350 v. 250 m/a., 6.3 v. 6 amps., 4 v. 8 amps., 4 v. 3 amps., 0.2-6.3 v. 2 amps. Fully shrouded	65/-
FS160X. Output 350-0-350 v. 160 m/a., 6.3 v. 6 amps., 6.3 v. 3 amps., 5 v. 3 amps. Fully shrouded	44/-
FS43X. Output 425-0-425 v. 250 m/a., 6.3 v. 6 amps., 6.3 v. 6 amps., 5 v. 3 amps. Fully shrouded	63/6
HS6. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. For receiver RI355. Half shrouded	26/6
HS150. Output 350-0-350 v. 150 m/a., 6.3 v. 3 amps., C.T. 5 v. 3 amps. Half shrouded	27/9
F36. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. Fully shrouded	29/6
FS120. Output 350-0-350 v. 120 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 2 amps., C.T. 5 v. 3 amps. Fully shrouded	29/9
FS256. Output 250-0-250 v. 80 m/a., 6.3 v. at 6 amps., 5 v. at 3 amps. Fully shrouded	28/6
PRI/1. Output 230 v. at 30 m/a. 6.3 v. at 1.5/2 amps.	21/-
FS150. 350-0-350 v. 150 m/a., 6.3 v. 4 amps., 5 v. 3 amps.	31/6
FS150X. Output 350-0-350 v. at 150 m/a., 6.3 v. at 2 amps., C.T. 6.3 v. at 2 amps., C.T. 5 v. at 3 amps. Fully shrouded	31/6
The above have inputs of 200/250 v.	

OUTPUT TRANSFORMERS

MIDGET OP. 5,000Ω to 3Ω	3/9
8,000Ω to 3Ω	3/9
OP10. 10/15 watts output. 20 ratios on Full and Half Primary	17/9
OP30. 30 watts output, 20 ratios on Full and Half Primary	25/9
Williamson's O.P. Transformer to Author's specification	£4/13/6
Chokes for Williamson's Amplifier, 30 H. at 20 m/a.	16/6
10 H. at 150 m/a.	32/-

FILAMENT TRANSFORMERS

All 200/250 v. Input.

F3. 6.3 v. @ 3 amps.	9/6
F4. 4 v. @ 2 amps., 7/6. F6. 6.3 v. @ 2 amps.	7/6
F6X. 6.3 v. @ 0.3 amps., 5/6. F12X. 12 v. @ 1 amp.	8/-
FU6. 0.2-4.5-6.3 v. @ 2 amps., 10/-. F12. 12.6 v. tapped 6.3 v. @ 3 amps.	16/6
F24. 24 v. tapped 12 v. @ 3 amps.	23/6
F29. 0.2-4.5-6.3 v. @ 4 amps., 18/9. FU12. 0.4-6.3 v. @ 3 amps.	17/6
FU24. 0.12-24 v. @ 1 amp.	17/6
F5. 6.3 v. @ 10 amps. or 5 v. @ 10 amps., or 12.6 v. @ 5 amps., or 10 v. @ 5 amps.	34/-
F6/4. Four windings at 6.3 v. tapped 5 v. @ 5 amps. each, giving by suitable series and parallel connections up to 6.3 v. @ 20 amps.	51/6

Quotations, etc., stamped addressed envelope please.

C.W.O. (add 1/6 in £ for carriage).

Export enquiries invited.

**H. ASHWORTH (Dept. W.W.),
676, Gt. Horton Road, Bradford 7, Yorks.**

And NOW—a range of 'CERAMICAPS' for your **LAB** Storage Unit!



The LAB Continuous Storage Unit is widely acknowledged as the most efficient and convenient method of storing and selecting resistors. Now its usefulness is still further extended with the introduction of LAB pak'd 'Ceramicaps'.

With the LAB Unit, research and experimental laboratories and small production groups have to hand immediately, a complete range of resistors and 'Ceramicaps', easily selected with card index simplicity from some 700 sorted and carded components. Empty cards are merely replaced with full ones from stock.

The LAB unit is supplied FREE with initial purchase to your specification. Standard assortments available. Each LAB Unit can be used to store one type of component exclusively, or quantities of the complete range of resistors and 'Ceramicaps'. Full details and illustrated list will be sent on application.

RESISTORS					
Ref.	Type	Loading	Max. Volts	Range	Dimensions
T	½ watt	½ watt	250	10 ohms to 10 megohms	1" x ½"
R	½ watt	1 watt	500	10%, 5%	2" x ½"
		Tolerance available ±20%			
HS3	½ watt	HIGH STABILITY RESISTORS		1 ohm to 500 megohms	1.1" x 0.1"
		½ watt	750		
		Tolerance available ±5%		2%, 1%	
		WIREWOUND RESISTORS			
		5 ohms to 100K ohms	— 5 - 10 watts		
		'CERAMICAPS'			
		Tubulars 3 - 470 pf	Tolerances ±2%, 10%	Hi-K	
		500 - 5000 pf			

The Lab Continuous Storage Units are available from your normal source of supply, but more detailed information can be obtained from

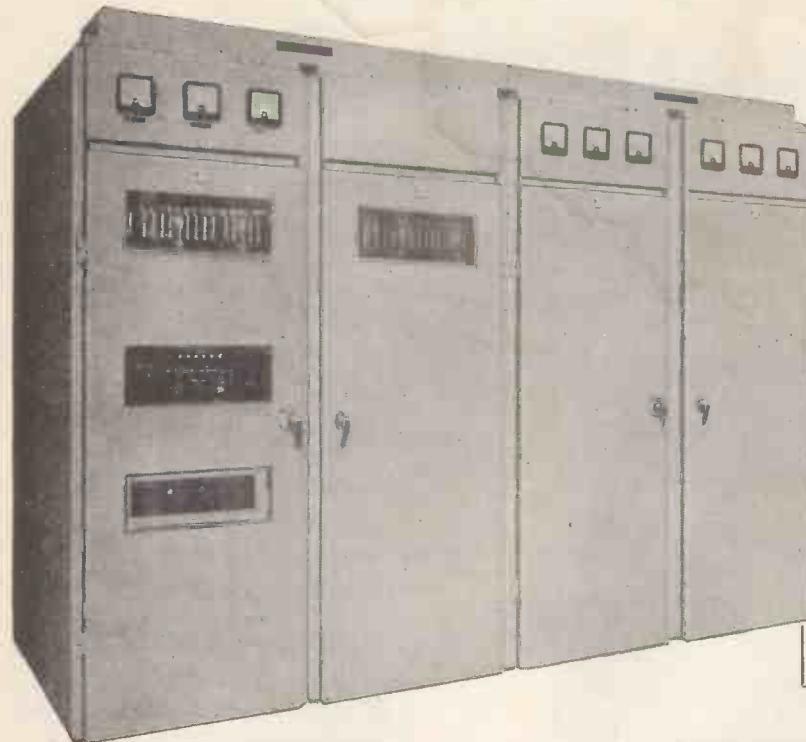
THE LAB
TESTED
CONTINUOUS
STORAGE UNIT

- ★ Continuous Storage for Resistors and 'Ceramicaps'
- ★ Values separately carded
- ★ Finger-tip Selection

THE RADIO RESISTOR COMPANY LTD

50 ABBEY GARDENS · LONDON · N.W.8 · Telephone: Maida Vale 5522

Marconi 6kW HF ISB Transmitters



TYPES

HS 71 AND HS 72

The assembly is enclosed by unit sections, as shown here, with access through front and rear doors. The two left hand bays house the rectifier and power equipment and the right hand bays the low power and auxiliary transmitting circuits and the main output stage.

These transmitters, designed in accordance with the most advanced practice, provide :—

- (a) Telegraphy on CW and FSK (A1 and F1)
- (b) Independent Sideband Operation (A3b)

The drive equipment is external and provides either ISB modulation or telegraph keying at 3.1 Mc/s and suitable RF oscillator signals for frequency changing in the transmitter. HS 71 is manually operated; HS 72 provides full automatic tuning and selection of any one of six pre-set frequencies.

FEATURES INCLUDE

- Tuning over the whole range without change of components
- Air cooling throughout, with dust filtering.
- Double screening of power stages reduces indirect radiation and cooling air noise.
- Envelope feed back to reduce distortion.
- Compact assembly with good access for servicing and safety interlocking.

More than 80 countries now have Marconi equipped telegraph and communication services, many of which, completed 20 years ago, still give trouble-free operation.

Lifeline of communication

MARCONI

COMPLETE COMMUNICATION SYSTEMS

Surveyed, planned, installed, maintained

Partners in progress with The 'ENGLISH ELECTRIC' Company Limited

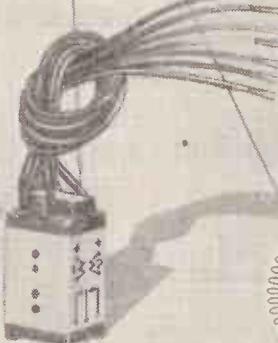
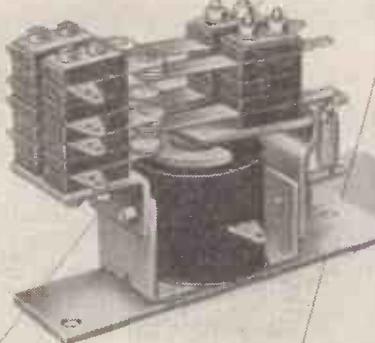
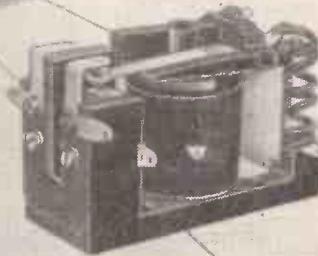
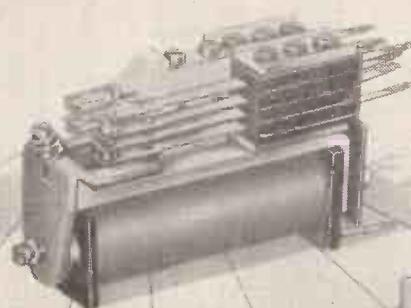
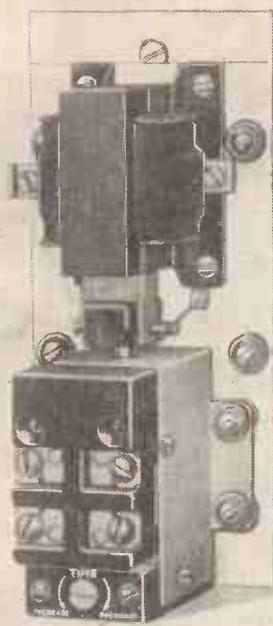
MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD, ESSEX

LC12

Precision Relays

An extensive range
of standard types
always available
for prompt delivery

SPECIAL TYPES
DESIGNED TO SUIT
YOUR NEEDS



— THE WORLD-RENNED SPECIALIST DESIGNERS
AND MANUFACTURERS OF ALL TYPES OF RELAYS

**ELECTRO
METHODS**

LTD
OF STEVENAGE

Now FREE to all!

THE E-M TECHNICAL ADVISORY SERVICE

Regardless of whether your relay problem is simple or complex, the fact remains that the only reliable solution is that which entirely eliminates risk.

We therefore respectfully invite you to avail yourself of the wide resources of technical knowledge and practical experience possessed by the specialist technicians of our Relay Division.

Full technical data
and illustrated leaflets
promptly forwarded
on request!

ELECTRO METHODS LTD. 12-36 CAXTON WAY, STEVENAGE, HERTS. Phone: STEVENAGE 780

Reflectograph

MAGNETIC TAPE RECORDERS

First introduced in Multi-Channel form as an airborne instrument for strain gauge recording, this Series has provided invaluable data on the performance of high power jet engines at operational heights and speeds. Now, since its introduction as a single channel recorder it is finding an ever-increasing application not only in research and industry, but among music lovers because of its wide frequency range, impressive performance and a number of exclusive features found only on this instrument.

Wow and Flutter are at a satisfactory low level (0.2% Peak to Peak at 7.50" per sec.) while a signal displayed on an oscilloscope at 12,000, 13,000 and 14,000 cycles shows a "clean" trace with very little high frequency Flutter component. The wide frequency range ($\pm 3\text{dB}$ 70 to 14,000 cycles) permits a playback response which approximates closely to the original signal when recording from a high quality input source. In cases where a very high record to playback tape speed accuracy is required, the Frequency Injection Control permits a short signal of a known frequency (normally 50 cycles) to be made on the tape before recording, this is "beat" back by means of the variable tape speed control at the commencement of replay, giving a record to playback accuracy loss, of less than 0.1%, the record level meter being used in this function as the error signal indicator. The inching control, now fitted as standard on all Reflectograph instruments, permits rapid shuttling of the tape between spools and brings the tape to a smooth stop before the mechanical brakes are applied. All Reflectograph Recorders conform to the C.C.I.R. recommended specifications and permit the full quality of pre-recorded tapes to be realised.

SCIENTIFIC and INDUSTRIAL

Series P. Recorders

For full information on the Reflectograph Range write to the Manufacturers

RUDMAN DARLINGTON (ELECTRONICS) LTD
Wednesfield, Staffs. Tel: Wolverhampton 31704

JW—Ad

AND NOW OUR

"Super" CONTROL KNOBS

DESCRIPTION. Well proportioned mouldings with high-gloss finish. Careful design ensures easy grip.

STYLING. Latest Continental style introducing gold circle—(formed during moulding and cannot be erased).

METHOD OF FIXING. By robust grub-screw and lock-nut. Will accept all $\frac{1}{4}$ " spindles.

'STANDARD' INSCRIPTIONS.

'S.M.L. Gram', 'Volume', 'Vol/On-Off', 'Wavechange', 'Tuning', 'Radio-Gram', 'Tone', 'On-Off', 'Treble', 'Bass', 'Gain', 'Middle', 'Record-Play', 'Contrast', 'Brilliance', 'Brilliance', 'On-Off', 'Focus', 'Brightness'.

We are always prepared to engrave to your special order.

'SUPER' MAJOR. Diameter $1\frac{3}{8}$ in. Height $\frac{3}{4}$ in.

Retail prices: With inscription—Walnut 1/9. Ivory 2/-.
Without inscription—Walnut 1/3. Ivory 1/7.

'SUPER' MINOR. Diameter 1in. Height $\frac{9}{16}$ in.

Retail prices: With inscription—Walnut or Ivory 1/6.
Without inscription—Walnut 1/-. Ivory 1/2.

The introduction of these mouldings supplements, but does not replace, our already popular types 'A' and 'B'. You now have an even wider choice. Attractive quantity rates can be quoted to bulk buyers.



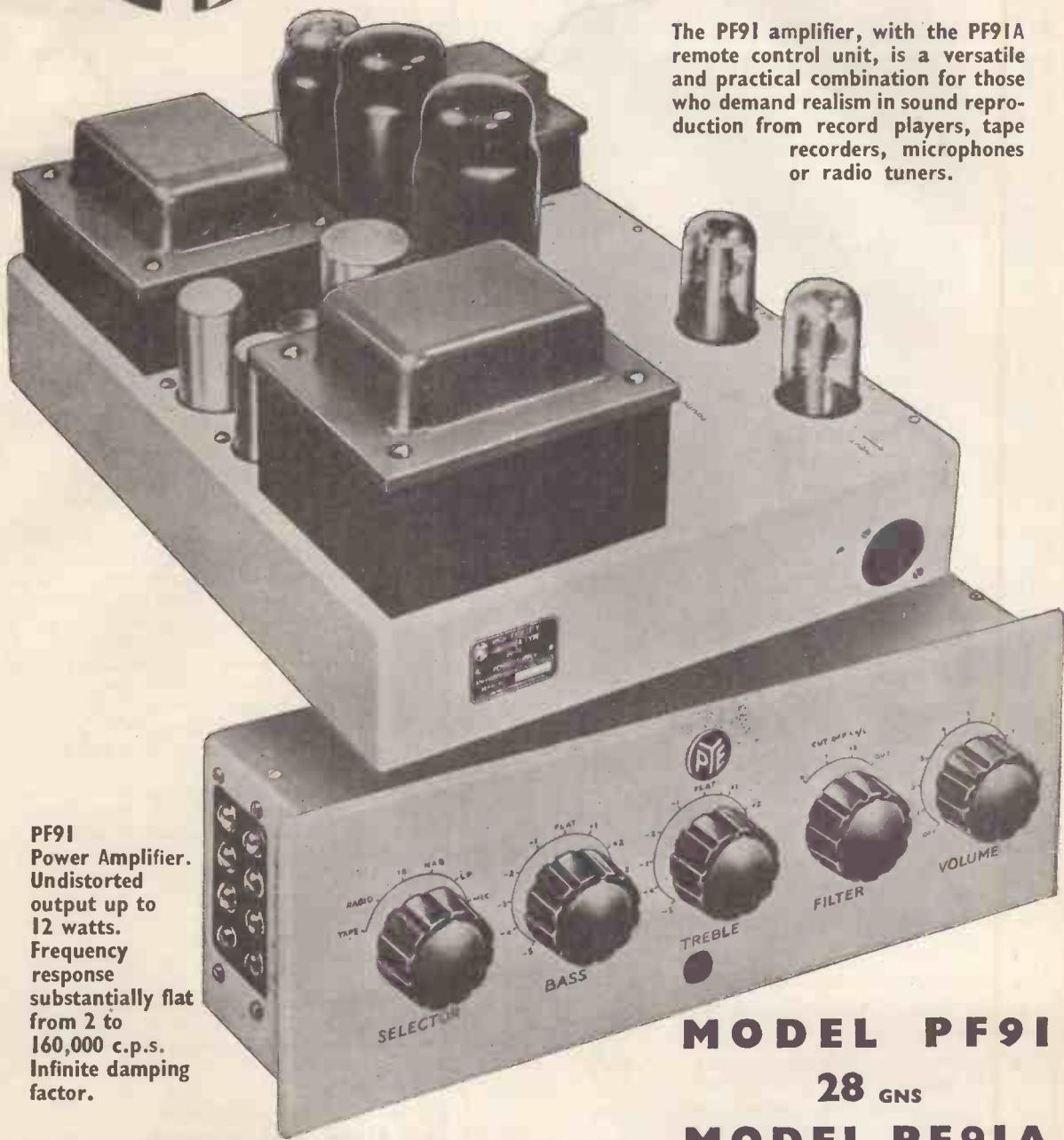
UNCLES, BLISS & CO. LTD

139, Cherry Orchard Road, East Croydon, Surrey.

Croydon 3379/6390



Hi Fi INFINITE DAMPING FACTOR AMPLIFIER



PF91
Power Amplifier.
Undistorted
output up to
12 watts.
Frequency
response
substantially flat
from 2 to
160,000 c.p.s.
Infinite damping
factor.

Demonstrations of the PF91 can be arranged through Pye Hi-Fi agents. Please write for a fully illustrated booklet to Pye Limited, Box 49, Cambridge.

The PF91 amplifier, with the PF91A remote control unit, is a versatile and practical combination for those who demand realism in sound reproduction from record players, tape recorders, microphones or radio tuners.

MODEL PF91

28 GNS

MODEL PF91A

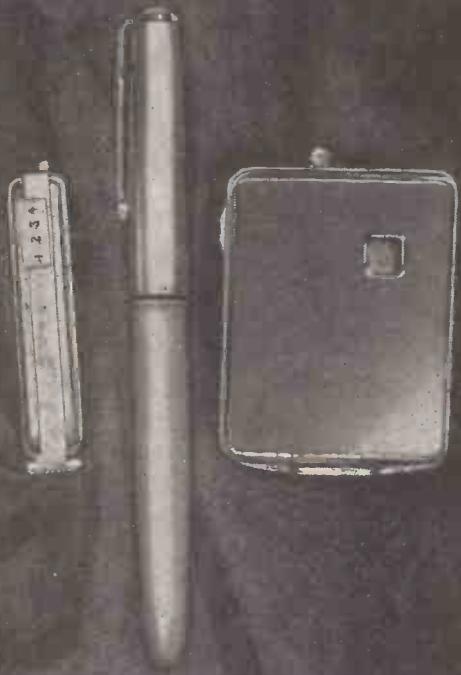
12 GNS

P Y E L I M I T E D • C A M B R I D G E • E N G L A N D
and EIRE • AUSTRALIA • NEW ZEALAND • CANADA • SOUTH AFRICA • U.S.A. • MEXICO

MULTITONE

SPECIALIZE

in equipment for the DEAF
and for PHYSIOTHERAPY



The MINUET ALL-TRANSISTOR HEARING AID

This 4-stage Resistance Capacity Coupled Transistor Amplifier has a crystal microphone and is powered by the small Mallory cell Type RM625. It is, we believe, the lightest, slimmest and most elegant 4-stage Hearing Aid in existence.

- ★ Weighs only 1½oz. complete.
- ★ Can be worn by ladies in the hair; by men, behind a coat lapel or necktie.
- ★ The single battery lasts approx. 200 hours. NO high tension battery required.
- ★ Two-position Tone Control; ample volume for the majority of the hard-of-hearing.

Inquiries should be addressed to

MULTITONE ELECTRIC CO. LTD.
223-227 St. John Street, London, E.C.I.

PIONEERS IN SOUND AMPLIFICATION

Opportunities In Component Development

The Plessey Co. Ltd. is continuing the expansion of its laboratories associated with the production of radio, electronics, and electrical components at Ilford and in other areas of Southern England. There are projects planned or in progress embracing many types of components for Government service, including interesting work in connection with high temperature operational conditions. The design of many components used in the commercial field is also being reviewed so that advantage can be taken of recent developments in special purpose production plant, together with improved techniques and materials.

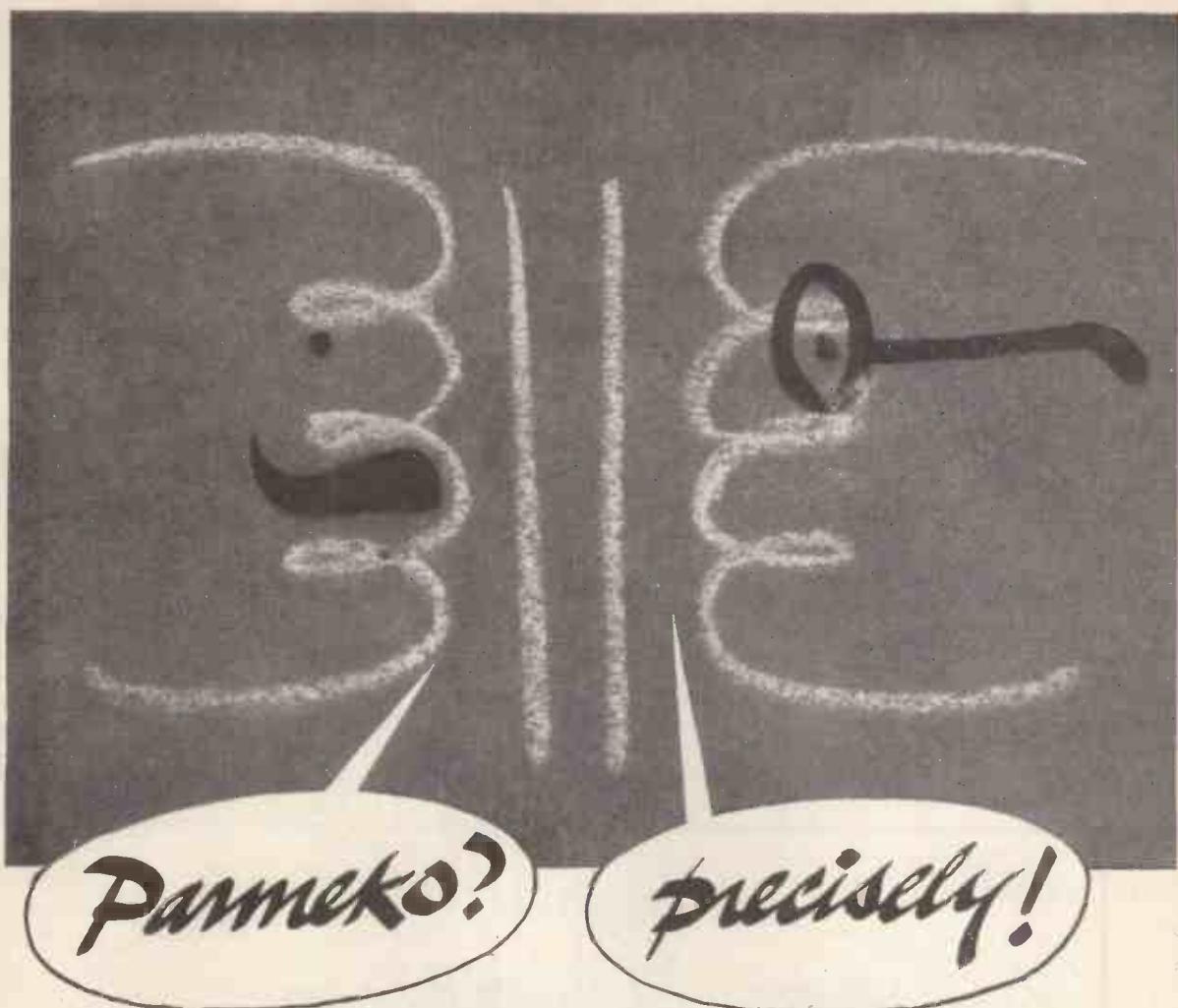
There are vacancies for technical staff to engage in the following fields of activity

Variable Capacitor and Switch design
Transformer design
Television circuit development
Television Scanning Components
V.H.F. and U.H.F. Tuner development
Vibrator and Relay design
Vibrator Power Unit Investigations
R.F. and I.F. Inductors
Loudspeakers, Pick-ups and Transducers
Type approval testing and materials investigation.

Engineers and Physicists with experience of mechanical or electrical design, circuit technique or production methods will be eligible for posts as product development engineers, and there are several senior posts where the ability to direct a team of assistants is required. A degree or associate membership of a professional institution is preferred but extended practical experience will be an acceptable substitute in some cases. Vacancies also occur for both senior and detail draughtsmen. Applicants experienced in the design of small mechanisms or familiar with mass production methods will be favourably considered. Young men wishing to obtain experience of design and manufacturing problems will find good opportunities for extending their training in a practical direction. Those about to complete courses at university or technical college and National Servicemen technicians due for release in the near future will be accepted as technical assistants or trainee draughtsmen to engage in one or more of the fields listed above. There are excellent opportunities for advancement to more senior positions. All positions on the laboratory staff are permanent and pensionable, while salaries and working conditions are fully comparable with those existing elsewhere in the engineering industry.

*Applicants should write in confidence to
THE PERSONNEL MANAGER,
THE PLESSEY COMPANY, LTD.
ILFORD, ESSEX,
giving particulars of training,
experience, and age.*





What's this thing between us, George, that prevents our seeing eye to eye?

It's that darned line of Parmeko's. . . .

You mean that 'one-track mind' of theirs?

That's exactly what I do mean, old boy.

Aren't they a little off the rails, George?

Not on your transformers! Single purpose, single plant—one man, one job team of technicians—planning, perfecting, dreaming only transformers. . . .

But where does all this singlemindedness lead to, George?

To the finest transformers possible—and other things; as we shall see if, as they say in advertisements, we watch this space.

PARMEKO of LEICESTER

MAKERS OF TRANSFORMERS FOR THE ELECTRONIC AND ELECTRICAL INDUSTRY

SPECIAL EDITION

Osmor News

PUBLISHED MONTHLY

VOL. 1. No. 1.

MAY 1955

TECHNICAL RESEARCH RESULTS IN ADVANCED COIL PERFORMANCE !

F.M. Frequency Modulation comes to stay. OSMOR does its share in the design of coils and a really first-class circuit of complete receiver and tuner. Free circuit, point to point wiring diagram, and full constructional information. (Send 5d. in stamps.)

OSMOR 'Q' COIL PACKS

Size only $1\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$ with variable iron-dust cores and Polystyrene formers. Built-in trimmers. Tropicalised. Prealigned Receiver-tested and guaranteed. Only 5 connections to make.

All types for Mains and Battery Superhet and T.R.F. receivers. Ideal for the reliable construction of new sets, also for conversion of the 21 Receiver. TR1196, Type 18, Wartime Utility and others.



The NEW Osmor 'SWITCH PACK' is now ready! Complete and Prealigned full circuit included. State which station required. 2 M.W., 1 L.W. or 3 M.W. 48/- inc. P. Tax.

SUPER 'Q' For Maximum Selectivity

A full range is available for all popular wavebands and purposes. The magnetic screening of the cup prevents other components from absorbing the coil's power, thus maintaining the high "Q" value. Simple one-hole fixing. ★ Only 1in. high. ★ Packed in damp-proof containers. ★ Adjustable iron-dust cores. ★ Fitted tags for easy connection. L. or M.W. 5/- inc. CIRCUIT.

FREE!

Send 5d. (stamps) for fully descriptive literature including Circuit and practical Drawings. "The really efficient 5-valve Superhet", 6-valve s'het, 3-valve (plus rectifier) T.R.F. circuit. Battery portable Superhet circuit, Coil and Coilpack leaflets, and full radio and component lists, and interesting miniature circuits, etc.



OSMOR RADIO PRODUCTS
Limited (Dept. W65)
418 BRIGHTON ROAD,
SOUTH CROYDON, SURREY.
Croydon 5148/9
(Trade Enquiries Invited)

OSMOR STATION 7/6 SEPARATOR COMPLETE

The Separator may easily be tuned to eliminate any one station within the ranges stated and fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.

TYPE METRES	TYPE METRES	TYPE METRES
1-141-250	4-319-405	7-1450-1550
2-218-283	5-395-492	8-410-550 k.c.
3-267-341	6-455-567	

Special Separator to clear Radio Luxembourg, 10/6 each.

Our Technical Dept. will be pleased to answer any enquiry by manufacturers and others relating to circuits which OSMOR coils or coil packs are used or are intended to be used.

READERS' QUERIES!

Dear Sirs,
Can you suggest a cure for modulation hum, please?

To prevent modulation hum, connect a 10K resistor or R.F. choke from aerial to earth. This presents a low impedance to lower frequencies (such as 50 c.p.s. mains) and a high impedance to R.F. Acts as an anti-static shunt.

Dear Sirs,
I wish to increase the 1.4v output of my battery superhet to obtain maximum output. What valve do you recommend?
Mullard D.L.93.

THE NEED FOR

Quicker Servicing

THE B.P.L. UNIVERSAL TEST SET

Laboratory sensitivity combined with robust construction makes the B.P.L. Universal Test Set the ideal all-purpose set for electricians and radio engineers. Sensitivity is 20,000 ohms per volt for D.C. or A.C. and two ohms ranges allow precise measurement of low resistances. The easy-to-read two-colour dial and mirror scale provide added accuracy. Ranges: A.C./D.C. Volts: 10, 50, 100, 500, 1,000; D.C. Current: 100 μ A, 1 mA, 10 mA, 100 mA; Resistance: 0-10,000 ohms (first divn. 10 ohms), 0-1 megohm. List Price: £11.10.0 incl. test leads, subject to Trade Discount.

We also supply B.P.L. Super Ranges and D.C. Test Sets, Moving Coil and Moving Iron Panel Mounting Meters and a comprehensive range of Measuring Bridges and Electronic Testing instruments. Write to-day for full details.

LEADS TO

British Physical Laboratories

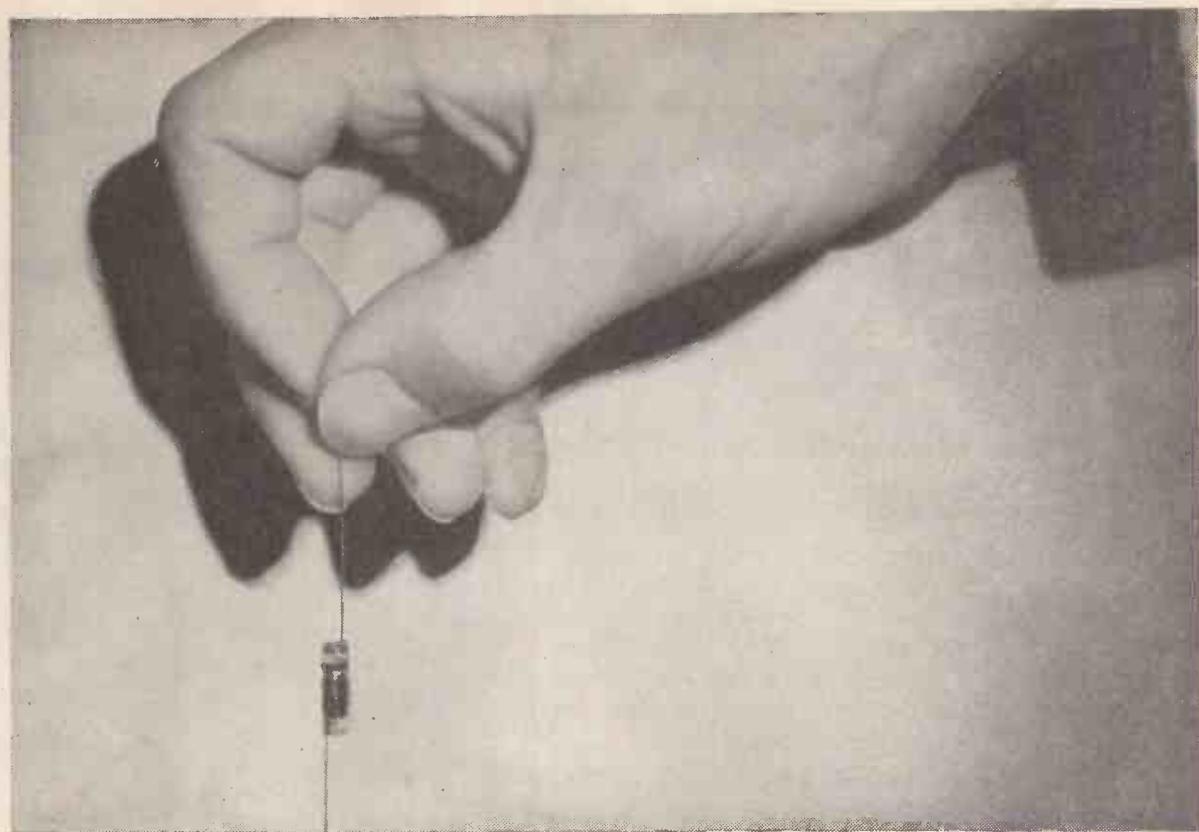
Radlett, HERTS.



Telephone: Radlett 5674/5/6

LONDON STOCKIST : M.R. SUPPLIES LTD., 68, New Oxford Street, W.C.1.

dm BP3



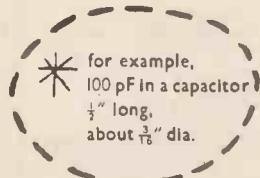
More
pF
per
in *

Suflex Polystyrene Capacitors

put a quart of capacitance into a pint of space.
If you have a problem which demands
a capacitor of excellent electrical performance
and the smallest possible size,
you may well find the solution if you
contact Suflex

SUFLEX
Limited

LONDON



The Suflex range of good electrical products includes
Polystyrene capacitors • Silicone/varnished insulating sleeving •
Plastic sleeving • Plastic covered wire • PVC/Nylon lacing cord •
Glass/Nylon dial drive cord • Copper wire braids • Cotton braids



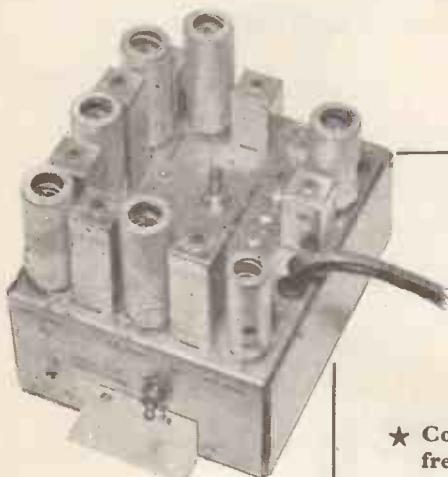
INDUSTRIAL ELECTRONICS

This Woden Transformer is typical of many supplied for Industrial Electronics and is for incorporation in a large R.F. Heater made by a well known manufacturer. Transformers in this field are individually and specially constructed to suit design of heater. Price is an important factor and all Woden Transformers are built at the lowest cost, consistent with first-class workmanship and materials, to guarantee the utmost reliability in service.

WODEN TRANSFORMER CO. LTD.

sm/W.2097 a.

MOXLEY RD., BILSTON, STAFFS. Telephone: Bilston 4195



**DYNATRON
RADIO LIMITED**

Sales Office :

"THE FIRS" CASTLE HILL
MAIDENHEAD, BERKS.

Tel. : MAIDENHEAD 3811/23

DYNATRON

PRE-TUNED F.M. TUNER
TRUE HIGH FIDELITY RECEPTION

OUTSTANDING FEATURES

7-VALVE F.M. TUNER — NOW IN PRODUCTION

- ★ Pre-tuned 3 programmes switch-operated
- ★ Automatic Frequency Correction
- ★ Complete freedom from frequency drift.
- ★ Connects to gramophone pick-up sockets of most receivers.
- ★ Range 88-95 m/cs. Output .2 v. R.M.S.
- ★ Separate Power Unit available.
- ★ Compact only 5½ x 6½ x 5½ in.
- ★ One knob operation.
- ★ Easily installed in most cabinets.
- ★ Chassis can be operated from either end.
- ★ Consumption 22 watts.

Prices : Tuner Type FMI £18/-
Power-Unit-PI - £6/15/-
PURCHASE TAX EXTRA.

VISUAL VALVE TESTER

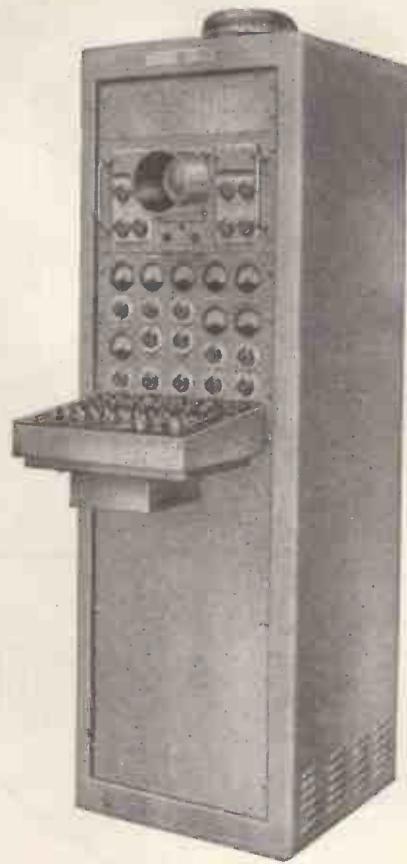
This equipment displays on a cathode-ray tube a family of I_a/V_g curves for any receiving type thermionic valve. Eleven curves corresponding to eleven different grid voltages are presented simultaneously and a calibrated graticule permits rapid comparison with published data.

Nine standard valve bases are provided, with facilities for connecting others, and the various valve electrodes are connected to the requisite supplies by a multi-button switching board.

This permits any electrode to be connected to any supply without damage and also enables electrodes to be paralleled for test purposes.

All external parameters V_a , V_s , V_h , V_g , are continuously variable over a wide range and current and voltage values are metered.

Full technical data is available on request.



CINEMA TELEVISION LTD

A COMPANY WITHIN THE J. ARTHUR RANK ORGANISATION

WORSLEY BRIDGE ROAD • LONDON • S.E.26
HITHER GREEN 4600

SALES AND SERVICING AGENTS:

Hawnt & Co. Ltd., 59 Moor St. Birmingham, 4

Atkins, Robertson & Whiteford Ltd., 100 Torrisdale Street, Glasgow, S.2

F. C. Robinson & Partners Ltd., 122 Seymour Grove, Old Trafford, Manchester, 16



Photograph by courtesy
The Acoustical Mfg. Co. Ltd.

MUREX SINTERED PERMANENT MAGNETS *are used in this new* **FERRANTI RIBBON PICK UP** (designed by D. T. N. Williamson)

Yet another example of the use of Murex Sintered Magnets where the need is for high flux density and magnetic stability. In this application, as in many others, Murex Sintered Magnets continue to give accurate and reliable service.

MUREX LIMITED (Powder Metallurgy Division)
RAINHAM • ESSEX Rainham, Essex 3322

London Sales Office: CENTRAL HOUSE, UPPER WOBURN PLACE, W.C.I. EUSTON 8265



ELPICO Amplifying EQUIPMENT



A high-quality versatile A.C. amplifier with a maximum power output of 16 watts (rated 12.5 watts .1 per cent. distortion) for 3. or 15 ohms matching. This unit contains its own pre-amplifier with mixing facilities for mike, radio and gram. with disc equalization; and incorporates the latest Elpico 3.D tone control circuit.
MODEL AC 85. PRICE 22 gns. (AMPLIFIER ONLY).



Supplied complete with 2 transportable L10/6 corner loudspeaker units. PRICE 32 gns.

Pedestal stand crystal mike with internal volume control, 12ft. of cable and plug. MODEL M 401 V. PRICE 4½ gns.

Illustrated brochure with technical specification available on request.

LEE Products
GREAT BRITAIN
LIMITED

ELPICO HOUSE GT. EASTERN ST
LONDON E.C.2
Telephone BIS 0444 all lines

There's a
big future in
printed circuits
and dip-soldering—
consult ENTHOVEN
who can provide
everything necessary
to ensure perfect results

ENTHOVEN SOLDERS LIMITED

Enthoven House, 89 Upper Thames Street

London, E.C.4

MANSION HOUSE 4533

McMURDO

MICRONECTORS

MICRONECTORS
are precision
miniature connectors,
designed for instrument and
aircraft applications where
space is limited.

Plug and socket bodies
moulded in Nylon Loaded
P.F.

Contacts finished in pure gold plating to ensure ease of
soldering, low contact resistance, and long storage life
without corrosion.

Covers made of anodised aluminium fitted with sturdy cable
clamp.

The full range, which will shortly be available, will
include: 9, 18, 26 and 34 way.

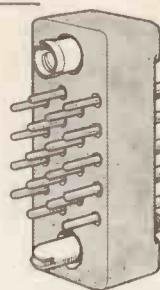
New Wholesale Agents:—Lugton and Company Limited,
209-212, Tottenham Court Road, London, W.1.
Telephone: MUSEum 3261.

For full details apply to:—

THE McMURDO INSTRUMENT COMPANY LTD., Victoria Works, Ashtead, Surrey. Tel.: Ashtead 3401.



Socket
MS18

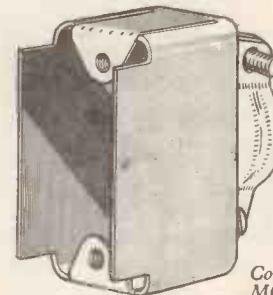


Plug
MP18

Actual size

18 way

now available



Cover
MC18/A

OMNI-DIRECTIONAL

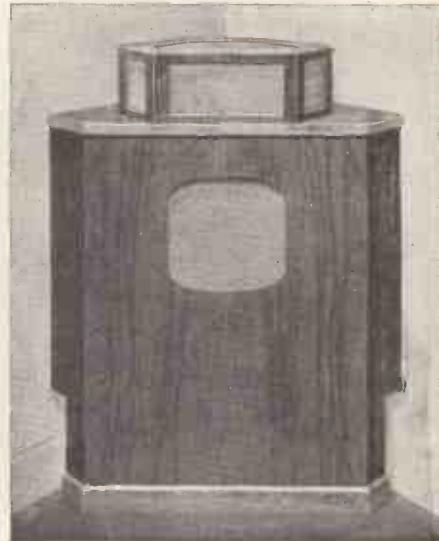
3-Speaker System

W15/CS SUPER 8/CS SUPER 5

Treble Units Facing Upwards Crossover Frequencies 800 and 5,000 c/s

The bass speaker is the W15/CS with a fundamental resonance below 30 C/S; the middle speaker is the Super 8/CS; and the third speaker is the Super 5 with response well maintained to 16,000 C/S. The crossover unit is a $\frac{1}{2}$ section type, with crossover frequencies of 800 and 5,000 C/S. A volume Control is now fitted to the middle and top speakers which also face upwards to avoid undue directional effects.

This Speaker System was demonstrated at the Royal Festival Hall on November 1st, 1954, and will again be used on May 21st, 1955. Festival Hall Demonstration, 21st May, 1955. 8-page Programme, including 3 pages of explanatory notes and full details of the records to be played, now available post free at 1s. each from Wharfedale Wireless Works, Ltd., Idle, Bradford, Yorkshire. Stamps acceptable.



PRICES (TAX FREE)

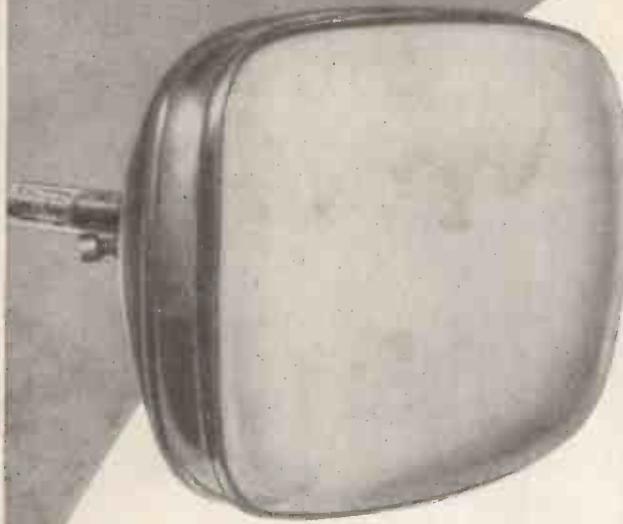
W15/CS sand-filled Enclosure	£47	0	0
Treble Assembly	£18	0	0
HS/CR3 Crossover with V.C.'s	£8	10	0

£73 10 0

2 Sand-filled Back Panels (40in. x 24in.) to complete the enclosure, where a suitable corner is not available, can be supplied at £12 per pair.

Wharfedale
WIRELESS WORKS LTD.
BRADFORD ROAD · IDLE · BRADFORD · YORKS
Phone: Idle 1235/6 (2 lines). Grams: Wharfde, Idle, Bradford.

This **ALUMINIZED** Picture tube gives



60% brighter pictures
more contrast
extra tube life

AN Ediswan Mazda aluminized picture tube gives a picture 60% brighter and more contrasty than is possible with an ordinary tube.

In addition, Ediswan aluminizing protects the screen from ion burn and, with the new Ediswan ion trap tetrode gun to protect the cathode, tube life is increased.

Ediswan production methods, which include the special in-line vacuumizing system, ensure a higher, more uniform standard of lasting efficiency. For complete satisfaction demonstrate and recommend Ediswan Mazda aluminized picture tubes.

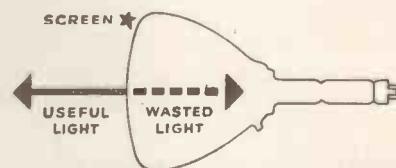
EDISWAN

MAZDA

ALUMINIZED CATHODE RAY TUBES

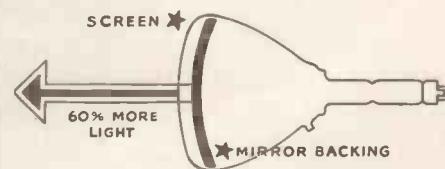
THE EDISON SWAN ELECTRIC COMPANY LIMITED,
155 Charing Cross Road, London, W.C.2 and Branches.

Member of the A.E.I. Group of Companies.



WITHOUT ALUMINIZING

Without aluminizing, tubes waste half their light (see diagram above). To counteract this the brilliance must be increased and the tube life is shortened.



WITH EDISWAN ALUMINIZING

Ediswan aluminized tubes have a mirror backing to the screen. All the light is thus thrown forwards giving brighter, clearer pictures and extra life.

NATION WIDE SERVICE

6 fully equipped cathode ray tube service depots provide better, quicker tube testing should the need arise. Stocks of tubes are available in 26 Ediswan Offices. Only Ediswan give such complete backing to the Trade.

MODERN ELECTRICS LTD.

164 Charing Cross Road, London, W.C.2.

Tel.: TEMple Bar 7587.

Cables: Modcharex, London.

Export enquiries welcomed.

TAPE RECORDERS

GRUNDIG TK12	£73 10 0
GRUNDIG TK819	£99 15 0
GRUNDIG TK9	£68 5 0
FERROGRAPH 2A/N	£79 16 0
VORTEXION 2A	£84 0 0
VORTEXION 2B	£99 0 0
SUPER EDITOR	£57 15 0
ACE (Batter*)	£52 0 0

RECORDING TAPES

GRUNDIG	
L.G.S. 1,200ft.	£2 0 0
850ft.	£1 14 0
600ft.	£1 5 0

FERROVOICE

1,200ft.	£1 2 6
Spare Spools	4 6
E.M.I. type 88, 1,200ft.	£1 15 0

GEVAERT

1,200ft.	£1 15 0
----------	---------

SCOTCH BOY

1,200ft.	£1 15 0
600ft.	£1 1 0
Spare Spools 1,200ft.	4 3
Spare Spools 600ft.	3 6

FERROGRAPH

1,200ft.	£2 5 0
1,750ft.	£3 3 0
8½in. Spools	9 6

AGFA

1,200ft.	£1 17 6
600ft.	£1 2 6
Lead on tape 150ft.	8 0

RECORD REPRODUCING EQUIPMENT

COLLARO TRANSCRIPTION	
Model 2000	£13 9 6
Model 2010	£18 6 6

GARRARD UNITS

RC80M AC	£17 9 6
RC80M AC/DC	£26 3 5
301 Transcrip	£25 3 6
Type TA/JAC	£10 16 0
Type TA/B w th Deca heads	£14 0 11

CONNOISSEUR

Variable 3 speed	£25 15 5
------------------	----------

SPEAKERS

W.B. STENTORIAN

HF.610	£2 10 6
HF.810	£3 0 6
HF.912	£3 9 6
HF.1012 tapped coil, 3, 7.5 or 15 ohms	£3 17 6

GOODMANS

Axiom 150 Mk. II	£10 5 6
Axiom 102	£9 18 2
Axiom 101	£6 12 1

WHARFEDALE

W15 CS	£17 10 0
Super 12 CS/AL	£17 10 0
W12 CS	£9 15 0
Golden 10 CSB	£8 6 7
Super 5 and 8 CS/AL	£6 13 3
Bronze 10in.	£4 12 9
Bronze 8in.	£3 4 0
W.B. Crossover Unit	£1 10 0
W.B. Tweeter Unit	£4 4 0

Immediate delivery from stock.

TEST EQUIPMENT

AVO

Model 8	£23 10 0
Model 7 (latest)	£19 10 0
Uniminor Mk. II	£10 10 0
Electronic Meter	£40 0 0
Wide Band Sig/Gen.	£30 0 0

VALVE CHARACTERISTIC

METER (new type)

D.C. MINOR

10kV MULTIPLIER FOR

MODEL 8

CARRYING CASES FOR

MODELS 7, 8 AND 40

£3 5 0

£3 0 0

£19 19 0

COSSOR

OSCILLOSCOPE 1035

... £120 0 0

OSCILLOSCOPE 1052

... £104 0 0

VOLT: CALIBRATOR 1433

£18 5 0

TAYLOR

ALL NEW TAYLOR TEST GEAR IN

STOCK.

PICK-UPS

ACOS HIG 20

... £3 8 4

DECCA

X.M.S. MAGNETIC

... £6 9 5

CONNOISSEUR

SUPER L/WEIGHT

... £9 9 11

SPARE HEADS

... £3 7 10

COLLARO STUDIO

TYPE O OR P

... £3 14 8

PROMPT ATTENTION TO POST ORDERS

LEAK

2 HEADS WITH DIAMOND STYLUS

... £20 19 9

MICROPHONES

ACOS

MIC 22 (CRYSTAL)

... £4 4 0

MIC INSERTS FOR ABOVE

... £1 0 0

MIC 16 (CRYSTAL)

... £12 12 6

MIC 35-i (CRYSTAL)

... £1 5 0

LUSTRAPHONE

M/J HIGH IMP.

... £5 15 6

RESLO

URA RIBBON

... £7 5 0

RVA RIBBON

... £9 0 0

VMC (LOW IMP.)

... £6 0 0

FILM INDUSTRIES

RIBBON

... £10 0 0

MICROPHONE STANDS

FLOOR, 3 EXTENSIONS

... £3 12 6

TABLE STAND

... £1 5 0

LEAK AMPLIFIERS

TL.10 COMPLETE

... £28 7 0

POINT 1, TL.12

... £28 7 0

POINT 2, TL.25

... £34 7 0

QUAD, MK. II

... £42 0 0

SOLON

NEW INSTRUMENT

IRON 200-250 V.

25 V.

... £19 8

ALL GARRARD, CONNOISSEUR, DECCA AND COLLARO HEADS, SAPPHIRE AND DIAMOND STYLUS

FOR THE ABOVE HEADS NOW AVAILABLE

Quartz Crystal Goniometer

For the production of high quality piezo-electric crystals it is necessary that the quartz blanks should be cut in a specified relationship to a given atomic plane and to a high degree of accuracy. This may be done simply, quickly and accurately by X-ray diffraction methods. The Hilger Quartz Crystal Goniometer was specially designed for this work.

A few of its outstanding features are:

1. Reading of angular measurement with an accuracy of 30 seconds.
2. Interchangeable crystal mounts for uncut quartz and finished blanks.
3. Easy reading of angle by optical scale projected on screen.
4. Reflection peak readings read direct from intensity meter mounted on apparatus.
5. Fine focus X-ray unit giving high intensity X-ray beam from a focus 0.04 mm. diameter.
6. Extremely sharp and narrow reflection peaks due to fine focus, giving increased accuracy and speed of reading.

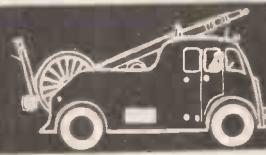
Please write for catalogue CH 381 (W.5) for further information.



HILGER & WATTS LTD., 98 St. Pancras Way, Camden Rd., London, N.W.1, England



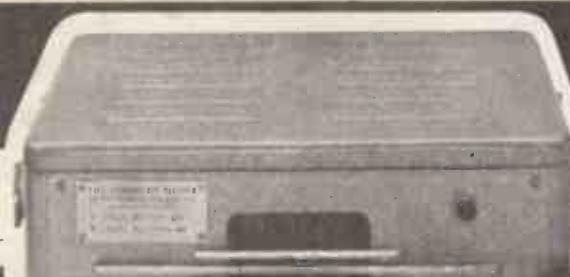
An important new achievement



a lightweight mobile transmitter/receiver 68U

has been added to B.C.C. range of communications equipment

68U designed and built with the same precision and care



as a scientific instrument,

has several new features



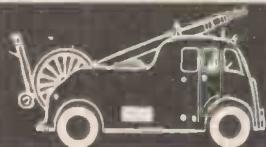
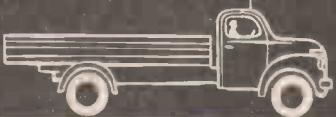
TYPE 68U.

VHF TRANSMITTER RECEIVER



which make 68U really outstanding in its class

B.C.C. sets the standard

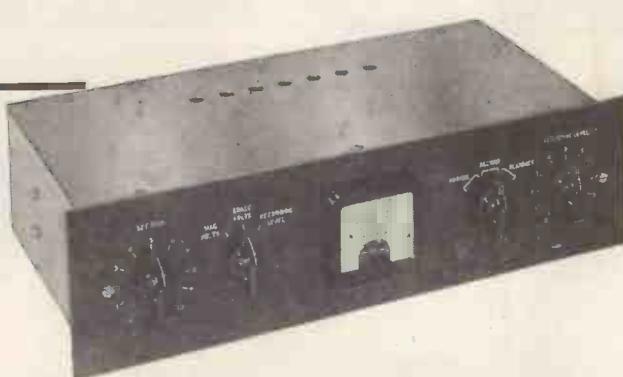


BRITISH COMMUNICATIONS CORPORATION LIMITED
Second Way, Exhibition Grounds, Wembley, Middlesex
Telephone : Wembley 1212

GOODSELL

T.W. 100 Tape Amplifier (below)

For use with Wearite "A" or "B" deck. Separate circuit for immediate playback when used with "B" deck. Meter monitoring facilities. With PFA pre-amplifier £45 complete.



Type PFA Pre-amplifiers (above)

The latest PFA unit is built especially for use with our range of Williamson Amplifiers. Separate bass and treble control in equaliser section. Low noise—high gain, 5 mv. input, 6 valves. Price £20.

★ Demonstrations of all these units at B.K. Partners Ltd., 229 Regent St., London, W.I., and Classic Electric Co. Ltd., Croydon.

GOODSELL LTD.

40 Gardner Street · Brighton I · Sussex
Tel.: Brighton 26735

Industry is Solving Valve Testing Problems

WITH THE

Mullard HIGH SPEED VALVE TESTER



Industries which deal extensively with radio and other electronic equipment are finding the Mullard High Speed Electronic Valve Tester ideal for routine checks. This instrument provides the quickest method of checking large quantities of valves, and can be operated if necessary by non-technical personnel after only a few minutes' instruction. Write for full details and a copy of the folder "High Speed Testing in Industry" to Department E.V.D. at the address below.

Mullard



MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, W.C.2

A HIGH Mu PENTODE with low hum, noise and microphony

TYPICAL OPERATING CONDITIONS

Anode Voltage (Va)	... ...	250	250	250	250
Screen Voltage (Vg ₂)	... ...	80	100	160	200
Grid Bias (Vg ₁)	... ...	1.25	1.7	2.75	3.5
Anode Current (mA)	... ...	7.8	7.9	10.5	12.3
Screen Current (mA)	... ...	2.45	2.5	3.3	3.85
Mutual Conductance (mA/V)	...	7.0	7.0	7.45	7.6
Anode AC Resistance (ra) (Megohms)	...	0.55	0.55	0.4	0.3
Input Capacity (Hot) (μμF)	...	20	19.9	19.7	19.5

RATING

Heater Voltage	... ...	V _h	4.0
Heater Current (Amps)	... ...	I _h	1.0
Maximum Anode Voltage	... ...	V _a	250
Maximum Screen Voltage	... ...	V _{g₂}	250
Mutual Conductance (mA/V)	...	g _m	7.7

Taken at V_a=250; V_{g₂}=100; V_{g₁}=1.5

BASE

British 7 pin	Pin No. 5 Heater
Pin No. 1 Metallising	Pin. No. 6 Cathode
Pin No. 2 Anode	Pin No. 7 Screen (g ₂)
Pin No. 3 Suppressor Grid (g ₃)	Top Cap Control Grid (g ₁)
Pin No. 4 Heater	

The AC/SP3 RH is available in two grades. The valves in both grades are characteristically identical, the grading 'A' or 'B' relating only to relative levels of hum, noise and microphony. B Grade valves are suitable for the majority of applications, but for particular applications where the noise level is very important Grade A may be preferred.

Under typical operating conditions with V_a=250v, R_a=150 KΩ, R_g=150 KΩ, R_{g₂}=500 KΩ, R_k=1 KΩ, with the heater fed from a centre-tapped A.C. supply the equivalent hum voltage at the grid of an average grade A valve is approximately 5μV, whilst the combined noise (excluding hum generated by the valve and grid resistances, using a high quality A.F. amplifier) is not greater than 8μV.

The following table compares the noise, hum and microphony from the two grades of valve.

HUM 'A' × 5.6 down on 'B'	NOISE 'A' × 2 down on 'B'
MICROPHONY 'A' × 8 down on 'B'	

SV3



THE EDISWAN MAZDA AC/SP3 RH
is an indirectly heated Pentode with a special heater-construction designed to reduce hum due to A.C. fields within the valve.

Provided precautions are taken to minimise hum due to external wiring, the AC/SP3 RH may be used in the early stages of amplifiers where the reduction of hum, noise and microphony is of primary importance.

Full technical information on request.

EDISWAN

MAZDA

VALVES & CATHODE RAY TUBES

The Edison Swan Electric Co. Ltd.
155 Charing Cross Road, London, W.C.2
and Branches

Member of the A.E.I. Group of Companies

Telephone: Gerrard 8660. Telegrams: Ediswan, Westcent, London

FIDELITY WITH ECONOMY

Is that possible? YES! The answer is to be found in the now complete range of "BAKERS Quality Speakers" comprising some 14 models covering the requirements of both the "Quality" enthusiast and the more general purpose Public Address. Further information on the above, including constructional details of suitable enclosures, will be gladly forwarded on request.

THE 12" 15W. DE LUXE MK. I & MK. II

ALL EXPORT enquiries to:-

JOHN LIONNET & COMPANY,
62-63, Queen Street, London, E.C.4.

PROMPT QUOTATIONS WILL BE SUBMITTED ON REQUEST

BAKERS
'Selhurst'
RADIO

Please write for full details to:

24 DINGWALL ROAD, CROYDON, SURREY.

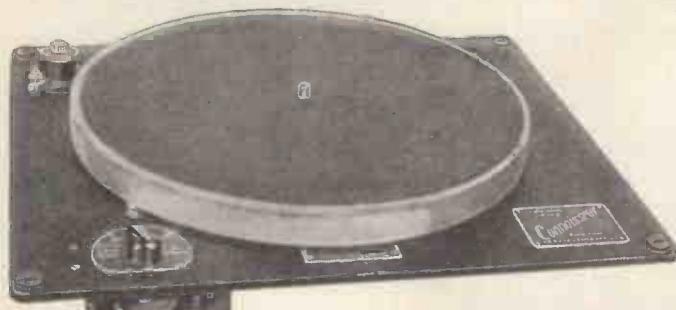
Croydon 2271/2

Sole Distributors for Eire: BRIAN CURRAN, 283, Harold Cross Road, TERENURE, DUBLIN



Connoisseur

VARIABLE 3-SPEED GRAMOPHONE MOTOR



CONNOISSEUR Super Lightweight 3-head Pickup with Sapphire Stylus

Prices: Complete Pickup with one head (either Standard 78 r.p.m. or Microgroove 33½ or 45 r.p.m.) £4 10s. 0d. + P.T. £1 12s. 1d. Total £6 2s. 1d. Each additional head £2 10s. 0d. + P.T. 17s. 10d. Total £3 7s. 10d. Replacement Armature 10s. 3d. + P.T. 3s. 8d. Total 13s. 11d.

Fitted with Diamond Stylus, complete Pickup with one head £7 12s. 9d. + P.T. £2 14s. 5d. Total £10 7s. 2d. Each additional head £5 12s. 9d. + P.T. £2 0s. 2d. Total £7 12s. 11d. Replacement Armature £3 13s. 0d. + P.T. £1 6s. 0d. Total £4 19s. 0d.

We present an entirely new three-speed unit operating at 33½, 45 and 78 r.p.m. The full 12" turntable is lathe-turned and manufactured of non-ferrous material. The main spindle is precision ground and lapped to mirror finish and runs in phosphor bronze bearings. The synchronous motor is dynamically balanced and resiliently mounted, making it virtually vibrationless, with low noise level and low hum induction.

The speed change is arranged mechanically and gives a 2% variation on all speeds, the synchronous motor running at constant speed at all settings. No braking action is employed to obtain speed change.

It is suitable for playing standard transcription and micro-groove recordings. Input voltages 200/250 v. A.C. 50 cycles or, as specified to order for 200/250 v. A.C. 60 cycles, or 110 v. A.C. 50 or 60 cycles. Mounted on 4" die-cast board 15¾" x 13¾" with 3½" clearance distance below motor-board. Speed selector turret is fitted at left rear of motor-board. On-off switch at left front also releases pressure on the rubber drive assembly. All motorboards are drilled to take Connoisseur Standard and Super Lightweight Pickups unless otherwise ordered. When used with these pickups mounted in position, 3½" clearance above motorboard is recommended.

Price: £19 + P.T. £6 15s. 5d. Total £25 15s. 5d.

OVERSEAS AGENTS: S. Africa: W. L. Proctor (Pty) Ltd., 63 Strand Street, Cape Town. Australia: J. H. McGrath & Co. Pty. Ltd., 208 Little Lonsdale Street, Melbourne. Canada: The Astral Electric Co. Ltd., 44 Danforth Road, Toronto 13, Ontario. New Zealand: Turnbull & Jones Ltd., Head Office, 12/14 Courtenay Place, Wellington. Hong Kong: The Radio People Ltd., 31 Nathan Road, Hong Kong. Malaya: (Main Distributors) Eastland Trading Co., 1 Prince Street, Singapore. U.S.A.: (Main Distributors) Danby Radio Corporation, 2042 Chestnut Street, Philadelphia, 3, Pa. Audio Supply Laboratories, Nickels Arcade Buildings, Ann Arbor, Michigan.

A. R. SUGDEN & CO. (Engineers) LTD.
WELL GREEN LANE : BRIGHOUSE : YORKSHIRE
Phone: Halifax 69169. Grams: Connoisseur, Brighouse

A NEW TECHNIQUE IN HIGH SPEED WAVEFORM MONITORING

BANDWIDTH :

10 kc/s to 300 mc/s

INPUT IMPEDANCE OF EACH PROBE :

Approx. 1 pf (input element of variable capacity divider)

MAXIMUM SENSITIVITY :

Full Scale Deflection for 1 Volt input

TIME SCALE :

Variable from .05 microsecs to 5 microsecs

RECURRENCE RATE OF MONITORED WAVEFORM :

100 c/s to 10 kc/s

CALIBRATION :

Provision is made for accurate measurement of time and voltage scales of a waveform

PREVENTION OF JITTER :

A circuit is incorporated for providing a stable display when a monitored waveform is jittering with respect to its driving pulse.



HIGH SPEED RECURRENT WAVEFORM MONITOR TYPE 500

The wide bandwidth and high sensitivity of the instrument as well as the very high input impedance result from the use of a sampling technique.

During each recurrence a measurement is made of the instantaneous amplitude of one point in the waveform. This measurement is amplified and applied to the cathode ray tube as one co-ordinate of a graph of the waveform. During subsequent recurrences, instantaneous measurements are made of different points, resulting, after about 100 recurrences, in a complete graph.

Please write
for further
information;

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

Member of the AEI group of companies

Leading Electrical Progress

THE NEW GRUNDIG TK12

is perfectly attuned to
the New V.H.F.



FOR the new V.H.F. broadcasts you need the new Grundig TK12 Two-speed Tape Recorder. Those owners of the TK12 who tune in to Wrotham, 91.4 and 93.8 mc/s, will be thrilled with its possibilities for high-fidelity recording. The same satisfaction will be enjoyed when the proposed eight additional high-power transmitting stations start operating throughout the country, in Band II (88-95 mc/s), on wavelengths of approximately 3 meters.

Similar in size to the popular Grundig TK9, the TK12 has 2 speeds: 7½ ins./sec. with frequency range of 50 to 12,000 c.p.s. and 3½ ins./sec. with frequency range of 50 to 9,000 c.p.s. It is in the middle price group and within the range, in every sense of the word, of all wireless fans and experimentalists.

GRUNDIG (Gt. Britain) LTD., (Dept. W.W.)
39/41 New Oxford Street, London, W.C.I
(Electronics Division, Gas Purification and Chemical Co. Ltd.)

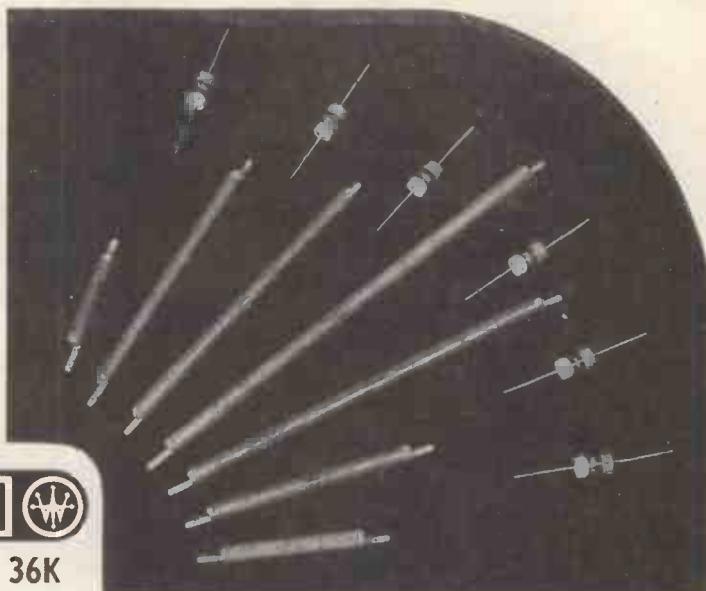
- **SPECIAL FEATURES**
 - *Two Speeds.* Track Buttons identify which Track has been used. *Magic Eye* tuning for sound modulation if Illuminated time running Indicator.

GRUNDIG

TK12

 - PRICE 70 GNS. (less microphone).
 - Ribbon Microphone GRM 1Z 12½ gns.
 - Dynamic Microphone GDM 5Z 6½ gns.

Developed for use in very high voltage-low current circuits, these rectifiers give approx. 600 volts output for each inch of length. The highly insulated tubular construction and the end tags for soldering enable them to be wired directly into circuit, whilst, providing adequate insulation is present, there is no limit to the number that may be connected in series. Below are tabulated some of the many types available in this range of:



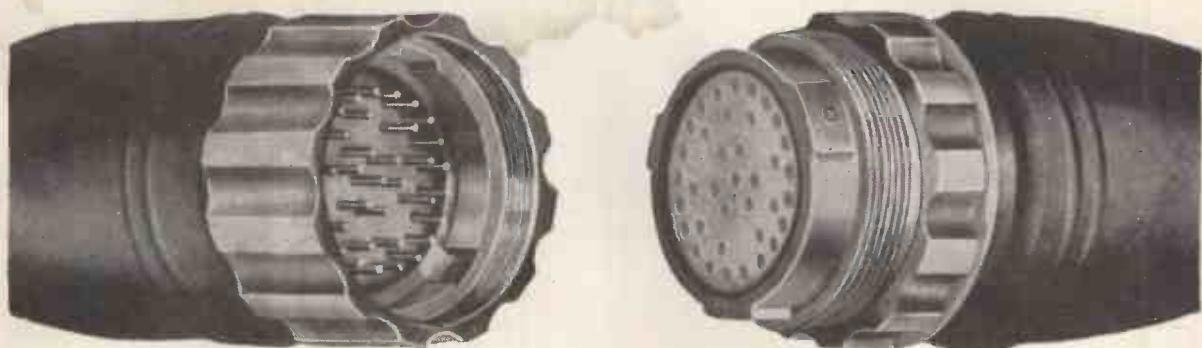
RECTIFIERS TYPE 36EHT & 36K

TYPE No.	PEAK INVERSE VOLTAGE	R.M.S. INPUT VOLTAGE	OUTPUT VOLTAGE		PEAK PULSE VOLTAGE	TYPICAL OUTPUT VOLTAGE 100 μ A
			100 μ A	2 mA		
36K1	85	27	35	30	—	—
36K6	510	162	210	185	—	—
36K14	1190	378	490	440	—	—
36EHT25	2125	675	875	820	1810	1640
36EHT70	5950	1890	2450	2320	5080	4580
36EHT100	8500	2700	3500	3250	7250	6550
36EHT130	11050	3520	4550	4300	9420	8500
36EHT240	20400	6480	8400	7900	17400	15700

For further information on EHT rectifiers, write for Data Sheet No. 60 to:
Dept. W.W.5.

WESTINGHOUSE
BRAKE & SIGNAL CO. LTD.
82 York Way, King's Cross, London, N.1
Telephone : *TERminus* 6432

TELEVISION

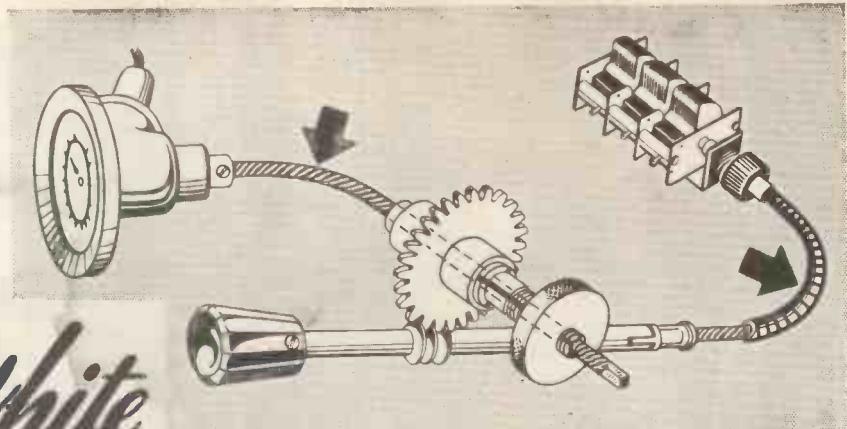


In the impressive link-up of national television services, large numbers of BICC Multi-Unit Cables and Polypole Couplers were used throughout Europe. They were employed with both V.H.F. link equipment and T/V cameras. These cables and couplers are designed to provide a robust trailing cable system to withstand the hazards of outside television service. For further information please ask for Publication T.D.T.15.

BICC multi-unit cables and polypole couplers

BRITISH INSULATED CALLENDER'S CABLES LIMITED
21 BLOOMSBURY STREET, LONDON, W.C.1





S.S. White

FLEXIBLE SHAFTING

for REMOTE CONTROL of ELECTRONIC EQUIPMENT

- RADIO TUNING
- INSTRUMENT CONTROL
- COMPONENT COUPLING

Flexible Shafts give freedom in design because they can be run between any two parts and eliminate alignment problems.

The S. S. White Company produce Remote Control Shafts to meet any requirement.

THE *S.S. White* CO. OF GREAT BRITAIN LTD.
INDUSTRIAL DIVISION

Britannia Works, 25-31 St. Pancras Way, London, N.W.1
Telephone : EUSton 5393



Junction

TRANSISTORS for hearing aids



Illustrations
are actual
size

The smallest glass-encapsulated transistor in the world; a result of the specialised valve manufacturing techniques pioneered by HIVAC. Hermetically sealed against moisture.

All British manufacture throughout.

Contains a germanium junction element manufactured by



The new HIVAC junction transistor type XFTI, because of its extremely small size and high performance, is the perfect element for all stages of the most modern Hearing Aids.

Dimensions are only 5.3 x 3.8 x 15 mm.

Hivac Ltd

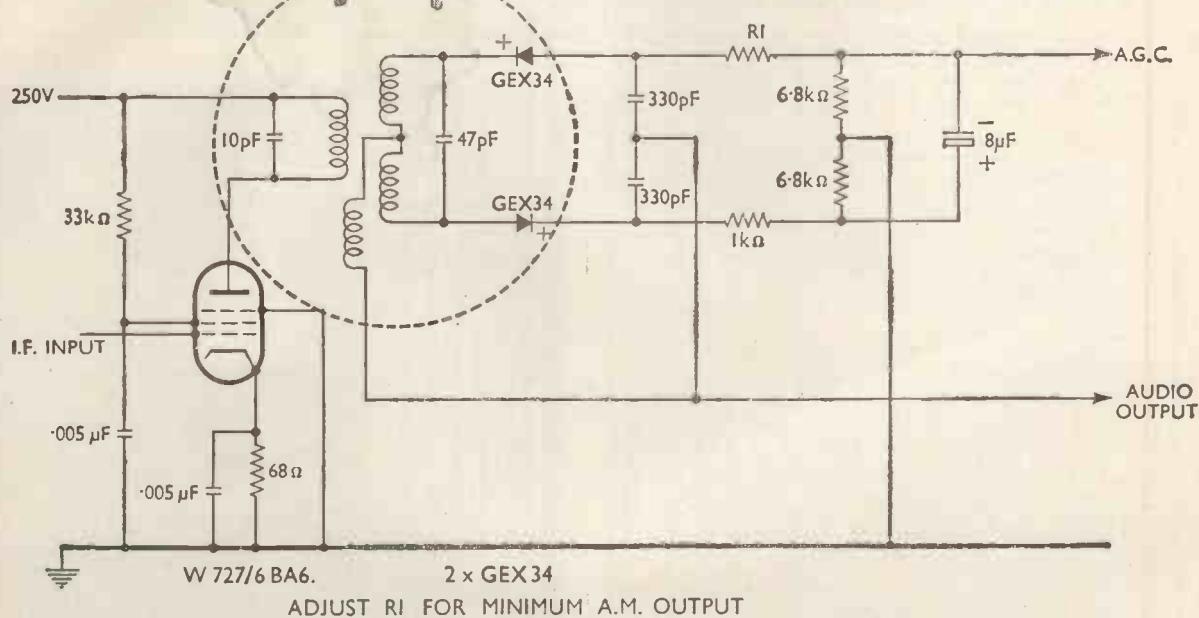
STONEFIELD WAY, VICTORIA ROAD, Telephone:
SOUTH RUISLIP, MIDDLESEX. Ruislip
3366

GERMANIUM DIODES



GEX 34 in the Ratio Detector

The Ratio Detector has been generally accepted as the most practical form of detector for receivers designed for the new High Quality F. M. Service since it obviates the need for a separate limiter stage. The illustration shows the application of two GEX 34 in a typical ratio detector where full advantage has been taken of its small size by enclosing them in the I.F. transformer can. This construction reduces the risk of instability and eliminates the possibility of harmonic feed back via the heater leads.



Transformer Design. Although the circuit shown above is conventional, an I.F. transformer designed for use with thermionic diodes is not necessarily the most suitable for germanium diodes. A suitable design of transformer has been evolved at The G.E.C. Research Laboratories, details of which are available on request.

Rola Celestion

The Final Word

In all radio reproduction it is the LOUDSPEAKER which has the Final Word. It is the LOUDSPEAKER which finally determines the quality of reproduction.

The finest radio receiver in the world can only give indifferent results if fitted with an indifferent LOUDSPEAKER.

It is the LOUDSPEAKER which re-creates the sound and it is the LOUDSPEAKER above all which must be BEYOND REPROACH.

We have loudspeakers for every purpose and set manufacturers are invited to collaborate with us on all problems relating to sound reproduction.



Model P44
Lightweight 12" Loudspeaker

Rola Celestion Ltd.

FERRY WORKS,
THAMES DITTON, SURREY
Telephone: Emberbrook 3402-6

M. R. SUPPLIES Ltd.

For high quality materials at the most attractive prices. Rapid delivery from the diligent and enthusiastic service. All prices nett.

CONVECTOR HEATERS, 3 kilowatt. 230/250 v. 50 c. Fitted Delco induction motor, silent running. In tilt housing 11in. square by 8in. deep by 14in. overall height. Many industrial and domestic applications. A few, in new condition. £6/18/6 (des. U.K. 9/-).

LOW VOLTAGE MOTORS (Klaxon) 6-volt D.C., for model makers, car fans, etc.. 3in. dia. 2½in. deep, with ½in. shaft projecting 1in., 9/6 (des. 1/3). **ROTARY RESISTANCES** for small motor control, battery chargers, etc., "Ohmite" 350 ohms 25-watts, 4/6. 50 ohms 1 amp., 7/6. Cressall 30 ohms 2 amps., 15/- All wire wound and new (des. any one, 9d.).

HOOVER AIR BLOWERS, 230 v. A.C., portable type with handle in housing. 7in. dia. by 6in. deep, outlet 2in. dia. The 8,000 r.p.m. motor gives very high duty performance. £3/17/6 (des. 3/6).

ONE-HALF H.P. MOTORS, brand new capacitor/induction (with capacitor fitted to motor), 230 v. 50 c. 1 ph., ball bearings, 1,425 r.p.m., reversible, shaft ½in. dia. by 2in. proj. Very special limited offer, £7/5/- (des. U.K. 7/6).

F.H.P. GEARED MOTORS. Immediate delivery from the largest stockists in London.

Full details in our new list (GM/34) for all applications. **GEARED MOTORS**. Large choice of brand new units, off the shelf. All with leads brought out for reversing, all continuous rated—Series wound, 220/240 v. A.C./D.C. final speed 100 or 50 r.p.m., overall length 6½in. either £5/17/6 (des. 2/6). Capacitor/Induction, 100 r.p.m., 46 r.p.m., 33 r.p.m. and 17 r.p.m. with capacitor, £8/17/6 (des. 2/6). Also Cap. Ind. High duty models, 60 r.p.m. (35 lb. in.), overall length 5in. £10/10/- also same model 20 r.p.m., same price. Also 10 r.p.m. and 1 r.p.m. (50 lb. in.), overall length 10in., either £14/10/- (des. 8/-). And many others. Please send us your F.H.P. Geared Motor enquiries. We are supplying many of the large industrial firms.

SEWING MACHINE MOTOR OUTFITS (Complete). Really high quality job at about half usual price. 200/250 v. A.C./D.C., including motor, foot control, needle light, belt, etc., with instructions for easy installation on any machine, £6/15/- (des. 2/6).

SMALL GEAR BOXES. Double worm gear, 300/1 reduction, in die-cast housing 2½in. x 2½in. x 2in. Final shaft ½in. dia. by 1½in. proj. Ball bearings, transmission up to 1/10th H.P., 45/- (des. 1/6).

SYNCHRONOUS ELECTRIC CLOCK MOVEMENTS. (Again in stock!) 200/250 v. 50 c., with spindles for hours, minutes and central seconds hands, in plastic dust cover 3½in. dia., 2in. deep, with flex ready for use, 27/6 (des. 1/-). Set of three hands, in good style, for 5½in. dial, 2/-.

DUAL ELECTROMAGNETIC COUNTERS. Operation 20/24 v. D.C. (or 50 v. A.C.) with timer, with two separate sets. Each contains two separately energised counters each counting up to 9,999 (speed up to 1,000 operations per minute). In cylindrical housing 3½in. dia. by 5in. deep, suitable for panel mount. Brand new, each in moisture-proof pack, 37/6 (des. 2/-).

EXTRACTOR FANS, 200/250 v. A.C. (induction motor—no interference). With mounting frame and back grille, ready for easy mount, 8in. Impeller (12,000 c.f./hr.), £2/5/-, with 10in. impeller (15,000 c.f./hr.), £5/12/6 (des. either 2/6).

MICRO-PUMPS (first-class makers) 0/50 microamps, 1st grade microcoil in projection housing 3½in. dia. by 4in. proj., 52/6 (des. 1/6).

We are stockists of Philips Variable Transformers, Stuart Electric Pumps. G.E.C. Metal Cone Speakers.

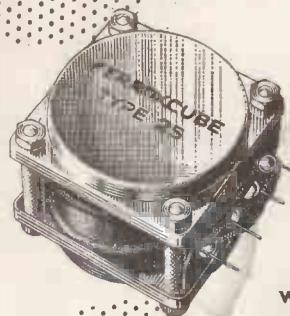
M. R. SUPPLIES, Ltd., 68 New Oxford St., London, W.C.1.
Telephone: MUSEum 2958



Quartz Crystals of any shape and size cut and ground precisely to specification and coated, if required, with Gold, Silver, Aluminium or Rhodium, etc.

BROOKES CRYSTALS LTD

Suppliers to Ministry of Supply, Home Office, B.B.C., etc.
181/3 TRAFALGAR ROAD, GREENWICH, LONDON, S.E.10
Phone: Greenwich 1828
Grams: Xtals Green, London. Cables: Xtals, London



High Q inductance coils

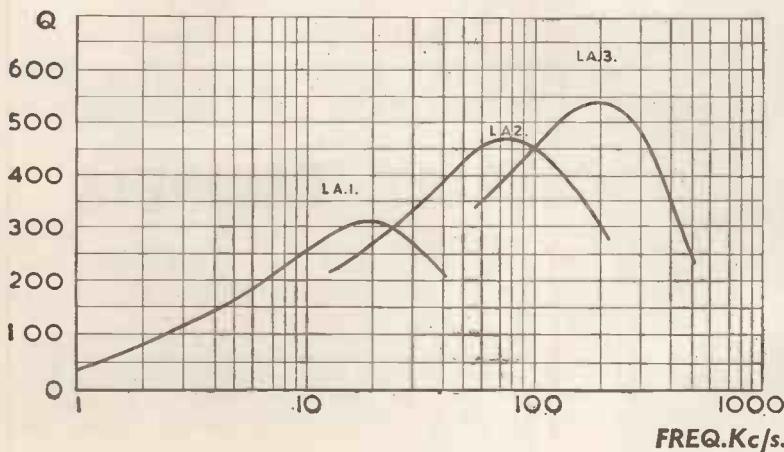
wound on Ferroxcube cores

DESIGNERS of compact and efficient tuned circuits and wave filters are making ever-increasing use of Mullard high Q inductance coils.

Based on Ferroxcube, the world's most advanced magnetic core material, these coils combine small size with an inductance of up to 30 henries over a wide frequency range. Furthermore, their convenient shape and self screening properties facilitate either individual mounting or stacking.

Full details of these and other high grade components now available from Mullard will be gladly supplied on request.

TYPICAL Q VALUES



Special Features

- Small size
- Low hysteresis loss factor
- High value of inductance
- Low self capacitance
- Controllable air gap facilitating inductance adjustment
- Self screening
- Controlled temperature coefficient
- Operation over a wide frequency range
- Easily mounted

Mullard



'Ticonal' permanent magnets,
'Magnadur' ceramic magnets,
Ferroxcube magnetic cores.

PREMIER RADIO CO.

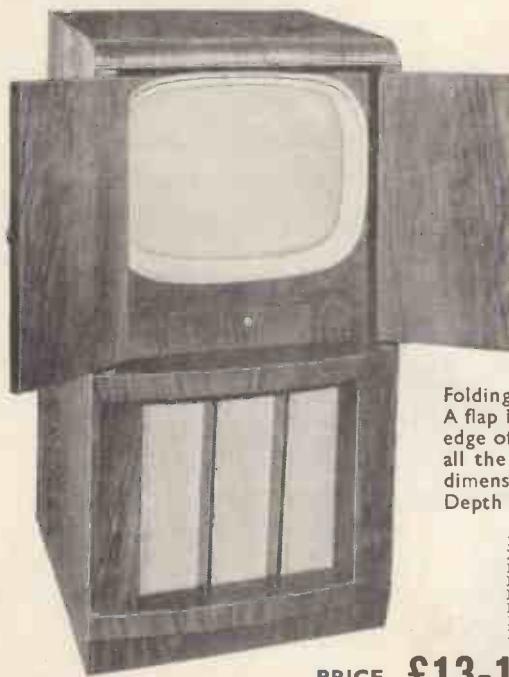
B. H. MORISS & CO. (RADIO) LTD. EST. 40 YRS.

(Dept. W.W.) 207 EDGWARE RD., LONDON, W.2. Tel.: AMBassador 4033 & PADdington 3271

MAY BE
BUILT FOR
£30.00
(including all valves
(plus cost of CRT)



THE COMPLETE TELEVISOR IS SAFE TO HANDLE, BEING COMPLETELY ISOLATED FROM THE MAINS BY A DOUBLE WOUND MAINS TRANSFORMER. ALL PRESET CONTROLS CAN BE ADJUSTED FROM THE FRONT, MAKING SETTING UP VERY SIMPLE.



The NEW PREMIER TELEVISOR

SUITABLE FOR USE WITH ANY POPULAR WIDE ANGLE TUBE

Brief Technical Details are as follows:

20 valves (plus tube) Superhet Receiver, tunable from 40-68 Mc/s without coil or core changing. Wide Angle scanning Flyback EHT giving 14 kV. Duomag Focaliser, permanent magnet focusing with simple picture centring adjustments, suitable for any wide angle Tube, may also be used with a 12in. Tube with very minor modifications.

VISION CIRCUIT. Common RF Amplifier, single valve frequency changer, two IF stages, Video Detector and Noise Limiter followed by special type of Video Output Valve. ALL COILS PRE-TUNED ASSURING ACCURATE ALIGNMENT AND EXCELLENT BANDWIDTH.

SOUND CIRCUIT. Coupling from anode of frequency changer, two IF stages, Double Diode Triode detector and first LF Amplifier, Diode Noise Limiter and Beam-type Output Valve, feeding a 10in. Speaker. ALL COILS PRE-TUNED.

TIME BASES. 2 valve sync. Separator, giving very firm lock and excellent interlace.

LINE TIME BASE. Blocking Oscillator using a pentode driving a high efficiency output stage comprising Ferrox cube Cored Output Transformer with Booster Diode.

FRAME TIME BASE. Blocking Oscillator driving a Beam Output Valve coupled through a Transformer to the high efficiency FERROX-CUBE Cored Scanning Coils.

POWER PACK. Double wound Mains Transformer supplying all L.T. and H.T. using two full-wave Rectifiers.

The Televisor may be constructed in 5 easy stages: (1) Vision, (2) Time Base, (3) Sound, (4) Power Pack, (5) Final Assembly. Each stage is fully covered in the Instruction Book, which includes layout, circuit diagrams and point-to-point wiring instructions.

The Instruction Book also includes full details for converting existing Premier Magnetic Televisors for use with modern wide angle tubes. All components are individually priced.

Instruction book 3/6, Post Free.

MULTI-CHANNEL TUNER AVAILABLE
SHORTLY—WATCH FOR ANNOUNCEMENT

CONSOLE CABINETS

For 14", 16" and 17" Televisors

A handsome Walnut Cabinet that will be a fitting housing for a first-class Televisor.

Folding doors are fitted to cover the Cathode Ray Tube when not in use. A flap is provided which gives access to the preset controls on the front edge of the Chassis. A baffle board suitable for a 10in. Loudspeaker and all the necessary Tube and Chassis bearers are included. The overall dimensions of the Cabinets are the same: Height 38½-in. Width 19in. Depth Top 19in. Depth Bottom 21in.

