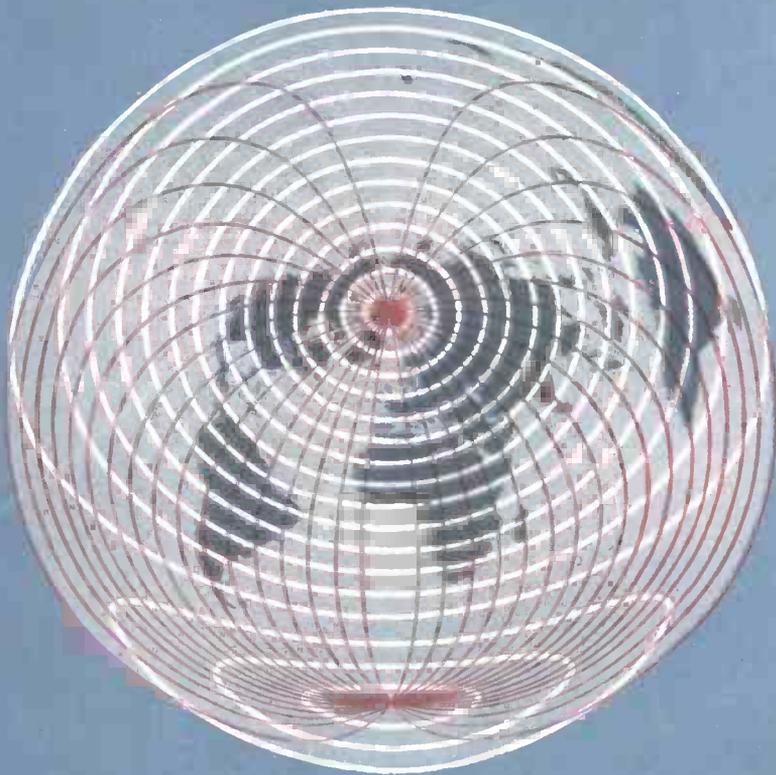


JANUARY 1957

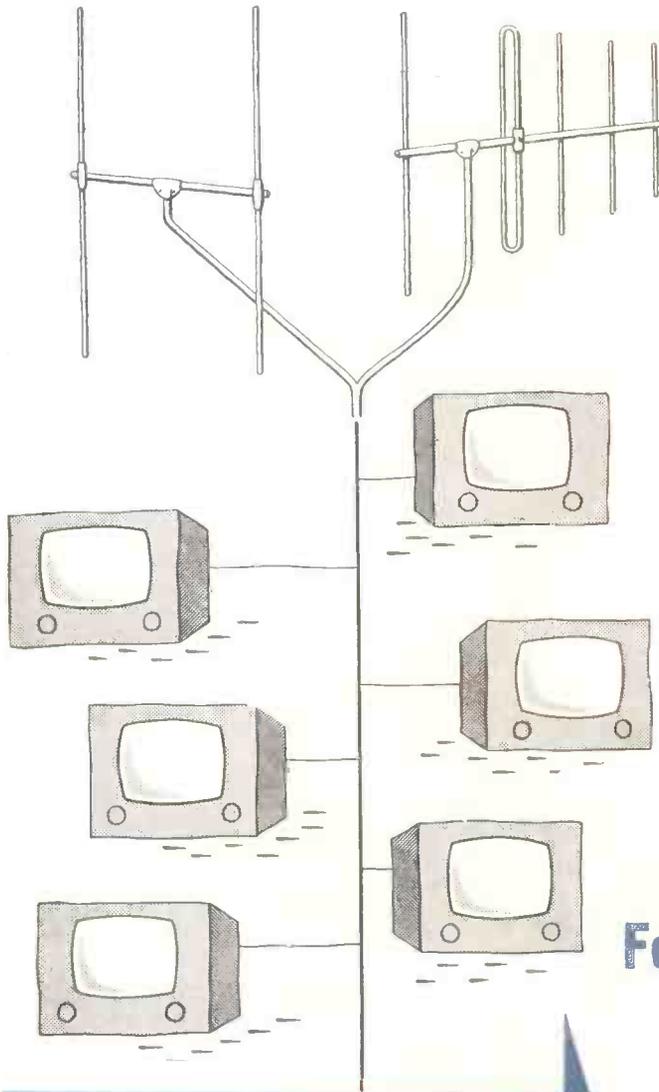
TWO SHILLINGS

Wireless World

ELECTRONICS
Radio · Television



FORTY-SIXTH YEAR OF PUBLICATION



For Communal T/V Aerial Systems

BICC make all types of radio frequency cables for communal television aerial systems in flats, hotels, television showrooms, hostels and hospitals.

Typical of the most popular range is a cable having an inner conductor of copper wire, insulated with cellular polythene dielectric and lead alloy sheathed, thus giving excellent screening properties with low attenuation. For certain situations a protective P.V.C. oversheath may be provided.

Further details are given in Publication TD T 23—available on request.

BICC

CELLULAR POLYTHENE RADIO FREQUENCY CABLES

Wireless World

ELECTRONICS, RADIO, TELEVISION

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

Editor : H. F. SMITH

Assistant Editor : F. L. DEVEREUX, B.Sc.

JANUARY 1957

In This Issue

VOLUME 63 No. 1

PRICE: TWO SHILLINGS

FORTY-SIXTH YEAR
OF PUBLICATION



Editorial, Advertising and
Publishing Offices:
Dorset House, Stamford Street,
London, S.E.1

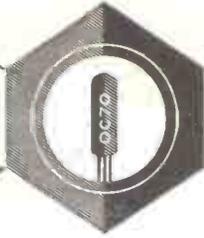
Telephone :
WATERloo 3333 (60 lines)

Telegraphic Address :
"Ethaworld, Sedist, London".