TUBE ESCUTCHEONS

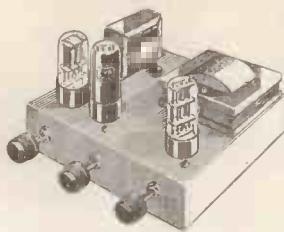
17in. White Moulded	21/- (pkgs. & post 1/6)
17in. Bronze Moulded, complete with Protective Glass.....	48/- (pkgs. & post 2/6)
14in. Black Moulded	7/6 (pkgs. & post 1/-)
Dark Screen Filter suitable for 14in. Tube	21/- (pkgs. & post 1/6)
Dark Screen Filter suitable for 16in. and 17in. Tubes	35/- (pkgs. & post 1/6)
Polystyrene Mask for E.E.T.901	45/4 (pkgs. & post 2/6)
Rubber Ring (anti-Corona) for E.E.T.901	6/8
Polystyrene Shroud for E.E.T.901	6/2

PRICE £13-10-0 PLUS 2/- PKG. & CAR. 12 MONTHLY PAYMENTS OF 18/9

TERMS OF BUSINESS: Cash with order or C.O.D. over £1. Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, unless otherwise stated.

PREMIER RADIO COMPANY

4-WATT AMPLIFIER



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

Valve line-up 6SL7, 6V6 and 6X5, FOR A.C. MAINS 200/250 VOLTS. The twin triode 6SL7 is used for preamplification and also for a comprehensive tone control circuit, which includes two very wide range and continuously variable tone controls for bass and treble. The output valve is of the beam type and feeds 4 watts into a specially designed output transformer which is suitable for either 3 ohm or 15 ohm speakers. Negative feed-back is applied from the secondary of the output transformer over the whole amplifier to the input stage giving an excellent frequency response. Due to the high gain and wide range tone controls any type of pick-up may be used. Overall size 9 x 7 x 5in. Price of Amplifier complete, tested and ready for use, £5/5/- plus 3/6 ppg. and carr.

INSTRUCTION BOOK, 1/- (Post Free) which includes Assembly and wiring diagram, also a detailed Stock List of priced components.

UNITELEX 5-watt Amplifier Type MG4/MG4A

For Gramophone and Microphone operation, enclosed in metal case, output suitable for 15 and 3 ohms speakers, switched input BVA miniature valves, separate treble and bass tone controls, for A.C. mains 200/250 v. Price, enclosed in metal case, £9/19/6. Price, less metal case, £8/18/6. Packing and Postage 7/6.

RECTIFIERS.

Type K3/25	650 v.	1 mA.....	4/7
.. K3/40	3.2 kV.	1 mA.....	6/-
.. K3/45	3.6 kV.	1 mA.....	8/2
.. K3/50	4 kV.	1 mA.....	8/8
.. K3/100	8 kV.	3 mA.....	14/8
.. N3/150	12 kV.	1 mA.....	21/6
.. K3/180	14.4 kV.	1 mA.....	24/6

H.T. Type S.T.O.

Type RM1	125 v.	60 mA.....	4/-
RM2	125 v.	120 mA.....	4/6
.. RM3	125 v.	125 mA.....	5/6
.. RM4	250 v.	250 mA.....	18/-
		L.T. Type Full Wave	
6 v. 1 amp.			4/-
12 v. 1 amp.			8/-
12 v. 2 amp.			10/9
12 v. 4 amp.			19/6

BATTERY CHARGERS

200-250 v. A.C. Will charge 2 v., 6 v. and 12 v. Car Battery at 1 amp. Housed in strong metal casing. Finished in Green hammered enamel. Size 6in. long, 3 1/2in. wide, 3 1/2in. high. Guaranteed 12 mths. The above unit is manufactured by PREMIER and does not contain Ex - Govt. components.
35/6
Plus 2/6 P. and P.

BATTERY CHARGER KITS

All incorporate metal rectifiers. Transformers are suitable for 200-250 v. A.C. cycle mains.

Cat. No. 2002 Charge 6 volt accumulator at 1 amp. Resistance supplied to charge 2-volt Accumulator.

2004 Charges 2, 6 and 12 v. accumulators at 1 amp. 19/11

ALUMINIUM CHASSIS 18 s.w.g.

Substantially made from Bright Aluminium with four sides.

7 x 5 x 2in. ..	4/-	10 x 9 x 3in. ..	7/-
7 x 3 x 2in. ..	3/9	12 x 10 x 3in. ..	7/9
9 x 4 x 2in. ..	4/3	14 x 10 x 3in. ..	7/11
10 x 8 x 2 1/2in. ..	5/6	16 x 10 x 3in. ..	8/3
12 x 9 x 2 1/2in. ..	7/-	16 x 8 x 2 1/2in. ..	8/-
14 x 2 x 2 1/2in. ..	7/6		

ALUMINIUM PANELS 18 s.w.g.

Substantially made from Bright Aluminium with four sides.

7 x 6in.	1/3	7 x 4in.	1/-
9 x 6in.	1/8	9 x 4in.	1/5
10 x 9in.	2/2	10 x 7in.	1/11
12 x 9in.	2/8	12 x 7in.	2/5
14 x 9in.	3/2	14 x 7in.	2/11
16 x 9in.	3/8	16 x 7in.	3/5
20 x 9in.	4/8	20 x 7in.	4/5
22 x 9in.	5/2	22 x 7in.	4/11

CABINETS—PORTABLE

Model PC/1

Brown Rexine covered

15/11

Overall dimensions

15in. x 13 1/2in. x 5in.

Clearance under lid

when closed 2 1/2in.

Model PC/2C

Grey Lizard Rexine

covered

45/-

Overall dimensions

15in. x 13in. x 6in.

Clearance under lid

when closed 3in.

Model PC/3

Rexine type covering

in various cols., 69/6.

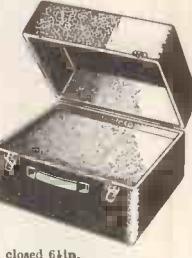
Overall dimensions

16in. x 13 1/2in. x 6in.

Clearance under lid when closed 6 1/2in.

All the above Cabinets are supplied with Panel, Carrying Handle and Clips.

Packing and Postage 2/6.



Famous Manufacturer's Surplus of
ANTI - INTERFERENCE AERIALS
offered at a fraction of original cost.

The aerial is designed for reception of long, medium and short waves, with any ordinary or communications receiver, having an input impedance greater than 1,000 ohms long/medium waves and 150 ohms short waves. The installation discriminates against locally generated electrical interference, especially on the short wavebands. The equipment enables the installation of an 8.3 Mc/s flatly-tuned dipole which operates as a "T" aerial on medium and long waves. The aerial and receiver transformers are intended to be interconnected with a 70 ohms co-axial cable.

COMPONENT PARTS

Aluminum Aerial Transformer Assembly. Comprising one each: Aluminum transformer, Transformer clip rubber sucker, 1in. x 1/2in. brass screw, 4BA x 1in. brass bolt, 4BA nut.

Receiver Transformer. Complete with insulators, clips, etc.: 1/2in. dia. insulators, 2 inch, 60ft. insulated aerial wire, 60ft. screened co-axial down lead.

Installation instruction leaflet included.

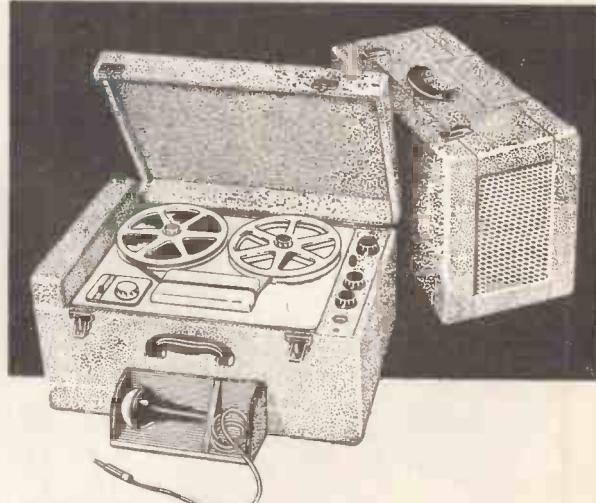
LESS CO-AXIAL CABLE & AERIAL WIRE, 15/-, plus

1/6 pkg. and carr.

COMPLETE, 35/-, plus 1/6 pkg. and carr.

★ QUALITY CRYSTAL PICK-UP ROTHER-

MEL TYPE U48 26/- Plus 1/6 Pkg. and Carr.



The New "PREMIER PORTABLE" TAPE RECORDER

USING THE NEW LANE 2-SPEED TAPE-UNIT MARK 6

COMPLETE 39 GNS CASH

Packing & Carriage 1 gn.

(Including Reel of Scotch Boy Tape and Microphone)

H.P. Terms: Deposit £10.4.9 and 12 monthly payments of £2.16.11,

or Complete Kit Including All Parts, Valves, Speaker Cabinet, Tape Unit, Reel of Scotch Boy Tape, Rewind Spool and Microphone at £37.4.0 plus pkg. & carr. 15/-.

H.P. Terms: Deposit £9.6.0 and 12 monthly payments of £2.11.9.

SPECIFICATION

- ★ TWO SPEEDS 7in. AND 3 1/2in. ★ 7-VALVE HIGH QUALITY AMPLIFIER.
- ★ THREE SPECIALLY DESIGNED RECORDING MOTORS.
- ★ 1,200ft. TAPE REELS PROVIDING PLAYING TIMES OF 1 HR. AND 2 HRS.
- ★ DROP-IN TAPE LOADING.
- ★ EASY FORWARD OR REWIND WITHOUT REMOVING TAPE.
- ★ ONE KNOB DECK OPERATION.
- ★ INDEPENDENT TREBLE AND BASS CONTROLS.
- ★ MAGIC EYE RECORD LEVEL INDICATOR.
- ★ AMPLIFIER MAY BE USED FOR RECORD REPRODUCTION OF HIGH QUALITY.
- ★ COMPARTMENT FOR HOUSING MICROPHONE.
- ★ SPECIALLY DESIGNED MICROPHONE BY A LEADING MANUFACTURER.

SEPARATE UNITS CAN BE SUPPLIED AS LISTED BELOW:-

Amplifier (built, wired and tested with Speaker). £14/15/-, plus postage and carriage 7/6.

Hire purchase terms, Deposit £3/13/9 and 12 monthly payments of £1/0/6.

Amplifier Kit (including Speaker). £11/- plus packing and carriage 5/-.

Hire purchase terms, Deposit £2/15/- and 9 monthly payments of £1/0/7.

New Lane 2-speed Tape Unit Mark 6. £18/10/- plus packing and carriage 7/6.

Hire purchase terms, Deposit £4/12/6 and 12 monthly payments of £1/5/9.

Portable Cabinet (rexine covered). £4/19/6, plus postage and carriage 5/-.

Microphone, £2/15/-, plus postage and carriage 1/-.

Reel Scotch Boy Tape MC2-111 (200ft.), £1/15/-, plus packing and carriage 1/-.

Instruction Booklet. 2/6. Post free.

PREMIER RADIO COMPANY

WILLIAMSON AMPLIFIER KIT 15 gns.

Plus 7/6 p. & p.

H.P. Terms:**Deposit £3.18.9 & 12 m'nthly payments of £1.11**

This Kit is absolutely complete and all components are guaranteed exactly to author's specification.

WILLIAMSON OUTPUT TRANSFORMER

Author's Specification 3.8 ohms secondaries £4.40

MAINS TRANSFORMER SP425A

(Completely Shrouded)

This Transformer has an additional 6.3 v. 3 A. and is capable of supplying an extra 50 mA. for Pre-amp or Feeder unit. £2.12.6

WILLIAMSON CHOKES
12H 150 mA. Fully shrouded 19/6
30H 20 mA. Fully shrouded 11/9
METERS

Full Scale Deflection	External Dimensions	Movement	
3.5 A.	2½ x 2½	R.F. Thermo	7/6
20 A.	2½ round	M/O	8/6
40 A.	2½ round	M/O	8/6
5 mA.	2½ x 2½		7/6
500 mA.	2½ round	M/O	10/6
30 A.	2½ x 2½	M/O	8/6
50 mA.	2½ x 2½	M/O	7/6
20 V.	2½ x 2½	M/O	6/6
40 V.	2½ x 2½	M/O	8/6
1 mA.	2½ x 2½	M/C	11/6
1 mA.	2½ round	M/C	22/6
1 mA.	2½ round	Desk type M/G	25/-

PREMIER MAINS TRANSFORMERS

All primaries are tapped for 200-230-250 v. mains 40-100 cycles. All primaries are screened.

SP175B, 175-0-175, 50 mA., 4 v. @ 1 a., 4 v. @ 2-3 a., 6.3 v. @ 15/

@ 2-3 a. 21/-

SP350A, 350-0-350, 100 mA., 5 v. @ 2-3 a., 6.3 v. @ 15/

@ 2-3 a. 21/-

SP351A, 350-0-350, 150 mA., 4 v. @ 2-3 a., 4 v. @ 30/-

@ 3-6 a., 4 v. @ 1-2 a., 6.3 v. @ 1-2 a. 30/-

SP352, 350-0-350, 150 mA., 5 v. @ 2-3 a., 6.3 v. @ 30/-

@ 2-3 a., 6.3 v. @ 2-3 a. 30/-

SP425A, 425-0-425, 200 mA., 6.3 v. @ 2-5 a., 10/6

250-0-250, 200 mA., 6.3 v. @ 2 a., 5 v. @ 2 a. 10/6

350-0-350, 80 mA., 6.3 v. @ 4 a., 5 v. @ 2 a. 10/6

200-230-250 output 3 v.-30 v., @ 2 a. 17/6

200-230-250 output 3 v.-30 v., @ 2 a. 17/6

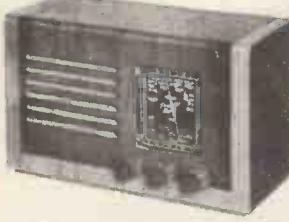
E.H.T. primary 230 v., secondary 1.75 Kv., 2 x 4 v. tapped 2 v. 37/6

E.H.T. TRANSFORMER, primary 210 v., 230 v., 250 v., secondary 4 Kv. and 2 v. 23/7/6

E.H.T. TRANSFORMER, primary 210 v., 230 v., 250 v., secondary 5 Kv. and 2 v. 23/12/6

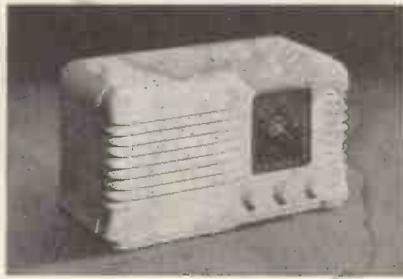
Build these NEW PREMIER DESIGNS

3-BAND SUPERHET RECEIVER


MAY BE BUILT FOR £7.19.6 Plus 2/6 pk. & Carr.

Latest type Superhet Circuit using 4 valves and metal rectifiers for operation on 200/250 volts A.C. mains. Waveband coverage—short 16-50 metres, medium 180-550 metres, and long 900-2,000 metres. Valve line-up 6K8 freq. changer, 6K7, IF, 6Q7, Detector AVC and first AF, 6V6 output. The attractive cabinet to house the Receiver size 12in. long, 6½in. high, 5½in. deep can be supplied in either WALNUT or IVORY BAKELITE or WOOD. Instruction Book 1/- (post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

TRF RECEIVER


MAY BE BUILT FOR £5.15.0 Plus 2/6 Pkg. & Carr.

The circuit is the latest type TRF using 3 valves and Metal Rectifiers for operation on 200/250 A.C. mains. Waveband coverage is 180-550 metres on medium wave and 800-2,000 metres on long wave. The dial is illuminated and the Valve line-up is 6K7 H.F. Pentode 617 Detector and 6V6—Output. The attractive Cabinets to house the Receiver size 12in. long, 6½in. high, 5½in. deep, can be supplied in either WALNUT or IVORY BAKELITE or WOOD. INSTRUCTION BOOK 1/- (post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

ALL-DRY BATTERY PORTABLE RADIO RECEIVER


MAY BE BUILT FOR £7.8.0 Plus 2/6 Pkg. and Carr.

4 miniature Valves in a Superhet Circuit covering medium and long waves. Rexine covered Cabinets 11½in. x 10in. x 5½in. in two contrasting colours. Wine with Grey Panel, or Blue with Grey Panel, please state choice when ordering. THE SET MAY BE USED EVERYWHERE—home, office, car or holidays. INSTRUCTION BOOK, 1/6 (Post Free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

DECCA MODEL 33A RECORD PLAYER

ADAPTABLE FOR STND. OR L.P.

Includes crystal pick-up with sapphire stylus and a light-weight plastic spring balanced arm. Heavy gauge pressed steel case with brown enamel finish in good quality for operation on A.C. mains 200/250 v. 50 c.p.s. Supplied complete with single head (either standard or long playing). 24/19/6. Extra Head can be supplied. Plus Pkg. and Carr. 5/-.

3-SPEED AUTOMATIC RECORD CHANGER

Made by World-famous manufacturer. The Unit designed to play 12in., 10in. and 7in. Records interlocked in any order at 33, 45 or 78 r.p.m. Capacity 10 records. New reversible dual stylus crystal Pick-up has extended frequency range. An essential feature is the simplicity of design. For use on 100/125-200/250 volts 50 cycles. A.C. mains.

LIMITED QUANTITY ONLY.

Plus packing and carriage 5/-.
BRAND NEW, guaranteed and in manufacturers' original carton.


£11.11.0

 LIST PRICE
£16/10/-

MINIATURE TUNING CONDENSERS

2-gang .0005 mfd. with trimmers. 6/9

PREMIER VARIABLE IMPEDANCE "MATCHMAKER" M.O.15 OUTPUT TRANSFORMERS

Designed to meet the demand for an efficient variable ratio Output Transformer 11 ratios from 13 : 1 to 80 : 1 all centre tapped and can be used to match any output valves either single or push-pull Class "A" "AB1" "AB2" or "B" to any low impedance speech coil or combination thereof. Primary Inductance 50 henries 15 watts audio 100 mA. Price 45/-.

LOUDSPEAKERS

ELAC—2½in. dia., Moving Coil, 15 ohm Imp.... 15/-

ELAC—8in. dia., Moving Coil 3 ohms Imp.... 19/6

PLESSY—8in. dia., Mains Energised, 3 ohms Imp. (600 ohms field) with Pentode Transformer 22/6

PLESSY—8in. dia., Mains Energised, 3 ohms Imp. (600 ohms field)..... 19/6

PLESSY—10in. dia., Moving Coil, 3 ohms Imp... 23/6

GOODMANS—12in. dia., Moving Coil, 15 ohms.

Plus 5/- packing and carriage 28/12/6

VITAVOX—K12/20 12in. dia., Moving Coil 15 ohms. Imp.

Plus 5/- packing and carriage. 211/11/-

Plus 5/- packing and carriage.

ACCUMULATORS

2 volt 10 amp. (by famous maker) 4/11

2 volt 16 amp. 5/11

MOVING COIL METER

A super quality Moving Coil Meter basic movement 2 mA. and 4 mA. Scale dimensions 2½in. Overall dimensions 2½in. dia. 1¼in. deep. Bakelite Case projecting type. At present scaled 1 amp. R.F. By removing thermocouple reversing scale and recalibrating the meter, a high grade test instrument with any range above the basic F.S.D. may be built up. Price 2 mA., 5/9, 4 mA., 4/9.

MICROPHONES

LUSTRAPHONE: Moving Coil; High Impedance, Stand Type: £5/15/6—Hand Micro 26/6/-.

RONETTE—Crystal Micro Incorp. The Filter Cell Insert; High Impd. Ball Type, 22/10/-.

CRYSTAL MICROPHONE—Rothermel 2AD56. Especially recommended. £2/15/- Table stands for all the above 10/6 and 17/6.

ACOS. High Impedance Crystal Microphone, type 35-1, 25/-.

High Impedance Crystal Microphone, type 33-1, 22/10/-.

ACOS. "MIC30" impedance Crystal Microphone £2/10/- (This Microphone can be used as either Hand or Desk type.)

CRYSTAL MICROPHONE

An entirely insulated crystal microphone which can be safely used on A.C./D.C. amplifiers. High impedance. No background noise, really natural tone. The ideal Mike for tape, wire and sound projectors, price 19/6.

Mike for tape, wire and sound projectors, price 19/6.

Germanium Crystal Diodes. G.E.C. wire ended, 2/6.

24/- doz.

CRYSTAL MICROPHONE INSERTS

Ideal for tape recording and amplifiers. No Matching transformer required. 8/6 post free.

PREMIER RADIO COMPANY

1155 RECEIVER UNIT

NEW CONDITION

In original case complete with 10 valves. Frequency range 15.5 Mc/s. to 75 Mc/s. in 5 wavebands. £11/19/6. Plus 10/- packing and carriage. Hire Purchase Terms: £2/19/11 deposit and 10 monthly payments of £1.



POWER SUPPLY UNIT WITH OUTPUT STAGE FOR ABOVE



Jones plugs for connecting the Power Pack to the Receiver are included. The 6V6 output stage complete with Output Transformer and 6in. speaker is built into the unit. Price £5/5/-, plus 5/- packing and carriage. The two above Units together on Hire Purchase Terms £4/6/2 deposit and 12 monthly payments of £1/3/11 plus 15/8 pkgs. and carriage.

PUSH-PULL OUTPUT TRANSFORMERS. 2x6V6 into 2/3 ohms, 5/6, post free.

T.1154. BRAND NEW COMPLETE WITH VALVES, £3/19/6, post and carriage 7/6.

METER RECTIFIERS. Miniature type with leads 1.5 mA. 6/9 post paid.

AMPLIFIER TYPE A1134A. Battery operated 2 valves, type VR.21 and VR.35, 9/11, postage and carriage 1/6.

SLIDER RESISTANCE. Geared adjustments, 7.5 ohms, 4 a., 12/6, postage and carriage 1/6.

HEAVY DUTY POWER RESISTANCE. 17.5 ohms, 8 a., with adjustable taping 19in. long, 2½in. diameter, 10/- postage and carriage 2/-.

HEAVY DUTY L.T. TRANSFORMER. Primary tapped 180-230 volts, 50 cycles. Secondaries 4.2 v. 10 a. 4.2 v. 10 a., 25/-, postage and carriage 2/-.

ROTARY RESISTANCE. Wire wound heavy duty 14 k. ohms, 7/6, postage and carriage 1/-.

VACUUM PUMPS. For model makers, etc. Ex-R.A.F. Type B3-Mk. III, 22/6, postage and carriage 2/-.

E.A.R. MULLARD 5-10 AMPLIFIER

PRICE

£18.18.0

Plus postage and packing
7/6.



This Amplifier is based on the Mullard design and incorporates a change-over switch for standard, L.P. records and radio. Plug-in filter supplied, alternative types available. The switched input is fed in on 2 Co-axial Sockets, output is available for 3 to 15 ohms Speakers. Power supply for Pre-amplifier or Radio Unit provided by the Amplifier, H.T. 300 volts 50 mA. and 6.3 volts 2 amps. H.P. Terms are available. Deposit £4/14/6 and 12 monthly payments of £1/6/3.

SELECTION OF H.P. ITEMS

GRUNDIG TK.819. Cash price £99/15/- Deposit £24/4/-, 12 monthly payments £7. Postage and packing 21/-.

GRUNDIG TK.9 Cash price £83/5/- Deposit £17/1/-, 12 monthly payments £4/15/- Postage and packing 15/-.

LEAK TL 10 AMPLIFIER AND PREAMPLIFIER. Cash price £88/7/- Deposit £7/9/-, 12 monthly payments £1/19/6. Post and packing 7/6.

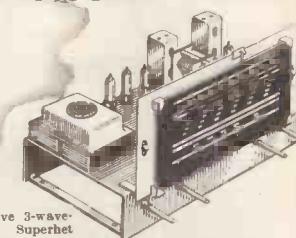
LEAK DYNAMIC PICKUP WITH DIAMOND STYLUS. (A) Cash price £11/8/6 Deposit £2/17/6. 9 monthly payments £1/1 4/-(B) with Extra head. Cash price £19/5/3 Deposit £4/16/9, 12 monthly payments £1/6/4 Mu Metal Transformer £1/15/- Post and packing 8/-.

TRUVOX TYPE G AMPLIFIER. Cash price £16/16/- Deposit £4/2/-, 12 monthly payments £1/3/6. Post and packing 7/6.

ELPICO TUNER UNIT MODEL RF.720. Cash price £15/15/- Deposit £3/13/9, 12 monthly payments £2/11. Post and packing 5/-.

REGENTONE HANDY GRAM. Cash price £21. Deposit £5/2/-, 12 monthly payments £1/9/6. Post and packing 7/6.

RADIOGRAM CHASSIS



5 Valve 3-waveband Superhet Receiver covering short, medium and long waves. Using the latest miniature all glass valves, overall chassis size 13½in. x 7in. high x 4in. deep, dial aperture 10in. x 4in. BRAND NEW, READY FOR USE AND GUARANTEED.

Packing and postage 10/- Or on Hire Purchase Terms, deposit £2/11/3 and 12 monthly payments of £1/1/9.

£10-5-0

CABINET available for above Chassis in figured walnut lined with white sycamore, size 3ft. wide, 2ft. 8in. high 1ft. 5in. deep, £15/15/- Or on Hire Purchase Terms, deposit £3/18/9 and 12 monthly payments of £1/1/11.

Packing and Carriage extra.

PORTABLE TAPE RECORDER CABINETS

All Rexine covered

TAPE DECK	AMPLIFIER	TYPE	PRICE
Lane Mk. VI	Premier	Mk. VI	£4/19/6
Truvox Mk. III	E.A.P.	T.D.1	£4/4/-
Truvox Mk. III	Premier	T.D.2	£4/4/-
Truvox Mk. III	Truvox G	T.D.3	£4/4/-

Plus Postage and Packing 5/-.

We carry a comprehensive stock of components by all leading Manufacturers.

British Plastics Exhibition and Convention, London, June 1-11

THIS WAY

for the best advance picture of Britain's Plastics Industry, 1955



Published by the organisers of the exhibition, the June issue of BRITISH PLASTICS gives the first news of what the plastics industry has achieved in 1955. It contains floor plans, descriptions of exhibits and quick-reference charts to material manufacturers, moulders, fabricators, plant and equipment. It serves not only as a daily Show Guide, but as a permanent buyers' reference for everyone engaged in the industry.

A PERMANENT

Buyers' Guide to the
Plastics Industry

A GUIDE

to the Exhibition
and Convention

BRITISH PLASTICS

Show Guide

Out 1 June

FROM NEWSAGENTS - 2s. 6d.

Introducing

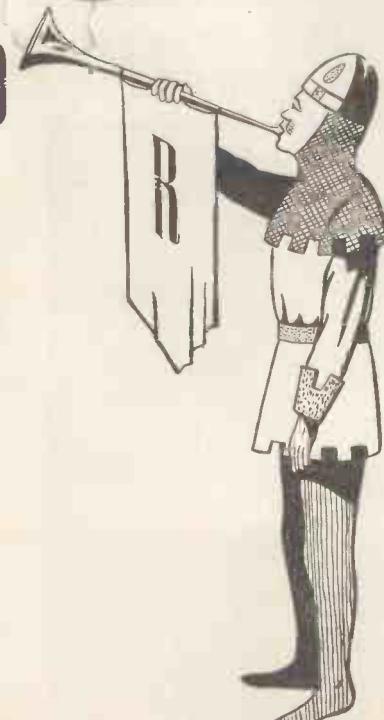


THE REGENT H.F.100

Here is a brilliant new high-fidelity single record player which brings top quality reproduction within the reach of all record lovers.

The Regent HF.100 is built to the same high standard as the Monarch Autochanger. It plays all records, all speeds, all sizes. Its many features include: a new lightweight pickup incorporating a high-fidelity turnover crystal cartridge with dual sapphire styli; a concealed automatic stop which operates on all records, irrespective of run-off groove diameter; powerful constant-speed 4-pole motor ensuring smooth power and the well-known "Rotocam" speed change.

We shall be pleased to send you literature on request.



BIRMINGHAM SOUND REPRODUCERS LTD., OLD HILL, STAFFS

Wireless World

RADIO, ELECTRONICS, TELEVISION

Managing Editor:

HUGH S. POCOCK, M.I.E.E.

Editor:

H. F. SMITH

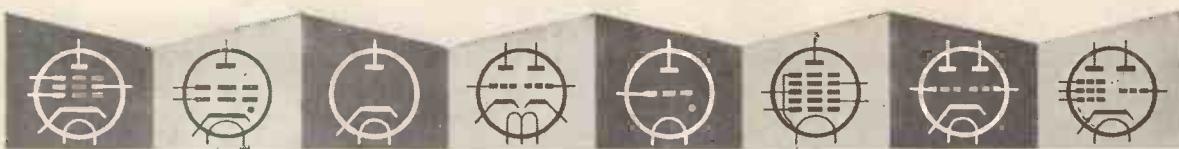
MAY 1955

In This Issue

Editorial Comment	201
Twin-Channel Tape Records	202
Books Received	202
Mobile Radio	203
World of Wireless	204
Sources of Interference	207
Wide Range Electrostatic Loudspeakers. By P. J. Walker	208
Short-wave Conditions	211
Air Traffic Control at London Airport	212
Letters to the Editor	213
Open Letter to the Postmaster General. By C. I. Orr-Ewing	215
Design for an F.M. Tuner—2. By S. W. Amos and G. G. Johnstone	216
Design for a 20-watt High Quality Amplifier. By W. A. Ferguson	223
V.H.F. and U.H.F. Reception. By J. A. Saxton and J. A. Lane	229
"Needles for Talking Machines." By S. Kelly	233
More Distortion. By "Cathode Ray"	239
Airfield Radar Developments	243
Manufacturers' Products	244
The Ratio Detector. By M. R. Murray	245
Northern Radio Show	247
May Meetings	247
Random Radiations. By "Diallist"	248
Unbiased. By "Free Grid"	250

VOLUME 61 NO. 5
PRICE: TWO SHILLINGS

FORTY-FIFTH YEAR
OF PUBLICATION



VALVES, TUBES & CIRCUITS

29. EF89 & UF89: IMPROVEMENTS IN I.F. AMPLIFIERS FOR F.M./A.M. RECEIVERS

PRELIMINARY DATA : EF89

I.F. amplifiers for f.m. reception are normally 'neutralised' in order (i) to achieve satisfactory stability and (ii) to minimise the effects of capacitive feedback from anode to signal grid in producing phase distortion and distortion of the bandpass curve. An i.f. voltage is led back on to the screen grid through a neutralising capacitor, and passes through the interelectrode capacity $C_{g1,g2}$ to the signal grid; there it cancels out the voltage passed through the capacity C_{a-g1} , the two voltages being of equal magnitude and opposite phase. The neutralising capacitor forms the fourth arm of a bridge network, and its value is chosen to balance the bridge. Unfortunately a bridge which has been balanced for f.m. reception may not remain balanced during a.m. operation.

The Mullard EF89 is a medium slope variable-mu pentode whose introduction will tend to make neutralising requirements less critical. Unneutralised r.f. and i.f. circuits can be considered under some conditions where previously neutralising would have been required.

The maximum amplification realised with the EF89 is higher than that obtained with previously available valves such as the EF41. An indication of the maximum amplification obtainable from an r.f. and i.f. pentode is given by a quality factor defined as the ratio of slope to anode-to-grid capacitance. When designing the EF89, the small anode-to-grid capacitance of the EF41 ($C_{a-g1} < 0.002 \mu\text{F}$) was used as a starting point, and the design of the EF41 modified to produce the highest practicable slope without increasing the capacitance.

Under normal operating conditions, with a 9mA anode current, the slope is 3.5mA/V for a grid bias of -2.0V.

For f.m. reception the first stage of i.f. amplification is provided by the heptode section of the ECH81 (which during a.m. reception functions as a conventional triode heptode frequency changer). The second i.f. amplifier will be the EF89, feeding into the ratio detector (diodes s''a and a''a of the EABC80).

The EF89 has been so designed that when it follows the ECH81 connected as the a.m. frequency changer, the a.g.c. voltage can be applied to both valves if desired. (Normally of course a.g.c. is not necessary for f.m. reception.) At high input signals overcontrolling does not occur, that is, an increase in signal strength does not lead to a decrease in output, and the distortion associated with overcontrolling is avoided. The cut-off characteristics of the EF89 and ECH81 mixer heptode are so matched that, when the grid voltage is changed from -2V to -16.5V, the slope of the EF89 falls to one-tenth of its original value whilst the slope of the ECH81 heptode falls to one-twentyfourth. The cross-modulation curve is better than for the EF41, and the a.g.c. voltage therefore can be allowed to take the slope down to a small value without appreciable distortion.

The EF89 may be used also as a variable-mu r.f. amplifier. The screen grid is brought out to its own pin connection (No. 8), and the internal screening is connected to two separate pins (Nos. 1 and 6). These connections are very helpful in the design of r.f. (and, for that matter, i.f.) amplifiers, in that no additional damping is introduced by earthing the suppressor grid and screening. The suppressor grid connection to the chassis should have the lowest possible resistance (R_{g3} max = $10k\Omega$).

The UF89 is rated at 12.6V, 100mA and is intended for d.c./a.c. mains receivers. In all other respects it is identical with the EF89 (6.3V, 200mA), and the same operating conditions apply to the E- and U-versions.

HEATER

V_h	6.3	V
I_h	200	mA

CAPACITANCES

C_{in}	5.5	pF
C_{out}	5.1	pF
C_{a-g1}	<0.002	pF
C_{g1-h}	0.05	pF

CHARACTERISTICS

V_a	250	V
V_{g3}	0	V
V_{g2}	100	V
V_{g1}	-2.0	V
I_a	9.0	mA
I_{g2}	3.0	mA
g_m	3.6	mA/V
r_a	1.0	MΩ

TYPICAL OPERATING CONDITIONS

$V_a = V_b$	250	V
V_{g3}	0	V
R_{g2}	51	kΩ
R_k	160	Ω
I_a	9.0	mA
I_{g2}	3.0	mA
g_m	3.5	mA/V
r_a	1.0	MΩ
R_{eq}	4.2	kΩ
$g_m (V_{g1} = -20V)$	240	μA/V

LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
P_a max.	2.25	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
P_{g2} max.	0.45	W
I_k max.	16.5	mA
R_{gl-k} max.	3.0	MΩ
V_{h-k} max.	100	V

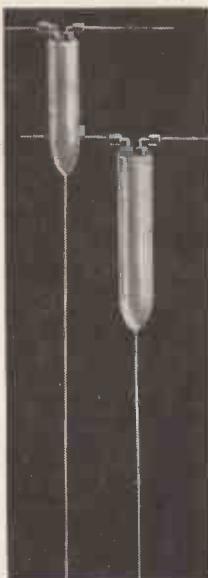
BASE

Pin:	1	2	3	4	5	6	7	8	9
	s	g ₁	k	h	h	s	a	g ₂	g ₃



Reprints of this advertisement and additional information may be obtained free of charge from

BRIMAR

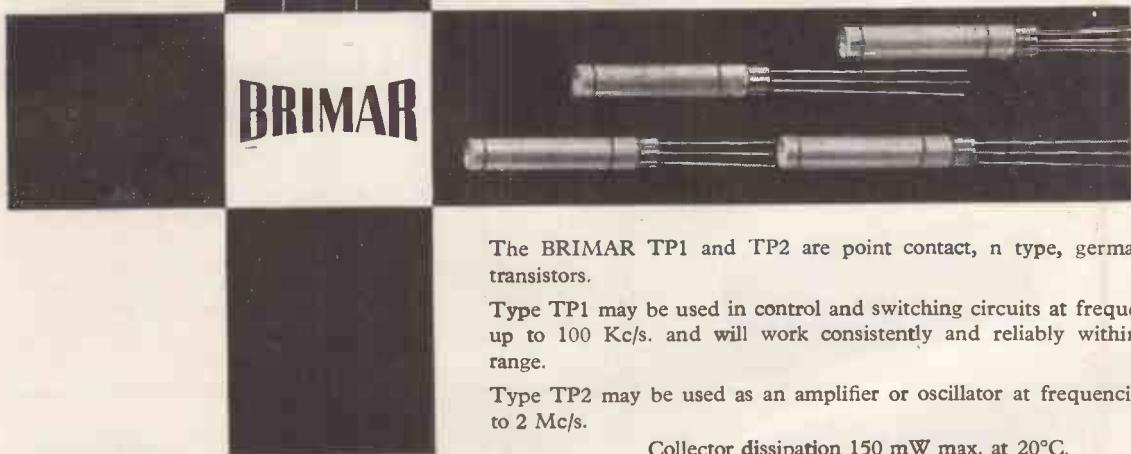


**transistors
are good!**

These long life transistors in your circuits will save space and power and incidentally save weight.

Brimar transistors are the result of extensive development. Exhaustive tests have proved their reliability over a long period.

Brimar are now able to offer several types in small quantities for development work.



The BRIMAR TP1 and TP2 are point contact, n type, germanium transistors.

Type TP1 may be used in control and switching circuits at frequencies up to 100 Kc/s. and will work consistently and reliably within this range.

Type TP2 may be used as an amplifier or oscillator at frequencies up to 2 Mc/s.

Collector dissipation 150 mW max. at 20°C.

The BRIMAR TJ1, TJ2 and TJ3 are p.n.p. alloyed junction transistors intended for use in low frequency applications up to 500 Kc/s. The small size and low power consumption of these transistors permits the design of light, compact equipment. Since the cases are of metal there is little danger of accidental fracture, and the transistors are also thereby rendered lightproof.

Collector dissipation 200 mW at 20°C.

Send for data sheet of these transistors to

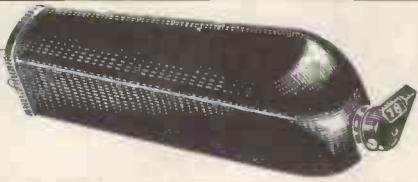
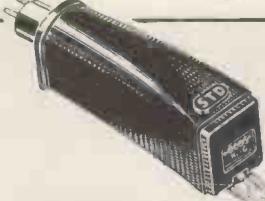
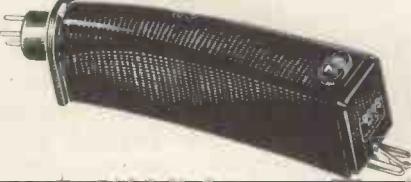
Standard Telephones and Cables Limited

Publicity Department : FOOTSCRAY, SIDCUP, KENT. FOotscray 3333

Bring your equipment up to date with •ACOS• REPLACEMENT PICK-UP HEADS

If you already own a fine radiogram or record-player you now have the opportunity of rejuvenating it—of bringing it right up to date for a quite modest sum. Acos Hi-g crystal pick-ups are now available in a range of specially designed "plug-in" models to suit most famous

makes of record reproducing equipment. These Acos "Hi-g" pick-ups, you will find, represent a truly phenomenal advance in pick-up design—with regard to both reproduction and tracking characteristics (so important with many of the new microgroove recordings). Ask your Dealer!

MODEL	
HGP 37-I Collaro	
HGP 37-I Garrard	
HGP 39-I	
HGP 35-I	
HGP 41-I	
HGP 45	

A Hi-g pick-up head incorporating the HGP 37-I turnover cartridge with cantilever sapphire stylus. Designed for both standard and micro-groove records. Will fit Collaro units RC 532; AC 534; AC3/534; 3RC 532 and the Studio pick-up. Available in cream or walnut.

Ask for Data Sheet No. 4800.

A Hi-g pick-up head incorporating the HGP 37-I turnover cartridge with cantilever sapphire stylus. Designed for both standard and micro-groove records. Will fit Garrard units RC 75M; RC 80M; RC 90; RC 111; Model TA.

Ask for Data Sheet No. 4800.

Hi-g pick-up heads incorporating cantilever sapphire stylus. Separate heads for standard and microgroove records. Will fit the Acos GP 20 pick-up arm and the Garrard C type adaptor. Used on the following Garrard units: RC 72A; RC 75A; RC 80; and the model M unit. Can be used on any units which at present use the GP 19 heads.

Ask for Data Sheet No. 4400.

Separate plug-in type Hi-g heads for standard and microgroove records; fitted with cantilever sapphire stylus. The crystal unit is identical to that of the HGP 39-I above. Can be used on Garrard units RC 75M; RC 80M; RC 90; RC 111; and the TA player.

Ask for Data Sheet No. 4000.

Separate Hi-g plug-in type heads for standard and microgroove records incorporating the crystal unit as used in the HGP 39 pick-up head. Will fit Collaro units RC 532; AC 534; AC3/534; 3RC 532. Available in cream or walnut.

Ask for Data Sheet No. 4500.

Separate Hi-g pick-up heads for either standard or microgroove records. The crystal unit is identical to that used in the HGP 39-I head. Will fit Garrard units RC 80; RC 72A; RC 75A; and the Model M player. Can be used on any unit which at present uses the Garrard C adaptor with GP 19 heads.

Ask for Data Sheet No. 4600.



... always well ahead

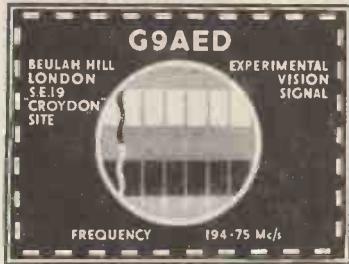
ACOS devices are protected by patents, patent applications and registered designs in Great Britain and abroad.

PRICE 32/6 (Plus 10/5 P.T.)

for all types except

HGP 39 models which

are 32/- (Plus 10/3 P.T.)



"BELLING-LEE" BAND III EXPERIMENTAL TRANSMITTER

G9AED is the call sign allocated by the Postmaster General to the "Belling-Lee" band III experimental transmitter which, through the helpful co-operation of the Independent Television Authority, will be situated on part of the site of their temporary mast and transmitter at Croydon. The site is actually named on the 1in. ordnance map sheet No. 170, as "Beulah Hill" with a map reference 333696.

Transmissions are due to commence on April 1st.

The test card is primarily intended for the investigation of ghost images and provides the following features:

(a) A wavy line in black and white, followed by white, grey and black. This line is wavy to differentiate from the vertical range marks. With ghost signals the wavy line predominates, the positive or negative ghosts can be identified.

(b) Vertical lines numbered 1, 2, 3 and 4 indicating the additional path in miles that the ghost has travelled, i.e., if the reflecting object is situated directly behind the receiving aerial, in line with the transmitter, the distance of the reflecting object is exactly half the extra distance travelled by the delayed image.

(c) A circle to enable approximate linearity adjustments to be made to the receiver.

(d) The black and white border to the card corresponds to the similar design on test card C and indicates the edge of the picture.

The "Belling-Lee" mast is a 75ft. self-supporting "Skytower" to which has been added a 16ft. top mast carrying the aerial system comprising four stacked bays, each of four vertical half wave folded dipoles spaced equidistant. Thus there are sixteen dipoles designed to give all round coverage and, it is hoped, a power gain of four.

The transmitter, which has been designed and constructed in its entirety in the "Belling-Lee" research laboratory at Enfield, has an output of 250 watts, thus the E.R.P. of the station will approximate 1 kW. The equipment will be housed in a temporary wooden hut measuring 24 x 10 feet.

It is hoped to transmit between the hours of 10 and 12 and certain unspecified periods during the afternoon, excluding Saturdays, Sundays and public holidays. It should be appreciated that the equipment is just as liable to develop a "technical hitch" as is that used by other television services and that it has not been possible in the time to build stand-by equipment for every stage, so in the event of breakdown there will be a certain amount of unavoidable inconvenience.

Advertisement for

BELLING & LEE LTD.

Great Cambridge Rd., Enfield, Middx.
Written 24th March, 1955

"BELLING-LEE" NOTES

Combined band I, band III aerials are available for fringe, normal and local reception. Those shown below are for use where transmitters are co-sited. Single feeder only required.

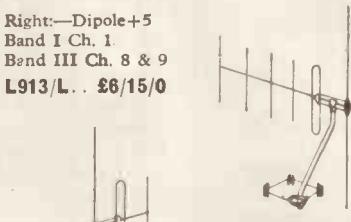


Left:—Director "H" + 2 x 6
Band I Ch. 1
Band III Ch. 8 & 9
L916/L £17/17/0

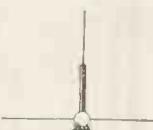


Right:—Reflector "H" + 2 x 3
Band I Ch. 1
Band III Ch. 8 & 9
L915/L £12/12/0

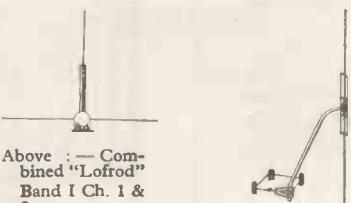
Right:—Dipole + 5
Band I Ch. 1
Band III Ch. 8 & 9
L913/L £6/15/0



Left:—Dipole + 2
Band I Ch. 1
Band III Ch. Ch. 8 & 9
L912/L £4/15/0
L912/WS £3/8/0

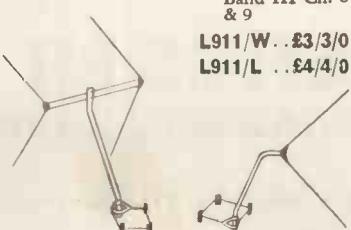


Above:—Combined "Lofrod"
Band I Ch. 1 & 2
Band III Ch. 8 & 9
L910 . . . £1/10/0

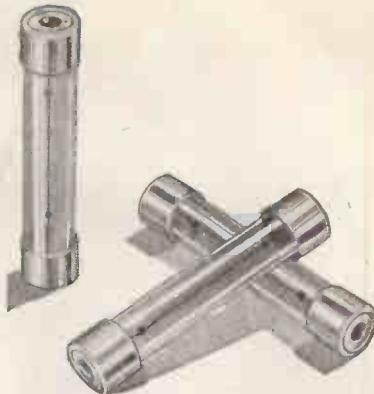


Above:—Combined dipole
Band I Ch. 1 &
2
Band III Ch. 8 & 9

L911/W . . . £3/3/0
L911/L . . . £4/4/0



Above:—Combined aerials for Midland will differ in appearance. More precise details and prices will become available when the site of the transmitter is known.



"BELLING-LEE"

"MAG-NICKEL"

FUSES



Ratings now

available up to

750 mA

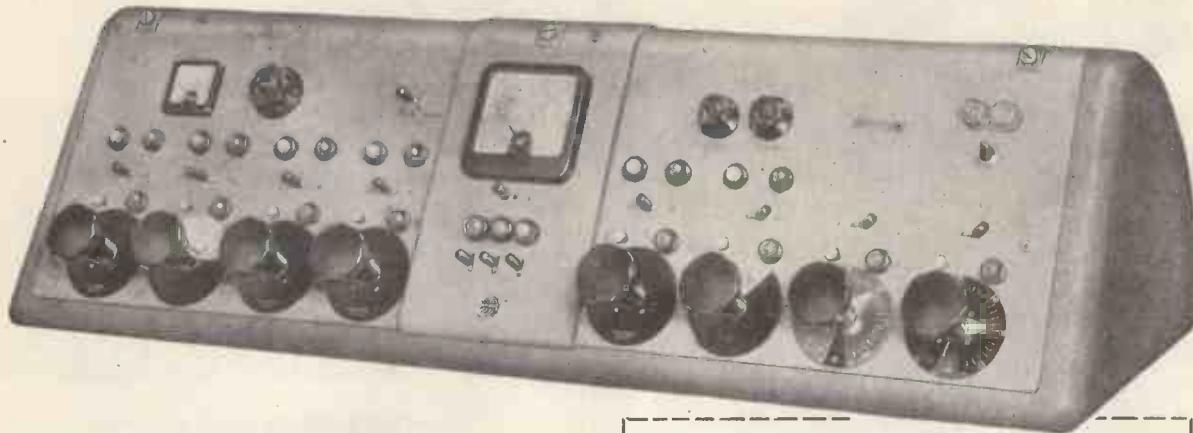
OUR well-known range of "Mag-Nickel" delay fuse-links are now available up to 750 mA. These fuses conform to the dimensions (1 $\frac{1}{4}$ " x 1 $\frac{1}{4}$ ") and blowing requirements of the standard L.1055 fuse, but can withstand a surge current of 10/30 times their rated current for a period not exceeding 0.01 second, without affecting their normal length of life. Available in 250 mA (brown), 500 mA (yellow) and 750 mA (green) ratings, the colour coding conforming to B.S. 646(B).

"Mag-Nickel" Delay Fuse **L.338**

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

Marconi Complete

SOUND STUDIO EQUIPMENT



Marconi sound broadcasting equipment provides an extensive, flexible and versatile range of units from cue lamps and control consoles to automatic monitors and aerials. It covers every phase of the common operating requirements of the majority of systems. No two broadcasting administrations, however, have the same problems and therefore Marconi's are ready to engineer particular schemes and can meet every requirement in AM and FM broadcasting.

The first advertised sound broadcast was made from the Marconi transmitter at Chelmsford in June 1920. Today 75% of the countries in the world rely on Marconi broadcasting equipment.

Shown above is the Control Console Type BD 501 which handles input of programme material from two studios, announcer's microphone, a local microphone, several disc reproducers and four O.B. lines. Two output channels for rehearsal and programme conditions are provided.

Below is the heavy duty Disc Reproducer Type BD503B, designed for accurate groove location. A 3-speed turntable and long arm lightweight pick-up are employed, and a universal corrector unit is incorporated. The novel features of this equipment are the optical groove locator and an automatic raise/lower device coupled to the fader.



Lifeline of communication

MARCONI

Complete Broadcasting and Television Systems

MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD, ESSEX

Partners in progress with The 'ENGLISH ELECTRIC' Company Limited



EMITAPE '88"

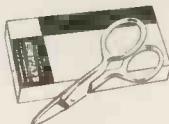
The Recording Tape preferred by the Experts

Emitape is preferred by the research scientist and the development engineer in industrial fields — by the specialists and teachers in medical and scholastic professions and music — in fact wherever true-to-life sound recording is critically important. They are in excellent company — Emitape is also used by ' His Master's Voice ', Columbia and Parlophone and the world's leading broadcasting organisations.

Special Features

- HIGH SENSITIVITY
- ANTI-STATIC P.V.C. BASE
- HIGH TENSILE STRENGTH
- FREEDOM FROM CURL
- EDITING LEADER
AND TRAILER STRIPS

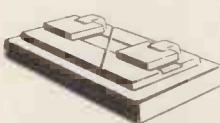
TAPE ACCESSORIES



NON-MAGNETIC
SCISSORS AP.39
PRICE 16s.



P.V.C. TAPE JOINT-
ING COMPOUND
AP.77 PRICE 4s. 6d.



MAGNETIC TAPE
JOINTING BLOCK
AP.46 PRICE 8s.



GUMMED
JOINTING TAPE
AP.37 PRICE 6s. 6d.
WHITE P.V.C. EDITING
TAPE IN 150 ft. ROLL
AP.38 PRICE 4s. 6d.



Full particulars of Emitape and accessories obtainable from your local dealer.

Manufactured and distributed by:



E.M.I. SALES & SERVICE LTD.
RECORDING EQUIPMENT DIVISION
HAYES, MIDDLESEX

TELEPHONE : SOUTHALL 2468

Export enquiries for products mentioned in this advertisement should be addressed to :

E.M.I. INTERNATIONAL LTD.
HAYES, MIDDLESEX, ENGLAND

Caslite

Iron Dust Cores

by **Plessey**

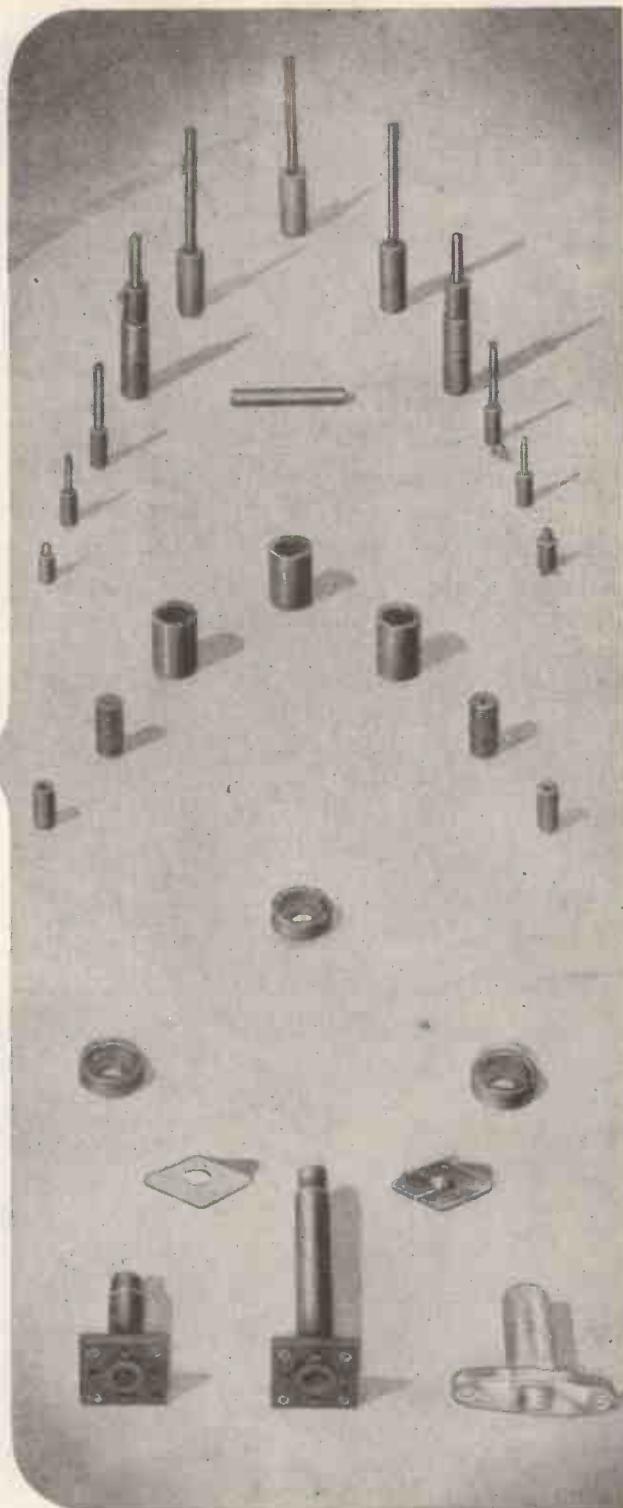
Bigger Standard Range . . .

Under the registered name CASLITE, The Plessey Company presents a range of superior iron dust cores of the types in constant demand by the radio industry. New manufacturing techniques developed at the Towcester factory have resulted not only in the establishment of a better product within the various material gradings but also in more economic production. In consequence, prices are keenly competitive.

Where cores outside the standard range are required, the Company is always willing to advise on design and to produce iron dust cores to suit special needs.

Better Product . . .

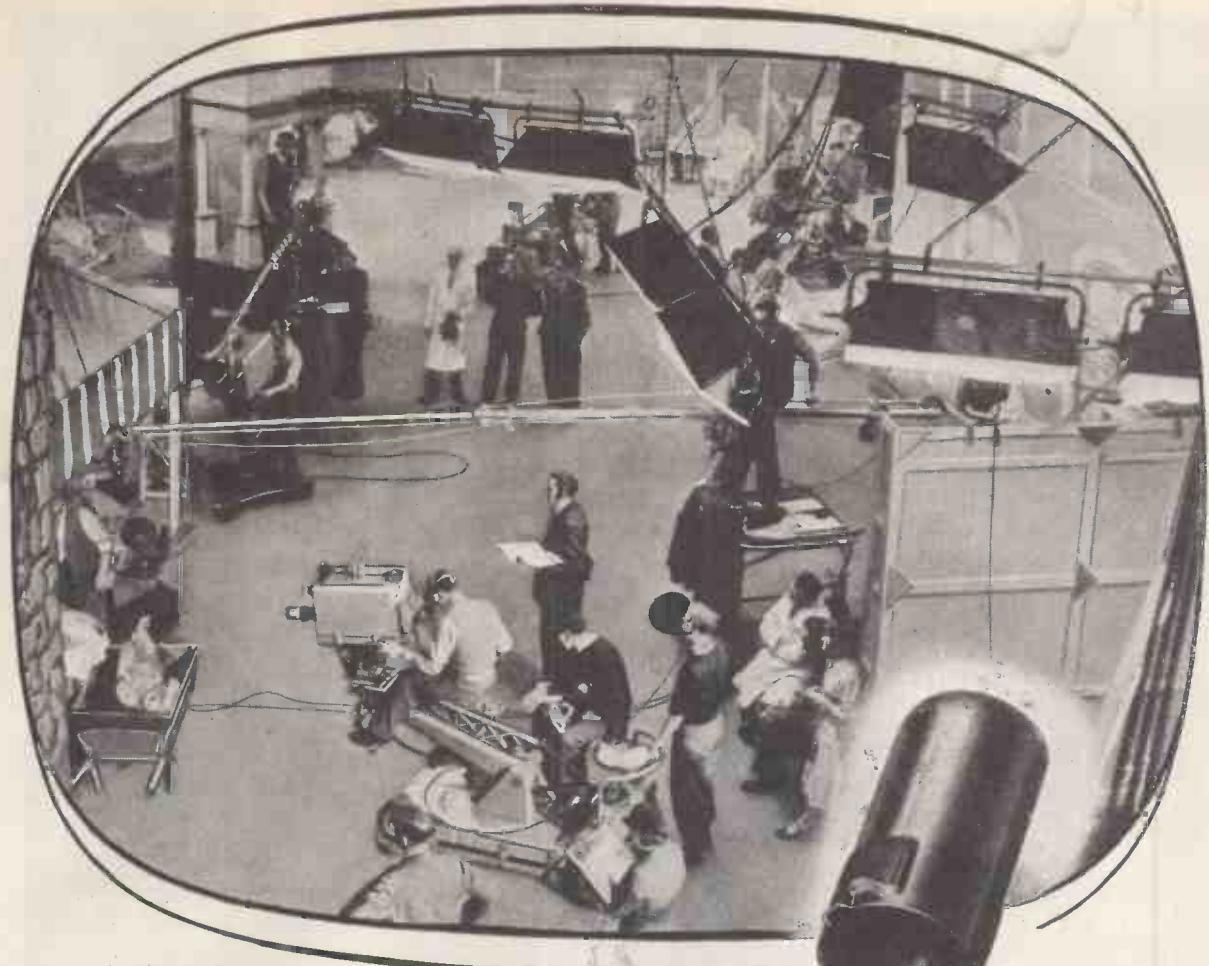
Due almost entirely to their own continuity of effort to improve the performance of iron dust cores, The Plessey Company now hold an unchallenged position in the breadth and quality of their standard range of cores, both for use at normal I.F. and broadcast frequencies and again for the more recent exploitation of the V.H.F. region and television. In the latter context, the Company is able to announce the introduction of several materials possessing greatly improved qualities for use in these fields. These are the Grade 22 and Grade 23 powders, mechanically suitable for use in conventional constructions and available at economic prices.



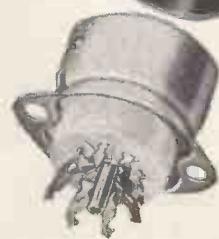
Manufacturers are invited to write for Plessey Publication No. 650/2 which contains comprehensive details of these products.

'Caslite' Iron Dust Cores are produced by

THE CHEMICAL & METALLURGICAL DIVISION OF PLESSEY • WOOD BURCOTE WAY • TOWCESTER • NORTHANTS



Why Ediswan Clix P.T.F.E. Valveholders are widely used in B.B.C. Television equipment



Large quantities of Ediswan Clix P.T.F.E. Valveholders are used in B.B.C. Television equipment. Only the combination of the finest insulation—P.T.F.E., the most efficient contact material—Beryllium copper—and Ediswan Clix design and manufacture can match the requirements of efficiency and reliability in this and all other

stringent valveholder applications. Ediswan Clix P.T.F.E. Valveholders are fully type approved for Services Grade 1, Class 1 conditions. Full details of these valveholders and other components in the Ediswan range are given in catalogue CR. 1681. Manufacturers and Development Groups may have a copy on request.

EDISWAN

CLIX

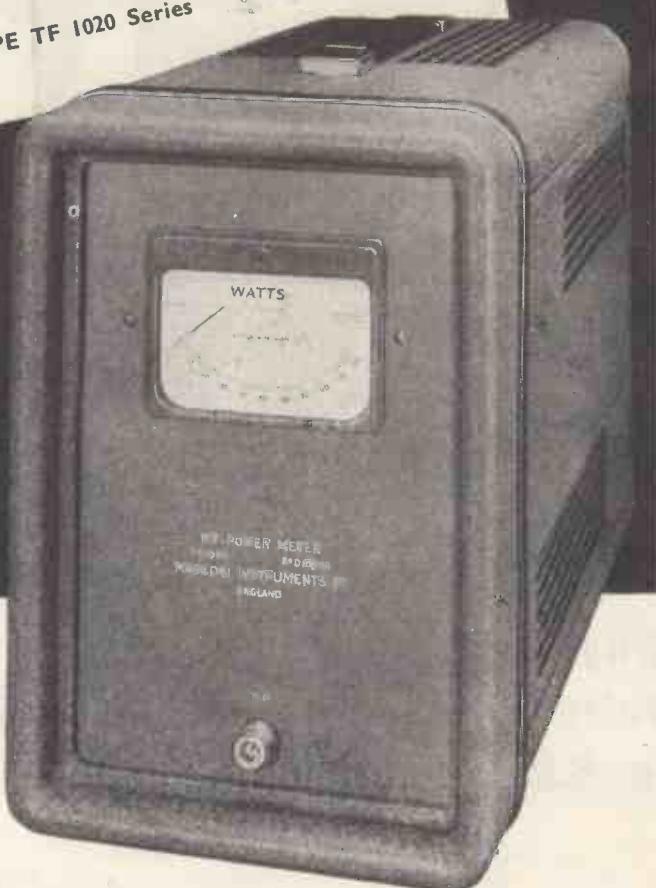
RADIO, TELEVISION & ELECTRONIC COMPONENTS

THE EDISON SWAN ELECTRIC COMPANY LIMITED, Member of the A.E.I. Group of Companies
155 Charing Cross Road, London, W.C.2 and Branches. Telephone: Gerrard 8660. Telegrams: Ediswan, Westcent, London
CR3 Radio Components Sales Office: 21 Bruton Street, London, W.1. Telephone: Mayfair 5543

*TWO New MARCONI
R.F. POWER METERS*
TYPE TF 1020 Series

POWER RANGE
0 to 100 Watts
FREQUENCY RANGE
D.C. to 250 Mc/s

Both instruments have a linear power scale and accurately register mean power input regardless of waveform. The TF 1020 has an input impedance of 75 ohms; The TF 1020/i, an input impedance of 50 ohms.



MARCONI INSTRUMENTS

SIGNAL GENERATORS · BRIDGES · VALVE VOLTMETERS · Q METERS · WAVEMETERS
FREQUENCY STANDARDS · WAVE ANALYSERS · BEAT FREQUENCY OSCILLATORS

MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTS · Telephone: ST. ALBANS 6160/9
30 Albion Street, Kingston-upon-Hull. Phone: Hull Central 16144. 19 The Parade, Leamington Spa. Phone: 1408

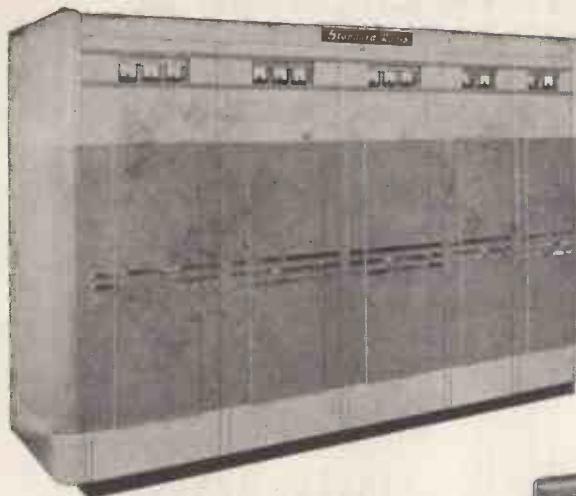
Managing Agents in Export:

MARCONI'S WIRELESS TELEGRAPH CO. LTD · MARCONI HOUSE · STRAND · LONDON · W.C.2
TC64

Standard in 6 Continents

The D.S. RADIO POINT-TO-POINT

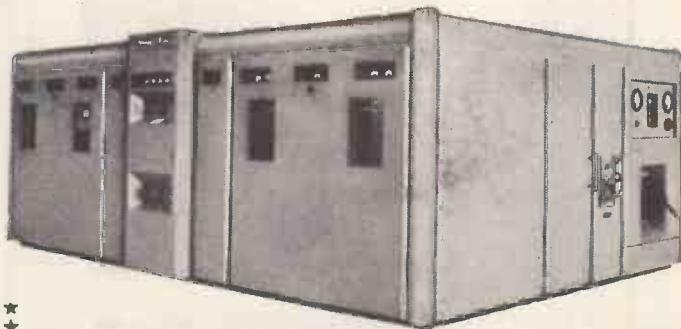
TRANSMITTER



More than 180 of these transmitters are in use throughout the World

* Available for early delivery

D.S. series of transmitters ★★★★★★★★★★★★		
★ D.S.10	3/5 kW	Double Sideband
★ D.S.12	4 kW	Independent or Single Sideband
★ D.S.13	40 kW	Independent or Single Sideband
★★★★★★★★★★★★★★★★★★★★★★		



Write for Radio leaflets :

Type	D.S.10	No. 179/41
Type	D.S.12	No. 129/41
Type	D.S.13	No. 130/41

Standard Radio



Standard Telephones and Cables Limited

Registered Office: Connaught House, 63 Aldwych, London, W.C.2.

RADIO DIVISION · OAKLEIGH ROAD · NEW SOUTHGATE · LONDON, N.11

*There's a wonderful future
for you in -*

ELECTRONICS

Every day the demand for the expert in electronics grows. Radio, television, radar and the whole field of industrial electronics are rapidly expanding, and the trained specialist in these fields is assured

of a well-paid career in this quickly developing profession. Here is your opportunity to acquire specialist knowledge. Write for our free brochure giving details of the following courses:

3-year Course

in Telecommunication Engineering (including opportunity for nine months' practical attachment in

E.M.I. Laboratories and Workshops). Next course commences on 14th September, 1955.

4-year Course in Electronic Engineering

Intended for outstanding Science sixth-formers who are capable of training into future team leaders in scientific applications. Final qualifications

are B.Sc. and City and Guilds Full Technological Certificate in Telecommunication Engineering. Next course commences on 4th October, 1955.

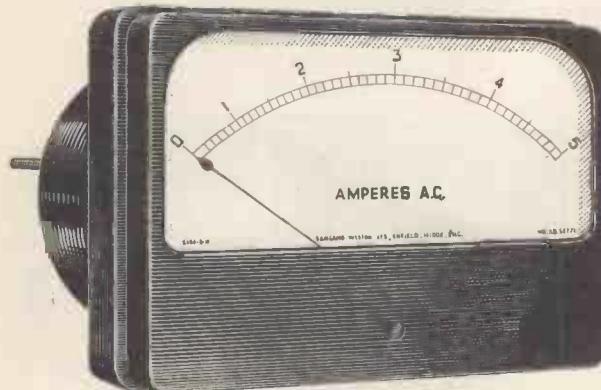
E.M.I. INSTITUTES

Dept. 127K, 10 Pembridge Square, London, W.2.

Telephone : BAYswater 5131/2

The College associated with a world-wide electronics industry, including "His Master's Voice," Marconiphone, Columbia, etc.

IA32



WESTON ELECTRICAL INSTRUMENTS INCLUDE :—
LABORATORY STANDARDS • PRECISION GRADE
INSTRUMENTS • INDUSTRIAL GRADE INSTRUMENTS
PORTABLE, ROUND, RECTANGULAR AND EDGEWISE
SWITCHBOARD AND PANEL MODELS • PORTABLE TEST
SETS • RELAYS • AIRCRAFT INSTRUMENTS

THE WESTON RANGE OF RECTANGULAR INSTRUMENTS

Supplied as D.C. moving coil, A.C. rectifier and H.F. thermocouple types; also A.C./D.C. moving iron types. Four sizes are available with scale lengths of 2.5in., 3.2in., 4.2in. and 6.25in. Front of panel or back of panel mounting may be adopted as desired, and if the former method is used there is complete interchangeability with existing round models. The 3.2in. and 4.2in. scale instruments are available with either illuminated or non-illuminated dials; the 2.5in. and 6.25in. scale instruments being available only with non-illuminated dials.

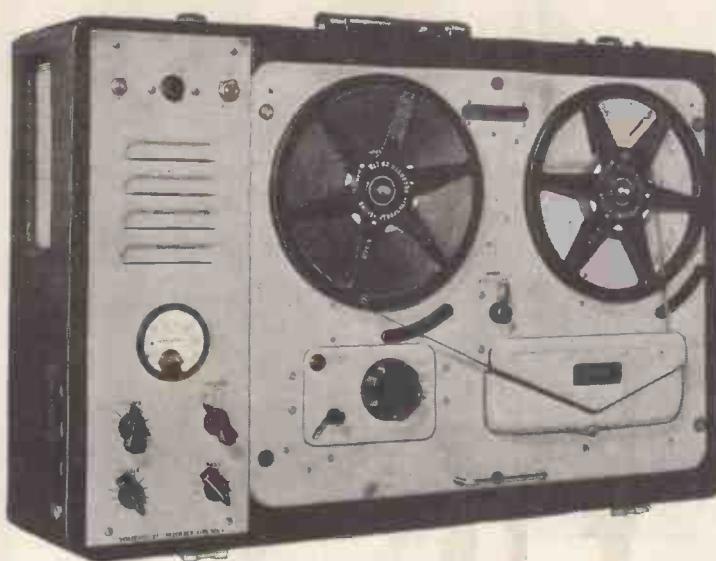
WESTON
Measuring Instruments

SANGAMO WESTON LIMITED

Enfield, Middlesex. Tel: Enfield 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151.
 Branches: London, CHAncery 4971 . Glasgow, Central 6208 . Manchester, Central 7904 . Newcastle-on-Tyne,
 Newcastle 26867 . Leeds, Leeds 30867 . Liverpool, Central 0230 . Wolverhampton, Wolverhampton 21912
 Nottingham, Nottingham 42403 . Bristol, Bristol 21781 . Southampton, Soton 23328 . Brighton, Brighton 28497

VORTEXION TAPE RECORDER



The amplifier, speaker and case, with detachable lid, measures $8\frac{1}{4}$ in. x $22\frac{1}{2}$ in. x $15\frac{3}{4}$ in. and weighs 30 lb.

PRICE, complete with WEARITE TAPE DECK £84 0 0

- ★ The play back amplifier may be used as a microphone or gramophone amplifier separately or whilst recording is being made.
- ★ The unit may be left running on record or play back, even with 1,750ft. reels, with the lid closed.

POWER SUPPLY UNIT to work from 12 volt Battery with an output of 230 v., 120 watts, 50 cycles within 1%. Suppressed for use with Tape Recorder. **PRICE £18 0 0.**

3-WAY MIXER AND PEAK PROGRAMME METER

FOR RECORDING AND LARGE SOUND INSTALLATIONS, ETC.

One milliwatt output on 600 ohm line (.775V) for an input of 30 micro-volts on 7.5-30 ohm balanced input.

Output balanced or unbalanced by internal switch. The meter reading is obtained by a valve voltmeter with 1 second time constant, which reads programme level, and responds to transient peaks.

Calibration in 2 db steps, to plus 12 db and minus 20 db referred to zero level. Special low field internal power pack supplies 8 valves including stabilising and selenium rectifier, consumption 23 watts.



Manufactured by

VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19

Telephones: LIBerty 2814 and 6242-3

Telegrams: "Vortexion, Wimble, London."

★ The total hum and noise at $7\frac{1}{2}$ inches per second 50-12,000 c.p.s. unweighted is better than 50 db.

★ The meter fitted for reading signal level will also read bias voltage to enable a level response to be obtained under all circumstances. A control is provided for bias adjustment to compensate low mains or ageing valves.

★ A lower bias lifts the treble response and increases distortion. A high bias attenuates the treble and reduces distortion. The normal setting is inscribed for each instrument.

★ The distortion of the recording amplifier under recording conditions is too low to be accurately measured and is negligible.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load. This is equivalent to 20ft. from a ribbon microphone and the cable may be extended 440 yds. without appreciable loss.

★ The .5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.'s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 3.5 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.



NEW! LEARN THE PRACTICAL WAY

COURSES WITH EQUIPMENT

With many courses we supply actual equipment thus combining theory and practice in the correct educational sequence. This equipment, specially prepared and designed, remains your property. Courses include: Radio, Television, Mechanics, Electricity, Draughtsmanship, Carpentry, Photography, Commercial Art, etc.

COURSES FROM 15/- PER MONTH

EMI INSTITUTES

The only Postal College which is part of a world-wide Industrial Organisation

Also courses for University Degrees, General Certificate of Education, B.Sc.Eng., A.M.I.Mech.E., L.I.O.B., A.C.C.A., A.C.I.S., A.M.Brit.I.R.E., A.M.I.I.A., City & Guilds Examinations, R.S.A. Certificates, etc.

The Advantages of E.M.I. Training ★ The teaching methods are planned to meet modern industrial requirements. ★ We offer training in all subjects which provide lucrative jobs or interesting hobbies. ★ A tutor is personally allotted by name to ensure private and individual tuition.

★ Free advice covering all aspects of training is given to students before and after enrolment with us. ★ Equipment supplied upon enrolment and remains your property.

POST THIS COUPON TODAY

Please send without obligation your FREE book.

E.M.I. INSTITUTES (Dept. 127k)
Grove Park Road, London, W.4

NAME _____

ADDRESS _____

SUBJECT(S) OF INTEREST
MAY

IC38

The Cultured Voice of Quality

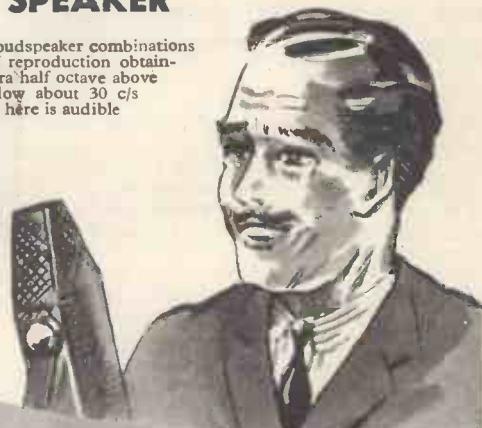
SOUND SALES PHASE INVERTER SPEAKER

For its size, this is one of the most attractive loudspeaker combinations I have yet come across . . . "the standard of reproduction obtainable must be heard to be believed." That extra half octave above about 12 kc/s and the corresponding one below about 30 c/s usually cost an awful lot of money. The range here is audible from below 30 up to above 15,000 c/s!

TECHNICAL REPORT by P. WILSON, M.A.,
of "THE GRAMOPHONE"

Price £14.10.0

complete with cabinet



OBtainable from all leading stockists
WEST STREET, FARNHAM, SURREY

Tel.: FARNHAM 6461/2/3

SOUND SALES LIMITED

Manufacturers of Electronic Equipment

Established since 1931

Extract from one of many letters received :—"It is unbelievable that a speaker at this price can be so very good. A friend of mine who heard it remarked that the clarity was amazing. I am now really hearing my records for the very first time."—J. A. Pearson, Doncaster.



Leonard Carduner (President, British Industries Corp., New York): Mr. Leak, please tell our readers what the "Point One" amplifier combination does in a high fidelity music system.

H. J. Leak: As you know, Mr. Carduner, the amplifier is actually the "heart" of the system. Your record player, radio tuner, or tape recorder feeds electrical impulses into the pre-amplifier and amplifier. These, in turn, strengthen the signals and feed them into a speaker.

It is difficult to strengthen a signal without distortion. "Point One" means that the Leak reproduces voice and instruments with insignificant harmonic distortion of 0.1% at 8 watts! This gives the illusion of the actual "presence" of the performer.

L.C.: In demonstrating the "Point One" amplifier at Audio Fairs, the most impressive thing we do is to turn the amplifier on its side, show people the terminal board "custom" construction used in American scientific instruments, almost never in radios.

H.J.L.: We had a practical reason for this . . . because every terminal connection is easily accessible. It keeps servicing costs down.

L.C.: Yes, and many have praised the control panel of the "Point One" pre-amplifier, because it offers every sensible adjustment to match the new hi-fi records . . . and full 25 db bass and treble range.

H.J.L.: In fact, the "Point One" has more adjustments than the Leak amplifiers supplied to the B.B.C., but no superfluous settings to add unnecessary cost.

L.C.: Well, you have one very important exclusive feature. Plug-in jacks on the Leak front panel make it easy to give any tape recorder the full benefit of the Leak circuit, in recording and playback! People with portable tape recorders, who put them away when not in use, can connect them instantly. Practical features like this make the "Point One" most enjoyable to use.



TL/10 & POINT ONE 27 Gns. COMPLETE, In Great Britain. AMPLIFIER PRE-AMPLIFIER

Write for illustrated literature W.

H. J. LEAK & CO. LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3
'Phone: SHEpherds Bush 1173/4

Telegrams: Sinusoidal, Ealux, London

Cables: Sinusoidal, London

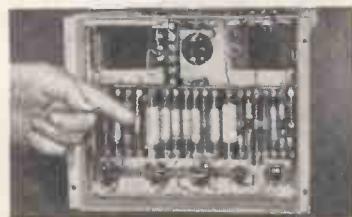
In the U.S.A.

and all over the world
you will find

LEAK

E Q U I P M E N T

This advertisement, prepared by our American Agents, is appearing in current U.S.A. technical publications and is reproduced here for the interest of our friends in this country.



27 Gns. COMPLETE, In Great Britain.
A price made possible only by world-wide sales.

POTTED MAINS TRANSFORMERS

These are really superior construction fitted in cast metal cases and compound filled. Terminals come to ebony baseboard. All are upright mounting and have 220/230 normal 50 cycle mains input and fully screened primary.

Type 5F1. 265-0-265 at 300 mA. 6.3 v. at 7 amp.; 4.4 v. at 2.5 amp.; Price 35/- plus 3/- carriage.

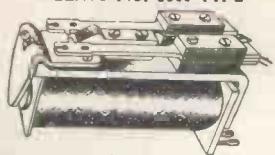
Type 5F2. 365-0-365 at 150 mA. 4 v. at 2.5 a.; 0.9 v. at 4.2 a. Price 32/6, carriage and packing 3/-.

Type 5F3. 360-0-360 at 2 v. at 2 a.; 4 v. at 1 a.; This is an ideal transformer for televisions and scopes using V.O.C.R. 97, etc. Price 25/-, carriage 2/6.

POTTED CHOKES

These chokes are in similar type cases and therefore match the above transformers. Type 5F4. 5 H. at 300 mA. Price 10/-, carriage and packing 2/6.

Type 5F5. 10 H. at 150 mA. Price 12/6, post and packing 2/6.

RELAYS P.O. 3000 TYPE

Ref. 5A1. 2000 ohm, slow close coil plat. contacts, one break, two make. Price 12/6 each.

Ref. 5A2. 2000 ohm, standard coil, plat. contacts, change over make before break, two make, 1 break. Price 15/-.

Ref. 5A3. 200 ohm, standard coil, plat. contacts, two make, 1 break. Price 7/6 each.

Ref. 5A4. 10 ohm, standard coil, one pair plat. contacts, also mounted but not operated by the relay, are thermal change-over contacts, make before break. Price 8/8 each.

RACKS AND RACK EQUIPMENT

Standard 6ft. rack, heavy gauge channel construction, tapped holes and standard 19in. centres. Price 24/15/- plus carriage. Ditto, but enclosed with sheet metal sides (vented) and with door, fitted handle and locking bars. Price 25/15/-.

Ref. 5A8. Safety switch, cuts off mains directly door is opened. Price 8/-.

MOUNTING PLATES FOR ABOVE RACKS

Fitted with side supports to hold chassis, chassis will be included if requested but this will already have several holes punched and drilled.

Ref. 5A5. 14in. front plate with chassis supports. Price 17/6.

Ref. 5A6. 12in. front plate with chassis supports. Price 16/6.

Ref. 5A7. 10in. front plate with chassis supports but cut out for meters and other items. Price 8/6.

AUTO TRANSFORMERS

For working American equipment of our main etc., etc., Input tapped 200-240 v. Output 115 v. In addition to those listed below we have

special this month 150/200 watt totally enclosed in metal box with input and output leads. Price 47/6, plus 2/- post and packing.

Totally enclosed and screened. Price 50 watt £21/2/6 1/6
100 watt £21/16/- 1/6
150 watt £23/- 2/-
250 watt £24/10/- 2/6
500 watt £25/10/- 2/6

Unscreened.

1 KVA (1,000 w.) £26/10/- 5/-
1.5 KVA (1,500 w.) £27/17/6 5/-
2 KVA (2,000 w.) £21/0/17/6 7/6
3 KVA (3,000 w.) £21/2/7/6 10/-
5 KVA (5,000 w.) £19/5/- 12/6

SLIDER RESISTORS

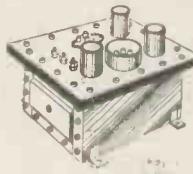
Heavy Duty Type.
Size 7in. x 1in. 11 ohms 4.5 amp. 22/-; Size 5in. x 1in. 1.2 ohms 16 amp. 15/-; Size 13in. x 1in. 3 ohms 10 amp. 15/-; 1 ohm 25 amp. 15/-

SPECIAL PAGE FOR INDUSTRIAL USERS**R. F. HEATER CONSTRUCTORS KIT**

All the parts including metal chassis for building a 250/500 watt R.F. Heater for dielectric or induction heating is available as a kit complete with theoretical diagram and practical notes—price for the complete kit of parts is £40 plus carriage at cost.

RADAR TRANSFORMER

For pulse work at 4 kV., this is Ministry style No. 224261 Type 2. Oil filled and fitted with two valve holders and ceramic insulators. It contains a pulse transformer, a choke and a filament transformer, all of which are designed to operate on 4 kV., 25/- each.

**AMERICAN FORCES UNITS I-122A and TR-24A**

These provide a means for rotating an aerial (or other medium) to any desired azimuth. The operation is briefly as follows:

1. Dial or control handle is turned to desired azimuth.
2. The Selvyn in the indicator gives a voltage which after being amplified causes the driving motor to rotate the tower.
3. As the tower rotates towards the null position the voltage applied to the drive motor decreases and is removed before the tower stops. If the tower stops before correct position voltage is again automatically applied. If the tower rotates beyond the correct position, the reverse relay operates and causes the tower to move backwards, until it stops at the null point where it remains at rest.

PROTECTION DEVICES

1. Circuit breaker prevents voltage being applied before valve 7 has warmed up.
2. Circuit breaker prevents the drive motor from over-loading.

SELYNS MOTORS

Both receiver and transmitter selsyns are three phase rotor induction motors. The operation is briefly as follows:

Stators of transmitter are connected to corresponding stators of receiver. Note the rotor of one is connected to single phase supply. A voltage would appear on the rotor terminals of the other. This voltage will be of the same frequency as the voltage applied but its value will depend upon the relative angular positions of the rotors of the two selsyns.

DRIVING MOTOR

This is a two phase squirrel cage induction motor geared to the antenna mast. In order to operate the motor from a single phase source a condenser is connected in series with one of the phase windings. Direction of rotation is reversed by switching the condenser from one phase to the other by means of reversing relay.

IMPEDANCE AMPLIFIER

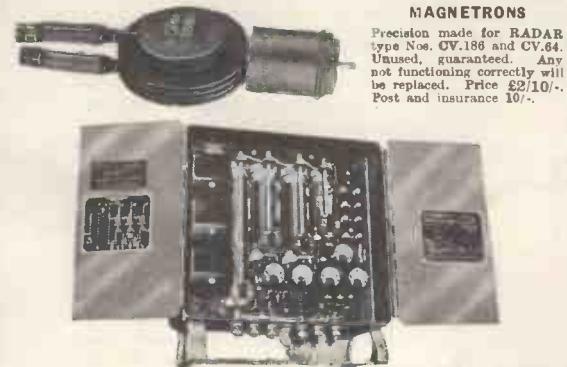
When the two selsyns have an angular displacement a voltage is generated in the receiving selsyn. This is amplified by two independent amplifiers. THE IMPEDANCE AMPLIFIER controls the magnitude of an impedance connected in series with the antenna motor and consequently controls the motor. THE CONTROL IMPEDANCE consists of the anode circuit of Valve 7, matched to the motor by means of Transformer 102. When Valve 7 has negative bias the anode circuit has high impedance. When conducting, however, the impedance falls to just a few ohms. The effect of which will vary the voltage to the motor and thus control its speed of rotation.

THE RELAY AMPLIFIER

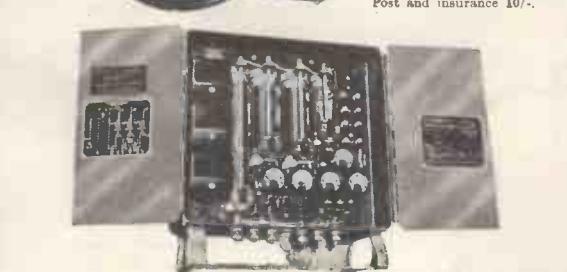
The output of the selsyn receiver is also applied to the relay amplifier, through transformers so that it is either in phase or 180° out of phase with the amplifier voltage depending upon which side of the present position the antenna rests. The relay controls the direction of rotation of the motor.

POWER SUPPLIES

The equipment is fitted with power components for 117 volts 60 c.p.s. but will operate on our Mains if supply is connected through a step-down transformer of 1 K.W. rating. Price £25 the two units, or separately I-122A £25, TR-24A £35. carriage extra at cost.

**MAGNETRONS**

Precision made for RADAR Precision made for RADAR type Nos. CV.18/88 and CV.64. Unused, guaranteed. Any not functioning correctly will be replaced. Price £2/10/- Post and insurance 10/-.

**CHARGING SWITCHBOARD**

Feed this Switchboard through a Mains Transformer and Rectifier giving 24 volt D.C. up to 50 amps, and you have an excellent multi-circuit charger for simultaneously charging several batteries at different currents. This is an ex-Government switchboard rated at 350 watts 18 volts fitted into steel cases with doors. It contains three reverse current relays, one voltmeter, one main ammeter, two secondary ammeters and three variable resistors for controlling circuits. These are brand new, in original cases. Price £24/10/-, carriage 10/-.

We can supply a 12 volt, 50 amp. Mains Transformer at £24/5/-, plus 5/- carriage.

IMPORTANT NOTICE

The equipment described on this page is not available at our normal retail shops—it can be seen at our special sales department address as below. Order and enquiries should also be addressed as below:

E.P.E. LTD., SPECIAL SALES DEPT., BOURNE HOUSE, GROVE ROAD, EASTBOURNE, SUSSEX.

HIGH POWER TRANSFORMERS

For R.F. Heaters, transmitters, etc., etc. These are open wound type for maximum cooling and have the normal 200-250 primary fully screened.

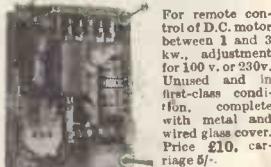
Type 5F6. 1,000 v. at 1/2 amp., e.g. 5 K.V.A. Price £28/10/- carriage and packing 5/-.

Type 5F7. 1,500 v. at 1 amp., e.g. 1.5 K.V.A. Price £21/5, carriage and packing 7/6.

Type 5M1. 1000-0-1000 v. at 1.5 amps. e.g. 1½ KVA. Price £21/2/10/-, carriage and packing 7/6.

Type 5M2. 1000-0-1000 v. at 500 mA. and 4 a. at 4 a. Price £27/10/-, carriage and packing 4/6.

Type 5M3. 375-0-375 v. at 250 mA. and 4 v. at 4 a. Price 37/6, carriage and packing 3/6.

AUTOMATIC MOTOR STARTER

For remote control of D.C. motor between 1 and 3 kw., adjustment for 100 v. or 230v. Unadjusted and in first-class condition, complete with metal and wired glass cover. Price £10, carriage 5/-.

POWER FILAMENT TRANSFORMERS

Type 5M4. 4 v. at 4 a. 2-0-2 v. at 10 a. Price 18/6, carriage and packing 3/6. Type 5M5. 3.15-0-3.15 at 10 a. 4-0-4 at 10 a. 4-0-4 at 2 a. 4 at 4 a. 2.5-0.2-5 at 3 a. Price 27/6, plus carriage and packing 3/6. Type 5M6. 34 v. at 2 a. tapped 32 v., 30 v. and 28 v., for relays, etc., 22/6, plus 3/6 carriage and packing.

POWER CHOKES. Open wound type and with clamps.

Type 5M7. 30 Henry at 500 ma. 35/-.

Type 5M8. 20 Henry at 500 ma. 32/6.

Type 5M9. 15 Henry at 500 ma. 27/6.

Type 5M10. 10 Henry at 500 ma. 22/6.

Type 5M11. 25 Henry at 250 ma. 18/6.

Type 5M12. 3 Henry at 10 amps. 18/6.

Type 5M13. 200 Henry at 5 ma. 15/-.

POWER FOR TR1154/55

We can offer brand-new, and unused, the two rectifier units for mains operating the transmitter TR1154 and its associated receiver R1155. Both rectifier units are completely enclosed in metal cases and operate directly from normal 50 cycle A.C. mains. Price £17/10/- the pair, carriage and packing £2 extra.

TRANSMITTER 1131

This is a high powered transmitter for operating over the same frequency range as the Receiver 1132, i.e., 70-130 megacycles. It is a very bulky transmitter and probably contains around £300 worth of equipment. As far as we know these have never been used but of course have been in store for a long time and therefore they will need attention before being put into operation. We offer these less valves £37/10/- Buyer collects. We also have a quantity already stripped so if you are needing spares for this transmitter please get in touch with us now.

R1132

We have a small quantity of these receivers still available less valves. Their condition unfortunately is not good but they appear to be repairable, and, of course, contain a multitude of spare parts. At 30/- each they represent a real bargain. If not collecting, please include 5/- for packing and carriage.

RECEIVER TRANSMITTER 38

This is the British equivalent of the walkie-talkie. It operates on the frequency range 7.4-9 mc/s. It has many novelty applications in the home and can eventually be turned into a useful little portable receiver. Complete and with valves, unused but not guaranteed, price 37/6, post 2/- extra.

STABILAVOLT

This is a valve designed and constructed to facilitate the taking off stabilized voltage.