- 1 Editorial Comment
- 2 Single Beam Colour Tube
- 4 World of Wireless
- 8 Limiters and Discriminators for F.M. Receivers. *G. G. Johnstone*
- 15 Portable Transistor Superhet. *W. Woods-Hill*
- 18 Resistance-Current-Voltage-Power Nomogram. *B. E. Jackson*
- 20 Is Radio Propagation Always Two-way? *T. W. Bennington*
- 22 Books Received
- 23 The Gated-Beam Valve. *Lawrence W. Johnson*
- 27 Modernizing T.R.F. Television Receivers. *P. F. Cundy*
- 28 Short-wave Conditions
- 29 Letters to the Editor
- 31 High-Quality Sound Broadcasting. *G. H. Russell*
- 33 Cascode Characteristics. *W. Grant*
- 36 Fish-Finding Asdic
- 37 Simple V.H.F. Test Oscillator. *Bernard Driver*
- 40 Technical Notebook
- 42 Negative Resistance. "Cathode Ray"
- 47 January Meetings
- 48 Random Radiations. "Diallist"
- 50 Unbiased. "Free Grid"

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Biffepres, Sedist, London." Annual Subscription: Home and Overseas, £1 12s. 6d. U.S.A. and Canada \$5.00. BRANCH OFFICES: BIRMINGHAM: King Edward House, New Street, 2. Telephone: Midland 7191. COVENTRY: 8-10, Corporation Street. Telephone: Coventry 5210. GLASGOW: 26a, Renfield Street, C.2. Telephone: Central 1265. MANCHESTER: 280, Deansgate, 3. Telephone: Blackfriars 4412. OVERSEAS OFFICES: U.S.A.: 111, Broadway, New York, 6, N.Y. Telephone: Digby 9-1197. CANADA: 74 College Street, Toronto 2 Ontario. Telephone: Walnut 4-5631

200mW Transistor



amplifier operated from a 6V supply

In a previous advertisement (June 1956) details were given of an audio amplifier using transistors, which derived its power from a nominal 4.5 volt battery. In portable equipment such as record reproducers, it is convenient to operate the amplifier from the same supply as the turntable motor, and since most portable motors operate from a 6 volt battery, the 200mW amplifier circuit has been adapted for use with this higher voltage.

The 4.5 volt and 6 volt versions are very similar in performance, except for the greater sensitivity of the latter. Both are capable of an output of just over 200mW with 10% total harmonic distortion. In the 6V amplifier, the gain at 8kc/s and 50c/s falls 3dB below level response at 1kc/s.

The sensitivity of the 6V version is slightly higher than that of the original in spite of a higher series input resistance of 330kΩ. This can be attributed to the higher supply voltage. Since the output stage requires a lower driving current, and a higher voltage is available for the driver, a higher turns ratio can be used for the interstage transformer T1 and thus the stage to stage gain can be increased. The basic sensitivity across the low impedance terminals YY is 3mV, compared with 6mV in the original, and across the high impedance terminals XX it is 400mV compared with 500mV.

The circuit and component values are given in the accompanying diagram. Alternative high or low impedance inputs for crystal pickups or a radio tuner are available at XX and YY respectively. The input and driver stages (each using an OC71) are R-C coupled, and the driver stage is transformer-coupled to the output stage which is a Class B push-pull arrangement of two OC72's (sold in matched pairs as Mullard type 2-OC72).

Interstage Transformer

The turns ratio of the interstage transformer, T1, which is rated at 2mW, is 3.5 : 1+1. The inductance of the primary should be 10H with a current of 15mA d.c. flowing, and its d.c. resistance should be less than 200Ω. The resistance of each half of the secondary should be kept below 50Ω and the leakage inductance should be as low as possible. The d.c. currents in the secondary windings are balanced.

Output Transformer

The output stage is matched to the load by a push-pull transformer, T2, rated at 250mW. For a 3Ω load the turns ratio is 4.9+4.9 : 1, for a 5Ω load, 3.8+3.8 : 1, and for a 15Ω load, 2.2+2.2 : 1. Each half primary should be capable of handling peak currents of 83mA.

The currents in each half of the primary will only be balanced if the transistors in the output stage are perfectly matched. At large-signal currents it is possible for the OC72's to be mismatched by as much as 35%, consequently the output

transformer should be constructed to allow for unbalanced currents.

The d.c. resistance of each half of the primary winding of T2 should be less than 3Ω and the total inductance should be greater than 0.5H.

The dynamic load for each collector of the push-pull stage should be 72Ω. The d.c. resistance of the secondary winding should be less than 5% of the load resistance and the leakage inductance should be low.

The turns ratio of the output transformer, and the value of the feedback resistor R13 for various loudspeaker impedances are shown in the top left hand corner of the diagram. The loudspeaker impedance must be quoted when the output transformer is ordered from the manufacturer.

Stabilisation

Potential dividers R3, R4 and R7, R8 and emitter resistors R6 and R9 provide stabilised d.c. bias for the input and driver stages.

The effects of changes in the temperature of the surroundings, production spreads in the transistors, and deterioration of the supply battery on the performance have been minimised by careful choice of the value of R11. The optimum value is 8.2kΩ, giving satisfactory performance under the conditions

likely to be encountered. Slightly lower distortion can be obtained by presetting the value of R11 to give quiescent currents of 0.5mA for each transistor at 20°C. The amplifier can be used safely in ambient temperatures as high as 45°C.

Negative feedback from the secondary of the output transformer is applied to the collector of the first OC71 by R13, whose value must be

chosen to match the loudspeaker load, as shown in the table.

Filter Components

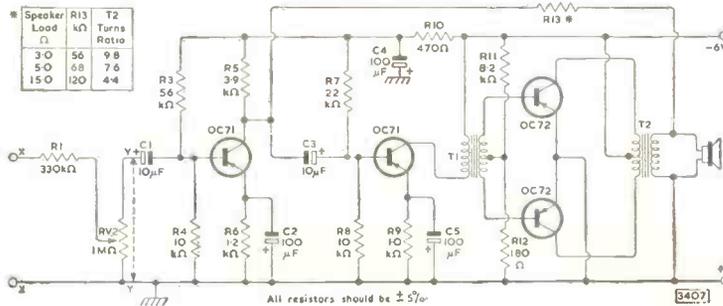
An increase in battery impedance causes undesired feedback through the supply to the earlier stages and it results in considerable distortion in the output. This unwanted feedback is prevented by the filter network C4-R10.

Performance

- Output Power**
215mW at 10% total harmonic distortion
- Frequency Response**
Gain, at 50c/s and 8kc/s, is reduced 3dB below the response level at 1kc/s
- Sensitivity** (with nominal transistors)
3.0mV at the low impedance terminals YY
400mV at the high impedance terminals XX
- Current Drain**
5 to 6mA at zero signal
15mA with average music
75mA at maximum output with sine wave drive

MULLARD COMPONENTS

Mullard pot cores and other Ferror-cube components, air-space trimmers, Varite thermistors etc. are now available in small quantities for experimenters. For information regarding the nearest source of supply please enquire of Mullard Valve Sales Dept. at the address below.



Speaker Load Ω	R13 kΩ	T2 Turns Ratio
3.0	56	9.8
5.0	68	7.6
15.0	120	4.4

All resistors should be ± 5%



EDITORIAL COMMENT

INFORMATION THEORY AND BROADCASTING

Broadcasting techniques are now pretty well established, both on the engineering and programme sides. But, all the same, it might be a worth-while New Year's resolution for broadcasters to decide upon a re-examination of these techniques in the light of information theory. That theory, it will be remembered, did not originally concern itself with the *meaning* of the message or symbols transmitted. Of recent years, however, there has been a growing tendency to widen the scope of the theory, even to the extent of trying to fit the human mind into its place as a link of calculable capacity in a chain of communication.

There is already quite a formidable and highly esoteric literature on this widened aspect of information theory. "Formidable" seems to be a singularly appropriate word in this context; any attempt directly to apply the principles enunciated to say, the improvement of broadcast programme techniques, leads us into deep and turgid waters. But even an unsuccessful attempt may bring up useful ideas.

For instance, the rate at which the human mind can assimilate information is always strictly limited, though it varies with the individual. This truism is brought out in an easily digestible form (though it must be admitted with no reference to information theory) in Professor Kapp's book* on technical writing. All the author's principles are applicable to some extent to the presentation of any kind of factual information (as opposed to imaginative writing or speaking) whether by the written or spoken word. The information in many broadcast talks seems to us to be presented at a rate that is far too high for the medium of communication. Some of them, indeed, can hardly be assimilated at a first reading when they are reprinted in *The Listener*, except perhaps by specialists.

What appears to be another fundamental misuse of broadcasting, considered purely as a means of communication, is the employment of it for disseminating information of purely local interest. Surely that is a function that can be much better carried out by local newspapers. The inhabitant of, say, a small town is almost certain to waste a vast amount of time in waiting for news of happenings in his own little community—if it ever comes. And, taking the South-Eastern broadcasting region of England, what common denominator of local interest can be found to link a London suburb, a New Town, a cathedral city and a secluded village?

This technically indefensible use of the radio medium for parish pump broadcasting, though representing an error of principle, is not highly significant in volume. On the wider issue, much of the philosophy behind the concept of regional programmes, to which the B.B.C. has long been devoted, seems to be based on an almost equally serious misconception of the proper use of the radio medium. For a small country like England, surely radio is essentially adapted to distributing material of nation-wide interest. For example, a high proportion of listeners served on medium waves by the West Region must feel a much closer affinity with London than with the robust and rural West Country.

* "The Presentation of Technical Writing" by R. O. Kapp. Constable.

W
i
r
e
l
e
s
s

W
o
r
l
d

JANUARY
1957

Vol. 63 No. 1

Single-beam Colour Tube

ONE of the main brakes on the development of colour television at present is the absence of a really cheap and simple colour display device that will make possible a low-cost receiver. It is doubtful whether the well-known three-gun shadow-mask tube is the best basis for this. Not only do three guns add to the expense of manufacture but they bring with them all the problems of registration (which are by no means solved in existing designs) and necessitate two extra wideband video output stages capable of providing about 100 volts swing and a stable black level.

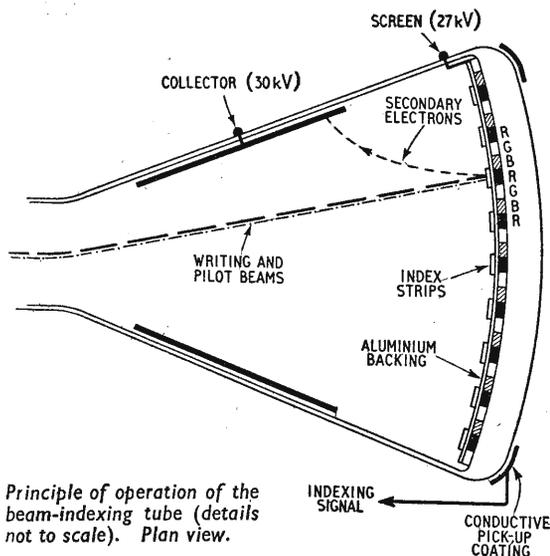
Fundamentally, what is required is a single electron gun, when the beam is on the green strip the green signal is switched on, and similarly with the blue strip.

In order to do this, some means must be incorporated for continuously giving information on the position of the beam across the screen. This is achieved by means of a "pilot" beam (travelling parallel with the normal "writing" beam) in conjunction with the magnesium oxide strips on the screen. Magnesium oxide has a higher secondary emission coefficient than the screen's aluminium backing, so that when the pilot beam crosses the strips it produces a greater secondary emission current than from the aluminium between, and a regular pulsation is obtained. The secondary electrons are picked up by the conical collector electrode, which is at 30kV relative to the screen's 27kV.

The pulsation of secondary emission current generates a signal at the screen, which is taken off capacitively by an external conductive coating. This waveform is known as an "indexing" signal and is combined with the colour signal to gate the writing beam at appropriate moments to produce the desired colours.

In the absence of the colour signal the "Apple" tube produces a good black-and-white picture, simply because the writing beam energizes all the phosphors equally as it passes over them in rapid succession. No critical adjustments are required as in the three-gun tube, where the three separate beams must be correctly aligned and matched to give satisfactory colour—and monochrome—reproduction.

Tubes of this kind are known generally as "beam indexing" tubes. The main advantage claimed for the Philco version is that the task of maintaining tight tolerances is relegated to the manufacturing equipment rather than to the tube itself, where it would have to be faced every time a tube is made. Another important point is that no high-voltage power is wasted through interception or deflection of the beam by an electrode structure near the screen. Technicians in this country have, however, complained of a pattern of vertical dark lines on the picture which results from the screen construction. Full details of the tube have been published in the September, 1956, issue of *Proc. I.R.E.*



Principle of operation of the beam-indexing tube (details not to scale). Plan view.

consisting of a mosaic of differently coloured phosphor dots or strips, with some mechanism which ensures that the spot excites only appropriately coloured dots or strips depending on the colour signal.

The Chromatron, or Lawrence tube, is one device that goes some way towards the ideal (see July, 1953, issue, p. 329). Another, more recent, design is a single-beam tube developed by Philco in America which has hitherto been known by the code name "Apple." In this, as shown by the figure, the screen comprises a pattern of vertical phosphor strips arranged in the cyclic order R G B R G B, etc. There is no internal structure comparable with the shadow-mask in the three-gun tube or the colour-controlling grid in the Chromatron, but on the inside face of the aluminium film backing the phosphor strips there are strips of magnesium oxide which register with a particular one of the phosphor strips.

The principle of operation here is that the incoming colour information is switched to modulate the tube according to the position of the beam. In other words, when the beam is passing across the red phosphor strip the red signal is switched to the electron

Tubeless Colour Television?

LOOKING forward beyond the single-beam tube and the flat tube (described last month), many people believe that the ultimate colour display will be a "picture-on-the-wall" device utilizing some solid-state phenomenon such as electro-luminescence. This method of producing light from phosphors by directly applied potentials* is now being actively investigated, mainly for lighting purposes and image intensification, but there is no doubt that the research workers have their eyes wide open for possible applications in television.