These are brand new and unused. Price 10/6 each, post 1/- extra.



THE TWIN 20
This is a complete fluorescent lighting fitting. It has built-in ballast and starters—stove enameled white and ready to work. It is an ideal unit for the kitchen, over the work-bench, and in similar locations. It takes two 20-watt lamps. Price, complete less tubes, £9/6, or with two tubes, 39/6. Post and insurance, 2/6. Extra 20-watt tubes 7/6 each.

ALL MAINS THREE



A handy mid-size A.C./D.C. 3-valve mains receiver giving powerful reception over long and medium waves. All component parts, including valves, coils, resistors, etc., but not loudspeaker and cabinet (you may already have these) will cost you only 19/6 plus 1/6 post—data available separately 2/- post free.



ELPREQ TAPE RECORDER

This instrument combines the Mk. IIIU Truxox Tape Deck and the Cleveland Wide Band Amplifier with a special high flux speaker and forms one of the finest tape recorder combinations available to-day. It will, of course, play recorded tapes as well as make its own recordings of radio, music, meetings, telephone conversations, letters, etc., etc. The price, complete with reel of tape and ready to operate, is

39 Gns.

Carriage and Insurance 12/6. Hire Purchase terms if required.



MINI-MAINS PORTABLE T.V.

Uses standard conventional circuitry employing a total of 13 valves and 2 crystal diodes. The Cathode-ray tube used is a 2Jin. Service type VCR139A. The layout is extremely clean, straightforward and professional. The wiring, whilst naturally being a little more intricate due to miniaturization, is nevertheless completely sensible. The total cost comes to £16/21/- It should be approximately 9½ x 8 x 5in. Full construction data, layouts, diagrams, templates, etc., running into some 50 sheets, is available, price 5/- post free.

MINI-MAINS FOUR

Uses a 4-valve circuit with high-efficiency coils—covers long and medium wave bands and fits into the neat white or brown Bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £3/19/6 plus 2/- post. Constructional data free with the parts or available separately 1/6.



P.V.C. HEATER WIRE

This has a resistance of 16 ohms per ft. It is wound on non-hygroscopic insulation and covered over with P.V.C. shrunk sleeving. Quite suitable for use underground or under water. Ideal also for twisting around pipes to stop freezing or to preheat liquid. Price 1/- per yard.

YOURS FOR £1 ONLY

COMMUNICATIONS RECEIVER R1155



This set, as most will know, is considered to be one of the finest communications receivers available to-day. The frequency range is 75 kc/s to 18 Mc/s. It is complete with 10 valves and is fitted in a black metal case. Made for the R.A.F., so obviously a robust receiver which will give years of service. Slightly used but working order. PRICES Grade 2 £7/19/6, Grade 1 £9/19/6, or new and unboxed £11/19/6. Or will be sent against deposit of £1. If you cannot call to collect please include an additional 10/- to cover cost of transit case and carriage. This partly returnable to you if and when you return the transit case.

MAINS POWER PACK FOR R1155

With Pentode output stage. Plugs into socket on receiver so no internal modifications are required. Price 25/10/- complete with speaker ready to work, carriage 3/6. If bought with receiver, deposit is 11/-.

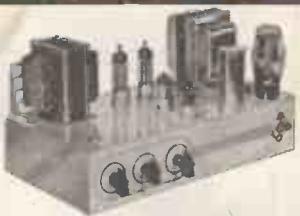


NOBLEMAN GRAM

A 70 Gu. RADIOPHONIC direct from makers for only 40 Guineas. Or £4 deposit. A beautiful piece of furniture yet a most up-to-date radiogram—figured walnut lined sycamore—radio raised to comfortable level—compartment for records—5-valve A.C. mains superhet, covers long, medium and short waves—all latest refinements, negative feed-back tone control, etc.—large multi-coloured edget dial—latest "Hi G" three-speed auto-changer with the famous pick-up—plays all types of records perfectly. Free Delivery in London Area. Elsewhere £2.

RECORD PLAYER BARGAIN

3-speed record player with pick-up using the famous Acos "Hi G" turnover crystal—motor also by very famous maker—speed selection is by Bakelite knob. All on unit board ready for installation. A wonderful bargain at £8/10/- plus 5/- carriage—Hire Purchase 15/- deposit.



MULLARD AMPLIFIER "510"

A High Quality Amplifier designed by Mullard engineers. Robust high fidelity, with a power output exceeding 10 watts and a harmonic distortion less than .4% at 10 watts. Its frequency response is extremely wide and level being almost flat from 10 to 20,000 C.P.S.—three controls are provided and the whole unit is very suitable for use with the Collaro Studio and most other good pick-ups. The price of the unit complete only needs to be paid to £12/10/- or 25/- deposit, plus 10/- carriage and insurance. Alternatively, if you wish to make up the unit yourself we shall be glad to supply the components separately. Send for the Mullard amplifier shopping list.

CABINETS FOR ALL

We confidently believe we carry the best stock of cabinets in London. The one illustrated is The Bureau, a really beautiful cabinet elegantly veneered in walnut and finely polished. The control board is revealed when the front is dropped. Both radio board and motor board are left uncut to suit your own equipment. Price is 16 guineas, carriage 12/6. We have many other types in stock. Pay us a visit, or send for Cabinet List.



THE CONTEMPORARY

In the modern trend is this very stylish contemporary console. Veneered in oak with contrasting mouldings, and is ideal for use with modern furniture or with other contemporary fittings or furnishings. The radio and motor board is uncut and its size, 30 x 15½in., provides ample room for all equipment. Price £3/15/-, carriage, etc., 12/6.



BARGAIN FOR CONSTRUCTORS

Modern style cabinet in contrasting veneers, with metal chassis, three knobs, colour scale, and pointer. Price 29/6, post, etc., 2/-. All other components to build 2-waveband superhet. Price 25/- Data, 1/6 (free with components).



GRAMOPHONE AUTO-CHANGER

The latest model by very famous manufacturers. 3 speed, mixes 10in. and 12in. with crystal turn-over pick-up, brand new and perfect in original cartons. Price £11/10/- Carr., etc., 12/6.

E.P.E. LTD. (SEE OVER)

BEST SELECTION OF RADIO CHASSIS IN LONDON

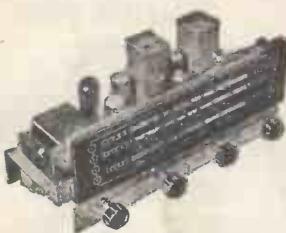


TABLE RADIO CABINET

Due to a special purchase, we are able to offer this very fine cabinet, size approx. $15\frac{1}{2} \times 14 \times 6\frac{1}{2}$ in. Walnut veneered and satin finished, 37/6, carriage and packing 3/6. Note.—This cabinet is the correct one for the Windsor chassis above with 6 in. speaker.

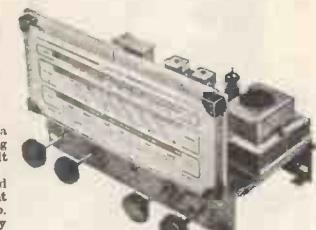
THE "WINDSOR 5"

This is a 5-valve A.C. superhet covering the usual long, medium and short wave bands. It has a particularly fine clear dial with an extra long pointer travel. The latest type local valves are used and the chassis is complete and ready to operate. Chassis size 15in. x 6in. x 6in. Price £9/19/6 complete with 8 in. speaker, carriage and insurance 10/- H.P. terms if required.



THE

CLEVELAND "ORGANTONE"



The Cleveland "ORGANTONE" is a 5-valve 3-wave band superhet covering long, medium and short wave. Built to a very stringent specification.

Osram miniature valves are employed and low loss iron cored coils account for an excellent signal to noise ratio. Full A.V.C. is applied to both frequency changer and I.F. stages, and particular care has been taken to ensure freedom from frequency drift.

The output stage utilises variable negative feedback for tone control, and, but for standard pentode correction, no cut in the ordinary sense is applied. A gram. position is provided and reproduction of records is particularly good. An amply proportioned power transformer with a primary tapped for 110-220 volts gives complete isolation from the mains.

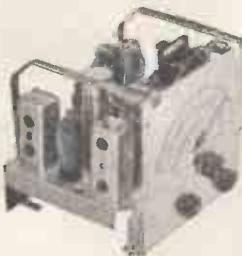
Chassis size is 12in. x 7in. x 7in.—Scale size is 10in. x 4in.

This receiver has been tested in particularly difficult areas and its stability and noise rejection have produced exceptional results.

Price £11/10/- or £15/- deposit—carriage, etc., 7/6.

A circuit diagram and photograph available price 2/- post free.

SUPERHET RADIO BY BEETHOVEN

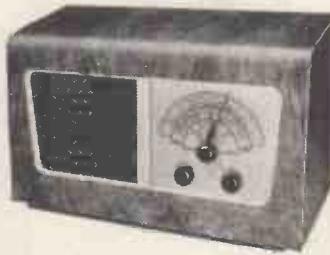


NOW AVAILABLE FOR LONG, MEDIUM and SHORT WAVES

Extremely well built on chassis size approx. $9\frac{1}{2} \times 7\frac{1}{2} \times 8\frac{1}{2}$ using only first-class components, fully aligned and tested, 110-240 volt a.c. normal operation. Large clear edge-set dial. Three wave bands covering Long, Medium and Short waves complete with five Mullard valves, frequency changer, double diode triode, pentode output and full wave rectifier. Complete with Bola loudspeaker ready to operate. Special cash-with-order price this month, £8/17/6, carriage and insurance 7/6. Hire purchase terms £3 deposit, balance over 12 months.

SAVE £1

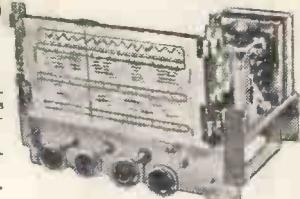
Really beautiful walnut veneered and polished cabinet for only 39/6 if purchased at the same time as the Beethoven 5 valve superhet chassis (illustrated) above. Bought separately the price of the cabinet is 59/6. H.P. deposit on cabinet and chassis is 32/- only.



ANOTHER CLEVELAND CHASSIS—"THE TREMENDO"

The first Cleveland chassis was good, but this one is really superb. It has a 7-valve circuit with 6 watts output, fitted with independent bass and treble controls. It is really an efficient R.F. circuit coupled to a high-fidelity amplifier. The chassis size is the same as the Organtone, namely $12 \times 7 \times 7$ with the $10\frac{1}{2} \times 4\frac{1}{2}$ multi-coloured scale, and it is built to the same exacting specification as the Organtone. Price £14/10/-, carriage and packing, 7/6. H.P. terms if required.

DULCI RADIO CHASSIS



Complete range of these famous receivers now available at all our branches—Cash or Hire Purchase—demonstrations gladly given.

3-wave (L. M. & S.) 5-valve £12/12/- Ref. B3.

Pushpull 6-valve 3-wave £15/15/- Ref. B3PP

	s.	d.	Ref.
Pushpull with R.F. stage 3-wave 7-valve	18	18	0 B3PP/RF
6-wave L.M. and 4 short waves (band spread)	15	15	0 B6
6-wave with pushpull	18	18	0 B6PP
6-wave with pushpull and R.F. stage	23	2	0 B6PPRF

All available on H.P.—deposit 15 per cent, balance over 12 months

THE ARMSTRONG F.C. 48

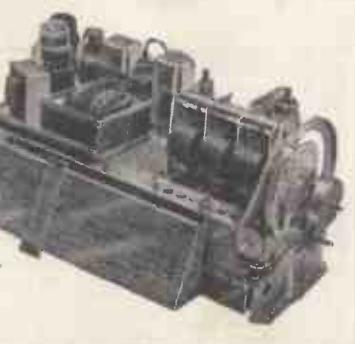
Among high class radio chassis, the name Armstrong is probably the most famous, and their new model FC48 certainly lives up to tradition. Of course, only the best of everything has been used and extreme attention has been paid to the lining up. It is virtually a 10 valve circuit, for among its eight valves two double triodes are employed. Special features of this chassis are (a) 8-watts output in a pushpull circuit with ample negative feed-back to ensure the highest efficiency, (b) provision for using F.M. e.g. power brought out to sockets and indicator on dial; (c) independent bass and treble controls with visual indication of setting, (d) four wave-bands covering 16-51, 50-120, 190-350, and 1,000-2,000 metres. The size of this chassis is $12\frac{1}{2}$ in. x 9in. x 9in. Price £23/18/-, plus 7/6 carriage and insurance.



THE EXPORT 5 3-WAVE BAND 5 VALVE SUPERHET CHASSIS

Brand new, tested and ready for immediate operation, full vision scale size 6in. x 8in. covering the long wave 900-2,000 metres, medium wave 185-550 metres, and short wave 16-50 metres. Complete with valves and covered by our six months' guarantee. First-class parts. Parmelet resistors, Eire resistors, Hunte condensers, etc. Special points include (1) Flywheel tuning, (2) Dust cored I.F.'s, (3) Sockets for extension speaker and pick-up, (4) 4-watts output. Price £8/10/-, carriage, packing and insurance 7/6 extra.

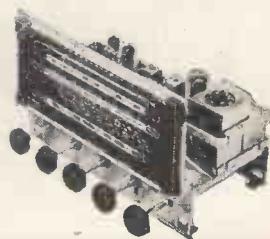
10/- SECURES THIS BARGAIN



The set, a product of one of our famous manufacturers, has H.F. stage, tuning indicator, and all modern refinements, covers 5 wavebands including short waves to 11 metres. Offered less valves, power-pack, scale and tone drive, otherwise complete and unused, price 25/- or 10/- deposit, balance over 12 months, carriage 7/6 (uses octal range valves).

THE LATEST DULCI

This is the Model F3PP. Developed especially to meet the increasing demand for high fidelity equipment. Particularly suitable for replacement in a radiogram. This is a 7-valve 3-wave band superhet with pushpull output, incorporating separate bass and treble controls thereby ensuring a maximum control of fidelity, volume and tone. Wave band coverage 16-50, 190-550, 900-2,000 metres. Valve line X79, 6BA6, ECC83, G230, and two 6AQ5. This chassis is suitable for use on A.C. mains from 100-110 v., and 200-250 v. Price 17 guineas or £2 deposit, carriage and insurance 7/6.



THIS MONTH'S NEW OFFERS

Hi-Fi EQUIPMENT

We carry good stocks of the latest equipment, except for very busy periods we can usually give demonstrations. To name a few items of stock which we carry and recommend.

SPEAKERS

The latest W.B. cambric cone speaker units all in die cast frames with universal impedance speech coils 3 ohm, 7.5 ohm, and 15 ohm.

Model H.F. 812 8in. £3 5/-
Model H.F. 912 9in. £3 9/-
Model H.F. 1012 10in. £3 17/-
Also in die cast frames but with 3 ohm or 15 ohm, speech coils.

Model H.F. 610 5in. £1 19/-
Model H.F. 610 6in. £2 12/-
Model H.F. 1212 12in. £9 15/-

We also carry a range of G.E.C. Wharfedale and Goodmans Hi-Fi speakers.

PICKUPS

ACOS HI-G HEADS for use with Garrard or Colaro plug-in units in brown or ivory 42/- each.

THE B.J. ARM, new type to give correct tracking over the whole recording. Extra light weight, suitable for Decca, Garrard and Chippingham heads 22/10/-.

ACOS GLOW HEADS with the new HI-G plug-in heads, all designed to obtain the nearest to perfect reproduction. Pressure only 8 grammes. Complete with either head £3/7/6 extra head £2/2/-.

THE NEW LEAK TL-10 AMPLIFIER WITH "POINT-ONE" PRE-AMP.

In the amplifier world the name Leak probably stands highest. It is symbolic of precision sound engineering. The TL-10 has an output of 10 watts and with its pre-amplifier will operate from any good pickup. A continuously variable input attenuator in the pre-amp, permits the use of crystal, moving iron or moving coil pickup. Provision is made for tape recording and play-back as an exclusive feature. Easy accessible jacks being provided on the front panel for speedy hook-up. The complete amplifier with pre-amp. £28/7/- or TL-10 amplifier only 17 gns. or Point-One amp. only 10 gns.

In this instrument is combined the exceptional qualities of the G.E.C. metal cone loud-speaker in its ideal cabinet (the Octagonal illustrated below) and a most modern 3-valve amplifier. This combination will give a realism of musical reproduction not easily obtained even at twice or three times its price and is definitely the reproducer for bringing out the full frequency now available in long playing microgroove recordings. If you can, please come to one of our branches and hear this fine instrument—failing this, then take our word that it is really good and send an order today.

Price 27 guineas or £24/10/- deposit, balance over 12 months. Amplifier available separately at £10/10/-.



FRICITION DRIVE MOTOR



Operates from standard 50 cycle mains—a thoroughly good job with dozens of applications—limited quantity only 17/6 each, post and packing 1/6.

SPECIAL BATTERY VALVES

All 1.5 v. heaters. IT4, 1R5, 1S5, 3A4, offered as a set 30/- the four.

THIS MONTH'S SNIP

Mains transformer and choke by Haines Radio Ltd. Standard 50 cycle input with 10 volts tappings. Secondaries: 500-0-500 volt at 500 milliamper and 6.3 volts at 6 amper, also choke to match 10 Henry's at 500 millamps. Limited quantity only at 45/- the pair. Carriage and packing 5/- extra.

P.M. SPEAKERS

All by best makers. Rola, Elac, Plessey, Truvox, etc.

5in. p.m. 19/6
6in. p.m. 17/6
8in. p.m. 19/6
10in. p.m. 25/-
12in. p.m. 35/-

COMPONENT BARGAINS

(all new and unused.)

ELAC FOCUS MAGNET. Type No. E25-7D. Price 12/6, plus 9d. post.

OUTPUT TRANSFORMERS. Standard pentode matching ordinary 2/6, push pull centre tapped, 3/6.

COILS suitable for F.M. and T.V. with dust core and fixing lugs. 12 assorted 5/6.

I.F. TRANSFORMERS. Medium size exceptions high Q potted construction, spanning over 450-470 K.C.s., 5/6 per pair.

2-DAG TUNING CONDENSER. Midget .0005 5/8.

HALF MEG. POTS. With switch, 1/2, long switch 1/3, double pole switch, 2/2—(all short spindle but room for knob).

1 MEG. POTS. Long switch 1/3, short spindle preset 1/—

CERAMIC CAPACITORS. 1,000 pf. and 800 pf. 3/6 doz.

TRIMMERS. 3-30 pf. standard compression type, 4/- doz.

RESISTORS



50 assorted 1 and 1/2 watt resistors. Ranging between 10 ohms and 10 megohm (Our selection). Price 5/- pkt. Ditto 1 watt, 7/6.

TRANSFORMER 100 WATTS

These are transformers with a wound primary tapped 200, 220, 240, but no secondary. There is ample window space, however, for the hand winding of secondary to suit your own requirements. Approximately two turns per volt are required. The amps. taken out will depend upon volts, e.g., 10 amps. at 10 volts, 50 amps. at 2 volts, etc. etc. Price 10/- post and packing 2/-.



CHASSIS ASSEMBLY

3 colour, 3 waveband scales covering standard, Long, Medium, and Short wavebands, scale pan, chassis punched for standard 5-valve superhet, pulley driving head, springs, etc., to suit. Scale size 14in. x 3in. Chassis size 15in. x 5in. x 2in. deep. Price 15/- plus 1/6 post. Note.—This is the one that fits our 39/6 table cabinet.

BENDIX RA-IB COMMUNICATIONS RECEIVER

Originally intended for the American Forces this fine receiver. (A small quantity of which has been released by the Ministry of Supply) is available to you if you act promptly. Designed to receive C.W. or R.T. it uses probably the finest Verner tuning and band spreading arrangement possible. It covers the following bands:—

Band 1	.15	to	.315 mc.
Band 2	.315	to	.680 mc.
Band 3	.680	to	1.5 mc.
Band 4	.18	to	3.7 mc.
Band 5	3.7	to	7.5 mc.
Band 6	7.5	to	15.0 mc.

The sensitivity is 4 micro volts for full output. It uses 8 valves and operates from batteries (12 or 24 volt) or from the mains through a power pack. It has built in output stage with a jack socket for phones. Controls all of which are brought to the front panel, include: aerial switch, aerial compensating condenser, main tuning condenser, band selector, C.W. switch, power on/off switch, and volume control.

Very compactly built in cracking finished case, these sets are brand new having never been used and in perfect working order—special price this month £124/10/- each. Order now to avoid disappointment. Circuit diagram and component data given free with sets, or available separately price 2/6. post free.

A PRESENT FOR WIFE OR MOTHER

Probably the most tiring part of dressmaking is the cutting out operation. Any dressmaker then will be pleased to receive a pair of electric (mainly operated) scissors. The scissors illustrated not only prevent the fatigue of cutting out, but also permit more control as they have only to be guided. These Swiss made scissors will cut all materials but not fingers they are in fact 100% safe even for young children to use. Price is 68/6 post free.



MADE-UP—READY TO WORK

The astonishing "Occasional 55"—two wave band T.R.F.—completely assembled and ready to switch on—complete with all accessories and 5in. speaker—Covers both medium and long wave bands and uses dust cored coils in a unique modern circuit which gives almost superhet performance. Price £20/5/- plus 3/6 post—Bakelite or wooden cabinet available price 16/6, post 2/6.



ELECTRONIC PRECISION EQUIPMENT LTD.

249, Kilburn High Road.

Kilburn.
(Now Open)

42-46, Windmill Hill, Ruislip,

Middlesex.
Phone: RUISLIP 5780
Half-day Wednesday.

152-153, Fleet Street, E.C.4.

Phone: CENTRAL 2833
Half-day Saturday.

Post orders should be marked "Dept. 2" and addressed to our Ruislip dept.

29, Stroud Green Road, Finsbury

Park, N.4.

Phone: ARCHWAY 1049
Half-day Thursday.

TRUVOX

Introduce A NEW
HIGH FIDELITY
CORNER
DIFFUSION SPEAKER



Designed for small and medium sized halls and for use in homes where quality is a vital factor.

The lower registers are reproduced with exceptional smoothness assisted by the bass reflex action of the corner cabinet. The high notes are brought out with brilliant clarity from the specially designed acoustic system.

The overall effect of this construction is to give life and extraordinary depth to the sound which thereby approaches a three dimensional quality and truly justifies the term "high fidelity." The technical excellence of this instrument is matched by its artistic conception as a piece of stylish furniture finished in walnut veneers.

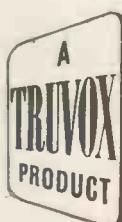
Maximum handling capacity.....	12 watts
Speaker flux density	10,000 lines
Impedance.....	15 ohms
Height	32 inches
Maximum width	27 inches
Maximum depth	18 inches
Net weight	54 lbs.

PRICE:

CABINET Only (Pats. applied for).....	£26 8 6
SPECIAL SPEAKER TO MATCH.....	£3 0 0
Plus Purchase Tax on Speaker.....	£1 0 6

TRUVOX LIMITED
HARROW · MIDDLESEX

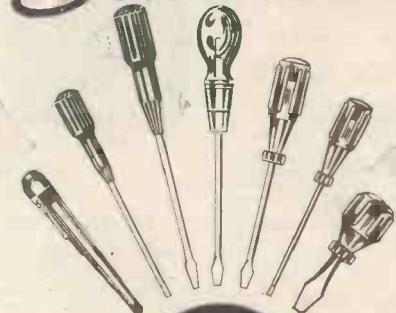
Sales Office: 15 Lyon Road, Harrow, Middlesex.
Telephone: Harrow 9282.
Technical & Service Depts.: 328 The Broadway,
Station Road, Harrow, Middlesex.
Telephone: Harrow 4455.



Handles with
many times the life of wood
and blades of Sheffield steel,
chromium-plated to prevent rust,
combine to make Screwmasters that
will last a lifetime. Fully insulated to 5,000 volts

PLASTIC & AMBER HANDLED

Screwmasters



Obtainable
from
Suppliers
everywhere

Manufactured
by
J. STEAD & Co. Ltd.,
SHEFFIELD 2



S.G. Brown
AUDIO AIDS

Headphones with individual volume control. Ideal for use with church and cinema deaf aid installations or for individuals with impaired hearing.

They provide the essential clarity of reception when listening to Radio and T.V.

Send for Brochure 'W' of all types available. If desired, advice is given on selection of type most suited to individual needs.

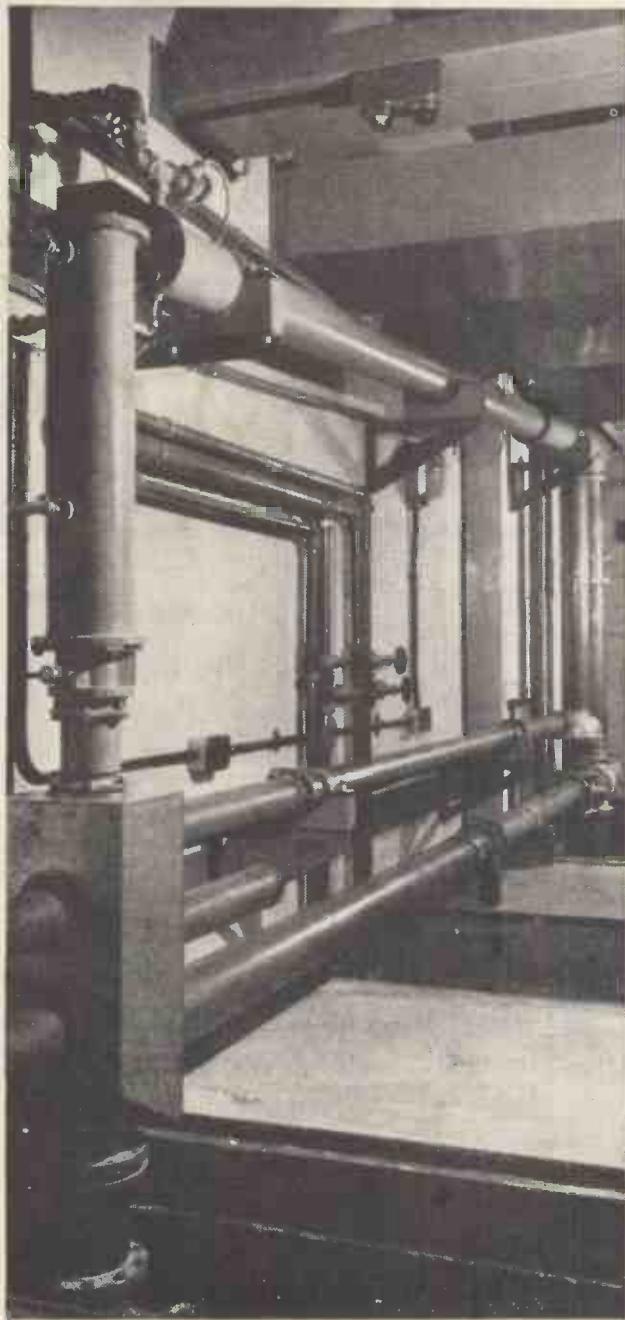
S. G. Brown provide Headphones and associated equipment for all known purposes.

S.G.Brown, Ltd.

SHAKESPEARE STREET, WATFORD, HERTS.
Telephone: Watford 7241

B.B.C. TELEVISION AERIALS

are matched to better than 1.1 : 1 VSWR
using Wayne Kerr V.H.F. Bridges



MODELS B.701 AND B.801

Balanced and unbalanced measurement from 1-100 Mc/s.

MODEL B.901

For unbalanced measurement from 50-250 Mc/s.

These instruments are also ideal for the measurement of receiver input admittances.

Specially designed bridge sources and detectors cover the ranges 5-100 Mc/s and 50-250 Mc/s.



THE WAYNE KERR LABORATORIES
LIMITED
NEW MALDEN · SURREY · ENGLAND

The asymmetric sideband filter behind the high-power vision transmitter at Holme-Moss. (By courtesy of the B.B.C.)



Type O-120

Two NEW 'Scopes!

**MAY WE SEND
YOU PARTICULARS?**



Type O-100

Portable, Lightweight, High-sensitivity Audio 'scope. 4mV/cm. r.m.s. (max.). Push-pull Plate deflection. External terminal connections to "X" Amplifier and C.R.T. available. 3c/s to 25Kc/s.

Servo and General Purpose 'scope. 7mV/cm. r.m.s. (max.). Direct coupled, symmetrical "X" and "Y" Amplifiers. Triggered Time Base. Time and Voltage calibration. D.C. to 4Mc/s.

Furzehill Laboratories Ltd.

57, CLARENDON ROAD · WATFORD · HERTS.

Cables: FURZLAB, LONDON.

Tel.: Gadebrook 4686/7

- T/V TECHNOLOGY
- RADIO ENGINEERING
- ELECTRONICS
- RADIO SERVICING

There's a big future in T/V and Radio. Act now! Increase your knowledge. Back up experience with a sound theoretical background. I.C.S. offer courses of instruction in—

T/V TECHNOLOGY ● ADVANCED SHORT-WAVE RADIO ● RADIO ENGINEERING ● RADIO SERVICE ENGINEERING ● RADAR ● BASIC ELECTRONICS. FREQUENCY MODULATION.

I.C.S. will also coach you for the following examinations:—B.I.R.E.; P.M.G. Certificate for Wireless Operators; Radio Servicing Certificate (R.T.E.B.); C. & G. Telecommunications, etc., etc.

DON'T DELAY—SEND COUPON TODAY or free descriptive booklet, stating which subject or examination interests you. Fees include all books needed. Examination students coached until successful.

Reduced terms for H.M. Forces.
Dept. 223E, I.C.S., 71 Kingsway, W.C.2.

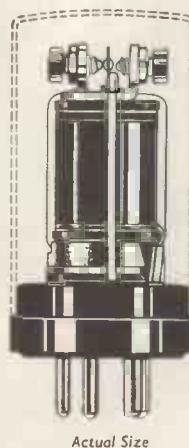
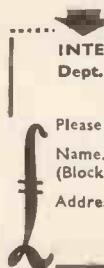
INTERNATIONAL CORRESPONDENCE SCHOOLS,
Dept. 223E, International Buildings, Kingsway, London,
W.C.2.

Please send Booklet on subject.....

Name..... Age.....
(Block letters, please)

Address.....

REDUCED SUMMER TERMS—
Use the coupon and save money



Actual Size

Announcing the new Manning-Carr P.53C Miniature Polarised Relay

Now in dust-proof heavy gauge anodised aluminium can and miniature 5- or 9-pin base for plugging in, thus protecting the relay and obviating wiring.

(Original version still available.)

BOTH TYPES FITTED WITH PLATINUM POINTS IF SPECIFIED

DATA—A Sensitivity of 25 milli-watts and capable of handling mains voltage on the contacts with alternating currents up to 0.25 amps. Being polarised it has the advantage that the Armature contact can be biased to lock in either direction by suitable adjustment of the contact screws which provides a useful facility where pulse operation is required. Speed of operation is also high and the Relay will follow A.C. frequency of 50 c.p.s. Resistance up to 7,000 ohms which is acceptable for Anode circuits. Alternatives to specification if required. Sole Concessionaires.

POST OFFICE TYPES 3,000 AND 600 RELAYS

to specification. Tropicalising, impregnating and Services jungle finish if required. Delivery 3-4 weeks. Manufacturers to H.M. Govt. Depts. and leading contractors

L. E. SIMMONDS LTD.
5, BYRON ROAD, HARROW, MIDDX.
Telephone : Harrow 2524-0315.

for

SELENIUM RECTIFIERS

consult



WHETHER the need is for a single unit or a supply running into thousands . . . if it's a Selenium Rectifier that must fulfil critical requirements and maintain its characteristics over long periods . . . the answer is to be found with Electrix.

- Electrix Rectifiers are characterized by their cool running and consistent long-life conformity to stated specification.
- Manufacturers, Traders and Electronic Engineers, send us your specific requirements.
- Your needs may possibly be met from "standard" types, or
- "To specification" models can be quickly prepared.
- Quotations by return . . . and deliveries a matter of days only.
- We welcome export enquiries.

Here are some typical "standard" full-wave types each

Output 12/15 Volts D.C. 1 Ampere.	List Price	9/-
Output 12/15 Volts D.C. 2.5 Ampere.	"	13/6
Output 12/15 Volts D.C. 4 Ampere.	"	22/6
Output 12/15 Volts D.C. 6 Ampere.	"	35/-

New range H.T. Rectifiers ($\frac{1}{2}$ Wave)

Max. A.C. Input	Max. D.C. Current	List Price
125 Volts	80 mA	4/3
250 Volts	50 mA	8/-
250 Volts	300 mA	18/-

Trade supplied

- We use only freshly manufactured selenium plates and components, no ex-W.D. materials whatsoever

HOUSEHOLD ELECTRIX LTD

47-49 HIGH ST., KINGSTON-ON-THAMES

Telephone: KINGston 4585

Estd.

L.R.S

1925

EASY

TERMS

LEAK QUALITY EQUIPMENT for the Connoisseur

If you want the Finest Quality Reproduction together with Workmanship of the Highest Order your choice must be LEAK.

AS USED BY BROADCASTING CORPORATIONS THROUGHOUT THE WORLD.

LEAK "TL/10" AND "POINT ONE" PRE-AMPLIFIER. Cash Price £28/7/-, or sent for £4/10/- Deposit and 18 monthly payments of 30/-, carr. and crate free.

LEAK TL/10 AND VARISLOPE MK. II PRE-AMPLIFIER. Cash Price £34/13/- or sent for £6 Deposit and 18 monthly payments of 35/-, carr. and crate free.

LEAK DYNAMIC PICK-UP

Complete with two detachable diamond heads and transformer. Cash Price £20/19/9 or sent for £3 Deposit and 10 monthly payments of 40/-. Post and packing paid.

Delivery of all the above is from stock. We can also supply Wharfedale, Goodmans and Tannoy loudspeakers, etc., Connoisseur Variable 3-speed Motors and all other Quality Equipment on EASY TERMS.

Please let us have your requirements.

14 DAYS FREE TRIAL

with the SUPERB NEW

REMINGTON

'60'

ELECTRIC SHAVER



will convince you

that it really does shave quicker and smoother than any other method. The extra long shaving heads are slightly arched to fit easily into those hard-to-shave spots.

SEND DEPOSIT OF ONLY

(Returned if not satisfied)

5/- FOR IMMEDIATE DELIVERY

Balance after 14 DAYS FREE TRIAL 15/-, and 8 monthly payments of 24/-. Cash Price £9.17.11. AC/DC 200-250V. Brand new. Sent post paid in silk lined presentation case.

- WE WILL ALLOW YOU 40/- FOR YOUR OLD ELECTRIC SHAVER if you decide to keep the REMINGTON after trial.

SEND FOR FREE BROCHURE

The L. R. SUPPLY Co. Ltd.

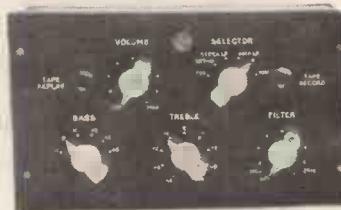
BALCOMBE : SUSSEX Phone 254



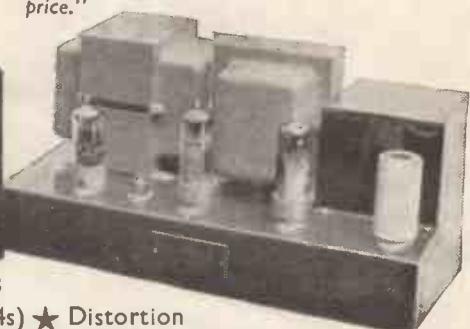
RD JUNIOR

AMPLIFIER AND CONTROL UNIT

Designed solely as the nucleus for domestic high fidelity installations, the RD JUNIOR has, since its introduction only some four months ago, already gained an enviable reputation both in this country and abroad. Representing the finest value in contemporary high fidelity equipment it combines precise workmanship with a flexibility of control and standard of performance never before attained in this price class.



RECORD NEWS. DEC., '54:
...the 'RD JUNIOR' is something out of the ordinary. Everything about it is right, from appearance and performance to price."



MAIN FEATURES

- ★ Power Output 8-10 watts ("UL" Class "A" p.p. EL84s) ★ Distortion .12% at 8 watts
- ★ Frequency Response ± .25 DB 20-30,000 cps ★ 20 DB NFB ★ Hum and Noise—80DB below 8 watts
- ★ O.P.T. employs C-core lamination material ★ Simplified speaker matching
- ★ Ample Spare Power (40m/A H.T.) ★ Four accurate playback characteristics ★ Two Radio Inputs
- ★ Simplified pick-up matching ★ High Input Sensitivity ★ INDEPENDENT VARIABLE LOW PASS FILTER
- ★ Switched Bass and Variable Treble Controls
- ★ Tape Record and Replay Jacks ★ Choice of Panel Colours—BLACK, IVORY, BRONZE, or RED
- ★ TWO-YEAR GUARANTEE:

PRICE COMPLETE

£25

Recommended Accessories:—RD JUNIOR CORNER HORN, fitted either Goodmans AXIOM 102 or Wharfedale SUPER 8 AL; Collaro STUDIO "P" pick-up.

12-page Illustrated Booklet post free on request.

ROGERS DEVELOPMENTS Co.

Trade and Export enquiries invited
"RODEVCO HOUSE" 116, Blackheath Road,
Greenwich, London, S.E.10. TIDeway 1723



SIGNAL GENERATOR TYPE 10. 100 Kc/s-100 Mc/s

Price £7. 10 . 0 (Postage and packing 3/6 extra)

- 100 Kc/s to 100 Mc/s
- Modulated or unmodulated carrier
- Direct calibration
- Adjustable 400c. p.s. AF signal
- Stable RF oscillator
- Large, easily read scale
- AC mains operation.

PATTERN GENERATOR TYPE 4

Price £8. 0 . 0 (Postage and packing 3/6 extra)

- Coverage 40-70 Mc/s
- AC mains operation
- Provides vertical and horizontal bars for time base testing and setting up.

Obtainable only direct from the manufacturers. Send for full technical details or call at address below.

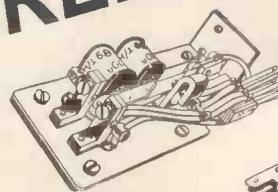
Easy Payment Terms available on all our instruments

HOMELAB INSTRUMENTS LTD.,
615-617, HIGH ROAD, LEYTON, LONDON, E.10

Telephone: LEY 5651

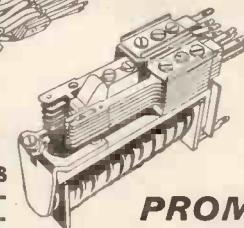
RELAYS

P.O. TYPES
TO YOUR
SPECIFICATION

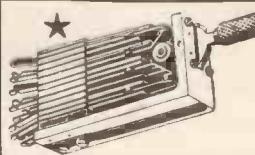


3000 TYPES

1Ω to 80,000Ω COILS
1 Make to 8 c/o CONTACTS.
600 and HIGH-SPEED TYPES also Supplied.



PROMPT
DELIVERY



LARGE
STOCKS
OF
KEYSWITCHES

THE KEYSWITCH CO.

ALL POST OFFICE EQUIPMENT

Enquiries to Sales Manager

126 KENSAL ROAD, LONDON, W.10

Telephone: LAD. 0666, 4640

VIBRATION TESTING ?

No, we do not recommend this method! We offer, instead, SAVAGE 'VLF' and 'LRF' Amplifiers, giving

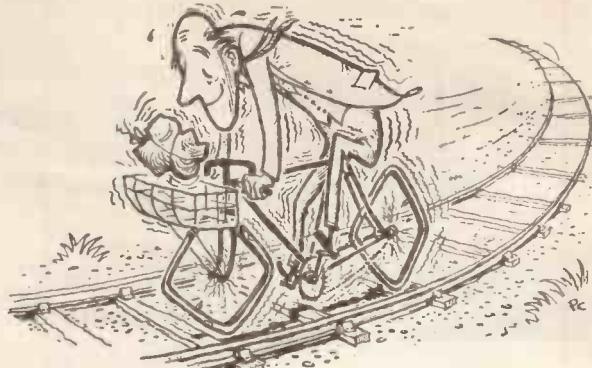
A SOURCE OF POWER

where it is required for vibration and fatigue testing of structures, components, engineering products, engines, special metals, etc. In this direction, the applications of this equipment are countless, as they are, also, as a variable frequency power source for transformers, meters, motors and electrical component design.

This equipment is inexpensive to purchase, simple and economical to use; gives complete and accurate control at all times.

Ask us TO-DAY for full details, without obligation. Or let us know your problem in this field and we will gladly help you.

W. BRYAN SAVAGE LTD.
WESTMORELAND ROAD, LONDON, N.W.9
TELEPHONE: COLINDALE 7131



Leading organisations now using this equipment include: Bristol Aeroplane Co.; The Brush Electrical Engineering Co., Ltd.; English Electric Co., Ltd.; Ferranti Ltd.; G.E.C.; Handley Page Ltd.; The Imperial College of Science; Siemens Bros. & Co., Ltd.; S.T.C.; Vickers-Armstrongs; R.A.E., Farnborough, etc.

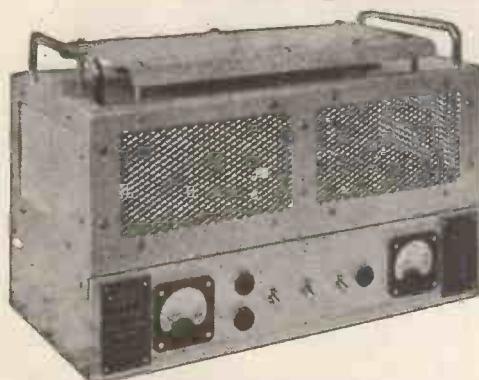
W. BRYAN
Savage

V.L.F & L.R.F
VERY LOW FREQUENCY LOW RADIO FREQUENCY

OUTPUTS
100 watts 'VLF' 3 c/s to 6 c/s
1000 watts 'VLF' 6 c/s to 2000 c/s
MARK II STAR 50 c/s to 10 Kc/s
'LRF'
5Kc/s to 100 Kc/s

AMPLIFIERS

GRUBB PARSONS A.C. STABILISER NEW & IMPROVED MODEL



PERFORMANCE DATA

Stability	± 0.05% for input voltage changes of at least ± 10% at all loads and for normal frequency variations.
Regulation	Within ± 0.1% for changes from no load to full load.
Waveform	Total introduced harmonic content within 3% (Mainly 3rd and 5th) under average conditions.
Reactive Loads	Above performance maintained for loads of P.F. from 0.8 to unity, lagging or leading.
Input Volts	(Nominal) 210, 220, 230, 240 and 250, switch selected.

- ★ Even greater constancy of output voltage than with earlier model.
- ★ Increased output—up to 1 amp.
- ★ Safety device incorporated to avoid any dangerous rise in output voltage in event of failure of any part of the unit.
- ★ Optional provision of voltmeter and ammeter to measure input and output voltages and output current.
- ★ Stabiliser can be adapted at small cost to stabilise the radiation emission from light sources such as filament lamps and Nernst filaments.

**SIR HOWARD GRUBB, PARSONS & COMPANY
WALKER GATE, NEWCASTLE UPON TYNE 6
PROPRIETORS: C. A. PARSONS & COMPANY LIMITED**

ANNOUNCING THE
'SECUNDUS'
FOR
SUB MINIATURE WORK

by

ADCOLA
PRODUCTS LIMITED

(Regd. Trade Mark)

$\frac{1}{8}$ "
BIT
Illustrated
List No. 70
(Actual Size)

SPECIAL FEATURES

1. Traditional British quality.
2. Designed temperatures.
3. Weight 2 oz. (excluding flex)
4. Length 8in.
5. 18 watts.
6. Practical temperature for high class solder jointing.

Supplied in all volt ranges

Models
to
cover all fields
of the
Radio, TV. and
Electronic Industry.

For all Soldering
Instruments
and
Allied equipment,

WRITE TO:-

ADCOLA
PRODUCTS LIMITED
(Regd. Trade Mark)

Head Office and Sales

GAUDEN RD.
CLAPHAM HIGH ST.
LONDON S.W.4

Telephone
MACAULAY 4272

ASK ARTHURS FIRST

★ NEW VALVES

Send your enquiries for all Radio and Electrical goods, especially those in short supply.

AVO METERS IN STOCK

Avo Model 7	£19 10 0
Avo Model 8	£23 10 0
Signal Generator, Mains and Battery Models	£30 0 0
Electronic Test Meter	£40 0 0
Valve Characteristics Meter.....	£60 0 0

Also full range TAYLOR METERS. List on request.

VALVE MANUALS

Mullard	5 0
Osram	5 0
Osram, Part 2 ...	10 0
Brimar, No. 5.....	5 0
Mazda, Part 2.....	2 0
Mullard Valve Replacement Guide	2 6
Art and Science in Sound Reproduction by F. H. Brittain, D.F.H. 2-6 Postage 6d. each extra.	6

Leak TL/10 Amplifier and "Point One" Preamplifier complete

£28 7 0
Chapman Tuning Units £16 0 0
Leak Tuning Unit..... £35 6 3

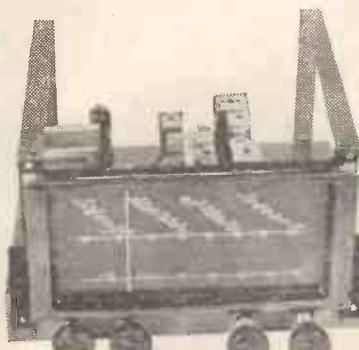
Terms: C.O.D. or Cash with order. Goods offered subject to being unsold and to price alteration.

NOW EXHIBITING AND DEMONSTRATING — HIGH FIDELITY SOUND REPRODUCTION

Arthur's

EST.
1919

PROPS: ARTHUR GRAY, LTD.
GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.C.2
TEMPLE BAR 5833/4 and 4765
Cables: TELEGRAY, LONDON



F · M TUNERS

Basic Model "A," is thoroughly proven in sensitivity, stability and reliability. Early deliveries are being maintained. These are in use from Bognor to Ely.

Closely to the Amos & Johnstone design. Additions include a modern hammer finish frontplate, "3-D" scale, and latest magic eye.

The kit version uses the same new miniature VHF type components. Fully worked chassis is stove enamelled, and wound tested coils are included, it is completed with valves, even nuts and bolts.

F.M. with really sensitive Medium Wave reception is possible with the CB4 double superhet as illustrated above. Incorporates variable de-emphasis, variable matching, ferramic rod aerial, mains power supply. Single or push-pull output can be added. A "hand-built" BEL product.

Model "A"	£11 17 6
"A" kit.....	£7 5 0
"A" tuning scale, magic eye	£2 0 0
Standard power unit.....	£3 0 0
Aerials 5/- and	£1 10 0
CB4, less output stage, mains driven	£21 0 0
"B" local station receiver.....	£9 0 0

MULLARD 5-10 AMPLIFIER

Complete parts kit including valves..... £12 10 0
Built and Tested..... £14 10 0

Scaled down to 11in. x 6in. plan. Hammer finish symmetrical frontplate.

Hear these and Transistor Receiver at MARLBOROUGH YARD, MARLBOROUGH ROAD, N.19. 25 mins. West End, 8 mins. Archway Station. Evening dems. arranged.

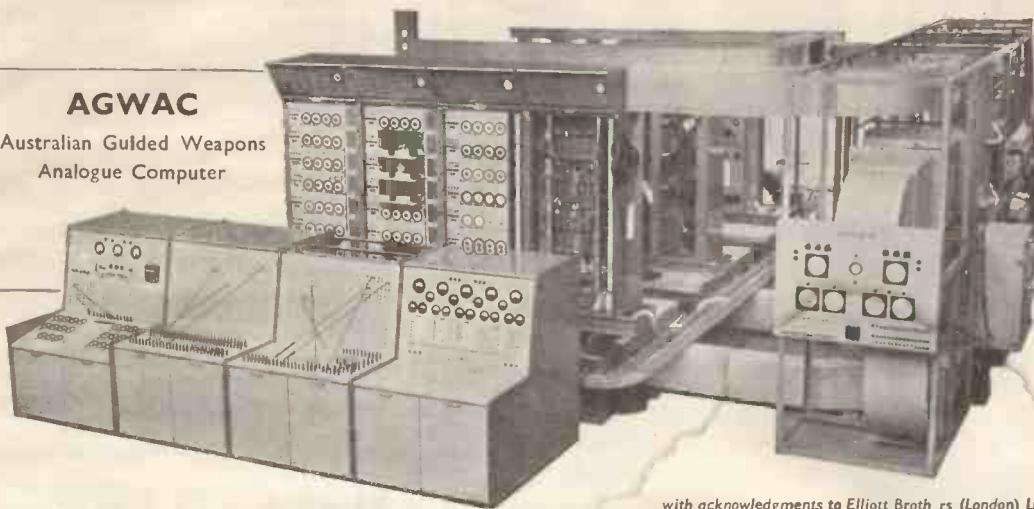
BEL SOUND PRODUCTS CO. ARC. 5078

high stability by resistors

CONSTANTA

AGWAC

Australian Guided Weapons
Analogue Computer



with acknowledgments to Elliott Brothers (London) Ltd.

Elliott Brothers (London) Ltd., manufacturers of AGWAC—the largest electronic calculating machine in the Southern Hemisphere—**CHOOSE CONSTANTA HIGH STABILITY RESISTORS**, Class 0.5 (Stability $\pm 0.5\%$), for the exacting requirement of the computer's summation circuits.

Write for Technical Folder 162/WW giving full details of the Constant range which includes:

★ 3 STABILITY CLASSES

★ TOLERANCES DOWN TO $\pm 0.5\%$

★ INSULATED AND NON-INSULATED TYPES

★ STANDARD AND MINIATURE SIZES

G. A. STANLEY PALMER, A.R.Ae.S., Maxwell House, Arundel St., London, W.C.2. Tel: TEMple Bar 1610

Quality Equipment Designers Ltd.

75 GRAND PARADE, HARRINGAY
LONDON, N.4. Phone: STA 3712



THE NEW LOOK T.R.F. RECEIVER

Build this superb radio at a total cost of only

£5·15-0

Complete Set of Components

plus 2/6 Pkg. & Carr.

This is a 3 valve T.R.F. plus Metal Rectifiers with a valve line up as follows: 6K7 (HF); 6J7 (DET); 6V6 (OUPUT). Wave band wave, and 800/2,000 metres on Long wave.

Coverage is 180/550 metres on Medium. The Walnut cabinet is the latest design and is outstanding in appearance. Assembly Instructions 1/- (post free), include point-to-point wiring, chassis layout, etc. Also stock list of priced components (which may be purchased separately). This receiver may be purchased completely built and ready for use at total cost of £6/15/- plus 3/8 Pkg. and Carr. All components are guaranteed for one year. Valves 3 months.

4-WATT QUALITY AMPLIFIER for use with Gram or Radio. Valve line up:—6SL7, 6V6 output, 5Z4. Separate Bass and Treble Controls. Suitable for Mag or Crystal pick-ups. Speaker imp. 3 ohms. Mains voltage 200/250 v. A.C. (Mains transformer fully shrouded.)

COMPLETE KIT £4/15/- or Ready Built, tested at £5/10/- plus 2/6 postage and packing.

Full wiring instructions, theoretical circuit, priced stock list, etc., 1/- FREE TECHNICAL ADVICE GIVEN TO ALL OUR CUSTOMERS.

MAINS NOISE SUPPRESSOR UNIT

A simple and effective method of cutting out all mains noise. The Kit consists of 2 specially designed chokes together with 3 condensers. The unit can be assembled in existing receivers or separately if so desired.

4/11 COMPLETE WITH CIRCUIT DIAGRAM
Plus 6d. post, etc.

ALUMINIUM CHASSIS WITH REINFORCED CORNERS

6 x 4 x 2½	4/9	8 x 6 x 2½	6/9
10 x 7 x 2½	7/8	12 x 8 x 2½	9/9
14 x 8 x 2½	10/9	16 x 9 x 2½	13/6
12 x 3 x 2½	6/7	14 x 8 x 2½	6/6
12 x 5 x 2½	7/7	16 x 6 x 2½	10/-

Add 1/- to whichever size required for post/pack.

RADIO-GRAM CHASSIS

Using a 3-waveband coil pack covering L.M.S. wave bands. Valve line up: 6K8, 6K7, 6Q7, 6V6, 5Z4 Rec. Illuminated 3 colour Dial, size 10in. x 4½in., overall chassis dimensions: 7in. x 13½in. x 7in.

Four front controls: tone, on/off volume, w/change; tuner. For operation on A.C. mains only, 200/250 v. Fully guaranteed 12 months. £10/17/6, plus 5/- post and pkg.

F.M. FEEDER UNIT

To Denco specification. Valve line up: 6AM6, 12A8H, EB91, 2-6A86s. Complete kit, £6/7/6 (or supplied least valves). Point to point diagram and complete instructions, 1/6.

BALL BEARING SLIDERS

BRAND NEW AT A THIRD BELOW NORMAL PRICE. Specially designed to give smooth silent movement with complete rigidity in any position. Cadmium plated steel captive ball carriage with brass spring. These sliders are suitable for extending Radiogram Motor Boards, Tape Decks, Cabinet drawers, etc.

LENGTH 13in.—RUNNER EXTENDS 9in.

**10/- p.a.
POST FREE**

GRAM UNITS

We carry stocks of leading makes of Record Players—Monarch, Plessey, Collaro, etc. Send 2d. stamp for full details.

TERMS OF BUSINESS:—Cash with order or C.O.D. All orders for small items totalling over £2 post free unless otherwise stated.

ALL ITEMS LISTED ABOVE CAN BE SEEN AND HEARD WORKING IN OUR SHOWROOM.

Shoppers wishing to visit our premises ALIGHT AT HARRINGAY AREA. OPEN 9 a.m.-6 p.m. MON.-SAT. (EARLY CLOSING WED.)

WEIR

Instruments manufactured in Moving Coil and rectifier types to B.S. 89-1954.



SMALL PANEL INSTRUMENTS



2in., 2½in. and 3½in. enclosed in cases of black moulded insulating material and provided with scales printed in black on matt white enamelled metal dials.

Available as Ammeters, Voltmeters, Milliammeters and Microammeters.

MANUFACTURED BY

WEIR ELECTRICAL INSTRUMENTS CO. LTD.
BRADFORD-ON-AVON
WILTSHIRE

TELEPHONE 2378



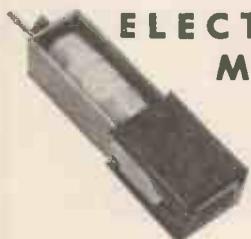
MAGNETIC RELAYS

Built to specification

TYPES 3000 and 600

HIGH SPEED, also A.C. 6-400 volts

KEY SWITCHES. SEVERAL TYPES IN STOCK



MAJOR TYPE 6×1½×1½ ins.
for all D.C. voltages.

Tested and guaranteed.
17/6, Post and Packing, 9d.

ELECTRO- MAGNETIC COUNTER

215178

JACK DAVIS (RELAYS) LTD.

36 PERCY STREET · LONDON · W.I.
MUSEUM 7960

LANGHAM 4821

BC610 TRANSMITTERS with speech amplifier, aerial tuning unit, etc. Brand new.

RCA TRANSMITTERS. Type ET-4336. Complete with original speech amplifier, crystal multiplier and VFO units. Unused and reconditioned. Can be supplied with very large quantity of spares.

RCA TRANSMITTERS. Type ET-4332 modified by R.A.F. for use on crystal or master oscillator. Complete with speech amplifier.

MULTI CHANNEL TRANSMITTER T-4/FRC, with modulators MD-1/FRC, 2 Mc/s to 18 Mc/s. Each channel 400 w. output. W.S. No. 19 & 22. Both complete with installation kit. Tropicalised. New.

MAGNETO 10 LINE U.C. 40 Line F & F TELEPHONE SWITCHBOARDS (complete).

MARCONI SIGNAL GENERATORS Type T.F. 144G. As new, checked.

A.R.88D's, A.R.77's, S27's, HRO, BC.312, BC.342, R.109 and others.

METAL RECTIFIERS Type IB, D.C. output 10 amps at 22 v. input 220/250 v., 50 c/s.

All above items in excellent working condition
Working demonstration upon request.

SPARES A large selection available for SCR399 (BC610), ET4336, SCR610, EE8 Telephones, and Teleprinters type 7B.

TX VALVES 805, 807, 813, 861, 66A, 100TH, 250TH, and many others.

Large stock of Tx condensers, crystals and other components.

P.C.A. RADIO

New Address, Offices and Works

BEAVOR LANE, HAMMERSMITH, LONDON, W.G.

Telephone : RIV 8006/7

HANNEY of BATH offers :-

OSRAM 612 Erie resistor-pot, kit with ceramic tube resistors, very highly recommended, 29/6; Lab resistor kit, 32/4; T.C.G. condensers, 55/-; PARTRIDGE Components, with loose lead terminations, Mains trans., 44/-; Smoothing Choke, 29/6; Output trans., 78/9. Price includes Partridge carriage/packing charge. Printed panel, 14/6. W.B. chassis, 28/6. DENCO 16 S.W.G. All-Chassis with beautiful Bronze Front Panel, 21/-. (Printed.) S.A.E. List.

MULLARD 5 VALVE 10 WATT AMPLIFIER. T.C.G. Condensers, 45/-; Erie resistor-pot kit, 37/6; Elestone Mains trans., 36/-; Elestone Output trans., 43/- (both types); Denco chassis, 14/6; Printed bronze panel 14in. x 5in., 6/6. Small parts as per our list. Matched valves available for both on the above designs.

WILLIAMSON AMPLIFIER. Wooden potted components. Output trans., WOT.25 (1.7Q), 130/-; PTM 14 a. mains trans., 87/6; PCF.12 150 mA. choke, 44/-; PCF.22 30 H. 20 mA. choke, 30/-; PIM 25 (mains trans. for pre-amp.), 47/6. Resistor (RK and Condenser kits) (CK) available, RK, main amplifier, 29/6; RK figs. 13 and 27, 12/6; RK fig. 15, 28/9; RK fig. 19, 36/-; RK fig. 29, 29/3; CK fig. 13, 15/-; CK fig. 15, 47/-; CK fig. 19, 54/6; CK fig. 27, 19/-; CK fig. 29, 54/6. 12 1½" silver micas (fig. 19), 15/1-; 7 5/8"; 7 1/2"; Elestone output trans., 90/-; mains trans., 57/6; 1 OH 150 mA. choke, 20/-; 39 H. 20 mA. choke, 10/-.

FREQUENCY MODULATION. For Wrotham high fidelity transmissions, DENCO technical bulletin giving circuit and point to point wiring diagram for building an F.M. Feeder unit, 1/9, post free. We have all components available. Priced parts list on application.

COIL PACKS. DENCO, CP 4/L and CP 4/M, 33/4; CP 3/370 pf. and CP 3/500 pf., 42/8; OSMOR "Q" HO, 48/-; LM, 40/-; Batt., 50/-; TRF, 40/-; HF stage for HO pack, 20/-; ETA 4-station pack, 43/8. We stock COILS by Weymouth, Osmer, Wearite, Denco, Teletron and R.E.P.

WIDE ANGLE COMPONENTS. ALLEN. Teleking Chassis, 50/-; Collets (TK and Super-Viseer), 44/6; LO.300, 40/-; FO.305, 21/-; DC.300c., 39/6; FC.302, 31/-; GL.16 and 18, 7/6 each; SC.312, 21/-; AT.310, 30/-; OF.117, 9/-; BT.314, 15/-; DENCO Chassis Magnaview, 37/6; Chassis, Super-Visor, 51/6; Coil sets Magnaview, 41/2; WA/DCAL, 43/-; WA/FCAL, 31/-; WA/LCI and WC1, 7/8 each; WA/FMAL, 21/-; WA/LOTL, 42/-; WA/FBT1, 16/-.

Send 6d. stamps for our General List of components for Viewmaster, Soundmaster Williamson Amplifier, Teleking, Magnaview (Brimar and English Electric large screen TV), Super-Visor, Mullard Universal, Close tolerance Silver Micas, etc., etc. Please add 1/- postage to orders under £2.

L. F. HANNEY

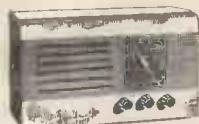
77 LOWER BRISTOL ROAD, BATH

Tel. : 3811.

MONEY BACK GUARANTEE
GOODS OF QUALITY
PROMPT DESPATCH

MAIL ORDER, WORKS & DESPATCH DEPT.: 44, TOTTENHAM STREET, LONDON, W.I.
OFFICE: 34, MONTPELIER RISE, LONDON, N.W.II. Tel.: MEAdway 1736.

BUILD YOUR OWN RADIO !



We can supply all the parts (including valves, 5in. moving coil speaker, cabinet, chassis and everything down to the last nut and bolt) to enable YOU to build a professional-looking radio. The chassis is punched and drilled ready to mount the components. There is a choice of any of three attractive cabinets 12in. long, 5in. wide by 6in. high as follows:

MODEL I T.R.F. RECEIVER

This is a 3-valve plus metal rectifier T.R.F. receiver with a valve line-up as follows: 6K7 (HF), 6J7 (Det.) and 6V6 (Output). The dial is illuminated. Coverage is for the Medium and Long Wave Bands. Model 1—200/250 volts A.C. Mains operation. Model 3—200/250 volts A.C./D.C. Mains operation.

Plus 2/6 Packing, Carriage, Insurance

£5.10.0

MODEL 2 SUPERHET RECEIVER

Model 2 Superhet Receiver with a valve line-up as follows: 6K8, 6K7, 6Q7, 6V8. The dial is illuminated and coverage is for the Short Wave bands between 16-50 metres, the Medium Wave bands between 190-450 metres, and the Long Wave bands between 1,000-2,000 metres. Operates on 200/250

Plus 2/6 Packing, Carriage, Insurance

£7.19.6

THE MODELS 1 & 3 T.R.F. RECEIVERS can be supplied ready built at 28/15/8 plus 3/6 P. & C.
THE NEW T.R.F. . . MODEL I PLUS . . . THE RECEIVER WITH THE SENSATIONAL PERFORMANCE ! !

This is a completely new design 4-valve 2-Waveband T.R.F. Receiver, incorporating the latest type MINIATURE HIGH "Q" IRON CORED COILS, ensuring greatly increased sensitivity and selectivity over the whole of the Medium Wavebands and providing outstanding performance on the Long Wavebands. Valves—6JB8 R.F. Amplifier, 6BH6 Anode Bend Det., 6AQ8 Output, 6X4 Rectifier. For operation on 200/250 volts A.C. Mains. All the parts to build this Receiver can be supplied at Plus 2/6 Packing, Carriage and Insurance. **£6.19.6**

Can also be supplied ready built at £8.5/-, plus 3/6 p. & c.

INSTRUCTION BOOKLET and PRICED PARTS LIST for any of the above receivers available separately at 1/- This money will be refunded if circuit diagram is returned as new within 7 days.

RADIO TUNER UNIT

A new T.R.F. Tuner Unit designed for High Quality Local Station Reception at Low Cost. Incorporates 2 Valves—6K7 and 6J7, Volume, Tuning and Wavechange Controls. Medium and Long Wave coverage. Dimensions: L. 6in., H. 5½in., D. 4½in.

Power Requirements: 6.3 volts at 0.6 amperes, 250-300 volts 15 mA. (This supply is already available in the above illustrated Amplifier.) All the parts to build this Tuner Unit can be supplied at

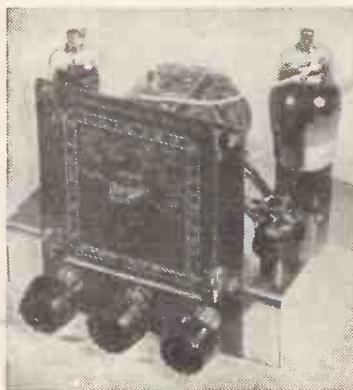
£2.15.0

Plus 2/6 Packing and Carriage.

Complete with easy-to-follow Circuit diagram and Parts List.

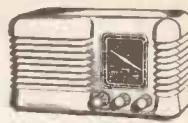
Circuit Diagram and Parts List available separately at 1/-.

ALL COMPONENTS SUPPLIED ARE GUARANTEED FOR 12 MONTHS



4 WATT AMPLIFIER KIT

This is a 3-valve 3-stage Amplifier for use with Gramophone, Microphone or Radio. Valve line-up is as follows: 6SL7, 6V6, 5Z4. Negative feed-back. Tone control. Voltage adjustment panel incorporated. 4 watts output. For operation on A.C. Mains 200/250 volts. The complete Kit, which includes every item down to the last nut and bolt, drilled and punched chassis, and comprehensive point-to-point wiring circuit diagram



£4.50.

Plus 2/6 Packing, Carriage and Insurance.

The Output Transformer supplied is for use with a loud-speaker of 3 ohms impedance, and we would suggest that the output of the completed amplifier justifies the use of one of the latest W.B. H.F. Speakers which can be supplied as follows: 8in., 60/8; 9in., 67/-; 10in., 73/6. All plus 2/6 pkg., carr., ins.

Circuit Diagram and Parts List available separately at 1/-.

CITY SALE & EXCHANGE LTD

The High Fidelity Specialists

OFFER FROM STOCK

NEW APPARATUS

Chapman FM81 Tuner magic eye	£21 0 0
Chapman FM82 3-station pre-set tuner with built-in power pack, output 2 volts A.F.	£24 0 0
Leak TL10 amplifier and point one pre-amp.	27 gns.
Collaro RC54 3-speed autochange gram unit, O. or P. heads... .	£13 6 8
Collaro 3/S54 3-speed unit, turnover head....	£8 18 11
Margolin disc player, with Monarch 3-speed auto unit	£13 19 6
Ditto, with R.C. OMNIMAX	£18 18 0
Wharfedale W10 CS/B speaker ...	£12 6 6
Tannoy direct radiator 12in. unit ...	£12 0 0
Table cases cut out for any type motor, veneered in any colour to order	£6 0 0
Table cases for amplifiers to match above, cut out for pre-amp.	£4 10 0
Gram units, 3 speed with 2 Acos or Decca heads	£8 0 0
Trixette de Luxe 3-speed auto portable record reproducer	35 gns.
Pam 3-speed auto portable record reproducer.....	39 gns.
Console of above	47 gns.
Grundig TK12 tape recorder	70 gns.
Editor de Luxe portable	55 gns.
Champion "Berkeley" 5-valve auto table R/G, contemporary styling	33 gns.
Plus-a-Gram Dansette, red leather cloth, 3-speed auto, tone control	24 gns.
Bureau cabinet to house amplifier, tuner and rec. player, cross grained veneer	£40 0 0
Other Cabinets from	£11 0 0

Mail Orders executed promptly,
also long playing records by
return—no post charges.

Part Exchange is our speciality.
Demonstrations daily of all high
fidelity equipment.

RECONDITIONED & SHOPSPOILED

Cossor all dry battery portable	10 gns.
Wharfedale 8in. baffle	£2 10 0
Charles push pull bass/treble amplifier, case	10 gns.
R.D. Baby Amplifier, separate pre-amp.	£15 0 0
Wharfedale microgroove equaliser	£1 10 0
Charles straight/superhet all wave tuner	10 gns.
Stentorian SI2 8in. speaker 15 ohm	£1 10 0
Bel-sound FM tuner	£10 0 0
12in. W/B Duplex speaker	£12 0 0
Connoisseur 2-speed motor studio p.u.	£16 0 0
Decca 2-speed motor, 2 XMS p.u.s ..	£6 0 0
B.S.R. 3-speed Regent gram unit ...	£7 10 0
B.S.R. 2-speed motor	£3 0 0
Wharfedale super 12/CS/AL speaker, as new	£13 0 0
Leak preamp, LP/78 bass/treble	£3 0 0
Ditto, RC/PA/W	£6 0 0
Ditto Varislope!	£8 0 0
EM6 steep slope filter 15 ohm	£3 0 0
R.D. Junior Mark II pre-amp.	£7 0 0
Philips disc-jockey	£7 10 0
Connoisseur 78 motor	9 gns.
Truchord push pull amp., case and speaker	18 gns.
Goodmans Audiom 60 speaker 12in.	£7 0 0

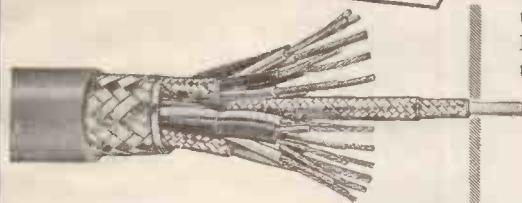
Great Britain's Valve Mail-Order House

SALE**2000****V
A
L
V
E
S****FROM****2/-****One Year's Guarantee**

IR5	16/5	ECC40	22/1
IS4	14/6	ECC81	22/1
IS5	16/5	ECC82	22/1
IT4	14/6	ECC83	22/1
3S4	14/6	ECC81	31/6
3V4	14/6	ECH3	22/6
LA7GT	18/11	ECH35	20/2
IC5G7	14/6	ECH42	20/2
1H5G7	14/6	ECH81	20/2
3N5GT	14/6	ECL80	23/4
3A4	19/11	EF9	29/6
3A5	16/5	EF37A	22/1
3Y3GT	13/3	EF39	26/5
G44	15/1	EF40	22/1
G45	11/4	EF41	16/5
G46	16/5	EF42	22/1
GAT6	15/1	EF50	22/1
GAU6	22/1	EF50	22/1
GBA6	16/5	EF91	26/6
GEE6	20/2	EF98	16/5
GJ6	31/6	EK32	22/8
GSAT7G	20/2	EK90	20/2
GSQ7GT	16/5	EL3N	20/2
EL33	16/5	EL37	22/1
EL35	16/5	EL37	22/1
EL38	16/5	EL37	22/1
EL41	16/5	EL42	22/1
EL42	16/5	EL42	22/1
EL84	16/5	EL90	16/5
EM1	16/5	EM4	16/5
EM34	16/5	EP51	25/2
EP52	16/5	EP53	20/1
EP54	16/5	EP55	21/1
EP56	16/5	EP57	21/1
EP58	16/5	EP59	15/9
EP59	16/5	EP60	21/1
EP61	16/5	EP62	21/1
EP63	16/5	EP64	21/1
EP65	16/5	EP66	21/1
EP67	16/5	EP68	21/1
EP69	16/5	EP70	21/1
EP71	16/5	EP72	21/1
EP73	16/5	EP74	21/1
EP75	16/5	EP76	21/1
EP77	16/5	EP78	21/1
EP79	16/5	EP80	21/1
EP81	16/5	EP82	21/1
EP83	16/5	EP84	21/1
EP85	16/5	EP86	21/1
EP87	16/5	EP88	21/1
EP89	16/5	EP90	21/1
EP91	16/5	EP92	21/1
EP93	16/5	EP94	21/1
EP95	16/5	EP96	21/1
EP97	16/5	EP98	21/1
EP99	16/5	EP100	21/1
EP101	16/5	EP102	21/1
EP103	16/5	EP104	21/1
EP105	16/5	EP106	21/1
EP107	16/5	EP108	21/1
EP109	16/5	EP110	21/1
EP111	16/5	EP112	21/1
EP113	16/5	EP114	21/1
EP115	16/5	EP116	21/1
EP117	16/5	EP118	21/1
EP119	16/5	EP120	21/1
EP121	16/5	EP122	21/1
EP123	16/5	EP124	21/1
EP125	16/5	EP126	21/1
EP127	16/5	EP128	21/1
EP129	16/5	EP130	21/1
EP131	16/5	EP132	21/1
EP133	16/5	EP134	21/1
EP135	16/5	EP136	21/1
EP137	16/5	EP138	21/1
EP139	16/5	EP140	21/1
EP141	16/5	EP142	21/1
EP143	16/5	EP144	21/1
EP145	16/5	EP146	21/1
EP147	16/5	EP148	21/1
EP149	16/5	EP150	21/1
EP151	16/5	EP152	20/2
EP153	16/5	EP154	20/2
EP155	16/5	EP156	20/2
EP157	16/5	EP158	20/2
EP159	16/5	EP160	20/2
EP161	16/5	EP162	20/2
EP163	16/5	EP164	20/2
EP165	16/5	EP166	20/2
EP167	16/5	EP168	20/2
EP169	16/5	EP170	20/2
EP171	16/5	EP172	20/2
EP173	16/5	EP174	20/2
EP175	16/5	EP176	20/2
EP177	16/5	EP178	20/2
EP179	16/5	EP180	20/2
EP181	16/5	EP182	20/2
EP183	16/5	EP184	20/2
EP185	16/5	EP186	20/2
EP187	16/5	EP188	20/2
EP189	16/5	EP190	20/2
EP191	16/5	EP192	20/2
EP193	16/5	EP194	20/2
EP195	16/5	EP196	20/2
EP197	16/5	EP198	20/2
EP199	16/5	EP200	20/2
EP201	16/5	EP202	20/2
EP203	16/5	EP204	20/2
EP205	16/5	EP206	20/2
EP207	16/5	EP208	20/2
EP209	16/5	EP210	20/2
EP211	16/5	EP212	20/2
EP213	16/5	EP214	20/2
EP215	16/5	EP216	20/2
EP217	16/5	EP218	20/2
EP219	16/5	EP220	20/2
EP221	16/5	EP222	20/2
EP223	16/5	EP224	20/2
EP225	16/5	EP226	20/2
EP227	16/5	EP228	20/2
EP229	16/5	EP230	20/2
EP231	16/5	EP232	20/2
EP233	16/5	EP234	20/2
EP235	16/5	EP236	20/2
EP237	16/5	EP238	20/2
EP239	16/5	EP240	20/2
EP241	16/5	EP242	20/2
EP243	16/5	EP244	20/2
EP245	16/5	EP246	20/2
EP247	16/5	EP248	20/2
EP249	16/5	EP250	20/2
EP251	16/5	EP252	20/2
EP253	16/5	EP254	20/2
EP255	16/5	EP256	20/2
EP257	16/5	EP258	20/2
EP259	16/5	EP260	20/2
EP261	16/5	EP262	20/2
EP263	16/5	EP264	20/2
EP265	16/5	EP266	20/2
EP267	16/5	EP268	20/2
EP269	16/5	EP270	20/2
EP271	16/5	EP272	20/2
EP273	16/5	EP274	20/2
EP275	16/5	EP276	20/2
EP277	16/5	EP278	20/2
EP279	16/5	EP280	20/2
EP281	16/5	EP282	20/2
EP283	16/5	EP284	20/2
EP285	16/5	EP286	20/2
EP287	16/5	EP288	20/2
EP289	16/5	EP290	20/2
EP291	16/5	EP292	20/2
EP293	16/5	EP294	20/2
EP295	16/5	EP296	20/2
EP297	16/5	EP298	20/2
EP299	16/5	EP300	20/2
EP301	16/5	EP302	20/2
EP303	16/5	EP304	20/2
EP305	16/5	EP306	20/2
EP307	16/5	EP308	20/2
EP309	16/5	EP310	20/2
EP311	16/5	EP312	20/2
EP313	16/5	EP314	20/2
EP315	16/5	EP316	20/2
EP317	16/5	EP318	20/2
EP319	16/5	EP320	20/2
EP321	16/5	EP322	20/2
EP323	16/5	EP324	20/2
EP325	16/5	EP326	20/2
EP327	16/5	EP328	20/2
EP329	16/5	EP330	20/2
EP331	16/5	EP332	20/2
EP333	16/5	EP334	20/2
EP335	16/5	EP336	20/2
EP337	16/5	EP338	20/2
EP339	16/5	EP340	20/2
EP341	16/5	EP342	20/2
EP343	16/5	EP344	20/2
EP345	16/5	EP346	20/2
EP347	16/5	EP348	20/2
EP349	16/5	EP350	20/2
EP351	16/5	EP352	20/2
EP353	16/5	EP354	20/2
EP355	16/5	EP356	20/2
EP357	16/5	EP358	20/2
EP359	16/5	EP360	20/2
EP361	16/5	EP362	20/2
EP363	16/5	EP364	20/2
EP365	16/5	EP366	20/2
EP367	16/5	EP368	20/2
EP369	16/5	EP370	20/2
EP371	16/5	EP372	20/2
EP373	16/5	EP374	20/2
EP375	16/5	EP376	20/2
EP377	16/5	EP378	20/2
EP379	16/5	EP380	20/2
EP381	16/5	EP382	20/2
EP383	16/5	EP384	20/2
EP385	16/5	EP386	20/2
EP387	16/5	EP388	20/2
EP389	16/5	EP390	20/2
EP391	16/5	EP392	20/2
EP393	16/5	EP394	20/2
EP395	16/5	EP396	20/2
EP397	16/5	EP398	20/2
EP399	16/5	EP400	20/2
EP401	16/5	EP402	20/2
EP403	16/5	EP404	20/2
EP405	16/5	EP406	20/2
EP407	16/5	EP408	20/2
EP409	16/5	EP410	20/2
EP411	16/5	EP412	20/2
EP413	16/5	EP414	20/2
EP415	16/5	EP416	20/2
EP417	16/5	EP418	20/2
EP419	16/5	EP420	20/2
EP421	16/5	EP422	20/2
EP423	16/5	EP424	20/2
EP425	16/5	EP426	20/2
EP427	16/5	EP428	20/2
EP429	16/5	EP430	20/2
EP431	16/5	EP432	20/2
EP433	16/5	EP434	20/2
EP435	16/5	EP436	20/2
EP437	16/5	EP438	20/2
EP439	16/5	EP440	20/2
EP441	16/5	EP442	20/2
EP443	16/5	EP444	20/2
EP445	16/5	EP446	20/2
EP447	16/5	EP448	20/2
EP449	16/5	EP450	20/2
EP451	16/5	EP452	20/2
EP453	16/5	EP454	20/2
EP455	16/5	EP456	20/2
EP457	16/5	EP458	20/2
EP459	16/5	EP460	20/2
EP461	16/5	EP462	20/2
EP463	16/5	EP464	20/2
EP465	16/5	EP466	20/2
EP467	16/5	EP468	20/2
EP469	16/5	EP470	20/2
EP471	16/5	EP472	20/2
EP473	16/5	EP474	20/2
EP475	16/5	EP476	20/2
EP477	16/5	EP478	20/2
EP479	16/5	EP480	20/2
EP481	16/5	EP482	20/2
EP483	16/5	EP484	20/2
EP485	16/5	EP486	20/2
EP487	16/5	EP488	20/2
EP489	16/5	EP490	20/2
EP491	16/5	EP492	20/2
EP493	16/5	EP494	20/2
EP495	16/5	EP496	20/2
EP497	16/5	EP498	20/2
EP499	16/5	EP500	20/2
EP501	16/5	EP502	20/2
EP503	16/5	EP504	20/2
EP505	16/5	EP506	20/2
EP507	16/5	EP508	20/2
EP509	16/5	EP510	20/2
EP511	16/5	EP512	20/2
EP513	16/5	EP514	20/2
EP515	16/5	EP516	20/2
EP517	16/5	EP518	20/2
EP519	16/5	EP520	20/2
EP521	16/5	EP522	20/2
EP523	16/5	EP524	20/2
EP525	16/5	EP526	20/2
EP527	16/5	EP528	20/2
EP529	16/5	EP530	20/2
EP531	16/5	EP532	20/2
EP533	16/5	EP534	20/2
EP535	16/5	EP536	20/2
EP537	16/5	EP538	20/2
EP539	16/5	EP540	20/2
EP541	16/5	EP542	20/2
EP543	16/5	EP544	20/2
EP545	16/5	EP546	20/2
EP547	16/5	EP548	20/2
EP549	16/5	EP550	20/2
EP551	16/5	EP552	20/2
EP553	16/5	EP554	20/2
EP555	16/5	EP556	20/2
EP557	16/5	EP558	20/2
EP559	16/5	EP560	20/2
EP561	16/5	EP562	20/2
EP563	16/5	EP564	20/2
EP565	16/5	EP566	20/2
EP567	16/5	EP568	20/2
EP569	16/5	EP570	20/2
EP571	16/5	EP572	20/2
EP573	16/5	EP574	20/2
EP575	16/5	EP576	20/2
EP577	16/5	EP578	20/2
EP579	16/5	EP580	

TELCON

and TELEVISION



CAMERA LEADS

One of many specially manufactured multicore cables for trailing camera leads, capable of withstanding continuous flexing.



TRANSMITTER AERIAL FEEDERS

Thimble-type air-spaced coaxial, as used as feeder cables at all the B.B.C. Television Transmitters.



TELEVISION RECEIVER DOWNLEADS

Type BA.24, PSM. 80-ohm balanced twin for "fringe area" reception.

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD.

Head Office: 22, OLD BROAD STREET, LONDON, E.C.2. Telephone: LONDON Wall 7104
Enquiries to: TELCON WORKS, GREENWICH, S.E.10. Telephone: GReenwich 3291



"You can rely on us"

We specialise and stock **ONLY** Radio Components

Suppliers to the Amateur Constructor, Laboratories, Manufacturers and Educational Authorities.

Just a few of our current stock lines :—

AVO INSTRUMENTS D.C.

Avoxmin £5/5/-, Universal £10/10/-, Model 40 £19/10/-, Model 7 £19/10/-, Model 8 £23/10/-, Taylor 120A, 72A, 88A, Ampion Testmeter £5/19/6. Tape Decks, Wearite, Motek, Truvox, and Lane, Stockists of "Scotch Boy" products, 1,200ft. 35/-, 600ft. 21/-. Empty spools all sizes. "Bib" tape splicer.

MAINS TRANSFORMERS. Over 70 different types in stock: Ellison, Elstone, Partridge, W.B., Haddon. Charging transformers for 2 v., 6 v., 12 v. at 2 a., 19/6, at 4 a. plus 30 v. at 2 a., 24/-.

CLOSE TOLERANCE PARTS. 2% high stab. resistors, 100 to 2 meg.,

1/6 each. Silver micas 1%, 1.5 to 100 pf., 1/-, 100-280 pf. 1/2, 300 to 500 pf. 1/4, 1,000 to 5,000 pf. 2/6. Green vitreous wirewound resistors 5% 10 w. max., 25 ohms to 20 k., 2/- each.

CAPACITORS. Over 200 types of TCC and 180 types of Hunts in stock.

COLVERN. 3 w. wirewound pots. 100 ohms to 100 k. 6/4. Preset type to 30 k. 3/2, 1 watt midget, 10 ohms to 150 ohms, 5/11. Replacement EMI strips 25 k., 250, 3/9.

SPEAKERS. Wharfedale, W.B., Goodmans, Rola, Celestion, Elac. Including oval types.

BULGIN. C114 4/-, C109 2/3, C120 1/3, D170 2/6, D360(MBC) 4/-, D670/1 12/6, J6 2/-, J2 2/-, J13 3/3, K370 1/6, K107 10/-, K108 1/3, K382 1/6, F55 3/9, P92 1/3, P38 3/-, P73 4/6, P74 4/3, P437 6/6, P161 6/-, P162 6/6, P112 2/3, P448 2/3, P463 6/-, P340 4/-, P3 3/6, Q257/1 5/9, S270 4/9, S257 4/3, S267 4/-, S359 5/3, S259 3/6, S265 4/-, S300/PD 6/-, T17, T19, 4/-, T21, T22, 7d., T25 9d., T27 10/-, TPI, TP3, 2/9, VH85 9d., P420/421 2/6.

Q MAX. CHASSIS PUNCHES. 1in., 2in., 12/4, 2in., 13/4, 1in., 1in., 1in., 16/-, 1in., 1in., 17/9, 1in., 19/9, 1in. square 24/3. All prices include keys.

DENCO. All parts stocked. Coils, F.M. Tuner, etc., and Weymouth, Osmor, Wearite, R.E.P. BOOKS (post paid). Electronic Gadgets 3/9, Mullard Valve Manual 5/6, Osram 5/6, Brimar 5/6, Wireless World 3/9, Comprehensive Valve Guide 5/3, Valve Equivalents (incl. ex Gov.) 5/3, Band I and III Aerials 4/9, TV Faults (with Commercial Circuits) 5/3.

Proprietary No. 12 Catalogue 1/-, Supplementary with surplus stock 6d.

C.W.O. C.O.D. (over £1), Educational Authorities, Hospital Management, Government and G.P.O. Depts., and Companies Monthly Account. Add Postage.

RADIO SERVICING COMPANY

82, SOUTH EALING ROAD, LONDON, W.5.

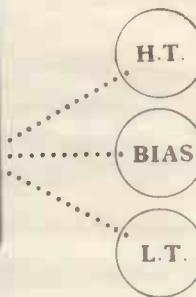
Telephone: EAL 5737

Next to South Ealing Tube Station (TURN LEFT)

Boulton Paul Electronics

stabilised
power
unit

E.P.
258



This Stabilised Power Unit, covering the lower voltage range, is extremely portable, weighing only 16½ lb. While it has been specifically designed to replace the troublesome H.T. battery, it has the added advantage of a built-in BIAS and L.T. SUPPLY. These facilities, coupled with its superior performance, make this unit an essential item in the laboratory or on the test bench.

All these attractive facilities are provided for the very modest price of: £38·0·0

Write today (mentioning this journal) for leaflets describing our range of Stabilised Power Units.



BOULTON PAUL ELECTRONICS

Boulton Paul Aircraft Ltd., Wolverhampton, England.

Tel.: Fordhouses 3191 Ext. 99. Telegraphic address "Aircraft Wolverhampton."

J1721



METERS

LARGE AND VARIED STOCKS AVAILABLE FOR IMMEDIATE DELIVERY

EXAMPLES FROM OUR RANGE OF 2½" FLUSH PATTERN MOVING COIL INSTRUMENTS (as illustrated)

AMPERES D.C. 0-1, 2, 3, 5, 10, 15, 20,

25, 30, 50.

MILLIAMPS. 0-1, 1-0-1, 0-5, 10, 15, 20, 25, 30, 50, 100, 250, 500.

MICROAMPS. 0-50, 100, 200, 250, 400, 500, 750, 50-0-50, 100-0-100, 250-0-250, 500-0-500.

MILLIVOLTS. 0-10, 25, 50, 75, 100, 500.

VOLTS D.C. 0-1, 5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.

VOLTS A.C. 0-5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.

We can supply meters with NON-STANDARD CURRENT and VOLTAGE RANGES to any specification. DELIVERY 7-14 days.

MOVING IRON, THERMO & ELECTROSTATIC INSTRUMENTS ALSO AVAILABLE.

ANDERS ELECTRONICS LTD.

91, HAMPSTEAD ROAD, LONDON, N.W.I.

Telephone: EUSton 1639

Supplied to Government Departments, B.B.C.,
Leading Manufacturers & Research Laboratories

direct TV REPLACEMENTS

134/136 LEWISHAM WAY · NEW CROSS · S.E.14 · TIDeway 3696-2330

Direct TV Replacement & Rewind Handbook

the most complete guide of T.V. Components to be published in this country. Price 1/-.

Components

EVERY SERVICE DEPARTMENT

Should Stock

STANDARD FRAME OSCILLATOR TRANSFORMER TYPE 01204

This transformer will function correctly in hundreds of different models including wide angle sets.

STANDARD FRAME OUTPUT TRANSFORMER UNIFRAME NO. 1

This replacement gives good results in many sets including Baird, Decca 101, Argosy TV 1412, Regentone, Etronic and Sobel, price 20/6, plus 2/- packing and postage.

UNISCAN I

A line output transformer complete with a universal fixing plate. It is suitable for the early type of sets using a two winding type transformer, price 37/6, plus 2/6 packing and postage.

NURAY MK. II

A booster isolator unit that "just plugs in," does not require any soldering or drilling. For use with 2-volt cathode ray tubes, with low emission or cathode heater short. Price 27/6, plus 2/- packing and postage.

SILICONE GREASE MS4

The best anti-corona grease available, no service kit is complete without it. Price 10/6.

Terms: C.W.O. or C.O.D.

UNIVERSAL ELECTRONICS

BCI277-A. 10cm SIGNAL GENERATOR.



Electrical Description
Signal Generator BC-1277-A consists of a resonant-cavity type, ultra - high - frequency oscillator, a pulser circuit, a frequency meter, a power measuring circuit, a calibrated attenuator, and power-supply circuit. A CW or pulsed signal of 6 milliwatts is provided over the range of 2720 to 3333 mc.

watts is provided over the range of 2720 to 3333 mc. The signal generator impedance is 72 ohms.

Electrical Characteristics

Frequency Range: 2700 to 3400 mc.

Measuring Range: Ultra-high-frequency power:

Maximum 5 watt RMS (+37 dbm) or 6 kw peak (+68 dbm) (input to attenuator). Minimum 16 db above 6 milliwatts (+33 dbm) (input to attenuator). Six milliwatts of CW power required into crystal rectifier for reference deflection on meter. Six milliwatts peak power into crystal rectifier required for 0.1 volt peak video output.

Average Accuracy

Peak power—within ± 1.5 db. CW power—within ± 1.0 db. Frequency—within ± 1 mc at beacon frequency; with ± 2 mc at other than beacon frequency.

Power Requirements

105-125 volts, 50-1200 cycles, approximate current drain 2.3 amperes.

Large range of VHF receivers and Microwave test equipment.
Kindly write for details or requirements.

EACH MONTH we will be illustrating and fully describing British and U.S.A. LABORATORY INSTRUMENTS which we have in stock. Cut out and file the data for future reference.

22 LISLE STREET, LEICESTER SQ., LONDON, W.C.2.

Shop hours, 9.30 a.m. to 6 p.m.

Thursday 9.30 a.m. to 1 p.m.

Write, Call or Telephone
GERRARD 4447 and 8410 (Day)
MEAdway 3145 (Night)

OPEN ALL DAY SATURDAY

equipment, whether new or used, is guaranteed to be in perfect condition.

RECEIVERS

Eddystone 640, 1.2-30 Mc/s., £22 10/-, 740 550 kc/s.-30 Mc/s., £32. 750, £45. 680, £65. **RCA AR88LF-D** from £55. **AR77E** 550 kc/s.-32 Mc/s., £32. **Hallicrafters SX28**, £45. **Marconi CR100**, £32. **National HRO**, £30, Senior and Junior models, complete.