The problem of constructing such an electro-luminescent colour display was raised by a speaker at a recent Brit. I.R.E. lecture on the light amplifier given by Dr. T. B. Tomlinson of G.E.C. It has been discovered that

the light emitted from the phosphor can be made to change colour with different frequencies, of a.c. excitation, and the speaker suggested that this effect might be exploited in some way. In reply Dr. Tomlinson said that the change with frequency could only be accomplished between green and blue, and in practice the method was only suitable for producing an overall colour change in complete sheets of phosphor.

He felt that a more likely solution would be a mosaic type of screen made up of phosphor dots of different electro-luminescent materials, with some arrangement for activating the dots separately in synchronism with the scanning process. A method which has already been suggested involves a matrix consisting of horizontal wires on one side of the screen and vertical wires on the other. Each phosphor dot is placed at the intersection point of an *x* wire and a *y* wire and, in theory, can be activated separately by applying the appropriate voltage to these electrodes. Apart from the elaborate and high-speed switching system required for scanning the matrix, one of the major difficulties, as Dr. Tomlinson

pointed out, would be the inevitable stray cross-coupling between the electrodes.

Earlier, the lecturer had demonstrated electro-luminescent panels of different compositions giving blue, green and orange lights. A good red, he said, was very difficult to obtain chemically. Other problems to be overcome were the low light efficiency and slow response time of the phosphors to activation, but the efficiency in particular was being steadily improved.

In discussing the light amplifier itself, Dr. Tomlinson thought that it might possibly be incorporated in the screens of conventional television cathode-ray tubes. This would make possible lower velocity electron beams and hence lower e.h.t. voltages and reduced scanning power. However, one speaker who had seen an American light amplifier in operation said that, although the amplification and picture quality were both good, there was a considerable time lag in response which would be a disadvantage on moving television images.

* See April, 1955, issue, p. 153.

Drilled-Ferrite Switching Circuit

AN unusual form of construction for two-state switching and computing circuits recently developed at the Radar Research Establishment consists of a block of ferrite with small holes drilled in it, with transistors mounted on top so that their leads pass directly through the holes. This has arisen from the need for switching circuits which are small, reliable and economical in operation.

The idea of using small, square hysteresis-loop ferrite cores, with transistors to drive them from one state of remanent induction to the other, is becoming quite a well-known technique. Unfortunately it brings difficulties in manufacture in that the tiny cores—which are only 2mm across—require a great many turns of fine wire to produce the necessary switching m.m.f. from the small transistor driving currents.

The desirable simplification is a one-turn winding, but to attain this it would be necessary to have a core shaped like a thin-walled tube which would be capable of being switched by a low m.m.f. In the absence of

arranged as a shift register. The change of flux in each magnetic cell resulting from the switching action causes a current to be induced in a one-turn winding connected to the base of the associated transistor. The amplified current change at the collector is then passed through a single-turn winding of the next magnetic cell, which accordingly changes its state and applies an induced current to the next transistor . . . and so on. The action is initiated by a third single-turn winding in each magnetic cell, which serves to introduce shift pulses for moving the pattern of 0 and 1 digits along the length of the register.

The three pieces of 37 s.w.g. wire passing through each cell actually take the place of some 100 turns of 47 s.w.g. that are necessary on a conventional ferrite core performing the same action. The only disadvantage in using the magnetic cell is that it does not saturate. This means that the stored flux is largely dependent on the applied current, so that the two states are not so well defined and uncritical as in the ferrite toroidal core.

Equipments based on the transistor/magnetic-core element already give something like a 3,000:1 reduction in power consumption over valve circuits and about 100:1 reduction in size.

Student Exchange

SINCE the foundation of the International Association for the Exchange of Students for Technical Experience in 1948, nearly 29,000 students from 22 countries have taken advantage of the facilities provided by the Association whereby they can obtain practical experience abroad during the summer vacation. The 9th annual report records that in 1956 a total of 5,711 students went abroad under the scheme. By far the greatest number was from Germany (1,284) with Great Britain second (743). Sweden, who sent only 415 students abroad, received the greatest number (1,305) with Germany second (1,019). A total of 774 overseas students came to this country.

Although the radio and electronics industry is not given a separate classification—it is included in electrical engineering—it is obvious from the lists of the participating companies and research organizations in this country and abroad that a large number of them are in this field.

Details of the Association are obtainable from J. Newby, Imperial College, South Kensington, London, S.W.7.

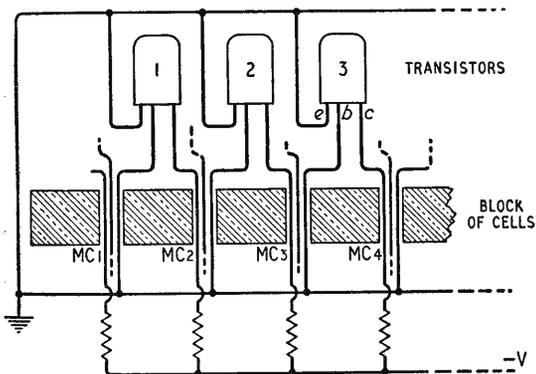


Fig. 1. Construction of transistor/magnetic-cell two-state elements arranged as a shift register.

such cores on the market, the nearest practical alternative that can be switched by low currents is the "magnetic cell" or narrow hole drilled in a block of ferrite. This principle was described by D. S. Ridler and R. Grimmond at the recent I.E.E. Ferrites Convention (see December, 1956, issue, p.596), and the R.R.E. device was actually disclosed by G. H. Perry in a discussion following the paper.

Fig. 1 shows diagrammatically the construction of a group of the transistor/magnetic-cell two-state elements

WORLD OF WIRELESS

Organizational, Personal and Industrial Notes and News

Radio Shows

WE HAVE often deplored the proliferation of exhibitions catering for radio and its electronics offshoots. Will the situation be eased by the dates of some of the shows overlapping?

The Radio Industry Council has announced that this year's National Radio Show, which will again be held at Earls Court, London, will be from August 28th to September 7th with a preview for invited guests on the 27th. The static section of the S.B.A.C. Show at Farnborough, which has become the aeronautical radio exhibition, will be held from September 3rd to 9th with a preview on the 2nd.

The exhibition at which the marine side of the radio industry is usually well represented—the Engineering, Marine and Welding Exhibition—overlaps the National Radio Show still further, for it opens at Olympia on August 29th for fifteen days.

Audio Fair

ALL but four of the fifty-one exhibitors who have taken space at this year's Audio Fair will have demonstration rooms. The four-day fair will be held from April 12th to 15th, inclusive, at the Waldorf Hotel, Aldwych, London, W.C.2.

It is being run by Audio Fairs, Ltd., a non-profit-making company on which the following serve "on a purely voluntary basis": chairman, V. G. P. Weake (Pamphonic); vice-chairman, D. A. Lyons (Trix); M. L. Berry (Trix), L. H. Brooks (M.S.S.), J. W. Maunder (Vitavox), H. V. Slade (Garrard), G. E. Spark (M.S.S.), T. R. Threlfall (Goodmans).



DOCTORS Bardeen, Shockley and Brattain (L to R), who jointly received the 1956 Nobel Physics Prize in Stockholm in December, photographed when they worked together on the development of the transistor at Bell Laboratories.

G.E.C. Valve Policy

A FEW months ago the trade name of "Osram" valves was changed to "G.E.C." This foreshadowed a change in policy resulting from the acquisition by the General Electric Company of the share in the Marconi-Osram Valve Company formerly held by E.M.I.

In future, the M-O. Valve Company, which is now a wholly-owned subsidiary of G.E.C., will concern itself mainly with the manufacture of transmitting and special-purpose valves. Among the transmitting types will be klystrons, magnetrons, travelling wave tubes and backward wave oscillators, as well as valves for r.f. heaters. Receiving valves will include "reliable" and high-performance types in addition to audio amplifiers. Gas-filled valves such as thyatrons and xenon rectifiers represent an important side of the company's activities.

News in Morse

IT is some months since we published a schedule of the transmissions of English news bulletins prepared by the overseas press division of the Central Office of Information. For the bulletins to North America and the Far East an R.T.T. (printing radio telegraph) link, employing frequency-shift keying, is now used, and for a number of other areas the Hellschreiber method has taken the place of morse. There are, however, a number of areas for which morse is still used and below we give the latest schedule of these transmissions from Post Office stations. The morse speed varies from 22 to 28 words a minute.

Region	Times (G.M.T.)		Call	Freq. (Mc/s)
Distant Europe	Monday	0200-0430	GIQ25	5.365
	Tues. to Sun.	0300-0530		
Middle East	Monday	0200-0430	GBB33	13.595
	Tues. to Sun.	0300-0530		
Caribbean	Mon. and Fri.	1145-1215	GIB36	16.190
	Mon. to Fri.	1215-1315		
	Mon. to Fri.	1700-1830	GIB38	18.680
South America	Friday	2015-2130	GIN31	11.645
	Mon. to Sat.	0115-0230		
Africa	Mon. to Fri.	0915-0945	GAY40	20.100
	Monday	2015-2100		
South East Asia	Sunday	1915-2115	GAY27	7.447
	Mon. to Sat.	1715-1800	GAY33	13.665
	Mon. to Sat.	1815-2215	GAY27	7.447
	Mon. and Sat.	1600-1715	GAY33	13.665

PERSONALITIES

A.V.-M. Raymond G. Hart, C.B., C.B.E., a member of Watson-Watt's Bawdsey team in 1936, has been appointed controller of engineering and equipment at the Air Ministry. In 1941 he went to the Air Ministry as deputy director of radar. He was subsequently concerned with the planning of the air signals in the invasion of Europe and became chief air signals officer at S.H.A.E.F.

Under the Department of Scientific and Industrial Research Act, 1956, which came into force on November 7th, a new research council has been formed in place of the former advisory council. **Dr. H. W. Melville, F.R.S.**, is secretary of the council, and among the eleven members are **Professor P. M. S. Blackett, F.R.S.**, (Imperial College) and **Dr. Willis Jackson, F.R.S.**, (Metropolitan-Vickers).

R. H. Tizard, B.A., A.M.I.E.E., who had been superintendent of the Control Mechanisms and Electronics Division of the National Physical Laboratory, Teddington, since its formation in 1954, recently left to take up an appointment at the London School of Economics. He is succeeded by **Dr. A. M. Uttley**, who from 1940 until his present appointment was at the Radar Research Establishment (previously T.R.E.), Malvern. During the war he was concerned with the design of a number of synthetic trainers, and more recently was largely responsible for the functional design of TREAC, the electronic digital computer used in the Physics Department of R.R.E.

L. A. Woodhead, director and general manager of Cossor Instruments, Ltd., is the new chairman of the Electrical and Electronics Section of the Scientific Instrument Manufacturers' Association. He joined the parent company, A. C. Cossor, Ltd., in 1930 and during the war was in charge of the final test and inspection of valves and c.r. tubes at a large shadow factory.

William Culshaw, B.Sc., Ph.D., recently left the Radar Research Establishment, where he specialized in the field of microwave optics and later in millimetre wave magnetron development, and has joined the laboratories of the National Bureau of Standards at Boulder, Colorado. Dr. Culshaw, who joined T.R.E. in 1942, is in the N.B.S. Microwave Physics Section.

Dr. A. V. J. Martin, until recently editor of our French contemporary *Télévision*, has been appointed professor of electrical engineering at the Carnegie Institute of Technology, Pittsburgh, Pennsylvania.

L. S. Crutch, B.Sc., M.I.E.E., deputy chief engineer of Siemens Brothers and Company, which he joined in 1931, is appointed a director of the company. He has specialized in the development of telecommunication systems, and was for some years assistant chief engineer of Siemens' telecommunications department.

G. K. Nicholls, Assoc.I.E.E., has been appointed manager of the Cable and Wireless cable station and engineering school at Porthcurno, Cornwall, in succession to C. J. V. Lawson, recently appointed deputy engineer-in-chief.

I. C. I. Lamb, A.M.Brit.I.R.E., has been appointed engineer-in-charge of the recently opened I.T.A. station at Emley Moor, Yorks. Employed by the B.B.C. both before and immediately after the war, first as a maintenance engineer at Daventry and later in the research department, he subsequently went to Pye, Ltd. Last February he joined the I.T.A.

The announcement of the above appointment affords an opportunity to mention the engineers-in-charge of the first three I.T.A. stations. **W. Woollenden** (Croydon), after service as a R.A.F. radar officer, went into industry for a short while before joining the B.B.C. in 1947. He has been with the I.T.A. since August 1955. **N. G. Payne, A.M.I.E.E.**, was for 16 years on the maintenance staff of the B.B.C. before being appointed to Lichfield last February. **W. H. Jarvis, A.M.I.E.E.** (Winter Hill), was a marine radio officer from 1918 until 1935 when he joined the B.B.C. He was senior maintenance engineer at Alexandra Palace before joining the I.T.A. last April.

W. F. Harkness, who in the early days of broadcasting formed Electrical Appliances, Ltd., selling Eureka transformers, and after service with Cossor's went to the U.S.A. in 1939, has now retired and returned to this country. His address is 5, Dawson Place, London, W.2.