MANUALS

For receivers. **RCA AR88LF-D, AR77E, Marconi CR100, R107, HROs, SX28, SX24, S20R, B2 TX/RX.** Set of three dials for **RCA AR88D**, £1 10/- per set.

BRITISH TEST EQUIPMENT

AVO Model 7 as NEW, £15. Model 40, £12. A.C./D.C. minor, £6/15/-. **AVO electronic test meter**, £30. **Roller panel valve testers**, £12. **Wide range signal generator**, £22. **AVO valve characteristic meter**, £50. **AVO signal generator**, £9. **Taylor 65C signal generator**, £13. **90A test meter**, £10. **260A TV Wobbulator**, as NEW, £30. **Evershed Wee meggers** 500 v., £14. **Bridge type and others** in stock. **Cossor Double Beam oscilloscope**, type 339 from £35. **Mullard Valve Tester**, complete with cards, £65.

SERVICE AND REALIGNMENT
of all British and U.S.A. types
COMMUNICATIONS RECEIVERS
to makers' specifications AT LOW COST.

BENDIX BC221 Frequency Meters 125 kc/s.-20 Mc/s. available from stock (individually calibrated).

STILL AVAILABLE—MARCONI SIGNAL GENERATOR 390G AS PER MARCH ISSUE £25.

SUPERIOR RADIO SUPPLIES
(WWM), 37 HILLSIDE, STONEBRIDGE, LONDON, N.W.10. Tel: ELGar 3644

IMPROVED PERFORMANCE

Reduced Price!

The New

SUPERIOR THREE

T.R.F. BUILDING COST £6-17-6, Plus P.P.

- ★ SIMPLE TO CONSTRUCT
- ★ ALL NEW COMPONENTS
- ★ WALNUT VENEERED CABINET
- ★ CABINET SIZE: 10¹/2" w. x 10¹/2" h. x 5¹/2" d.



Our new Three-valve T.R.F. Receiver, suitable for A.C. mains 200/250 volts, M. and L. waves. Improved selectivity due to use of high quality coils. Latest type contact cooled H.T. rectifier. A 7in. x 4in. elliptical speaker ensures ample volume and quality. Valve line-up: 6SG7, 6SG7, 6V6, chassis drilled ready for mounting components, which can all be purchased separately. Send 1/6 for "Superior Three" price list and construction booklet.

PERSONAL SHOPPERS WELCOME

A REALLY
OUTSTANDING
PORTABLE!

The
SUPEREX
55 ATTACHE

BUILDING COST £7-15-0
Plus P.P.

- ★ 4 valve superhet L.M. wave.
- ★ 7in. x 4in. elliptical speaker.
- ★ Latest miniature valves.
- ★ Very attractive cabinet.
- ★ A.B.C. Construction booklet.



This is a first-class receiver which we guarantee will give the very best of reception in all parts of the country. No trouble has been spared to ensure simplicity of construction, combined with equality in appearance and performance to any commercial models. All parts available separately. Send 1/6 for "Superex 55" construction booklet.

TERMS: Cash with order
or C.O.D. Extra charge
for C.O.D. U.K. and N.
Ireland only.

Shop open 9 a.m. to 6 p.m. Monday
to Saturday. 1 p.m. Thursday.

**ALPHA**

COMPARE THIS PRICE

THE "EKE"
QUALITY 3 WATT
AMPLIFIER

**ALPHA INVITE YOU TO
BUILD THIS
4 VALVE 2 WAVE-BAND,
SUPERHET PORTABLE
FOR ONLY**



**6½
GNS.**

Full details, circuit diagram, point to point wiring instructions, and complete list of components. Available 2/6 each. Case can be supplied separately. Available in the following attractive colours :

● Lizard Grey ● Blue

● Maroon

● Brown

All components can be supplied separately.

TRANSFORMERS FOR
BATTERY CHARGERS

230 v. Input Tapped 6-
12 v. 1 amp. 13/6 ea.
230 v. Input Tapped 6-
12 v. 3 amp. 18/- ea.
Both with tap on Primary for
2.5 v. Pilot light.

IRON ELEMENTS

Standard adaptable type, 230 v.
450 w., 1/8 ea. Morphy-Richards
replacement type, 3/9 ea. H.M.V.
replacement type, 3/- ea.

PLIERS, with side cutters, 4/3 pair.

MIDGET RADIO CABINETS



This well-known cabinet of which
thousands have been sold is ideal for
every constructor. Complete with
chassis, dial, backplate, cord drive,
pointer and dial drum. Price 27/6 each

POCKET TEST METER
Ex-Govt. volt meter two ranges
0-15 v.; 0-250 v. D.C. Complete
in case, 17/6 each.

HEATER TRANSFORMERS

230 v. Input 2 volt .5 amp. 4/6
230 v. Input 2 volt 3.0 amp. 7/9
230 v. Input 4 volt 1.5 amp. 5/-
230 v. Input 4 volt 3.0 amp. 10/-
230 v. Input 5 volt 2.0 amp. 10/-
230 v. Input 6.3 volt .5 amp. 5/-
230 v. Input 6.3 volt 1.5 amp. 6/-
230 v. Input 6.3 volt 3.0 amp. 9/-
230 v. Input 12 volt .75 amp. 5/-

SENTERCEL RECTIFIERS

RML, 3/9 ea.; RM2, 4/2 ea.; RM3
5/- ea.; RM4, 16/- ea.

METAL RECTIFIERS

12 v. 1 amp., 1/6 ea.; 12 v. 1 amp.
4/6 ea.; 2 v. 1 amp., 3/- ea.; 230 v.
45 mA., 6/3 ea.; 250 v. 75 mA., 7/6
ea.; 300 v. 60 mA., 7/6 ea.

GOLDRING PICK-UP HEADS. Pick-
up head type No. 112 (2,000 ohms),
complete with lead. Price 17/6 each.

CARRYING CASE

Suitable for use as a projector
or recording case, size 15in.
x 9 1/2 in. x 13 1/2 in. Internal
dimensions 14in. long, 11 1/2 in.
deep, 5 1/2 in. front H.T., 8 1/2 in.
rear H.T. With a black
resin finish. Weight 8 1/2 lb., 13/6 ea.
Post and packing 2/6.

CHOKES

20H, 250Ω, 60 mA. Clamp
construction 6/- ea.
10H, 200Ω, 90 mA. Clamp
construction 9/3 ea.
5H, 250 mA, 200Ω. Fully
shrouded 18/3 ea.

TINNED COPPER WIRE—All 4 oz.
Reels.

16 S.W.G.	Price	8.W.G.	Price
18 S.W.G.	2/2	20 S.W.G.	2/4
22 S.W.G.	2/6	24 S.W.G.	2/8
26 S.W.G.	2/10		

ENAMELLED COPPER WIRE—All 4 oz.
Reels.

S.W.G.	Price	S.W.G.	Price
16	1/11	30	3/1
18	2/1	32	3/3
20	2/3	34	3/5
22	2/5	36	3/7
24	2/7	38	3/11
26	2/9	40	4/2
28	2/11		

CHASSIS

Aluminium Undrilled with Reinforced
Corners. Available in the following
sizes.

6in. x 4in. x 2 1/2in. 4/6 ea.

8in. x 6in. x 2 1/2in. 6/3 ea.

10in. x 7in. x 2 1/2in. 7/3 ea.

12in. x 8in. x 2 1/2in. 8/6 ea.

14in. x 9in. x 2 1/2in. 9/6 ea.

16in. x 9in. x 2 1/2in. 12/- ea.

All are four slided—ideal for radio
receivers—amplifiers—powerpacks,
etc.

PERSPEX IMPLOSION GUARDS

Incorporating escutcheon and filter.
12in. type, 11/6 ea.; 16in. type,
14/6 ea.

NYLON DRIVE CORD

25 yard reel nylon drive cord on
wooden reel, 2/9 ea.

CRYSTAL DIODES

Plastic case, wire ends, 2 for 2/1.

TERMS: Cash with order or C.O.D. Post-
age and Packing charges extra, as follows:
Orders value 10/- add 9d.; 20/- add 1/-;
40/- add 1/6; £5 add 2/- unless otherwise
stated. Minimum C.O.D. fee and post-
age 2/3.

MAIL ORDER ONLY

PENCIL RECTIFIERS

K3/25, 5/8; K3/40, 7/6; K3/45, 8/2; K3/50, 8/8; K3/60, 9/8;
K3/100, 14/8.

CONDENSERS

each	each
8 x 16 mfd. 450 v.	32 x 32 mfd. 450 v. 6/11
8 x 16 mfd. 350 v.	32 x 32 x 8 mfd. 350 v. 5/6
8 x 34 mfd. 350 v.	32 x 32 mfd. 350 v. 25
8 x 32 mfd. 475 v.	25 mfd. 250 v. 5/9
12 x 4 mfd. 450 v.	60 mfd. 450 v. 2/9
16 x 8 mfd. 450 v.	64 mfd. 350 v. 2/-
16 x 8 mfd. 350 v.	Dubliver (B.R. Range): BR 850, 8 mfd. 500 v. 2/9
16 x 16 mfd. 350 v.	BR 1650, 16 mfd. 500 v. 3/3
20 x 20 mfd. 500 v.	BR 2050, 20 mfd. 500 v. 3/6
24 mfd. 450 v.	8 x 8 mfd. 500 v. 4/-
24 x 16 mfd. 350 v.	BR 501, 50 mfd. 12 v. 1/9
32 mfd. 450 v.	16 x 16 mfd. 500 v. 5/-
32 x 8 mfd. 350 v.	16 x 8 mfd. 500 v. 4/9
32 x 16 mfd. 350 v.	16 x 8 mfd. 500 v. 4/9

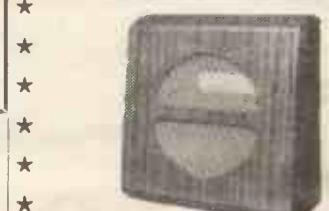
OSMOR COIL PACKS

Type H.O., 48/- each. Type L.M., 40/- each. Type T.B., 50/-
each. Type TRF, 40/- each.

SPRAUKE CONDENSERS

.05 mfd., 500 v.; .01 mfd., 1,000 v.; 1 mfd., 350 v.; .02 mfd., 750 v.
All 9/- doz.

LOUDSPEAKER CABINETS



This attractive walnut finished cabinet is available
for 6 1/2in. or 8in. speaker units. Metal speaker fret,
complete with back and rubber feet.

6in. type: Measures 8 1/2in. x 10 1/2in. x 4 1/2in. at base.
Price 15/6 each.

8in. type: Measures 10 1/2in. x 10 1/2in. x 5in. at base.
Price 19/6 each.

LOUDSPEAKER UNITS	16/- ea.
Rola 5in. Speaker with transformer	16/- ea.
Plessey 6in. lightweight unit	16/6 ea.
Rola 6in. standard type	16/6 ea.
Lectron 6in. with transformer	18/- ea.
Truvox 6in. wafer type	20/- ea.
Plessey 8in. lightweight unit	17/6 ea.
Mains energised 8in. unit, 1,000Ω	21/- ea.
Mains energised 6in. unit, 600Ω	17/6 ea.

MAINS TRANSFORMERS

3-WAY MOUNTING TYPE

M12	Primary: 200-220-240 v. Secondaries: 275-0-275 v. 80 mA. 0-6.3 v. 4 amp. 0-5 v. 2 amp. Both tapped at 4 v.	17/6 ea.
-----	---	----------

M22
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M24
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M26
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M28
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M32
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M34
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M36
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M38
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M40
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M42
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M44
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M46
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M48
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M50
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M52
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M54
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M56
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M58
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M60
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M62
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M64
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M66
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M68
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M70
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M72
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M74
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M76
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M78
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M80
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M82
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M84
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M86
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M88
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M90
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M92
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M94
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M96
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M98
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M100
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M102
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M104
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M106
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M108
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M110
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M112
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M114
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M116
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M118
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M120
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M122
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M124
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M126
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

M128
Primary: 200-220-240 v.
Secondaries: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp.
0-5 v. 2 amp. Both tapped at 4 v.

RADIO · TELEVISION · HI-FI · ELECTRONICS · RECORDERS

Limited
Quantity
Only.



★ SPECIAL PURCHASE OF 16" C.R. TUBES

Famous make offered at nearly Half-
Price. Metal cone, .3 amp. heater, e.h.t.
required 10-14 Kv.

LASKY'S PRICE £12.19.6

Carr. & Ins. 22/6 ex.
16in. FILTER MASK ESCUTCHEON
to suit above C.R.T. 15/- Post extra.

HIRE
PURCHASE

terms on certain
items. Please give
details of your
requirements.

LASKY'S RADIO

"LANE" MK. VI TAPE
TABLE in stock. Two speed,
7½in. and 3½in./sec. Three high-
grade motors. Price £18/10/-.
Carr. 3/6.
Available on H.P. terms.

Other TAPE DECKS & AMPLIFIERS in stock, including Truvox
Weirite, Motek, etc., etc.

RECORDING TAPE

Every make and type stocked.
Scotch Boy, E.M.I., Ferrovoice,
Grundig, Ferrograph, Puretone,
Gevaert and Agfa, etc.

MAINS TRANSFORMERS
Special for MT1155, etc. Drop-
through chassis mounting, half
shrouded. 275-0-275 v., 110 mA.
6.3 v. 4 amps., 5 v. 3 amps.
LASKY'S PRICE, each 29/6.

LARGE STOCKS OF AUTO-
CHANGERS

All types, including Garrard
RC.80M, Collaro, RC.531, 521,
511, also the very latest RC.54,
B.S.R. Monarch, Plessey. All
3-speed A.C. Mains. Prices
from £9/19/6 to £17/9/6. H.P.
Terms available.

CABINETS & CASES for
Auto-Changers. All types in
stock at competitive prices.

SINGLE SPEED AUTO-
CHANGERS, 78 r.p.m. in
stock, from £6/19/6.

COLLARO
3-SPEED AUTO-CHANGERS
With dual purpose crystal P.U.
Limited quantity only. **LASKY'S
PRICE** £9/19/6. Carriage 2/6.

**COLLARO 3-SPEED
RECORD PLAYERS**
Complete with P.U. and ortho-
dynamic switched head. P.U.
transformer also included. Limi-
ted quantity only. £6/19/6.
As above, with "Studio" turn-
over Crystal Pick Up (O or P),
£8/18/4. Post, either type, 3/6.

LOUDSPEAKERS
12in. Plessey, 3 ohms.... 37/6
10in. heavy duty, alumin-
ium speech coil, 3
ohms..... 26/6
P.M. Speakers: 3in. 12/6;
6in., 17/6; 8in., 19/6;
10in. 19/-
Goodmans "Audium" 60," 15-
watt, few only. Listed £8/12/6.
LASKY'S PRICE £6/19/6

HI-FI SPEAKERS
Full range of leading makes.
Wharfedale, Stentorian, Good-
mans, G.E.C., Bakers, etc.

**FILAMENT
TRANSFORMERS**
6.3 v., 1.5 amps. 5/11
6.3 v., 1.75 amps. 6/11
6.3 v., 3 amps. 9/6
2 v., 2 amps. 6/11

**CHARGER
TRANSFORMERS**
6-12 v. 1 amp. 9/9
2 amp. 11/9. 4 amp. 17/6

CONVERT YOUR "VIEW MASTER" TO
14, 16 or 18 inch SCREEN

Wide Angle Conversion Kit using only W/B components as specified.

The Kit consisting of line trans., frame trans., scanning coils, width and linearity controls, focus magnet, ion trap, tube base, 1-K3/100, 1-K3/40, metal rectifiers, 1-6CD6, 1-6U4GT, 3 resistors, 9 condensers.

COMPLETE PARCEL including valves and data book £7.19.6

Post and packing 3/6 extra
Booklet, 3/6, post free. 16in. C.R. Tube available at £12.19.6. See next page

TWO OUTSTANDING OFFERS!

6-VALVE RADIogram CHASSIS

Famous Manufacturer's Surplus—Brand New and Complete

6 valve 3-wave Superhet, 13-50 m. short, 200-550 m.
medium, 1,000-2,000 m. long. Brand new Mullard
valves: ECH42, EF41, L63, EB41, 6V6 g.t., EZ40,
and finest quality components. Gram. switch, 645 Kc/s
I.F., tone control, 3-colour dial. Overall size: 13½ ×
5, height 12½. Aperture required for dial and controls.
11 × 3½in. Complete with valves, output trans., knobs, etc.

LASKY'S PRICE £10.19.6 Carr. & Pkg. 7/6 extra.

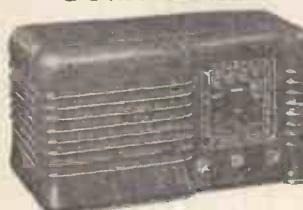
DRILLED CHASSIS & DIAL ASSEMBLY

Size 13½ × 7 × 2½in., drilled for five latest type mini-
ature valves, mains trans., I.F. etc., Dial, 13 × 4in., for
horizontal or vertical mounting. Spin wheel tuning.
All pulleys and spindle supplied.

LASKY'S PRICE 19/6 Post 3/-.

THIS TRF 3-VALVE RECEIVER CAN BE
BUILT FOR £5.10.0

(Carr. & Pkg. 2/6 extra)



Latest type circuit for 200/250
A.C. Mains, medium and long
wave. Uses 6K7G, 6J7, 6V6,
and Metal Rectifiers. Handsome
Plastic Cabinet, 12 × 6½ × 5½in.
deep, Walnut or Ivory finish.
If preferred a Wood Cabinet
is available (see illus. below).

FULL DATA, wiring and
circuit diagrams and price list
of components, 1/- post free.
CABINET only, plastic or wood,
17/6. Carr. & Pkg. 2/6 extra.

THIS 4-VALVE, 3-WAVE SUPERHET CAN
BE BUILT FOR £7.19.6

(Carr. & Pkg. 2/6 extra)

Very efficient Superhet Circuit
for 200/250 A.C. Mains, long,
medium and short wavebands.
Uses 6K8 freq. changer, 6K7
I.F. amp., 6Q7 det., A.V.C.,
AF-amp., and 6V6 output valves.
Wood cabinet, Walnut veneer,
size 12 × 6½ × 5½in. deep, or
Plastic Cabinet as illus. above.

FULL DATA, wiring and circuit
diagrams and price list of com-
ponents, 1/- post free.

CABINET only, plastic or wood,
17/6. Carr. & Pkg. 2/6 extra.

LASKY'S T.V.
CONSTRUCTORS' PARCELS
No. 1 WIDE ANGLE PARCEL

Containing ferrocube line E.H.T.
transformer, ferrocube scanning
coils, frame output trans-
former, p.m. focus unit, frame
blocking osc. transformer, 14-
16- or 17-inch mask and glass
width and linearity control's.
Also the following valves: 6U4p1
6CD6, 6AL5, 2-6AM5 (N78-
3-12AU7. Full circuit.

LASKY'S PRICE
COMPLETE £8/15/11
Carriage 3/6 extra.

No. 2 WIDE ANGLE PARCEL
As No. 1 parcel but less valves.
LASKY'S PRICE 94/11.
Carriage 2/6 extra.

No. 3 PARCEL
All brand new components by
well known manufacturers. Com-
prises E.H.T. flyback line trans-
former, 7-10 Kv. with ferrocube
core and rectifier heater winding;
scanning coils; frame output
transformer; Elac focus unit with
vernier adjuster, EY51 E.H.T.
rectifier, 12in. mask and glass.

LASKY'S PRICE
COMPLETE 79/6
Carriage 3/6 extra.

AMPLIFIERS
One of the best stocks in London.
Leak, Rodgers, Unitelex, Trix, etc.

The E.A.R. Mullard (design)
5/10. AMPLIFIER, complete
£18/18/-. Post Free. H.P.
Terms available.

UNITELEX 5 watt GENERAL
PURPOSE AMPLIFIER, type
MG4, £8/18/6. With Cover,
£9/19/6. Post Free.

TRANSCRIPTION
TURNTABLES
Connoisseur 3-speed, latest model,
£25/15/5. Collaro 2,000, £13/9/6.
Collaro 2010, complete with
trans. pick up (P), £18/4/9.
Garrard 301, £25/3/6. Carriage
extra.

EVERY TYPE OF PICK UP
We stock Pick Ups, P.U. Heads
and Styli by Garrard, Acos,
Decca, Chancery, Collaro, B.S.R.,
etc.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

LASKY'S RADIO

BARGAIN OFFER OF EX-GOV'T.

ACCUMULATORS

2 volt, 10 a.h. Size: 1in. square x 5½in. high. Made by Canadian Exide.

LASKY'S PRICE 4/6 Each Post 1/-

3 for 13/-, post free.
12 for 40/-, post free.

HOUSE YOUR TV MAGNIFICENTLY IN ONE OF THESE SUPERB CABINETS!

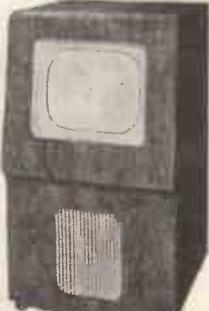
THE DE LUXE

Complete with mask, glass, castors, shelf, bearers, C.R.T. neck end protector, back, speaker fret and baffle board. Finished in beautiful figured medium, light or dark walnut veneer, with high polish. Suitable for most home constructor TV receivers, including the "Viewmaster," "Practical Television," "Tele-King," "Magnaview," "Wireless World," etc. Can be supplied with cut-out for 14in., 16in. and 17in. C.R. tubes at no extra cost.

An allowance of 4/6 will be made if the mask is not required.
Inside Dimensions: Depth 16½in.; width 17½in.; height 28in. Overall height 32in. and width 18½in.

WHY NOT CONVERT YOUR TABLE RECEIVER TO A CONSOLE MODEL?
Adaptor frames for fitting 9in. or 10in. C.R. tubes available if required.

LASKY'S PRICE £8/10/-
Carriage 12/6 extra.



H.P. Terms. Dep. £2/17/- plus carriage. Balance plus charges spread over 12 mths.

MANUFACTURERS' SURPLUS

WIDE ANGLE 38 mm.	STANDARD 35 mm.
Line E.H.T. trans., ferroxcube core. 9-16 KV. 25/-	Line Output Transformers No. E.H.T. 12/6 Line Output Transformers 6-9 KV. E.H.T. and 6.3 v. winding. Ferro cube. 19/6
Scanning Coils, low imp. line and frame 25/-	Scanning coils. Low imp. line and frame 12/6
Frame Output Transformer 10/6	Scanning Coils. Low imp. line and frame, by Igranic 14/6
Scanning Coils low imp. line and frame 17/6	Line blocking oscillator transformer 4/6
Frame blocking, osc. transformer 4/6	Frame blocking oscillator transformer 4/6
Line Blocking osc. transformer, cascode cored .. 4/6	Frame output transformer 7/6
Focus Magnets Ferrocore 25/-	Focus Magnets:
P.M. Focus Magnets. Iron Cores 19/6	Without Vernier 12/6
Duomag Focalisers 29/6	With Vernier 17/6
300 mA. Smoothing chokes 15/-	Focus Coils. Electromagnetic 12/6
Electromagnetic focus coil, with combined scan coils 25/-	200 mA. Smoothing chokes 10/6



12-VOLT 4-WATT AMPLIFIERS

Famous makes, brand new and unused. KT.61 output. Complete with power unit, synchronous vibrator (Wearite type QFA/12), and all valves. Fitted rubber covered heavy duty battery lead. In strong metal cabinet, grey crackle finish, size: 10 x 6½ x 8in. Output impedance 3 ohms. Ready for use with the addition of a suitable loudspeaker.

LASKY'S PRICE £6.19.6 Carriage 5/-.

MICROPHONE 20/- extra.

SUPERHET COIL PACKS With Circuit.

No. 1. L.M.S.G. size 4½ x 5 x 2½in. With ½in. spindle. 19/6.

No. 2. M.S.S. size 4 x 4 x 3in. With ½in. spindle. 16/-.

Both for use with 465 kc/s. I.F.

SPEAKER CABINETS

Attractive design finished in figured walnut veneer. Size 12½ x 8 x 4½in. Will take 6½in. speaker.

LASKY'S PRICE 17/11 Post & p/c. 2/6.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

BUILD THE "TELE-KING"

5 Channel 16 or 17 inch SUPERHET RECEIVER

This famous and well tried home constructor set can now be built for £29/10/-. Tube and cabinet extra.

EVERY COMPONENT
CAN BE SUPPLIED
SEPARATELY.

Full constructional data, wiring diagrams and circuits.

PRICE 6/- POST FREE

WRITE NOW FOR OUR NEW
"TELE-KING" PRICE LIST.
WE CAN SAVE YOU MONEY.



MAINS TRANSFORMERS
All 200-250 v. 50 c.p.s. primary.
Finest quality, fully guaranteed.

MBA/3. 350-0-350 v. 80 mA. 6.3 v. 4 a., 5 v. 2 a. Both filaments tapped at 4 volts. An ideal replacement trans. 18/-.

MBA/6. 325-0-325 v. 100 mA. 6.3 v. 3 a., 5 v. 2 a. With mains tapping board. Price 22/6.

MBA/7. 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. 18/-.

MBA/8. SPECIAL OFFER.
Drop through type. 235-0-235 v. 60 mA. 6.3 v. 3 a. 12/6.

MBA/9. 400-0-400 v. 60 mA. 6.3 v. 1 a., 4 v. 2.5 a. Price 12/6.

AT/3. Auto transformer. 0-10-120, 200-230-240 volts 100 watts. Price 17/6.

THE ROTHESAY

The last word in outstanding contemporary design. Absolutely rigid construction throughout with the finest laminated woods, veneered in walnut, polished light, medium or dark shade. Fitted with gold anodised speaker grille. The C.R.T. aperture frame is detachable, supplied to suit any size tube to order. Full length doors if required can be supplied with the cabinet. Veneered both sides, polished to match the cabinet, and mounted with full length piano hinges.

NOTE THESE GENEROUS SIZES.
Outside dim. 34½in. high, 21½in. wide, 21½in. deep. Inside dim. 18½in. wide, 19½in. deep. Size of top 22½in. x 21½in. Thickness ½in.

LASKY'S PRICE £9/19/6

Carriage 15/- extra. H.P. Terms. Deposit £3/10/- plus carriage charge. Balance plus charges spread over 12 months.



"TELETON" SUPER INDUCTOR COILS

Ferrite Rod Aerials, wound on high permeability Ferroxcube Rod, 5/16in. diam. 4in., medium wave 8/9 8in., med. and long wave 12/9 Full range of all types in stock.

ION TRAPS. All types, 3/-.

ELECTROLYTIC CAPACITORS ALL BRAND NEW

8 mfd. 450 v.w.	1/9
16 mfd. 350 v.w.	2/6
16 mfd. 500 v.w.	3/6
20 mfd. 500 v.w.	3/6
30 mfd. 450 v.w.	3/3
60 mfd. 350 v.w.	3/11
64 mfd. 450 v.w.	3/11
150 mfd. 350 v.w.	3/6
400 mfd. 150 v.w.	2/6
8 + 8 mfd. 450 v.w.	3/6
8 + 16 mfd. 450 v.w.	4/3
12 + 12 mfd. 350 v.w.	2/6
16 + 16 mfd. 350 v.w.	3/6
16 + 16 mfd. 450 v.w.	4/6
20 + 20 mfd. 257 v.w.	2/-
60 + 100 mfd. 350 v.w.	7/6
32 + 32 mfd. 450 v.w.	5/11
Many other single and multiple condensers.	

HIGH VOLTAGE E.H.T. CONDENSERS

.1 + .1 mfd. 3.5 Kv.	5/11
1 mfd. 7 Kv.	15/-
.001 mfd. 12.5 Kv.	7/6
.001 mfd. 15 Kv.	10/-
.0005 mfd. 10 Kv.	3/6
.0005 mfd. 15 Kv.	6/6
.04 mfd. 12.5 Kv.	5/-

★ THE MULLARD 5/10 AMPLIFIER KIT

All components, chassis and valves in stock. Available separately. THE BOOK, 2/6, post free.

★ THE OSRAM 912 AMPLIFIER KIT

All components in stock. Chassis, Partridge trans., chokes, W/B's, etc. Available separately. THE BOOK, 3/6, post free.

C.R.T. MASKS PLASTIC. Brand New.

14in. 6/6 16 in. and 17in. 9/6 RUBBER, 12in., including fitted armour plate glass. Black ... 8/6 Cream ... 11/6 Post Extra.

PERSPEX IMPLOSION GUARDS

Incorporating escutcheon & filter. 12in. ... 7/6 16in. ... 12/6 12 in. de Luxe ... 10/6

C.R.T. NECK PROTECTORS 2/6.

SPECIAL TV CONDENSERS

64 mfd. 450 v.w. 3/11
100 mfd. 450 v.w. 4/11
32 + 100 mfd. 450 v.w. 7/6
100 + 200 mfd. 350 v.w. 5/11

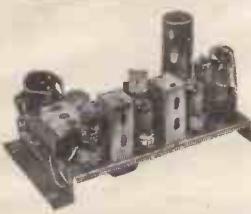
DENCO F.M. FEEDER UNIT
All components and valves in stock
Uses 6AM6, 12AH8, EB91, and two 6AB6. THE COMPLETE PARCEL £6/7/6. Post extra. All components available separately.

VALVES & C.R. TUBES. Over 25,000 in stock. Mullard, Brimar, Osram, G.E.C., Ferranti, etc.

METROSILS. 10 Kv. 5/-.

EVERYTHING FOR HOME CONSTRUCTOR & SERVICEMAN

COMPLETE 5-VALVE RADIO CHASSIS



Completely wired and ready for use with the addition of a speaker and output transformer. Two controls: Volume and Station switch. Valves used: 10C1, 10F9 or UF41, 10LD11 or UBC41, 10P14, U404 or UF41.

LASKY'S PRICE, 69/6 Post less valves, 3/6. Complete with valves, £5/19/6.

- ★ I.R. 465 kc/s.
- ★ A.V.C.
- ★ 4 watts output.
- ★ 3 Station Pre Set.
- ★ Frame aerial.
- ★ Fully aligned.
- ★ Chassis size only 10in. x 5 1/2 in. Max. height 5 1/2 in.

LASKY'S RADIO

LASKY'S LATEST SUPER SCOOP!

THE "SOUND MASTER" TAPE DECK KIT

LIMITED QUANTITY ONLY

ORIGINAL LIST PRICE £13.13.0

LASKY'S PRICE £6.15.0 Plus 5/-
P. & P.

The only real high-fidelity Tape Recorder for the home constructor. Built from precision-machined parts and standard radio components. Easily wired and assembled without previous experience.

Lasky's now offer the Complete Kit of Brenell components to make this super-quality Deck, including full data, circuit diagrams and stage-by-stage details, for only £6.15/- plus 5/- post.

Remember, a Deck of this quality deserves the finest motors and heads:-

The Set of three Collaro "Wearite" Heads. Red Seal, £4/4/- pair. Gold Seal, £7/7/- pair.

The cost of building the "Sound Master" Deck complete with motors, heads, switches and sundries is £17/17/-.

If you require the Amplifier and Speaker we can supply all the specified components, chassis, etc., at competitive prices. Cabinet, as illustrated, also available.

When completed this Tape Recorder is comparable with models costing £100 or more.

Data Book, 30 pages, containing full wiring diagrams and stage-by-stage construction details, 6/6 post free. (Credited in full if Deck Kit purchased.)



CRYSTAL DIODES

Glass type, wire ends. Each 1/6 Higher grades, 12 assorted for 30/-, post free.

AERIAL ROD SECTIONS

Steel, heavily copper plated. 12in. long, 1/16 in. diameter. Any number may be fitted together. 2/6 per doz. Post free.

SPECIAL TRANSFORMER

Secondary tapped as follows: 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volts at 2 amps.

PRICE 17/6.

3-WATT MIDGET AC/DC AMPLIFIERS

PUSH PULL, VERY HIGH GAIN.

4 valves: 2 UL41 in metal case and 1 UCH41 and 1 UAF42.

Input voltage 100/110

AC/DC. Very easily converted

to 230 volts. Supplied

with circuit diagram and full details. Size: -9 x 4 x 4 inches. Uses 2 metal rectifiers, 1 each RM2 and RM3. Ideal for ships record players, tape recorders, home record players, baby alarms, etc., etc. Supplied completely fully assembled and wired, with 4 valves.

LASKY'S PRICE, 65/-, carriage free.



CO-AXIAL CABLE

75-80 ohms impedance.
Single Core, per yard .. 8d.
Twin Core 1/-
Twin Balanced Feeder .. 6d.

DULCI RADIO CHASSIS

Full range stocked. 6 types to choose from.

METAL RECTIFIERS

6 or 12 v.
F.W. Bridge
2 amp. ... 11/3
4 amp. 15/-
6 amp. 23/6
1 amp. 6/6
10 amp. ... 32/6
1/2 amp., 6 v. 2/6
1/2 amp., 12 v. 3/11
3 amp., 12 v. 12/6

ALUMINIUM CHASSIS. 18 S.W.G., un-drilled, with 4 sides, reinforced corners. Depth 2 1/2 in.

6 x 4in., 4/- 12 x 8in., 7/- 16 x 10in., 8/3
8 x 5in., 5/- 14 x 9in., 7/6 12 x 3in., 4/9
10 x 7in., 6/- 16 x 9in., 8/- 12 x 6in., 6/6

Post 1/- per chassis extra.

R.1155 RECEIVERS

Now available on H.P. terms

5 Frequency ranges: 18.5-7.0 Mc/s; 7.5-3.0 Mc/s; 1,500-600 kc/s; 500-200 kc/s; 200-75 kc/s. Supplied in maker's original wood transit case.

LASKY'S PRICE, brand new .. £11/19/6

Secondhand, Grade 1 £9/19/6

Secondhand, Grade 2 £7/19/6

Carriage 17/6 extra, including 10/- returnable on packing case.

ASSEMBLED POWER PACK/OUTPUT STAGE for R.1155 RECEIVER. For use on 200-250 v. A.C. Complete with 2 valves. In metal case, size 12 x 7 x 5 1/2 in. 79/6.

Carriage 5/- extra.

POWER PACK as above, fitted with 6 1/2 in. P.M. Speaker, £5/5/- Carriage 5/- extra.

ARMOUR PLATE GLASS
16in. (17 1/2 x 15 1/2 x 1 1/2 in.) 7/11
15 1/2 x 13 1/2 x 1 1/2 in. 6/11
12in. (13 x 10 1/2 x 1 1/2 in.) 4/-
9in. (9 x 8 x 1 1/2 in.) 3/-

TRIPLEX DARK SCREEN FILTERS

14 x 12 1/2 x 1 1/2 in. 7/6
15 1/2 x 13 1/2 x 1 1/2 in. 9/6

Postage and packing 5/- per piece extra. (This charge is necessary owing to extra packing required.)

BRIMISTORS.

CZ.1 1/6 each. CZ.3 6d. each.

OUTPUT TRANSFORMERS

Midget Pentode	3/6
Miniature Personal, 3S4, etc.	3/6
Standard Pentode	3/11
Push-pull, 6V6	9/6
Multi Ratio, P.P.	12/6
Heavy Duty P.P.	14/11

MINIATURE 3-GANG TUNING CONDENSERS

1/2 in. spindle, size 3 x 1 1/2 x 1 1/2 in., less trimmers, 10/6.

Post 1/- extra.

BRANDENBURG E.H.T. UNITS

13-16 kV., £9/9/-. 6-9 kV., £6/6/-; 6-9 kV. Osc. Coil, 39/-.	Post free.
--	------------

"SENTERCEL" SELENIUM RECTIFIERS

K3/10, 250 v.	2/6
K8/40, 3.2 kV.	6/-
K3/45, 3.6 kV.	8/2
K3/50, 4.0 kV.	8/8
K3/100, 8.0 kV.	14/8
K3/160, 12.8 kV.	21/6
K3/200, 16 kV.	26/-

"SENTERCEL" METAL RECTIFIERS

RM1, 125 v., 60 m/A.	3/10
RM2, 125 v., 100 m/A.	4/3
RM3, 125 v., 125 m/A.	5/-
RM4, 250 v., 250 m/A.	16/-

POSTAGE & PKG. CHARGES (unless otherwise stated)

Orders value £1, 1/- extra.
Orders value £5, 2/- extra.
Orders value £10, 3/6 extra.

Over £10 carriage free.

All goods fully insured in transit.



TWO ADDRESSES FOR PERSONAL CALLERS

Open all day Saturday. Early closing : Thursday.

370 HARROW ROAD, | 42 TOTTENHAM COURT
PADDINGTON, W.9. | ROAD, W.1.

(Opposite Paddington Hospital)
CUNningham 1979/7214.

Between T.C.R. and Goodge St. Stns.
MUSEum 2605.

ALL MAIL ORDERS TO HARROW ROAD PLEASE

LASKY'S RADIO

LASKY'S
(HARROW LTD.)

CLYNE RADIO LTD.



18, TOTTENHAM COURT ROAD, LONDON, W.1

MUSEUM 5929/0095.

All goods specially selected for quality and value. Prompt Service—Money-back guarantee—It will pay you to visit our new rebuilt shop premises. Situated 50 yds. only from Tottenham Court Road Tube (Genuine)

VERY LATEST 3-SPEED AUTO-CHANGER BY FAMOUS MANUFACTURER

Further limited quantity—mixer, turn-over crystal head. Cream finish. Our price £11 10/- only, plus 3/6 p. & p., or 50/- deposit plus p. & p., and 12 monthly payments of 16/9.

COLLARO RC/54 PLAYER !



Just released. Fawn leatherette covered portable case, incorporating very latest Collaro 3 speed mixer-changer. Cream finish. Lightweight turn-over crystal pick up head. Only £13 19/8 cash, plus 5/- p. & p. Complete, or, 69/6 deposit plus p. & p. and 12 monthly payments of 19/8.

REGAL A well-made cabinet in medium coloured walnut veneer. Size 29½ x 14½ x 29½ in. Uncut motor-board measures 25½ x 13½ in. Record or tape storage aperture alongside motor-board measures 3½ in. wide x 12½ in. deep. Price £9/10/6 plus 10/- F. & P. H.P. terms available.

We have in stock the identical cabinet to this above illustrated, but slightly larger. Measurements: 29½ in. high x 31 in. x 14½ in. Uncut motor-board measures 25½ x 14½ in. Aperture 5½ x 12½ in. deep. Price £10/17/6 plus 10/- F. & P. We carry a very large selection of portable cabinets for all purposes. A stamp will bring illustrated cabinet list.

EL115A RECEIVERS. Guaranteed serviceable in original packing cases. £7/19/6. Fully assembled Power Pack and output stage, to plug straight into EL115 for A.C. 200/250 volts at 78/6. We have a few brand new EL115 at £10/17/6 also in original packing cases. Deduct 10/- if purchasing either receiver together with power pack. Plus 10/- packing and carriage.

R1124 RECEIVER UNIT. Coverage 30-40 Mc/s. including 6 valves—3 type 9D2, 1 each, 6D2, 15D9 and 4D1. Six valve screening cans, 24 ceramic trimmers, 6 ceramic valve holders, resistors, condensers, I.F.T.'s, etc. In very good condition, a bargain at 16/8 each only, plus 3/6 packing and postage.

RECEIVER TYPE 25/73. (The receiver section of TR119.) Supplied complete with full data for conversion to 3-wave superhet receiver. Unit is complete with 6 valves 2-EF39, 2-EF36, FK32 and EBC33, also standard I.F.T.'s 465 Kc/s. Price 27/6 plus 2/8 F. & P.

TR119 TRANSMITTER PORTION. We can also supply the transmitter portion of the above receiver incorporating valves, ELS2, EF50, CV501. Type 600 relay, transformer, coils, switches, etc. Limited quantity at 12/6 only, plus 2/8 F. & P.

HIRE PURCHASE
We are pleased to announce advantages hire purchase facilities on any single item over £5. Ask for details, mentioning what you are interested in. We regret we cannot extend this facility to kits.

22 SET POWER UNITS NO. 4MK1 ZA10478

Complete with 4 metal rectifiers each 250 v. 60 mA. 2-12 v. 4 pin Mallory Vibrators, transformers, condensers, resistors, signal 1 amp. indicator, etc., etc., in good condition. Complete in metal box size 10½in. x 6in. x 8in. Weight 19 lb. 27/6, plus 5/-

L.T. RECTIFIERS TYPE R.K. A newly manufactured range guaranteed 12 months. 6 or 12 v. 1. F.W. bridge type.... 7/6
6 or 12 v. 1.5. F.W. bridge type.... 9/6
6 or 12 v. 2. F.W. bridge type.... 11/3
6 or 12 v. 2.5. 12/6

6 or 12 v. 4. F.W. bridge type.... 15/-

CHARGER TRANSFORMERS. Input 230 v. 6/12 v. 1 a. 9/9
6/12 v. 2 a. 14/6
6/12 v. 4 a. 17/6

ARMSTRONG F.C.49 The very latest high quality replacement chassis having provision for F.M. 1000 kc/s. 8 valves, four wavebands. Independent bias and treble with unique thermometer visual indicator. Ready for use £23/15/- plus 5/- p. & p.

METER SPECIAL! We have a limited quantity of accurate electrical thermometers. Brand new, by Weston. Small moving coil meter, flush square fitting. These meters have a luminous scale graduated 40-140 degrees centigrade, but the full scale deflection is approximately 150 microamps.

Price 12/6 each only, plus 1/- F. & P.

VIBRATOR PACK. Brand new, by Mallory. 12 volt input, 150 v. 40 mA. output. Complete with synchronous vibrator. 27/6.

DECCA LIGHTWEIGHT PICKUPS. Complete with either standard or L.P. Crystal Cartridge insets. Complete with Rest and Tracking instructions. 32/6 plus 1/6 F. & P.

Also their very latest type, as above, but with turn-over head 47/6 only! Plus 1/6 F. & P.

6-VOLT VIBRATOR PACK. Ex-W.D. 6-volt input, output 140 v. 30 mA. Fully smoothed and rectified, incorporating Wearite 6 volt 4 pin vibrator type NSB6. Unit size only 6½in. x 5in. x 2½in. Price 15/- plus 1/6 F. & P. New condition.

SPECIAL OFFER—TRANSMITTING VALVES. These are brand new originally boxed, and guaranteed O.K. Type 813, 80/- ea. Type 866A, 17/- per pair, both post free. Also type 2SC1 at 20/- 12/6

VALVES. We have a very comprehensive stock of surplus valves at competitive prices. A stamp will bring Valve Price List.

SPECIAL OFFER—METERS. Taken from equipment, but guaranteed perfect. 21n. round 0-90 m.m.p. 21n. round, 0-40 m.m.p. 21n. round 0-50 amp. 3½ in. ea. or 3 for 10/6

2½ in. round panel-mounting 0-500 mA. 5/-. All the above plus F. & P. please!

METERS. All new condition and complete. Cases also 9½in. x 7in. x 5in.

Type 24—20-30 Mc/s. 15/- Switched Tuning. Type 25—40-50 Mc/s. 19/6. Switched Tuning. Type 27—65-86 Mc/s.

45/- Variable Tuning. Type 28—50-65 Mc/s. Variable Tuning 35/- We have a limited supply of RF27 new condition and complete, but tuning dial damaged. Price only 30/- each. ALL these units Post Free!

LOUDSPEAKER SPECIAL !! 12in. 3 ohm Plessy P.M. 37/6 plus 2/8 F. & P.

TRANSFORMER SPECIAL !! Drop-through tropicalized. 110-210-240 v. primary 350-0-350 at 120 mA. 6.3 v. 6 a. 6.3½ a. 5 v. 3 a. 21/- plus 2/8 F. & P.

AMERICAN CONTROL UNIT C58/APT1. Box measures only 6in. x 3½in. x 1in. Incorporating 21n. 0-100 mA. meter

Post Free. Price 22/6, post free.

HEADPHONES. Brand new, ex-Govt., by S. G. Brown. Type CLR. Low resistance, 7/6 per pair. Type CIRR high resistance, 12/6 per pair.

We can also supply very special brand new American ex-Govt. lightweight high resistance phones by Trimm at 15/- per pair.

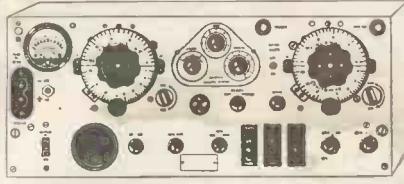
VOLTA-LYTE 2 volt 60 amp. ACCUMULATORS MULTI-PLATE Type in Celluloid containers. Size 3in. x 3in. x 4½in. height at 9/6 each plus 2/8 F. & P. Or 3 for 28/6. Post free.

No. 38 TRANSMITTER/RECEIVER WALKIE-TALKIE. Range approx. 5 miles. Coverage 7-49 Mc/s. The set only, complete with valves at 30/-, in very good condition.

RECORD PLAYER CABINETS. Specially made to house any type of single record unit. Finished in dove-grey leatherette. Backboard measures 14½in. x 12½in. Clearance above and below board 3in. 45/- plus 3/- F. & P.

24 VOLT ROTARY CONVERTER. Input 24 v. D.C. Output 20/250 v. A.O. 100 watts. Complete in black steel box 18½in. x 11½in. x 8½in. Weight approx. 30 lbs. Completely smoothed incorporates Sodium Lamp transformer. Brand new 82/6.

LAST FEW ONLY! EX-NEW ZEALAND ARMY TRANSMITTER/RECEIVERS.

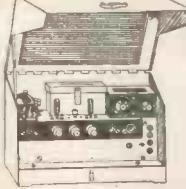


coverage 2-6.5 Mc/s. Front panel layout very slightly different to Mk. II illustrations. Transmitter output up to 2 watts depending on type of aerial used, gives range up to 35 miles on Morse and 30 miles in wave counter. Considerably greater ranges may be obtained by the use of horizontal aerials. E.L.T. is supplied with a built-in vibrator pack, requiring 12 volt input. Valve lineup, 2-6V6GT, 7-6V7G, 6K5G and 6Q9GT. 465 Kc/s. I.F.T.'s. Set weighs 5½lb. Measurements 22½in. x 10½in. x 10in. These units are now condition, and price is £5/19/6 only, plus 10/- packing and carriage. This price includes fully illustrated 60-page instruction booklet including full circuit diagrams, suggested aerials, fault-finding, etc. An unrepeatable bargain!!

REMOTE CONTROL UNITS.

These units originally intended for use with the above transmitter/receiver, when inter-connected can be used as ordinary telephones or for practice Morse-working one-to-one. Complete in handsome steel case, can be operated by ordinary torch battery. Has built-in Morse key and buzzer unit. Price for each is 15/-. Suitable headphones can be supplied at 7/6 plus 5/- for carbon hand microphone. The whole plus 2/8 F. & P. Each unit includes full operating instructions—and is brand new.

OTHER ACCESSORIES AVAILABLE. Moving Coil Microphones for transmitter 7/6 each. 100 yd. drum twin cable with plugs both ends. 10/- 70 yd. drum ditto. 7/-, etc., etc. M/O earphones 7/6.



F.S.D.	Size	Type	Fitting	Price
50 microamp	D.C. 2in.	M.C.	R.P.	50/-
100 microamp	D.C. 2½in.	M.C.	F.R.	45/-
500 microamp	D.C. 2in.	M.C.	R.P.	13/6
500 microamp	D.C. 2in.	M.C.	F.R.	18/6
1 mA.	D.C. 2in.	M.C.	F.R.	17/6
1 mA.	D.C. 2½in.	M.C.	F.R.	22/6
1 mA.	D.C. 2½in.	M.C.	Desk Type	27/6
5 mA.	D.C. 2in.	M.C.	F Sq.	7/6
10 mA.	D.C. 2½in.	M.C.	F.P.	8/-
10 mA.	D.C. 2½in.	M.C.	F.R.	10/-
50 mA.	D.C. 2in.	M.C.	F Sq.	8/6
150 mA.	D.C. 2in.	M.C.	F Sq.	7/6
200 mA.	D.C. 2in.	M.C.	R.P.	10/-
1 amp.	R.F. 2½in.	Thermo	R.P.	9/-
3 amp.	R.F. 2in.	Thermo	F Sq.	13/6
5 amp.	D.C. 2in.	M.C.	F Sq.	7/6
6 amp.	R.F. 2½in.	M.C.	Thermo F.R.	10/6
20 amp.	D.C. 2in.	—	R.P. (with shunt)	12/8
25 amp.	D.C. 2½in.	M.I.	F.R.	6/8
30 amp.	D.C. 2½in.	M.I.	F.R.	12/8
15 volt	A.C. 2½in.	M.C.	F.R.	10/-
20 volt	D.C. 2in.	M.C.	F Sq.	7/6
15-0-15 volt	D.C. 2½in.	M.C.	F.R.	17/6
150 volt	D.C. 2in.	M.C.	F.R.	15/-

R.P. = Round projection. M.C. = Moving Coll. Thermo = Thermo-couple.

F Sq. = Flush Square. F.R. = Flush Round. M.I. = Moving Iron.

AMERICAN RECTIFIERS. 1 m.a. by G.E.C., at 8/6, also 5 m.a. by Westinghouse at 8/6.

EX-W.D. CATHODE RAY TUBES. Guaranteed full picture. VCR97 at 40/-, VCR517C at 35/-. Also VCR139A—Ideal for oscilloscope 2½in. screen at 35/-. We also have VOB97 with slight cut-off, very suitable for oscilloscope, testing purposes, etc., at 15/- only. All these tubes are brand new, in original packing, and tested before despatch. Please add 2/8 packing and carriage for any of the above tubes.

AMERICAN INDICATOR UNIT TYPE B929A. Brand new incorporating 3 tube 3BPL, with mu-metal shield, 2-8SN7GT, 2-6H9GT, 6X6G, 864G, 9 potentialometers 2½ in. a.c. switch motor, transformer, and a host of small components. The whole unit which measures only 8½in. x 8½in. x 13½in. is brand new, enclosed in black crackle box, and can be supplied at 65/-, plus 5/- p. & p.

BRAND NEW G.R. TUBES.—By leading manufacturer. 14KP4A. Latest type 14in. rectangular 6.3 v. heater. 12-14 Kv. In original sealed cartons. Limited quantity only at £13/19/6. Plus 15/- packing, carriage and insurance.

TRIPPLET RECTANGULAR METER. 4in. scale. Knife-edge needle. Basic movement 0-100 microamps. At present graduated for multi-range meter. Brand new in sealed cartons, 90/+, plus 2/- p. & p.

STOP PRESS !!!

2½ IN. ROUND FLUSH MOUNTING METER by WESTON, blank scale ready for re-engraving, FSD 850 microamps, brand new, 27/6 only.

OUR NEW "POPULAR" AMPLIFIER. A.C. Mains 2/3 ohms. 4 watts output. Suitable for either crystal or magnetic pick-up. Valve line-up, 6V6GT, 6S1, L7GT, 6V3GT. Provision for radio feed-in.

Volume and tone controls. Built in cradle.

finished steel box, with chrome carrying handle. Attractive bakelite engraved front panel. Box measures 9in. x 7½in. x 6in. Price only £6/12/6 carriage paid. Ready for use.

We have in stock the very latest "Elpico" Feeder Unit type RFT20. Superhet for L.M. Short and Traveller Bands. Very attractive illuminated black and gold dial suitable for immediate use with any amplifier. 15 gns. tax paid.

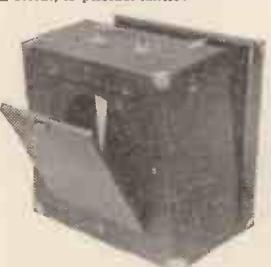
No. 17 Mk. II TRANSMITTER/RECEIVER. Built into a strong wooden cabinet 15in. x 14in. x 9in. Complete with headphones and microphone. Range 5-8 miles with simple aerial 44-61 m/c. (5.7 metres). Uses standard 120 v. H.T. and 2 v. L.T. batteries. Illustrated instruction book supplied with each unit. 50/- each plus 7/6 post and packing.

THE R.C. 3/4 WATT AMPLIFIER KIT.—Just released! Compare the advantages! Treble, bass, AND middle tone controls. For crystal or magnetic pickup. A.O. Mains, 200/250 v. Valve line-up, 6V6GT, 6SG7 metal, 6X5GT. Negative feedback. Built on stove enamelled steel chassis, measuring only 8in. x 4in. x 11in. Four engraved cream knobs are included in the price of the complete kit with all necessary practical and theoretical diagrams, at £4/5/- only, plus 2/6 packing and post, or Instruction Book, fully illustrated, for 1/- post free! This amplifier can be supplied complete, tested, and ready for use at £5/5/-, plus p. & p. Hearing is believing!

Valve line-up, 6V6GT, 6SG7 metal, 6X5GT. Negative feedback. Built on stove enamelled steel chassis, measuring only 8in. x 4in. x 11in. Four engraved cream knobs are included in the price of the complete kit with all necessary practical and theoretical diagrams, at £4/5/- only, plus 2/6 packing and post, or Instruction Book, fully illustrated, for 1/- post free! This amplifier can be supplied complete, tested, and ready for use at £5/5/-, plus p. & p. Hearing is believing!

SUPER-QUALITY 6-VALVE RADIOPHONIC CHASSIS

Very limited quantity by Britain's leading quality manufacturers, 3 waveband, superhet, valve line-up, 6V6G, EZ40, EC42, L63, EF41 and EB41. Combined pick-up amplifier and A.F. amplifier on Radio and Gram. Employs a special circuit for gramophone pre-amplification. Large glass panel horizontal tuning, 14in. x 9in. x 2in. Chassis measurement, 14in. x 9in. x 2in. This is a superior chassis designed to sell originally in a Radiogram costing £79. Our price is £12/19/6 only, tax paid, plus 5/- packing and carriage. We will gladly demonstrate this chassis or any other working item from our stocks, to personal callers!



Carrying cases in black leatherette finish. An extremely well-made case with chrome locks and corner-pieces for extra strength. This cabinet will house any 12in. Hi-Fi speaker, but can be put to a number of uses. Front panel and lid are removable. Size: 18in. x 10in. x 16in. high. 47/6, plus 5/- post and packing.

F.M. !! (Frequency Modulation)

We are pleased to announce our complete Kit for the "Denco" F.M. Feeder Unit.

This unit provides an A.F. output suitable for feeding into the audio section of a standard broadcast receiver where triode/pentode output are available. Within an average of 30 miles from a V.H.F. transmitter one I.F. stage should be adequate, but our complete Kit supplied includes all components and valves for an extra I.F. stage if necessary, or if the unit is used at greater distances. Full constructional details, theoretical circuit and point-to-point wiring diagram can be supplied for 1/6 post free, or the complete Kit right down to the last nut and bolt, at only £8/7/6, plus 2/6 packing and postage. This unit can be supplied, if desired, ready assembled, aligned and tested, at £8/10/- plus 2/6 packing and postage.

If required we shall be pleased to align this unit for constructors not possessing the necessary equipment, for a charge of 7/8. N.B.—Valve line-up is 6AM8, 12AH8, 2-6BA6 and 6AL5. Chassis measures only 6in. x 5in. x 1in. Demonstrations at 18, Tottenham Court Road !

Full assembly details with practical and theoretical diagrams can be supplied at 1/6 post free. This is a truly professional 4-valve superhet—all dry—for medium wave bands. The case is made of wood panel, with dial engraved in red and green, adds to the very imposing appearance of this model which is housed in an attractive cream and grey leatherette covered attaché-case type cabinet, measuring only 9in. x 7in. x 5in. Weight less batteries, 4lb. with batteries 6lb. This set really has everything! Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the min. speaker. Valve line-up: 3V4, 1E5, 1S5, 1T4. Also the required components exactly as specified, including cabinet, can be supplied from stock at the special inclusive price of £7/7/- plus 2/6 p. & p. (less batteries). Used Ever Ready 90 v. H.T. type B126 at 9/3. Also L.T. 1.5 v. A.D.35 at 1/4

THE R.C. RAMBLER ALL-DRY PORTABLE KIT

Full assembly details with practical and theoretical diagrams can be supplied at 1/6 post free. This is a truly professional 4-valve superhet—all dry—for medium wave bands. The case is made of wood panel, with dial engraved in red and green, adds to the very imposing appearance of this model which is housed in an attractive cream and grey leatherette covered attaché-case type cabinet, measuring only 9in. x 7in. x 5in. Weight less batteries, 4lb. with batteries 6lb. This set really has everything! Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the min. speaker. Valve line-up: 3V4, 1E5, 1S5, 1T4. Also the required components exactly as specified, including cabinet, can be supplied from stock at the special inclusive price of £7/7/- plus 2/6 p. & p. (less batteries). Used Ever Ready 90 v. H.T. type B126 at 9/3. Also L.T. 1.5 v. A.D.35 at 1/4

Demonstrations at 18, Tottenham Court Road !

The "SUPERIOR" FOUR KIT. Our new four-valve receiver. A.C. mains, 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size, 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 volts, 4 watts output. Excellent quality. High sensitivity. Provision for gram. Attractive illuminated black, red, green and gold dial for horizontal tuning. Four controls are: Tuning, L/M/S/Gram. Vol./on/off, Tone (variable), Chassis size: 13in. x 5in. x 2in. Dial size: 10in. x 4in. Assembly is simplified by the use of a 3-waveband coil pack, and pre-aligned 465 Kc/s. I.F. transformers—high-grade drop-through half-shrouded Mains Transformer, with voltage adjustable panel. This chassis can easily be assembled in one evening. Illustrated assembly with full assembly instructions, practical and theoretical wiring diagrams and itemised price list, 1/6, post free. The main items for this receiver can be supplied separately, as under. Drilled chassis, complete with valve-holders, A/E panel, P/U panel, tuning condenser and ready-assembled dial and drive at 39/6. 3 waveband coil pack with gram position, 39/6, tax paid. Pair of 465 Kc/s. I.F. Transformers, 9/8 pair. Half shrouded drop through Mains Transformer, 22/8. The total cost of ALL items purchased separately is nearly £10, but we shall be pleased to supply all the required components right down to the last nut and bolt, at a special inclusive price of £8/8/-, plus 2/6 packing and postage. A set of four small brown and cream engraved knobs to suit is available at 1/2 each knob. This chassis is a professional job in every respect and can be seen and heard at our premises. This chassis can also be supplied, ready assembled, in very limited quantities at £9/19/6, plus 5/- carriage and packing.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For Long, Medium, and Short Waves. Valve line-up: 6K8 Frequency changer, 6K7, 1F Amplifier, 607 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2-6SG7, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size 10in. x 10in. wide. Maximum depth at base 5in. Depth to 3in. at top sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6, post free. Our price for complete kit, £6/9/6 11/1. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wavechange switch, dial, pointer, drum pulleys, drive spindle, drive spring, and knobs, at 45/-, plus 2/6 packing and carriage.

N.B.—Our kits are even supplied with sufficient solder for the job.

THE R.C. GRAM REPLACEMENT CHASSIS KIT

To meet the very great demand for this type of receiver, we have produced this unit. For

SELENIUM RECTIFIERS

L.T. Types	H.T. Type H.W.	
2/6 v. ½ a.h.w....	1/9	120 v. 40 mA.... 3/11
6/12 v. ½ a.h.w....	2/9	250 v. 50 mA.... 6/9
		250 v. 80 mA.... 7/9
		250 v. 150 mA.... 9/9
F.W. Bridge Types		RM4 250 v. 250
6/12 v. 1 a.....	4/11	mA. 11/9
6/12 v. 1.5 a....	7/9	300 v. 275 mA.... 12/11
6/12 v. 2. a....	9/9	F.W. (Bridge Type)
6/12 v. 3 a.....	12/9	250 v. 80 mA.... 11/9

CO-AXIAL CABLE. 75 ohms $\frac{1}{2}$ in., 7d yard. Twin screened feeder, 10d. yd.

SILVER MICA CAPACITORS. 5, 10, 15, 20, 25, 30, 35, 50, 100, 120, 150, 180, 200, 230, 300, 330, 400, 470, 500, 1,000 pfd. (.001 μ F), .002 mfd. (2,000 pfd.). All at 5d. each, 3/9 dozen one type.

DIAL BULBS, M.E.S., 8 v. 0.15 a., 6/9 doz.; 6.5 v. 0.3 a., 6/9 doz.; 4.5 v. 0.3 a., 6/9 doz.;

ELECTROLYTICS (Current production) NOT ex Govt.

Tubular Types	Can Types	
8 μ F 450 v.	1/9	16 mfd. 350 v.... 1/11
8 mfd. 500 v....	2/6	16F 450 v.... 2/9
16 μ F 350 v....	2/3	16F 450 v.... 2/11
16 μ F 450 v....	2/9	24F 350 v.... 2/11
16 μ F 500 v....	3/9	32 μ F 350 v.... 2/11
32 μ F 350 v....	3/9	32 mfd. 450 v.... 4/9
32 mfd. 500 v....	5/9	64 mfd. 450 v.... 4/9
8-16 μ F 500 v....	4/11	100 mfd. 450 v.... 4/9
25 μ F 25 v....	1/3	8-8 μ F 450 v.... 3/11
50 μ F 12 v....	1/3	8-8 mfd. 500 v.... 4/9
100 mfd. 12 v....	1/9	8-16 μ F 450 v.... 4/11
100 mfd. 25 v....	2/3	16-16 μ F 450 v.... 4/11
Can Types		16-32 μ F 350 v.... 4/9
8 mfd. 350 v....	1/3	32-32 μ F 350 v.... 4/9
8 mfd. 450 v....	2/3	32-32 μ F 450 v.... 5/11

VOLUME CONTROLS with long spindles, all values, less switch, 2/9; with S.P. switch, 3/9.

WIRE WOUND POTS: 20 ohms, 500 ohms, 5K, 20K, 50K, 100K (medium length spindles), 2/9. 220 ohms, 2K, 10K, 20K, Preset type, 1/9 each

EX GOVT. AMMETERS. Moving coil. G.E.C. 0-5 amps., 2in. scale, 11/9.

EX-GOV. E.H.T. SMOOTHING CAPACITORS
25 mfd., 4,000 v. Blocks 4/9
5 mfd., 2,500 v. Blocks 3/9
.5 mfd., 3,600 v. Cans 3/3
.1 mfd. plus 1 mfd. 8,000 v., large blocks (common negative isolated) 9/6
1.5 mfd., 4,000 v. Blocks 5/9

EX-GOV. ACCUMULATORS with non-spill vents. Unused and guaranteed. 2 v 16 A.H., 5/9 each

EX-GOV. BLOCK PAPER CAPACITORS
2 mfd. 800 v. 1/9 6-6 mfd. 450 v.... 5/9
4 mfd. 500 v.... 2/9 8 mfd. 500 v.... 5/9
4 mfd. 1,000 v.... 4/3 8-8 mfd. 500 v.... 6/11
4 mfd. 1,500 v.... 4/9 15 mfd. 500 v.... 7/9
4 mfd. 2,000 v.... 6/9 15 mfd. 500 v.... 7/9
4 mfd. 400 v. plus 2 mfd. 250 v. 1/11

M.E. SPEAKERS. All 2-3 ohms, 8in. R.A. field, 600 ohms, 11/9. 10in. R.A. field, 1,500 ohms, 23/9. 10in. R.A. field, 1,000 ohms, 23/9.

SPECIAL OFFERS. Mains Trans., 200-250 v. 50 c/s. Primary Secs. 250-0-250 v. 200 mA. 6.3 v. 8 a. 5 v. 3 a., 21/9. Small output Transformer, 5,000 ohms to 3 ohms, 1/11.

GOODMAN'S 3in. P.M. SPEAKER (ex equip.), with battery pentode trans., 12/9.

HEAVY DUTY BATTERY CHARGER
For normal 200/250 v. A.C. mains input. To charge 12 v. battery. Variable charge rate of up to 10 amps. Fitted Meter and Fuses. Guaranteed 12 months. Carr. 7/6. £6/19/6.

DRYDEX HANDLAMPS. Suitable for garage lights, etc. (Normal price 29/6). Limited number. Brand new boxed, fitted with bulb, 19/6.

H.T. ELIMINATOR AND TRICKLE CHARGER
Kit with louvred crackle finished case, Mains input 200-250 v. Output 120 v. 40 mA., and 2 v. ½ a. Price with circuit, 29/6.
Or in working order, 37/6.

R.S.C. TRANSFORMERS

FULLY GUARANTEED, INTERLEAVED AND IMPREGNATED

MAINS TRANSFORMERS

Primaries 200-230-250 v. 50 c/s.

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 mA. 6.3 v. 2 a., 5 v. 2 a.,

Midget type, 24-3-3in. 17/6

350-0-350 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a. 19/9

250-0-250 v. 100 mA. 6.3 v. 4 a., 4 a. c.t.,

0-4-5 v. 3 a. 26/9

250-0-250 v. 100 mA. 6.3 v. 4 a., 5 v. 3 a. 23/9

250-0-250 v. 100 mA. 6.3 v. 6 a., 5 v. 3 a.,

for R1355 conversion 31/-

300-0-300 v. 100 mA. 6.3 v. 4 a., 5 v. 3 a. 23/9

300-0-300 v. 100 mA. 6.3 v. 4 a., 4 a. c.t.,

0-4-5 v. 3 a. 26/9

350-0-350 v. 100 mA. 6.3 v. 4 a., 5 v. 3 a. 23/9

350-0-350 v. 100 mA. 6.3 v. 6 a., 5 v. 3 a.,

0-4-5 v. 3 a. 33/9

425-0-425 v. 200 mA. 6.3 v. 4 a., c.t., 6.3 v.

4 a. c.t., 5 v. 3 a., suitable Williamson

Amplifier, etc. 49/9

450-0-450 v. 250 mA. 6.3 v. 6 a., 6.3 v. 6 a.,

5 v. 3 a. 69/6

TOP SHROUDED DROP THROUGH TYPE

250-0-250 v. 70 mA. 6.3 v. 2.5 a.... 13/9

260-0-260 v. 70 mA. 6.3 v. 2 a., 5 v. 2 a.... 16/9

350-0-350 v. 80 mA. 6.3 v. 2 a., 5 v. 2 a.... 18/9

250-0-250 v. 100 mA. 6.3 v. 4 a., 5 v. 3 a. 22/9

300-0-300 v. 100 mA. 6.3 v. 4 a., 4 a. c.t.,

0-4-5 v. 3 a. 23/9

350-0-350 v. 100 mA. 6.3 v. 4 a., c.t., 5 v. 22/9

0-4-5 v. 3 a. 23/9

350-0-350 v. 100 mA. 6.3 v. 4 a., c.t., 5 v. 29/11

350-0-350 v. 150 mA. 6.3 v. 4 a., 5 v. 3 a. 29/9

E.H.T. TRANSFORMERS

2,500 v. 5 mA., 2-0-2 v. 1.1 a., for VCR97,

VCR517 36/6

FILAMENT TRANSFORMERS

Primaries 200-250 v. 50 c/s.

6.3 v. 1.5 a.... 5/9

6.3 v. 3 a.... 8/11

12 v. 1 a.... 7/9

6.3 v. 6 a.... 17/6

6.3 v. 2 a.... 7/6

6.3 v. 1.5 a.... 17/6

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s. Primaries: 0-9-15 v.

11 a. 1/11; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19/9; 0-15 v. 6 a. 22/9.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s. 120 v. 40 mA. 7/11

120 v. 40 mA., 5-0-5 v. 1 a. 14/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 60:1 for 3S4, etc. 3/8

Small Pentode, 5,000Ω to 3Ω 3/9

Standard Pentode, 5,000Ω to 3Ω 4/9

Battery Pentode, 10,000 ohms to 3 ohms.... 4/9

Multi-ratio 40 mA. 30:1, 45:1, 60:1, 90:1, Class B Push-Pull 5/6

Class B Push-Pull 5/6

Push-Pull 8 Watts 6V6 to 3 ohms 8/9

Push-Pull 10-12 Watts 6V6 to 3Ω to 15Ω 15/9

Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω 16/9

Push-Pull 20 Watts high-quality sectionally wound, 6L6, KT66, etc., to 3 or 15Ω 47/9

SMOOTHING CHOKES

250 mA, 3 H, 50 ohms 11/9

150 mA, 7-10 H, 250 ohms 11/9

100 mA, 10 H, 150 ohms potted 9/9

100 mA, 10 H, 200 ohms 8/9

80 mA, 10 H, 350 ohms 5/6

60 mA, 10 H, 400 ohms 4/1

50 mA, 40 H, 1,000 ohms. Potted 10/9

EX.GOV. MAINS TRANSFORMERS

All 230 v. 50 c/s. input. 9/9

8.8 v. 4 a.... 9/9

48 v. 1 a.... 9/9

0-11-22 v. 30 a.... 72/6

16-18-20 v. 35 a.... 79/6

7.7 v. C.T. 7 amps., 4 times 25/9

460 v. 200 mA., 6.3 v. 5 a.... 27/9

365-0-365 v. 150 mA.... 8/9

300-0-300 v. 80 mA. 5 v. 3 a.... 8/11

278-0-278 v. 100 mA.... 8/9

300-0-300 v. 150 mA., 610-0-610 v. 150 mA., 1,220 v. 350 mA.... 29/6

400 v. C.T. 150 mA., 4 v. 5 a., 6.3 v. 0-6 a., 4 v. 6 a., 4 v. 6 a., 4 v. 3 a., 4 v. 2 a.... 22/9

EX-GOV. AUTO TRANSFORMERS

15-10-5-0-195-215-235 v. 500 watts 27/9

Double wound 10-0-200-240 v. to 10-0-275-295-315 v. 1,000 watts 69/6

0-230 v. in steps of 11 volts from 57.5

5 KVA (21 amps.) 68/15-75

Double wound 0-110-240 v. to 0-130-140-150-160-170 v. 1,500 watts 69/6

Carriage on any of above 5/- extra.

EX-GOV. SMOOTHING CHOKES

250 mA, 10 H, 50 ohms 14/9

250 mA, 10 H, 100 ohms 14/9

250 mA, 3 H, 50 ohms 8/9

150 mA, 10 H, 50 ohms 10/11

100 mA, 10 H, 100 ohms, Tropicalised 6/9

100 mA, 5 H, 100 ohms, Tropicalised 3/11

50 mA, 50 H, 1,000 ohms. Potted 8/11

50 mA., 5-10 H. 8/9

L.T. type 1 amp. 2/9

CHASSIS

18 s.w.g. undrilled aluminium amplifier type (4-sided).

14in. x 9in. x 2½ in. 6/11

16in. x 8in. x 2½ in. 7/6

16in. x 10in. x 3in. 8/3

18 s.w.g. aluminium receiver type.

12in. x 8in. x 2½ in. 5/3

16in. x 8in. x 2½ in. 7/6

20in. x 8in. x 2½ in. 10/11

16in. x 8in. x 2½ in. 13/6

14in. x 10in. x 3in. 13/6

R.S.C. 6 V. OR 12 V. BATTERY CHARGER

For normal A.C. mains input 200-230-250 v., 50 c/s.

Selector panel for 6 v. or 12 v. charging.

Variable charge rate of up to 4 AMPS.

and with 5 amp meter.

Well ventilated metal case with attractive crackle finish.

Guaranteed for 12 months, 89/6. Carr. 2/6.

Or in working order, 37/6.

R.S.C. 6 V. OR 12 V. BATTERY CHARGER

For normal A.C. mains input 200-230-250 v., 50 c/s.

Selector panel for 6 v. or 12 v. charging.

Variable charge rate of up to 4 AMPS.

and with 5 amp meter.

Well ventilated metal case with attractive crackle finish.

Guaranteed for 12 months, 89/6. Carr. 2/6.

Or in working order, 37/6.

R.S.C. 6 V. OR 12 V. BATTERY CHARGER

For normal A.C. mains input 200-230-250 v., 50 c/s.

Selector panel for 6 v. or 12 v. charging.

Variable charge rate of up to 4 AMPS.

and with 5 amp meter.

Well ventilated metal case with attractive crackle finish.

Guaranteed for 12 months, 89/6. Carr. 2/6.

Or in working order, 37/6.

R.S.C. HIGH FIDELITY 25 watt AMPLIFIER A4

A NEW DESIGN FOR 1955
HIGH GAIN "PUSH PULL OUTPUT," BUILT-IN PRE-AMP. TONE CONTROL STAGES. INCLUDES 7 valves, sectionally wound output transformer, block paper reservoir condenser, and reliable small components. AN INPUT OF ONLY 20 millivolts IS REQUIRED FOR FULL OUTPUT. THIS MEANS THAT ANY TYPE OF MICROPHONE OR PICK-UP IS SUITABLE. Two separate inputs controlled by separate volume controls allow simultaneous use of "Mike" and Gram., or Tape and Radio, etc., etc. Individual controls for Bass and Treble "lift" and "cut." Six negative feedback loops giving total of 24 D.B. Frequency response ± 3 D.B. 30-20,000 c/s.

H.P. Terms on assembled units. Deposit £2 and 10 monthly payments 22/6. plus carr. 10/-
 Terms to include cover, mike, speakers, etc., on request. Cover as illustrated if required, price 17/6 extra.

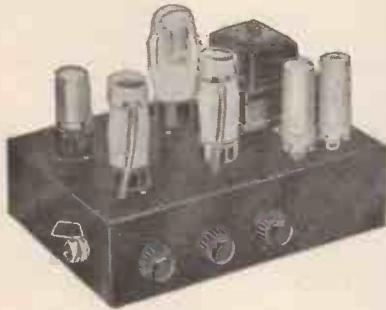
W.B. "STENTORIAN" High Fidelity P.M. Speaker HF1012, 10 watts, 15 ohm (or 3 ohm) speech coil. Where a really good quality speaker at a low price is required we highly recommend this unit with an amazing performance. £3/17/6.

MICROPHONES. Crystal, hand or Desk type, high fidelity Acos, 50/- Stand type with base and adjustable stand, £6/19/6. Both suitable for use with our amplifiers.

PLESSEY 3-SPEED MIXER AUTOCHANGERS with crystal pick-up having alloy stylus with separate sapphire points for long playing or standard records. (Will play 2,000 records before replacement stylus required.) Brand new, cartoned, guaranteed. For 200-250 v. A.C. mains. Limited stocks at only 10 gns. plus 5/- carr.

H.M.V. LONG PLAYING RECORD TURNTABLE COMPLETE WITH CRYSTAL PICK-UP (SAPPHIRE STYLUS). Speed 33½ r.p.m. BRAND NEW, CARTONED. Only £3/19/6 (approx. half price). Carr. 5/- (For 200-250 v. A.C. Mains).

R.S.C. 4-5 WATT HIGH GAIN AMPLIFIER TYPE A5



A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads, in addition to all other types of pick-ups and practically all mikes. Separate Bass and Treble controls are provided. These give full long playing record equalisation. Hum level is negligible being 71 D.B. down, 15 D.B. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate), with green crackle finish, and point-to-point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use 30/- extra, plus 3/8 carr.



A PUSH PULL 3-4 WATT HIGH GAIN AMPLIFIER FOR 53/7/6.

For mains input 200-250 v. 50 c/s. Complete kit of parts including point-to-point wiring diagrams and instructions. Amplifier can be used with any type of feeder unit or pick-up. This is not A.C./D.C. with "live" chassis but A.C. only with 400-400 v. Trans. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by Rola at 27/9.) The amplifier can be supplied ready for use for 25/- extra. Full descriptive leaflet, 6d.



R.S.C. MASTER INTERCOMM. UNIT. with provision for up to 4 "Listen-Task Back Units" individually switched. A high gain amplifier enables speech and other sounds emanating from the rooms containing remote control units to be heard at the master control. The unit is in kit form and point-to-point wiring diagrams are supplied. A walnut veneered wood or Brown Bakelite cabinet is included. Mains input is 200-250 v. 50 c/s. H.T. line 300 v. **CLASSIB NOT "ALIVE."** Ideal for use as "Baby Alarm." Sound amplification 4 watts. Price only £5/19/6. "Listen Task Back Unit" in bakelite or walnut veneered cabinet, can be supplied at 35/- each. The Master Unit can be supplied assembled and tested for 30/- extra.

PERSONAL SET BATTERY SUPERSEDER KIT.



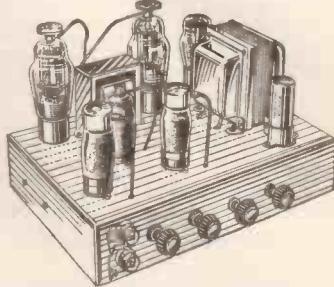
All parts for an "All Dry" Battery Eliminator. Complete with case. For 4 valve receivers requiring 90 v. 10 mA. and 1.4 v. 250 mA. Fully smoothed. Outputs from normal 200-250 v. 50 c/s. Price with circuit, 35/9. Or ready for use, 42/6. Size of units 5½-4-1½in.

BATTERY SET CONVERTER KIT. All parts for converting any type of battery receiver to all mains. A.C. 200-250 v. 50 c/s. Kit will supply fully smoothed H.T. of 120 v. 90 v. or 60 v. at up to 40 mA., and fully smoothed L.T. of 2 v. at 0.4 a. to 1 a. Price complete with circuit and instructions only 48/9. Supplied ready for use for 8/9 extra.

Hum level 66 D.B. down. Certified total harmonic distortion of only 0.35% measured at 10 watts. Comparable with the very best designs. **SUITABLE FOR SMALL HOMES OR LARGE HALLS, CLUBS, GARDEN PARTIES, DANCE HALLS, etc., etc.** For ELECTRONIC ORGAN OR GUITAR. For STANDARD OR LONG PLAYING RECORDS. Size 12 x 10 x 9in. For mains A.C. 200-250 v. 50 c/s. Power consumption 175 watts. Outputs for 3 and 15 ohm speakers. The kit is complete in every detail. Chassis is fully punched. Easy to follow point-to-point wiring diagrams, are supplied. **EXTRA HIGH SENSITIVITY, HIGHEST QUALITY for 9 Gns.** Or assembled ready for use 50/- extra 9 Gns.

R.S.C. A3 10 WATT "PUSH PULL" HIGH FIDELITY AMPLIFIER.

With Self Contained Pre-amplifier and Tone Control.



This amplifier, whilst having sufficient output to fill a small hall, is the ideal amplifier for the quality enthusiast who knows that though the average listening level is less than one watt it is necessary, for the very highest quality, to have an output of at least ten times this figure in order to obtain completely distortionless reproduction of sudden loud sounds. The layout of the components has been planned to give the very maximum of performance with the minimum of construction effort. Large safety factors in every component A.C. and H.T. fuses, punched chassis with baseplate, screened input plugs, valves, and with easy-to-follow point-to-point wiring diagrams. Everything is supplied down to the last nut and bolt. Two independent inputs are provided with two associated independent volume controls so that programmes can be mixed together if desired, such as microphone announcements superimposed on a musical programme, or two independent inputs fed into headphones or even just gramophone/radio, fading from one to the other. Variable base lift and cut with variable treble lift and cut tone controls are fitted, giving full long playing record equalisation for uncorrected pick-ups. They are also provided so that the user can alter the tonal value to suit his personal taste and surroundings. Because of the large negative feedback employed the output transformer can be so designed that it provides all the specified power even with large variations of loudspeaker impedance. Terminals are provided for 3 ohm and 15 ohm loudspeakers.

H.T. and L.T. available for the supply of a Radio Feeder Unit.

Six Negative Feedback Loops. 130 millivolts Input only required for full output. Frequency response ± 3 DB 50-20,000 cycles. Negligible hum and distortion.

For A.C. mains input 200/230/250 v. 50 c/s.

COMPLETE KIT OF PARTS 7 GNS. (carriage 5/-)
 Supplied assembled and tested for 45/- extra.

H.P. TERMS AVAILABLE ON ASSEMBLED UNITS.

FOUR STAGE RADIO FEEDER UNIT.

Design of a HIGH FIDELITY, L. and M. wave T.R.F. Unit with self-contained heater supply and thorough H.T. decoupling. Only 250-400 v. 15-20 mA. H.T. required from main amplifier. Three valves and Low Distortion Driver. Dial and Drive knobs, with bell-shaped astatics. Loaded H.F. coils. Two variable Mu controlled H.F. stages, 3 gang condenser tuning. Cathode follower output stage. Switch position for Gram. and Gram. Input and output sockets. Performance comparable with the best in Feeder Units. For A.C. mains 200-230-250 v. operation. Size 11-6-7½in. Illustration, full set of easy-to-follow wiring diagrams and instructions and individually priced parts list 2/6. This unit can be built for only £3/15/- including Dial and Drive Knobs and every item required.

Radio Supply Co. (LEEDS) LTD.

32 THE CALLS. — LEEDS, 2.

Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/- extra under 10/-, 1/6 extra under £2, 2/6 extra under £3. Full Price List 6d. Trade List 5d.
 Open to Callers : 9 a.m. to 5.30 p.m. Saturdays until 1 p.m.

"Hi-Fi" EQUIPMENT and KITS TO SUIT ANY BUDGET

TWO COMPLETE "Hi-Fi" AMPLIFIER KITS

"STERNS" HIGH QUALITY 8-10 WATT AMPLIFIER

Having a front panel which is very attractively finished in deep gold, and on which the controls are clearly identified. The ideal amplifier for general home use and for small halls, etc.

Price of COMPLETE KIT
including Valves and Drilled £7/10/-
Chassis, etc. (Plus 2/6 Carr. and Ins.).

We will supply it Completely Built for £9/10/-
(Plus 5/- Carr. & Ins.)



Designed for high quality reproduction up to an output level of 10 watts, having 6V6s in Push-Pull and incorporating negative feedback. It is suitable for use with all types of Pick-ups and most types of microphones and the output transformer provides for use of 3 and 15 ohm speakers.

BRIEF FEATURES

- Valve line up 6Z5, 6SN7, 5Z4, with 6V6s in push pull.
- The undistorted output level of up to 10 watts is produced from an input of .25 volts.
- First class reproduction of Radio (where a Tuning Unit is used) and Record Playing. Separate Bass Boost and Treble Controls provide an excellent range of frequency control.
- Very satisfactory results are obtained with an average type of high impedance Moving Coil or Crystal Microphone, a clear speech level of approx. 5 watts output being obtained.
- Power supplies (H.T. and L.T.) are available for a Tuning Unit.
- For operation on A.C. Mains 200-250 volts 50 cycles.

THE ASSEMBLY MANUAL is available for 1/- and includes detailed layouts and component Price List.

SPECIAL PRICE REDUCTIONS

FOR COMPLETE EQUIPMENT

SELECT A TUNING UNIT and AMPLIFIER
or TUNING UNIT, AMPLIFIER and RECORD PLAYER
(and a SPEAKER if required) and we will supply at a
REDUCED PRICE.

H.P. TERMS ALSO QUOTED.

WE HAVE IN STOCK... THE DENO F.M. FEEDER UNIT

Consisting of a 5 valve Superhet design incorporating B.F. (6AM6) and P/C (12AB8) Stages followed by Two L.F.s (6BA6's) and Ratio Discriminator 6AO5, the coverage provided being 88-100 Mcs.

THE COMPLETE KIT including VALVES and DRILLED CHASSIS is available for £6/13/6

It is suitable for use with any type of High Fidelity Amplifier. (Plus 4/- Carr. and Ins.) The descriptive manual, including circuit and Component Layout, etc., is available for 1/6.

THE COMPLETELY ASSEMBLED CHASSIS, £8/17/6 Plus 6/- Carr. & Ins.
ready for use, aligned and tuned

ACH PRICE INCLUDES TWO I.F. STAGES.

!! ANOTHER OUTSTANDING OFFER !!

A PORTABLE RECORD PLAYER incorporating
The New COLLARO 3-SPEED AUTOCHANGER
MODEL R.C. 54 for only £14/14/-
Plus 7/6 carriage and insurance).

H.P. TERMS: Deposit £3/14/- followed by 12 monthly payments of £1/0/5.

This is a really GENUINE BARGAIN...
The PORTABLE CASE is extremely well made and covered with grey rexine, and, as will be seen by the illustration, has space available to accommodate an Amplifier thereby enabling a complete "RECORD REPRODUCER" to be quite easily made.

The COLLARO MODEL C.54 is a "mixer" 3-speed Autochange Unit incorporating the famous light-weight STUDIO "O" Crystal Pick Up, and it is undoubtedly one of the best Autochangers made.

Our MODEL CP3G 3 AMPLIFIER will operate perfectly with the Collaro Changer and can quite easily be accommodated in the above Portable Case. It comprises a 3 valve A.C. Mains design employing a 6K6 Output Valve for about 3 Watts and incorporates an efficient Tone Control. Price £4/4/- assembled and including a 6J1n. P.M. Speaker.

"STERNS" MODEL CP3G 3 WAVEBAND SUPERHET TUNING UNIT

providing for excellent reception of stations on the short wavebands (16-50 metres), medium waveband (200-550 metres) and the long waveband (800-2,000 metres). We can supply this tuner to correctly operate with each of the Amplifiers.

- Valve line-up: 6K8G (Frequency Changer), 6SK7g (L.F. Amplifier), 6Q7g (Detector, A.V.C. and 1st A.F. Amplifier), and 5Z4g (rectifier).
- A gramophone position is incorporated with the wavechange switch and the 6Q7g valve becomes the 1st A.F. Amplifier for the gramophone pickup.
- The illustration shows the Tuner with four controls—Tuning, Volume, Tone and the Wavelength Switch (Tone and Volume operate as both Radio and Gram)—but if your Amplifier already has the Tone and Volume Controls we can omit both. When ordering please state what is required.
- Overall chassis dimensions are 12in. x 8½in. x 8in. including the full vision screen 8½in. x 4½in.
- For A.C. Mains only power supply required—H.T. 250 volts 30 m.A., L.T. 6.3 volts 1½ amperes.

Price completely assembled and including built-in power supply £10/10/- H.P. Terms. Deposit £2/12/6, 12 months of 15/- each. Price completely assembled excluding Power Supply £9. Carriage and Insurance 7/6 extra. (Dial Escutcheon is 4/6 extra.)

"STERNS" 12 Watt "HIGH FIDELITY" Push-Pull AMPLIFIER

A very high quality Unit attractively finished in deep gold with each control clearly identified on the front panel. Comprising a Main Amplifier Chassis and a Remote Control Pre-Amplifier-Tone Control Unit. The remote control unit measures only 9 x 4 x 2½in. and contains four controls, being Bass-Treble-VOLUME and a Gain. Microphone Switch control. It incorporates its own feedback circuit on the Base Channel. Loop negative feedback is employed on the Main Amplifier which has a valve line up of 6J5-6N7-5U4 with two PX25's in push-pull and 6J5 and 6SN7 are used in the remote control unit.

THE COMPLETE KIT IS AVAILABLE FOR £14/- (Carr. & Ins. 6/- extra.) THE COMPLETE UNIT ASSEMBLED AND READY FOR USE £17/- (H.P. Terms 24/5/- Deposit, 12 months at £1/3/11. (Carr. & Ins. 7/6 extra.)

The measured frequency range of the amplifier with this unit shows an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 50. It can be seen, therefore, that ample correction is provided to suit any type of pick-up with any type of recording. Input voltage for maximum output is 70 mV and 6.3 volts at 2 amps. and 30 mA. H.T. is provided for tuning unit, etc. This Amplifier compares well with the Williamson and similar designs at a fraction of their cost. The complete set of assembly instructions is available for 2/-.



The NEW "LEAK" TL/10 AMPLIFIER and "Point One" PRE-AMPLIFIER

This Amplifier has a maximum output of 10 watts and maintains in every respect the world renowned LEAK reputation for precision engineering: fine appearance and faultless working. The Pre-Amplifier will operate from any make or type of pick-up continuing on variable input attenuator at the rear of the Pre-amp. permits the instantaneous use of crystal, moving iron and moving coil pickups. H.T. and L.T. supplies are available for a Radio Tuning Unit. An input attenuator is fitted. S.A.E. for descriptive leaflet.

PRICES :

- (a) The COMPLETE AMPLIFIER WITH PRE-AMPLIFIER, £28/7/-, or £7/2/- Deposit and 12 months at 2/-
- (b) The TL/10 MAIN AMPLIFIER ONLY: £17/17/-, or £4/7/- Deposit and 12 months at £1/5/4.
- (c) The "POINT ONE" PRE-AMPLIFIER ONLY: £10/10/-, or £2/12/6 Deposit and 12 months at 15/-.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM 912 AMPLIFIER.

Designed by General Electric Co.

A modern high quality 12 watt Amplifier for the HOME CONSTRUCTOR, having a Valve line-up of U709, B309, Z729 and two N709's in Push-Pull.

The Assembly Instructions include five "easy stage-by-stage" diagrams and are available for 3/6.

Price of COM- £21/4/- (Plus 7/6 Carr. and Ins.)

WE WILL SUPPLY THE COMPLETELY ASSEMBLED AMPLIFIER for £25/- (Plus 7/6 Carr. and Ins.)

H.P. Terms: £6/5/- Deposit and 12 months at £1/5/2.

WE CAN SUPPLY... COMPLETE KIT or ASSEMBLED CHASSIS FOR THE OSRAM

RECEIVER CHASSIS

Modernise your old Radiogram

RECORD PLAYERS

COMPLETE RADIOPHONIC EQUIPMENT—QUALITY AT LOW COST

STERN'S DESIGN FOR HOME CONSTRUCTORS

The "SUPER-SIX"

A compact and highly efficient superhet Radio-Radiogram chassis of outstanding quality.

YOU CAN BUILD IT FOR £10/7/6

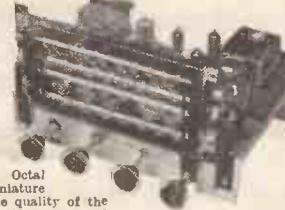
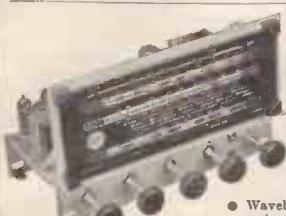
Including the OCTAL VALVE LINE-UP (£12/7/6 with the miniature valves)

Incorporating the new B.V.A. Miniature Valve Line-up. This receiver is designed to the very latest specification and provision is made to incorporate either the standard Octal Valve Line-up or the new B.V.A. range of miniature valves. Great attention has been paid to the quality of the reproduction of both Radio reception and Record playings, and excellent clarity of speech and music is obtained.