H. E. F. Taylor is the new secretary of the Radio Communication and Electronic Engineering Association in succession to Neill Christie. During the war Mr. Taylor was a lieutenant-colonel in the Royal Signals and was concerned mostly with long distance telecommunication projects. He has been a radio amateur for some 35 years and has operated in India with the call-sign VU2AT. His British call is G6HT.

L. Essen, D.Sc., Ph.D., A.M.I.E.E., who joined the National Physical Laboratory in 1929 and has been concerned with precise microwave measurements, in particular with the measurement of frequency and time, has been promoted to senior principal scientific officer in the scientific civil service. Dr. Essen, who is 48, recently developed a frequency standard, based on a resonance of the caesium atom.

The B.B.C. has appointed **G. K. Drake** as engineer-in-charge of the television and v.h.f. sound broadcasting station at Blaen Plwy, Wales, and **B. M. Britton** as e-in-c of the Sandale, Cumberland, television station. Mr. Drake, who joined the Alexandra Palace television station in 1938, has been senior maintenance engineer at Wrotham, Kent, since 1949. Mr. Britton has been with the Corporation for 14 years.

T. P. Lynott, A.M.I.E.E., has been appointed chief engineer to Gardners Radio Ltd., of Somerford, Christchurch, Hants. Since 1947 he has been at the Atomic Energy Research Establishment, Harwell, as transformer design engineer, having previously been first with G.E.C. and then the directorate of instrument production at the Ministry of Supply. Mr. Lynott, who is 42, is chairman of the subcommittee of the Radio Components Standardization Committee of the Ministry of Supply dealing with transformers and chokes.

W. Grant, contributor of the article on page 33, studied at the Royal Technical College, Glasgow, for his B.Sc. in electrical engineering. During the war he was commissioned Electrical and Mechanical Engineer in R.E.M.E. He has since been undertaking research and development work and is at present with J. Stone and Company (Deptford).

OBITUARY

Air Commodore R. L. Phillips, C.B., C.B.E., who died on November 22nd at the age of 47, was associated with aeronautical radio for the major part of his career in the R.A.F. He had held the positions of Director of Radio and Director of Signals Policy at the Air Ministry.

The death is announced by the Canadian Department of Transport of **G. C. W. Browne**, retired controller of telecommunications, at the age of 66. He went to Canada from Ireland in 1912 and entered the Canadian Government Radio Service two years later. Since his retirement last year Mr. Browne had been acting as consultant to the Fowler Commission on Broadcasting in Canada.

George T. Clack, who for many years (until 1953) was honorary lecture secretary of the Television Society, died on November 17th at the age of 47. He had been with Bush Radio since 1939 where, as a senior laboratory engineer, he had been latterly primarily engaged on technical liaison work.

IN BRIEF

Receiving Licences.—During October the number of television licences current in the U.K. increased by 151,299, bringing the total to 6,291,072. The total number of broadcast receiving licences, including those for television and 310,301 for car radio, was 14,419,741.

Test transmissions from a 1-kW pilot transmitter will begin on March 1st from the site of the first Scottish I.T.A. station at Black Hill, Lanarks. The station will operate in Channel 10 (199.75 Mc/s vision and 196.25 Mc/s sound) although the carriers will actually be offset by -19.5 kc/s and -10.5 kc/s, respectively.

In preparation for the opening of the Scottish I.T.A. station at Black Hill, Lanarks., at the end of August, the programme contractors, Scottish Television, Ltd., are arranging a series of weekly exhibitions from February to June in the principal burghs to be served by the station. The Scottish Radio Retailers' Association is participating, and advice on the conversion of existing sets will be given to enquirers.

Lichfield Increased Power.—By adding 20-kW amplifiers to both the sound and vision transmitters at Lichfield the e.r.p. of the I.T.A. station was increased on November 23rd to 200 kW. Duplicate sets of transmitters were previously operated in parallel to bring the e.r.p. up to 100 kW. The spare sound and vision transmitters are now being kept as standbys in case of breakdown of the main equipment. All the transmitting equipment at Lichfield was designed and installed by Pye, Ltd.

The B.B.C.'s eighth v.h.f. sound broadcasting station, **Holme Moss**, was brought into service on December 10th. It is radiating a three-programme service on 89.3, 91.5 and 93.7 Mc/s with an e.r.p. of 120 kW. The six 10-kW transmitters (two for each service) were installed by Marconi's.

Four of the seven gold medals awarded to British manufacturers for goods displayed at the California State Fair, held in Sacramento in September, were won for radio and electronic equipment. Two of the medals went to Trix Electrical for their Trixon amplifier 800 and record player A720, one to Pye for their "Leadsman" echo sounder, and one to Fonadek for their telephone amplifier. The medals were presented at a conference of the Dollar Exports Council by the Minister of Economic Affairs at the U.S. Embassy.

Sea-going trials of Gee (the Cossor hyperbolic navigational aid) have shown that sea-level ranges up to 200 nautical miles from coast chains can be relied upon. This was accomplished using the South Western chain which operates on a frequency around 25 Mc/s. The long range is attributed to tropospheric propagation.

Ferranti-Ekco Link.—Domestic radio and television receivers with the Ferranti trade mark will, in future, be marketed by a new company being formed by E. K. Cole, Ltd.

The scope of this year's Radio Society of Great Britain exhibition is to be widened considerably and the title changed to **Radio Hobbies Exhibition**. It will be held in October at Seymour Hall, Seymour Place, London, W.1, and is again being organized by P. A. Thorogood (G4KD), who is chairman of the London u.h.f. group.



JUBILEE of the invention of the triode valve by Dr. Lee de Forest is commemorated on this franking on a recent letter from the United States.

American Facts and Figures.—Dr. W. R. G. Baker, head of the General Electric Company's Electronics Park, at Syracuse, N.Y., in a review of the progress of the electronics industry, stated that one out of every forty jobs in the United States is in electronics, and that 75% of these did not exist ten years ago. Moreover, whereas the electrical industry in the States approximately doubles every ten years, the electronics industry is doubling every five or six years. Dr. Baker forecast that the use of semi-conductor equipment will increase 100% in the U.S.A. during 1957. Incidentally, during the past ten months the price of G.E. transistors has been reduced 35%.

"W.E." Editorials.—For nearly 30 years Professor G. W. O. Howe contributed editorials to our sister journal *Wireless Engineer* (now *Electronic & Radio Engineer*). An index to these contributions, including chronological, author and subject indexes, was compiled by Dr. A. J. Small, of the Department of Electrical Engineering at Glasgow University, some two years ago. An addendum bringing it up to date has now been prepared, and this, together with the original index (covering the period January, 1926, to March, 1955, the last of his regular editorials) is obtainable from Dr. Small, price 5s.

The Radio Trades Examination Board has issued a reminder that the closing dates for entries for this year's **Servicing Certificate Examinations** are January 15th for television and February 1st for sound receivers. Forms and regulations for the examinations, which will be held in May, are obtainable from the R.T.E.B., 9, Bedford Square, London, W.C.1.

Danish TV.—The information regarding Denmark included in the E.B.U. television map on page 605 of the December issue was incomplete. Three transmitters have been in use for the past eight months—Copenhagen (5 kW), Fyn, near Odense (5 kW) and Aarhus (2.5 kW).

"Audio-Frequency Response Measurements."—The equipment described under this heading in our December, 1956, issue was developed by the staff of Grundig (Great Britain), Ltd., in the company's laboratories.

Two nine-week courses on digital computers and on colour television will be held at the **Southall Technical College**, Middlesex, on Wednesday evenings, beginning January 16th. An eight-week course on experimental servomechanisms will also be held on Wednesday evenings, beginning February 6th. The fee for each course is £1.

A radio and television **maintenance and servicing** course will again be held during the spring term at the Wesley Institute, Wesley Road, London, N.W.10, on Monday evenings, beginning January 7th. (Fee £1.)

Transistors.—An evening course of eight lectures on transistor physics and transistor applications commences on Thursday, February 7th, at the South-East London Technical College, Lewisham Way, London, S.E.4. (Fee £1.)

Eight lectures covering the theory and practice of **electronic instruments** used in chemical analysis will be given at Battersea Polytechnic, Battersea Park Road, London, S.W.11, on successive Wednesday evenings commencing February 6th. (Fee £1.)

Most of the courses set out above deal with the technology of electronic communication. But, before information can be communicated, whatever the means, it must be clothed in words. To find the best words for the job becomes more and more difficult as the complexity of life increases. Managements of firms are realizing to an increasing extent that clear **presentation of information**, technical and otherwise, by their employees is important. Courses of instruction in various aspects of this subject are offered by Osmond Turner Mead Associates, of 3, Gower Street, London, W.C.1. A booklet describing the courses is issued.

BUSINESS NOTES

Vision and sound transmitters for the I.T.A. South Wales station are to be supplied by **Pye**. The equipment will be similar to that installed at Lichfield—20-kW vision transmitter and 5-kW sound transmitter with 5- and 1.25-kW standby equipment.

In the annual report of the **Solartron** group of companies it is recorded that sales increased from £152,300 in 1954 to £758,000 during the year ended last June. During the same period the staff has grown from 240 to 550, the average age being 33. A joint company (Industrial Automation Developments, Ltd.) has been formed by the Solartron Electronic Group, Ltd., and Scribbans-Kemp, Ltd., for research and development of automation in the food processing industries.

With the installation of **Pye** industrial television equipment at the airways terminal at Victoria, London, the announcer is both seen and heard. **Pye** industrial television equipment has also been installed by a firm of stockbrokers at the London Stock Exchange. It conveys by line to the company's offices a quarter of a mile away details of the constantly changing stocks and shares listed on the "board."

Within a few weeks of its announcement **Decca** true motion radar (TM 46) had been ordered for over one hundred vessels. Orders for all types of Decca marine radar now total more than six thousand—an increase of one thousand in about eight months.

A tour of U.K. ports is being undertaken by a demonstration caravan equipped with **Kelvin Hughes** marine gear, including the new Type 14 radar which has a slotted waveguide aerial. In January and February demonstrations will be given mainly in Northern Irish, Scottish and Welsh ports.

An order for the supply of fifty 10-watt f.m. mobile transmitter-receivers has been placed with **Marconi's** by the Metropolitan Police. Up to seven crystal-controlled channels are available within a 0.5 Mc/s section of the 70 to 100-Mc/s band.

A further fifty lifeboats of the Royal National Lifeboat Institution, making one hundred in all, are to be equipped with v.h.f. radio-telephone equipment by **British Communications Corporation, Ltd.**

The sales and service division of **F. C. Robinson and Partners**, at 122, Seymour Grove, Old Trafford, Manchester, 16 (Tel.: Chorlton 5366), will in future operate under the title of **McKellen Automation, Ltd.** The change does not affect the manufacturing operations at Cheadle of F. C. Robinson and Partners, of which F. P. McKellen (managing director of McKellen Automation) has been general manager for some years.

The sole manufacturing rights in Great Britain for the Bradford loudspeaker enclosure (of American origin) have been secured by **John Lionnet & Company** who have recently moved from the City to the West End. Their new address is 17, Charing Cross Road, London, W.C.2. (Tel.: Trafalgar 5575.)

An American patent (No. 254567), in addition to British patent No. 689695, has been granted to **Lustraphone** for their noise-cancelling microphone (Type VC52).

Two members of **Mullard Overseas, Ltd.**, have joined **Mullard South Africa (Pty.), Ltd.** They are T. W. Hogg, a commercial executive of the radio division, and R. E. Collins, of the electronic tube division, who is to organize a technical service department.

A kit of relay parts comprising seven coils (500 ohms to 20 K ohms) and a variety of contact banks has been produced by **Stevenage Relays, Ltd.**, associates of W. H. Sanders (Electronics), Ltd.

A large-screen television receiver without loudspeaker but with headphones for individual patients has been installed by **Hadley Telephone & Sound Systems, Ltd.**, at the Royal Orthopaedic Hospital, Birmingham.

Lithgow Electronics, Ltd., sole representatives in the U.K. and Eire for the products of the Hewlett-Packard Company, of Palo Alto, California, have moved from Harrow to 198/200, Bath Road, Slough. (Tel.: Slough 21292). At their new office facilities are provided for demonstrating such H.P. equipment as electronic counters, signal generators, and oscilloscopes.

With the opening of **Mullard's** new headquarters at Mullard House, Torrington Place, London, W.C.1 (Tel.: Langham 6633), the various departments of the organization which have been in a number of separate buildings will be under one roof.

OVERSEAS TRADE

Equipment for the provision of direct **radio-telephone links** between the islands of San Miguel and Terceira, and between Terceira and Faial, in the Azores group, is to be supplied by **Marconi's**. Initially the links will carry seven speech channels and six voice-frequency telegraph channels.