A few brief details:

- Covers 3 wavebands 18-50 metres, 190-550 and 800-2,000 metres.
- Employs 6 valves having PUSH-PULL for 5-6 watts output.
- Incorporates delayed A.V.C. on all wavebands and pre-selective feedback.
- A 4 position Tone Control operation on both Radio and Gram.
- Has independent mains supply socket for a Record Player.
- Size of Assembled Chassis 12in. x 8in. x 8in. Dial aperture 8½in. x 4in.
- For operation on A.C. mains 200-250 volts 50 cycles.

THE INSTRUCTION and ASSEMBLY MANUAL is available for 1/6. It contains very detailed practical drawings and circuit diagrams and a complete Component Price List.



!!! THE LATEST !!!

RADIO-RADIOPHONIC CHASSIS

Model F3PP. A 7-valve 3-waveband Superhet Chassis with Push-Pull Stage. This Chassis has been designed with particular regard to the quality of reproduction. It incorporates SEPARATE BASS and TREBLE CONTROLS thereby ensuring the utmost flexibility of Tone on both Radio and Gram.

Briefly:

- Waveband coverage 16-50, 190-550 and 800-2,000 metres.
- Valve Line-up X79, 6BA6, 6AT6, ECC83, GZ30 and two 6AQ5's in push-pull for approx. 6 watts output.

- Negative Feedback and delayed A.V.C.
- Has independent mains supply socket for gram. connection.
- Overall size of Chassis 12in. x 8in. high x 7in. with dial size 11½in. long x 4in.

For use on A.C. Mains 100/110 volts and 200/250 volts.

Cash Price, tested and ready for use £17/17/0 (plus 7/6 Carr. and Ins.)

H.P. Terms: Deposit £4/7/- and 12 monthly payments of £1/5/4.

THREE COMPLETELY ASSEMBLED ALL-WAVE SUPERHET CHASSIS

- Model B.3. A 5-valve 3-waveband receiver.
- Model B.3.P.P. A 6-valve 3-waveband Receiver with PUSH-PULL OUTPUT.
- Model B.3.P.P.R.F. A 7-valve 3-waveband Receiver Incorporating an R.F. stage with PUSH-PULL OUTPUT.

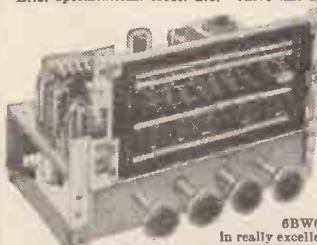
The three Receivers are for operation on A.C. mains 100/110 volts and 200/250 volts, and employ the very latest miniature valves. They were designed to the most modern specification, great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both gram. and radio, making them the ideal replacement chassis for that "old Radiogram," etc.

Brief specifications: Model B.3.—Valve Line-up, 6BE6, 6BA6, 6AT6, 6X4—waveband coverage short 16-50, medium 187-550, long 800-2,000 metres. Controls: (1) volume with on/off; (2) tuning (flywheel type); (3) wavechange and gram.; (4) Tone Control (operative on gram. and radio). Negative feedback is employed over the entire audio stages. Chassis size 11 x 7½ x 8½in. high. Dial size 8½ x 4in. Price complete and READY FOR USE, excluding speaker £12/12/- (Carr. and Ins. 7/6 extra).

H.P. Terms £3/4/- deposit, 12 months at 17/8.

Model B.3.P.P. This model is the B.3. Receiver but incorporates two 6BW6 VALVES in PUSH-PULL, resulting

In really excellent quality reproduction up to approximately 6 watts. Price £15/15/- (plus 7/6 Carr. and Ins.) or £31/19/- deposit, 12 months at £12/2. Model B.3.P.P.R.F. similar to the above but includes an R.F. STAGE together with PUSH-PULL OUTPUT, employing a total of 7 valves with two type 6BW6 in Push-Pull. This makes for a really sensitive receiver with genuine quality reproduction. Price £18/18/- (plus 7/6 Carr. and Ins.) or £43/1/- deposit, 12 months at £16/9.



months at £12/2. Model B.3. P.P.R.F. similar to the above but includes an R.F. STAGE together with PUSH-PULL OUTPUT, employing a total of 7 valves with two type 6BW6 in Push-Pull. This makes for a really sensitive receiver with genuine quality reproduction. Price £18/18/- (plus 7/6 Carr. and Ins.) or £43/1/- deposit, 12 months at £16/9.

This 3-SPEED AUTOCHANGER is by a Famous Manufacturer and is offered for

£11/10'0

(Plus 7/6 Carr. & Ins.)

Normal Price £16/10/0

Hire Purchase Terms £2/17/6 Dep. and 12 months at 16/4.

● These units will autochange on all three speeds, 7in., 10in. and 12in.

● They play MIXED 7in., 10in. and 12in. records.

● They have separate sapphire for L.P. and 78 r.p.m. which are moved into position by a simple switch.

● Minimum baseboard size required 14in. x 12½in. with height above 5in. and height below baseboard 2½in. A bulk purchase enables us to offer these BRAND NEW UNITS at this exceptional price.



WE HAVE THE LATEST 3-SPEED AUTOCHANGERS IN STOCK

SEND S.A.E. FOR DETAILS

WE CAN ALSO OFFER THE LATEST 3-SPEED NON-AUTOCHANGE UNIT

THE NEW ARMSTRONG F.C. 48

A high quality replacement Radio or Radiogram Chassis having provision for an F.M. Feeder Unit.

PRICE ASSEMBLED and READY

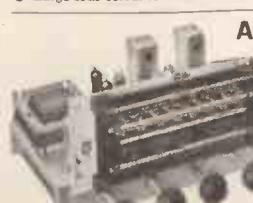
FOR USE £23/18'0

(Plus 7/6 Carr. and Ins.)

H.P. Terms £5/18/- Deposit and 12 months at £1/13/9.

OUTSTANDING FEATURES INCLUDE:-

- 8 Valves including 2 double Triodes.
- 8 Watts output from push-pull tetrodes. Heavy negative feedback is used, resulting in negligible distortion and high damping factor.
- Provision for using F.M. adaptor to receive the present high quality transmissions from Wrotham and the new B.B.C. V.H.F. stations.
- An accessible socket at rear provides the power supply for this unit.
- Independent controls give BASS and TREBLE lift and cut with unique Thermometer visual indicator.
- Gram. position on wavechange switch.
- 4 Wavebands Coverage 16-51, 50-120, 190-550, 1,000-2,000 metres.
- Large four-colour illuminated dial.



AN OUTSTANDING OFFER

A BULK PURCHASE ENABLES US TO OFFER THIS "PUSH-PULL" 7-VALVE SUPERHET RECEIVER

For only £12/19/6 (Carr. & Ins. 7/6 extra)

H.P.—£3/4/6 Dep. 12 mths. at 18/4.

These receivers Models AW3-7 are made by a well-known set of manufacturers and incorporate the latest Gramophone Valve Line-up of X70—W77—DH77—H77—U78 and two N78's in Push-Pull for approx. 7 watts output. They cover 3 wavebands 16-50

metres, 190-550 and 800-2,000 metres, and are for operation on A.C. mains 200-250

voltas. A Gram. position is on the Wavechange Switch. They make an excellent replacement Radiogram chassis having a P.U. connection on the chassis. Extension speaker connection is also provided. Overall size of chassis: 12in. long x 7½in.

x 6½in. high, dial aperture 8½in. x 4in. (Dial Escutcheon available for 4/9).

THESE RECEIVERS ARE BRAND NEW AND FULLY GUARANTEED.

SPECIAL REDUCTIONS FOR COMPLETE EQUIPMENT

SUMMARY—Select a RECEIVER CHASSIS and we will supply it TOGETHER WITH THE ABOVE 3-SPEED CHANGER AND AN 8-inch or 10-inch P.M. SPEAKER as follows:—

THE 211/10/- AUTOCHANGE WITH A SPEAKER AND:—

	Cash Price	Deposit	Monthly
(a) With Model B.3 chassis,.....	224 15 0	26 4 0	12 of £1 14 10 0
(b) " B.3PP	228 0 0	27 0 0	12 of £20 19 5 0
(c) " B.3PP.R.F.	231 2 0	27 15 0	12 of £22 3 3 9
(d) " Armstrong F.C.48	236 4 0	28 1 0	12 of £22 10 11 0
(e) " AW3-7	225 5 0	26 7 0	12 of £21 18 2 0
(f) " F3PP.....	230 2 0	27 10 0	12 of £22 2 0 0

An additional charge of 10/- is made in each case to cover Carriage and Insurance.

**109 & 115 FLEET ST.
LONDON, E.C.4. Phone: CENTRAL 5812-34**

!! Home Constructors !!

YOU CAN ASSEMBLE

The
Stern's
"Fidelity"

TAPE
RECORDER
FOR ONLY £40

H.P. Terms are shown below.

!! IT ONLY NEEDS CONNECTING UP !!



- WILL TAKE ALL STANDARD TAPES UP TO 1,200ft.
- WILL PROVIDE 2 HOURS' PLAYING AT 3½in. or 1 hour at 7½in. per second.

- WILL PLAY THE NEW PRE-RECORDED TAPES

- INCORPORATES AN ELLIPTICAL P.M. SPEAKER 7in. x 4in., with EXTENDED FREQUENCY RANGE.

SEND S.A.E. FOR DESCRIPTIVE LEAFLET.



THE NEW TRUVOX MODEL TR7U TAPE DECK

THE NEW TRUVOX MODEL TR7U TAPE DECK. 3 Shaded-Pole motors. Drop-in Tape Loading. Push Button Control. Separate Push Button Brake. Fast forward and fast-reverse. Silent drive eliminating Wow and Flutter. Half Track working and 2 speeds, 3½in. and 7½in. per sec. Positive Azimuth Adjustment. Overall size only 14½in. x 12½in.



MODEL T.R.I./F. QUALITY AMPLIFIER

This amplifier has been expressly designed to meet the requirements of enthusiasts for fidelity reproduction, and in particular to CORRECTLY operate the above TRUVOX DECK. It is supplied complete with a matched Elliptical 3 ohm P.M. Speaker, it incorporates an efficient Tone Control arrangement and has a Magic Eye Level Indicator (Operative on Record). In addition it can be used as a general purpose Amplifier for high quality reproduction of gramophone records direct from a Gram Unit.



GUARANTEED FOR 12 MONTHS (B.V.A. VALVES 90 DAYS)

PRICE SUMMARY

WE WILL SUPPLY ALL FIVE UNITS LISTED ABOVE, i.e., THE COMPLETE BUT UNASSEMBLED RECORDER FOR £40/-.. H.P. Terms: Deposit £10 and 12 monthly payments of £2/15/10 or in two parts as follows:-

CASH PRICE	12 monthly DEPOSIT payments of
------------	--------------------------------

(a) TRUVOX Mk. TR7U TAPE DECK MODEL TRIF AMPLIFIER WITH SPEAKER, 1,200ft. REEL OF TAPE.. £33 10 0 £8 10 0 £2 6 8 See note below re packing charge

(b) ATTACHE CASE AS ILLUSTRATED} ACOS CRYSTAL MIKE £6 10 0 — —

NOTE: Please send 30/- to cover cost of packing, carriage and insurance. We will refund £1 if the packing case is returned to us intact.

EACH UNIT IS AVAILABLE SEPARATELY AS FOLLOWS:

CASH PRICE	12 monthly DEPOSIT payments of
£23 2 0	£5 17 0 £1 12 4

(a) TRUVOX Mk. TR7U TAPE DECK £14 14 0 £4 16 6. £1 0 5

(b) AMPLIFIER MODEL TRIF WITH SPEAKER £5 0 0 — —

(c) PORTABLE ATTACHE CASE £2 10 0 — —

(d) ACOS CRYSTAL MIKE "33" £1 15 0 — —

Please include £1 when ordering (a) or (c) for packing charge, this whole amount will be refunded if case is returned to us intact.

ACOS CRYSTAL MICROPHONE MODEL MIC-33-1. A highly sensitive mike which accurately matches the input arrangement of the amplifier.

SCOTCH BOY MAGNETIC RECORDING TAPE. Supplied with a 1,200ft. reel of Scotch Boy plastic tape famous for its true brilliant quality. The Recorder will take all standard makes of tape.

PORTABLE ATTACHE CASE

This, as may be judged from the illustration opposite, is a neat, compact and attractively finished case, being covered with maroon rexine and having an ivory coloured speaker escutcheon. It contains concealed pockets to accommodate the Microphone, Mains Lead and a spare 1,200ft. reel of tape.

IT CAN BE SUPPLIED
COMPLETE and READY
FOR USE for £50

(as illustrated above).

FOR USE ON A.C. MAINS.
H.P. Terms: Deposit £12/10/- and
12 monthly payments of £3/10/-
Including MIKE and 1,200ft.
REEL of TAPE.

**STERN
RADIO LTD.**



**CONSTRUCTORS SAY
"IT'S STILL THE BEST MAINS OR
BATTERY PORTABLE SET"**

A Midget 4-valve Superhet Portable covering medium and long wavebands. Designed to operate on A.C. mains 200/240 volts or by an "Aldry" battery. The set is designed so that the main section can be supplied as a separate unit, and can be added at any time. The set supplied as an "Aldry" battery Superhet can be accommodated in the attaché case illustrated (size 9in. x 4in. x 7in.). This is attractively finished in lizard, maroon, dark green or blue rexine. As a combined Mains/Battery Superhet Portable a polished cabinet is available to accommodate both Mains Unit and Batteries. Circuit incorporates delayed blue reverb. As a combined Mains/Battery Superhet Portable a polished cabinet is available to accommodate both Mains Unit and Batteries. Circuit incorporates delayed blue reverb.

A.V.C. and pre-selective Audio Feedback. The set is complete in every detail and includes ready-wound frame aerials, fully aligned I.F. transist and drilled chassis, etc. Overall size of assembled chassis 8in. x 4in. x 2in. This receiver, as illustrated, can be completely built for £8/16/3 (plus Mains Unit if required). Send 1/3 for the full descriptive Assembly Book which includes Practical Layouts and complete Price List of Components. Portable case available separately, 37/6.

"PERSONAL SET" BATTERY ELIMINATOR

A complete Kit of parts to build a Midget "Aldry" Battery Eliminator, giving approx. 69 volts at 10 mA. and 1.4 volts at 250 mA.

This eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet Receiver, requiring H.T. and L.T. voltage as above, or approx. to 69 volts.

The Kit is quite easily and quickly assembled and is housed in a light-aluminium case size 4in. x 1in. x 3in. Price of complete Kit with easy-to-follow assembly instructions, 42/6. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts at 10 mA. and 1.4 volts at 250 mA. Size of assembled unit 7in. x 2in. x 1in. Price 47/6

**A COMPLETE
"CAR RADIO"**

FOR THE HOME
CONSTRUCTOR

11in. x 4in. x 3in.

A design of a complete 5-VALVE SUPERHET RECEIVER employing an R.F. Stage, and incorporating a separate VIBRATOR PACK size 4in. x 2in. x 6in. for use on 6 or 12 volt D.C. supplies.

We can supply all components to build this complete Receiver and Vibrator Pack including a Metal Case, Valves, Drilled Chassis and 5in. P.M. Speaker for £13/9/6 (Car. and Inc. 5/6 extra.) Or the Receiver Components for £9/16/6 and the Vibrator Components for £2/10/-.

This is NOT an EX-GOV'T. Receiver, it is a new design employing new Components. Send 2/8 for the complete set of ASSEMBLY INSTRUCTIONS, CIRCUITS and PRACTICAL LAYOUTS, including a complete individual Component Price List.

**A BULK PURCHASE ENABLES THIS
SPECIAL PRICE REDUCTION
OF THE FAMOUS**

SHAFTESBURY PORTABLE AMPLIFIER



Suitable for home use and small Halls. Has matched inputs for both Record Players and Microphone. Also provides for the "mixing" and "fading" of both Gram. and speech as request.



COMPRISED

- (a) A 4-Valve High Gain Amplifier for use on A.C. or D.C. mains 200-240 volts with 5 watts output. Incorporating independent Volume Controls for Mike and Gram., either of which can be faded at will, a variable Tone Control and independent input sockets for Mike and Gram.
- (b) A Transverse Carbon microphone which obtains its polarizing current from the amplifier—no batteries are necessary.
- (c) An 8in. Goodmans P.M. Speaker with the "Ticonal" magnet for first-class reproduction.

THE COMPLETE EQUIPMENT is all contained in the **PORTABLE CARRYING CASE** £18'0'0

Having been reduced from £30/9/-. HIRE PURCHASE TERMS. DEPOSIT £4/10/- and 12 monthly payments of £1/5/4. Light in weight. Easy to CARRY. GENUINELY PORTABLE. An illustrated leaflet containing free data is available on receipt of S.A.E.

**109 and 115 FLEET ST.
LONDON, E.C.4. Phone: CENTRAL 5812-3-4**

THE "MINI TWO-THREE"

An "Aldry" Battery Portable of midget size, 6in. x 4in. x 3in. designed to cover medium waveband 190-559 metres, with use of short trailer aerial. The simple design of this Receiver is so arranged that either a 3-valve set or a 2-valve (afterwards easily converted to the 3-valve) can be made.

Consists of a T.R.F. circuit using a regenerative detector with H.F. stage and a high gain output pentode. Valve line up IT4-IT4-IT4-IT4.

The 2-valve set can be completely built for £4/3/6 (less case) and the 3-valve for £5/3/- (less case). Each price includes valves, speaker and drilled chassis.

Send 2/- for the assembly instructions; they include simple and complete practical component layouts and diagrams.

**! CONSTRUCTORS !!
A NEW SUPERHET TRANSPORTABLE
THE "SUPER THERE"**



Designed for local station reception without the use of an external aerial. This design provides for a 3-valve (plus Metal Rectifier) Superhet Receiver incorporating a Frame Aerial for "room to room" use, provision is also made for a short external aerial if required, for the reception of Continental Stations.

Briefly the features are as follows:

- For use on A.C. Mains 200-250 volts.
- This set includes a Mains Transformer and Chassis is NOT live to mains (as many other sets of this type are) and consequently the Receiver can safely be used in the Kitchen, etc.
- Valve line up 6K8-637-KT61, plus Metal Rectifier.
- The I.F. Transformer is supplied "pre-aligned" and thereby ensures extreme simplicity of Tuning—in fact, more simple than most T.R.F. Receivers.
- Compact and easy to build simple "point to point" practical diagrams are supplied with a completely drilled chassis.

The complete Receiver Chassis can be built to cover the Medium Waveband only

Or to cover both Long and Medium Waves for £6 . 6 . 6
£6 . 16 . 3
£1 . 1 . 0

The attractive Polished Wood Cabinet 11½ inches wide, 8½ inches high and 6 inches deep illustrated above is The CONSTRUCTOR'S MANUAL is available for 1/-, this shows the component prices which are all available for separate purchase.

**A DUAL-CHANNEL PRE-AMPLIFIER and
TONE CONTROL UNIT**

Attractively finished in "Old Gold" and providing full control of BASS and TREBLE in conjunction with a main volume control. It can be used with any amplifier and with any pick-up, the range of frequency control provided by the unit affording ample compensation for all types of pick-ups and all natures of recordings, i.e., English, American and long-playing with full recourse to pick-up correction. The extreme flexibility of the bass and treble control is such that the level of bass and treble can be set to suit all conditions irrespective of the volume output of the amplifier. Response characteristics are given in 12-watt amplifier advt. The unit measures only 9in. x 4in. x 2in. including self-contained power supply and can be accommodated either on or away from the main amplifier, i.e., on the front panel of a cabinet or any other position. Price including drilled chassis, valves (6SN7 and 6J5), £3/16/9. Complete assembly data are available separately for 1/- Completely assembled and ready for use £5/5/-

SPEAKER BARGAINS

ELLESSEY, 10in. 3 ohm V/cell	£1/5/0
GOODMAN'S, 10in. 3 ohm V/cell	£1/13/6
TRITON, 12in. 3 ohm V/cell	£2/7/6
BOLA, 12in. 3 ohm V/cell	£3/19/6
BAKERS, 12in. 15 ohm V/cell	£4/19/6
GOODMAN'S, 12in. 15 ohm V/cell	£5/19/6
(Carriage and Ins. 1/6 extra.)	

**THE NEW W.B. "STENTORIAN"
HI FI SPEAKERS ARE IN STOCK**

Model H.F. 6-inch £2/10/8

Model H.F. 8-inch £2/10/8

Model H.F. 9-inch £2/17/0

Model H.F. 10-inch £3/13/8

These speakers are of the very latest design and provide quality reproduction for the lower-price range, 3 or 10 ohm models are available.

**A COMPLETELY ASSEMBLED
4 VALVE T.R.F. CHASSIS**

£6'9'6
(Plus 7/6 carr. and ins.)

This receiver is of the very latest design and is for use on A.C. or D.C. Mains. It covers both Long and Medium Wavebands, and includes the modern BVA miniature valves. The line up being 12BA6—12AT6—12A6—35W4. It incorporates Permeability Tuned Coils, thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including speaker is 10in. x 4in. x 6½in. An attractive Cabinet size 11in. x 5in. x 6in. is available for 16/6 (plus 2/6 carriage and insurance).

RADIO - GRAM CHASSIS 5 VALVE, SUPERHET LATEST B.V.A. MIDGET SERIES VALVES

3 WAVEBANDS:—L.W. 800m-2000m, M.W. 200m-550m, S.W. 16m-50m
Chassis size 13½in. x 5½in. x 2½in. Attractive Glass Dial 10in. x 4½in. edge lit by 2 pilot lamps. Horizontal or Vertical Station Names and 4 control knobs, walnut or ivory to choice. 4 position W/C switch, L.M. S. and Gram. P.U. sockets. Modern circuitry, all coils adjustable dust covered and only quality components used throughout. Delayed A.V.O. and neg. feed-back. A.C. mains 200/250 v. Double wound transf. isolates chassis from mains. Aligned and calibrated ready for use.

BRAND NEW & GUARANTEED £9.15.0 Carr. and ins. 4/6.

3-ohm speakers suitable for this chassis available 8" 17/6 10" 20/-

This chassis is a genuine bargain and delivery is reasonably good.

BARGAIN VALUE IN RECORD PLAYERS

By Plessey—3 speed Model 331, 45 and 78 R.P.M. This brand new autochanger Mixer Unit will play 7, 10 and 12 inch records. Xtal Cartridge Type Pick Up with Sapphire Stylus plays 4,000 records. Spring mounting. Base board size 15½in. x 12½in. Height 5½in. Depth 2in. Special Bargain Price whilst stock lasts.

Price 9½gns. only

★MIXER TYPE MECHANISM — DUO POINT SAPPHIRE STYLUS★

WE SPECIALISE IN RADIO COMPONENTS

The following are a few items from our stock—send for our Bargain Lists, price 3d.

COAXIAL CABLE

Latest semi-air spaced Polythene insulated 80 ohm coaxial by leading manufacturer. Feeder losses cut by 50 per cent (soaker's guarantee). 1m. diam., stranded conductor, highest quality. Only 8d. per yd. 8/9 per doz. yds. P. & P. extra.

50 ohm Standard Coaxial cable 1in. diam., 8d. yd.

80 ohm Twin Screened Feeder, 1/- yd.

80 ohm Balanced Twin Feeder 6d. yd.

CONDENSERS ELECTROLYTICS

Leading Makes New Stock

TUBULAR	TUBULAR-wireends	CAN TYPES	
.001 350 v. 9d.			
.005 .005 .01. 9d.			
.05 .1. 500 v. Mold-seal 9d.			
.05 .1. 500 v. Mold-seal 9d.	25/25 v., 50/12 v. 1/9	8+8/450 v. 4/6	
.02 .1. 350 v. 9d.	50/50 v., 4/500 v. 2/-	8+10/450 v. 5/-	
.02 .1. 350 v. 9d.	9/8 v. 2/3	8+16/500 v. 5/6	
1,600v. Mallory 9d.	1/10 v. 2/9	16+16/450 v. 5/6	
.25 .5. 350 v. 9d.	8+8/500 v. 2/5	16+16/500 v. 6/-	
.1. 1500 v. 9d.	8+16/450 v. 5/6	32/350 v. 4/-	
MICA and SILVER MIGAS 16/450 v. 9d.	8+16/450 v. 5/6	32+32/450 v. 6/6	
3 p.f., 5 p.f., 50 p.f., 100 p.f. 9d.	18+16/450 v. 5/6	60/350 v. 6/6	
150 p.f., 200 p.f., 300 p.f. 9d.	32/350 v. 4/-	60+100/350 v. 11/6	
500 p.f., 680 p.f., 1000 p.f. 9d.	32/500 v. 5/-	100+200/375 v. 12/6	
etc. 9d.	32+32/350 v. 5/6	1500/8 v. 4/6	
6d. each. 5/6 per doz.	32+32/500 v. 7/6	1000/1000 8 v. 6/6	

CLOSE TOLERANCE SILVER MICAS

1% TYPES. 56 p.f. to 500 p.f., 1/9; 515 p.f. to 5000 p.f., 2/-; 1.5 p.f. to 50 p.f. (tolerance, 1 p.f.) 1/9.
10% TYPE. 5 p.f. to 500 p.f., 1/-; 600 p.f. to 3000 p.f. 1/3.

MAINS TRANSFORMERS

Fully interleaved and impregnated. Made in our own workshops to highest grade specification. Fully guaranteed. All primaries tapped 200/250 v. All secondaries full wave.

HEATER TRANSFORMERS.

CRT HEATER ISOLATION TRANSFORMERS. Low leakage windings, with or without 25% sec. boost voltage. 1:1 or 1:1.25 ratio. 2 v., 10/6; 4 v., 10/6; 6.3 v., 10/6; 13.3 v., 10/6 etc. Ditto, but with mains primaries 12/6 each.

All Universal mounting. Fully shrouded 1/3 extra. L.F. CHOKES: 10H 65 mA., 5/-; 15H 100 mA., 10/6; *20H 150 mA., 12/6; *3H 200 mA., 13/6.

*Fully shrouded 1/3 extra.

Rewinds or specials made to order up to 500 V.A.

RESISTORS

20% Tolerance. Leading makes only. All values 10 ohms to 10 Megohms, 1/2 w., 4d.; 1/2 w., 5d.; 1 w., 6d.; 2 w., 9d. 1% HIGH STABILITY.

1 watt, 100 ohms—10 Megohms, 2/- each.

WIRE WOUND RESISTORS

Wire ends. Silicone coated, 25 ohms—10000 ohms, 5 w. 1/3; 10 w., 1/6; 15 w., 2/-; 20 w., 2/3; 30000 ohms—33000 ohms, 5 w., 1/9; 10 w., 2/3; 47000 ohms—50000 ohms, 5 w., 2/3; 10 w., 2/3.

WIRE WOUND POTTS

Standard 3-watt type—long spindles, 100 ohms, to 50000 ohms, 5/6; 100000 ohms, 6/6.

PRE-SET W/W POTS

T.V. knurled slotted knob type. 25 ohms to 30000 ohms, 3/6; 50000 ohms, 4/6; 50000 ohms to 2 Megohms (carbon track), 3/6.

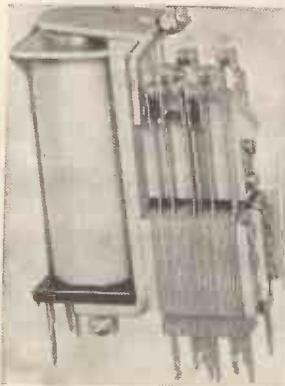
MAINS DROPPERS

with 2 variable sliders.
1.5 amp. 1500 ohms 1in. x 2½in., 4/3.
2.5 amp. 1000 ohms 1in. x 2½in., 4/3.
3.5 amp. 750 ohms 1½in. x 2½in., 4/6.

VOLUME CONTROLS

lin. semi Midget Type. Long spindles All valves, 10000 ohms to 2 Megohms Less sw., 2/3; S.P. sw., 4/6; D.P. sw., 4/9 All individually boxed. Guar. 12 months

T.R.S. RADIO COMPONENT SPECIALISTS
70 BRIGSTOCK RD., THORNTON HEATH, SURREY
Phone: THO 2188 Hours 9am—6pm. Ipm. Wed. Open all day Saturday
BY THORNTON HEATH STATION BUSES 130A, 133, 159, 166, 190
Taxis: G.W.O. or C.O.D. Post & Packing up to 1lb., 6d.; 1lb., 1/-; 3lb., 1/6; 5lb., 2/-; 10lb., 2/6.



Manufacturers of
POST OFFICE TYPE

MAGNETIC RELAYS

3,000 and 600

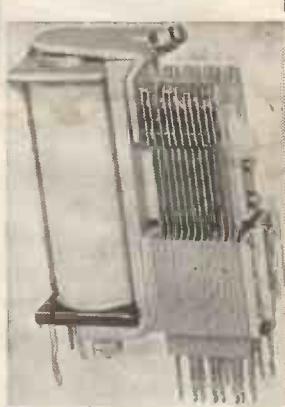
Contractors to:

H.M. GOVERNMENT AND LEADING MANUFACTURERS

COILS up to 80,000Ω.

CONTACTS up to 8 amps.

INSULATION up to 5 kv.



Specialists in Tropicalisation and Inter Services Jungle Finish

Conforming to A.I.D. and C.I.E.M.E. standards

PROTOTYPE Relays

made to specification.

POST OFFICE TYPE

KEYS supplied to

specification.

Speedy Deliveries—

Enquiries Invited

A.D.S. RELAYS LTD. Dept. W.W.
12, STORE STREET, LONDON, W.C.I.

Tel.: MUSEum 2453



TELEPHONE EQUIPMENT

Brand new and boxed American Desk telephones with built in ringer complete with handsets as shown. 59/6.

Ditto:—of English manufacture, complete with distributor boards. 49/6 each.

Telephone Secrecy Equipment:—Army No. GAC-YBO2700. Complete frequency scrambler units for secret telephone conversations which cannot be tapped or overheard, for operation from 230 v. A.C. or 12 volt D.C. Offered in brand new condition at a fraction of their original cost. £5 each. Limited number only available.

G. W. SMITH & CO. (RADIO) LTD.
3-34, LISLE STREET, LONDON, W.C.2

Telephone: Gerrard 8204/9155.

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155

3-34, LISLE ST., LONDON, W.C.2.

TRADE ENQUIRIES
INVITED

FOR ALL RADIO BARGAINS

WE PURCHASE ALL TYPES OF
RECEIVERS AND TEST GEAR

SPECIAL OFFER. PACKARD BELL AMPLIFIERS. These brand new American amplifiers are complete with a 6SL7 and 28D7 valves, condensers, resistors, midget relay, pot and 8-way midget plug and socket. 12/6 each with circuit.

METERS. All brand new and boxed. 0-10 m/a., 2½ in. round, F/M., M/coil, 9/6; 0-100 m/a., 2½ in. round, F/M., M/coil, 9/6; 0-150 m/a., 2 in. square, F/M., M/coil, 7/6; 0-200 m/a., 2 in. square, F/M., M/coil, 7/6; 0-200 m/a., 2½ in. round, F/M., M/coil, 9/6; 0-20 volts, 2 in. square, F/M., M/coil, 7/6.

AMMETERS. 0-1 amp., 2½ in. projecting, R.F., 7/6; 0-5 amp., 2½ in. round, F/M., R.F., 7/6; 20/20 amp., 2 in. round, F/M., M/I., 6/6; 0-30 amp., 2 in. square, F/M., M/coil, 7/6.

A.C. VOLT METERS 50 CYCLE. 0-15 volts, 2½ in. round, F/M., M/I., 8/6; 0-20 volts, 2½ in. round, F/M., M/I., 10/-; 0-300 volts, 2½ in. round, F/M., M/I., 25/-; 0-300 volts, 5 in. projection, M/I., 50/-.

CRYSTAL MICROPHONES INSERTS. We are again able to offer these small sensitive microphone inserts at a fraction of original cost. Size only ½ x ¼ x ½ in., innumerable applications, price 7/6 each!!

MAINS TRANSFORMERS. All 230 volt 50 cycle input. 250 x 250 volts 150 m/a., 4 volt 3 amp., 9/6; 500 x 500 volt 170 m/a., 4 volt C.T. 4 amp., 3,000 volt insulation, 22/6 each; 670 x 670 volt 200 m/a., 6.3 volts 4 amp., 5 volts 3 amp., 49/6 each; 1,500 volts 330 m/a., 52/6; 2,000 volts 5 m/a., 15/6; 4 volt 14 amp., 6.3 volts 1½ amp., 10/6; 6.3 volts 1½ amp., 5/9; 6.3 volts 3 amp., 9/6 each.

AMERICAN INSTRUMENT POTENTIOMETERS. Brand new and boxed. 10,000 ohms, 5½ in. diameter. Ideal for bridge, etc., 22/6 each.

CHROMIUM PLATED TELESCOPIC AERIALS. Min. length 12 in., extends to 48 in. Ideal for car radios, etc., 7/3 each.

HEADPHONES. Brand new, Canadian, "Northern Electric," finest ever produced, 100 ohms, complete with P.O. Jack Plug, 10/6 each.

METER RECTIFIERS. Full wave 2 m/a., S.T.C., brand new, 5/6 each.

TYPE 4 WAVEMETERS. Cavity tuned absorption wavemeter covering 200 M/cs.-220 M/cs., brand new and boxed, supplied with VU39, SP61, EA50 and CV51 magic eye tuner, 29/6 each. Less valves 10/6 each.

MIDGET REVERSIBLE MOTORS. For operation on 4, 6, 12 or 24 volt D.C. Size 2 x 1½ in., spindle length ½ x ½ in. Ideal for model makers, locos, boats, etc., 10/6 each.

MUIRHEAD PRECISION BUILT KEY SWITCHES with heavy contacts. 8 pole, 2 way, brand new, 4/6 each.

CERAMIC SWITCHES. 3 pole 4 way 4 bank, 10/6 each; 4 pole 3 way 3 bank, 6/6 each; 7 pole 2 way 3 bank, 5/6 each.

TELEPHONE HANDSETS. Ex-American, standard P.O. type, 12/6 each.

H.R.O. 6 VOLT VIBRATOR SUPPLY UNITS. Output 165 volts 80 m/a., 6.3 volts 3 amp., 6X5 rectifier, choke and condenser smoothed, cabinet size 7 x 7 x 6 in. Supplied with clips and leads, brand new, 25/6 each.

R.1155 COMMUNICATION RECEIVERS.



Individually aerial tested. Brand new in original transit cases, £11/19/6 each. Brand new but shop soiled, £9/19/6 each. A combined power pack and audio output stage for A.C. mains, can be supplied with a receiver for an extra cost of 79/6.

P.O. UNISELECTOR SWITCHES. 4 bank, double wipers, 25 position, brand new, 32/6 each. Ditto, 8 bank, 45/- each.

AMERICAN "SPRAGUE" CONDENSERS. Brand new 4MFD, 600 volt. The finest ever produced, 10/6 each.

CAMERA CONTROL UNITS TYPE 35 NO. 20. For operation on 24 volts D.C. Brand new, 22/6 each.

PYE 45 MEG. I.F. STRIPS. Complete television I.F. strip

with 6EF50 valves. Size 14 x 3½ x 3½ in., finest strip ever produced, 69/6 each complete. Brand new.

RELAYS. Polarised twin 600 ohm coils, 8/6 each. We stock all types of relays, 600 and 3,000 types, heavy and light contacts, including platinum, send us your enquiries, we are the cheapest in the trade.

HOUR RECORDERS. A time recorder for operation on 200-250 volts A.C. Range from 1/10-10,000 hours on 5 separate scales. Supplied brand new and boxed, 39/6 each.

MULTIWAY TOGGLE SWITCH BOXES. Fitted with 16 toggle type switches. Ideal for train or model control, brand new and boxed, 4/- each.

NIPHAN PLUGS. 3 pin 5 amp. waterproof mains plugs and sockets. Set of three, 12/6 per set. Set of two, 10/6 per set.

100 MICROAMP METERS. A 2½ in. flush mounting meter, scaled 0-1,500 yards, first-grade instruments, brand new and boxed, 42/6 each.

TEST SET TYPE 109. Brand new, fitted with 2 in. 0-5 m/a., M/C meter, also 0-40 watts 2 in. M/C meter, with mains plugs and leads and many other useful parts, 12/6 each.

CONSTRUCT A QUALITY AMPLIFIER. This amplifier is designed to give quality reproduction of records at a price to suit any pocket. Supplied complete to the last nut and bolt with an attractive cream cabinet and easy to build point to point wiring diagrams. Push-pull 6V6 output stage giving 8 watts output. Output matched to 3 ohms or 15 ohms, tone and volume controls. For operation on 200-250 volts A.C. Complete valve line-up, 6SN7, 6V6, 6V6, 5Z4. Complete kit, £5/10/-. This amplifier can be supplied ready built and tested, £6/10/-. Circuit only, 2/6.

TEST SET TYPE 74A. "The ideal basis for an oscilloscope." These units contain a VCR139 3 in. CRT and 11 other valves. A complete A.C. power pack giving E.H.T., H.T. and L.T., fully smoothed, paper condensers throughout. Supplied tube tested, £4/19/6 each.

S441B POWER PACK. 200-250 volts input. Output 300 volts 200 m/a., 12 volts 3 amp., choke and condenser smoothed, 5U4G rectifier, 62/6 each.

AMERICAN POWER RHEOSTATS. Brand new and boxed. 8 ohm, 3.3 amp., 8/6 each; 8 ohm, 2.5 amp., 7/6 each; 60 ohm, 1.3 amp., 7/6 each; 90 ohm, 0.74 amp., 7/6 each; 200 ohm, 0.3 amp., 5/6 each. Ideal for train, model or charging control.

P.40 POWER PACKS. Input 200-250 volts A.C. Output 175 volts 60 m/a., 12 volts 2.5 amp. Fully smoothed, 5Z4 rectifier. An ideal power supply unit for the American RA-1B receiver, 32/6 each.

"S" PHONES. A MINIATURE U.H.F. TRANSMITTER RECEIVER. Complete with all valves, vibrator power pack, headphones and microphone, aerial and canvas satchels for attaching to the body, £4/10/- each.

P.O. KEY SWITCHES. Double pole change-over. Complete with knob, brand new, 2/9 each.

DEAF-AID EAR PIECES. A miniature ear piece ideal for crystal sets etc., 3/6 each.

TELEPRINTER EQUIPMENT. APPARATUS TELEGRAPH TWO TONE MK. II. Complete with all valves and send-receive relays, £7/10/- each.

EX-W.D. POWER PACKS. 230 volts A.C. input. Output 150 volts 60 m/a., 6.3 volts 1½ amps. Fully smoothed, metal rectifiers, 29/6 each.

BATTERY CHARGERS 200-250 volts A.C. input, 24 volts 10 amps. output, perfect working condition, fine and coarse controls, £12/10/- each.

METER SWITCHES. Standard "Yaxley" type, 8 bank, single pole, 9, 11 or 12 way, 7/6 each.

SOUND POWERED MICROPHONES AND RECEIVERS. No batteries required, just connect wires to speak or listen, 3/6 each.

TEST SET TYPE 28. Complete with flush mounting 50 microamp, 2½ in. meter, housed in instrument case with many other useful components, supplied, meter tested, 65/- each.

TRANSMITTING VALVES. We have a large selection, 829b, 250TH, TX3-200, TX4-400, etc., send us your enquiries.

600-900 MC/S R.F. UNITS. Set of three, R.F.116, R.F.118 and R.F.119, £4/10/- complete set.

A.C. OR D.C. TEST METER. 300 volt moving iron, 3½ in. meter, housed in wooden case, complete with test leads, 39/6 each.

DEAF-AID VALVES. Type CK505AX, brand new, 2/6 each.

EX-A.M. SWITCH BOXES. Fitted with 3 independent 5 amp. switches, size 3½ x 2 x 2 in. Ideal for models, cars, boats, etc., 1/9 each.

HOURS OF BUSINESS: 9 a.m.-6 p.m. Thursday 1 p.m. Open all day Saturday.

PLEASE PRINT YOUR NAME AND ADDRESS CLEARLY ALSO INCLUDE POSTAGE OR CARRIAGE ON ALL ITEMS

GEE GOVT RADIO LTD.

SCR-720 RADAR EQUIPMENT EX-USA CONSISTING OF THE FOLLOWING ITEMS:

RADIO MODULATOR B.C. 1142A. RADIO FREQUENCY UNIT B.C. 1091AM. CONTROL BOX B.C. 1150V. RECTIFIER RA-88-A. RECTIFIER RA-90-A AND POWER EQUIPMENT P.E.158B.

ALL THE ABOVE ITEMS ARE SOUND AND CLEAN AND FORM THE MAJOR PART OF THE COMPLETE SCR-720 SET AND OFFERED AT A FRACTION OF THE ORIGINAL COST. LIMITED QUANTITY AVAILABLE ONLY. PLEASE WRITE FOR FURTHER DETAILS, ETC.

50 WATT AMPLIFIER EX-GOV'T. With 4-KT66s in paralleled push-pull Standard 200-250 v. mains input, A.C. Output impedance 600 ohms line. High imp., gram, and microphone input. Bass boost control fitted. This excellent quality amplifier is housed in a strong metal case and is ready for use. Our price £25, carriage paid.

ELECTRIC LIGHT SLOT METERS. 200-250 v. at 10/- amps. 1/- in slot at 6d. per unit, by Measurements Ltd. All bakelite case, in very good condition. 50/-, p.p. 2/6.

TELEPHONE L/SPEAKER NO. 2 (By Vitavox). Semi-re-entrant all-metal. H/Duty 6in. P.M. 15 ohms S/Coil, with 600 ohm built-in line transformer, housed in a strong wooden case. £1/5/-, carriage 5/-.

WESTON BATTERY-OSCILLATOR, MODEL E.692 TYPE 2. New and unused. Coverage 100 kc/s-26 Mc/s. Audio output approx. 400 c/s. Available complete with instruction booklet at the ridiculously low price of only £5/19/6, p.p. 4/6 extra.

VITAVOX PRESSURE UNITS. Heavy duty, P.M. 20 watts. Brand new. £4/9/6, carriage 5/-.

TRUVOX 12in. 3 OHMS P.M. SPEAKERS. Brand new and boxed, 39/6, post paid.

ROTARY CONVERTERS. 12 v. D.C. Input, 230 v. A.C. 50 cycles output at 100 watts. Brand new. £4/17/6. Ditto 24 v., same price, carriage 7/6.

INDICATOR UNIT TYPE 302. Containing VCR97 with screen and base, 4-VR91s (EF50), 3-VR65s, 3-VR54s, diode; 1 at 2.5 kv., etc. Bargain value at £2/19/6, carriage 5/- extra.

RA-88 RECTIFIER UNIT (PART OF SCR-720) EQUIPMENT. Containing the following valves line-up: 3-6L6 metal valves, 3-5T4 metal valves. 2-6SL7gts, 2-VR150/30s, etc., etc. Bargain value at £4/19/6, carriage 5/-.

A.C./D.C. SUPPLY UNIT. (S.T.C. Selenium rectifier). Complete with mains isolation transformer, fixed and housed in strong metal cabinet. 250 v. A.C. at 200-220 v. D.C. at 3-4 amps. Ready to use for £8/10/- only, carriage 10/-.

R.1155 COMMUNICATION RECEIVERS. Individually tested and despatched in good working order. Cases slightly soiled. £8/19/6, brand new, £10/19/6.

RECEIVER TYPE 109. In good condition. Freq. range 1.8-3.9 mc/s and 3.9-8.5 mc/s continuous. Designed to operate on 6 v. battery. Limited quantity only, £4/7/6, plus 10/- carriage.

TRANSMITTER-RECEIVER No. 19. Complete with all valves. Soiled but good. Bargain value at £6, carriage 10/-.

CATHODE RAY TUBES. Type 3BPI, 3in. new and unused with base and screen, 42/6, p.p. 2/-, Type VCR138 (ECR35), 3½in. with screen and base, in new and unused condition, 42/6, p.p. 2/-, Type VCR97, 6in., ex-equip., in good order, 20/-, p.p. 3/6. VCR131, 1in. C.R.T. new and in perfect condition. Miniscope replacement tube, etc., 35/6, p.p. 1/-, Type CV1526, 2½in., 4 v. filament, 3,000 v. anode. Complete with base and mu-metal screen, 20/-, p.p. 2/6.

PHOTO ELECTRIC MULTIPLIER CELLS. TYPE 931A, £2/10/-, p.p. 1/-. Also 931A complete on chassis with multiplier network and 2-832 valveholders, etc., £3/10/-, p.p. 2/6.

PAINTON PLUGS AND SOCKETS (MIN. JONES). All types available. Delivery ex stock. Please let us quote you.

HIGH VOLTAGE TRANSMITTING CONDENSERS. Hank post type (25 pf. 8 kv.), (40 pf. 9.6 kv.), (500 pf. 15 kv.), (600 pf. 9.6 kv.), (750 pf. 15 kv.). Any type, 3/6 each, p.p. 6d. Also in stock, glass vacuum condensers, 50 pf. 32 kv. 25/-, p.p. 1/-.

L.M.S. SMALL COIL PACK. Size 2½in. x 2½in. x 1½in. Very good quality, with circuit diagram. 19/6 each only. Every one guaranteed.

CERAMIC WAVE-CHANGE SWITCH (WEARITE). One-pole 12 position 2 bank, 7/6, p.p. 1/-.
813 CERAMIC VALVE HOLDERS. 9/6 each, p.p. 6d. Also 4-pin large "Jumbo" ceramic valve holders, 6/6 each, p.p. 6d.

B.C.614A SPEECH AMPLIFIER (Part of B.C.610 Equipment). As new, £25.

EVERSHED AND VIGNOLES (EX-G.P.O.) HIGH-RANGE CONSTANT PRESSURE MEGGER. 5 meg.-1,000 meg.-infinity. In good working condition. Housed in wooden case, £7/10/-, carriage 10/-.

EVERSHED AND VIGNOLES 250 v. LOW RANGE BRIDGE MEGGER. 5,000 ohms-20 mags.-infinity. Finished as above, £7/10/-, carriage 10/-.

CRYSTAL CALIBRATOR - MARCONI (EX-GOV'T.) Freq. range 170-240 Mc/s. Perfect condition, complete with instruction book and spare valves. Standard input, 200-250 v. A.C. at 50 cycles. £6/19/6. Carriage extra.

AN/APA-1 CATHODE RAY INDICATOR AMPLIFIER UNIT. Complete, comprising 3BPI C.R.T., 7-6SN7gts, 1-6H6, 1-6G6, 1-2X2, 1-6X5, valves. Bargain value, £4/19/6, plus 10/- carriage.

TELESCOPIC AERIALS. Min. length 12in., max. length 48in., suitable for car radio aerials. 8/6 each, p.p. 9d.

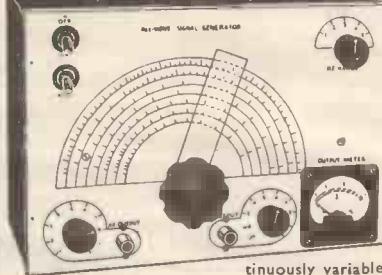
HALF MILE OF TWIN 8" TELEPHONE WIRE Brand new, on wooden drums, £2/12/6, per drum, carriage 10/- extra, England only.

MANY OTHER LINES IN STOCK. YOUR ENQUIRIES INVITED. TRADE SUPPLIED.

15 LITTLE NEWPORT ST., LONDON, W.C.2.

GERrard 6794/1453

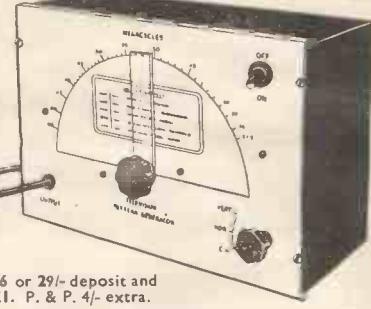
COMPLETELY BUILT SIGNAL GENERATOR



Coverage 120 Kc/s., 300 Kc/s., 900 Kc/s., 1,275 Kc/s., 1,575 Mc/s., 1,875 Mc/s., 2,175 Mc/s., 2,475 Mc/s., 2,775 Mc/s., 3,075 Mc/s., 3,375 Mc/s., 3,675 Mc/s., 4,000 Mc/s. Metal case 10 x 6½ x 4½in. Size of scale 6½ x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated, R.F. output continuously variable 100 milli volts. C.W. and mod. switch, variable A.F. output and panel. Accuracy plus or minus 2%. £4/19/6 or 34/- deposit and 3 monthly payments 25/-, P. & P. 4/- extra.

PATTERN GENERATOR

40-70 Mc/s. direct calibration, checks frame and line time base, frequency and linearity, vision channel alignment, sound channel and sound rejection circuits and vision channel band width. Silver plated coils, black crackle finished case 10 x 6½ x 4½in. and white front panel. A.C. mains 200/250 volts. This instrument will align any T.V. receiver, accuracy plus or minus 1%. Cash price £3/19/6 or 29/- deposit and 3 monthly payments of £1. P. & P. 4/- extra.



EXPORT & TRADE ENQUIRIES INVITED

(N.B. Post and packing charges stated apply to British Isles only.)
★ Both generators guaranteed for 12 months ★

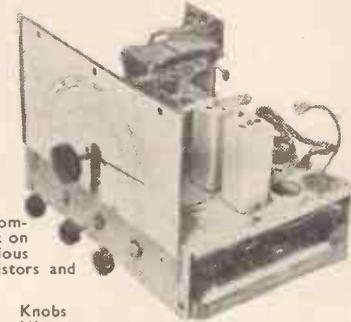
USED A.C. MAINS 5 VALVE, 3 WAVE-BAND SUPERHET

CHASSIS

Size 11½ x 8½ x 3in., complete with 3 wave-band scale, size 10½ x 5½in., pair of 465 Kc/s IFs, tuning condenser, mains transformer, volume control with switch, tone control. 3 wave-band coil pack (this is a completely detachable coil pack on separate small chassis) various small condensers and resistors and biasing condensers.

19'6 Post & Packing 3/6 Knobs 1/6 extra.

As above, two wave-band.



15'- Post & Packing 3/6 Knobs 1/6 extra.

USED TELEVISION TUBES WITH HEATER CATHODE SHORT

GUARANTEED FOR THREE MONTHS

6 volt heater, duodecal base: all with bent gun construction.	£3/17/6.
12in.	Post & Packing 7/6 extra.

9in. £1/17/6. Post & Packing 7/6 extra.

Maximum E.H.T. 10 Kv.

Any of the above complete with line and E.H.T. Trans., Ferrocart core, line and width control scan coils and frame.

Output Transformer, 35/- extra.

SPECIAL NOTE: NO GOODS SENT WHERE CUSTOMS DECLARATION IS APPLICABLE

Terms of Business: Cash with order. Despatch of goods within 3 days from receipt of order. Where post and packing charge is not stated please add 1/6 up to 10/-, 2/- up to £1, and 2/6 up to £2. All enquiries S.A.E., lists 5d. each.

MAINS TRANSFORMERS

Primary, 200-250 v. P. & F. 2/-.
300-400, 100 mA., 6 v. 3 amp.,
5 v. 2 amp., 22/6.

Semi-Shrouded, drop-through, 380-0-
380 v., 120 mA., 6.3 v. 4 amp., 5 v.,
2.5 amp., 22/6.

Drop thro' 380-0-350 v. 70 mA., 6 v.
2.5 amp., 5 v. 2 amp., 14/6.

Drop thro' 250-0-250 v. 80 mA., 6 v.
3 amp., 5 v. 2 amp., 14/6.

280-0-280, drop through, 80 mA.
6 v. 3 amp., 5 v. 2 amp., 14/6.

250-0-250 80 mA., 6 v. 4 amp., 14/-.

Drop thro' 270-0-270, 80 mA., 6 v.
3 amp., 6 v. 1.5 amp., 13/6.

Drop thro' 270-0-270, 60 mA., 6 v.
3 amp., 11/6.

250 v. 250 mA., 6.3 v. 4 a., twice 2 v.
2 a., 19/6.

Auto Trans., Input 200/250. H.T. 500 v.
250 mA., 6 v. 4 a., twice, 2 v. 2 a., 19/6.

250-0-250, 60 mA., 6.3 v. 1.5 a.
0.5-0.3 v. 1.5 a., 10/6.

Auto Trans., Input 200/250. H.T. 500 v.
250 mA., 6.3 v. 1.5 amp., 5 v. 3 amp., 25/-.
P. & F. 3/-.

Primary, 230 v., fully shrouded, screened
primary, 13 v. 1 amp., 7/6.

Pri 200 v. Sec. 500-0-500 and 500-0-500
250 mA. both windings, 4 v. 3 amp.,
4 v. 3 amp., 39/6. P. & F. 5/-.

Main Transformer, fully impregnated,
Input 210, 220, 230 and 240. Sec.
800-0-800, 275 mA., and 100 v. at
90 mA. complete with separate heater
transformer. Input 210, 220, 230, 240.
Sec. 6.3 v. 2 amp., three times, 0.4,
6.3 v. at 1 amp. and 6 v. 3 amp., 45/-.
P. & F. 6/-.

Mains Transformer, fully impregnated.
Input 210, 220, 230, 240. Sec.
800-0-800, 275 mA., and 100 v. at
90 mA. complete with separate heater
transformer. Input 210, 220, 230, 240. Sec.
6.3 v. 2 amp., 6.3 v. 3 amp., 4 v. 6 amp.,
and 5 v. 2 amp., 30/- P. & F. 5/-.

MAINS TRANSFORMERS, chassis
mounting, feet and voltage panel.
Primaries 200/250.

350-0-350 75 mA., 6.3 v. 3 a. tap 4 v.
6.3 v. 1 a., 13/6.

500-0-500 125 mA., 4 v. C.T. 4 a., 4 v.
C.T. 4 a., 4 v. C.T. 2.5 a., 27/6.

500-0-500 250 mA., 4 v. C.T. 5 a., 4 v.

C.T. 5 a., 4 v. C.T. 4 a., 39/6.

9in. T.V. Cabinet, front in contrasting
walnut veneers, size 16in. long, 11in.
high, by 12in. wide. Complete with
two pieces expanded aluminium in gold
12 x 9in. and 5in. speaker baffle and
chassis, 20/- post paid.

6in. M.E. Speaker, 1,000 ohm field,
15/-.

R. & A. T.V. energised 6in. speaker,
with O.P. trans., field coil, 175 ohms
9/6. P. & F. 2/6.

R. & A. 6in. M.E. speaker, with O.P.
trans., field 440 ohms, 10/6. P. & F. 2/6.

Volume Controls. Long spindle less
switch, 50K. 500K. 1 meg., 2/6 each.

P. & F. 3d. each.

Volume Controls. Long spindle and
switch, $\frac{1}{2}$, 1 and 2 meg., 4/- each.

10K. and 50K. 3/6 each. $\frac{1}{2}$ and 1 meg.,
long spindle double pole switch, miniature,
5/- P. & F. 3d. each.

Trimmers, 5-40 pf., 5d. 10-110, 10-250,
10-450 pf., 10d.

Twin-Gang .0005 Tuning Condenser, 5/-.
With trimmers, 7/6.

Twin Gaus., .0005, with feet, size
 $\frac{3}{4} \times 1 \frac{1}{2}$ in. 6/6.

3-Gang .0005, with feet, size $4 \frac{1}{2} \times 3 \times$
1 in. 7/6.

T.V. Coils, moulded former, iron-cored
wound for re-winding purposes only.
All-can 1 $\frac{1}{2}$ x 1 $\frac{1}{2}$ in. 1/- each. 2 iron-core
All-can 2 $\frac{1}{2}$ x 1 $\frac{1}{2}$ in. 1/6 each.

Used Metal Rectifier, 250 v. 150 mA.,
6/6.

Metal Rectifier, 230 v. 45 mA., 6/-.

Metal Rectifier, RM2, 125 v. 100 mA.,
3/6.



6in. deep, 4in. high, 9in. blank-scale. Width including scale-overlap 14in. Four stages
permeability tuned. Complete with 3 valves. Post and Pgk. 3/-, 22/19/6.

T.V. CONVERTER for 4 wavebands. Station complete with 2 valves. Frequency can
be set to any channel within the 188-198 Mc/s. range. Line and width control. Tuned
line and E.H.T. Transformer, 9 Kv., using ferrocarr core, complete with line and
width control. Dimensions 9in. wide.

PERMEABILITY TUNED T.V. UNIT
INPUT 300 ohm balanced line, coverage
54 Mc/s.-89 Mc/s. and 174 Mc/s.-217 Mc/s.

Vision I.F., -45 Mc/s., sound 40.5 Mc/s. Uses
GAK5 RF valve, GAK5 as mixer, and 6CA4
oscillator. Provision for auto-gain control.
Dimensions 9in. wide.

LINE AND E.H.T. TRANSFORMER, 9 KV.,
using ferrocarr core, complete with built-in line and width control. Mounted on
small all-chassis. Overall size 4 $\frac{1}{2} \times 13$ in. EVS1 rec. winding, 27/6.

Scan coils, low loss low impedance
frame, complete with frame transformer,
to match above, 27/6. P. & F. 2/6.

LIMA and E.H.T. TRANSFORMER, 9 KV.
ferrocarr core, EVS1, transformer winding,
complete with scan coils and frame
output transformer, and line and width
control, 22/5/-, P. & F. 3/-.

As above, but complete with line and
frame blocking transformers, 5 Henry
250 mA. choke, 100 mfd. and 150 mfd.
250 wkg. 380 mA. A.C. ripple. 22/19/6
P. & F. 3/-.

VALVE HOLDERS, moulded octal Mazda
and loctal, 7d. each. Parolin, octal
Mazda and loctal, 4d. each. Moulded
B7G, B8A and B9A, 7d. each. B7G
moulded and B9A with screening can
1/6 each.

32 mfd., 350 wkg. 2/-
16 x 24, 350 wkg. 4/-
4 mfd., 200 wkg. 1/3
40 mfd., 400 wkg. 3/6
18 x 16 mfd., 500 wkg. 4/6
16 x 16 mfd., 500 wkg. 5/9
16 x 16 mfd., 450 wkg. 3/9
32 x 32 mfd., 350 wkg. 4/-
32 x 32 mfd., 350 wkg. 4/-
25 mfd., 25 wkg. 6/6
25 mfd., 25 wkg. 11d.
250 mfd., 12 v. wkg. 1/-
16 mfd., 600 wkg., wire ends ... 2/6
8 mfd., 500 v. wkg., wire ends ... 2/6
8 mfd., 350 v. wkg., tag ends ... 1/6
50 mfd., 25 v. wkg., wire ends ... 1/9
100 mfd., 350 wkg. 4/-
100 mfd., 450 v. wkg., 280 mA.,
A.C. ripple 3/11
150 mfd., 350 v. wkg., 280 mA.,
A.C. ripple 4/6
100+200 mfd., 350 wkg. 9/6
18+16 mfd., 350 wkg. 3/3
60 mfd., 180 wkg. 1/9
85 mfd., 180 v. wkg. 1/6
8 mfd., 150 v. wkg. 1/6
60+100 mfd., 280 wkg. 7/6
50 mfd., 12 wkg. 11a
32+32 mfd., min. 275 wkg. 4/-
50 mfd., 50 wkg. 1/9

MINIATURE WIRE ENDS MOULDED, 100 pL,
500 pL, and .002 in. each, 7d.

T.V. FILTER, in lightly tinted Perspex,
size 13 x 11 x 3/16in. 4/6.

COMBINED 12in. MASK AND ESCORTON,
in lightly tinted Perspex. New aspect
edge in brown. Fita on front of
cabinet, 12/6. As above for 15in. tube,
17/6.

FRAME OSCILLATOR BLOCKING TRANS., 4/6.
LINE OSC. BLOCKING TRANS., 4/6.

LINE MOUNTING BRACKET, size 9 $\frac{1}{2} \times 4$ in.
12in. tube clamps, 2/-.

CHOKES:

2-20 Hen. 150 mA., 15/-, P. & F. 3/-.

6 Hen., 270 mA., 15/-, P. & F. 3/-.

100 Hen., 40 mA., 15/-, P. & F. 3/-.

2 Henry 150 mA., 3/6; 250 mA. 10 hen.,
10/6; 5 henry 250 mA., 60 ohms,
8/6.

P.M. FOCUS UNIT FOR ANY 9 OR 12 IN. TUBE
EXCEPT MAZDA 12IN. WITH VERNIER
ADJUSTMENT, 15/-.

P.M. FOCUS UNIT FOR MAZDA, 12IN., LESS
VERNIER ADJUSTMENT, 15/-.

WIDE ANGLE P.M. FOCUS UNITS, VERNIER
ADJ. STATE TUBE, 25/-.

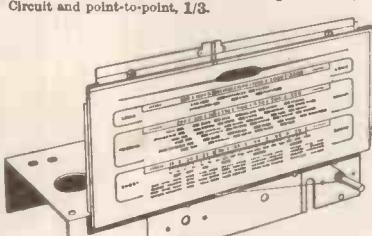
ENERGISED FOCUS COIL, LOW RESISTANCE
MOUNTING BRACKET, 17/6.

ION TRANS. FOR MULLARD OR ENGLISH ELECTRIC
TUBES, 5/-, POST PAID.

STANDARD 465 KC. IRON-CORED I.F.S.,
4 $\frac{1}{2} \times 1 \frac{1}{2}$ in., per pr. 7/6. WEARITE
STANDARD IRON-CORED, 465 KC. I.F.S.,
3 $\frac{1}{2} \times 1 \frac{1}{2}$ in., per pr. 9/6.

IRON-CORED 465 KC. WHISTLE FILTER, 2/6.

465 KC. MIDGET I.F.S., Q.120 size
1 $\frac{1}{2}$ in. long, 1 in. wide, 1 in. deep by very
famous manufacturer. PRE-ALIGNED
ADJUSTABLE IRON-DUST CORES, per pair,
12/6.



BATTERY CHARGER, INPUT 230/250 v., OUTPUT 6 AND 12 VOLT 1 AMP. BLACK
CRACKLE FINISHED CASE SIZE 10 x 6 x 4in. INCORPORATING METAL RECTIFIER,

MAIN ON-OFF SWITCH, AND OUTPUT SWITCH, 21/-. P. & F. 3/-.

OUTPUT TRANSFORMERS. STANDARD TYPE 5,000 OHMS IMP., 4/9; 42-1 WITH EXTRA FEEDBACK
WINDINGS, 4/3. MINIATURE 42-1, 3/3. MULTI-RATIO 3,500, 7,000 AND 14,000, 5/6. 10-WATT PUSH-
PULL, 6V6 MATCHING, 7/-. 90-13 OHM SPEECH COIL, 6/6.

PUSH-BACK CONNECTING WIRE. DOZ. YDS., 1/6. POST PAID.

STANDARD WAVE-CHANGE SWITCHES 4-POLE 3-WAY, 1/9; 5-POLE 3-WAY, 1/9; 3-POLE, 3-WAY
1/9; 9-POLE 3-WAY, 3/6; MINIATURE TYPE, LONG SPINDLE 3-POLE 4-WAY, 4-POLE 3-WAY AND 4-POLE
2-WAY, 2/6 EACH. 2-POLE 11-WAY TWIN WAFER 5/-. 1-POLE 12-WAY SINGLE WAFER 5/-. P. & F. 3d.

POTATO AND VEGETABLE PEELER

BY FAMOUS MANUFACTURER. TO SUIT MODELS A200 AND A700. CAPACITY 4 1/2 LBS., COMPLETE WITH
WATER PUMP. ALL ALUMINIUM CONSTRUCTION, WHITE STOVE-ENAMELED FINISH. ORIGINALLY INTENDED
FOR ADAPTION ON AN ELECTRIC FOOD-MIXER, CAN BE EASILY CONVERTED FOR HAND OPERATION. 39/6.

P. & F. 3/-.

MAINS DROPPERS. 0.2 AMPS., 400 OHMS., TAPPED 280 AND 410. 1/6; 0.2 AMP., 717
OHMS., TAPPED AT 100 OHMS, VITREOUS, 1/8;

0.3 AMP., 850 OHMS., TAPPED 700 AND 825.
2/6; 0.2 AMP., 1,000 OHMS, VITREOUS, TAPPED
726; 0.2 AMP., 700 TAPPED 680.
640, 600, 3/6. P. & F. ON EACH 3d.

LINE O.P. TRANSFORMER IN ALUMINIUM CAN
MOUNTED IN RUBBER, 12/6.

PERSONAL SHOPPERS ONLY. 9IN.
ENLARGER, 17/6; 12IN., 27/6.

GERMANIUM CRYSTAL DIODE, 1/6. POST PAID.

USED 9IN. TUBE WITH IRON BURN, 17/6. POST
PAID.

LINE O.P. TRANSFORMER IN ALUMINIUM CAN
MOUNTED IN RUBBER, 12/6.

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

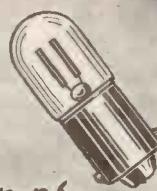
(Late D. COHEN)

23 HIGH STREET (Uxbridge Road) ACTON, W.3. Telephone: ACOrn 5901

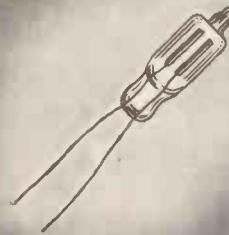
Hours of Business: Saturday 9-5 p.m. Wednesday 9-1 p.m. Other days 9-4.30 p.m.

HIVAC
INDICATOR
LAMPS

Neon indicator lamps
for electrical equipment



CC7L



CC8L



CC10L

(illustrations are actual size)

For all A.C. or D.C. mains voltages - long life - negligible power consumption - extreme reliability

MAY WE SEND YOU A DETAILED FOLDER ?

Hivac Limited

STONEFIELD WAY, VICTORIA ROAD, RUISLIP,
MIDDLESEX

STL

Hermetically
sealed
transformers
for
tropical
conditions



STL TRANSFORMERS

incorporate sound design and are manufactured to the highest standards called for in the electronic and communication fields. Consult us for your next transformer requirements.

STEWART TRANSFORMERS Ltd.

75 KILBURN LANE, LONDON, W.10 · LADbrooke 2296/7

The new
LUSTRAPHONE 'FULL VISION'

Model LFV. 59 Personal MICROPHONE



Miss Carole Carr using the LFV. 59

For television • recording
• broadcasting • public
address.

THE MODEL LFV. 59 is the acme of dynamic microphones for highest quality personal presentation in television, recording, broadcasting and public address. Its beautiful styling and high performance, plus extremely smooth frequency response and non-directional polar patterns, makes this handsome full-vision microphone the finest obtainable.

MODEL LFV. 59 can be used anywhere—indoors or outdoors—in your hand-mounted on a floor or table stand—with 'Stayput' flexible tube to tilt microphone to desired positions. There is no need to shield the microphone when used in the open air, it is already protected from wind noise effects. Its design enables **MODEL LFV. 59** to be used under all conditions—in all temperatures and it is unaffected by rapid climatic changes.

LUSTRAPHONE, the foremost name in MICROPHONES

Literature gladly sent on request.

Lustraphone Ltd.

St. George's Works, Regent's Park Road, London, N.W.1.
Telephone: PRImrose 8844/6.
Telegrams: LUSTRAPHON NORWEST LONDON.
Cables: LUSTRAPHON LONDON.

Z & I AERO SERVICES LTD.,

OFFER THE FOLLOWING EQUIPMENT:

SIGNAL GENERATORS

Marconi Type TF-144G, range 85 kc. to 25 Mc., rebuil't as new	£90	0	0
Marconi Type TF-390G, range 16-150 Mc.	£25	0	0
Marconi Type TF-390G/7, range 4-100 Mc.	£25	0	0
Marconi Type TF-785B, FM-AM, range 0.4 to 60 Mc.	£45	0	0
G.E.C. Type BW-232, range 500-1,000 Mc.	£120	0	0
Type 59 FM-AM, range 96-160 Mc.	£45	0	0

BEAT FREQUENCY OSCILLATORS

B.S.R., mains operated, range 0-5,000 c/s, output approx. 0.5 watts, with attenuator	£40	0	0
B.S.R. dry battery operated, portable, range 0-16,000 c/s, with attenuator	£40	0	0
G.R. Type 613, dry battery operated, range 0-12,500 c/s	£40	0	0

"Q" METERS

Marconi Type TF-329C, range 50 kc. to 50 Mc.	£75	0	0
Boonton Type 100-A, range 50 kc. to 50 Mc.	£75	0	0

All the above equipment is offered in perfect operating condition, and guaranteed.

Many other types of Test Equipment in stock.

We stock also a comprehensive range of communication receivers, Aircraft Radio Sets, Accessories, etc.

HEADPHONES

R.A.F. Type Headgear Assembly, comprising low or high impedance earpieces, including electro-magnetic microphone	£1	5	0
American Headsets HS-38, brand new, comprising two earpieces ANB-H-1, Cord and Plug PL-354	12	6	0

Please write for detailed stock list to:

Z & I AERO SERVICES LTD.,
19, Buckingham St., London, W.C.2

Telephone: TRAfalgar 2371/2

We always buy American Radio Equipment and Test Equipment of any description.

Best Buy at Britain's

HEAVY DUTY L.T. TRANSFORMERS. Standard tapped primary. Type A, 30 v. 36 Amp. or Type B, 50 v. 16 amp. Size 6in. x 5½in. x 8in. high. Weight 24 lb. BRAND NEW, not ex-Govt. Suitable for soil heating, rectifiers, chargers, etc., special offer, 55/- each, plus 5/- carriage.

EX-ADMIRALTY. Primary 250 v. 50 c.s. Secondary 5-0.5 v., 5-0.5 v., and 5-0.5 v., all at 5 amps., each winding. This means, in effect, that you can have 5, 10, 15, 20, 25, 30 v. at 5 amps. or other possible combinations. Size 4½in. x 4½in. x 6in. high. Weight 12 lb. BRAND NEW. A very useful transformer at only 39/6.

EX-ADMIRALTY. Primary 230 v. 50 c.s. Secondary 620-550-375-0.375-550-620 v. (620 v. at 200 mA., 550 v. at 250 mA.). Two rectifier windings at 5 v. 3 amps. each. Total rating 278 vA. Upright mtg. weight 24 lb. BRAND NEW, 42/6.

E.H.T. TRANSFORMERS. For VCR97, etc. Mains input. Output 2,500 v., 4 v. 2 a. and 2-0.2 v. at 2 a. Fully guaranteed at 35/-, plus 2/- postage. SPECIAL SURPLUS SNIP. 230 v. 50 c.s. input. 2 kV. R.M.S. output (2.8 kV. when rectified). Size 2½in. x 2in. x 3½in. high. Upright mtg. ONLY 15/- plus 2/- postage.

EX-MANUFACTURERS' SURPLUS. Drop through type. Pri. 200-250 v. 50 c.s. Secondary 310-0-310 v. 70 mA., 6.3 v. at 3 a., 4 v. at 2 a. Can be used with either 4 or 6.3 volt rectifier. Only 9/6 plus 1/- postage. A similar type, 325-0-325 v. 100 mA., 6.3 v. 4 a., 4 v. 2 a., supplied to callers only, 12/6 each.

METAL RECTIFIERS. Heavy duty, funnel cooled, 2 units required for bridge. Size 12in. x 12in. x 4½in. Input 36 v. R.M.S. Output 50 amps., £7/10/- per pair, plus 5/- carriage. BRAND NEW ex-Govt. RM4, 250 volts, 250 mA., only 12/6 each. Selenium, 300 volts, 100 mA. Brand new, ex-W.D., 6/9 each. 12 v. 1 amp. Full wave bridge, 7/6 each.

E.M.I. OUTPUT METER. Desk type incorporating a 2½in. 1 mA. meter together with instrument rectifier, etc. 2 ranges 0-500 milliwatts and 0.5 watts and decibel scale. Brand new in original manufacturers' boxes with instructions. Price 35/-, post 1/6.

METER BARGAINS, ALL BRAND NEW

15 v. (50~) mov. iron 2½in. pln. mtg....	8/6
3,500 volts moving coil 3½in. projection	10/-
150 milli-amp. 2in. sq. pln. mtg.....	7/6
20 amp. moving coil 2½in. dia.....	7/6
1 mA. 2½in. barrel flush pln. mtg.....	22/6
1 milli-amp. 2½in. barrel desk type	25/-
100 micro-amps. barrel pln. mtg. scaled 0-1,500 in 15 clear divisions. Only... .	42/6
500 mA. Thermo Couple 2in. sq. pln. mtg.	5/-

METER RECTIFIERS 1 mA. Salford Instruments, 8/6. 5 mA. Salford Instruments, 6/9. 2 mA., S.T.C. as used in E.M.I. Output Meter, 5/6. All are full wave bridge and brand new.

COMMUNICATIONS RECEIVER R.1155

World-wide reception is ensured by the R.F. and 2 I.F. stages. Five wavebands, 2 L.W., M.W. and 2 S.W. Magic-eye, large dial and vernier make tuning simple. Contained in attractive black crackled cabinet, its handsome appearance does justice to its superb performance. Supplied with FREE BOOKLET giving circuit data and details of the power pack required for A.C. mains operation. Fully aerial-tested before despatch. Gladly demonstrated to callers.

BRAND NEW. "MINT" condition, in ORIGINAL MAKER'S TRANSIT CASES, £11/19/6. Shop soiled models, as new, £9/19/6. A few only used models, £7/19/6. 10/6 carriage on each. Send S.A.E. for full details of power packs and receivers, or 1/3 for booklet. D.F. Loops and Visual Indicator Meters available.

A.C. MAINS POWER PACKS AND OUTPUT STAGE. Enable the R.1155 to be used to operate speaker from 200/250 volts A.C. without ANY MODIFICATION WHATSOEVER. All our power packs have heavy duty transformers, are complete with leads and Jones plugs and are guaranteed for 6 months. Type A. In smart black metal case, size 8in. x 4½in. x 6in. less speaker, price £4/10/- plus 3/6 carriage.

Type B. With built-in 5in. speaker in black metal case size 13½in. x 5½in. x 7½in. Price £5/5/- plus 3/6 carriage.

Type C. With an 8in. speaker in specially designed beautiful black crackle cabinet speaker to match receiver, size 11½in. x 10½in. x 6in. A de Luxe job. Price £6/10/- plus 3/6 carriage.

NOTE: 10/- REDUCTION WHEN PURCHASING ANY OF THE ABOVE POWER PACKS WITH RECEIVER.

R.F. UNITS. ALL BRAND NEW and BOXED. RF24, 20-30 Mc/s., 12/6. RF25, 40-50 Mc/s., 17/6. RF26, 50-65 Mc/s. 29/6 and RF27, 65-85 Mc/s., 32/6.

45 Mc/s. PYE STRIPS Vision unit for London frequency. Complete with 6 EF60 and EA50. Circuit provided. Brand new. £3/10/- each.

VALVE VOLTETERS. Ex-R.A.F. Operate from standard A.C. mains, stabilised H.T. supply. Three ranges: 50/200/500 volts D.C. Meter employed 2½in. 1 mA. F.S.D. Contained in handsome wooden instrument case size 14in. x 8½in. x 9in. Complete with all valves and tested prior to despatch. In brand new condition and a real bargain at only 79/6 plus 5/6 carriage.

HOUR-METERS. Indicate the time any given A.C. mains operated apparatus has been in use. Ideal for life testing, process timing, etc. BRAND NEW and BOXED. 39/6 each.

BLOCK CAPACITORS. 8 mfd. 600 v. D.C. wkg. at 71° C. size 4 x 2 x 4½in. high. Very suitable for all good quality amplifiers, etc. Brand new. Price 5/- each.

HEAVY DUTY SLIDING RESISTORS 250 watts rated to carry 25 amps., resistance 0.4 ohms, suitable for physics labs., charging board, etc. Laboratory type with worm drive, on metal stand, size 9in. x 4in. x 6in. high. Price 7/6 each. BRAND NEW.

B.F.O.s. Ganging Oscillators, 18-19-21 & 22 sets; 1403 Transmitters, Indicators 233, Valve voltmeters at Clearance Prices.

VALVE BARGAINS

New and in original boxes. 6AG5, VR53 (EF39), VR56 (EF36), 6K7G, 6CS5Met., 6H7-Met., VT501 (TT11), all at 6/6. RK34, EI148, 954, 2X2, VU120A, all at 2/6. Replacement bargain EL50, 5/-.

New, ex units 6AK5, VR91 (EF50), Sylvania, VT501 (EL32), 807, 7/6. VR65 (SP61), 3/6.

VT501 (TT11), 3/6. CV6, VR78. VR92 (EA50), 1/6 each, 15/- dozen.

RACKS. 6ft. "U" channel P.O. type for 19in. panels, heavy angle base. Price 79/6, plus carriage at cost.

H.R. HEADPHONES. Consist of two high resistance earpieces with adjustable metal headbands. Price, less cord, 6/6.

POWER UNIT TYPE 285. A.C. mains input 230 v. 50 cps. Outputs E.H.T. 2 kV. @ 5 mA., H.T. 450 volts @ 200 mA., L.T. 6.3 v. @ 17 amps., fully smoothed, 2 chokes, paper condensers, etc., complete with valves SU4G, VU 120 and EF 50. This was the ground power unit for the "Gee" equipment and should be very useful for T.V., etc. A REAL BARGAIN AT ONLY 69/6.

INDICATOR UNIT TYPE 95. Exactly the same as the 62 indicator unit but is 50 cycle version. Double decker chassis, containing loads of components, 16 SP61, 2 EB34, 4 EA50, etc., etc. Brand new condition (less VCR97). Only 45/- plus 7/6 carriage.

INDICATOR TYPE 182A

Indicator contains 3 EF50, 1 SU4G, 4 SP61 and a 6½in. C.R.T. Type VCR 517, complete with Mu Metal-screen, 9 wire wound pots, with large assortment of resistors and condensers. Can be converted to Oscilloscope (as described in "Radio Constructor"). Circuit supplied. Tubes have no "Cut-off" and can be demonstrated to callers. BRAND NEW (less relays). In original transit case, 67/6, plus 7/6 carriage.

HEAVY DUTY POTENTIOMETERS. Wire-wound on porcelain former, 2½in. diam. 20 W. 1,200 ohms, 6/6 each. Colver-type wire-wound 5,000 ohms, 2½in. diam. 7/6 each.

X'TALS

465 kc/s. S.T.C. ½in. pins suitable for crystal, gates, IF checking, etc. Brand new, boxed 10/- each.

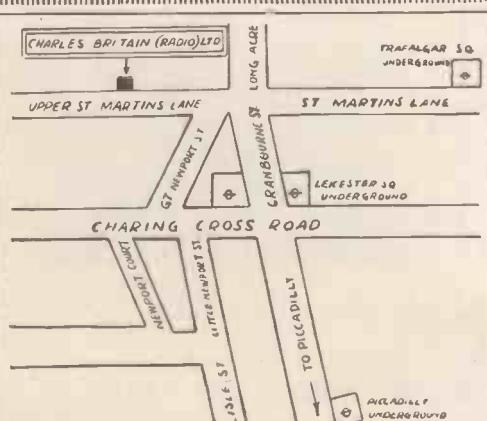
200 kc/s. American G.E.C. ½in. pins suitable for crystal calibrators, etc. Brand new, boxed, 10/- each.

100 kc/s. ½in. pin spacing. British, ex new units, 15/- each.

U.H.F. SIGNAL GENERATORS by R.C.A. TYPE 710A. Cover 370 to 560 Mc/s. Large directly calibrated dial. Carrier level and 400 c.f.s. modulation monitored by large 200 micro-amp. meter. Precision piston attenuator. For A.C. mains operation 117 volts 50/60 c/s. Complete with instruction manual. BRAND NEW. £35.

TEST SET TYPE 87. Ex-R.A.F. corresponds to TF796. Incorporates a signal generator covering 150 to 300 Mc/s. Also pulse generator. Operates from standard A.C. mains. Contained in handsome grey instrument case size 23in. x 10in. x 8½in. Basis of the audio signal generator described in "W.W." Aug./Sept. 1949. Complete with all valves and in brand new condition. Price £4/19/6. Circuit included.

BARGAINS, BARGAINS, BARGAINS. HUGE STOCKS OF COMPONENTS, RECEIVERS, VALVES, AT SPECIAL REDUCED PRICES FOR CALLERS.



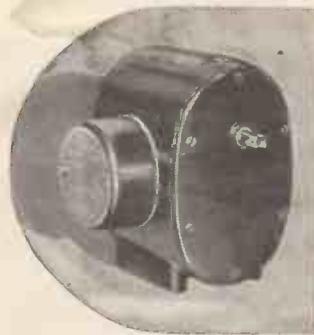
CHARLES BRITAIN (Radio) Ltd.

11 UPPER SAINT MARTIN'S LANE
LONDON, W.C.2. TEMple Bar 0545

One Minute from Leicester Sq. Station (up Cranbourne St.)
Shop Hours: 9-6 p.m. (9-1 p.m. Thursday)

Open all day Saturday

Fractional H.P. MOTOR UNITS



The ORAYTON 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.

R.Q.G GEARLESS

Running at 2,700 r.p.m. continuously or intermittently in either direction or continuously reversed.

R.Q.R GEARED

For continuous or intermittent running or reversing at speeds from 27 mins. per rev. to 600 revs. per min., with or without self-switching up to 2 1/3 r.p.m.

R.Q.H GEARED

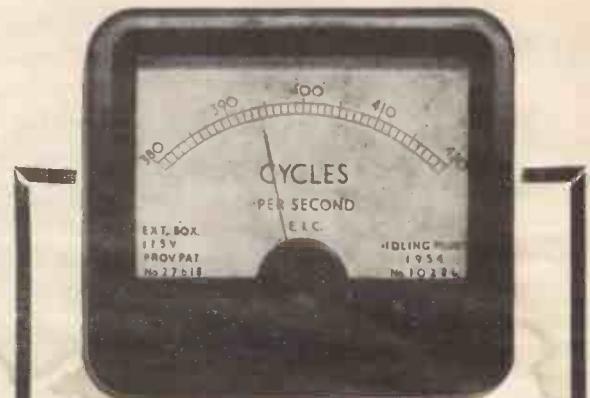
For high final shaft speeds for continuous or intermittent running, forward or reverse.

Send for List No. N. 302-1.

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

-The DRAYTON 'R.Q.'

The Drayton Regulator & Instrument Co. Ltd., West Drayton, Middlesex



FREQUENCY METERS

2 1/2-8" up to 10,000 cycles

DIFFERENTIAL A.C. CURRENT METERS

COMPARING THE MAGNITUDE OF TWO CURRENTS.

A full range of switchboard and portable instruments, including four types of Millirange Meters.

THE ELECTRICAL INSTRUMENT CO. (HILLINGTON), LTD.

Boswell Square Industrial Estate, Hillington, Glasgow, S.W.2. Halfway 1166 and 2194

M O T E K



TWO SPEED—SIMPLE PUSH BUTTON CONTROL

THE NEW K6 UNIT

List Price 19 GNS.

SEE AND HEAR IT AT
YOUR LOCAL DEALER

MODERN TECHNIQUES

138-144 Petherton Road, London, N.5

Tel.: Canonbury 5896

BK CORNER HORN ENCLOSURES

Types H.C.8 & H.C.10

For use

with

high quality

8" and 10"

loudspeaker

units



Available in a wide range of hand-polished veneers in both contemporary and traditional designs.

H.C.8 £24

H.C.10 £26



H.P. TERMS AVAILABLE

* Send for illustrated brochures

B. K. PARTNERS LTD.

229 Regent St., London, W.1. (Entrance Hanover St.) *Phone: REG 7363

These and other high fidelity equipments are demonstrated at our showrooms. Daily 10.30 a.m. - 5.30 p.m. Saturdays 10.30 a.m. - 12.30 p.m.

"MUST HAVE" BARGAINS!

BC.610 MODULATION TRANSFORMERS. Brand New spares for this famous American Transmitter. In Maker's Original Cases. ONLY £5 each.

RF UNITS TYPE 26 and 27. For use with the R.1355 or any receiver with a 6.3 v. supply. These are the variable tuning units which use 2 valves EF54 and 1 of EC52. Type 26 covers 65-50 Mc/s (5-6 metres) and Type 27 covers 85-65 Mc/s. (3.5-5.0 metres). Complete with valves, and BRAND NEW IN MAKER'S CARTONS. ONLY 29/6 each.

"PYE" 45 MC/S I.F. STRIP. Ready made for London Vision Channel, this 5-stage strip contains 6 valves EF50 and 1 EAS0. Supplied with circuit and details of very slight mods. required. BRAND NEW, ONLY 69/6 or less valves 50/-.

MODULATOR TYPE 67. Contains fully smoothed normal A.C. Mains Power Pack, transformer being 345 v.-0-345 v. at 200 mA., 6.3 v. 5 a., 6.3 v. 250 mA., 5 v. 2 a., 6 valves SP61, 3 of EAS0, 2 of EB34, and 1 of 524. BRAND NEW IN MAKER'S CASES. ONLY 47/6 (carriage 7/6).

TRANSFORMERS. Manufactured to our specification and fully guaranteed. Upright mounting, fully shrouded, normal primaries.

425 v.-0-425 v. 250 mA., 6.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a., 65/-.
350 v.-0-350 v. 160 mA., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a., 47/6.
350 v.-0-350 v. 150 mA., 6.3 v. 5 a., 0-4-5 v. 3 a., 37/6.
250 v.-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., 37/6.
250 v.-0-250 v. 60 mA., 6.3 v. 3 a., 5 v. 2 a., 21/-.

Please add 2/- per transformer postage.

TRANSFORMERS, FILAMENT. 6.3 v. 2 a., 7/6 (postage 1/-), 6.3 v. 3 a., 10/6.

TRANSFORMERS, EHT. Upright mounting.

EHT for VCR97 Tube 2,500 v. 5 mA. 2 v.-0-2 v. 1.1 a., 2 v.-0-2 v. 2 a., 42/6.

EHT 5,500 v. 5 mA., 2 v. 1 a., 79/6.
EHT 7,000 v. 5 mA., 2 v. 1 a., 89/6.
EHT 7,000 v. 5 mA., 4 v. 1 a., 89/6.

Please add 2/- per transformer postage.

TRANSFORMERS, EX W.D. AND ADMIRALTY, built to more than 50 per cent. safety factor with normal A.C. mains primaries. Brand New and unused. 330-0-330 v. 100 mA. 4 v. 3 a., 22/6.

L.T. 6.3 v. 7.7 amp., 4.2 v. 2.5 amp. 4 v. 1 amp., 19/6.

L.T. HEAVY DUTY. Has 3 separate windings of 5 v.-0-5 v. at 5 amps., and by using combinations will give various voltages at high current. ONLY 39/6. Please add 2/6 per transformer postage.

COMMUNICATIONS RECEIVER R.1155

The famous ex-Bomber Command Receiver known the world over to be supreme in its class. Covers 5 wave ranges: 18.5-7.5 Mc/s., 7.5-3.0 Mc/s., 1,500-600 kc/s., 500-200 kc/s., 200-75 kc/s., and is easily and simply adapted for normal mains use. full details being supplied. Aerial tested before despatch, BRAND NEW AND UNUSED IN MAKER'S TRANSIT CASES, ONLY £11/19/6

BRAND NEW BUT SHOP-SOILED, also tested working before despatch, £9/19/6 (carriage 10/6).

A.C. MAINS POWER PACK OUTPUT STAGE, in black metal case, enabling the receiver to be operated immediately, by just plugging in, without any modification. Can be supplied as follows, WITH built-in 6in. P.M. Speaker, £5/5/-, LESS speaker, £4/10/- (carriage 3/6).

DEDUCT 10/- IF PURCHASING RECEIVER AND POWER PACK TOGETHER.

Send S.A.E. for illustrated leaflet, or 1/3 for 14 page booklet, which gives technical information, circuits, etc., and is supplied free with each receiver.

COMMUNICATIONS RECEIVER RA-1B

Just released by the Air Ministry, this is a superb 6 waveband American Receiver covering 150-315 kc/s., 315-680 kc/s., 680-1500 kc/s., 1,80-3.70 Mc/s., 3.70-7.50 Mc/s., 7.50-15.0 Mc/s., Takes in all important bands, including Trawlers. Illuminated vernier scale is most accurately calibrated, and slow motion tuning is completely free from backlash. Incorporates AVC, CW, and Sensitivity controls. Valves are 5 of 6K7G, 1 of 6L7G, 1 of 6R7G, and 1 of 6K6G (output). Case size 10in. x 7in. x 14in. finished in black crackle. Power requirements 6.3 v. and 250 v. All receivers aerial tested before despatch. ONLY £11/19/6 (carriage etc., 10/6).

BENDIX TRANSMITTER TA-12-D

Another magnificent item of American equipment. Wave ranges are 1050-1700 kc/s., 2.0-3.4 Mc/s., 3.0-4.8 Mc/s., 4.3-7.0 Mc/s., and 1 spot frequency on each can be selected. Valves employed are 3 of 807 and 4 of 12SK7. A "MUST" for every transmitting enthusiast. BRAND NEW. ONLY £4/19/6 (carriage etc., 10/6)

METERS

F.S.D.	SIZE AND TYPE	PRICE
5 milliamp.	D.C. 2in. Flush square.....	7/6
100 "	D.C. 2½in. Flush circular.....	12/6
150 "	D.C. 2in. Flush square.....	7/6
500 "	thermo 2in. Flush square.....	5/-
500 "	thermo 2in. Proj. circular.....	5/-
20 amps.	D.C. 2in. Proj. circular.....	7/6
40 amps.	D.C. 2in. Proj. circular.....	7/6
30-0-30 amps.	D.C. Car type moving iron.....	5/-
15 volts	A.C. 2½in. Flush, circ., mov. iron.....	8/6
All meters Brand New in Maker's Cartons.		

100 MICROAMPS METERS

2½in. circular flush mounting. Widely calibrated scale of 15 divisions marked "yards" which can be rewritten to suit requirements. These movements are almost unobtainable today and being BRAND NEW IN MAKER'S CARTONS are a snip at ONLY 42/6.

HOUR METERS

For checking running time of equipment up to 9,999 hours. Operates from normal 50 cycles mains. BRAND NEW IN MAKER'S CARTONS. ONLY 39/6.

MODEL MAKERS MOTOR. Reversible poles. Only 2in. long and 1½in. diameter, with ½in. long spindle. Will operate on 4, 6, 12 or 24 volts D.C. ONLY 10/6.

12 v. AMERICAN DYNAMOTO. Output 255 v. 60 mA. Ideal for car radio or running electric shaver from car battery ONLY 22/6.

Cash with order please, and print name and address clearly

U.E.I. CORPORATION

(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).

Radio Corner, 138, Gray's Inn Road,
London, W.C.I. Phone: TERMINUS 7937

SPECIAL OFFER. Ex-Admiralty LT. TRANSFORMER. Normal mains input, output 4 v. 20 amps. C. New and unused, these have become damaged, but are still usable, the damage being confined to broken fixing lugs, and/or broken bakelite terminal panels. Formerly sold at 30/-, now offered at 17/6 (post, etc., 2/6).

POCKET VOLTMETERS. Not Ex-Govt. Read 0-15 v. and 0-300 v. A.C. or D.C. BRAND NEW AND UNUSED. ONLY 18/6.

SUNDRIES. Warning light assemblies, Red, Green, or Clear, 2/- ea. Miniature plugs and sockets, 3 way 7d. pair, 4-way 9d. pair, 5-way 10d. pair. Jack plugs, 2/- each. 3in. coil formers with slug 10d., ½in. 8d. Valveholders 1.O. & M.O. Amphenol, 6d. ea., B3G (diode) 6d., B3G ceramic 10d., Brit. 5-pin Ceramic 1/- Co-axial plugs and sockets, Pye 6d. ea., Bellini, plug 1/3, socket 1/4, coupler for joining cable 2/- (post 3d. per item).

POTENTIOMETERS, less switch, long spindle, 1K, 3K, 5K, 10K, 20K, 50K, 100K, 250K, 500K, 2M, 2½/9 ea. short spindle 50K, 75K, 1M, 2/- ea. WITH switch long spindle, 1K, 2K, 2.5K, 10K, 15K, 20K, 25K, 50K, 75K, 250K, 500K, 2M, 3/9 ea. (post 3d.).

SPRAGUE .1 mfd. 600 v. metal tubulars, 10d. ea., 9/6 dozen (add post).

SILVER MICAS AND MICAS. 2pf, 5pf, 10pf, 11.5pf, 15pf, 20pf, 25pf, 40pf, 45pf, 47pf, 50pf, 75pf, 80pf, 100pf, 115pf, 160pf, 300pf, 430pf, 440pf, 1050pf, 2300pf, .0001 mfd., .00016 mfd., .0002 mfd., .00025 mfd., .001 mfd., .002 mfd., .005 mfd., 5d. each, or 3/6 per dozen 1 type.

INTERNATIONAL OCTAL PLUG
Fits into I.O. valveholder, 2/- (post 3d.).

GANGED POTENTIOMETERS. Double 50K and double 1 meg. 7/6 each.

CERAMIC 2-WAY 3-BANK SWITCHES, 7/6 each.

24 v. BLOWER MOTORS. Only 12/6.

CRYSTALS. British Standard 2-pin 500 kc/s. 15/-. Miniature 200 kc/s. and 465 kc/s. 10/- each.

SPEAKERS. P.M., 6½in. less trans., 19/6; 8in. less trans., 16/6; 10in. with trans., 27/6 (postage 2/- ea.).

CHOKES. 10H 60 mA., 4/-, 5H 200 mA., 7/6, 20H 120 mA., 10/6 (post 1/- ea.).

MU-METAL SCREEN FOR VCR97 TUBE, etc., ONLY 8/6.

CABLE. CLEARANCE OFFER of 23/36 twin polythene. Weatherproof, and suitable for outdoor use, 39/6 per 100 yard coil (carriage, etc., 3/6). S.A.E. for sample, trade enquiries invited.

Transformers

Transformers

Transformers

QUALITY-RELIABILITY

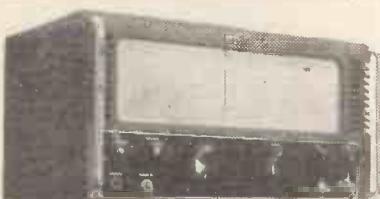
For the Mullard Amplifier.
For the Osram 912 Amplifier.
For the Williamson Amplifier.
C. R. Tube Isolation Transformers.
Instrument Transformers,
and all popular types.

FROM

Ellison Transformers

LIMITED

62, BRIDGE ST. NORTHAMPTON
AND ALL LEADING COMPONENT DEALERS



EDDYSTONE COMMUNICATION RECEIVERS
Now available on attractive Hire Purchase Terms.

Model	Cash Price	Deposit	Monthly
740	£42 15 0	£8 11 0	£3 2 10
840A	£49 0 0	£9 0 0	£3 13 4
750	£68 0 0	£13 12 0	£5 0 0
680	£106 0 0	£21 4 0	£7 15 6

Instalments are for 12 months.

The model illustrated is the new 840A. All models are for A.C. operation except the 840A which is A.C./D.C. 110/250 v. making it especially suitable for universal use. Descriptive literature of all models gladly forwarded.

Latest Eddystone Component Catalogue 1/-.

The
Eddystone
Specialists

RADIO SERVICES LTD.

55 COUNTY ROAD, LIVERPOOL, 4
Telephone: AINTREE 1445
ESTAB. 1935

Branch Address: MARKET CROSS, ORMSKIRK

WE PAY TOP PRICES

FOR
AMERICAN SURPLUS
ELECTRONIC EQUIPMENT
LOOK AT THESE EXAMPLES

For equipment in good condition

Receiver R54/APR4 complete	£200
Test Sets, TS13	£100
Frequency Meter TS175/JU	£80
Frequency Meter BC221	£20
Receiver BC348R	£25

We pay similar remarkable prices for many other U.S.A. units not listed above. We particularly require American test equipment. If you have anything to offer, telephone Central 7834, transfer charge.

TO HAMS WHO CONVERTED BC348, BC342, BC312
Post to us the dynamotors and power units which you removed.
We pay top prices for these items i.e., DM28, DM21, RA20.

TO OVERSEAS BUYERS

We have the largest stock in Europe of American Government surplus electronic equipment and we would be pleased to quote by return of post against your enquiries. The following are a few examples only of the equipment which we can supply from stock.

BC221 Frequency Meter.
BC348 Receiver.
SCR522 Transmitter/Receiver.
ET4336 Transmitter.
SCR720C Search Radar complete, also separate units and spare parts.

Please write for our list.

Deal with the firm that has been established for twenty-five years.

ALTHAM RADIO CO.

JERSEY HOUSE, JERSEY STREET
MANCHESTER 4

Telephone : Central 7834/5/6

G2AK

This Month's Bargains

G2AK

THE IDEAL POWER TRANSFORMER FOR THE TABLE TOP RIG.

This Parmeko-made transformer has the following conservative ratings: Primary, 230 v. 50 c/s. Secondary, 620/550/375/0/375/550/620 V. Rated at 275 v.A. will give 620 or 550 volts at 200 mA. simultaneously with 375 V. at 250 mA. All the H.T. you require for R.F. and Modulator. Also 2.5 V. 3 A. windings for suitable rectifiers such as SR4GY, 5Z3, 83, 5U4, etc. Weight 24lb. Size 6½ x 6½ x 5½ in. high. Worth at least £7. Our price £3 only, Carr. Paid. C.W.O. only, no C.O.D.

We regret that we cannot accept orders for these from EIRE or abroad.

METERS: 2½in. Scale Flush Mounting. 0-10 mA. Ditto 0-30 mA. ditto 0-100 mA., 12½ in. each. 2½in. Scale Square Flush Mounting 0-50mA., ditto 0-150 mA., ditto 0-3 Amp. Thermo., ditto 0-20 V. d.c., ditto 20/200 Amp. d.c., 7½ in. each. 2½in. Scale Projecting Type 0-15 Amp. Thermo., 7½ in. Scale Round Flush 0-1 Amp. R.F., ditto 0-350 mA. Thermo., 7½ in.

SPECIAL OFFER,
Gen Amer. 807 Valves, 6/- each or 4 for £1.

P.I. CIRCUIT OUTPUT TUNING CONDENSERS.

Made by E. F. Johnson Co., U.S.A. Max. cap. 500 p.f. 1,500 v. rating. Ceramic insulation, size 5in. long x 2½in. wide x 2½in. high, excluding spindle projection. Our price only 15/- post free.

ABSORPTION WAVEMETERS. 3.00 to 35.00 Mc/s., in 3 switched bands. 3.5, 7, 14, 21 and 28 Mc/s. Ham bands marked on scale. Complete with indicator bulb. A MUST for any ham shack. Only 10/6. Post and packing 1/-.

HEADPHONES: L.R. Type CLR No. 3, 9/6, DLR No. 2, 13/6, H.R. Type CHR Mx. 2, 17/6, DHR 5b (very sensitive), 18/6, p. & p. 1/-.

CONDENSERS: 8½F 600 V. Trop. 750 V normal condensers. New ex-W.D. stock, 5/6, p. & p. 1/-.

Carriage paid on all orders over £1 except where stated. Please include small amount for orders under £1.

Please print your name and address All Mail Orders to:-

CHAS. H. YOUNG, G2AK

Dept 'W' 102 HOLLOWAY HEAD, BIRMINGHAM 1

'Phone: MIDLAND 3254

All callers to 110 DALE END, BIRMINGHAM 4

'Phone: CENTRAL 1635

PROOPS BROS. LTD.

The Walk-around Shop

Miniature POCKET RADIO

incorporating high "Q" technique using the New Ferrite rod. Made possible by simple conversion of the 'Medresco' Deaf Aid.

RADIO MINDED AMATEURS will at once grasp the interesting possibilities of this unique unit. Good reception (without using a trailing aerial) of broadcast programmes wherever you are, in home, office, cycling or hiking, etc.

The Complete KIT of parts includes a Type OL10 Deaf Aid (with Crystal Microphone) in perfect working order and miniature ear phone with moulded ear insert attached; Ferrite rod 4in. x 5/16in. dia., germanium diode, components, circuit diagram and full instructions.

£2.6.0 Post Paid

Batteries: 1.5 v. L.T. (Type D 18) 8d.
30 v. H.T. (Type B 119) 4/3.

NOTE: The Crystal Microphone in the Deaf Aid is not used in the Pocket Radio; it can if desired be used as a general microphone and it does not require a matching transformer.

All who have already purchased our Conversion Kit can obtain the Ferrite rod at 5/6 post paid.

Come along. SEE and
HEAR this new Miniature
POCKET RADIO
demonstrated.

FOR DEAF PEOPLE. The 'Medresco' Deaf Aid in perfect working order is also available with miniature ear phone and moulded ear insert for ONLY 35/9, post 1/-, Batteries extra. See details above.

AERIAL SECTIONS.—12in. long, sleeved for making up length desired, 1/8in. diam. Copper plated, 2/3 per doz. sections. Post paid.

HYDROMETERS.—Ball type No. 1 Portable, 6in. long, 1/6 post paid.

HEADBAND TORCHES.—(Leave both hands free for awkward jobs.) M.E.S. holder, bulb and reflector, headband with rubber pad, battery box with 4ft. cable; all wired ready for use. Price 4/-, post 1/-. Needs 4½ V. battery Vidor V0017 or similar standard battery.

VALVES.—6SN7gt 6/9 (ex-new surplus units) 807 (American) 8/6. Disc-sealed Triode (Lighthouse tube GL446A (19E4) Boxed, New, 25/-. All post paid.

NOTE: Orders and Enquiries to Dept. 'W.'

INSPECTION LAMP.—2 pole S.B.C. Holder with 6ft. spring-loaded lead in case 3in. x 3in. x 4in. with on-off switch on front panel. Price 6/- post paid.

SLOW MOTION DRIVE.—Reduction 40-1. Excellent for S.W. operation. Price 3/6 post paid.

INDICATORS.—Aircraft undercarriage type with 4 miniature E.S. holders in bakelite case. Price 1/6 post paid.

TANNOY P.A. SPEAKERS.—8 watt, 6in. diam. P.M. with re-entrant baffle mounted in wooden cabinet with line OP trans. Military surplus Cat. No. ZB11565. Price 20/- post paid. Enquiries invited for quantities.

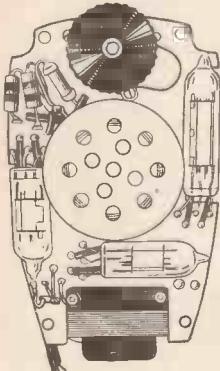
AMPLIFIER UNIT Ex-TRII43A.—A 3-stage transformer coupled amplifier. Push pull VT52s output to modulate push pull VT501s. Circuit diagram free. Price, less valves, 4/6 post paid.

Shop hours : 9 a.m. to 6 p.m. Thursday : 9 a.m. to 1 p.m. OPEN ALL DAY SATURDAY.



TECHNICAL DESCRIPTION

A three-stage resistance coupled amplifier, two stages with CV 385 (U.S.A. equivalent CK 505) Pentodes and a CV 386 (U.S.A. equivalent CK 502) output Pentode. Total L.T. supply required is 1.5 V. at .06 A., total H.T. supply required is 30 V. at approximately 1.2 mA. A sensitive Crystal microphone is incorporated. The output circuit consists of a 60H choke with a feed back winding and suitable condenser to isolate the H.T. current. A two position tone control switch is incorporated. A knurled knob (see case) gives finger-tip volume control. Case sizes: length 3½in. Width 2½in. Depth 1in. Battery leads and plugs are fitted.



CONVERSION DETAILS

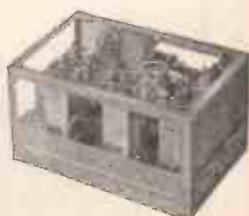
All components for the conversion are fitted into the space originally occupied by the crystal microphone with the exception of the Ferrite rod used as an aerial. The conversion unit consists of a germanium diode detector with a high "Q" Ferrite rod; this is followed by the 3-stage amplifier of the 'Medresco' unit, giving high amplification and good quality reception.

The conversion can be carried out in approximately 30 minutes.

RECEIVER UNIT

Ex-TRII43A.

Suitable for conversion to 2 metres and F.M. Wrottemham. Circuit diagram free.



Price—less valves, 9/-, post paid.

TRANSMITTER UNIT Ex-TRII43A. Suitable for conversion to 2 metres. Circuit diagram and coil conversion details supplied free. Price, less valves, 5/-, post paid.

PROOPS BROS. LTD.

52 TOTTENHAM COURT ROAD

LONDON

The Walk-around Shop

Telephone : LANGHAM 0141

PULLIN
SERIES 100
TEST METER
AC/DC 10,000 ohms
21 RANGES
100µA to 1000V
COMPLETE IN DIE-CAST
CASE WITH TEST LEADS
CLIPS AND PRODS
FULLY GUARANTEED

SENT POST FREE FOR £2.10s.
DEPOSIT AND TEN FURTHER MONTHLY
PAYMENTS OF £1. CASH PRICE 11 GNS

Frith
RADIOCRAFT Ltd
69-71 CHURCH GATE LEICESTER
PHONE 58927

"LAFCO" EASY PAYMENT GUIDE LOOK FOR US EVERY MONTH HERE



THIS IS THE METRIX MODEL 460 with 28 ranges. Internal resistance 10,000 ohms per volt A.C. and D.C. Voltages 3.7-5-30-75-150-300-750 v. A.C. and D.C. All-round resistance from 0 to 2 megohms in two ranges. Dimensions: 5½ in. x 4 in. x 1½ in. Weight: 1lb. 6oz. Cash Price: £14/6/- or 35/- deposit and 8 monthly payments of 35/-.

METRIX MODEL 410.—19 ranges with a sensitivity of 100 ohms per volt from 75-750 volts. A.C. and D.C. Volts 15-75-150-300-750. Resistance 0-100 ohms. Weight: 1lb. 2oz. Cash Price: £9/2/11 or 22/5 deposit and 8 x 22/5. Send stamp for leaflets of the Metrix range, all of which are available on easy terms.

SOLDIER THE "PRIMAX" WAY FOR 8/7 DEPOSIT AND 8 monthly payments of 8/7

PRIMAX 70/11 (Instant Heating) ready for use in 6 seconds, and weighs only 23ozs.)

Also Handyman's tools as follows: B. & D. 3in. Electric Drill 13/11 deposit and 8 monthly payments of 13/11 (25/19/8 CASED), 3in. Electric Drill Kit 27/11 and 8x27/11 (£11/17/8). Craftsman Lathe, 12/3 and 8x12/3 (£5/5/-). Sander Polisher Kit 23/- and 8x23/- (£9/17/6). (This list is not complete.)

We also stock Wolf, Bridges, Burgess products, etc. Send stamp for leaflet. If you have any particular item in mind, please let us know, we can probably obtain for you and quote our terms.

Desk 159, LAFCO COMPOUNDS LTD.
3, CORBETTS PASSAGE, ROTHERHITH
NEW RD., S.E.16. BER 4341 (Ext. 1)

Radiospares Quality Parts

The
Service Engineer's
First Choice

COMMUNICATIONS EQUIPMENT



60-WATT RADIOTELEPHONE
1.5-12 mc/s. for A.C. mains or 12 and 24 volt D.C. This non-radiating type communication receiver has 8 valves and BFO. Suitable for Land or Marine use. With 7 crystals or available with precision VFO and 5 crystals. Price £225 complete, ex works.

HALLICRAFTER RADIOTELEPHONES
25 watt R/T 24 volt 1-12 mc/s. with 7 crystals, £150.

Press-button Crystal Controlled R/T equipment in stock for mobile or marine use. RECEIVERS AR88, AR77, S27, etc.

Full details upon request

Export Enquiries Invited

SOUTHERN MARINE RADIO CO.

353a Ballards Lane, London, N.12.
Hillside 7951



DECCA RECORD PLAYERS
Standard or L.P.
List Price £12/1/6
OUR PRICE
6 GNS.

Packing, carriage, insurance, etc., 10/6.

Decca 78 r.p.m. variable speed record players fitted centre drive Garrard motors, 11" plug-in heads, sapphire stylus, Rexine case. List price £12/18/6. Our price £8/19/6. Packing, carriage, insurance, etc., 10/6.

Send stamp for bargain list of record players.
RONALD WILSON & Co.
12, BRIDGE ST., WORCESTER

Good Investments

CONTACTORS, by leading makers. D.P. on-off with auxiliary circuit for bell or light, or 3-pole on-off arranged with slow make action for 1 or 2 seconds, quick break. 415 volts, 15 amps, with operating coil wound for 115 volts A.C. or to specification.

NIFE BATTERIES, for long life. 1.2 volts, 45 a.h. per cell, 30/-, post 2/-. Crate of 10 cells for 12 volts 45 a.h., £12/10/-, carr. 10/-.

MOTOR PUMPS. 230 volts, a.c., lift 3ft., head 10ft., capacity 120 g.p.h., £7/10/-, carr. 2/6. 12 volt d.c. model, lift 2ft., head 10ft., capacity 100 g.p.h., £5/10/-, carr. 2/6.

SEWING MACHINE MOTORS. New and guaranteed, radio suppressed, 230 volts A.C./D.C., with fixing bracket, foot control and needle light, £6/10/-, carr. 2/6.

BATTERY CHARGERS. The Lesdix "NITENDAY" Battery Charger keeps your accumulator in good order during the winter months. Double wound transformer, metal rectifier wired in vent, metal case with Ammeter and terminals; for use on 230 volt A.C. 50 cycle supply, output 12 volts 4amps, 85/-, carr. 3/6, or 6 volts 3amps, 75/-, carr. 3/6.

FLEXIBLE DRIVES for small motors, 7ft. long, 5/6, post 1/-.

TERRY ANGLEPOISE LAMPS for drawing boards or Workshop wall or machine fixing. Will stay in any position; now, with S.B.C. Lampholder, flex and shade, 35/-, post 2/6.

PERISCOPE. Ex-W.D. in ali. case each containing angle prism. Size 3½ in. x 4½ in. x 1½ in. Easily extended by wood or metal strips to any height required. 6/3 per pair, post 1/9.

REPAIRS to Variable Slider Resistances and Motor Starters; best quality resistance wires used. Prices moderate.

Leslie Dixon & Co.

Dept. A, 214 Queenstown Road, London, S.W.8
Telephone: MACaulay 2159

The NEW ACRU CELLOPHANE SEALING IRON

Gives the right heat in the right spot and makes perfect joints. Suitable for most plastics.



Ask for leaflet

THE ACRU ELECTRIC TOOL MFG. CO.,
CHAPEL STREET, LEVENSHULME, MANCHESTER, 19.

Tel.: Rusholme 4613

C.R.T. ISOLATION TRANSFORMERS

Designed to cover practically every demand for Transformers for Cathode Ray Tubes having Heater/Cathode short circuit or for C.B. Tubes with falling emission. Type A. Low leakage windings. Ratio 1-1.25 giving a 25% boost on Secondary.

2 volt	10/6 each	With Tag
4 volt	10/6 each	Panel and
6.3 volt	10/6 each	Solder Tags
10.8 volt	10/6 each	
13.3 volt	10/6 each	

Type B. Main Input 220/240 volts. Multi Output 24/12/7.5/10 and 12/10. Input with tags which increase output volts by 25% and 50% respectively. This transformer is suitable for most Cathode Ray Tubes. The MOST versatile Low Capacity C.R. Transformer with Universal Output. With Tag Panel and Solder Tags. 21/- each.

Type C. A most useful low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 230/240 volts. Output 2.24-21-21-3 volts at 2 amps. With Tag Panel and Solder Tags 17/6 each. All Isolation Transformers are individually boxed, labelled and clearly marked with relevant data.

Volume Controls

80 ohm CABLE COAXIAL

Midget type. Long spindle. Guaranteed 1 year. All values 10,000 ohms to 2 Meg-ohms.

No Sw. S.P.S.W. D.P.S.W.

3/- 4/- 4/9

COAXIAL PLUGS 1/2

SOCKETS 1/2

LINE CONNECTOR 1/2

OUTLET BOXES 4/6

Semi-air spaced Polythene

insulated. 1/8 in. diameter.

Stranded core.

Losses cut 50%.

9d. yd.

BALANCED TWIN FEEDER per yd. 6d.

80 TWIN BALANCED FEEDER 1/- yd. { 80 ohms

50 OHM COAXIAL CABLE, 8d per yd. 1/8 in. dia.

TRIMMERS, Ceramic, 30, 50, 70 pf., 9d. 100 pf., 150 pf.

1/3; 250 pf., 1/6; 600 pf., 750 pf., 1/8.

RESISTORS.—All values: 10 ohms to 10 meg. 1 w., 4d.; 1w., 6d.; 1w., 8d.; 2w., 1w.

High resistance, 1 w. 1% 2/-.

Preferred values 100 ohms to 10 Meg.

WIRE-WOUND RESISTORS—Best Makes Miniature Ceramic Type—5 w., 15 ohm to 4 K. 1/9; 10 w., 20 ohm to 6 K. 2/3; 15 w., 30 ohms to 10 K. 2/8; 5 w. Vitreous, 12 K. to 25 K. 3/-.

WIRE-WOUND POTS. 3 WATT LAB. COLVERN, ETC.

Pre-Set Min. TV Type Standard Size Pots, 2 1/2 in. Knurled. Slotted Knob. Spindle High Grade. All.

All values 25 ohms to 30

K., 3/-; ca. 50 K., 4/-.

Ditto Carbon Track 50 K. W/W. EXT. SPEAKER CONTROL 10D. 3/-.

O/P TRANSFORMERS.—Heavy Duty 70 mA, 4/6. Ditto

tapped primary, 4/9. Multitap Q.P.P. push pull 6/6. Tapped small pentode, 3/9.

LF. CHOKES. 15/10 H. 60/65 mA, 5/-; 25/20 H. 100/120

mA, 11/6; 20/15 H. 120/140 mA, 12/6. MAINS TRANS.

350-0-350, 80 mA, 6.3 v. 4 a., 5 v., 2 a., ditto 250-0-250,

81/2. AMPLIFIER TRANS. 250-0-250 v. 50 mA. 6.3 v. 2 a., 17/6. MAINS HEATER TRANS. 6.3 v. 1 1/2 a., 7/6;

6.3 v. 3 a., 10/8.

ELECTRODYNAMIC MIKE INSERT.—U.S.A. make, precision engineered. Size only 1in. diam by 1in. Bargain Price 3/9. Matching Trans. 3/9.

SPEAKER FRET.—Spanned anodised metal, 14in. by 9in., 3/-, EXT. L.S.—Switched Socket, on-off and parallel switching, complete with plug, 2/-.

COPPER PLATED AERIAL RODS. 1/8 in. x 12in. push fitting, 2/- doz. p. & p.

MAIN LEADS.—Twin Twisted Maroon Flex. 1/-.

2 yd. Non-kink Apparatus Leads. Bargain 1/3.

TYANA—Midget Soldering Iron. 200/220 v. or 230/250 v.

14/11. TYANA TRIPLE THREE.—Complete with detachable bench stand, 19/6. 200/220 v. or 230/250 v.

NEW SOLON MIDGET IRON.—25 w., 19/6. EASY FOR

RADIO CONSTRUCTORS. 200/220 v. or 230/250 v.

MIKE TRANSF.—Ratio 50:1. 3/9 ea. new and boxed.

V'HOLDERS.—Par. Int. Oct., 4d.; EF50, EA50, 6d.;

B12A CRT, 1/3. Moulded. Int. Oct. 6d.; BTG, 9d. with

screening can, 1/6; B8A, B8G, B9A, 1/-; VCR97, 2/6.

Ceramic: EF50, 1/2. BG, 1/- Paroxin ENG. and AMER. 5/-

7-9 pin, etc. 1/-.

Nuts, Bolts and Washers, 12 of ea. 1/- packets, 2 4 or 6 B.A.

TAPE.—2 in. 10 way, 6d. etc.

TOGGLE SWITCHES EX-GOV'T.—"On-Off" 9d. Erin

M' copper solder 60/40, 16 g. or 18 g. 5/6; 1lb. 4d. yd. T.C.

wire, 18 to 22 s.w.g., 2/-; 1/2 lb. P.V.C. Connecting wire, 8

colours. Sling or Stranded, 2d. 2K. 5W. H.D. w/w Pots, 4/6. 10 K. 25 K. Colvern w/w Pot. 1in. spindle, 3/6.

SCREENED GRID CAPS L Oct. or Mazda, 6d. ea.

BULGIN HIGH VOLTAGE VALVE CAPS. 1 Oct. 1/-.

FUSES.—1/4 in. all values 60 mA. to 10 a., 6d.

ALADDIN FORMERS and cores. 1in. dia. 10d.

SLOW MOTION DRIVES.—Epicyclic ratio 6: 2/3.

INT. OCTAL CABLE PLUG (8-pin), with cover, 1/3.

200-250 Volt SELECTOR SOCKET (2in. x 1in.) with

Plug 1/-. PILOT LAMPS.—6.3 v. 3 a., 8d.

MAINS DROPPERS. 3in. x 1in. Adj. Sliders, .3 amp.

.750 ohms 4/3, .2 amp. 1,000 ohms, 4/3.

LINE CORD.—3 amp., 60 ohms per foot, .2 amp., 100

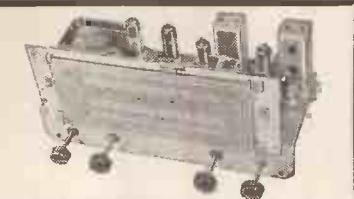
ohms per foot, 2 way, 1/8 a yard; 3-way, 1/8 a yard.

We have no connection with any other firm. Please address all correspondence correctly as below.

RADIO COMPONENT SPECIALISTS

*Phone THO 1665, after 6 p.m. 4198. Buses 133 or 68 pass door.

48-hour postal service.



ALL WAVE RADIogram CHASSIS

THREE WAVEBANDS

LATEST MULLARD

CONDENSERS

5/8. Ditto, 12.5 kV, 9/6; 2 pf. to 500 pf. Mica, 6d.; .001.

Mica or Tub. 500 v., .01 Sprague 500 v., .02 500 v., 1 mfd.

350 v. Tub. 9d.; Hunts Molded 500 v., .005. 9d.; .05

mfd. and 1 mfd. 1/-, 25 mfd. 1/8. 1 mfd. 600 v.,

1/3; Tubular 5 mfd. 500 v., 1/8.

SILVER MICA CONDENSERS—10%.

5 pf. to 500 pf., 1/-, 600 pf. to 3,000 pf., 1/3.

DITTO 1% (ex. stock).

1.5 pf. to 500 pf., 1/9. 515 pf. to 1,000 pf., 2/-.

ELECTROLYTICS ALL TYPES NEW STOCK.

TUBULAR WIRE ENDS

8+16/500 v. 5/6 50/50 v. 1/9

16+16/500 v. 6/- Can Types, Clips, 3d. es.

1/275 v. 2/- 32+32/350 v. 4/6

2/450 v. 1/6 32/32+275 v. 4/6

4/500 v. 2/- 32/320 v. 4/-

8/500 v. 2/9 250/350 v. 6/8

10/500 v. 2/8 8+16/450 v. 5/-

16/500 v. 4/- 8+16/500 v. 5/8

8+8/500 v. 4/- 16+16/450 v. 5/8

32/350 v. 4/- 16+16/500 v. 6/-

32/500 v. 5/- 32+32/450 v. 6/8

32+32/600 v. 7/6 100+200/275 v. 12/6

23/25 v. 1/9

SPECIALS. Case Types. 500 mfd. 12 v., 3/-; 1,000 mfd.

+ 1,000 mfd., 6 v., 6/6; 1,500 mfd. 6 v., 4/6; 1 mfd. 1.5

E.V. T.C.C. 3/6

SENTERGEL RECTIFIERS. E.H.T. TYPE FLY-BACK

VOLTAGES. K3/25 2 kV., 4/3; K3/40 3.2 kV., 6/-; K3/45,

3.6 kV., 6/-; K3/80 4 kV., 7/3; K3/100 8 kV., 12/6;

K3/160 12 kV., 18/-, MAINS TYPE.—RM1, 125 v., 60 mA

4/-; RM2, 100 mA., 4/9; RM3, 120 mA., 5/9; RM4 250 v.

275 mA., 18/-

TV. AERIALS. Aerolite, all channels in stock. Indoor

loft type Inv. T., 13/6.

KNOBS, GOLD ENGRAVED.—Walnut or Ivory, 1 1/8 in. diam., 1/8 each. "Focus," "Contrast," "Brilliant," "Brilliance-On-Off," "On-Off," "Volume," "Vol.-On-Off," "Tone," "Tuning," "Treble," "Bass," "Wavechange," "Radio-gram," "S., M., L., Gram," "Record-Play," "Brightness." Ditto not engraved, 1/- each. Size "B" 1in. engraved, 1/2, plain 8d.

POINTER KNOBS.—Brown with white marking line, small

9d., large 1/-.

COILS.—P.T. type, 2/6 each. Midget "Q" Type

adj. dust core, 3/6 each. All ranges in stock.

REACTION COND.—.0001, .0003, .0005 mfd. 3/6 ea.

ALUMINIUM CHASSIS.—18 s.w.g. Plain, undrilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2 1/2 in. sides, 7in. x 4in., 4/6; 11in. x 7in., 6/8; 13in. x 9in., 8/6; 14in. x 11in., 10/6; and 18 x 16in. x 3in., 18/6.

FULL WAVE BRIDGE SELENIUM RECTIFIERS.—2, 6 or 12 v. 1/- amp., 8/9; 2 a., 11/3; 4 a., 17/6. F.W.

only 6 v. 1 a. (9v.-9v. 9 a.C.) 5/6.

CHARGER TRANSFORMERS.—Tapped input 200/250 v.

for charging at 2, 6 or 12 v., 14 amp., 13/6, 4 amp., 21/-.

ACID HYDROMETERS.—New ex-Govt. Unbreakable. Packed in metal case. 7in. x 1in., dia. 4/6.

H. F. MIDGET CHOKES.—14 M.E. 2/6 each.

BRIMSTONERS.—CZ1 for 3 a. heater chains, 3/6. CZ2 for

13 a., or 2 a., 2/6. CZ3, 1/6.

COPPER ENAMEL WIRE.—1/2 lb. 16 to 20 s.w.g., 2/-;

22 to 28 s.w.g., 2/6; 30 to 40 s.w.g., 3/6.

SWITCH CLEANER Fluid, squirt spout, 3/9 tin.

TWIN GANG TUNING CONDENSERS.—.0005 mfd. midget

with trimmers, 6/8; .375 pif. midget lead trimmers, 6/8; .0006 Standard size with trimmers and feet, 9/6; less trimmers, 8/6; ditto, soiled, 2/6.

SLEEPING.—Various colours, 1, 2 mm., 2d.; 3, 4 mm.,

3d. yd.; 6 mm., 5d. yd.

LOUDSPEAKERS P.M. 3 OHM. 5in. 16/6, 6in. 17/6.

6in., 19/6, 10in., 25/-, 6in. Goodmans with trans., 21/-.

CRYSTAL DIODE.—Very Sensitive. G.E.C. 3/6.

H.B. PHONES.—(Hi-grade Amer.), 15/6 pr.

S. G. BROWN'S. 4,000 ohms, 15/6 pr.

VCR97 £2 TESTED FULL PICTURE

I. F. TRANSFORMERS

WEARITE TYPE 500. 465 Ko/s., adjustable 450-470 Ko/s., size 3 1/2 x 1 1/2 x 1 1/2. Q value 110. BRAND NEW.

HALF PRICE. 10/6 PAIR

307 WHITEHORSE RD., WEST CROYDON
OPEN ALL DAY SATURDAY.
P. & P., 6d. £1 orders post free. C.O.D. Service 1/6.
Lists S.A.E.

RHEOSTATS. 12 v. 1a. 2/6. 12 v. 5a. 10/6.

NEW AC/DC MOTORS. 24 v. 2a. 6" x 2". Spindle 1" x 1", 18/6. **NEW FREQUENCY CRYSTALS.** 9100 kc. 10/6. 4250 kc. 6/6. Also Type FT243 from 5675-8650 kc. In 25 kc. intervals. 10/6 each. **NEW ROTARY TRANSFORMERS.** Inputs 6 or 12 volts, output 250 v. 80 mA. 17/6.

NEW VR65, SP61 VALVES, 5/6, 4 for £1.

CYLDON 5-CHANNEL PRE-TUNER. Gives 26 D.B. gain. Fit one of these to your T.V. for better pictures. I.F. Output 9.5-14 Mc/s., 15.5-22 Mc/s. With valves EF80, ECC81, 52/6. Less valves, 15/-.
MAINS TRANSFORMERS. Input 200/240 v. Output 350-0-350 or 250-0-250 volt 80 mA., and 4 and 6.3 v. 4 a. and 4 and 5 v. 2 a. Price 21/6. Input 200/240 v. Output tapped 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 volts, 2 amp., 21/6. Output 17-11-5 volts 5 amp., 22/6. Output 17-11-5 v. 1½ a. 16/6. 6.3 v. 2½ a. 8/6. All with one year's guarantee.

D.P.D.T. RELAYS. Operate at 200/300 volts D.C. 8/6. We can supply any type of voltage and contacts at varying prices.

NEW SELENIUM RECTIFIERS. F.W. 12/6 volts 3 amps., 14/6; 4 amp., 22/6; 6 amp., 30/-; 1 amp., 8/6; 12 v. 100 mA., 3/-; 24 v. 2 amp., 30/-; H.W., 250 v. 100 mA., 9/-; 250 v. 275 mA., 17/6; 250 v. 60 mA., 6/6.

GERMANIUM or SILICON CRYSTAL DIODES, 3/9.

M/C MICROPHONES with matched Trans., 15/6.

FL5 FILTER UNITS, 8/6. Same as FL8 but less switch.

TRI196 TRANSMITTER SECTION. New and complete but less valves. 4.6-6.8 Mc/s. Easily converted, 15/-. With valves TT11, EL32, EF50, £2.

L.R. ARMY HEADPHONES, 9/6.

TIME DELAY RELAYS. We specialise in units giving varying time constants. Please send us your requirements or problems.

FISHING ROD AERIALS. Set 3-12ft., 8/6. RUBBER BASES, 3/6. P.O. VEEDER COUNTERS 0-9999, 24/50 volts D.C., 15/6.

POCKET VOLTMETER. 12in. M.C., 0-20-200, 11/6.

U.H.F. AERIALS. Complete with base, 180-200 Mc/s, 6/6.

NEW BROWNS M/C HEADPHONES. With earpads and 6ft. lead and plug, list price £5/5/- Our price 18/6.

VCR97 TUBES. Brand new, in original crates, picture tested, 45/-.

SPECIAL OFFER—SELENIUM RECTIFIERS, 12 v. 16 amp., full wave, 50/-.

All Carriage Paid in the U.K. from Dept. W.W.

EX-R.A.F. BATTERY RECEIVER. RI224 1-9 Mc/s., £7. RII16A, 142 kc/s.-20 Mc/s. £10. Signal Generator L1270, 18-131 Mc/s. Less Crystals. £10. Wavemeters, W1432, 160/220 Mc/s., £3/10. Wavemeters, Class CI, Mk. II, 1360/7510 kc/s., £3.

Carriage on above items extra.

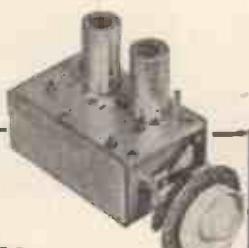
THE RADIO AND ELECTRICAL MART
253B PORTOBELLO ROAD, LONDON, W.11.

Phone: PARK 6026.

TUNERS for BAND III COMMERCIAL TELEVISION

Specially developed for incorporating into new T.V. receivers, or for tuning standard receivers for reception of Band III. Price £6.

**ABOUT 2½ MILLION T.V. SETS
WILL PROBABLY BE TUNED FOR
BAND III RECEPTION. MAKE SURE
THAT YOU ARE UP TO DATE. WRITE
TO US TODAY FOR FULLEST DETAILS**



Valradio
LIMITED

New Chapel Rd., High St., Feltham, Middx. Phone: Feltham 4242

INSIST ON HIFI

for Precision
instruments



PA 25W GIVING 25 WATTS
OUTPUT

PA 75W GIVING 75 WATTS
OUTPUT

- + 2 Microphone Faders
- + 2 Gramophone Faders
- + Bass and Treble Controls
- + High output and low distortion factor
- + Standard Low and High output impedances

Look for the Registered Trade Mark.

Hifi Ltd. DERRY ST., BRIERLEY HILL,
STAFFS. Telephone: Brierley Hill 7604

THE OUTPUT MUST BE RESTRICTED

to maintain the waveform, so say all the books. But not so with the HATFIELD oscillator, nor is it necessary to work near the point of instability.

COMPLETE STABILITY, LESS THAN 0.25 of 1% distortion, R.M.S. output voltage 50% greater than the H.T. voltage, 1 valve, 1 coil, simple circuit.

Sounds, incredible, but it is GUARANTEED.

Send for copy of N.P.L. report and see our ad. in April issue of "W.W." The HATFIELD oscillator is now made with 3 output impedances to suit any Head on the market. 45 Kc/s to 50 Kc/s

TAPE RECORDISTS! Are you Completely satisfied with your recordings? Bad waveform in an oscillator can cause DISTORTION due to intermodulation, NOISY BACKGROUND due to D.C. component in an asymmetrical waveform and INTERFERENCE with radio due to harmonics beating with incoming signal. The fundamental cannot do this!

COIL, complete with circuit, 10/6 post free. Patent app. for.

BIAS REJECTOR COILS

Even a small amount of bias frequency getting into the amplifier can cause a lot of trouble, and nearly all tape recorders need a rejector coil to prevent this.

COIL, complete with instructions, 5/6 post paid.

MOTEK TAPE DECKS

The famous K6 deck; twin track, two speed, with push buttons and electronic braking, is a beautifully finished job at only £19/10/- Post free. Or £3 down and 12 monthly payments of £1/10/-.

TAPE AMPLIFIERS

The HATFIELD amplifier is complete with oscillator as above, and magic eye, less speaker, at £12/15/- Or £2/10/- down.

COMPLETE RECORDERS

The HERGA recorder incorporates ALL the above items together with a first-class crystal mike and one reel of SCOTCH BOY tape in an attractive two-tone portable cabinet, absolutely complete at 39 gns. Or £7 down and 12 payments of £3.

Further details and H.P. forms from:

HATFIELD RADIO

78 STROUD GREEN RD., LONDON, N.4



5 Harrow Road, Paddington, W.2

PADDINGTON 1008/9 and 0401

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

SEND STAMPS FOR NEW 1955 28-PAGE CATALOGUE

RADIO-GRAM CHASSIS

3 Wave-band Superhet. Med., long and short.

5 Latest Type MULLARD Valves.

4 Position Switching Gram., med., long, and short.

Provision for Extension Speaker. A.C. Mains. 110/250 volts.

Chassis 11in. x 7in. x 2½in. Scale 8in. Square. Or Chassis 13½in. x 6in. x 2½in. Dial 10in. x 5in. PRICE £10/5/-.

BRAND NEW AND GUARANTEED.
CARR. PACKING AND INS. 10/-.

G.E.C. RECORDING TAPE

600ft. Reels 10/-

EF50 (VR91A)

The selected EF50, Red Sylvania, original boxes 10/- each, 90/- for ten.

PYE 45 Mc/s. STRIP TYPE 3583 UNITS

Size 15in. x 8in. x 2in. Complete with 45 Mc/s. Pye Strip, 12 valves 10 EF50, EB34 and EA50, volume controls, and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5. Carriage paid.



(CASE REMOVED FOR ILLUSTRATION)

CRYSTALS

200 kc/s, 2 pin, U.S.A..... 10/-
465 kc/s, 2 pin, U.S.A..... 10/-
500 kc/s, 2-pin, British..... 15/-
Holders for U.S.A. Types 1/6.

PHILIPS COMMUNICATION RECEIVER P.C.R.3.

Brand New. In original cartons. Valves. Frequency 12/560 metres. Less power unit. Can be adapted for mains at cost of 35/- £10/10/- Carr. 7/6.

"426" CONTROL UNIT

Containing 4 EF50, 2 SP61, 2 EA50, 1 EB34, 2 single-gang .0005 tuning condensers. V/V/W volume/controls switches, condensers and resistors. Size 12in. x 9in. x 5in. New condition. 35/-, carr. 3/-.

"R.F. 26" F.M. CONVERTOR UNIT—88/100 Mc/s.

We can now offer this self-contained Unit comprising 6 Valves—2-6BA6, EB91, VR137, EF54, EF54. Two I.F. stages and separate local oscillator, also Muirhead graduated vernier drive assuring easy tuning.

COMPONENTS OFFERED TO COMPLETE F.M. UNIT

- New RF26 Unit with 3 valves VR137, EF54, EF54. 21/12/-
- Complete set of all components for conversion including 6BA6 and EB91, tuning condenser, I.F.T.'s Osc. and coils. Resistors and fixed condensers, plus wire and tag strips. 24/12/6/-
- Instruction Book with technical circuit and complete lay-out diagrams. 2/-
- Voltage required 250 v. 50 mA. 6.3 2 amps.
- Special offer of all above items and RF26, including circuit, £65/5/- postage 3/-.
- ALL ITEMS SOLD SEPARATELY
- Charge for alignment when completed
- Assembled, aligned and ready for use

Call for demonstration.

7 6

£8 10 0



14 WATT HIGH FIDELITY F.M. AND RECORD AMPLIFIER

200/250 volt A.C. First Quality Components only. Stewart Transformers and Chokes. Partridge Output Transformer. Bass and Treble Controls (Boost and Cut). Supply Socket for Tuner Unit. Ideal for Denco F.M. Feeder. 5 valves—6SN7, 6SL7, 6L6, 6L6, 5Z4. Complete ready for use.

BARGAIN PRICE £17/10/-.

T.O.C. 1 mfd. 5/7,000 v. wkg. type CP58QO, Bakelite case, 7/6 each. B.I. 1 2,500 v. wkg. 4/-.

EXTRA SPECIAL VALUE IN MIDGET TYPE ELECTROLYTICS

Metal tubular wire ends with cardboard sleeves	
8 mfd., 450 v.....	2/-
16 mfd., 450 v.....	3/-
8 x 8 mfd., 450 v.....	3/6
16 x 8 mfd., 450 v.....	4/6
16 x 8 mfd., 250 v.....	3/6
32 x 32 mfd., 450 v. x 8 1½in.....	6/-
16 x 16 mfd., 450 v. x 8 1½in.....	5/-
60 x 40 mfd., 350 v. x 4 1½in.....	8/-
8 mfd., 500 v., block, 3 x 1½in.....	2/-

U.S.A. INDICATOR UNIT Type BC929A

These Units are in absolutely new condition. In black oracle cabinet 14½in. x 9in. x 9in. Complete with 3 BPL C/R Tube, Shield and Holder. 2-6SN7GT; 2-6H9GT; 1-6X5GT; 1-2X2; 1-6G6, V/controls, condensers, etc. Ideal for scope.

85/- Carr. & Packing 5/-.

TRANSMITTER/RECEIVER

"38" WALKIE TALKIE SETS

We have purchased large quantity of the above "38" Sets, and can now offer same complete in case with 5 valves 4-VP23 and ATP4, Throat Microphone, Headphones, Junction Box and Collapsible Aerial in absolutely new condition and guaranteed Air Tested. Freq. range 7.4 to 9 Mc/s. Range approx. 5 miles. Voltage 150 v. and 3 v. L.T.

59/6 CARR. 5/-.

T.V. PRE-AMPLIFIER FOR LONDON AND BIRMINGHAM

Complete with 6AM6. Ready to plug into your set. 27/6. P.P. 2/6.

CRYSTAL MICROPHONE INSERTS

8'6 POST FREE



8'6 POST FREE

Ideal for tape recording and amplifiers. No matching transformer required.

PLEASE ADD POSTAGE. ARTICLES UP TO 10/-, 1/-, £1, 1/6. £2, 2/-.

MORSE PRACTICE KIT

Complete with buzzer, morse tapper and battery compartment on baseboard. 6/-, post paid.

RCA 931A PHOTO-ELECTRIC CELL AND MULTIPLIER For facsimile transmission flying spot telecast transmission and research involving light-levels. 9-stage multiplier. Brand new and guaranteed, only £2/10/- Special 11-pin base 2/- Data sheets supplied.

TUNING CAPACITORS

.0005 Midget 24 x 11 x 1½in.....	5/-
.0005 Midsize 24 x 11 x 1¼in. with trimmers.....	6/6
.0005 Standard Size, with trimmers.....	7/6
.0005 with 4-way push-button assembly.....	7/6

NEON INDICATOR LAMP

Siemens type VI132. Diameter 1½ x 1in. Striking voltage 80 v. S.P.B.C. 2/6 post free.

INDICATOR UNIT TYPE 182A

Unit contains VCR517 Cathode Ray 5in. tube, complete with Mu-metal screen, 3 EF50, 4 SP61, and 1 MU40 valves, 9 wire-wound volume controls and quantity of resistors and condensers. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing cases at 67/6. Plus 7/6 carr. "Radio-Constructor" 'scope circuit included.

R.F. UNITS

R.F.24 20/30 Mc/s.....	15/-
R.F.25 40/50 Mc/s.....	19/6
R.F.26 50/65 Mc/s.....	35/-
R.F.27 60/80 Mc/s.....	35/-

Brand new, carr. free.

U.S.A. PACKARD-BELL PRE-AMPLIFIER



Complete with 6SL7GT-28D7GT, relay, plugs, condensers, etc. Instruction booklet, Brand new 12/6, p.p. 2/-.

CATHODE RAY TUBES

VCR139A. 2½in. Q/R Tube. Brand new in original cartons (carr. free).....	£1 15 0
VCR97. Guaranteed full T/V picture (carr. 2/-).....	£2 0 0
VCR517C. Guaranteed full T/V picture.....	£1 15 0
MU-METAL SCREENS for VCR97 or 517. P.P. 1/8.....	10 0
6in. ENLARGER for VCR97 or 517. E.P. 1/8.....	17 6
VCR517. Brand new and crated—slight cut-off—Ideal for 'Scopes. Limited quantity. Carr. 2/-.....	15 0

PHOTO CELLS G.S.18. Brand new, 25/-

STABILIZED Power



THE 'GATLEY'
STABILIZED
POWER
SUPPLY UNIT

The Type 541 is a Low Voltage Stabilized Power Unit supplying low voltage D.C. from A.C. mains. It provides a stabilized voltage as low as 1½ v. with current up to 50 mA. The Type 542 provides stabilized supply of 250-500 v. at up to 100 mA.

*Write for
leaflet*

F.C. ROBINSON
& PARTNERS LIMITED.
COUNCILLOR LANE · CHEADLE · CHESHIRE
MAKERS OF FINE INSTRUMENTS

Television · Radio · Record CABINETS MADE TO ORDER

ANY SIZE OR FINISH

CALL OR SEND DRAWINGS FOR QUOTATION

B. KOSKIE (DEPT. E.)
72-76 Leather Lane, Holborn, E.C.1
Phone: CHAncery 6791/2

WICO KIT VALVE VOLT-OHM METER 33 RANGES

A sensitive stable valve volt-ohm meter for the service engineer or the laboratory, available in kit form.

DATA

Seven volts ranges—0.01 v. to 1,000 v. D.C. plus, D.C. minus and A.C. R.M.S. 0-1 v., 3 v., 10 v., 30 v., 100 v., 300 v., 1,000 v. Five ohms ranges—0.5 ohm to 500 M. ohm, 0-500 ohm, 5 k., 500 k., 5 M., 500 M.

Seven Db ranges—20Db to plus 6IDb, ref. 1Mw into 600 ohm. Centre zero scale for F.M. discriminator alignment. 11M. ohm input on D.C., 10M. ohm on A.C. A.C. and D.C. read on same linear scales. Bridge circuit, test leads included. R.F. probe and voltage multiplier probe available shortly.



KIT £19 C.W.O. or C.O.D.

WIRED £26 H.P. Terms Available

EXPORT ENQUIRIES INVITED

WHARTON INSTRUMENT COMPANY
1081 FINCHLEY ROAD, LONDON, N.W.11
Telephone: MEADWAY 3407

BELCLERE MINIATURE INPUT, OUTPUT AND INTERSTAGE TRANSFORMERS

We specialise in the manufacture of coupling transformers to customers' requirements. An illustrated brochure describing the range of transformers we manufacture will gladly be sent on request.

Illustrated above is a standard input transformer type "E" size 1in. x $\frac{3}{8}$ in. x $\frac{3}{8}$ in. overall, available with varnish dip finish, encapsulated block form, or in mu-metal screening can.

Quick delivery—low prices—maximum efficiency.

JOHN BELL & CROYDEN, 117 HIGH STREET, OXFORD
Telephone: 47072. Cables: Belclere, Oxford.

hallicrafters & NATIONAL

Sole Concessionaire U.K.:

McELROY ADAMS MFG. GROUP LTD.

Phone: FUL 1138/9

COMMUNICATION
RECEIVERS and
TRANSMITTERS and
RAYTHEON
MARINE RADIO DEVICES

Again becoming available

328 LILLIE ROAD, LONDON, S.W.6

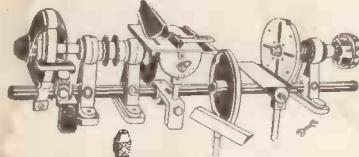
Cables: Hallicraft, London



Bargains

CARRIAGE FREE AND WITH MONEY-BACK GUARANTEE

PICADOR PUP



The most versatile tool ever offered to the public. Wood turning lathe, rise and fall and fully tilting circular saw, hooded grindstone with drill sharpening attachment, sanding and drilling attachments, all accessories as illustrated. Complete £6.15.0

Send 2d. FOR LEAFLET

3 INCH 4-JAW CHUCK, independent reversible jaws for "Picador Pup" £3.



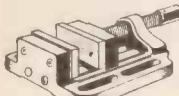
ROTO-SAW

For use with $\frac{1}{2}$ in. capacity electric drill. Cuts wood up to 1 in. thick £3.5/- Spare blades, 4 in. dia., 8/6 ea.



PICADOR POLITIK.

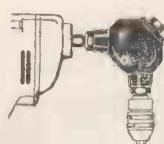
Contains lambwool bonnet, grindstone, rubber backing disc, sanding discs and all accessories. Will fit any electric drill. 22/6



PICADOR MACHINE VICE.
Steel jaws $2\frac{1}{2}$ in. wide,
1 in. deep. Vice opens
 $2\frac{1}{2}$ in.



SPECIAL OFFER. PICADOR RIGHT-ANGLE DRIVE. This is a must for every owner of an electric drill. Gives 2 ratios of speed, 1:2 and 2:1. Complete with adaptors to fit Black & Decker and Wolf $\frac{1}{2}$ in. cap. elec. drills. 21/-



All-Purpose Steel Spindle

15 in. long. Complete with $\frac{1}{2}$ in. capacity 3-jaw chuck, 4-speed pulley. Ideal for circular saw, grinder, polisher, drill, etc. 37/6

Apollo Spray Gun

Ideal for model maker and handyman. Will spray paints, insecticides, etc. Will work from foot pump, spare car tyre, compressor etc. New and boxed 15/-



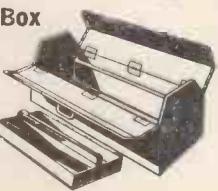
All-Steel Tool Box

Complete with removable inner tray. Fitted with strong hasp, staple and carrying handles.

Size 1, 14in. x 8in. x 8in. 25/-

Size 2, 17in. x 8in. x 8in. 30/-

Size 3, 24in. x 8in. x 8in. 36/6



Send 3d. for catalogue. Phone orders accepted. Cash with order. C.O.D. 1/- ex. Thousands of bargains for personal shoppers! Surplus of every description.

W.14.

SHERMAN'S SUPPLY CO⁰

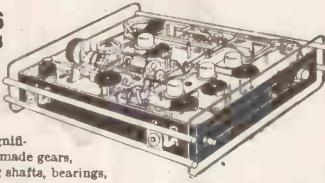
HIGH STREET, HARLESDEN,
LONDON, N.W.10. ELGar 5857

479, HARROW ROAD,
LONDON, W.10.

359, KILBURN HIGH RD., N.W.6
Adjoining Kilburn and Brondesbury Stations.

BOMB SIGHT COMPUTER

62/6
EACH



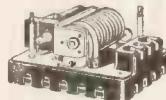
Over 65 lbs. of magnificently made gears, driving shafts, bearings, miniature motor, repeater motor, gyroscopes, etc. All in strong wooden case 24in. x 22in. x 11in. high, which is ideal as a tool box.

1,000 yd. DRUMS OF WIRE

PVC covered single strand cable. Light as string but ten times as strong. 1000 uses in the home and garden.

15/6

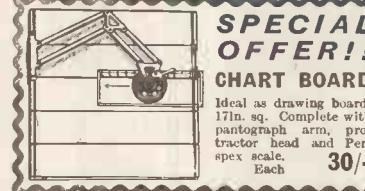
ACCUMULATOR CUT-OUT



12 or 94 v. 60 A. Ex R.A.F. originally cost over £6 each. suitable for battery charging, etc. Limited quantity available. 30/- each.

15/-

SPECIAL OFFER!! CHART BOARD



Ideal as drawing board. 17in. sq. Complete with pantograph arm, protractor head and Perspex scale. Each 30/-

OXYGEN BOTTLE

High pressure oxygen bottle approx. 14in. long x 7in. diameter. Tested to 3,000lbs. per sq. in.

25/-

PRECISION DRILL CHUCK

1 in. capacity, self-centring by H. D. Murray. Complete with $\frac{1}{2}$ in. parallel shank. At third of list price.

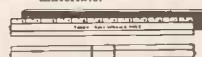
10/-

SET OF TWIST DRILLS
Comprising 9 drills between 1/16th. and $\frac{1}{2}$ in. Complete in plastic box and stand.

4/6

UNBREAKABLE T SQUARE

Very strongly made from laminated resin-bonded plastic. Reinforced stock, bevelled edge, 24in. long. Indestructible in normal use. Offered at less than cost of 9/11 materials.



ROLLING RULE

2/9

7/9

8/9

MODEL MAKER'S MOTOR

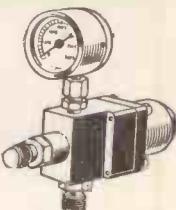
Extremely powerful and robustly designed motor measuring only 3in. x 1in. x 1in. Built-in variable resistance and centrifugal governor. 12 v. d.c. will operate on A.C. Unrepeatable at 15/-



High Pressure Reducing Valve

Complete with 0-3,000lb. per sq. in. pressure gauge. Suitable for Compressors, Cylinders of Gas, etc. Brand new and boxed

12/6



AIR BOTTLE

23in. x 5in. diam. Tested to 300lb. per sq. in. Suitable for above valve or compressor. Extra large size. 8in. diam. x 30in.

25/-

32/6



Ex.-R.A.F. WATER PUMP

Heavy duty 1,000 l.p.h. 1½ in. bore outlet. Splined drive. Requires $\frac{1}{2}$ h.p. to operate.

59/6



Engineer's Drawing Board

Half will. size. Fine Quebec yellow pine. Ebony working edge. Hardwood battens. Made by Thorntons

35/-

IMPELLER PUMP

Approx. 20in. long by 2in. dia. 2 amp. at 24 v. d.c. will work on 12 v. at 4 amp. d.c. Ideal for bilge pumps or for transferring fuel or water to header tanks. Pump is self-cooled by liquid passing through it. Brand new and boxed. Each 39/6



Model Maker's Mains Transformer

All purpose low voltage input 210/250 v. Output 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 v. Rating 2 amps. Suitable for above pump. Brand new fully guaranteed.

24/-

SELENIUM METAL RECTIFIER

Suitable for 2, 6 and 12 v. battery chargers. Max. capacity 15 v. at 1 amp. new and boxed

9/6

THERMOSTAT

Complete with fitting for insertion in hot water tank. Variable between 70 deg. F. and 190 deg. F. 250 v. mains. Suitable for immersion heater, greenhouse, etc.

25/-

SELF-PRIMING PUMP

Self-contained motor, 24 volt immersed type pump. Maximum capacity of 700 gallons per hour, with max. lift of 18ft. Flange mounting, suitable for bilge pumping, caravans.

30/-

STUART TURNER Water Pump

Motorised 250 v. A.C. bronze pump, 440 g.p.h. Lifts 3ft. head 6½ in. inlet and outlet.

Brand new £7.10.0



SET OF 5 RING SPANNERS

12 point offset, made of super chrome vanadium steel. 8½ in. x 1 in. Whitworth x 1 in. Fully guaranteed. Set 32/6



TOWARDS PERFECTION . . .

demands constant research and development

It is with pleasure that we announce the first of a new range of A.F. Power Amplifier :—TYPE T.P.10.

This amplifier is now available, designed for laboratory and other applications where the finest possible performance only, is acceptable for the reproduction of Audio frequencies.



Specification in brief:—

Input 1 v. r.p.m. (into 0.5 m. ohm) for 12 watts output, 16-ohm. load. Output impedance less than 0.4 ohms., damping factor 40 over full frequency range:—7-70,000 c.p.s. ± 1 db. at full output.

Hum and noise—90 db. below full output.

Valves:—EF86, ECC33, 6.A.B.6, 5.U.4G, 2 x EL34 (Mullard's new power pentode) in special Lowther pentode/triode output stage (Patent Pending).

Ample external H.T. and L.T. supplies.

Amplifier T.P.10 complete £40

Further details of this and other Lowther quality products gladly forwarded upon request.

LOWTHER MANUFACTURING COMPANY, LOWTHER HOUSE, ST. MARK'S ROAD, BROMLEY, KENT

Telephone: RAVensbourne 5225

**H. WHITAKER G3SJ,
10, YORKSHIRE STREET, BURNLEY**

Phone: BURNLEY 4924 (A.R.B. APPROVED)

Manufacturers of precision Quartz Crystals. In a wide variety of bases covering the complete range from 1 Kc. to 19 Mc. in fundamental frequencies. All are made to complete fine tolerances, and frequency adjustment can be given up to .005%. Plated electrodes of gold, silver or aluminium with wired in spot welded contacts are available. Quotations can be given for any type of cut or mode of oscillation including a complete range for filter circuits with zero temperature co-efficient over a sensibly wide temperature range. Our new works is equipped with up-to-the-minute production technique methods, X-ray orientation ensuring accuracy of all cuts. Artificial aging by etching and plating by evaporation under vacuum ensure long term stability of the final calibration. Early delivery can be given of most types. Our regrind service is still available and in some cases we are prepared to quote for lowering the frequency of your existing crystals.

SPECIAL OFFER:

200 kc. DT out, zero temperature co-efficient over the range—30° centigrade to +55° centigrade. Frequency adjustment .005% or better. Mode: Face shear. Silver-plated electrodes, wire mounted. Basing $\frac{1}{4}$ m. pin spaced. Other bases to order, £1 each.

Announcing the NEW
Junior LeeRaser

Neat, compact,
and erasing Sin.
tape spools with
the full efficiency
of the well-known
Standard and
Senior LeeRasers.
200/250v. A.C.
mains.

Price : £6 - 5 - 0

LEEVERS-RICH

EQUIPMENT LTD.

78, Hampstead Road, London, N.W.1



EUSTON
1481

THE WORLD'S GREATEST BOOKSHOP

FOYLES
★ ★ FOR BOOKS ★ ★

NEW AND SECOND-HAND
Technical Books

Foyles have Departments for Gramophone Records, Stationery, Handicraft Tools and Materials, Music, Magazine Subscriptions, Lending Library.

119-125 CHARING CROSS ROAD, LONDON, W.C.1

Gerrard 5660 (16 lines) ★ Open 9-6 (Thurs. 9-7)

Nearest Station: Tottenham Court Road

**TRANSFORMERS
COILS
CHOKES**

LARGE OR SMALL QUANTITIES
TRADE ENQUIRIES WELCOMED

SPECIALISTS IN

FINE WIRE WINDINGS

MINIATURE TRANSFORMERS, PICK-UP,
CLOCK AND INSTRUMENT COILS, ETC.
VACUUM IMPREGNATION TO APPROVED STANDARDS

ELECTRO-WINDS LTD.

CONTRACTORS TO G.P.O., M.O.S., L.E.B., ETC.

123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY
LIVINGSTONE 2261
EST. 1933

SHORT BROTHERS & HARLAND LIMITED

wish to engage Senior Engineers, Engineers and Technical Assistants for the Electronics Section of their Research Department, to work on Guided Missiles, Computing Systems, Navigational Equipment, and other interesting projects. Applicants should preferably have experience of servo-mechanisms, precision electronic or radio circuits, instruments or test gear.

Qualifications required are: **SENIOR ENGINEERS**—Honours Degree with at least five years' good engineering experience, and the ability to control a development team.

ENGINEERS—University Degree, or equivalent, with several years' experience of development work.

TECHNICAL ASSISTANTS: H.N.C. or equivalent, with good practical experience in appropriate field.

These are permanent positions in an expanding organisation with new and well equipped Laboratories. Good salaries and prospects for men with initiative; pension scheme; assistance with removal and housing. Interviews can be arranged either in London or Belfast. Applications will be treated as strictly confidential.

Send full particulars of age, qualifications, experience, with salary required to—

Staff Appointments Officer, Short Brothers & Harland Limited,
P.O. Box No. 241, Belfast, quoting Ref. No. S.A./31

SAMSON'S SURPLUS STORES

**LONDON'S GREATEST DEALERS IN RADIO
AND ELECTRONIC EQUIPMENT**

AMERICAN MINIATURE GEARED MOTORS



of motor $7\frac{1}{2}$ in. Brand new, 39/6. P.P. 2/-.
 $12\frac{1}{2}$ in. COPPER PLATED AERIAL RODS.

Push-in sleeve joint, $8\frac{1}{2}$ per half-gross, 15/- per gross, P.P. 1/6. SPECIAL PRICE OF £2 per thousand in ten thousand lots, plus carr.

WESTINGHOUSE HEAVY DUTY CHARGERS. A.C. input 200-250 v. D.C. output 144 volts 6 amps. Built in metal cabinets, size 2ft. x 1ft. $10\frac{1}{2}$ in. x $1\frac{1}{2}$ ft. Bin. With ammeter. Fine and coarse switch. Variable control fuses, and mains switch. £18/10, plus carr.

HOBART MOTOR GENERATOR CHARGING SET. A.C. input 220-240 v.; output 7.5-15 volts D.C. at 100 amps. Complete with meters, fuses and controls. ONE ONLY, £35. S.T.C. D.C. SUPPLY UNITS. A.C. Input 200-250 volts, D.C. output 220 volts 1.5 amps. at 50 degrees C. Built in strong metal grey cabinets completely fused, £15, plus carr.

ALL ORDERS & ENQUIRIES TO OUR EDGWARE ROAD BRANCH PLEASE. THIS IS OPEN ALL DAY SATURDAY. HOURS 9-6. 9-1 THURSDAY.

HEAVY DUTY SLIDING RESISTORS.

All by famous makers, offered at a fraction of the original price. 5.3 ohm 8 amp., with geared control, 35/-; 152 ohm 2 amp., with geared control, 32/6. 20 ohm tapered 7 to 1.5 amp., with right angle geared control, 37/6. 100 ohm 1.6 amp., 27/6. 1 ohm, 12 amp., 12/6. 50 ohm 1 amp., with slow motion control, 8/6. P.P. on all types 2/-.

INSTRUMENTS, ADMIRALTY INTEGRATORS, TYPE A S91.

Incorporating very fine Galvo movement, coil 40 ohms. Centre zero to F.S.D. 1 microamp. Small mirror one metre radius. A very useful laboratory instrument, 65/-, carr. 2/6. METRO-VICKERS MASTER VOLTMETERS, 0-20 volts A.C. 50 cy. M.I. 6in. mirrored scale, 25/-, P.P. 1/6. A.M. $2\frac{1}{2}$ in. panel mounting 500-0-500 microammeters, blank scale, brand new, 25/-, P.P. 1/6.

S.T.C. HEAVY DUTY D.C. SUPPLY UNIT.

A.C. input 200-240 volt, output D.C. 50 volts 24 amps. with ammeter, fuses and control switching. Built in strong grey metal cabinet size 2ft. 6in. x 1ft. 7in. £27/10/-, plus carr.

H.T. SUPPLY KIT.

Comprising Transformer, Pri. 200-250 volt and metal rectifiers, to give 220 volt D.C. 110 m/a. Originally designed for the 1155 Receiver power supply unit. 17/6 plus 2/-, carr.

1154 TX H.T. TRANSFORMERS.

Pri. 200-240 volt. Sec. 1,250-1,300 volt 350 m/a. 35/-, carr. 4/-.

169/171 EDGWARE ROAD, LONDON, W.2.

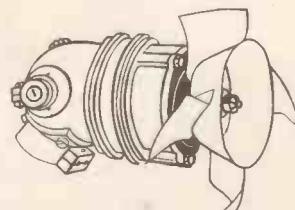
TEL.: PAD 7851

AND

125 TOTTENHAM COURT ROAD, W.1.

TEL.: EUS 4982

12 VOLT D.C. FANS BY G.E.C.



Very powerful. 5 $\frac{1}{2}$ in. blades, overall length 7 $\frac{1}{2}$ in. Will operate on 15-20 Volts A.C. Brand new at a fraction of make's price, 35/-, P.P. 2/-.

SPECIAL OFFER OF HEAVY DUTY L.T. TRANSFORMERS.

Pri. 200-250 volt. Sec. tapped 10 v.-12 v. 16 amps. tropical rating, 32/6. Carr 2/6. Pri. 200-250 volt, Sec. 50 volt, 20 amps. tropical rating, completely enclosed, £6/10/-, plus carr. Pri. 200-250 volt, Sec. 6.3 volt 15 amps. 25/-, P.P. 2/-. Many other types of heavy duty L.T. Transformers available.

HEAVY DUTY CANADIAN ADMIRALTY 6in. BLOWERS.

Motor Spec. 220 A.C. D.C. 1 h.p. R.P.M. 2,600. Series wound, continuous rating, £17/10/-, plus carr.

PERSONAL SHOPPERS WELCOME.

ORDERS ACCEPTED M/A FROM COLLEGES, SCHOOLS, LABORATORIES, ETC.

RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.I. (Coventry Street end)
Phone No. GERard 3977/8

Grams: "Radiotrade"

BARGAIN OFFER OF BATTERIES

4½ v. Heavy Duty Bell Battery. Size 6½ x 4½ x 2½ in.	4/6
72 v. H.T. 1.5 v. L.T. Size 6 x 5 x 1½ in.	5/6
150 v. H.T. Size 2½ x 5½ x 1½ in.	5/6
67½ v. Size 2½ x 1½ x 3½ in.	6/6
All batteries sealed and unused. All plus 1/6 post and pkg. Special reduction for quantities.	

ELECTROLYTIC CONDENSERS

	Per doz.
16 mfd. 375 v., 2/- each.	21/-
16 x 16 mfd. 350 v. 3/6 each	39/-
16 x 24 mfd. 350 v. 2/6 each	27/-
16 x 32 mfd. 275 v. 1/6 each	15/-
20 x 20 mfd. 275 v. 2/3 each	24/-
24 mfd. 350 v. 1/6 each	15/-
24 mfd. 450 v. 2/3 each	24/-
Condenser Clips for above	3/6

BIAS CONDENSERS

50 mfd. 12 v. Single Hole Fixing 1/- each	10/6
100 mfd. 6 v. Tag End 10d. each	9/-
100 mfd. 25 v. Tag End 1/3 each	12/-

BLOCK PAPER CONDENSERS

4 mfd. 400 v. D.C. 3/6 each. Many other types in stock. Your enquiries invited.	
---	--

LARGE ASSORTMENT OF TUBULAR CONDENSERS

MIDGET MICA CONDENSERS. .0001, .0002, .0003, .0004, .0005	6/-
200 Assorted Moulded Micas. Popular Values	£2 10 0
200 Assorted Silver Micas. Popular Values	£2 10 0
200 Assorted Carbon Resistors: 1/2, 1/4 and 1 watt. Good selection	£1 10 0

SPECIAL OFFER

0.1 mfd. 12,000 volts test Mansbridge Condensers. Height 6½ in. Width 3½ in. Depth 2½ in. Fixing Centres 4in. Plus 1/- post.	5/6
---	-----

PAXOLIN SHEET

18 x 4½ x 1/16in. 1/- each; 10 x 10 x 1/16in., 1/6 each; 20 x 10 x 1/32in., 1/6 each; 20 x 10 x 1/16in., 3/- each.	
--	--

RESISTORS

Carbon 1/2 watt 2/6; 1/2 watt 3/6; 1 watt 4/6; 2 watt 6/6 per doz.	
--	--

WIRE WOUND AND VITREOUS. 5 watt 1/6; 10 watt 2/6; 15 watt 3/6; 20 watt 3/6 each.	
--	--

HIGH STABILITY. 1/2 watt 5% 6d.; 1/2 watt 5% 9d.; 1 watt 5% 1/3 each. A few values in 1% and 2% still available.	
--	--

ALL ORDERS FOR RESISTORS C.O.D. PLEASE AS WE CANNOT GUARANTEE TO STOCK ALL VALUES.	
--	--

W.W. V/CONTROLS. ALL WELL KNOWN MAKES Pre-set 2/6 each. Spindle types 3/- each. Values from 5 ohms to 50k.	
--	--

V/CONTROLS WITH SWITCH 5k, 50k, 1/2 meg., 1 meg.... 3/6 each V/Controls Less Switch. Most values spindle and preset 2/- each	
--	--

METERS

0-300 mA 2½ in. Flush Mounting. Brand new. Guaranteed 8/6 each 0-500 mA. 2½ in. Flush Mounting. Brand new. Guaranteed 10/6 each	
--	--

TWIN GANG .0005 Less Trimmers 6/6 each 4-Way push button units 2/6 each; 27/- doz.; 6 way 3/6 each..... 39/- doz.	
--	--

Push Button Knobs 3/- doz.	
----------------------------------	--

TAG STRIPS. 3-way 2/-; 4-way 2/6; 5-way 3/-; 7-way 4/-; 28-way 12/- doz.	
--	--

SLEEVING. 2mm. 2/6; 3 mm. 3/6; 4 mm. 4/6; 5 mm. 5/6 per doz. yds.	
---	--

POINTER KNOBS. Small black with white line, standard ½ in. spindle 7/6 doz.	
---	--

WANDER PLUGS. Red and Black 2/- doz.	
--	--

PHILIPS TRIMMER TOOLS. 1/- each 10/6 doz.	
---	--

BELLING LEE FUSE HOLDERS. Type L 356 (Pnl. Mtg.) 2/6 each	
---	--

WEARITE COILS. PA4, PO4, PAS, POS, 1/3 each 12/- doz.	
---	--

VALVE HOLDERS. Moulded B9A 7/6; B7G 6/-; Int. Oct. 9/-; Eng. Oct. 4/6 doz.	
--	--

VALVE HOLDER FITTED WITH LOWER CAN 1/6 per doz. extra.	
--	--

Screening Cans for B7G and B9A 6/- doz.	
---	--

Paxolin V/H Int. Oct., B9A, B7G 5/- per doz.; Eng. Oct., 5-pin, 7-pin, 10-pin 3/- doz.	
--	--

STANDARD SCREENING CANS 3-piece 1/- each; Spring Loaded 1/- each	
--	--

BELLING LEE PLUGS AND SOCKETS, 5-pin 1/9; 7-pin 2/6; 10-pin 2/6 each	
--	--

BULGIN P.74-2-pin P. & S. 2/6 each; P.200 2-pin P. & S. 2/- each; Rotary Switches 2/- each; Dolly Switches S.267 2/- each; Standard Ex Govt. 1/6 each	
---	--

POST OFFICE LAMP JACKS No. 10 1/- each	9/- doz.
--	----------

Lamp covers for same 3/- doz.	
-------------------------------------	--

WESTINGHOUSE KHI Half-wave Rectifier, rating 6 v. at 10 mA, 2/6 each	27/6 doz.
--	-----------

OUTPUT TRANSFORMERS. Multi-ratio, 5/- each; Pentode or power 4/- each	
---	--

DRUM DRIVES, 3½ in. 1/- each	
------------------------------------	--

WESTECTORS, WX6, WX12, WI1, WI2, W4, 1/- each	9/- doz.
---	----------

ARCOLECTRIC (Whitney Lamp), Red, Green, Clear, 1/6 each	15/- doz.
---	-----------

SIGNAL LAMP HOLDERS. Panel mounting, complete with adjusting lampholder, 1/9 each	18/- doz.
---	-----------

JONES PLUGS AND SOCKETS. 4-pin, 2/6; 6-pin, 3/-; 8-pin, 3/6; 10-pin, 4/-; 12-pin 6/- pair	
---	--

CASH WITH ORDER OR C.O.D.	ALL ORDERS DEPT. W. I.
---------------------------	------------------------

We invite your enquiries for items not listed

Trade Counter open 9 to 6 Monday to Friday

Callers Welcomed

WHOLESALE, MANUFACTURERS' AND EXPORT ENQUIRIES INVITED

CABINETS!!

Many and varied types (Table and Console) and

Console Tape Recorder Types.

"THE CONTEMPORARY"

Console Tape Recorder Cabinet

A very well made cabinet in light oak and mahogany, to suit modern furniture, deck and amplifier panels supplied completely uncased and will accommodate most amplifier/tape deck units. Size of cabinet overall 30in. x 15in. x 29in. Motor board size, 28½in. x 13½in.

Send for our cabinet list which gives details of this and many other types.

Send for our current monthly bulletin of Replacement Radio/Radiogram chassis, Tape Recording equipment, etc.

Trade Only Supplied

HARVEYELECTRONICS LTD.
FARNBOROUGH, HANTS.
Tel.: Farnborough 1120
LONDON OFFICE :—
59 Union Street, S.E.1. Phone: HOP. 4567

A. C. SOLENOID TYPE SC.



JUST OUT !!!

OUR 1955

FULLY ILLUSTRATED

CATALOGUE

6d

POST FREE

BERRY'S

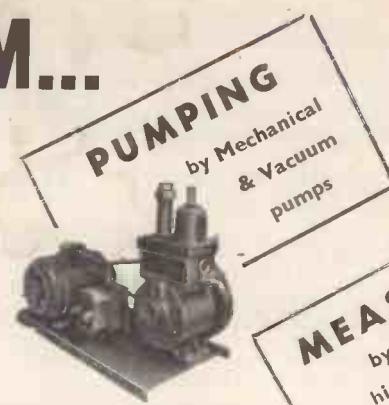
(SHORT WAVE) LTD.

25, HIGH HOLBORN, LONDON, W.C.I
Tel.: HOLborn 6231

HIGH VACUUM...



DEPOSITION
of THIN
METALLIC FILMS



PUMPING
by Mechanical
& Vacuum
pumps



MEASURING
by simple and
highly accurate
gauges

If your business is concerned with:-

- THE DEPOSITION OF METALLIC MICRO-FILMS onto glass, metal or plastic for critical electronic and electrical devices, such as diachroic and front surface mirrors, aluminised cathode ray tubes, crystal vibrators ...
- The VACUUM PUMPING of C.R.T., lamps and valves ...
- The VACUUM MEASURING and LEAK TESTING of all types of vacuum systems ...
- ... OR ANY OTHER APPLICATION OF HIGH VACUUM ...

... then we can help you as manufacturers of standard and special vacuum instruments and plant to electrical and electronic equipment makers all over the world.

W. EDWARDS

& CO. (LONDON) LTD.
MANOR ROYAL • CRAWLEY • SUSSEX
CRAWLEY 1500 (10 lines) EDCOHIVAC CRAWLEY

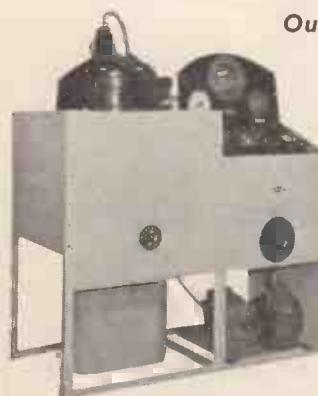


BRANCHES: GLASGOW & TORONTO. AGENTS THROUGHOUT THE WORLD

IMPREGNATE
your coils with ease

BLICKVAC

High Vacuum Impregnators meet the most stringent specifications and yet are easy to handle. Full range of models available to meet the needs of the large-scale producer, the research laboratory or the small Rewind shop.



Outstanding Features:

- Ease in control.
- Ease in cleaning.
- Elimination of vibration.
- Unequalled flexibility and performance.
- Simple attachment of auxiliary autoclaves.
- Units available suitable for Varnish, Wax, Bitumen and Potting Resins.

Users include M.O.S., N.C.B., G.E.C., Pye, Marconi, Metro-Vick.

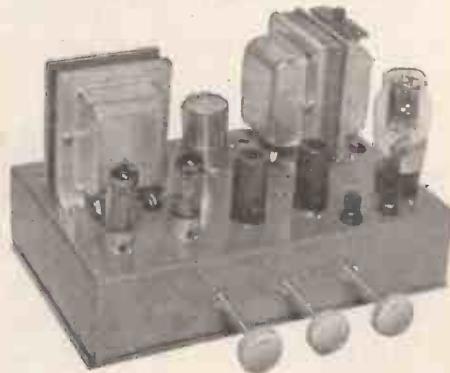
If your problem is COIL IMPREGNATION or impregnating or casting with Potting Resins consult:

BLICKVAC ENGINEERING LTD.

Bede Trading Estate, Jarrow, Co. Durham.
96/100 Aldersgate Street, London, E.C.I.

Jarrow 89/7155
Monarch 6256/8

STANLEY PRESENT A NEW
STANDARD OF EXCELLENCE IN
THE HIGH FIDELITY FIELD.



MODEL H.F. 125

BRIEF SPECIFICATION:

Response 10-20,000 Cycles within 2db, Hum and Noise -74db, total Distortion 0.4%, Output 12 Watts.

18 GNS.

Send for brochure.

STANLEY SOUND & VISION PRODUCTS LTD.

Stanley Works, Lower Street, Haslemere, Surrey

Phone: 1426

**THE
BRITISH NATIONAL
RADIO SCHOOL**
ESTD. 1940

NOW IN OUR FIFTEENTH YEAR
AND STILL

**NO B.N.R.S. STUDENT
HAS EVER FAILED**

to pass his examination(s) after completing
our appropriate study course.

*Good wishes to all B.N.R.S. students
at home, overseas and aboard ship who
will soon be sitting and passing City &
Guilds Examinations. Nothing succeeds
like success.*

A.M.Brit.I.R.E. and CITY and GUILDS Radio and
Telecommunications Exams., etc., etc.

**PRINCIPAL, M.I.E.E., M.Brit.I.R.E.
BRITISH NATIONAL RADIO SCHOOL
2, CANYNGE ROAD, CLIFTON, BRISTOL, 8**

Tel. BRISTOL 34755

ELECTRONIC ENGINEERS

with suitable backgrounds interested
in entering the rapidly expanding
field of

DIGITAL COMPUTORS

are offered the opportunity of acquiring
these new techniques at the new
ENGLISH ELECTRIC establishment at Kidsgrove. Previous Computer
experience is not necessary as the Company provides special
conversion courses in conjunction with
MARCONI COLLEGE. Full salary
will be paid during such courses.
Apply to Dept. C.P.S., 336/7, Strand,
W.C.2, quoting ref. no. 1353C.

SPECIAL OPPORTUNITY:-

● **250-WATT AM BROADCAST TRANSMITTERS**
Type BRS—Short Waves
Type BRM—Medium Waves

Features: Small size—low power consumption—high fidelity—
low distortion.

Price: Complete stations from £397 for all orders placed
during the month

Quick delivery—write for full technical details

● **COMMUNICATIONS TRANSMITTERS**

By leading American manufacturers (R.C.A., Hallicrafters,
Technitron and Westinghouse). 5 types available for immediate
delivery: 250 w., 400 w., 1 kW., 2½ kW. and 5 kW.
Full technical details will be gladly sent on request.

● We can supply a full range of spares for:
R.C.A. TRANSMITTERS ET-4331, 4332, 4336 and AVT-22

● **TEST EQUIPMENT**—A large range of laboratory test
equipment of American manufacture (including BC-221)

● **RADAR EQUIPMENT** (Airborne, Ground and Naval).
Our Radar Dept. will welcome your specific enquiries.

BRITISH SAROZAL LIMITED

ELECTRONIC WORKS

I-3 Marylebone Passage, Margaret St., London, W.I.

Cables: Sarozal, London. Telephone: LANgham 9351 (3 lines)

A.I.D. and A.R.B. approved

NELSON RESEARCH LABORATORIES

**ENGLISH ELECTRIC CO. LIMITED,
STAFFORD**

have vacancies for ASSISTANTS in interesting
work on the PHYSICS, development and applications
of magnetic and electrical insulating materials
and devices.

Graduates with or without industrial experience
and people with National Certificates in Electrical
Engineering or Physics are required.

Reply to Dept. C.P.S.,
336/7, Strand, W.C.2., quoting ref. no. 312A.

POLYTHENE
INSULATORS, END CAPS, PLUGS, ETC.

for
T.V. AERIALS

Standard Articles or Special Mouldings

AMPLEX APPLIANCES (KENT) LTD.

19 DARTMOUTH ROAD, HAYES, BROMLEY, KENT

(RAvensbourne 5531)

All export enquiries to
ANTEX LTD., 3 TOWER HILL, LONDON, E.C.3

Wireless World Classified Advertisements

Rate 7/- for 2 lines or less and 3/6 for every additional line or part thereof, average lines 6 words. Box Numbers 2 words plus 1/- (Address replies: Box 0000 o/o "Wireless World" Dorset House, Stamford St., London, S.E.1.) Trade discount details available on application. Press Day: June 1955 issue. Thursday, April 28th. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components and valves which may be offered for sale through our displayed or classified columns carry no manufacturers' guarantee. Many of these items 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 items purchased.

NEW RECEIVERS AND AMPLIFIERS

C. J. R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd., Bickford Rd., Witton, Birmingham, 6. Tel. East 0822. SPECIALIZE in the manufacture of High Fidelity Sound Reproducing equipment, including:-

WILLIAMSON Amplifiers, Tone Control Stages with variable Steep Cut Filters, Cross-over Units, High Fidelity Portable Tape Recording equipments, ideally suitable for replaying the new EMI pre-recorded tapes, Professional Recording Amplifiers, Microphone Mixing Units, etc. Send for details, [0105]

LANCASTER Hi-Fidelity for all audio requirements; full range of equipment stocked and demonstrated. The North's Reproduction Specialists, 29, Lancaster Ave., Manchester, 4. Deansgate 2503. [0066]

THE Mullard high-fidelity amplifier, superb reproduction, true bass, perfect treble, straightline response 10c/s-20,000c/s, silent background, finest workmanship and components; LP/78/tape/mic./radio switch and feeder power socket, individually matched to your pick-up and laboratory checked, a.c. or a.c./d.c.: £16/16.

MIDLAND RADIO SERVICE, North Sherwood St., Nottingham. [43/1]

SHIRLEY Laboratories, Ltd., 125, Tarring Road, Worthing, Sussex, the precision high fidelity specialists; amplifier type SB/1-15E, 15 watts output, response 15 to 60,000 c/s, bass lift 18 db, cut 18db, treble lift 14 db, cut 20 db. B.V.A. valves, complete with engraved panel, 18gns; with 3 position switched input filter 19gns; also the Jupiter reproducers at 34gns, the W.B.U. 6 watt amplifier, 12gns; tape amplifiers to suit most decks; specialized amplifiers to order for the musical and scientific industries. Tel. Worthing 513, 557. [4373]

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

FOR sale, RME 69 receiver with DB20 pre-selector, modern KB wire recorder.—Offers to Box 2725. [4461]

R 1355 sound receivers, as supplied R.A.F., unused, 27/6, car 10/-.—Smith, Highworth Rd., Faringdon Berks. [4464]

R.P. units, new in original cartons, 2/6 each, 26/27/26/25, 21/6, 24/11, post 2/6.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [4365]

VERY limited number R.1155 damaged and sold for parts only (all include I.F. Transformers, Coils, Tuning Condensers, etc. but exclude valves); £2/10 plus 7/6 carriage.

RECEIVER R.1426 as specified for the Inexpensive Television Receiver, these are all new and include all valves (7—SP61 and 1—EA 50) external cases slightly soiled due to storage; 15/- each, plus 5/- packing and carriage.

BRAND new ex M.O.S. Two-way Telephone sets, comprising 2 control units, 2 pairs headphones, 2 microphones and a drum of twin cable approx. 180ft, very simple to set up and operate, many applications; our special price for the complete outfit, £5/10 plus 5/- cart. extra drum cable complete with plugs and sockets 10/-, post 2/6.

2 SPECIAL meter offers (very limited number) 0-500 Micro amps 1/4 dia. flush mounting single nut fixing, 10/- post free; 0-500 Micro amps 2½ dia. flush mounting, 15/- post free; these meters are ex brand new units and fully guaranteed.

VALVE bargains, VR. 91 3/9, VR91 red 5/-, BM6A, X66, 884, CV181, all at 7/6; VR92, VR78, VR54, all at 1/-; VR18, VR21, CV54, VU120A, VU111, VU133, VT75A, VR65, VR65A all at 2/6; post 6d extra in each case; hundreds of others.

HAVE you sent for our special clearance list? If not send s.a.e. today! We have bargains for all.

WALTON'S Wireless Stores, 48, Stafford St., Wolverhampton. [0147]

LEAK Connoisseur point one amplifier, £18; L.E.A.K. Voigt corner horn speaker, with unit and power pack, £20.—A.C.S., 44, Widmore Rd., Bromley, Kent. (Rev. 0156). [4417]



PARTRIDGE TRANSFORMER Type 2038

and the
BRISTOL "BRITANNIA"

Partridge Transformers find a wide field of applications in the Aircraft Industry. They are used in many well-known aircraft, including the Bristol "Britannia". In addition to our wide range of standard

types, our Research and Development Department is always ready to undertake special designs to individual requirements.

Type 2038

100 STANDARD TYPES

The Partridge Range includes Power Transformers, single or multi-phase up to 100 kVA.; all grades of audio frequency transformers; hermetically sealed components, and transformers for special applications such as the Osram 912 and Mullard 510 amplifiers



Write for illustrated brochure giving full details of the Partridge components specified for the Osram 912 and Mullard 510 amplifiers.

PART RIDGE TRANSFORMERS LTD.

TOLWORTH SURREY

Phone: ELMbridge 6737/8

HRO Rx's and coils in stock, also AR88, BC348R, CR100, etc.—Requirements please to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0053]

WIRELESS WORLD 2R.F. 3-valve quality W tuner, M.W. and L.W., complete with fully smoothed power supply unit, unboxed, for use with all high fidelity amplifiers; £7, including 4 valves, approx. half original price; limited number bargain.—Box 2974. [4516]

LOUDSPEAKERS—SURPLUS AND SECONDHAND

GOODMAN'S Audiom 70, 35 c.p.s. unused; £9/10.—Colman, 1, St. Stephens Gdns., W.2. [4370]

GOODMAN'S Axiom 150 in corner cabinet, as new; £12.—Binks, 9, Elmerswood Rd., Redhill, Surrey. [4424]

W.B. famous 12in concentric-duplex 20-watt W high-fidelity loudspeaker, with crossover network, still unmounted; £15.—Box 2891. [4486]

TRANSMITTING EQUIPMENT

AVAILABLE: ET4332B, BC375 with T.U., A T1131, TR1430, TR1464, W.S.38.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [4366]

TEST EQUIPMENT—SURPLUS AND SECONDHAND

W1191A signal generator adapted A.C. mains; £10 or offer.—48, Eton Ave., New Malden, Surrey. [4469]

DAVANCE signal generator B.4-A2 surplus, A new and unused, 100Kc to 70Mc; price £40.—Box 2716. [4457]

COSSOR Oscill model 339A, guaranteed unused instruction manual, details; offers.—Box 2797. [4476]

TAYLOR electronic meter, 170A, £15; radar pattern generator, channel two, £25; condition as new.—Popplewell, Westgate, Otley, Yorks. [4504]

DAVANCE E2 signal generator, £20; Taylor A 45A valve tester, £16; Taylor 15A circuit analyser, £11/10; Avo model 7, £14; all perfect, little used.—Wood, 118, Moscow Drive, Liverpool, 13. [4423]

SIGNAL generators, oscilloscopes, output meters, valve voltmeters, frequency meters, multi-range meters in stock; your enquiries are invited.—Requirements to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0056]

AVO electronic test meter, Avo wide signal generator, both as new 150watt transmitter, whole or parts; wavechange switch for AB88, H.T. rectifiers, 1,000volt 150m.a., also good quality junk; what offers?—Write Joel, 35, Limeley Grove, S.E.13. [4463]

NEW DYNAMOS, MOTORS, ETC.

SPACIAL television rotary converters, guaranteed interference free, fitted radio and television filters, wt. 60lb. d.c. input 12v 200va. out, 24v, 32v, 110v, 230v, d.c. to 230v out, 250va £28/10 del. also converters for telegram and general use. Inputs, outputs and price as above; the above also supplied without smoothing, £25 del. immediate despatch; trade supplied.

AT a purchaser's home 60 mls. S.W. of Sutton Coldfield 24v.

TELSTAR SI/ON converter was tested on Eko television 12in tube satisfied consumption 135 watts d.c. current from battery only 94 amps, picture and sound were perfect and completely free of interference or flutter.

THE above is the latest product of British manufacture, and is guaranteed for one year. J.A.P. No. 2A 1.2hp petrol engine, air-cooled 2-stroke, starting rope, tools; £17/10 delivered T.W. PEARCE, 66, Great Percy St., W.C.1 (near Angel). [0013]

NEW GRAMOPHONE AND SOUND EQUIPMENT

T/R amps 18gns and pre-amps £5/15 for 3-headed decks, inc. p. pack and meter level ind.

GRUNDIG, Philips T/R promptly supplied; Reflexograph decks £31, for Lodestar; T/R amps. for Wearite, Truvox, etc., U/L output. TEL. Gla. 1770. [0032]

TAPE recorders for sale, exchange, or hire. In Greater London, good quality tape recorders wanted for cash, all types of repairs, mechanical and electronic, carried out by specialists, all accessories available, we deal exclusively in magnetic recording equipment.

THE MAGNEGRAPH RECORDING Co., Ltd., 1, Hanway Place, London, W.1. Tel. Langham 2156. [3396]

CINE-VOX disc recording equipments, type CT7 for high-quality recordings from existing microphone equipment; price from 28gns; also available as a complete channel inclusive of mic., amplifier and playback equipment, 70gns; type CT7 for highest quality professional requirements—recorder mechanism at 48gns, or complete channel at 110gns; demonstrations arranged in London.

PLEASE write for details to K.T.S., Ltd., "Coplow," Park Rd., Braintree, N. Devon Tel. Braintree 224. Callers by appointment only. [0209]

"AUTOMAT" HOME CHARGERS AND KITS

SELENIUM L.T. RECTIFIERS.
S.T.C., Westalite, G.E.C. etc., 40 m.a. to 10 amps
All new goods with full guarantee.

FOOLPROOF CHARGER KITS. Genuinely trouble free and ultra reliable. As sold for 11 years through "W.W." with full data sheet and instructions. No. 1 Kit. (As Illus.) Westalite 3 amp. rectifier, 65 watt tapped, impregnated trans., ballast bulb, for 21 v. 12 v. charger. All rectifier troubles eliminated. 46/10. Handsome steel case, ready punched, louvred, enamelled. 12/6. No. 1A Kit. 3 a. rectifier, 65 watt trans., ballast, res., ammeter for 2 v., 6 v., 12 v., 3 a. 52/6. P.P. 1/10. No. 2 Kit, 12 v. 2 a. rect. 45 watt trans., ballast/indicator bulb for 2 v., 6 v., 12 v. charger. 36/6. Case 12/6. p.p. 1/10. Wt. 8lb. with case. Minor Kit 6 v. 2 amp., 32/- p.p. 1/10. 12/6 extra. Senior Model, for 6 v./12 v. for 4 to 5 amp., 12 v. 5 amp. S.T.C. rect., 85 watt trans., ballast bulb, 64/- p.p. 2/-. Slide Kit, 12 v. watts trans., 14 v. amp., 12 v. 2 amp. rect., slides on, high grade ammeter, wt. 17lb. for 6 v. 12 v. charger. 24/13/- car. 4/- Ditto 9 a. 12 v. 4 a. 67/- p.p. 2/-.

"AUTOMAT" SELF REGULATING CHARGERS.
"Export" model for 6 v./12 v. 5 amps, using S.T.C. selenium rectifier, damp-proof, ultra reliable, wt. 16lb., for 215/245 v. A.C., £8/5/- car. 4/6 extra. Gtd. 12 months. Also our well known 12 v. 3 amp. charger with protective ballast and glow indicator. 69/6 ditto 6 v., 3 amp./12 v. 2 amp., 69/6 ditto. 6 v./12 v. 2 a., 59/6. postage 1/10. wt. 8lb.

SELENIUM RECTIFIERS. new stock not surplus with full data sheet, 6 v. 1 a., 4/-, 2 a., 7/6, 4 a., 15/-, 12 v. 0.5 a., 1 a., 7/6 2 a., 9/6 all p.p. 6d. 12 v./14 v. 3 a. to 3.4 a., 15/6 5 a., 27/- Large finned 5 a., 32/-, p.p. 10d. 24 v. 50 mA. 2/9. 24 v. 0.3 a., 9/6, 1.5 a., 15/-, 3 a., 27/-, 5 a., 42/- 8 a., 52/- all p.p. 1/6. 5 a., 15/-, 3 a., 27/-, 5 a., 42/- 8 a., 52/- all p.p. 1/6. H.T. rectifiers, 120 v., 50 mA. 2/9. 120 v., 100 mA. bridge, 14/6, 5/6. 250 v., 50 mA. 7/- 250 v., 100 mA. bridge, 14/6, all p.p. 6d. Many other L.T. and H.T. types in stock.

"RENEWBAT" BATTERY DESULPHATOR AND CONDITIONER. Car size, 3/6, p.p. 8d.

CHAMPION PRODUCTS

43 Uplands Way, LONDON, N.E.2. Phone LAB. 4457.

SURPLUS

AERIAL MASTS. American Yagi 5 element array AS-46/APG. 30ft, one piece 4in. dia. hollow wood masts. 36ft. 3 section 2in. dia. tubular steel masts. 45ft. 9 section 1 1/4 in. dia. American steel masts MS-44. 50ft. Bendix plywood masts MT-7A. 70ft. American plywood masts. 200 mc/s. Birdcage "H" array. 20ft. American tripod base aluminium mast AS/TPX. 9ft. one piece American police whips. 18ft. BC-610 6 section whips. DIRECTION FINDERS. SCR-206, SCR-208, SCR-291, SCR-503, DFG-20, DFG-24, etc.

TELEPHONE AND TELEGRAPH APPARATUS: 1 + 1 terminals and bypass filters; 1 + 3 terminals; 1 + 4 terminals and repeaters; S and SX, S and DX, filters; power bays; repeaters; V.F. ringers; perforators; Wheatstone equipment; teleprinters; undulators; switchboards; rectifiers; EE-65, TG-10, etc., etc.

AUDIO EQUIPMENT. R.C.A. squadron announcers (12-25 watt speakers). R.C.A. 25 watt high power speakers. Portable megaphones PA-4.

CONTROL UNITS. RM-6, 7, 12, 13, 21, 25, 29, 42.

AMERICAN TRANSMITTING TRANSFORMERS AND CHOKES. A large variety by Amertran, Kenyon, R.C.A., Thordason, etc., etc.

TRIPLE DIVERSITY RECEIVERS. 1.5 to 30 mc/s. Self contained on rack with all refinements. Full details available.

100 WATT BROADCASTING TRANSMITTERS by Woden. Self contained in 4ft. 6in. cabinet £22/10/- with valves.

RACKS, de luxe, 19 Inches wide channel Iron sides, 3 x 2, 3ft. 6in., 40/-; carr. 10/-.

Many other items too numerous to mention. Send your requirements. Lists available. All packing and shipping facilities.

P. HARRIS
ORGANFORD DORSET

Telephone: Lychett Minster 212.

GRAMOPHONE AND SOUND EQUIPMENT—SURPLUS AND SECONDHAND

SLIGHTLY used B.A.S.C. Scotch Boy, Ferrotapes, 1gn each.—Box 2957. [4515]

L.H.F. Exchange Mart for used quality equipment; send s.a.e. for lists.—31, Lancaster Ave., Manchester, 4. [0067]

As new, E.M.I. 12B battery tape-recorder A as used B.B.C.; cost over £100 with extras; will accept £70 o.n.o.—Box 2326. [4382]

GRUNDIG TK9, as new, Golden mike. £55; Truvox Mk. III deck, £15; Truvox amp., un-used, new, £13.50. Taylor, 191, Ashton Rd., Denton, M.C., Den. 1/2. [4387]

PRESTO disc recorder, 33 & 78, complete with amplifier. £45; also Memovox U.S. Signals Corps micro-groove recorder, with large quantity unused acetate discs, £20.—R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0164]

GRAMOPHONE AND SOUND EQUIPMENT—WANTED

£45 offered for Grundig tape-recorder model 700L or TK9 in as new condition; please write J. Kidd, 47, Southgate Lane, Reading. [4376]

NEW COMPONENTS

TRANSISTORS and associated parts, types up to 50 M/Cs., outputs of avg. speech power.—Bel, Marlborough Yard, N.19. Arc. 5078. [0185]

OSRAM 9-1/2 high quality amplifier constructional details, circuits, component list 3/6, post free.—Franklin & Hall, 371, Havant Rd., Farlington, Portsmouth. [4394]

AMMETERS 0-4 amps D.C., 1/4 in. diameter, 10/6; metal rectifiers, 6-12v 0-4 amps, 15/6; mains transformers for battery charging tapped 4, 10, 16 and 20 volts, 25/- wirewound resistors, 0-250mH 25w, 8/6; electric motors, 1/4hp 230v. A.C., s.p.d., 85/-; Kingston Electrical Supplies, 154, London Rd., Kingston-on-Thames. Kin. 7534. [4456]

COMPONENTS—SURPLUS AND SECONDHAND

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. ELECTROLYTICS, capacity, voltage, size, type of mounting, price post paid; 400, 6v, 1x2in, lug, 1/9; 250+250, 6v, 1x2in, lug, 2/:-; 40, 150v, 1x2, clip, 2/6; 20+20, 275v, 1x2, lug, 3/3; 16+32, 275v, 1/2, lug, 3/3, 16-16, 275v, 1x2, clip, 3/3; 100, 275, 350v, 1/4x3, clip, 3/6; 32+12, 350v, 1/4x2, clip, 4/-; 16, 350v, 1/2x2, lug, 1/9; 10, 450v, 3/2x2, lug, 1/6; 16, 450v, 1/2x2, tag, 2/9; 20, 450v, 1x2, 2/3; 32, 450/525v, 1/2x2, clip, 3/9; 15+15, 450v+20mf, 1/4x3, lug, 4/6; 200, 6v, 3/4x1/4, clip, 1/6; 10, 2v, 3/4x1/4, clip, 1/9; 8, 450v, 1x2, clip, 2/:-; 50, 12v, 3/4x1/4, clip, 1/6; 1/4x1/4, clip, 2/:-; 250, 12v, 3/4x1/4, wire, 2/:-; 275v, 1/2x2, clip, 3/3; 16+32, 275v, 1/2x2, clip, 3/3; 12, 1/4x2, clip, 3/3; 350v, 1/4x2, clip, 1/9; 32+32, 350/425v, 1/2x2, clip, 5/2; 2, 450/525v, 1/2x2, clip, 1/6; 8, 450v, 3/2x2, clip, 1/9; 64+120, 275v, 1/4x1/4, clip, 5/6; 1,000+1,000, 6v, 1x3in, lug, 3/3; all cans, some with sleeves, all voltages, WKD, surge where marked, new stock guaranteed. 5mA meters, moving coil, bakelite case, 2in square, flush mounting, new, boxed; 7/- post paid.

MAINS trans., 250-0-250v, 80ma 6.3v, 2.5A. 6.3v, 0.6A. Pri. 0-210-230-250v 12/- post paid. TUNING FOLDERS chassis, cadmium plated, steel, size 14x18x2 1/4in. complete with 15 valve holders (9-B9A, P9A, 1-B9A Cer, 2-B7G Cer, 1-Int. Oct. ampl.), 20 various tag strips, cut away for metal rect., line trans., etc.; 9/11 each, post paid.

FRONT and rear tube mounts to fit above chassis, 3/- pair, post paid.

P.M. focus rings, wide angle, tetrode tube, fully adjustable, 12/- post paid.

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015]

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport Street, London, W.C.2. See our displayed advertisement, page 155. [0016]

SUPREME RADIO, 746B, Romford Rd., Manor Park, London, E.12. Tel. Ilf. 1260. Est. 19 years.

SPRAGUE 0.1 mfd 350v w/end condensers; 6d ea. or 5/6 pr. doz.

ELECTROLYTIC cond., 8 mfd 450v wkg. sleeved tubular w/end; our price 1/11 ea.

32 mfd 350v tag end all can, small; 1/9 ea.

SPECIAL e/cond line, 64+120 mfd 275v wkg., 350v surge, 1/4in all can; our price 10/- ea.

MICROPACK 25 mfd 25v bias cond., very small; 1/4 ea.

E.F.50 valves, Red Sylvania, new boxed; 10/6 ea.

CERAMIC EF50 v/holders; 7d ea.

PHILIPS Beehive type 30 pF trimmer cond.; 1/- ea.

B7G screening can with spring, and skirted B7G v/hldr., 1 1/4 complete; B9A type, 1/11 complete.

2-POLE 2-way w/c switches; 1/- ea.

R.M.1 metal recs., 3/11 ea.; R.M.2 type, 4/3 ea.; R.M.3 type, 5/11 ea.; R.M.4 type, 18/- ea.

14A.86 metal rectifiers, 16/6 ea.; 14A.100, 19/6 ea.

STEEL chassis, ready punched for s/he layout, 14in x 6in x 3in; 2/6 ea.

All parts in stock for Denco F.M. unit, Moulards 5/11 high quality amplifier, etc.

Many other radio and television component parts in stock at very keen prices; your enquiries will be welcomed.

TERMS c.w.o.; no c.o.d.

SEND 9d extra for postage orders under £5; 2½d s.a.e. all enquiries and list. [0021]

THE INSTRUMENT MODEL

Specially designed for soldering operations in the compact assemblies used in present day radio, television and electronic industries. Weight 3½ oz. excluding flexible. Length 9 in. 25 Watts—

200/220 volts,
LIST NO. 624
220/240 volts,
LIST NO. 625

19 8d



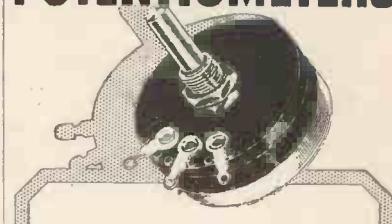
1. Bit 7/8" diameter, simple to replace.
2. Steel cased element, also replaceable.

3. Detachable hook for suspending iron when not in use.
4. Moulded two part handle, remains cool in use.
5. Six ft. Henley 3-core flexible.

HENLEY SOLON
ELECTRIC
SOLDERING IRONS

W.T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51/53, Hatton Garden, London, E.C.1

POTENTIOMETERS



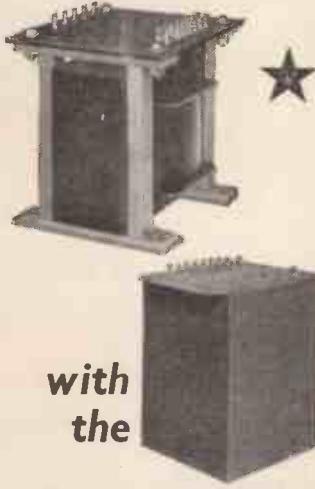
Wire-wound and Composition types. Single, Ganged, Tandem Units. Characteristics: linear, log., semi-log., non-inductive, etc. Full details on request.

RELIANCE

RELIANCE MNFG. CO. (SOUTHWARK), LTD.,
SUTHERLAND ROAD, HIGHHAM HILL, WALTHAMSTOW, E.17.
Telephone: Lutstead 3245

ENSURE THE BEST RESULTS

from your
**ULTRA - LINEAR
AMPLIFIER**



SAVAGE OUTPUT TRANSFORMER 3S95

The Savage Massicore output transformer type 3S95 is designed to the same standard as the 3C67A, which so many enthusiastic friends incorporated in the Williamson circuit. The specification is as follows:-

★ Primary D.C. resistance $100\Omega + 100\Omega$. Inductance taken at 5 v. $50\sim - 80$ hys minimum. Primary impedance $7,000\Omega$ tapped at 43% symmetrically about the centre tap. Leakage reactance tested at 1 v. 800 mH. Whole primary to secondary: 8 mH. Half primary to the other half primary: 8 mH. Secondary impedances: 0.45Ω, 1.8Ω, 4Ω, 7Ω, 11Ω, 16Ω, 22Ω, and 30Ω.



**NURSTEED ROAD,
DEVIZES : WILTS.**
Telephone: DEVIZES 932.

NEW G.E.C., S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS.
Largest L.T. range in Great Britain.
Latest Current Products. NOT Surplus.

CURRENT PRICE LIST

DEDUCT 15% FROM S.T. & C. PRICES.
S.T. & C. E.H.T. K3/15, 4/5; K3/45, 8/2;
K3/50, 8/8; K3/100, 14/8; all post 4d. extra.

BRIDGE CONNECTED FULL WAVE

17 v. 1.2 a.; 16/4; 1.6 a.; 26/1; 2.5 a.; 29/1; 3 a.; 30/-; 4 a.; 34/6; 5 a.; 37/6; all post 6d. 33 v. 0.7 a.; 24/3; 1 a.; 28/1; 1.5 a.; 45/-; 2 a.; 51/-; 3 a.; 52/-; 4 a.; 62/-; 5 a.; 67/-; all post 1/-; 54 v. 1 a.; 38/6; 1.5 a.; 62/-; 2 a.; 69/-; 3 a.; 70/-; 5 a.; 93/-; 72 v. 1 a.; 49/-; 1.5 a.; 78/-; 2 a.; 81/-; 3 a.; 92/-; 5 a.; 122/-; 100 v. 1 a.; 70/-; 1.5 a.; 112/-; 2 a.; 128/-; 5 a.; 174/-; all post 1/-.

BRIDGE CONNECTED HEAVY DUTY

7½in. SQUARE COOLING FINS. 17 v.

6 a.; 49/6; 10 a.; 56/-; all post 1/10.

BRIDGE CONNECTED HEAVY DUTY

Funnel Cooled, also

7½in. SQUARE COOLING FINS. Revised price, same both types. 17 v. 12 a.; 102/-; 20 a.; 118/-; 30 a.; 164/-; 50 a.; £12/15/-; 33 v. 6 a.; 91/-; 10 a.; 104/-; 12 a.; 168/-; 20 a.; 188/-; 54 v. 6 a.; 120/-; 10 a.; 142/-; 72 v. 6 a.; 154/-; 10 a.; 178/-; 100 v. 6 a.; £11; 10 a.; £12/15/-; all post 2/-.

"WESTALITE" (BRIDGE), 12-15 v. D.C., 1.2 a.; 15/10; 2.5 a.; 27/8; 5 a.; 31/9; 10 a.; 54/6; 20 a.; 99/6; 30 a.; 144/10; 50 a.; 257/-; 24 v. 1.2 a.; 15/10; 2.5 a.; 27/8; 5 a.; 51/-; 10 a.; 92/7; 20 a.; 176/2; 36 v. 1.2 a.; 27/8; 2.5 a.; 51/-; 5 a.; 69/10; 10 a.; 130/9; E.H.T. RECTS., 14D, 134, 22/-; 36 E.H.T. 60, 31/10, all post extra.

Wholesale and Retail
Special Price for Export and Quantity.

T. W. PEARCE

66 GREAT PERCY STREET, LONDON, W.C.1
Off Pentonville Rd. Between King's Cross and Angel

TANNOY
SOUND EQUIPMENT

Tells you what's going on clearly

WEST NORWOOD • S.E.27

Telephone: GIPsy Hill 1131 (7 lines)

QUARTZ CRYSTAL UNITS



Type
B7



The type B7 unit is mounted in the standard B7G valve envelope and is hermetically sealed and fully evacuated.

Available for the frequency ranges from 100 kc/s. to 500 kc/s. and from 3 Mc/s. to 16 Mc/s. Gold electrodes applied by cathodic sputtering give permanence of calibration. Normal adjustment accuracy 0.01% Max. adjustment accuracy 0.003%.

Early delivery can be given of some frequencies, and we will be pleased to quote for your specific requirements.

THE QUARTZ CRYSTAL Co. Ltd.
63-71 Kingston Road,
NEW Malden, Surrey

Telephone: Malden 0334
Cables, etc.: QUARTZCO NEWMALDEN

ELECTRICAL test instruments repaired and recalibrated, all makes, ammeters, voltmeters, multi-range test meters; meters supplied or converted to any range—Electrical Instrument Repair Service, 329, Kilburn Lane, W.9. Ladbrooke 4168. [4016]

24-HOUR service, 6 months' guarantee, any type transformer, rewind, mains outputs and i.f.s., etc. all types of new parts, etc. supplied to specification; business heading or service card for trade prices.—Majestic Winding Co., 180, Windham Rd., Bournemouth. [4268]

D. G. BOULTON for repairs to any loudspeaker, specialists on heavy and P.A. types; cone assemblies, field coils, repair accessories, pressure units, microphones; transformers, rewound and to specification; motor rewinds.—Lumbry St., Manchester Rd., Bradford. Tel. 22838. [0171]

PAINTS, CELLULOSE, ETC.

PAINT spraying handbook, 3/6 post free, cellulose and synthetic paints and all spraying requisites supplied; catalogues free.—Leonard Brooks, 53, Harold Wood, Romford. [0207]

WORK WANTED

A.I.D.-APPROVED contractors seek model room or short run work; comprehensive test gear and machine capacity.—

BEL SOUND PRODUCTS Co., Marlborough Yard, London Archway, N.19. Arc. 5078.

CAN we help? Your development or production; assembly and wiring service at your disposal.—R.A.E. Mfg. Co., 135a, Kentish Town Rd., N.W.1. Gul. 7011. [0219]

CAPACITY available for small plastic moulds and stamping tools; highest limits, clean work, reasonable prices; speciality, hearing aids and electronic components.—Toolmaker, 23b, St. Stephens Ave., London, W.12. [0084]

CAPACITY AVAILABLE

VACUUM Impregnation capacity available. Headless Solventless to R.C.S.214. Specification—Enquiries to Avis & Bages, Ltd., Gosbrook Rd., Caversham, Reading. Tel. 71763. [0094]

MISCELLANEOUS

SLIGHTLY used demonstration equipment and new surplus, all in perfect condition, unmarked.

WAVEFORMS Video and Pattern Generators, Type H; £44/17/7 each.

WAVEFORMS Video and Pattern Generators, Type C; £51/8 each.

LEAK T.L.10 Amplifiers C/W Pre Amps (new); £21/1/0 each.

MULLARD Oscilloscope Units Type B.100 (new); £12/15/2 each.

LEAK Pick-up 78 rpm (as new); £9/12/6 each.

LEAK Pick-up L.F. 33⅓ rpm (as new); £9/12/6 each.

LEAK Pick-up Transformer (new); £1/5/11 each.

G.E.C. Miniscope in case; £17/13/6 each.

PLESSEY 3-speed auto change units (new); £8/9/1 each.

PLESSEY 3-speed auto change unit in cabinet (new); £12/13/0 each.

MEICO M.C. Microphone and Table Stand; £6/12/0 each.

MEICO M.C. Microphone (new); £5/10/0 each.

TAYLOR "Windsor" Signal Generator. Type 66A; £17/17/8 each.

MET-VICKS. Universal Meters and R.F. Probe (new); £11 each.

E.M.I. Recording Tape 65B (new); £1/4/8 each.

CONVOWORD M.I.C.22 Microphone (new); £4/12/4 each.

TAYLOR Type 13GA Megohmeter (as new); £14/0/6 each.

GRAMPIAN Table Microphone DP/Z; £3/6/0 each.

TAYLOR Bridge Type 110C (new); £11/10/5 each.

LUSTRAPHONE Table Microphone; £3/6/0 each.

SPENCER West T.V. Pre-Amp AC3B; £3/17/0 each.

G.E.C. Layer Thickness Meter.

LIGHTWEIGHT head sets (new); £2/6/2 each.

BRITISH Universal E.M.E. Retailer Office Dictating Machines; £53/12/6 each.

CASE for above; £4/12/10 each.

F. C. ROBINSON & PARTNERS, Ltd., 122 Seymour Grove, Manchester. [0517]

FLUORESCENT 4ft batton; 39/6, less tube.—

(Dept. W.W.) B.D.C., 591, Green Lanes, London, N.8. [4277]

PROFESSIONAL tape-to-disc transfer service for trade and the public; 10in disc 15/6, 12in 18/6 inc. needles; also L.P.s.

SOUND NEWS PRODUCTIONS, 59, Bryanston St., Marble Arch, W.1. Tel. Ambassador 0091. [4500]

METALWORK, all types cabinets, chassis racks, etc. to your own specification; capacity available for small milling and cap-

itan work up to 1lb radio.

PHILPOT'S METAL WORKS, Ltd. (G4B1), Chapman St., Loughborough. [40208]

YOUR own tape recording transferred to disc.—Write, call or 'phone Queensway Private Recording Studios, 123, Queensway, W.2. Tel. Bay 4992. Studio recordings, tape recording service. [4341]

DOUGLAS wave winding machine, latest type, motor driven, complete accessories and extras, as new; £70; Deposit System willingly.

—H. E. Foard, La Vieille Corderie, St. Peters, Guernsey. [4444]

COPPER wires enamelled, tinned, Litz, cotton, silk covered, all gauges; B.A. screws, nuts, washers, soldering tags, eyelets, epoxite and laminated bakelite panels, tubes, coil formers; Tufo, cork, headphones, sleeves, etc.; latest radio publications, full range available; list, s.a.e.; trade supplied—Post Radio Supplies, 33, Bourne Gardens, London, E.4. [0138]

Electronics

By A. T. Starr, M.A., Ph.D., M.I.E.E. A complete treatise on theoretical and applied electronics. Pitman's Engineering Degree Series. 32/6 net. "... an outstanding textbook from the viewpoint of both teacher and student." THE ELECTRICAL JOURNAL.

Telecommunications

Also by A. T. Starr. Covers the London University Degree syllabus in Telecommunications, but the choice of material makes it of value to students studying for similar examinations, as well as to those needing a 'refresher' course. 35/- net.

Principles of Television Reception

By A. W. Keen, M.I.R.E., A.M.Brit.-I.R.E. An important book by a practising electronic research engineer. The entire receiving system is examined stage by stage, complete circuits are given of four up-to-date commercial receivers, and the problems of colour television are fully discussed. With over 200 illustrations. 30/- net.

PITMAN

Parker St. • Kingsway • London, W.C.2

Purchase or hire your
'VORTEXION TAPE RECORDER'
& ASSOC. EQUIPMENT FROM
GRIFFITHS HANSEN (Recordings) LTD.
32/33 GOSFIELD ST., LONDON, W.I.
MUSEUM 0642/2771.

COPPER WIRE

ENAMELED

SWG	2 oz.	4 oz.	2 oz.	4 oz.
16	1/6	2/3	1/6	2/3
18	1/6	2/5	1/6	2/5
20	1/7	2/7	1/7	2/7
22	1/8	2/9	1/8	2/9
24	1/9	2/11	1/9	2/11
26	1/10	3/1	1/10	3/1
28	1/11	3/3	1/11	3/3
30	2/-	3/5	2/1	3/8
32	2/1	3/7	2/3	3/11
34	2/2	3/9	2/5	4/3
36	2/3	3/11	2/8	4/8
38	2/5	4/3	2/11	5/2
40	2/7	4/7	3/2	5/9

Wires to 48 SWG available.

COPPER INSTRUMENT WIRE

ENAMELED, TINNED, LITZ,

COTTON AND SILK COVERED.

All 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.

SEND STAMP FOR LIST. TRADE SUPPLIED

POST RADIO SUPPLIES

33 Bourne Gardens, London, E.4.

GALPIN'S

ELECTRICAL STORES

408, HIGH STREET, LEWISHAM, S.E.13

Tel.: Lee Green 0309. Nr. Lewisham Hospital.

TERMS: CASH WITH ORDER. NO C.O.D.

All goods sent on 7 days' approval against cash.

EARLY CLOSING DAY THURSDAY

HEAVY DUTY SPOT WELDING TRANSFORMERS, input 200/250 volts. OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 120/150 amps. New £6/15/- each, carriage 6/-.**MEDIUM SPOT WELDING TRANSFORMERS**, input 200/250 volts, OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 50/70 amps. New £5/2/6 C/paid.**HEAVY DUTY L.T. OUTPUT TRANSFORMERS**, 200/250 volts Input. Output a combination of 6, 12, 18 and 24 volts at 30 amps. £4/2/6 each. C/paid.

Another Input as above, Output 0, 6, 12, 18, 24 volts at 12 amps., 55/- each, post 2/-. Another Input as above, Output 0, 6, 12, 18, 24 volts, 6/8 amps., 46/6 each.

HEAVY DUTY L.T. TRANSFORMERS suitable for rectifiers, soil heating, etc. Input 200/250 volts. Output a combination of 6, 12, 18, 24, 30, 36 volts at 15 amps., 67/6 each, post 2/6. Another Input and Output as above but at 6 amps., 47/6, post 2/-. Another Input and Output as above but at 4 amps., 36/6 each.**EX-RADAR MAINS TRANSFORMERS**. Input 230 volts. Output 4 or 5 Kilo-volts at 30 min. also 3 L.T. windings 4 v. 2 a., 6.3 v. 2 a., 2 v. 2 a. these transformers are capable of a larger output than stated and are immersed in oil. £3/15/- each, carriage 5/-.**EX-U.S.A. ROTARY CONVERTORS**, 12 volts D.C. Input, outputs 500 volts 50 mA. 275 v. 100 mA. Complete with smoothing, 22/6 each, carriage 2/6. As new.**1,000 WATT AUTO WOUND VOLTAGE CHANGER TRANSFORMER**, tapped 0/110/200/230/250 volts, £5/15/- each, carriage 4/6. 500 watt ditto, £7/15/- carriage 7/6.350 watts 55/-, 500 watt 75/-, 200 watt 45/-. **CHARGING KITS CONSISTING OF RECTIFIER AND TRANSFORMER** for charging 6 or 12 volt batteries at 2 amps. (input 200/250 volts) 32/6 each; ditto for 4 amps., 46/6 each.**EX-R.A.F. DYNAMOTORS** 24/28 volts D.C. input 1200 volts, 17 milliamps 1/2 hour rating, 11/6 each.**EX-RADAR IMPULSE TRANSFORMERS**, 2 Mu-Metal transformer in oil. Output believed to be 15 kV. at 3 kW. R.F. only 7/6 each.**ROTARY CONVERTORS**, 24 volts D.C., input 50 or 110 volts 500 cycles 1 phase, Output at 300 watts, £7/10/- each C/forward.**METAL RECTIFIERS**, large type, 50 volts at 1 amp. D.C. Output (70/75 volts A.C. Input), these can also be broken down for low tension rectts., 7/6 each.**EX-G.P.O. EARPHONE** with separate carbon type M' 'phone, 40 ohms resistance, 61/6 each.**AUTO WOUND TRANSFORMERS**, 4 kilowatts 110 to 230 volts or vice versa, £15 each, C/forward; ditto double wound 3 kW., Input 230 volts, Output 55/0/55 or can be used the other way round, £16/10/- each, C/forward.**MAINS TRANSFORMER**. Input 200/250 volts, Output 25 volts 2 amps., centre tapped, 22/6 each.**EX-R.A.F. MORSE TAPPING KEYS**, complete with flexible lead with Jack Plug, 3/6 each.**EX-GOVERNMENT MAINS TRANSFORMERS**, suitable for soil heating, garage lighting, etc. Input 180/250 volts, Output 0/14/17 volts 20 amps., 45/- each, carriage 3/6; another same input, Output 4 volts 20 amps. twice, 30/- each. C/paid.**LARGE WIRE WOUND FIXED RESISTANCES**, 350 ohms to carry 1/2 amp., slider easily fitted, 5/- each.**MAINS TRANSFORMERS**, 200/230 volts. Input 0/9/18 volts 3/4 amps., Output suitable for battery chargers, etc., 22/6 each.**ELECTROLYTIC CONDENSERS**, 1000 M.F.D. 75 volt working, 6/6 each; 2000 M.F.D. 12 volt working, 5/- each, post 1/-.**EX-W.D. CONVERTORS**, 18/24 volts D.C., Input 450 volts D.C., Output complete with reduction gear, these can be easily converted to work off A.C. mains, approx. power 1 h.p., suitable for grinders, lathes, etc., 20/- each, post 2/6.

Clients in Eire, please allow at least double the carriage stated to allow for customs clearance charges.

BUILD your own TV and learn about its operation, maintenance and servicing; qualified engineer-tutor available whilst you are learning and building.—Free brochure from E.M.I. Institutes, Dept. WW.58. London, W.4. (Associated with H.M.V.) [0180]**FERROGRAPH** recorders for dependability. We have several years' experience using, supplying these fine instruments. Microphones, tapes, splicers (8/9, post free). Disks from your tapes, L.P. and 7/8. Hear our recording Royal Fireworks Music Paxton Records pr. 648. Intending callers please telephone first.—Eroica Recording Studio (1949), 31, Peel St., Eccles, Manchester. Eccles 1624. [0121]**NOTICES****BRITISH SOUND RECORDING ASSOCIATION**. Details of membership, open to the professional sound recording engineer and all others interested in recording high quality reproduction and other branches of audio production together with details of the London Lecture programme and the Manchester, Portsmouth and Cardiff Centres, May. Details obtained from the Hon. Membership Secretary, H. J. Houltage, A.M.I.E.E., 12, Strongbow Rd., Eltham, S.E.9. [0031]**PATENTS****THE** proprietor of British Patent No. 567462, entitled "Electronic Tube" offers same for licence or otherwise to ensure practical working in Great Britain. Enquiries to Singer, Stern & Co., Ltd., 14, E. Jackson Blvd., Chicago 4, Illinois, U.S.A. [4356]**PUBLIC ANNOUNCEMENTS**
THE INSTITUTION OF ELECTRICAL ENGINEERS.**SCHOLARSHIPS**.

The Council of The Institution of Electrical Engineers will consider for award this year five Research Scholarships, one Graduate Scholarship and six Student Scholarships.

RESEARCH Scholarships.—Farranti, value £500 p.a. for two years. Oliver Lodge, value £420 for one year, may be extended. I.M.E.A., value £420 for one year, may be extended. Swan Memorial, value £120 for one year. C.P. Sparks Fund, value £100 for one year.

GRADUATE Scholarship.—For full-time post-graduate study—Duddell, value £400 for one year. May be awarded as a Student Scholarship.

STUDENT Scholarships for study at undergraduate level at a University or a Technical College—Duddell, value £200 p.a. for three years. Arthur Fleming, value £120 p.a. for four years (for a sandwich diploma course).

Salmons, value £60 for one year. David Hughes, value £60 for one year. Paul, value £75 p.a. for four years. Thorowgood, value £25 for one year.

THE closing date for the receipt of applications is 2nd May, 1955, for Student Scholarships and 1st June, 1955, for Graduate and Research Scholarships. Full particulars of the conditions of award attached to each scholarship and nomination forms may be obtained on application to the Secretary The Institution of Electrical Engineers, Savoy Place, W.C.2. [4372]

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is exempted from the provisions of The Notification of Vacancies Order, 1952.

SENIOR engineers.**JUNIOR engineers.**

TECHNICAL assistants ARE invited to apply for positions where ready initiation and skill will be well rewarded; the work relates to the development of television circuits, and the design of components for large scale production; experience of television receiver design is required in respect to means of scanning and focusing or the design of R.F. and I.F. circuits; the positions are permanent ones which offer scope for advancement to senior positions; the commencing salary will be in accordance with experience based on a generous and progressive scale.—Write, giving full personal particulars, to the Personnel Manager, The Plessey Co., Ltd., Ilford, Essex. [14403]

DESIGN and Development Engineers.

APPLICATIONS are invited from the following to undertake important work on a wide range of interesting problems in connection with Guided Weapons Research and Development.—SERVO Research Engineers. (Ref. W.W./8.)

TO work on electro-pneumatic and hydraulic servo-mechanisms. Degree or H.N.C. essential. SERVOPRINT Research Engineers. (Ref. W.W./7.)

TO work on Gyroscopic instruments and accelerometers with associated pick-offs. Degree or H.N.C. essential.

ELECTRONIC Engineers. (Ref. W.W./10.)

TO carry out work, associated with the above, on electronic circuitry or magnetic amplifiers. Degree or H.N.C. essential.

GRADUATE Engineers or Physicists. (Ref. W.W./9.)

TO solve problems on analogue computers. Previous experience desirable. Degree, electronic experience and a mathematical leaning essential.

GOOD salary and bonus. Pension scheme incorporated. Life Assurance. Thirty-eight-hour, five-day week.—Apply quoting appropriate references above, to the Assistant Manager, The Fairey Aviation Co., Ltd., Weapon Division, Heston Aerodrome, Hounslow, Middx. [4492]

-TELE-RADIO (1943) LTD**STEEL METER CASES WITH ALUMINIUM PANEL, SLOPING FRONT**

4in. x 4in. x 4in.	.....	9/6
5in. x 5in. x 8in.	.....	10/6
6in. x 6in. x 12in.	.....	18/-

SMALL STEEL TEST METER CASES WITH ALUMINIUM PANEL

4in. x 4in. x 2½in.	.....	5/6
5in. x 5in. x 3in.	.....	7/-
8in. x 6in. x 3in.	.....	8/6
10in. x 6in. x 2½in.	.....	10/6

STANDARD STEEL CASES WITH ALUMINIUM PANEL

10in. x 7in. x 7in.	18/6	16in. x 9in. x 8in.	39/6
12in. x 7in. x 7in.	23/6	18in. x 11in. x 8in.	46/-
14in. x 7in. x 7in.	27/6	17in. x 11in. x 10in.	52/-
14in. x 9in. x 8in.	36/-		

18 S.W.G. ALUMINIUM CHASSIS

8in. x 6in. x 2½in.	7/6	14in. x 5in. x 2½in.	9/6
8in. x 6in. x 2½in.	8/3	14in. x 6in. x 2½in.	10/6
12in. x 6in. x 2½in.	8/6	14in. x 10in. x 2½in.	11/-
12in. x 8in. x 2½in.	9/8	17in. x 10in. x 2½in.	12/6

18 S.W.G. STEEL CHASSIS

14in. x 8in. x 2½in.	9/8	17in. x 10in. x 3in.	11/3
14in. x 10in. x 2½in.	10/3	17in. x 10in. x 3in.	12/6

FULLY DRILLED CHASSIS FOR WILLIAMSON AMPLIFIER

.....	27/6
-------	------

G.E.C. OSRAM 912 AMPLIFIER DRILLED CHASSIS

.....	21/-
-------	------

G.E.C. OSRAM 912 FRONT PANEL

.....	14/6
-------	------

"PAUL" CRACKLE PAINT, BLACK, GREEN OR BROWN, 3/- per tin.**SUNDRIES**

0-15 v. A.C. Meter	.....	10/6
0-30 M.A. Meter	.....	7/6

Crystal Headphones	.....	7/6
London Channel T.V. Pre-amplifier	(1 valve EF42 or equivalent.)	21/-

813 Valve Bases (new)	.....	10/-
280 v. 80 mA. Half-wave Metal Rectifier	.....	7/6

40 H. 50 mA. Woden Chokes	.....	12/6
5-pin P/S. Belling Lee	.....	6 for

7-pin P/S. Belling Lee	.....	6 for
E.M.I. Variable Selectivity I.F.T.s., pair	.....	6/6

4K Colver Preset Wire-wound Potentiometers	.....	9/-
6K Colver Preset Wire-wound Potentiometers	.....	9/-

2K Colver 15-watt Precision Potentiometers	.....	8/6
E.M.I. 100-I Microphone Transformer, heavy screen	.....	7/6

OZ4, Govt. surplus. New and boxed	.....	3/-
PEN46. New and boxed	.....	8/6

866A. New and boxed	.....	10/-
HVR2A. New and Boxed	.....	8/6

Mains Transformer, drop through, 350-0-350 v. 60 mA., 6.3 v. 2.5 a., 5 v. 2 a., Standard Primary	14/6
--	-------	------

Postage & Packing extra. C.W.O. or C.O.D.

-TELE-RADIO (1943) LTD**189 EDGWARE ROAD,****LONDON, W.2.**

Phone: PAD. 4455/6.

Shop hours:

Mon-Sat. 9 a.m.-6 p.m.

Thursday 9 a.m.-1 p.m.

OPPORTUNITIES IN RADIO

ENGINEERING OPPORTUNITIES

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 144 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 £15 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
398B COLLEGE HOUSE,
29-31 WRIGHT'S LANE,
LONDON, W.8.



BRADMATIC

HIGH CLASS
TAPE RECORDING EQUIPMENT
HEADS, DESKS, TAPE, ETC.
Send for lists.

BRADMATIC LTD.
STATION ROAD, ASTON, BIRMINGHAM 6
Telephone: East 2881-2

THE "LODESTAR" HIGH FIDELITY TAPE RECORDER

can now be heard at

Smith's
of
EDGWARE ROAD

Component Specialists since Broadcasting started

Priced parts list available, also Booklet containing full constructional details, price 3/6, from

H. L. SMITH & CO. LTD.

287/289 EDGWARE ROAD, LONDON, W.2

Telephone: Paddington 5891

Hours 9 till 6 (Thursday 1 o'clock)

Near Edgware Rd. Stations, Metropolitan & Bakerloo

THE PLESSEY Co., Ltd.

VACANCIES exist in new well equipped and expanding laboratories of the Chemical and Metallurgical Division, for junior and senior metallurgists, chemists and ceramists with progressive ideas: experience in any of the following an advantage.

SEMICONDUCTORS.

ELECTROLYTIC capacitors.

MAGNETIC materials.

EDUCATIONAL circuits.

POSITIONS offered are permanent and pensionable and offer considerable scope for advancement: salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants.

[4407]

ELECTRONIC Engineers.

A DEVELOPMENT section for work on Government contracts is to be created at a new, modern and attractively situated G.E.C. factory. There are posts of varying responsibility requiring men with practical Electronic Development experience and with qualifications ranging from H.N.C. Cert. to Hons. Degree.—Applications which will be treated in strict confidence, should be detailed and addressed to Personnel Manager, S.E.I., Ltd., School St., Hazel Grove, Cheshire. [4425]

DRAWING office training.

MARCONI'S.

WIRELESS Telegraph Co., Ltd. OFFER a six months' course with fixed salary at their Drawing Office School, Chelmsford, from July 1955 onwards.

AFTER successful completion of the course, permanent posts will be available in the company's design drawing offices at Chelmsford.

QUALIFICATIONS:

AGE limit 28.

MUST have workshop experience.

MUST produce evidence of drawing ability.

PREFERABLY have O.N.C. Mech. or Elec.

A limited number of posts will also be available in the company's installation drawing offices at Chelmsford for which men with practical experience in the installation and maintenance of electrical equipment would be preferred: a few posts will also be available at Acton, London.

FIVE-DAY week; pension and life assurance scheme; social and athletic club.

APPLY (by writing) giving full details of education, training, experience etc. (including H.M. Forces), to The Secretary, Marconi's Wireless Telegraph Co., Ltd., New St., Chelmsford, Essex. [4495]

DEVELOPMENT engineer.

MUIRHEAD & Co., Ltd., Beckenham, Kent. have a vacancy for physicist or electrical engineer (with degree or similar qualifications) on the development of data transmission devices, miniature motors and instrument servo mechanisms; salary according to experience; pension scheme.—Apply in writing to Personnel Manager. [4399]

IMPORTANT vacancies for

ELECTRICAL Engineers for GUIDED Weapon Test Equipment.

THE following electrical engineers are required to develop and/or use electronic and electro-mechanical test gear:—

ELECTRICAL Engineer (ref. W.W./46) to lead a small test and fault-finding team. Applicants should have electronic experience, preferably in one or more of these fields: servo-mechanism, analogue computers, radar, micro-wave, pulse, communication or telemetry. Degree or H.N.C. standard essential.

DEVELOPMENT Engineer (ref. W.W./48). Young graduate required to design and develop electronic and pneumatic test equipment. Hons. Electrical Engineering degree essential.

ASSISTANT Engineer (ref. W.W./49) to compile inspection test instructions for component and missile testing. H.N.C. standard and electronic experience essential.

THESE interesting appointments offer scope for advancement, together with good salary and bonus. Pension scheme.—Send details of experience and qualifications, quoting appropriate reference, to the Assistant Manager, The Fairey Aviation Co., Ltd., Weapon Division, Heston Aerodrome, Hounslow, Middx. [4386]

ESSEX EDUCATION COMMITTEE.

SOUTH-EAST Essex Technical College and School of Art, Longbridge Rd., Dagenham. REQUIRED 1st September 1955.

ASSISTANT Grade B for radio and television servicing and

TELECOMMUNICATIONS. Salary £525 X £25 to £820 plus London Allowance, with additions for approved experience, training and qualifications. Application forms (returnable within 14 days) and details from Clerk to the Governors. [4442]

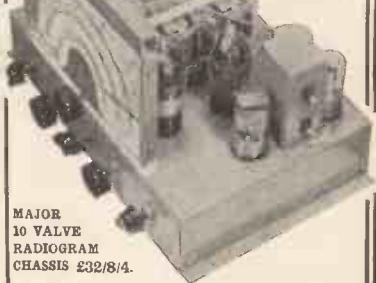
BRITISH Empire Cancer Campaign.

ELECTRONICS technician required to construct special apparatus for research and to assist with maintenance and operation of million volt electron accelerator; age 22-35 preferred; appointment will be either in the technical grade £470-£545 or in senior technical grade £570-£655, according to age and qualifications.—Apply to Director, Research Unit in Radiobiology, Mount Vernon Hospital, Northwood, Middx. [4397]

TELEVISION engineers able to drive required by leading and progressive dealers: good salary, conditions and prospects.—Singer's, 350, Edgware Road, W.2. Pad. 7915. [4213]

Fidelia

HAND BUILT
QUALITY
UNITS



MAJOR
10 VALVE
RADIOGRAM
CHASSIS £32/8/4.

Music Critic Fred, of world renown 'tis said, New to the Fidelia creation, sends us his commendation.—The opera ('tis sad) was very bad, the reproduction a sensation.'

Fidelia P.M. Tuner	£13 10 0
Fidelia Standard 7-valve model	£21 12 0
Fidelia de Luxe 9-valve model with 7 watt triode push-pull output	£25 5 0
Fidelia 10 watt amplifier	£27 10 0

Are you ready to receive the new V.H.F. Frequency Modulated transmissions. Helpful details about these and particulars of suitable equipment including a fringe area tuner on request.



2 AMHURST ROAD,
TELSOMBE CLIFFS,
Nr. Brighton,
SUSSEX
Tel: Peacehaven 3156

CABINETS

We specialise in making HIGH CLASS cabinets to individual specification, particularly in high fidelity field.

Competitive Prices.

ALAN CRANSTON (Cabinet Makers).
20, Lorrimore Bldgs., Olney Road, Walworth.
Phone: RODney 2349. LONDON, S.E.17.

LYONS RADIO Ltd.

WAVEMETERS TYPE W.1230. Frequency coverage 39-51 Mc/s. Rectifier type employing one each of the following valves, V.R92, 6J5, V103, 6X5. The tuning control is fitted with a Muirhead slow motion dial with a calibrated white escutcheon and vernier scale. Contains its own built-in power pack for A.C. mains 50 c.p.s. operation 200/250 v. Housed in copper lined wooden instrument cases 15½ x 10½ x 9in. with hinged lid. A useful addition to any laboratory or as an inexpensive basis for constructing test gear. Condition is as new and unused. Supplied in maker's transit case. PRICE ONLY 69/6, carriage 6/6.

AMMETERS. Switch board mounting, projection pattern, 4½in. dia. Moving iron type, calibrated 0/14 amperes. A.C. or D.C. first grade meter in maker's carton as new at the SPECIAL PRICE ONLY 12/6, post 1/3.

POWER UNITS TYPE 285. Input 230 v. 50 c.p.s. A.C. mains. Output E.H.T. 2,000 v. at 5 mA. H.T. 350 v. at 150 mA. both switchable. D.C. L.T. 6.3 v. at 5 a. and 6.3 v. at 10 a. Some specially selected units designed for operating " Gee " ground installations. Fitted with paper smoothing condensers (no electrolytes). Impregnated transformers, valves, type VU120, 5U4 and VR91 etc. Housed in metal cases 18 x 12 x 9in. with input/out. plugs, fuse holders and on/off switch mounted on front panel. In good condition and working order supplied with circuit diagram. A REAL SNIP AT ONLY 69/6.

STABILISER VALVES CV188. Operating current min. 1 mA., max. 10 mA. Regulat. volts 5 v. Striking 140 v. Operating 100 v. PRICE 5/6 each.

3 GOLDHAWK ROAD (Dept. M.W.)
SHEPHERD'S BUSH, LONDON, W.12

Telephone: Shepherd's Bush 1729

DEPENDABLE RADIO SUPPLIES

12a TOTTENHAM STREET, W.1

TEL.: LANGHAM 7391/7392

1 minute Goodge St. Station

Wireless Sets No. 19, Supply Units No. I, Mark III, Ref. No. ZA 15208, complete with two rotary transformers.



Price £5/5/-, post and packing extra. Cases, chassis, spares and motors can be supplied separately.

ROTARY TRANSFORMERS



H.T.31

Input 11.5 v.
Output 250 v. at 125 mA.

H.T.32

Input 11.5 v.
Output 490 v. at 65 mA.

H.T.31, 55/- Postage 2/-. H.T.32 30/- Postage 2/-.

Can be supplied for tropical use at a small extra cost.

SPECIAL OFFER

American Bulbs, 6-8 v., .25 amp., M.B.C., 6/- per dozen. 12-16 v., .1 amp., M.B.C., 7/6 per dozen. Post free.

LOUD HAILERS

Made by Tannoy
and Truvox.

22/6 each. 3/- P.P.
40/- for 2. 5/- P.P.
(BRAND NEW)

Impedance 15 Ω.
Handling Capacity
8-10 watts.



Large stocks of American aircraft fuses, switches, transmitter and radio components. Including spares for AR88Ds and AR77s, and American aircraft lamps.



Heavy Duty Sliding Resistors. 250 watts to carry 25 amps. Resistance 0.4 ohms. Suitable for charging board, etc. Size 9 x 4 x 6in. high. Brand new. Price 10/6. Post 2/-.

Quantities and Export. Inquiries invited. Callers also welcome.

Open Monday to Friday 9.30-5.30. Saturday 9.30-1.

TERMS—CASH WITH ORDER
DEPENDABLE—ALWAYS DEPENDABLE

DE HAVILLAND.

ADVANCED guided weapon projects. SPECIALIST Servo Engineers are required for positions in an expanding organisation engaged on research, design and development work. PERMANENT and progressive posts, both senior and junior, are available for men with ability and enthusiasm who can offer sound knowledge and experience of hydraulic servo mechanisms. Promotion prospects are good and conditions of employment are generous and enlightened.

WE operate a five-day week and assistance is given in obtaining single lodgings accommodation within easy reach of the works. THREE grades of specialist engineers are required, as follows:—

(i) SERVO Engineers with a theoretical background, having some practical experience of servo design. Candidates for these posts need not have any electronic experience. (Ref. 134.)

(ii) SERVO Engineers with a practical outlook. Candidates should possess a good knowledge of electronics and preferably be acquainted with hydraulics. (Ref. 135.)

(iii) ELECTRONIC Circuit Engineers for the detailed circuit design of the control equipment associated with hydraulic servos. (Ref. 136.) APPLY in confidence, quoting reference number of position sought, to The Personnel Manager (Technical Employment), de Havilland Propellers, Ltd., Hatfield, Herts. [4488]

ESSEX EDUCATION COMMITTEE.

SUPERVISORY Officer (technical) required to take charge of maintenance and repair of radio, gramophone and 16 mm film equipment in schools, etc. Good qualifications in radio theory essential; experience with 16 mm equipment and tape recorders an advantage. Salary £600-£125-£225. Further particulars and application forms obtainable (s.a.e.) from Chief Education Officer, County Offices, Chelmsford.

SENIOR technical engineering staff.

A London engineering company invite applications from project engineers who are capable of taking charge of microwave, electronics and mechanical engineering development in connection with guided weapon and other applications; these positions are permanent and offer ample opportunity for further advancement. The compensation salaries which will be in the region of £1,000 per annum upwards according to qualifications and experience, will be subject to review on a generous scale; engineering degree or H.N.C.—Replies, which will be treated in utmost confidence, should give full details of qualifications and experience and be addressed to Box 2828. [4477]

DEVELOPMENT Engineer required for

CYPRUS INLAND TELECOMMUNICATIONS AUTHORITY for one tour of three years in the first instance with prospect of a second tour. Salary scale £1,500 rising to £1,750 a year with gratuity at rate of £150 a year. Free passages. Outfit allowance £50. Free furnished house. Liberal leave on full salary. Candidates must hold City & Guilds Full Technological Certificate or equivalent and have at least 10 years' experience as an Executive Engineer with the G.P.O. or a manufacturing firm in the maintenance of V.H.F. multi-channel equipment and associated Carrier & V.F. telegraph equipments at major V.H.F. terminals. They should also have comprehensive experience of current line planning methods and of Field Survey work together with the preparation of fundamental plans and printing schedules.—Write to the Crown Agents, 4, Millbank, London, S.W.1 State age, name in block letters, full qualifications and experience and quote M2C/40697/WF. Candidates at present employed by the G.P.O. should submit their applications through their Establishment Division. [4428]

BRITISH ELECTRICITY AUTHORITY.

EASTERN Division. APPLICATIONS are invited for the following superannuable post in the Technical (Electrical) Department based at Ipswich:—GENERAL Assistant Engineer (TELECOMMUNICATIONS).

SALARY Grade 6. £600+£25—£725/£785 per annum.

APPLICANTS should preferably possess Higher National Certificate in Electrical Engineering or equivalent qualifications and have considerable experience in the maintenance of automatic and line transmission telephone apparatus. Some knowledge of power supervisory systems and V.H.F. radio would be an advantage.

THE duties will be concerned with the Authority's telecommunications systems in East Anglia.

APPLICATIONS stating age, qualifications and experience, should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, within 14 days of the appearance of the advertisement. W. N. C. CLINCH, Controller. [4393]

UNIVERSITY COLLEGE OF NORTH WALES.

APPLICATIONS are invited for the post of Technician in the Department of Applied Electricity. Salary £340 by annual increments of £15 to £415 (efficiency bar), then £440 by £20 to £480 per annum. Experience in the servicing of electronic apparatus desirable.

APPLICATIONS giving particulars of age, experience, etc., and names and addresses of two referees should be sent to the Registrar, University College of North Wales, Bangor, not later than Monday, 1st May, 1955. [4468]

TUNERS

AM and FM



FM81

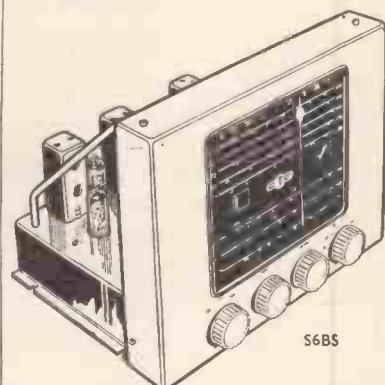
Our FM tuners provide excellent reproduction with absence of background noise and are tuneable between 87.5 Mc/s-100 Mc/s and will receive the proposed National B.B.C. Frequency Modulated V.H.F. transmissions as and when installed within approximately 60 miles of the transmitter.

Using the latest valves and techniques they are available in three forms:

FM81 illustrated above, £21 tax paid.

FM82 with pre-set station selection, output 1-2 volts, self-powered 200-250 volts, £24 tax paid.

SS/FM all waves AM and FM tuner, £32/10/- tax paid.



S6BS

S6BS 9 Band (6 Electrical band spread) with R.F. F.C. 2 I.F. Delayed Amplified A.V.C. Variable Selectivity. Fly Wheel Tuning Tropicalised. Suitable for use with an High Quality Amplifier. £44. Tax paid

S6 A new model similar to the well-known S6BS but only 3 Wave Bands; 16m-50m 195m-550m, 800m-2,000m. £30. Tax paid.

S6E As S6 but 4 Wave Bands: 12.5m-37m, 35m-100m, 90m-250m, 190m-550m. £30. Tax paid.

S5 3 Wave Bands. 16m-2,000m, R.F. pre-Amplifier, variable selectivity I.F. Delayed Amplified A.V.C. very low distortion. £21/6/8. Tax paid.

S5E As S5 but 12.5m-550m. £21/6/8. Tax paid. The Standard high-quality Feeder Unit Specification as S5 but without R.F. amplifier. £16. Tax paid.

A modified version of all models is available for use with Leak, Acoustical and other High Quality Amplifiers.

C. T. CHAPMAN (Reproducers) LTD.

RILEY WKS., RILEY ST., CHELSEA, S.W.10

FLAXMAN 4577/8

Export Enquiries Invited

CABINETS



We can supply any Cabinet to YOUR OWN SPECIFICATION. The one illustrated can be obtained in Walnut, Oak or Mahogany for £19/15/0 or as a COMPLETE RADIOPHONIC incorporating:

5 Valve Superhet Auto-changer and 10in. Speaker for ...	£48/17/4
8 Valve Armstrong F.C.48 Auto-changer and 10in. Speaker for ...	£62/14/4
10 Valve Armstrong R.F.41 Auto-changer and 10in. Speaker for ...	£70/16/0
14 Valve Armstrong 125/C Auto-changer and 10in. Speaker for ...	£88/6/4

(H.P. terms can be arranged)
Send 1/- for complete Catalogue of Cabinets, Chassis, Autochangers and Speakers (refunded on receipt of order).

LEWIS RADIO CO.
120, GREEN LANE, PALMERS GREEN,
LONDON, N.13. BOWES PARK 6064

PRECISION SHEET METALWORK

We specialise in manufacturing of Chassis in all metals, large or small quantities to your own specifications.

V. W. BEAMISH

Shardeloes Garage, Shardeloes Rd., New Cross
London, S.E.14.
Telephone: TIDeway 4795

WAFER SWITCHES TO SPECIFICATION

One or more type "H" switches having any desired contact arrangement or wafer spacing made from parts supplied by A.B. Metal Products Ltd.

Most types despatched within 48 hours.

Send for Price List of 82 "standard" arrangements and switch design chart

Orders and enquiries by post only:

SPECIALIST SWITCHES
24 CRANBOURN STREET,
LONDON, W.C.2

HER MAJESTY'S Overseas Civil Service. ENGINEERS, Posts and Telegraphic Department, Federal Government of Nigeria. DUTIES include (a) the supervision of African civil staff, installing and maintaining several types of wireless equipment, particularly V.H.F. single and multi-channel, or (b) the supervision of staff and the installation and maintenance of manual telephone exchanges; the planning, installation and maintenance of associated subscribers networks and the maintenance of carrier equipment and telegraphs used on physical or V.H.F. Radio Circuits, or (c) the carrying through of telephone Subscriber underground cable development schemes including the balancing of loaded cables, and telecommunications duties of a general nature if necessary.

APPOINTMENT is either pensionable on probation in the salary range £910-£1,560 per annum gross or on contract in the salary range £1,116-£1,898 per annum plus with gratuity of £150 per annum on satisfactory completion of contract. Free first class passages are provided for the officer, his wife, and assistance of up to £75 each for a maximum of 2 children is granted in respect of their passages or maintenance in the United Kingdom. Leave is granted at the rate of 7 days for each month of resident service in tour of 18-24 months and government quarters are provided, if available, at low rental.

CANDIDATES between 25 and 35 years of age, must have passed, or be exempt from Parts A and B of the examination for A.M.I.E.E. or hold a University Degree in Electrical Engineering (preferably telecommunication) or be Assistant Engineers in the British Post Office with considerable experience in modern telecommunications practice. Preferably given to candidates with experience in the installation and maintenance of V.H.F. multi-channel equipment.

APPLY in writing to the Director of Recruitment, Colonial Office, Great Smith St., London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number ECD 108/14/05. [4429]

ONE of two research engineers are required by THE ENGLISH ELECTRIC Co., Ltd., at their Guided Weapons Division at Luton.

FOR extended studies into miniature high-speed transmission armature hydraulic servo systems and their associated control valves.

THE suitable men should be well qualified in mechanical engineering but an ability for original thought, and to work without supervision is of paramount importance.

SALARIES will be generous to the right applicants and housing assistance is possible. These posts offer excellent prospects for original work for which every facility will be offered.

APPLICATIONS to Dept. C.P.S., 336-7, Strand, W.C.2, quoting Ref. 1181D. [4438]

AUTOMATIC TELEPHONE & ELECTRIC Co., Ltd., LIVERPOOL, 7.

COMMUNICATION engineers and DRAUGHTSMEN.

THE expanding programme of the Transmission Department offers vacancies in both senior and junior categories for line transmission laboratory engineers, and apparatus design engineers, and also for draughtsmen with experience in telecommunications or light current engineering.

SPECIALIST experience in any branch of line transmission engineering is desirable for some of the posts.

POSITIONS offered are on the company staff with contributory pension fund and usual staff conditions.

APPLICANTS should write to Personnel Manager, Automatic Telephone & Electric Co., Ltd., Sharrow Works, Edge Lane, Liverpool, 7, giving full details of age, qualifications, and experience. [4243]

MAINTENANCE and Construction Engineer required for CYPRUS Inland Telecommunications Authority for one tour of three years in the first instance with the prospect of a second tour. Salary scale £1,400 rising to £1,600 a year with gratuity at rate of £150 a year. Free passages. Outfit allowance £30. Free furnished house. Liberal leave on full salary. Candidates must hold C. and G. Full Technological Certificate or equivalent and have at least 10 years' experience as an executive engineer with the G.P.O. or equivalent employment. In the construction and maintenance of 2,000 type four direct automatic exchanges, V.H.F. multi-channel and associated carrier and V.F. telegraph equipment and other duties associated with the running of a telecommunications section. Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/40638/WP. Candidates at present employed by the G.P.O. should submit their applications through their Establishment Division. [4443]

T.V. engineer required, N. London, one able to make dept. pay; excellent returns and accommodation available.—Box 2949. [4511]

PARTIDGE Transformers, Ltd., have a vacancy for an engineer experienced in transformer testing and development; to take charge of transformer testing department. WRITTEN applications giving details of past experience, qualifications and age to the Chief Engineer, Partidge Transformers, Ltd., Tolworth, Surrey. [4475]

ENGINEER, experienced radio and L.F. amplifier for factory installation service, preferably own transport.—Apply General, 73, Great Peter Street, London, S.W.1. [4480]

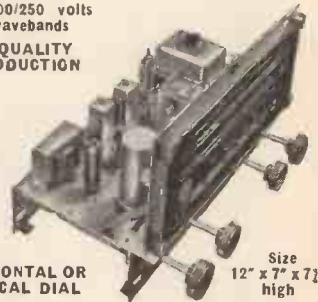
COMPLETE RADIO/RADIOGRAPHIC CHASSIS
NEW AND FULLY GUARANTEED

DIRECT FROM THE MANUFACTURER

NEW MODELS—WITH FERRITE ROD AERIALS

A/C 200/250 volts
3 wavebands

HIGH QUALITY
REPRODUCTION



HORIZONTAL OR
VERTICAL DIAL

Size
12" x 7" x 7 1/2"
high

BUILT FOR THE CONNOISSEUR OF QUALITY MUSIC REPRODUCTION

MODEL F3 5 valves, 4 watt output. Wide range tone control ... **£13.18.3**

MODEL F3 PUSH/PULL, 7 valves, 6 watt output. Separate bass and treble tone controls **£17.17.9**

Latest type components and B.V.A. miniature valves built on steel chassis. Plug-in connections for pick-up, speaker, Gram motor. Gram switching on wavechange switch. Negative feedback applied from output transformer secondary.

TRADE ENQUIRIES INVITED

THE DULCI CO. LTD.

97 VILLIERS ROAD, LONDON, N.W.2.
Telephone: WILLESDEN 6678.

OUR NEW GOVERNMENT SURPLUS CATALOGUE No. 12

containing over 400 items price 1/6d. post free. 2/6d. overseas seamail.

ARTHUR T. SALLIS (W.W.)
93 NORTH ROAD, BRIGHTON,
SUSSEX. Tel.: BRIGHTON 25806

Introducing the: TYANA TRIPLE THREE



Reg. Design.
No. 867884

MAKE SOLDERING A PLEASURE
SMALL SOLDERING IRON

Complete with detachable BENCH STAND ... 19/6

The smallest high-power soldering iron. Length only 8 1/2 in.; adjustable long bit dia. 3/16"; mains voltages 100/110, 200/220, 230/250.

The "STANDARD"
Popular Soldering Iron



now reduced to 14/11

Replacement Elements and Bits for both types always available.

KENROY LIMITED
152/297 UPPER ST., ISLINGTON,
LONDON, N.I.
Telephone: Canonbury 4905-4663

BENSON'S BETTER BARGAINS

BRAND NEW. ORIGINAL CARTONS.
R.F. UNITS. TYPES 26 or 27, 27/6; 24, 15/-.
(Postage 2/6.)

High Stability, Close-tolerance Resistors, mainly $\frac{1}{2}$ and 1 watt, from 10Ω to $5.1M\Omega$ in pref. values; 1/- each.
DYNAMOTORS (Post 2/-), D.C. (approx. 250 v. 80 mA., at 6 v.), 8/6, 12 v. input; 250 v. 80 mA. and 6.3 v. outputs, P.M. field, 7/6. Filters for these, 2/6.
I.F.T.S., new, carmine 10/13 Mo./s., 16/- POWER UNITS, 250 v. 230 v. 50 c.w. (each) D.O. 2/6.
5 mA. 350 v. 150 mA. A.G. 5.3 v. 15 v. a. 3 valves. New 75/- car, paid inland.
new, std. m.m.s. input; 600 v. H.W. 6.3 v. 2 a. 16/- 2/6.
10/6; 230 v. to 6.3 v. 5 a. and 10 a., 17/6; 2 k.v. 5 mA. 2 v. 2 a. 20/-; 350-0 250 v. 150 mA. 5 v. 3 a. 25/-; 55 v. 30 mA. (twice), 6.3 v. 3.2 a. 9/-; 220-0 220 v. 33 mA. 7.1 v. 8 a. 8.4 v. 10 a. 5 v. 3 a. each C.T. 15/6; 740-0 740 v. 163 mA. 470-0 470 v. 220 v.A. 4 v. 8 a. C.T. (twice), 30/- (cart. 6/-). 350-0 350 v. 120 mA. 6.3 v. 4 a. 4 v. 2 a. 16/- (post 2/- each).
METAL RECS. 600 v. 30 mA. 6/-, H.W. 400 v. 1 a. 22/6. 240 v. 250 mA. 10/-, FW 2 v. 2 a. 12/6.
MOTORS, tiny 24 v. driving aerial switch, 8/6. Co-ax Aerial c/o relay 12/24 v. or manual, 8/6. R1155, coilpacks, new, 12/6, used, 9/6; twin knob drives, 7/6; I.F. Filters, 2/6; Condensers, tubular, 1 a. 1 mfd., 1/-; RX 78, two band SW. Tuner, I.F. 660 k.c./s. with 100 k.c./s. crystal, 2 valves, 22/6; Double Insulators, perspex flat for 1" rods, 6/6; WAFER SWITCHES: 1/PW1B, 2/PW3B, 4/PW1B, 4/PW3B, 2/PW2B, 3/PW1B, 1/P10W1B, 4/P2W1B, 2/P2W1B, each 1/6.
Toggles SPST, new, metal, 1/6. RX161, valves 2/EF54, 1/EC52, 1/CV66, VHF, with rotary call selector, 17/6.

METERS—BRAND NEW—BOXED

FSD	Scale	Size	Type	Fit.	Price
500mA	3in.	MC	Fl.Rd.	25/-	
10mA	3in.	MC	Fl.Rd.	7/-	
10mA	4½in.	MC	Fl.Rd.	20/-	
20mA	200A	3½in.	MC	Fl.Rd.	7/-
25mA	50A	3in.	MC	Fl.Rd.	7/-
30mA		2in.	MC	Pr.Rd.	6/-
40 & 120mA		2in.	MC	Fl.Sq.	7/6
100mA	300mA	2in.	MC	Fl.Sq.	5/-
100mA		3in.	MC	Fl.Rd.	7/-
150mA		2in.	TC	Fl.Sq.	6/-
200mA		3in.	MC	Fl.Rd.	7/-
250mA		3in.	MC	Fl.Rd.	7/-
List and enquiries. S.A.E. please! Terms: Cash with order. Postage extra. Immediate despatch.					

Callers and Post Callers
W. A. BENSON (WW) S U P E R A D I O
308 Rathbone Rd. (W'chapel), LTD., 116
Liverpool 13. Whitechapel, Liver-
pool 1. ROY 1130.

SOUTHERN RADIO'S WIRELESS BARGAINS

TRANSRECEIVERS. Type "38" Mark II (Walkie-Talkie). With 5 valves and ready for use. Metal carrying case, 30/- per set.

THROAT MICROPHONES, with long lead and plug, 4/6.

JUNCTION BOX, 2/6. HEADPHONES 15/6 per pair. **AERIALS, 2/6.** ALL OF THESE ITEMS ARE FOR USE WITH THE "38" Walkie-Talkie.

TRANSRECEIVERS. Type "18" Mark III. Comprising Superhet Receiver and Transmitter. Two units contained in metal carrying case. Complete with 6 valves, £4/10/- per set.

RECEIVERS. Type "109". Built-in speaker. 8 Valves with VIBRATOR PACK for 6 volts. Contained in metal case. Perfect, £5 each.

TELESONIC 4-valve Battery Portable. Complete with Hivac valves in metal carrying case. Simply converted to Personal Portable, £2 per set including Conversion Sheet.

BOMBSIGHT COMPUTERS. BRAND NEW ex-R.A.F. Contains gyro, motors, rev. counters, gear wheels, etc., etc. Ideal for model makers, experimenters, etc., £3/5/- each, plus 10/- Carr.

LUFRA HOLE CUTTERS. Adjustable $\frac{1}{2}$ to 3½in. For metal, wood, plastic, etc., 6/6.

RESISTANCES. 100 Assorted, all useful values, etc. Wire end, 12/6 per 100.

CONDENSERS. 100 Assorted. Mica, Metal, Tub, etc., 15/- per 100.

PLASTIC CASES. 15in. by 10½in. Transparent. Ideal for maps, display, etc., 5/6.

STAR IDENTIFIERS. Type I A-N. Covers both Hemispheres, in case, 5/6.

CONTACTOR TIME SWITCHES. In sound-proof case, 2 impulses per second. Thermostatic control. Clockwork movement, 11/6 each.

REMOTE CONTACTORS for use with above, 7/6 each.

MORSE PRACTICE (WITH BUZZER) SET. Mounted, 6/9. Full List of Radio Books, 2½d.

METERS, 12 Instruments. May need adjustment or with broken cases, 35/- for 12.

Postage and carriage extra.

SOUTHERN RADIO SUPPLY LTD.
11 LITTLE NEWPORT STREET

Gerrard 6653

APPLICATIONS are invited for pensionable posts as ASSISTANT examiners in the Patent Office to undertake the official scientific technical and legal work in connection with Patent Applications; there are a small number of similar posts in the Ministry of Supply. Applications may be accepted up to 31st December 1955, but early application is advised as an earlier closing date may be announced. Interview boards will sit at frequent intervals.

CANDIDATES must be between 21 and 28 years of age during 1955 (up to 31 for permanent members of the experimental officer class) and have first or second class honours degree in physics, chemistry, mechanical or electrical engineering, or mathematics; candidates taking their degrees in 1955 may apply before the result of their degree examination is known. STARTING emoluments in London, including extra duty allowance for 45½ hour week, between £532 and £729 (men) £642 (women) according to periods of National Service and post-graduate experience rising to £896 (men) and £793 (women); promotion to examiners £934 (women); promotion to examiners £1,279 (men); £1,220 (men) £1,144 (women), normally after 5 years (3 or 4 years in exceptional cases); good expectation of promotion to senior examiner; candidates are recruited by selective interview.

APPLICATION forms and further information from the Civil Service Commission, Scientific Branch, 30, Old Burlington St., London, W.1, quoting number S 128/55. [4494]

ASSISTANT Lecturer (Radio Engineering) required for the ENGINEERING Dept. Nigerian Federal Government, for two or three tours totalling 36 months. Appointment either (a) on temporary terms with salary scale (including expatriation pay) £807, rising to £1,453 a year plus resettlement grant at rate of £100/£150 a year, or (b) with prospect of permanency with salary scale (including expatriation pay) £750, rising to £1,315 a year. Outfit allowance up to £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in United Kingdom. Liberal leave on full salary. Candidates with C or C in Electrical Engineering must have had sound training in radio receiving and transmitting theory and must be able to teach feeder and aerial theory; theory and practice of all types of recording apparatus and general audio and acoustic theory. They should have had wide experience in the industry and experience of teaching.—Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/40373/WF. [4507]

WIRELESS Station Superintendent required for the POSTS and Telecommunications Department, Gold Coast Local Civil Service, for two tours of 18 to 24 months in the first instance. Consolidated salary scale £990, rising to £1,250 a year. Gratuity at the rate of £100/£150 a year. Outfit allowance £60. Liberal leave on full salary. Free passages. Candidates should possess C and Gds. Final Certificate in Telecommunications (Radio) or C. and Gds. Certificates Radio III and IV equivalent, and have had 2½ years experience in two or more of the following fields: V.H.F. Link systems; H.F. communications systems; frequency shift keying and teletype; monitoring; V.H.F. and H.F. cathode ray direction finding system; aeronautical navigation aids (ground); manufacture of light engineering equipment. Candidates from the British Post Office should apply through departmental channels.

WRITE to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/29100/WF. [4391]

TECHNICAL Instructor (Broadcasting) required by the Broadcasting Service, NIGERIAN Federal Government, for two tours of 12 to 15 months each, with possibility of permanency. Salary scale (including expatriation pay) £1,307 rising to £1,453 a year plus gratuity at rate of £150 a year. Outfit allowance of £60. Liberal leave on full salary. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in United Kingdom. CANDIDATES should have instructional experience and should have a good theoretical and practical knowledge of radio communication as applied to M.F. H.F. and V.H.F. transmitters and receivers, with a knowledge of mathematics, electricity and magnetism.

WRITE to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30513/WF. [4451]

TELECOMMUNICATIONS (Radio Transmission) Engineer required by large organisation in the North-West to train for position in Technical Publicity Department. APPLICANTS should be aged between 25-30 years, and should have a good general educational background with the ability to write clear concise English; a sound knowledge of modern telecommunications techniques, including V.H.F. and U.H.F. multi-channel systems and frequency-shift signalling practices, essential.

THE position is on the established staff of the Company, with contributory Pension Fund, and usual staff conditions and amenities.—Please write to Box No. 434, Dorland Advertising, Ltd., 18-20, Regent Street, London, S.W.1, giving details of age, qualifications and experience. [4241]

SPRING TO DUODE



We could have perpetrated something about a Du-Ode to Spring, but resisted! The rain of brick-bats would have been well deserved, so we venture the less dangerous suggestion that a spring to Duode is both seasonable and sensible. It is also excellent for the pocket and kind to all musically critical ears.

Many, many people who have come to a final choice of Duode sound, often after long experience and searching, write to tell us how much they enjoy it. Letters from owners who have had Duode Units for several years are our great pleasure, because invariably they tell of enduring satisfaction.

There's no myth or mystery about it; every Duode is a hand-built job, tested individually and critically: Every Duode has the unique dual drive with built-in crossover and feedback; every Duode gives clean, clear reproduction of the full audio range, with smooth extreme top, firm boomless bass, transients as sharp and defined as the originals, and an overall NATURALNESS which delights the most exacting listener. SO—

INSIST on HEARING A DUODE

Send us a P.C. or a letter for details or see your dealer and ask him to do so. Any recognised music or radio dealer can, if he wishes, buy Duodes from us. If yours won't do this for you, let us know. We will be glad to help.

There are three standard 12-inch models:

DUODE 12A—The popular unit at the very modest price of £10 only, yet with all the basic Duode features.

DUODE 12B—The world-wide favourite with a 15,000 gauss magnet, ideal for all who appreciate fine sound at a fair cost—for a list price of £14.

DUODE 12C—The unit for use with first-class equipment. Specially treated cone and cloth surround, free suspension, large 17,000 gauss magnet, range from below 25 c.p.s. to over 16,000. A superb natural sound unit for the connoisseur, price £20.

Write for details to-day.

Barker Sound Reproducers
3 Newman Yd., London, W.1

**Solder with
LITESOL**

REGD. TRADE MARK

**THE
LIGHTWEIGHT
CHAMPION
WITH THE
REMARKABLE
PERMA-BIT**

REGD. TRADE MARK

The soldering bit which lasts indefinitely does not become pitted or lose its face and requires no reshaping, filing or maintenance. Fixed bit models and replaceable bits available in all sizes. All voltages supplied from 6/7 v. to 230/50 v. (State voltage when ordering.) Many leading manufacturers, after a test period, have "switched" to these instruments.

Details covering 20 models in folder No. S.P. 5 sent on request.

Sole Manufacturers and Distributors:
LIGHT SOLDERING DEVELOPMENTS LTD.
106, GEORGE STREET, CROYDON, SURREY.
TEL. CROYDON 3589

SENIOR draughtsmen.

DUE to expansion of the Electronics Division of the Plessey Company, Ltd., there are several vacancies for experienced men in the following fields:

1. DESIGN of a wide range of electronic equipment, including work to Service requirements.
2. MECHANICAL design of precision mechanisms for quantity production.

THESE vacancies carry attractive salaries and long-term prospects in reward for hard work and offer good staff conditions including superannuation and insurance schemes.—Applications, which will be treated in confidence, should be addressed to:

**THE PLESSEY COMPANY, LTD., VICARAGE LANE,
ILFORD, ESSEX.** [4474]

E.M.I. ENGINEERING DEVELOPMENT, LTD.

COMPUTOR Engineers.

APPLICATIONS are invited from senior and junior electrical engineers with experience in the design of digital computers to take part in a large scale development programme for commercial accounting systems; the posts carry good starting salaries and outstanding opportunities. VACANCIES also exist for assistant programmers.

APPLICANTS should write in confidence with full details to—Personnel Dept. (ED/226), E.M.I. Eng. Dev., Ltd., Hayes, Middx. [4411]

A MBITIOTS and energetic engineers are invited to apply for the following posts:—

1. SENIOR position for a competent valve engineer to study and advise on the use and application of valves in a wide range of electronic equipments and to liaise with valve manufacturers. Applicants must have experience suitable for the position, and a sound knowledge of microwave valves.
2. SENIOR microwave engineer for development of microwave components and aerials; qualifications and experience essential.

3. SENIOR engineer capable of controlling a project from "breadboard" to production; applicants must have at least three years' development experience. THESE posts are for permanent pensionable staff in a rapidly expanding development division offering unique opportunities for advancement to those who are prepared to work hard and produce results; write to—Chief Development Engineer, Decca Radar, Ltd., 9, Davis Rd., Tolworth, Surrey. [4434]

THE PLESSEY CO. has vacancies for development engineers familiar with one of the following subjects:—

- (a) VARIABLE capacitors.
- (b) SWITCHES for radio or electrical appliances.
- (c) V.H.F. or U.H.F. circuits and tuning mechanisms.

(d) RELAYS and vibrators.

(e) LOUDSPEAKERS and acoustics.

A GOOD salary and a progressive future are offered to men who can design components suitable for high production rates, while maintaining standards of quality and performance; there are also vacancies for qualified engineers and draughtsmen with less experience who will be able to undertake responsible design work after a period in the laboratory; all posts are permanent and pensionable and a modern laboratory provides efficient and agreeable working conditions. Send particulars of qualifications, experience and salary to the Personnel Manager, The Plessey Co., Ltd., Ilford, Essex. [4404]

THE PLESSEY COMPANY has vacancies for development engineers familiar with one of the following subjects:—

- (A) VARIABLE capacitors.
- (B) SWITCHES for radio or electrical appliances.

(C) V.H.F. or U.H.F. circuits and tuning mechanisms.

(D) RELAYS and vibrators.

(E) LOUDSPEAKERS and acoustics.

A GOOD salary and a progressive future are offered to men who can design components suitable for high production rates, while maintaining standards of quality and performance; there are also vacancies for qualified engineers and draughtsmen with less experience who will be able to undertake responsible design work after a period in the laboratory; all posts are permanent and pensionable and a modern laboratory provides efficient and agreeable working conditions.—Send particulars of qualifications, experience and salary required to the Personnel Manager, The Plessey Company, Ilford, Essex. [4478]

A. H. HUNT (CAPACITORS), LTD., require A engineers for design and development of paper, mica and ceramic capacitors.

APPLICANTS should have previous training in electrical engineering at least to intermediate B.Sc. standard.—Apply to Personnel Manager, A. H. Hunt (Capacitors), Ltd., Bendon Valley, Garratt Lane, Wandsworth, S.W.18. [10057]

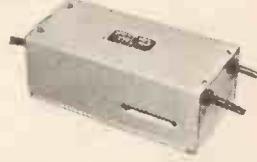
SENIOR TV engineers required; must drive; salary from £650 p.a.—Apply E. Coyne, 120, Ladbroke Grove, W.10. Bay. 1947. [10082]

ELECTRICIANS required by The Steel Company of Wales, Ltd. (Steel Division), Port Talbot, for work on industrial electronic equipment.

CANDIDATES should have previous experience and/or technical background as basis for period of training.

THOSE wishing to apply should write stating age, experience, etc., to the Personnel Superintendent, The Steel Company of Wales, Ltd. (Steel Division), Abbey Works, Port Talbot, Glam. [4422]

Rowridge & Norwich



CONVERTOR TYPE 26. For conversion from channel 3 to channel 1, complete with self-contained power supply unit and totally enclosed in a handsome, well finished steel case. Price complete, £11/17/-.

Also available in chassis form less HT supply but including mains operated heater supply for inclusion in receivers. Price complete, £8. **CONVERTOR TYPE AC/4.** For weak signal areas. Price complete, £15/15/-.

(Leaflets on request.)

SPENCER - WEST,
Quay Works, Gt. Yarmouth.
Telephone: 3009.
'Grams: Spencer-West, Gt. Yarmouth.



Approved

TRANSFORMERS

of all types up to 25 KVA for Single or Three Phase operation, Phase Conversion, etc.

MAINS

Output, and Special Purpose Transformers for Radio Equipment; Chokes, etc.

COILS

for Contactors, E.M. Brakes, Air Valves, etc., and Coil WINDINGS for all purposes.

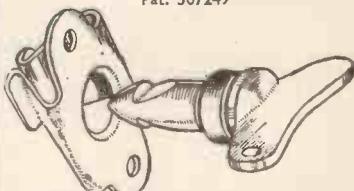
SOLENOIDS

for A.C. and D.C. Operation.

W. F. PARSONAGE & CO., LTD.
INDUCTA WORKS • Park Rd • Bloxwich • Walsall
Telephone: BLOX 66464

ODDIE FASTENERS

Pat. 507249



THIS FASTENER WITH ENDLESS APPLICATIONS—SIMPLE—POSITIVE SELF-LOCKING. MADE IN A VARIETY OF TYPES AND SIZES.

SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS.

WIDELY USED IN THE RADIO INDUSTRY.

Illustrated brochure and other information will be gladly sent on request.

DEPT. "W.W."

Oddie, Bradbury & Cull Ltd., Southampton
Tel.: 55883 Cables: Fasteners, Southampton

F.M. TUNER

Booklet Price 2/-.

This tuner features good sensitivity and freedom from drift. Four Osram valves used and two G.EX 34 crystals. Chassis, dial and coils made by

THE JASON MOTOR & ELECTRONIC CO.

328, Cricklewood Lane, London, N.W.2.

SPE 7050.

Mitcham Representative:

Home Radio of Mitcham,
187, London Road, Mitcham.

S.A.E. for complete price list.

Please call for a demonstration.

NEW ELECTRONIC MUSICAL INSTRUMENTS

By R. H. Dorf

From one volume, you can now learn all about the intricacies of commercial electronic organs, including the Allen, Baldwin, Connsonnian, Hammond, Minshall-Esteey, Lowrey Organo and others, together with many smaller instruments. Constructional details on the author's Electronorgan and the simpler Thyratone show you how to build one of these fascinating instruments.

55s. Od. Postage 1s. Od.

Transistor Audio Amplifiers by R. F. Shea. 52s. Od. Postage 1/-.
RCA Receiving Tube Manual. 8s. 6d. Postage 6d.

The Radio Amateur's Handbook: 1955 by "A.R.R.L." 30s. Od. Postage 1/-.
Radar Pocket Book by R. S. H. Boulding. 15s. Od. Postage 6d.

Transistors: Theory and Applications by A. Coblenz and H. L. Owens. 42s. 6d. Postage 1/-.

High Fidelity Techniques by J. R. Langham. 8s. Od. Postage 4d.

Radio Valve Data compiled by "Wireless World," 3s. 6d. Postage 3d.

Servomechanism Practice by W. R. Ahrendt. 50s. Od. Postage 1/-.

Please write or call for our catalogue.

THE MODERN BOOK CO.,

Britain's Largest Stockists of British and American Technical Books

19-23 PRAED ST., LONDON, W.2
(Dept. W.5)

Phone: PADdington 4185.

Open 6 days from 9-6 p.m.



THE "FLUXITE QUINS" AT WORK

Last night, at Fancy Dress Ball,
Young Ol' had a very bad fall,
But with FLUXITE'S sure aid
Repairs were soon made
Without any trouble at all!

Make a quick success of that soldering job—use Fluxite Paste. Suitable for all metals, except aluminium. Even solders and "tins" dirty metals! And, remember, Fluxite "wipes" joints that other methods won't touch.

Used for generations in Government Works and by leading Engineers and Manufacturers. Of all Ironmongers in tins from 1/- upwards.

FLUXITE

SOLDERING PASTE

A STURDY COMPANION TO
FLUXITE SOLDERING FLUID

Simplifies ALL Soldering

FLUXITE LTD BERMONSEY ST. LONDON S.E.1

THE Chemical and Metallurgical Division of the Plessey Co., Ltd., is engaged in the development of interesting new products for the electronics, radio and T.V. industries. CHEMISTS, metallurgists, and ceramists are required for development work on semiconductors, electrical ceramics, magnetic materials and electrolytic capacitors.

ATTRACTIVE posts are available for junior and senior grades in new, well equipped and expanding laboratories.

POSITIONS offered are permanent and pensionable and offer considerable scope for advancement; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager. The Plessey Co., Ltd., Towcester, Northants.

SENIOR sales engineer required by Telephone Manf. Co., Ltd., Martell Rd., West Dulwich, London, S.E.21, with a minimum of 10 years qualified experience.

MUST have comprehensive knowledge of the use of polarised relays in telecommunications, servo mechanisms, electronic circuits and allied applications.

PENSION and staff bonus schemes after qualifying period.

WRITE giving full particulars to Personnel Dept.

[4380]

FERRY AIRPORTS, Ltd. require radio mechanics licensed and unlicensed with knowledge of current British and American equipment for duty at our Ferryfield base. APPLICATION should be made to Personnel Office, Ferry Airports, Ltd., Blackbushe Airport, Nr. Camberley, Surrey, where interviews will be held.

TELECOMMUNICATIONS (Line Transmissions) Engineer required by large organisation in the North-West to train for position in Technical Publicity Department.

APPLICANTS should be aged between 25-30 years, and should have a good educational background with the ability to write clear concise English; a sound knowledge of modern telecommunications techniques, including coaxial and other multi-channel carrier telephone and telegraph systems, essential.

THE position is on the established staff of the Company, with contributory Pension Fund, and usual staff conditions and amenities.—Please write to Box No. 438, Dorland Advertising, Ltd., 18-20, Regent Street, London, S.W.1, giving details of age, qualifications and experience

[4242]

RADIO Salesman required. experienced, good salary and prospects.—Phone: Secretary, Ambassador 4035, or call Premier Radio Company, 207, Edgware Rd., London, W.2.

EXPERIENCED TV service engineer; old-established firm, good salary, small flat available.—Full particulars to Mr. J. Elliott, Ltd., Chequer St., St. Albans, Herts.

PERSONAL Assistant of high ability and integrity required by owner of retail radio and electrical business of good standing; state age and full details of career.—Box 2929.

RADIO and/or television engineer required for bench and outside repairs, driver; references, age, experience, salary expected.—Field's Radio, Ltd., 52, Hall Gate, Doncaster.

RESEARCH Engineers, preferably of degree standard, and with a sound knowledge of communications and, particularly, electronics, required for experimental work relating to underwater sound apparatus.

APPLICATIONS, giving past experience, technical qualifications, age and salary required, should be addressed to the Personnel Manager, Kelvin & Hughes, Ltd., New North Rd., Barkingside, Ilford, Essex.

CHEMISTS, metallurgists and ceramists are required for the Chemical and Metallurgical Division of the Plessey Co., Ltd.; attractive posts are available for junior and senior grades.

APPLICANTS should be interested in the development of semiconductors, electrical ceramics, magnetic materials and electrolytic capacitors and experience in any of these fields would be an advantage.

POSITIONS offered are permanent and pensionable and offer considerable scope for advancement; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager. The Plessey Co., Ltd., Towcester, Northants.

[4405]

CHIEF Mechanical Designer for Research Department of large manufacturers of electronic equipment. Prev exp. in electronic industry essential. Salary up to £1,500 p.a. North London area.—Write Box 2359.

A VACANCY exists in mid-Herts for a keen and conscientious radio mechanic for service work on industrial electronic equipment: write full details of experience, age and wages required.—Box 2489.

RADIO service mechanics required by Smiths (Radiomobile), Ltd., for many parts of the country.—Write details of experience and qualifications to Personnel Officer, Goodwood Works, North Circular Rd., London, N.W.2.

A SSISTANT to the Chief Engineer required by an established instrument company in the Home Counties, now pioneering new developments in the field of electronic technology.

WHILE academic qualifications are not essential applicants should have a sound theoretical training and considerable

PRACTICAL experience. The salary will be according to experience—£1,200 per annum is envisaged. There is a pension scheme.—Box 1540.

[4193]

EXCELLENT REPRODUCTION

with the

LOCKWOOD
Standard Loudspeaker Cabinet



This new Lockwood model has been designed to give reproduction of a very high order and can be "tuned" to suit any make of loudspeaker unit.

We especially recommend the "TANNOY" 15in. and 12in. DUAL CONCENTRIC units, and we can supply complete with either of these models.

* The LOCKWOOD STANDARD LOUDSPEAKER CABINET has been developed from the Monitoring Loudspeaker Cabinet used by the B.B.C. (B.B.C. Patent 696,671).

* "Wireless World," November and December, 1950.

Two versions are available :—

Major Model £35

Minor Model £25

A brochure, free on request, fully explains these new models and why they are supplied ready to assemble.

Export & Tropical Models available.

Trade enquiries invited.

Demonstrations by appointment only.

LOCKWOOD

Acoustically Designed Cabinets

LOCKWOOD & COMPANY
LOWLANDS ROAD, HARROW, MIDDX.

BYRon 3704

Excellence in design..

Specialists in Subminiature Telecommunication Components

AIR DIELECTRIC TRIMMERS 70pF

Illustration (approx.) actual size



12 Vane type 500 Volts
Width 16.5mm Length 22mm
Height 19mm Insulation 10,000 mhos.
Power Factor less than .001
Temp. Coeff. 50 parts/million/°C

OXLEY
DEVELOPMENTS CO. LTD.
ULVERSTON, NORTH LANC'S
Tel: ULVERSTON 3306

THE OSRAM NINE-ONE-TWO AMPLIFIER INSTRUCTION BOOK

and
HIGHEST QUALITY COMPONENTS
Available from

COVENTRY RADIO
189, DUNSTABLE ROAD, LUTON.
'Phone: 2677.

Price 3/6, plus 3d. postage
also

Our 1954-5 Component Catalogue at 1/-

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.
O. & G. (Electrical, etc.), General Cert., 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 £15 a week, tell
us what interests you
and write for your copy
of "ENGINEERING
OPPORTUNITIES"
today—FREE!

B.I.E.T.
387 College House, 29-
31, Wright's Lane,
London, W.8.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

AIRCRAFT electrical design draughtsmen required, excellent opportunities for advancement.—Apply Personnel Department, Vickers-Armstrongs, Ltd., Hursley Park, nr. Winchester. [4176]

TV and radio engineer, fully experienced, £12 p.w. to right man, and normal shop hours, able to drive.—Radio & Electrical Services, 35, Westbury Ave., Wood Green, N.22. Bow 2068. [4421]

ASSEMBLER/FITTER, aged 21-30, experienced precision electro mechanical assembly. Full details L.M.K. Manufacturing Co., Ltd., Harlequin Avenue, Great West Rd., Brentford, Middlesex. [4448]

(1) PHYSICISTS and Electronic Engineers are required for the Chemical and Metallurgical Division of the Plessey Co., Ltd. Attractive posts are available for junior and senior grades in new, well equipped and expanding Physics and Electronics Laboratories. APPLICANTS should be interested in the development and application of semi-conductors, dielectric, piezoelectric or magnetic materials.

POSITIONS are permanent and pensionable and offer considerable scope for creative work; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants.

(2) THE Chemical and Metallurgical Division of the Plessey Co., Ltd., is engaged in the development of interesting new products for the electronics, radio and TV industries.

PHYSICISTS and Electronic Engineers are required for development applications and instrumentation work on semi-conductors, ferroelectric and ferrimagnetic materials.

ATTRACTIVE posts are available for junior and senior grades in new, well equipped and expanding Physics and Electronics Laboratories. **POSITIONS** are permanent and pensionable and offer considerable scope for advancement. Salaries will be generous and commensurate with qualifications and experience.

WRITE in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants.

(3) THE Plessey Company, Ltd. vacancies exist in new, well equipped and expanding laboratories of the Chemical and Metallurgical Division for junior and senior Physicists and Electronic Engineers with progressive ideas; experience in any of the following fields an advantage:

Magnetic measurements.

Acoustics.

Piezoelectricity.

Design of electronic apparatus.

Radio interference suppression.

Design of electromagnetic devices.

POSITIONS are permanent and pensionable and offer considerable scope for advancement; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants.

THE Edison Swan Electric Company, Ltd. have vacancies in their Special Products Development Laboratory for Engineers for Development work on a wide range of electronic instruments and apparatus for Medical, Industrial and Government use.

PLEASE write, stating experience, age and salary required, to 155, Charing Cross Road, London, W.C.2. reference SP/LAB. [0083]

EXPERIENCED radio testers and inspectors required for production of communication and radio apparatus, also instrument makers, wires and assemblers, for factory test apparatus.—Apply Personnel Manager, E. K. Cole, Ltd., Ekco Works, Malmesbury, Wilts. [0238]

SENIOR and junior electronic engineers required for high fidelity sound reproduction projects; applicants should give full details of qualifications and experience by letter to Chief Engineer, Pye, Ltd., St. Andrew's Rd., Cambridge. [4487]

TRAINEE Television Service Engineer required by old-established London retail radio and electrical business; good opportunity for keen man with aptitude for this work, driving experience essential, state age and full details of career. Box 2930. [4502]

TELEVISION Expert fault locator/repairer, mostly for workshop, but able driver experienced particularly Ekco, Pye, and all radios; good wage to first class technician.—Refs. to Watson's Radios o/o "Ravencraig," White Knowle Rd., Buxton Spa. [4437]

ELECTRICAL SERVICE (EDGWARE), Ltd., 95, Edgware Rd., W.2, require urgently senior T.V. and radio service engineer; able to take complete charge of service dept.; clean licence, good refs., congenial, top salary.—Pad. 2342. [4264]

TRANSFORMER and filter design engineer required to take charge of design and manufacture; qualifications and experience essential.—Apply to Personnel Manager, Pye Telecommunications, Ltd., Ditton Works, Cambridge. [4287]

MICHAEL RADIO, Ltd., Slough, Bucks, have vacancies from time to time for electronic engineers to be engaged on Government projects; those wishing to be considered are invited to write fully to the Chief Engineer, Equipment Division. [0198]

REQUIRED by old-established West Country dealer holding all leading agencies, a top-class service engineer having experience with wide range of makes TV and radio. Permanent position with top salary. Suitable modern residence will be provided and with garage if required.—Fullest particulars to Box 2954. [4514]

IF YOU LIVE
L.H.F. DEA 2503
IN THE NORTH OF ENGLAND

After visiting the
Northern Radio Show

Come and inspect
ALL THE
LATEST
High Fidelity
Sound
Reproducers

Amplifiers
Loudspeakers
Pick-ups
Motors
R/G Chassis

AT

The North's Reproduction Specialists
LANCASTER HI-FIDELITY ACOUSTICAL EQUIPMENT CO.

29 Lancaster Avenue, Fennel Street,
(Nr Victoria Station) Manchester, 4

ARKAY KITS

WORLD'S FINEST
RADIOS PHONOGRAPHS TV
TEST EQUIPMENT HI-FI

Write for FREE Brochure

Radio Kits, Inc. • 120 CEDAR STREET
NEW YORK 6, NEW YORK • U.S.A.

WEBB'S SERVICE DEPARTMENT

for complete renovation of complex
communications receivers of any make

Test report issued showing sensitivity, selectivity, signal/noise equal to, or better than, makers' original figures.

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

MUST WE BE HEROES ?

And fight the Fire Fiend without NU-SWIFT? But why? Even the Royal Navy don't do that. Please send us details of your wonderfully rapid and reliable Fire Extinguishers—BEFORE IT IS TOO LATE!

Name
Address
Post NOW to Nu-Swift Ltd. 25 Piccadilly W.1.

In Every Ship of the Royal Navy

FERRANTI LTD. (Electronics Dept.)

Manchester, have the following vacancies at their Moston, Chadderton and Wythenshawe factories:—

1. CHIEF PLANNING ENGINEER for Cathode Ray Tube production. The essential qualification is previous responsibility and experience in planning and progress, preferably, though not necessarily, in C.R.T. manufacture.
2. PROCESS CONTROL ENGINEERS with considerable experience of C.R.T. production and of the technical problems involved.
3. TECHNICAL MAINTENANCE ENGINEER with experience of vacuum equipment and automatic and mechanical apparatus of the type used in C.R.T. production. Knowledge of electronic circuitry would be an advantage.
4. PLANT ENGINEER. A young mechanical engineer, preferably with some knowledge of vacuum or chemical techniques is required to assist in the design of automatic plant for C.R.T. and valve production.
5. CIRCUIT ENGINEER for work with new types of valves including the design of circuitry for use with them. The successful candidate would also assist the Sales Department in establishing these new types.
6. VALVE DESIGN ENGINEERS holding good hon. degrees in Physics or Electrical Engineering and preferably with previous experience of Valve design.
7. CIRCUIT ENGINEER for Ceramic Valve Laboratory, having experience of R.F. work and preferably of pulse circuitry. He would be required to determine the characteristics of advanced types of valves opening up new and interesting fields.

Salaries would depend on age and experience within the following ranges: Post 1, £800-£1,000 per annum. Posts 2, 4, 5, 6, and 7, £600-£900 per annum.

Post 3, £500-£700 per annum.

Permanent staff appointments with Pension benefits. Application forms from Mr. T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference PDH1, 2, 3, 4, 5, 6 OR 7.

A Leading Radio and Television Manufacturing Company requires the services of a Chief Engineer. Salary up to £3,000 per annum, according to qualifications and experience. Superannuation and Insurance Schemes in operation. Please reply, in strictest confidence, giving full details to Box No. 2694.

MODEL shop mechanics are required by a firm in S.W. London for work on electronic equipment; first-class men, able to read circuit diagrams and use simple machine tools, will be offered rates in the region of 5/3 an hour.—Write Box 2795. [4471]

TECHNICAL Assistants required for development of electro-mechanical and electronic instruments (marine). Work involves initial experiments, sea-going trials, pre-production models and factory liaison. Occasional visits overseas are arranged. Qualifications—Practical: 5 years' workshop or direct office experience. Academic: City & Guilds Telecommunications Final Group Certificate, or equivalent.

APPICATIONS, stating salary required, should be addressed to the Personnel Manager, Kelvin & Hughes, Ltd., New North Rd., Barkingside, Essex. [4508]

DEVELOPMENT engineer with a sound knowledge of circuits as applied to light-duty mechanisms; interesting work on new projects, excellent opportunity for man with the right experience and training; London, S.E. area; state age and salary required.—Box 2286. [4378]

RADIO Engineer for Bulawayo, Southern Rhodesia. Design and development engineer with at least five years' experience on domestic radio. Salary £1,200 per annum with free air passage to Rhodesia.—Application should be made to Box 2947. Applicants will be interviewed in London. [4509]

MULLARD RESEARCH LABORATORIES have vacancies for several technical assistants to be trained, at full salary, as microwave valve engineers; successful candidates will be engaged upon the design, construction and electrical measurement of valves in the research and development stages.

THE positions are permanent, progressive and carry attractive salaries; applicants, without National Service liabilities, should have scientific qualifications of, or equivalent to, G.C.E. (advanced level), O.N.C., H.N.C.; however these requirements might be waived if the applicant has experience in a suitable technical field; salaries are based on qualifications, experience and age, and are in keeping with present-day levels; general prospects within the organisation are excellent.—Apply Personnel Manager, Mullard Research Laboratories, Cross Oak Lane, Salfords, Near Redhill, Surrey.

TECHNICAL assistants. A small number of opportunities exist to enter the factory laboratory of a leading radio and television receiver manufacturer for young men of H.N.C. and O.N.C. standards; these positions provide interesting work in the pre-production stages of large scale manufacture.

COMMENCING salaries will be in accordance with age, experience and qualifications.—Please apply in writing to the Personnel Officer, Mitcham Works, Ltd., New Rd., Mitcham Junction, Surrey, quoting reference G.1. [4497]

TRANSFORMER Designer required for development projects involving audio-frequency power transformers, pulse transformers, oil-filled units, etc.—Apply stating age, qualifications and experience to The Personnel Manager (Ref. R.G.), The General Electric Co. Ltd., Brown's Lane, Allesley, Coventry. [0260]

ENGINEER with sound basic knowledge of light electrical and A.F. engineering for sound recording equipment department; pension scheme.—Apply, stating experience, qualifications, age and salary required, to the Personnel Manager, B.A.F., Ltd., Woodger Rd., London, W.12. [4433]

MANAGER for large electronic company in N. London, exp. of mass production and small batch production of coils and transformers, etc., for radio, television and radar equipment. Control of 300 employees. Good salary and prospects. Pension scheme, etc. Age 35-55.—Write Box 2360. [4389]

ELectRONIC engineers with degrees in physics or engineering required for important and interesting work on the research and development of special equipment; good opportunity and high salary rate.—Write to Managing Director, Microcell, Ltd., 56, Kinesway, London, W.C.2. [4402]

SERVICE engineers required in both Birmingham and London for industrial radio frequency equipment; applicants should have completed their National Service and should preferably be able to drive.—Apply in writing to Radii Heaters, Ltd., 46, Gray's Inn Rd., London, W.C.1. [4401]

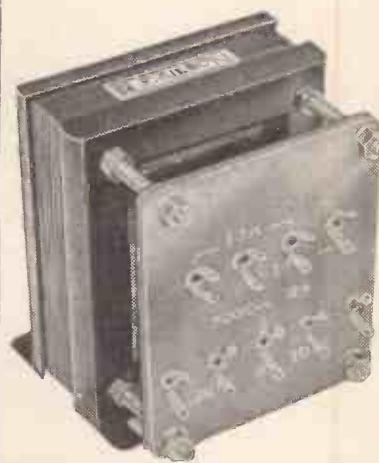
TELEVISION field and bench service engineers required immediately for modern service department of leading radio retailers in East London; wages up to £14 per week or according to ability; permanent position.—Apply for interview to Leytonia Radio, Ltd., Tel. Leytonstone 1396. [4271]

DEVELOPMENT engineer required for work on transistor oscillators, previous experience need not include transistor applications but a fundamental knowledge of time base circuits is desirable.—Applications to Personnel Manager (Quote A.12063), Ferguson Radio Corp., Ltd., Gt. Cambridge Rd., Enfield, Middx. [4518]

HONOURS graduate in physics or electrical engineering is required to work in a laboratory engaged in research and development on frequency control problems relating to communications systems. The position is open to men and women and affords excellent opportunities for detailed study of the theoretical and practical aspects of the subject. LIVING accommodation for single or married persons can be made available.

BOX W. R. 2421, A.K. Adv., 212a, Shaftesbury Ave., London, W.C.2. [4491]

GILSON TRANSFORMERS FOR THE ELECTRONIC ENGINEER FOR THE OSRAM 912 AMPLIFIER



The Gilson output transformer, Ref. WO 710, has been tested and approved by the General Electric Co. Ltd. for use in the Osram 912 Amplifier.

LIST PRICE £2.12.6

FOR THE MULLARD 5-10 AMPLIFIER

Extract from Mullard letter:

"We have much pleasure in informing you that the two sample transformers—Ref. Nos. WO 696A and 696B—for the Mullard 5 valve 10 watt amplifier which you exhibited to us for approval have been tested in our laboratory and have been found to meet all the specifications laid down."

LIST PRICE £2.7.6

Or less panel, tags on coil £2.3.6

MAINS TRANSFORMERS FOR THE 912 and 5-10 AMPLIFIERS

205-225-245 volts 50 c/s. 300-0-300 V. 150 m.A., 5 V. 2 A. or 6.3 V. 1 A., 6.3 V. 5 A. C.T. Ref. WO 695. List price £3, or less panel, tags on coil, £2/15. Choke 10H 150MA. List Price £1/15/-.

R. F. GILSON LTD

11a ST. GEORGE'S ROAD, WIMBLEDON, S.W.19

Phone: WIMbledon 5695

MAKERS OF NEON SIGN TRANSFORMERS
Specialists in the design and manufacture of small transformers for power and audio frequencies. Contractors to Admiralty, etc., A.I.D. Approved

NEW BOOKS ON RADIO & TELEVISION

Transistors and Crystal Diodes, by B. R. Bettridge	5/3
Sound Reproduction, by G. A. Briggs	18/6
Loudspeakers, by G. A. Briggs	8/-
Practical T.V. Aerial Manual for Bands I and III, by E. Laidlaw	4/9
Radio Valve Data, 4th ed., by "Wireless World"	3/10
Fundamentals of Transistor, by L. Krugman	22/-
T.V. Servicing Manual, by Bradley	4/9
Radio Control of Model Ships and Aircraft by F. C. Judd	9/-
Radio Amateurs Handbook A.R.R.L. 1955	31/-
An Introduction to Colour Television, by G. G. Gouriet, 72 pages, 12 diagrams, etc.	9/6
Foundation of Wireless, by Scroggie (revised)	13/6
Television Picture Faults, by J. Cura, containing 150 actual screen photographs	3/9
ALL POST FREE. Write for New List of ENGLISH AND AMERICAN BOOKS AND PERIODICALS	

UNIVERSAL BOOK CO.
12 LITTLE NEWPORT STREET,
LONDON, W.C.2 (Adjoining Lisle St.)

GUIDED WEAPONS

Design Engineers—Technicians.

The Guided Weapons Department of the Bristol Aeroplane Company Limited, at Filton, requires to recruit the following:

1. Design Engineer: To design and develop D.C. and L.F. circuitry for use in computing and other servo applications. A degree in Electrical Engineering or an equivalent professional qualification is desirable.
2. Technical Assistant: To service electronic-servo test equipment. Considerable practical experience, a high standard of education and a sense of responsibility are essential requirements.

Applications, quoting D.O.35, giving details of age, experience, and salary required, should be addressed to the Personnel Manager, Aircraft Division, BRISTOL AEROPLANE COMPANY LIMITED, Filton House, BRISTOL.

THE EDISON SWAN ELECTRIC CO. LTD.

Cosmos Works, Brimsdown, Enfield, Middlesex, has vacancies in its Research and Development Departments for:

1. Development Engineers for work on design and development of thermionic valves.
2. Technical Assistants for work in connection with design and development of thermionic valves.
3. Mechanical Engineers interested in the problems of mass production associated with thermionic valves.

These vacancies are the result of a rapid expansion in the Company's activities. The positions are progressive and carry the advantages of a Pension Scheme.

Applicants for vacancies (1) should have an Engineering or Physics degree, but applications from candidates with H.N.C. or equivalent will be considered.

Applicants for vacancies (2) and (3) should have Ordinary N.C. or H.N.C. or Inter B.Sc. or equivalent.

The starting salary will be in accordance with the qualifications, experience and age of the applicants.

Applications should be in writing and will be treated with the strictest confidence. Apply to the Personnel Superintendent.

RADIO testers and mechanical inspectors required (male): must have experience on service equipment and used to working to Government specifications; high rates of pay to first-class men; excellent conditions in modern factory in the West London area; write fullest details to—Box 2492. [4413]

FIRST-CLASS television engineer is required by Cadman's, 19, City Arcade, Hanley, S.O.T. Established 21 years. Applicants must be able to handle all types of television repairs speedily and efficiently; permanent situation and good pay are offered to a really good man. —Applicants should send full particulars.

ASSISTANTS (scientific); the Civil Service Commissioners invite applications for pensionable posts; applications may be accepted up to December, 31, 1955, but early application is advised as an earlier closing date may be announced either for the competition as a whole or in one or more subjects; interview boards will sit at frequent intervals. AGE at least 17½ and under 26 years of age on January 1, 1955, with extension for regular service in H.M. Forces but candidates over 26 with specialised experience may be admitted. CANDIDATES must produce evidence of having reached a prescribed standard of education, particularly in a science or mathematical subject. At least two years' experience in the duties of the class gained by service in a Government department or other civilian scientific establishment or in technical branches of the Forces essential in one of the following groups of scientific subjects:—

- (i) ENGINEERING and physical sciences.
- (ii) CHEMISTRY, bio-chemistry and metallurgy.
- (iii) Biological Sciences.
- (iv) GENERAL (including geology, meteorology, general work ranging over two or more groups (i) to (iii) and highly skilled work in laboratory craft or class plain English).

INCLUSIVE salary scale £262 (at 18) to £545

(men) or £457 (women). Starting pay up to £402 (men) or £357 (women) at 25; somewhat less in provinces; opportunities for promotion.

FURTHER particulars from Civil Service Commission, Scientific Branch 30, Old Burlington St., London, W.I., quoting No. S 53/55. [4420]

ELECTRONIC Engineers and Physicists reqd. For rapidly expanding research dept. Candidates should have experience of electronic instrument development. Experience in pulse circuits or ultrasonics desirable but not essential. B.Sc. or H.N.C. standard.—Write full particulars to Glass Developments, Ltd., Brixton, S.W.2.

TELECOMMUNICATION Development Engineers with good experience in carrier and/or telephone equipment required. Applicants who should be graduates holding a degree or H.N.C. should write details of qualifications, past experience and salaries earned to Personnel Manager, The Phoenix Telephone & Electric Works, Ltd., The Hyde, Hendon, N.W.9. [4435]

A FIRST-CLASS television and radio engineer is required by R. J. Stratton, Ltd., of Lyme Regis, Dorset; applicant must be able to handle all types of television and radio repairs speedily and efficiently; good pay and opportunity is offered to a really good man; applicants should send full particulars in envelope marked "Radio Enquiry—Private." [4419]

A FIRST-CLASS television and radio engineer is required by R. J. Stratton, Ltd., of Lyme Regis, Dorset; applicant must be able to handle all types of television and radio repairs speedily and efficiently; good pay and opportunity is offered to a really good man; applicants should send full particulars in envelope marked "Radio Enquiry—Private." [4419]

The TELEGRAPE CONDENSER Co. Ltd. require radio and TV engineer with laboratory experience for work in connection with printed circuits. H.N.C. standard. Superannuation scheme.—Write giving full details of education and experience, age and salary required to Personnel Manager, T.C.C., Ltd., North Acton W.3. [4311]

TECHNICAL writer required by a West London manufacturer of domestic radio and television equipment to take charge of a section engaged in the compilation of Service manuals and similar publications; previous experience of this work and a sound knowledge of electronic theory are essential; the position is permanent and pensionable.—Apply to Box 2399. [4396]

DECCA RADAR, Ltd. require Testers for fault-finding and alignment on radar equipment. Applicants with experience in radio or television testing considered. Good prospects in an expanding department for suitable applicants. Apply to Personnel Officer, Decca Radar, Ltd., 2, Tolworth Rise, Surbiton, Surrey. [4335]

APPLICATIONS are invited from young physicists possessing honours degree for work on the development of transistors. Post-graduate work on semi-conductors and solid state physics would be an added qualification. Laboratories in ideal country surroundings.

Applications to Personnel Manager, Standard Telephones and Cables, Ltd., Ilminster. [4235]

BUSH RADIO Ltd. require senior and junior engineers in their laboratories at Chiswick, Kew and Plymouth; applicants should preferably hold a Higher National Certificate, B.Sc. Engineering or Physics, or equivalent qualifications; experience in the following fields of development would be an advantage; Domestic radio or television, electronic equipment for aircraft, communications receivers, pulse circuits and micro-wave techniques. Write giving full details and salary required to the Chief Engineer, Power Rd., Chiswick, W.4. [4395]

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD

JUNIOR ENGINEERS

required for Valve Development Work, especially on the application of microwave valves to circuitry.

Applicants should have a degree and preferably some experience in microwave technique or alternatively with amateur transmitters.

Apply, quoting Ref. 497M, to Dept. C.P.S., 336/7, Strand, W.C.2.

Situations Vacant

HIVAC LIMITED

Manufacturers of specialised thermionic and electronic devices, offer interesting posts for scientists, engineers and technicians in their expanding organisation on research and development projects in valves, cold cathode tubes and transistors. Previous experience in these fields, though an advantage, is not essential, but a sound education and an active and enquiring mind are. Encouragement will be given, wherever possible, to the publication of original work.

The Company is a member of a major communications Group and the posts, which are available for both senior and junior applicants, are pensionable and offer scope for advancement. There is a five-day working week. Applications in writing, which will be treated in strict confidence, stating age, education, qualifications and salary expected, should be addressed to The Engineer-in-Chief, HIVAC Limited, Greenhill Crescent, Harrow, Middlesex.

FERRANTI LTD., (Moston) MANCHESTER

have vacancies for TEST ENGINEERS to undertake work under the following headings:—

1. General testing and fault finding on electronic and servo units.
2. Advanced testing of above units in final form as analogue computers.
3. General testing of electronic testing outfits. (This will mainly involve electrical measurements.)
4. General testing and fault finding on gyroscopic instruments.
5. Design, development and maintenance of test equipment for electronics, servos and gyroscopes. Knowledge of general power supplies would be an advantage.

A standard of approximately H.N.C. is desirable but lesser qualifications would be acceptable if combined with practical ability and experience of this or analogous work (e.g. in H.M. Forces). Permanent Staff appointments with Pension benefits.

Application forms from Mr. T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference HGN.

MULLARD LIMITED (Valve Division) require several Junior Engineers, preferably aged 20-25 and of Higher National Certificate or equivalent standard, as Assistants in their Technical Service Department to deal with data and Publications in one of the following capacities:

- (i) Preparing published data on Valves, Tubes and Transistors.
- (ii) Answering technical correspondence and enquiries from Home Constructors and Service Engineers.
- (iii) Editing laboratory reports and preparing technical articles for publication.

These positions offer an excellent opportunity to obtain a general grounding in all applications of Valves and similar devices prior to specialisation in a particular field. Good prospects of advancement for persons of ability. Write, stating age and giving full details of education, training and previous experience to **Personnel Officer, Mullard Limited, Century House, Shaftesbury Avenue, W.C.2.**

ELECTRONIC Engineer required for senior position in an expanding laboratory engaged on the development of electronic equipment, including control gear, servomechanisms and special purpose tape recorders. Applicants should state qualifications, experience and salary required—Write full details to Box 2948. [4510]

TWO graduate physicists or electrical engineers are required for the development of equipment for the measurement of the properties of semi-conductor materials and devices; previous experience in the design and construction of electronic equipment is desirable for one of the vacancies.—Box 1971. [4286]

SKILLED radio mechanics and assemblers (male) required; experienced on service equipment preferred but not essential; excellent conditions in modern factory, with good wages for the right type; ex-R.E.M.E. and R.A.F. personnel will also be favourably considered; Acton district; write fullest details to—Box 2491. [4412]

BANGKOK.—Eastern merchants require mercantile assistant for radio and electrical agencies, technical background and good general educational essentials; age about 25; bachelor; annual increments; cost-of-living allowance; provident fund, pension scheme; free accommodation and passage.—Write, Box 1571, c/o Abbotts, Eastcheap, London, E.C.3. [4481]

HONOURS graduates in physics or electrical engineering are required for advanced work in a quartz crystal laboratory; the positions offered afford excellent opportunities for young men or women to specialize in the study of piezoelectric materials from both the theoretical and practical viewpoints; an interest in mathematics and electronics would be an advantage for this work.

LIVING accommodation can be made available for successful applicants.—Write Box W.Q. 9363, A.C. ADVG., 212a, Shaftesbury Ave., London, W.C.2. [4460]

ENGINEER required for expanding West London company; degree or equivalent with sound knowledge of electronics required; experience with production and application of miniaturised precision electro-magnetic relays or similar equipment essential; this position is an executive one and only those with ability to organise and supervise development and production will be considered.—Box 1539. [4196]

HATFIELD INSTRUMENTS, Ltd., who are now expanding their laboratories, required senior and junior electronic engineers with experience in the design and test of high grade radio and industrial laboratory equipment.—Apply in writing, in the first instance, stating age, experience and salary required, to Hatfield Instruments, Ltd., 175, Uxbridge Rd., Hanwell, W.7. [4452]

SENIOR Engineer is required for a responsible post on design of Communications Receivers and Low Power V.H.F. R/T Equipment. Applicants should have a good engineering or science degree, or equivalent qualifications and at least five years' experience in these fields in responsible positions.—Applications should be addressed to Personnel Department, S.E. Murphy Radio, Ltd., Welwyn Garden City. [4430]

SENIOR CHEMICAL INDUSTRIES, Ltd., Nobel Division, requires assistant technical officers in the Physics Research Section, Stevenston, Ayrshire. Candidates should have a Pass Degree in Science, or its equivalent, and preference will be given to those with experience of electronics.—Applications should be made in writing to the Staff Manager, 460, Sauchiehall St., Glasgow. [4392]

SENIOR Communications Engineer is required for responsible post on design of Carrier Telephony Radio Links. Applicants should have a good engineering or science degree, or equivalent qualifications and at least five years' experience in a similar post.—Applications should be addressed to Personnel Department, S.C.E., Murphy Radio, Ltd., Welwyn Garden City. [4431]

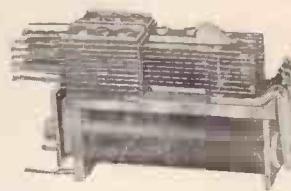
TECHNICAL writers for preparation of technical manuals, mainly in connection with navigational radar and associated electronic devices; engineers with suitable background but no specific writing experience would be considered; salary £550 to £750 p.a., according to qualifications and experience.—Apply in writing to Ref. RWD/CA, Decca Radar, Ltd., 1-3, Brixton Rd., S.W.9. [4446]

SIEMENS BROTHERS & Co., Ltd., require technicians for their Research Laboratories at Blackheath, S.E.3 engaged in work on electronics and telecommunications; pensionable staff posts with good prospects of advancement.—Apply in writing to Siemens Brothers & Co., Ltd., Ref. 742/12, Woolwich, S.E.18, giving particulars of age, qualifications, experience and salary required. [4462]

RADIO engineer for Bulawayo, Southern Rhodesia; design and development engineer with at least five years' experience on domestic radio; salary £1,200 per annum with free air passage to Rhodesia.—Application should be made to Advertiser, 31, Burlington Avene, Kew Gardens, Surrey, with copy to P.O. Box 2096, Bulawayo, Southern Rhodesia. Successful applicant will be interviewed in London, 14076.

ELECTRONIC engineer required by London firm to take charge of measurements laboratory and test gear design; experience of measurement of capacitors or telecommunication cables is essential; position involves direct responsibility to management and will suit engineer aged 25 to 35 who wishes to take up senior position; write details of qualifications, experience and present salary.—Box 2259. [4375]

RELAYS TYPE 3000



BUILT TO YOUR SPECIFICATION—EARLY DELIVERY—QUOTATION BY RETURN—PLEASE STATE RESISTANCE OF COIL REQUIRED AND CONTACT BUILD UP.

MICROPHONE. A most attractive professional mike for studio use, etc., with a beautiful friction slide, adjustable heavy floor stand, complete with 12ft. screened cable. £65/- Post 2/6.

MICROAMMETERS

250 F.S.D. 3½in. FLUSS MODEL S7
Specially scaled for tachometers.Knife edge pointers, magnetic shield. Brand new.

55/-

BLOWER MOTORS. Dual voltage 12-24 volts. Recommended for car cooling or heating, 25/- Post 2/-.

RECEIVER RI155

BRAND NEW. AERIAL TESTED
In maker's original transit case. Now is the chance to get one from the best delivery we have had from the Ministry. Car £11-19-6 10/6. Send S.A.E. for further details or 1/3 for publication giving circuit diagrams, etc. Others available from 29/10/- according to condition.

45 Mc/s PYE IF STRIP. These vision units are brand new and complete with 6 EF50 valves and EA50. Our price only 65/- Post 2/6.

TELEPHONE SETS

FOR PERFECT COMMUNICATION BETWEEN 2 OR MORE POSITIONS
WALL TYPE. One pair of units. £5. Batteries 5/6. Twin wire 5d. yd. Post 2/6.

DESK TYPE now available, latest modern style. Two complete units with battery, ready for use £8/17/6. 3 core flex required at 5d. per yard.

RACKS P.O. STANDARD for 19in. panels. Steel channel sides, correctly drilled. Heavy angle base. Height, 4ft. 10in. or 6ft.

VACUUM PUMPS or **Rotary Blowers**. EX-E.R.A.F. Brand new, 7 cu. ft. per min. 10 lb. per sq. in. at 1,200 r.p.m. Ideal for a brazing torch, etc. Size 6in. x 4in., shaft 2×4in., 22/6 each. Post 2/-.

SLOW MOTION DIALS, 6in. Scaled 0-100, reduction 200 to 1 or direct, ideal for wavemeters, signal generators, etc. Our price, while they last, 5/6 each. Post 1/-.

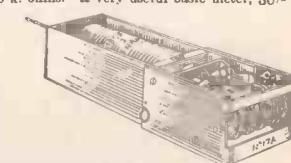
SIGNAL AND NOISE GENERATOR, 20/88 Mc/s in 4 bands. Crystal controlled. Leadfit available on request. Operating on 115 v. or 80 v. Suitable for conversion to 230 v. Special Price 23-17-6

VOLTMETERS, 0/300 v. A.C. 50 cy. 5in. projection-type moving iron, 60/-.

VOLTMMETERS, 0/300 2in. flush D.C. moving coil, 10/6; 0/40, 10/6; 0/20, 10/6. Post 1/-.

AMMETERS, 2in. Flush 0/20, 10/6 each. 20-0-20, 12/6 ea. 0/30, 10/6 ea. Moving Coil D.C.

MOVING COIL METER with 1 mA. movement, 2½in. flush, rectified type scaled 0/100 volts A.C. resistance, 100 k ohms. A very useful basic meter, 30/-.



ELECTRO MAGNETIC COUNTERS. Post Office type 11A, counting up to 9,999, 2 to 6 volts D.C., 3 ohm coil, 12/6 each. Post 1/- Many other types in stock, lists sent with order or send S.A.E.

HEADPHONES. HIGH RESISTANCE, 4,000 ohms. Type CHR. New. 12/6 pair. Post 1/-.

ACFL PUMPS. These pumps enable you to fill all accumulators on the bench with the carboy at floor level. Brand new, only 30/-, post 2/-.

R.F. UNITS TYPE 26. 50/65 Mc/s. Variable tuning, complete with valves, 35/- Post 2/6.

ROTARY CONVERTERS. Input 12 volts D.C. output 230 volts A.C. 50 cycles, 100 watt, 92/6 each. Also available with 24 volt input, curr. 7/6.

LISTS AVAILABLE. Motors, Meters, Telephones, Rectifiers, Relays, Potentiometers, Resistances. All types including High Stability Carbon and Wire-wound. Send S.A.E.

L. WILKINSON

(CROYDON) LTD. DEPT. W.W.
19, LANSDOWNE ROAD, CROYDON

Phone :
CRO 0839
Telegams:
"WILCO" CROYDON

MORSE CODE Training



COURSES for BEGINNERS and OPERATORS, also a SPECIAL COURSE for passing the G.P.O. Morse Test for securing an AMATEUR'S TRANSMITTING LICENCE.

Send for the Candler BOOK OF FACTS.

It gives details of all Courses.

Fees are reasonable

Terms: Cash or Monthly Payments.

THE CANDLER SYSTEM CO.

(55W) 52b ABINGDON ROAD, LONDON, W.8

Candler System Co., Denver, Colorado, U.S.A.



BASS REFLEX CABINETS

Walnut, Mahogany or Oak, 30" high, with gold anodised expanded metal grille.

12" Speaker Model £10. 0.0
16" " " £9.10.0
8" " Carr. paid £9. 0.0

GOODMAN & G.E.C.
Full range of cabinets for these speakers.

You can see your cabinet being made in our cabinet-making workshop.

Cabinets made to order.

Armstrong Chassis and Amplifiers.

The Leak TL/10 Amplifier.

LOUDSPEAKERS.

Open till 5.30 Saturdays

A. DAVIES & Co. (Cabinet Makers)

3 Parkhill Place, off Parkhill Road, London, N.W.3. GULLIVER 5775.

THE EDISON SWAN ELECTRIC CO. LTD.,

Cosmos Works, Brimsdown, Enfield, Middlesex, has vacancies in its Research and Development Laboratories for:

1. Circuit Development and Application Engineers for Colour Television investigations.
2. Circuit Development and Application Engineers for Black and White Television development work.
3. Engineers for development work on Television and F.M. Amplifier problems. Previous experience in V.H.F. or F.M. required.
4. Cathode Ray Tube Development: Engineers for development work on colour and black and white tubes. Previous experience on cathode ray tube development or design required.
5. Application Engineers for work in connection with Customer problems on Television, Radio and F.M.
6. Engineer for design of test equipment for Colour, Black and White Television and allied development work.
7. Engineers for Circuit development and Application work on Transmitters.

The above applicants should have a good Engineering or Physics degree or equivalent, but vacancies also exist for candidates with H.N.C. or equivalent qualifications.

The vacancies are a result of a large expansion in the Company's activities. Good salaries will be paid to suitable applicants and the positions are progressive and carry the advantage of a Pension Scheme.

The starting salary will depend on the qualifications, experience and age of the applicants.

Applications in writing, which will be treated with the strictest confidence, should be sent to the Personnel Superintendent.

JUNIOR engineers required in departments covering the design and construction of high grade television transmission equipment and a wide range of electronic equipment. Good fundamental knowledge required and some practical commercial experience desirable—pension scheme, 5-day week, good canteen.—Write, stating age, experience and salary required to Cinema-Television, Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26. [4383]

EDISON SWAN ELECTRIC CO. LTD., have a vacancy for an engineer to take charge of their Special Products' Development Laboratory, candidates should have an engineering degree or its equivalent, and should have experience in developing electronic equipment ready for factory production.—Please write full particulars, including age and salary required, to 155, Charing Cross Rd., London, W.C.2. Reference K.S.P. [0086]

RADIO technicians required by International Aeradio, Ltd., for overseas service; permanent and pensionable positions, inclusive salary from £394 per annum to £1,373 per annum, tax free, according to marital status; free accommodation; kit allowance; free air fares; generous U.K. leave.—Qualified candidates to whom replies only will be sent please write quoting RT to Personnel Officer, 40, Park St., W.C.1. [0262]

STANDARD TELEPHONES & CABLES, LTD. have vacancies for engineers, mathematicians or physicists, with degree or Higher National Certificate and experience of automatic switching controls, computers, or digital techniques; vacancies also exist for junior engineers.—Apply, giving full details of qualifications, experience and salary required, to Personnel Manager, Corporation Rd., Newport, Mon. [4449]

DEVELOPMENT Engineers.—A leading Manufacturer of Radio and Television Receivers has vacancies in its Laboratories for Electronic Engineers with experience in the Design and Development of this type of equipment. Situated in the Midlands. Salaries according to qualifications and experience. Those interested should write, giving details of career and salary expected to the Personnel Manager (Ref. GLB.) Box 2541. [4427]

ESTIMATOR.—Decca Radar, Ltd., invite applications for a responsible post as estimator in their laboratories; applicants must have a sound knowledge of mechanical and electronic engineering, coupled with substantial suitable industrial experience; excellent starting salary with a rising scale; British nationality essential; pension scheme.—Reply, quoting RLA 84, to Decca Radar, Ltd., 2, Tolworth Rise, Surbiton, Surrey. [4447]

ELECTRICAL Foreman, with wide production experience of small and medium electrical control gear manufacture, test and installation, required by manufacturers of materials handling vehicles in pleasant country district, 1 hour London. Good prospects of advancement; housing assistance; canteen and social facilities.—Please write, giving details of age, past experience, present salary, salary required, married/single, to Box 2950. [4512]

DEVELOPMENT engineer required for work on transistor amplifiers, previous experience not to include transistor applications but applicant should be conversant with general radio engineering practice in particular with negative feed back technique, Class B amplification and design of detector circuits.—Applications to Personnel Manager (Quote 0960), Ferguson Radco Corp., Ltd., Gt. Cambridge Rd., Enfield, Middlesex. [4519]

TELETRON engineer reqd. for exceptionally interesting development work; applicants should have some academic training, with 5 years practical experience of development, including some on communication equipment employing frequency modulation at U.H.F.; the post carries a good starting salary and excellent prospects; please write, with details to—Personnel Dept. (ED/189), E.M.I. Eng. Dev. Ltd., Hayes, Middx. [4410]

A MBASSADOR have vacancies for engineers in their Development Department due to an expanding production programme. The work entails the design of general radio and television circuitry, and production test gear; previous experience is desirable but not essential. H.N.C. or similar qualifications will count. The positions will carry staff status.—Apply by letter in first instance to Chief Engineer, Ambassador Radio and Television, Ltd., Princess Works, Brighouse, Yorkshire. [4410]

DESIGN draughtsmen are required by a firm in S.W. London for work on electronic equipment; there are excellent opportunities for men with initiative to establish themselves in an expanding company with a progressive policy; a technical background is essential, and familiarity with Ministry of Supply design standards is desirable. Salaries in the range £700-£850 will be offered to suitable applicants for whom the posts will be permanent and pensionable.—Write Box 2796. [4472]

RADIO Valve Engineers. Vacancies exist for several engineers to carry out pre-production, quality improvement and testing work in connection with an expanding programme of American type Miniature and Pinch type valves. Immediate work is available for fully experienced engineers and also for one or two juniors with the necessary technical background. Good salaries offered to the right applicants. Pension scheme. Modern canteen, and other facilities available.—Apply in writing to the Personnel Officer, British Tungsram Radio Works, Ltd., West Rd., Tottenham, N.17. [4513]

TECHNICAL AUTHORS

Marconi's Wireless Telegraph Company, Limited,
Chelmsford

have vacancies suitable for applicants capable of preparing technical descriptions, handbooks, etc., in connection with Ground and Airborne communication equipments and navigational aids.

Permanent and pensionable appointments are offered to selected applicants who must have had some experience of this work.

Please apply in confidence to Dept. C.P.S., 336/7, Strand, W.C.2, quoting Ref. 278F.

TELECRAFT

TV AERIALS
ARE CHEAPER AND BETTER

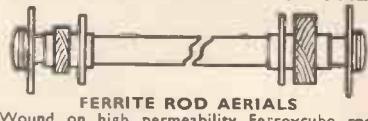
Send for Lists
TELECRAFT LTD.
Quadrant Works, Worley Rd. West Croydon, Surrey.
THOrnton Heath 1191-2-3

MALVYN ENGINEERING WORKS

Precision Engineers
Manufacturers of: Chassis, Small Pressings, Machined Components, Wiring and Mechanical Assemblies, to specification.

Single and Production Quantities. Enquiries Invited
100 PARK ROAD, WARE, HERTS.
Telephone: Ware 465

TELETRON SUPER INDUCTOR COILS


FERRITE ROD AERIALS
Wound on high permeability Ferroxcube rod.
Medium wave 8/9. Dual wave 12/9.

Type HAX. Selective crystal diode coil for tape and Quality amplifiers.
● High Q ● Litz wound
● Dust cored. 3/- ea.
HAX.L. (LW), 3/6 ea.
Dual wave TRF. coils, matched pairs (as illustrated) 7/- pr. Transistor coils—I.F.T.s, etc., etc.

Available from leading stockists.
Stamp for complete data and circuits.
THE TELETRON CO. LTD.
266, Nightingale Road, London, N.9. BOW 2527

YOUR METER DAMAGED?



Leading Electrical Instruments Repairers to the Industry

Contractors to the Ministry of Supply and General Post Office Repairs by skilled craftsmen of all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, etc. Quick deliveries—for speedy estimate send defective instruments by registered post to:

L. GLASER & CO. LTD.
Electrical Instrument Repairers
96-100 ALDERSGATE STREET, E.C.1
(Tel.: MONArch 6822)

NEW

OUR 1955 SUPA-HANDBOOK
"THE HOME CONSTRUCTOR"

20
CIRCUITS

76
PAGES

FOR 2/6 ONLY

incorporating these star attractions

★**20 CIRCUITS**—Supersets, T.R.F. Sets. Amplifiers, Feeder Units. Test Equipment, etc.

★**SUPERSETS**—Full constructional de-to-point wiring diagrams for building supa-simplified layout and point-supersets.

★**COIL PACK**—Full constructional details for building a superhet coil pack.

★**CAR RADIO**—Full constructional details for building a superhet car radio.

★**BATTERY CHARGER**, complete details for building a CHEAP CHARGER.

★**RADIO GEN**—Pages of information, "know-how," Resistance Colour Code, Formulae, and

★**RADIO CONTROL**—General information and list.

★**RADIOGRAM** Constructors' list.

★**BOOKS**—Comprehensive list of Radio Books.

★**CATALOGUE**—Profusely illustrated catalogues and price list of components, receivers, Wolf Cub Tools, Xacto Tools, Soldering Irons, etc.

YOU CAN'T GET BETTER VALUE!
IT'S TOPS!
The most helpful book in the Trade.
SEND 2/6 FOR YOUR COPY TODAY!
And, of course, our variable iron-dust cored COILS offer outstanding value at 3/- ea. 10-30, 16-50, 30-75, 75-200, or 190-550, 800-2,000 metres. Aerial H.F. or Osc.

SUPACOILS
21 Markhouse Road, London, E.17

SPECIAL OFFER G.E.C. & B.T.H. GERMANIUM CRYSTAL DIODES

1/- each. Postage 2½d.

Diagrams and three Crystal Set Circuits Free.

A large purchase of these fully GUARANTEED diodes from the manufacturers enables us to make this attractive offer.

POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

DESIGNS engineer.—There is a vacancy for a designer of magnetic recording equipment in the Domestic Electronics Division of E.M.I.: a number of interesting projects are in hand giving scope for inventive ability to applicants who have knowledge of electrical circuits or interest in small mechanisms. Salary will be commensurate with ability and all applications will be seen by the Chief Designer.—Write in first instance, giving full details, to Personnel Dept., E.M.I., Ltd., Blyth Rd., Hayes, Middx. [4520]

MAINS RADIO have vacancies in their development department for men with good knowledge of radio and television circuits and their practical application; the work will include the design and construction of radio and television receivers and test gear and should prove very interesting to those with a flair for experimentation; good salary, progressive staff positions.—Please apply to the Personnel Manager, Mains Radio Gramophones, Ltd., 359, Manchester Rd., Bradford, 5. [4453]

SIEMENS BROTHERS & Co., Ltd. have vacancies in their laboratories at Woolwich for assistant engineers to carry out experimental work on electronics as applied to long-distance telephony; the work covers multi-channel carrier current telephony and telegraphy over long distance submarine lines and cables; in addition to VHF and UHF radio circuits; field trials for such new equipments afford opportunities for short periods of overseas experience, and young engineers can obtain overseas installation experience.

THE laboratories are also engaged on the development of specialised carrier current terminal equipment for use with submarine cable systems employing submerged repeaters; opportunities are available for dealing with mechanical design, the physical principles of component design and the miniaturisation of equipment.

THERE are vacancies for young engineers who wish to take up sales and project engineering work involving commercial as well as technical requirements; this work necessitates a period of laboratory training before undertaking overseas travel.

APPLICANTS should have Ordinary National Certificate or higher qualification; experience in the maintenance of multi-channel carrier telephone or telegraph equipment an advantage. APPLI Siemens Brothers & Co., Ltd., Ref. 744/11, Woolwich, S.E.18. [4377]

CANADA NEEDS electronic engineers. Measurement Engineering Ltd., with expanding business in electronic instrument field, offer generous salary, excellent prospects, to keen man capable of starting and taking charge of a section to handle magnetic amplifier design. Applicants must be Phys. or Eng. graduates with several years industrial experience, including two years on magnetic amplifiers. The location Ontario, within easy reach of Chalk River and Ottawa. Interviews London (England) Box 2059. [4513]

An Electronic or Electrical Engineer, between the ages of 25 and 35 years, of degree standard, is required to take charge of the engineering department of a factory engaged in the manufacture of frequency control equipment. The successful applicant will be responsible for the design and specification of all new items, as well as routine engineering problems. The position offers a wide scope for a person possessing the necessary technical qualifications and initiative to expand the work along numerous channels.

LIVING accommodation can be made available to the successful applicant.

APPLY in writing to the Personnel Manager, Standard Telephones & Cables, Ltd., Crystal Factory, Harlow, Essex. [4466]

An electronic or electrical engineer of degree standard is required to take charge of the engineering department in a factory which is part of a large organisation engaged in the manufacture of all branches of communications equipment. The successful applicant will be responsible for engineering development, design and specification of new items, as well as routine engineering problems. The wide field of work to be covered offers considerable opportunity for advancement. Living accommodation for single or married persons can be made available.

BOX W., R2417, A.K. Adv., 212a, Shaftesbury Ave., London, W.C.2. [4490]

NATIONAL INSTITUTE FOR MEDICAL RESEARCH, The Ridgeway, Mill Hill, N.W.7, requires an assistant for the Instrument laboratory; min. qual.; G.C.E. ordinary level or equiv. with passes in English, Mathematics and Physics; experience of the production of experimental apparatus and some knowledge of electronics are desirable; initial salary £450 +London weighting of £20-£30 depending on age; 3 weeks holiday with pay; established supernumerary post after probationary period; excellent conditions.—Apply in writing to Administrative Officer at above address. (Quo ref. 54) [4531]

TEST Engineers are required by a Leading Midlands manufacturer for: (1) Testing and Fault-Finding on Radar Units and other Electronic Devices. (2) Construction and maintenance Test Equipment. (3) Testing and Fault-Finding on domestic Radio and Television Receivers. These progressive positions cover a wide range of activities and selection will be made not only on experience but also on ability to respond to further training. Ex-Service technicians are particularly suitable.—Applicants should write, giving details of career to date and salary expected to the Personnel Manager (Ref. GLB.), Box 2540. [4426]

MONEY BACK GUARANTEE DUKE & CO

621 ROMFORD ROAD, LONDON, E.12
CWO OR COD • TEL: GRA 6677

RADIO-GRAM CHASSIS

29/9, including Speaker.

5-valve s/het, 3 w/band A.C. mains, complete but less valves and dial. All used, tested, guaranteed. P. & P. 4/6. Drawings 2/6 or free with order. Knobs 1/6 a set extra. Complete with valves, 97/6.

RADIO CHASSIS. 7/9. A.C. or Universal, s/het receivers. Less valves and dial, and electrolytics, otherwise believed to be in working order.

Note.—Our 8in. M.E. Speaker fits some of these sets. We match on request with order. P. & P. 3/6.

RADIO CHASSIS. 14/9. As above with 3-band coil packs, 465 I.F.s. All used bargains. P. & P. 3/6.

SPEAKERS. 12/9. 8in. std. P.M. 3-5 ohms, or with O.P. trans., 14/6. Used, tested, guaranteed. Post 1/9.

SPEAKERS. 2/9. 8in. M.E. field, 1 k., 2 k. or 5 k. ohms. With O.P. trans., 4/9. Used, tested, guaranteed. Post 1/9.

V.H.F. II24 RECEIVER. 17/6. With 6 valves. Ex-W.D. Good condition, 6 channel switching. Receives T.V. sound, police, fire and amateurs. 30.5 to 40 Mc/s. I.F. 7 Mc/s. Post 2/6. Drawings and conversion data free with each set.

V.H.F. II25 SET. 7/9. New and boxed. This little set is a V.H.F. receiver, requires modification to put it into service. Complete with valves. Post 2/3.

R.F. UNIT 24. 12/6. New and packed. Tuning 20-30 Mc/s. Including 3 valves. Post 2/-.

T.V. TUBES AND T.V. CHASSIS. We hope to accept your further orders this month, after we have completed your overwhelming response to previous ads. We are sorry for the past delay in despatch.

O.P. TRANSFORMERS. 1/9. Salvage, used, tested, guaranteed. Std. size. Post 9d. Sample will convince you.

2-GANG CAPACITORS. 2/9. Std. size .0005 used, tested. Also 3 gang at 2/9. Post 9d.

I.F. TRANSFORMERS. 2/6 PAIR. 465 kc/s. Post 6d.

MAINS TRANSFORMER. 5/9. 350-0-350, 12 v. + 4 v. Primary 100, 120, 200, 250. Make ideal auto. trans. Post 2/-.

MAINS TRANSFORMER. 3/9. 350-0-350, 4 v. + 4 v., primary 200-250 tested, guaranteed. Post 2/-.

H.T. BATTERIES. 96 volts, 4/9. Made from our 12-volt batts. at 9d each, or 8 for 4/9. Post 1/-.

AMPLIFIERS. 57/6. 4 watts output A.C. or universal, 3 valve. Post 2/6.

AMPLIFIERS. 77/6. 7 watts output, 4 valve, universal only. Post 2/5.

AMPLIFIERS. 97/6. 10 watts output, 5 valve, with pre-amp. stage, 3 controls. Post 3/6. A.C. only.

.2 DROPPERS. 750 ohms. 1/6, including post.

TV CONDENSERS. 12/6. Electrolytic, 120 m.f.d. + 64 m.f.d., 350 volts. P. & P. 1/-.

MORSE KEY TAPPERS. 1/-. Post 3d.

LIFE JACKET LAMPS. 9d complete with lead and clip. U2 batt. and bulb to fit, 9d extra. Post 6d.

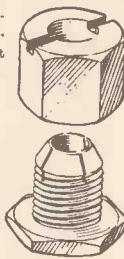
Send 2½d stamp for complete catalogue.

PRE-SET CONTROL LOCK

Designed to lock the spindles of preset potentiometers or trimmers without rotational or lateral displacement of shaft.



Send for leaflet 12



Will accept wide range of panel thicknesses.

TYPE C
(right)
TYPE P
(left)

Very attractive appearance for panel mount fitting.

SUTTON GOLDFIELD ELECTRICAL ENGINEERS
Clifton Street, Sutton Coldfield. 'phone: SUT. 5666

Kit of parts for the simple construction of a first class Tape Deck

Comprising complete set of accurately machined components with every nut and bolt and full instructions for building a high-quality 2-speed Tape Deck. Very compact, 11in. x 7in., taking 600ft. reels. Twin track recording with the very latest type High Fidelity Ferroxcube heads (30-12,000 C/S at 7in.). High-speed capstan, precision balanced flywheel, ball bearing pressure roller giving remarkable freedom from "wow." Fitted with the latest Collaro constant speed motor.

Price £7 10 0

E. W. A.

266, WARRECK DRIVE, BLACKPOOL

RADIO & TELEVISION COMPONENTS

WE OPERATE A PROMPT & EFFICIENT MAIL ORDER SERVICE
"VIEWMASTER" & "TELE-KING" specialists

Easy terms available. Stamp (only) for lists

JAMES H. MARTIN & CO.,
FINSTHWAITE, NEWBY BRIDGE,
ULVERSTON, LANCs.

THE "Dust Bug" AUTOMATIC GRAMOPHONE RECORD CLEANER

PATENT APPLIED FOR

From **CECIL E. WATTS**
Consultant and Engineer (Sound Recording and Reproduction),
Oakleigh Grange, High Cross, nr. Uckfield, Sussex.
Or your local dealer.

Price 18/6, plus 6/2 purchase tax



Leads the world in
TAPE RECORDING

For details of the world's most advanced Tape Units and Tape Recorders contact

VERDIK SALES LTD.

8, RUPERT COURT, WARDOUR ST., LONDON, W.1
Gerrard 8266

SCIENCE graduate, aged 21-26 years, required in Tolworth, Surrey area, for investigation and development work on ceramics dielectrics, sound electrical knowledge essential, some experience in this field an advantage; consideration will be given to man not yet qualified but who intends to do so.—Box 2847. [4483]

CRAFTSMEN for Radio and Television Service required at Shrewsbury and Ludlow districts; applicants must be fully experienced in the repair and maintenance of all types of radio and television receivers; rate of pay at present 4/1 per hour; N.J.C. conditions.—Apply, in writing, to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury. [4463]

SENIOR and junior design draughtsmen required for interesting work in connection with electronic equipment commercial radio and television and/or light electro-mechanical engineering, London area; the positions vacant offer ample scope and opportunity for future advancement to men of good ability; a high salary will be paid to the selected candidates; all recognised staff privileges available; please reply, giving full details of experience to—Box 2442. [4409]

TELEPHONE engineers.—A well-known London company manufacturing Telecommunications equipment have vacancies in their sales section for (a) engineers for preparing tenders, (b) engineers for editing and writing technical publications, (c) engineers for instructing and training customers' engineers; should have good knowledge of carrier telephone and V.F. telegraph systems; canteen and sports club facilities; pensionable staff posts; state age, qualifications and experience.—Box 2287. [4379]

BELLING & LEE LTD., wish to engage a young graduate electronics engineer with experience of V.H.F. receiver layout and circuit design, the work being in connection with the development of measurement apparatus for their television aerial laboratory, and communal broadcast and television amplifiers; British nationality essential; contributory pension scheme; Applications (which will be treated in confidence, stating age, experience and salary required, to the Secretary, Great Cambridge Rd., Enfield, Middlesex. [4394]

draughtsmen.—An expanding production programme has created a number of vacancies for mechanical designers, senior draughtsmen and detail draughtsmen, to be based in the Midlands; the work involves the complete engineering of electronic apparatus for Government contracts and of domestic radio and television equipment.—Applicants interested in this type of work, with or without experience, are invited to apply, giving details of career and salary expected to the Personnel Manager (Ref. GLB), Box 2438. [4398]

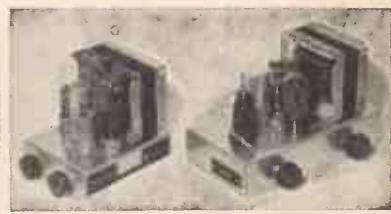
LABORATORY Technician (Physics). Queen Mary College (University of London), Mile End Rd., E.1, preference for experience any or all duties re glassblowing, lecture demonstrations, research assistance, electronics, salary according to ability on scale £340 p.a. by £15/20 to possible £480 subject to efficiency review at £415, plus London Weighting £20 to £30 according to age, pension scheme, three weeks minimum annual leave; letters only to Registrar, stating age, full details experience and present work. [4484]

THE GENERAL ELECTRIC CO. LTD., Brown's Lane, Allesley, Coventry, require technical development engineers, designer draughtsmen and draughtsmen, preferably with experience of radar-type equipments for work on guided weapons and like projects; also required, senior and junior electronic development engineers, particularly in the field of microwave and pulse applications; salary according to age, qualifications and experience.—Apply by letter, stating age and experience, to the Personnel Manager, Ref. R.G. [0259]

THE TELEGRAPH CONDENSER CO. LTD., invite applications from engineers fully experienced in radio and television design to assist Chief Development Engineer in development of printed circuits. Qualifications at least to A.M.I.E.E. standard. This position offers scope for the right man who must be capable of initiating and following projects to finality, including contact with customers. Superannuation scheme.—Write giving full details of qualifications and experience, age and salary required, to Personnel Manager, T.C.C., Ltd., North Acton, W.3. [4312]

ELECTRONIC Engineers are required for field trials on guided weapons by The English Electric Company, Ltd., Luton, Beds. Applications are invited from men with good electronics experience gained in industry or H.M. Forces, preferably with F.N.C. or equivalent. Assistants with similar experience are also required, preferably with O.N.C. Housing assistance available to successful applicants normally resident in the Greater London area. Applications giving full details of experience and qualifications to Dept. C.P.S., 336/7, Strand, W.C.2, quoting Ref. 1324. [4441]

SENIOR design and development engineers required for work of an interesting nature in connection with microwave, electronic and mechanical development of guided weapons and associated equipment; the vacancies offer ample opportunity for advancement in a modern laboratory; the positions are permanent and the commencing salaries will be in accordance with experience and will be based on a generous and progressive scale; degree or H.N.C.—Please reply, in confidence, giving full particulars, to: The Personnel Manager, The Plessey Co., Ltd., Vicarage Lane, Ilford, Essex. [4496]



3-VALVE QUALITY AMPLIFIERS

3-4 wt. 16 S.W.G. al. chass.; neg. f.d.b.; vol. and tone controls; A.C. 200-250 v.; voltage panel; 2-4Q2 spkr socket; new comp. and PLAYING TESTED; B7g 6½ x 5 x 4½in., £4/2/6.

INT. OCT. 9 x 6 x 4½in., £3/19/6.
Carr. 2/6 either model and state type P.U.
E.K.E., 47, Arksey Lane, Bentley,
Doncaster.

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE

ROD, BAR, SHEET, TUBE, STRIP, WIRE
3,000 STANDARD STOCK SIZES

No Quantity too Small List on application
H. ROLLET & Co., Ltd.
6 Chesham Place, S.W.1. SLOane 3463
ALSO AT LIVERPOOL, BIRMINGHAM,
MANCHESTER, LEEDS



BRIGHTON TERRACE, LONDON, SW.9
Phone BR1xton 4961
(3 lines)

A.R.I. 5206 (STR 16/17) EQUIPMENTS

150-505 Kc/s C.W., 14 watts.

2.4-13 Mc/s C.W., 25 watts.

MCW, R/F, 6 watts.

Built in 100 Kc/s X-tal calibrator.

Complete T/R installations of separate units.

Send your enquiries to:

AVIONICS LIMITED

Croydon Airport, Tel. Croydon 5791, 4383, 7744.
Surrey, Grams: Aeradio Croydon.

CROYDON TRANSFORMERS

G.R.T. ISOLATION TRANSFORMERS

Type A1 Rating 1-250, giving a 25% output on Secondary. 2 volt 7/6, 4 volt 7/8; 6.3 volt 7/6; 10.8 volt 7/6; 13.3 volt 7/6. Low leakage windings.

Type B: Mains Input 200/250 volts. Multi output, 0.2-4-6.3-7.3-10 and 13 volts. Input has two taps which increase output volts by 25% and 50%, 15% each. Low leakage windings.

Type C: For use with 9 volt Tubes with falling emission. Input 200/250 volts. Output 2-21-21-3 volts at 2 amps, 12/8 each. Low leakage windings.

Please add postage 1/-

2, Pawsons Rd., W. Croydon, THO 1665



ALL TYPES and MAKES
Single and Multi-Range

METERS SUPPLIED FROM STOCK OR
CONVERTED TO ANY RANGE

Phone for immediate service

THE ELECTRICAL INSTRUMENT REPAIR SERVICE

329 Kilburn Lane, London, W.9

Tel.: LADbrooke 4168

STANDARD TELEPHONES & CABLES. Ltd., Corporation Rd., Newport, Mon., have a vacancy in their transmission laboratory for an engineer to work on the development of testing apparatus employing transistors; excellent opportunity for a qualified physicist or mathematician interested in the application of semi-conductors; previous experience is desirable but not essential.—Apply, giving details of qualifications, experience and salary required, to the Personnel Manager. [4450]

D.S.R. require an assistant experimental officer at the Radio Research Station, Datchet, near Windsor, Berks, for abstracting scientific and technical articles on radio research and development; qualifications in physics or electrical engineering; minimum G.C.E. (advanced level) in two scientific subjects, or equivalent; candidates over 22 would normally be expected to have passed degree H.N.C. or equivalent; some knowledge and experience of radio research or development is necessary and ability to read technical French and German an advantage; inclusive annual remuneration for a 45½ hour week men £297 (age 18)—£659, women £297 (aged 18)—£556.—Application forms from M.L.N.S. Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting A114/5A. Closing date 13 May, 1955. [4493]

TECHNICAL sales/service manager required for British West African branches of large British company distributing domestic radio receivers, V.H.F. radiotelephone equipment, intercommunication telephones, domestic and commercial refrigerators, air conditioners, and office equipment; good technical radio background essential; refrigeration experience desirable; familiarisation course arranged with U.K. manufacturers prior to departure for Africa; first-class passage sea/air, free furnished quarters, gratuity on leave after approximately 18 months' tour, pension scheme; apply in own handwriting, stating age (preferably between 21 and 30), whether married or single, full details education, qualifications, national service and business experience; original references should not be sent.—Apply T. S. D., Box 1134. [4483]

MURPHY RADIO, Ltd., have vacancies in the Electronics Division Laboratories for qualified engineers to design and develop the following: 1. V.H.F. and U.H.F. Communications equipment. 2. Airborne and Ground radar equipment. 3. Computing devices and servo systems. 4. Nucleonic equipment and measuring instruments. 5. Transistors. The salary range is £600–£1,000 per annum depending upon experience. Further posts are available to engineers of H.N.C. standard of equivalent having less experience, the salary range being £450–£650 per annum. These vacancies are at Weybridge, Surrey, but one or two vacancies of a similar nature are available at the Rushmoor Works.—Applications giving age, full details of qualifications, experience and salary required, should be forwarded to Personnel Department, Murphy Radio, Ltd., Weybridge, Surrey. [4432]

R. B. PULLIN & Co., Ltd., invite experienced electronic engineers to apply for a vacant post in the company's electronic development division; applicants should possess an honours degree or equivalent qualifications, and should have had several years experience of the development of electronic circuits, preferably including work on electrical servos and magnetic amplifiers; the post is of a senior and permanent nature, it offers excellent prospects in a recently created and expanding laboratory, and the work calls for a high degree of individual technical responsibility and initiative; a commensurate salary will be paid; contributory pension scheme, canteen and recreational facilities; applications will be treated as confidential, and should be made in writing, stating full details to the Superintendent, Electronic Development Division, R. B. Pullin & Co., Ltd., Phoenix Works, Great West Rd., Brentford, Middlesex. [4416]

MINISTRY of Supply requires technical authors at Chesham (also for posts (b) at Farnborough and Malvern) for publications dealing with all aspects of (a) mechanical and electro-mechanical equipment related to guided weapons or telegraphy, tele-mechanics and radio (Ref. D87/5A); (b) airborne/ground electronic equipment relating to radio communications, radio/radar control, search and navigation or guided weapons (Ref. D88/5A); (c) aircraft instruments, training aids and photographic equipment (Ref. D89/5A); (d) aircraft electrical, instrument and radio installations or ground servicing and test equipment (Ref. D90/5A); qualifications: British or British parents; recognised engineering apprenticeship or equivalent with A.M.I.C.E. or Mech.E. or E.E. or A.F.R.A.E.S. or H.N.C. or O.N.C. or equivalent; experience: posts (a) development or operation and maintenance of equipment concerned, and for guided weapons knowledge of servo-mechanisms and electronic devices desirable; posts (b) development or operation and maintenance of radio equipment; posts (c) electrical and mechanical instruments particularly for aircraft; apprenticeship in instrument making preferred; posts (d) appropriate experience; except for (c) experience of writing or editing technical publications advantageous; vacancies in three grades at salaries between £645 and £1,015, according to age and qualifications; not established, but opportunities to compete for establishment may arise.—APPLICATION forms from M.L.N.S. Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting appropriate reference: closing date May 13, 1955. [4406]

BRITISH OVERSEAS AIRWAYS CORPORATION require engineers for the overhaul and maintenance of flight simulators in their Central Training Unit, near London Airport; applicants should have a thorough knowledge of electronic techniques; practical experience in the maintenance of analog computers, aircraft radio equipment and remote indicating systems an advantage; duties 3-shift system covering 24 hours per day; salary according to qualifications, £640 to £756/12 p.a. ann plus approx. £80 p.a. shift pay.—Applications to be addressed to Staff Supt. (Recruitment), B.O.A.C., London Airport, Hounslow, Middx. [4455]

EXPERIENCED engineers are invited to apply for a position where energy, initiative and skill will be well rewarded; the work relates to the development of television circuits, and the design of components for large scale production; experience of television receiver design is required in respect to means of scanning and focusing and design of R.F. and I.F. circuits; the position is a permanent one which offers scope for advancement to senior position; the commencing salary will be in accordance with experience based on a generous and progressive scale.—Write, giving full personal particulars to the Personnel Manager, The Plessey Company, Ltd., Ilford, Essex. [4473]

AIR MINISTRY require experimental officers (min. age 26) at Ruislip, Middlesex, for general experimental duties concerned with radio and radar installations employed in the Royal Air Force; duties include technical investigations into existing systems, field measurements, design of modifications and development of ancillary equipment; short periods of duty overseas may be necessary; qualifications: minimum of Higher School Certificate (Science) or equivalent; some experience of communications systems or radar control is essential; salary within range £735–£900.—Application forms from M.L.N.S. Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting D 112/5A, closing date 13 May, 1955. [4458]

AIR MINISTRY require scientific officer (male) at R.A.F. Station near Maidenhead, Berks, for operational research duties, theoretical studies and development work in the field of communications and general electronics; qualifications: First or Second Class Honours Degree in Physics or Electrical Engineering, or equivalent; salary within range £1,010 to £2,045; post established 10th Jan. Pay rates of establishment through the Civil Service Commission for successful candidate whilst remaining under age 31; opportunities for promotion to higher grade posts on staff of Scientific Adviser to Air Ministry.—Application forms, quoting A 113/5A, from M.L.N.S. Technical and Scientific Register (K), 26, King St., London, S.W.1. Closing date 15 May, 1955. [4459]

CITY AND GUILDS (Electrical, etc.) on "No Pass—No Fee" terms over 95% success.—For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook, free and post free, B.I.E.T. (Dept. 388A). 29, Wright's Lane, London, W.8. [0117]

TELEVISION and radio engineer seeks position abroad, 24 years' experience, age 41 and married; accept maximum responsibility.—Box 2488. [4418]

RADIO (Meteorological) Technicians required by Meteorological Office. Qualifications: Basic knowledge of radio and radar and experience in maintenance/operation of radar equipment, including oscilloscopes. Successful applicants serve in United Kingdom and overseas. Commencing London salary £667/10 at age 25 or over, rising annually to £665/21; subject to deductions for each year below age 25. Provincial salary £20 to £30 lower, overtime, night duty allowance, etc.—Apply at any Employment Exchange, quoting Borough 881. [4467]

RESEARCH assistant (male) required for research on the reactions of fish to water at different temperatures; work (in London) includes development, operation and maintenance of electrical and photographic recording apparatus; degree in mathematics or science preferred; practical knowledge of electricity required; salary of assistant experimental officer starting according to age and qualifications, between £290 and £520; pension scheme.—Applications, with particulars, education, qualifications, national service, experience and addresses of two referees, to the Director, Freshwater Biological Association, The Ferry House, Far Sawrey, Ambleside, Westmorland, by 15 May. [4445]

SITUATIONS WANTED

TELEVISION and radio engineer seeks position abroad, 24 years' experience, age 41 and married; accept maximum responsibility.—Box 2488. [4418]

TECHNICAL TRAINING

LEARN it as you do it—we provide practical equipment combined with instruction in radio, television, electricity, mechanics, chemistry, photography, etc.—Write for full details to E.M.I. Institutes, Dept. WW.47, London, W.4. [0101]

CITY AND GUILDS (Electrical, etc.) on "No Pass—No Fee" terms over 95% success.—For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook, free and post free, B.I.E.T. (Dept. 388A). 29, Wright's Lane, London, W.8. [0117]

TUITION

NOTHING succeeds like success! What we have done a thousand times we can do again for you—see the B.N.F.S. advt. page 146. [0172]

WIRELESS operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7. [0117]

FULL-TIME courses for P.M.G. Certs. C.G.L.I. Telecommunications, Radar Maintenance Cert., and B.Sc.(Eng.); prospectus free.—Technical College, Hull. [0111]

SEE the world as a Radio Officer. Short training period—low fees. Scholarships, etc., available. Boarding and day students. Send 2d stamp for prospectus.—Wireless College, Colwyn Bay. [0118]

A.M.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., etc., on "No Pass—No Fee" terms; over 95% successes.—Or details of Exams and courses in all branches of Engineering, Building, etc., write for 144-page Handbook—Free: B.I.E.T. (Dept. 387B), 29, Wright's Lane, London, W.8. [0118]

T/V & Radio—A.M.Brit.I.R.E., City and Guilds, R.T.E.B. Cert., etc., on "No Pass—No Fee" terms; over 95% successes.—Details of Exams and Home Training Courses in all branches of Radio and T.V., write for 144-page Handbook—Free: B.I.E.T. (Dept. 387A), 29, Wright's Lane, London, W.8. [0116]

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]

FREE—Brochure giving details of Home Study Training in Radio, Television, and all branches of electronics; courses for the hobby enthusiast, or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other professional examinations; train with the College operated by Britain's largest electronics organisation; moderate fees.—Write to E.M.I. Institutes, Dept. WW.28, London, W.4. [0117]

WIRELESS telegraphy.—Merchant Navy offers to youths 16 upwards after qualification, lucrative positions as radio officers.—Apply British School of Telegraphy, 179, Clapham Rd., S.W.9. (Est. 1906). Recognised by Ministry of Education, moderate fees, modern equipment, day and evening tuition; also postal courses in theory of wireless telegraphy for P.M.G. Certs. and Amateur Transmitters. Licence. [0124]

BOOKS, INSTRUCTIONS, ETC. "WIRELESS World," 1946 to 1951 and 1953 complete; offers part or whole.—Box 2667. [4454]

CALLING amateur radio enthusiasts: 1955 A.R.R.L. Handbook, 31/6 post free, from Hudson's Technical Bookshop, New St., Birmingham. [4506]

BACK numbers "Wireless World," 1936 to 1941 bound volumes; 1942-3 odd issues, perfect condition offered.—43, Trafalgar Rd., Birkdale, Lancs. [4436]

I.P.R.E. technical publications, 5,500 Align. Peak for Superheterodynes, 5/9, post free, date for constructing TV aerial strength meter, 7/6; sample copy "The Practical Radio Engineer," quarterly publication of the Institute 2/-; membership and examination data, 1/-; Sec. I.P.R.E., 20, Fairfield Rd., London, N.8. [0124]

CABLE

CHEAPER IN SMALL COILS

No coil under 25 yds.	unless requested.	All prices per a 100-yd. lot. Less supplied, add 5%	3/029	7/029
Twist Flat.	1/044	3/029	W/E	W/E
Rubber	47/6	60/	71/6	123/6
Plastic	49/6	63/6	75/6	131/6
Single V.I.R.	21/-	26/-	—	42/-
SARFIRE WIRE	7/029	tinned copper, 10/- a 100-ft. lot.		
100 yds. of other cables, flexible, annealed, and surplus switch and fuse gear. (We buy surplus electrical items, send details.) Add post carriage to small orders please.				

BRITISH DISTRIBUTING (Desk W.), 691 Green Lane, London, N.8.

AUTOMATIC (TIME) SWITCHES

New and reconditioned 15 day clockwork and electric switches

from 35/-

Send S.A.E. for illustrated details to:—
DONOHUE (TIMERS) GEORGE STREET NORTH SHIELDS, NORTHUMBERLAND

PRECISION RESISTORS

Wirewound to 1% accuracy, any value between 1 and 1,000 ohms. 2/6d.

Set of twelve Resistance Box Standards to cover 1 to 1,110 ohms in 1 ohm steps. accuracy 1%, wirewound, 27/- per set.

R. MASSEY, 25, DOMINION AVE., LEEDS, 7

THE

Cape 25

AUDIO AMPLIFIER for the acoustics laboratory or with a

CAPE FOUR STAGE PREAMPLIFIER forming a high fidelity reproducer which sets a new standard of performance.

AMPLIFIER £25. PREAMPLIFIERS from £10.

Illustrated leaflets upon request.

CAPE ELECTROPHONICS LTD.

43-45, Shirley High Street, Southampton.

Telephone : Southampton 74261.

INDEX TO ADVERTISERS

PAGE	PAGE
Acoustical Mfg. Co., Ltd.	14
Acru Electric Tool Mfg. Co., Ltd. The	136
Adcols Products, Ltd.	106
A.D.S. Relays, Ltd.	126
Advance Components, Ltd.	18
Artalite, Ltd.	40
Asco Research, Ltd.	25
Airmed, Ltd.	12
Allen Components, Ltd.	36
Alpha Radio Supply Co., The	114
Altham Radio Co.	134
Amplex Appliances (Kent), Ltd.	146
Anders Electronics, Ltd.	112
Antex	36
Antiflare, Ltd.	43
Appointments Vacant 146, 160, 161, 162.	165
Arcolectric Switches, Ltd.	46
Ariel Sound	156
Armstrong Wireless & Television Co., Ltd.	42, 149
Ashworth, H.	48
Automatic Coil Winder & Electrical Equipment Co., Ltd. The	1
Automatic Telephone & Electric Co., Ltd.	45
Aeronautics	164
Baker's Selhurst Radio	68
Barker Natural Reproducers	153
Barton's (Radio)	153
Beamish, F. W.	154
Bell, John, & Croyden	140
Beng & Lee, Ltd.	85
Bell South Products, Ltd.	106
Benson, W. A.	155
Berry's (Short Wave), Ltd.	144
Birmingham Sound Reproducers, Ltd.	80
B. K. Partners, Ltd.	132
Blackvac	145
Boulton Paul Aircraft, Ltd.	112
Bradmatic, Ltd.	152
Britain, Chas., (Radio), Ltd.	131
British Communications Corp., Ltd.	65
British Distributing Co.	165
British Industries Fair	11
British Institute of Engineering Technology, Ltd.	152
British Insulated Callender's Cables, Ltd.	56
British National Radio School	56
British Optical Laboratories	56
British Plastics Exhibition	146
British Seacoil, Ltd.	146
Brookes Crystals, Ltd.	104
Brown, S. G., Ltd.	246
Bugin, A. F., & Co., Ltd.	Edit. 246
Bullers, Ltd.	38
Bull, J., & Sons	110
Candler System Co.	165
Cape Electrophonics, Ltd.	165
Chaffey Cabinet Co.	142
Champion Products, Ltd.	153
Chapman, C. T., (Reproducers), Ltd.	59
Cinema Television, Ltd.	101
City Sale & Exchange, Ltd.	101
Classic Electrical Co., Ltd.	39
Clyne Radio, Ltd.	118
Cosmocord, Ltd.	84
Cossor, A. O., Ltd.	32
Coventry Radio	158
Cranston, Alan	152
Croydon Transformers, Ltd.	163
Daly (Condensers), Ltd.	74
Davies, A., & Co.	165
Davis, Jack, (Relays), Ltd.	108
Denco (Clacton), Ltd.	153
Dependable Radio Supplies	158
Direct T.V. Replacements	152
Dixon, L., & Co.	112
Donohoe, (Timers)	165
Drayton Regulator & Instrument Co., Ltd.	165
Dubilier Condenser Co. (1925), Ltd.	163
Duke & Co.	154
Dulic Co., Ltd. The	58
Dynatron Radio, Ltd.	164
Easco Electrical (Holdings), Ltd.	164
Edison Swan Electric Co., Ltd.	Cover ii, 63, 89, 101
Edwards, W., & Co.	145
Egen Electric, Ltd.	40
Electrical Instrument Repair Service, The	164
Electrical Instrument Co. (Hillington), Ltd. The	164
Electro-Acoustic Developments	132
Electro-Acoustic Industries, Ltd.	152
Electro-Methods Ltd.	2
Electronic Precision Equipment 96, 97, 98,	99
Electro-Winds, Ltd.	142
Ellison Transformers, Ltd.	134
E.M.I. Institutes 34, 87, 82, 94	27
English Electric Valve Co., Ltd.	61
Enthoven Solderers, Ltd.	164
E.W.A.	164
Fisher Electronics Co., Ltd.	157
Fluxlite, Ltd.	142
Foyle, W. & G., Ltd.	136
Frith Radiocraft, Ltd.	136
Furzenhill Laboratories, Ltd.	102
Galpins	151
Gardners Radio, Ltd.	31
Garrard Eng. Co., Ltd.	6
Gee Bros., Radio, Ltd.	128
General Electric Co., Ltd.	73
Gilson, R. F., Ltd.	159
Glaser, L., & Co.	162
Goodmans Industries, Ltd.	8, 21
Goodsell, Ltd.	66
Gray, Arthur, Ltd.	106
Gresham Transformers, Ltd.	10
Griffiths Hansen (Recordings), Ltd.	150
Grundig (Gt. Britain), Ltd.	70
Hall Electric, Ltd.	55
Hannay, L. F.	108
Harris, P.	148
Hartley, H. A., Co., Ltd.	40
Harvey Electronics, Ltd.	144
Hatfield Radio	138
Henley's, W. T., Telegraph Works Co., Ltd.	148
Henry's	139
Hin, Ltd.	138
Holger & Watts, Ltd.	64
Hivac, Ltd.	72, 150
Homelac Instruments, Ltd.	100
Household Electrix, Ltd.	105
H.P. Radio Services Ltd.	134
Hunton, Ltd.	110
Imhof, Alfred, Ltd.	42
International Correspondence Schools	102
Jason Motor & Electronic Co.	156
Kenroy, Ltd.	154
Keyswitch Co., The	104
Koskie, B.	140
Lafco Compounds, Ltd.	158
Lancaster Hi-Fidelity	165
Lasky's Radio	115, 116, 117
Lee Products (Gt. Britain), Ltd.	95
Leevere-Rich Equipment, Ltd.	142
Lewis Radio Co.	154
Light Soldering Developments, Ltd.	156
Lockwood & Co.	157
Lowther Mfr. Co.	142
L.R. Supply Co., Ltd.	103
Lustraphone, Ltd.	130
Lyon Radio	152
Magnetic Coatings, Ltd.	111
Magnetic Devices, Ltd.	15, 24
Malvyn Enz, Co.	17
Marconi Instruments, Ltd.	162
Marconi's Wireless Telegraph Co., Ltd.	28, 86, 90
Martin, J. H.	164
Massey R.	165
McGroary-Adams Mfg. Group, Ltd.	140
McMurdo Instrument Co., Ltd.	62
Metropolitan-Vickers Elec. Co., Ltd.	69
Midland Instrument Co.	110
Modern Book Co.	157
Modern Electrics, Ltd.	64
Modern Techniques	132
Morris, H., Ltd.	162
M.R. Supplies, Ltd.	74
Mullard, Ltd.	3, 7, 50, 66, 75, 82
Multicore Solderers, Ltd.	Cover iv
Multitone Electric Co., Ltd.	54
Murex, Ltd.	60
Northern Radio Services	30, 31
Nu-Swift, Ltd.	158
Oddie, Bradbury & Cull, Ltd.	156
Osmar Radio Products, Ltd.	156
Oxley Developments Co., Ltd.	159
Painton, Ltd.	67
Palmer, G. A. Stanley	107
Parmeko, Ltd.	41
Parsonage, W. F., & Co., Ltd.	156
Parsons, C. A., & Co., Ltd.	105
Partidge, Transformers Ltd.	147
P.E.A. Radio	136
Percer, T. W.	156
Pitman, Sir Isaac, & Son, Ltd.	150
Plessey Co., Ltd.	54, 88
Power Controls, Ltd.	150, 163
Premier Radio Co.	4
Proops Bros., Ltd.	76, 77, 78, 79
Pye, Ltd.	135
Quality Equipment Designers, Ltd.	107
Quartz Crystal Co., Ltd.	150
Radio & Electrical Mart, The	138
Radio & T.V. Components	128, 129
Radio Component Specialists	137
Radio Corporation of America	26
Radio Industry Council	37
Radio Kits, Inc.	165
Radio Pioneer Co., Ltd. The	49
Radio Servicing Co.	111
Radiospares, Ltd.	136
Radio Supply Co.	120, 121
Radio Traders, Ltd.	144
Reliance Mfg. Co. (Southwark), Ltd.	148
Robinson, F. C., Ltd.	140
Rogers Development Co.	104
Rola Celestion, Ltd.	48
Rollef, H. & Co., Ltd.	164
Rudman Darlington (Electronics), Ltd.	52
Salford Electrical Instruments, Ltd.	19
Sails, A. T.	154
Samson Surplus Stores	143
Sangamo Weston, Ltd.	92
Savage Bryant, Ltd.	105
Savage Transformers, Ltd.	149
Sherman's Supply Co.	141
Spoot Bros. & Harland, Ltd.	143
Simmonds, L. E., Ltd.	102
Simon Sound Service	23
Smith, G. W. (Radio), Ltd.	126, 127
Smith, H. L. & Co., Ltd.	152
Sound Sales, Ltd.	94
Southern Marine Radio	158
Southern Radio Supply, Ltd.	154
Specialist Switches	154
Spencer-West, Ltd.	156
Standard Telephones & Cables, Ltd.	20, 83, 91
Stanley Sound & Vision Products	145
Stead, J. & Co., Ltd.	100
Stern Radio, Ltd.	122, 123, 124, 125
Stewart Transformers, Ltd.	130
Suflex, Ltd.	57
Sugden, A. R., & Co. (Engineers), Ltd.	68
Supacolls	163
Superior Radio Supplies	113
Sutton Coldfield Electrical Engineers	164
Tanney Products, Ltd.	150
Taylor Electrical Instruments, Ltd.	147
Taylor-Tunclif (Refractories), Ltd.	35
Tektronix, Inc.	22
Telecraft, Ltd.	162
Telegraph Condenser Co., Ltd. Cover iii	108
Tele-Radio (1943), Ltd.	151
Teletron Co., The	162
Thorn Electrical Industries, Ltd.	13
Trix Electrica, Co., Ltd.	Edit. 244
T.R.S.	126
Truvox, Ltd.	100
Uncles, Bliss & Co., Ltd.	52
Universal Book Co.	160
Universal Electronics	113
University Electrical Instruments Corp.	133
Watts, Cecil E.	164
Wayne Kerr Laboratories, Ltd. The	53
Webber, R. A., Ltd.	144
Webb's Radio	158
Weir Elec. Inst. Co.	136
Westinghouse Brake & Signal Co., Ltd.	70
Weymouth Radio Mfg. Co., Ltd. The	44
Wharfedale Wireless Works	62
Whitenton Instrument Co.	140
Whitaker, R.	142
White, S. S. Co. of Gt. Britain, Ltd. The	72
Wilkinson, L. (Croydon), Ltd.	161
Willesden Transformer Co., Ltd.	38
Wilson, R. & Co.	136
Woden Transformers, Ltd.	58
Wright & Weaire, Ltd.	5
Young, C. H.	134
Z. & I. Aero Services, Ltd.	130



PRINTED CIRCUITS

Soon after the turn of the century a new word appeared at Somerset House. There, for the first time in the Register of Companies, appeared the word "Condenser". The first Company in Britain — perhaps in the world — to use it as part of its name was The Telegraph Condenser Co. Ltd.

During its long history, T.C.C. has been credited with many famous 'firsts' — indeed, pioneering is an essential part of its policy. And now comes T.C.C. leadership in the new field of Printed Circuits — destined, we believe, to change drastically many of the basic manufacturing processes in Radio, T/V and Instrumentation.

by



Engineers wishing to keep abreast of these fast moving developments are invited to register their names with us to receive our Technical Bulletins. Manufacturers should apply to our Special Products Division for details of service available.

THE TELEGRAPH CONDENSER CO. LTD

SPECIAL PRODUCTS DIVISION · North Acton · London W3 · Tel: ACOrn 0061

**STAGED AT THE
NORTHERN RADIO SHOW
— AN EXHIBITION OF**

EFFICIENT SOLDERING BY FERRANTI OPERATIVES USING

Ersin Multicore Solder



Above: An operative from Ferranti Ltd. soldering I.F. strips for incorporation in Ferranti Combined Band 1 and 3 Receivers.

At the Northern Radio Show this year Ferranti Ltd. are co-operating with Multicore Solders Ltd. to show an absorbing demonstration of precision soldering under factory conditions. Ferranti operatives will assemble and solder I.F. strips on the Multicore Stand. These units will later be incorporated in Ferranti Combined Band 1 and 3 T/V Receivers at the Ferranti factory.

Ferranti Ltd., in common with other leading manufacturers in the Radio and Electronic Industry, insist upon Ersin Multicore Solder for all electrical connections because they know that they can rely upon its unfailing characteristics. Every batch is the same—the same high quality that ensure faultless, trouble-free soldering.

7 lb. REELS

Ersin Multicore 5-core Solder is available in 9 gauges and 6 alloys on nominal 7 lb. reels for factory use. It is fully approved by A.I.D., G.P.O., A.R.B., D.T.D. 599, R.C.S. 1,000 and meets all pertinent U.S.A. Federal specifications. Ersin Multicore Solder is also supplied in even gauges from 16 to 34 s.w.g. on 1 lb. and $\frac{1}{2}$ lb. reels.



Bib WIRE STRIPPER AND CUTTER



These sturdy nickel plated tools strip insulation without nicking the wire, cut wires cleanly and split plastic extruded twin flex. They are adjustable to most wire thicknesses by the turn of a screw. Bib Strippers are only 5" long and can easily be carried in the pocket. They save hours of time and irritation because of the speed and efficiency with which wires can be prepared for connection 3/6 each (subject).

Bib RECORDING TAPE SPlicer

On the new Mark II Bib Recording Tape Splicer the clamps are of the easy lift type and are both on the same side to facilitate easy removal of the jointed tape. These improvements ensure even easier and quicker joining of tapes. Price 18/- each (subject). If you have already bought an early model we will gladly modify it for you. Post it to us with stamps or P.O. value 2/- and do not forget to include your name and address.

SIZE 1 CARTON

This pack is the ideal size for service engineers and radio enthusiasts. The solder is conveniently drawn as required through a hole in the top of the carton and will not become tangled inside. Size 1 cartons can be obtained containing Ersin Multicore Solder in any of 4 specifications.

5/- CARTONS (SUBJECT)

Catalogue Ref. No.	Alloy	S.W.G.	Approx. length per carton
C 16014	60/40	14	21 feet
C 16018	60/40	18	55 feet
C 14013	40/60	13	19 feet
C 14016	40/60	16	38 feet