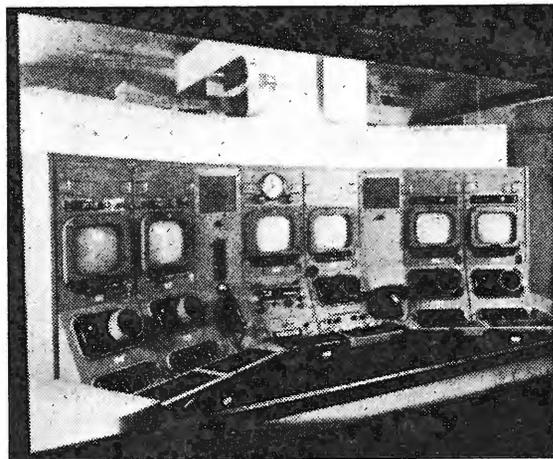
Electronic control equipment is being supplied by E.M.I. Electronics, Ltd., for an automatic conveyor system being installed by Geo. W. King, Ltd., of Stevenage, Herts., in the body-painting plant of a new Simca car factory at Poissy, France.

Solartron Incorporated has been formed to distribute and sell in the United States **electronic equipment** produced by the Solartron group in this country.

European Office.—Plessey International, Ltd., have opened an office at Singel 160, Amsterdam C, for the supervision of Plessey's interests in northern and central Europe.

This year's **International Liege Fair**, Belgium, will be held from April 27th to May 12th. Details of space available in the electronic section are obtainable from the U.K. representative, R. C. Liebman, 178, Fleet Street, London, E.C.4.

In order to overcome the delay caused by the recent New York dock strike Birmingham Sound Reproducers, Ltd., chartered planes to carry regular deliveries of **record changers** to the United States. American receiver manufacturers, who purchase \$100,000 worth of B.S.R. equipment a week, volunteered to help defray the extra cost involved.



EASE OF CONTROL is the keynote of the whole installation at the two television studios at Riverside, Hammersmith, recently brought into use by the B.B.C. This is especially true of the lighting which is remotely controlled from positions adjacent to the sound, vision and production control rooms. Facilities for electronic effects, such as inlay and overlay, are also provided. Marconi camera control equipment is shown here.

Limiters and Discriminators

I—Wide or Narrow Bandwidth : Basic Equivalent Circuits :

By G. G. JOHNSTONE, BSc.*

The Round-Travis Discriminator

WE shall begin by considering the bandwidth required in a discriminator, more especially in view of the arguments put forward by Prof. Arguimbau and his colleagues in favour of wide-band discriminators.

If two f.m. signals interfere, they may be on the same carrier frequency (i.e., co-channel) or on nearby carrier frequencies (i.e., adjacent channel). Briefly Arguimbau maintains that in the presence of co-channel or adjacent-channel interference, the interfering signal will produce unwanted audio output even when the difference between the frequencies of wanted and unwanted signals is above the audible limit. The two signals add together to produce a composite signal which varies in amplitude and frequency according to the relative magnitudes and frequencies of the two signals. This is

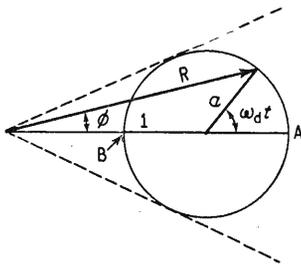


Fig. 1. Vector diagram of wanted signal (1) and interfering signal (a) with a small frequency difference.

shown in the vector diagram of Fig. 1, where the ratio of the amplitude of the unwanted signal to that of the wanted signal is $a : 1$. The wanted-signal vector is assumed stationary and the unwanted-signal vector rotates at a relative angular frequency ω_d , which corresponds to the difference f_d between the frequencies of the two signals.

The magnitude of the resultant, R , varies between $(1 + a)$ and $(1 - a)$; this amplitude modulation can be removed by limiting and need not concern us further. The phase displacement (ϕ) of the resultant swings between the limits indicated by the dotted lines in Fig. 1. The phase displacement can be calculated and, since the instantaneous frequency shift is equal to $1/2\pi$ times the rate of change of phase angle, i.e., $f = \omega/2\pi$ and $\omega = d\phi/dt$ we can determine the frequency shift at any instant. The calculation is straightforward, but rather long, and it is sufficient for our purpose to note that the interfering frequency-modulated signal has the form shown in Fig. 2. The peaks at α occur when the vectors are in line as at A in Fig. 1; the peaks at β occur when the vectors have the position B in Fig. 1. The peak value of the frequency shift at α is given by $af_d/(1 + a)$ and at β by $af_d/(1 - a)$. Thus as the ratio of unwanted signal amplitude approaches that of the wanted signal a approaches 1

and the peak shift β becomes very large. The positive-going and negative-going excursions of the waveform of Fig. 2 have a different form but the areas included between the curves and the horizontal axis are equal, the mean resultant frequency shift is zero and there is no d.c. component in the output of the discriminator, provided that the discriminator is linear over the range of frequency excursion.

The period of the wave of Fig. 2 is $1/f_d$ and, if the frequencies of the two signals differ by more than the highest audio frequency, there will be no audible output under the steady state conditions postulated. If the frequency difference is less than the highest audible frequency, there is a heterodyne whistle; this is true whether the discriminator is "wide-band" or not.

To carry the argument further, suppose the difference between the frequencies of the two signals exceeds the highest audible frequency and the discriminator is narrow band. As the unwanted-signal amplitude approaches that of the wanted signal the ratio a tends to unity and the peak frequency shifts become progressively larger, tending to a limit of $f_d/2$ in one direction and infinity in the other. We shall concentrate on the peak at β because this is always greater than that at α . For an idealized narrow-band discriminator characteristic of the type shown in Fig. 3, the peaks at β are "clipped" as shown in Fig. 4. The areas under the positive-

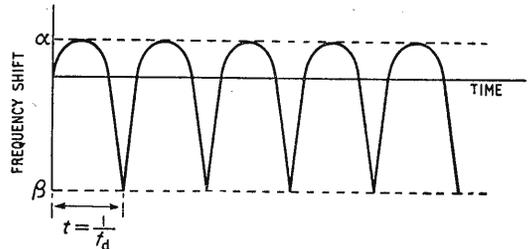


Fig. 2. Form of frequency modulation produced as a result of the conditions shown in Fig. 1.

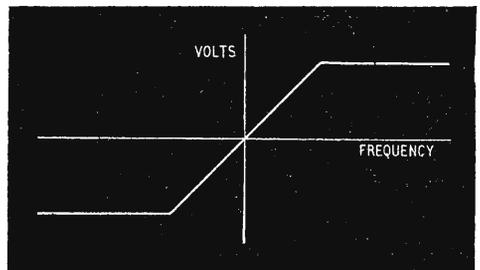


Fig. 3. Idealized narrow-band discriminator characteristic.

* B.B.C. Engineering Training Department.

for F.M. Receivers

A GREAT deal has been written about the performance of various types of limiter and discriminator for use in f.m. receivers, but much of this information is contradictory and the choice of a limiter and discriminator for a particular application may appear difficult, particularly to the newcomer to the subject. It is the purpose of this and subsequent articles to discuss the performance of the basic types of limiter and discriminator in an attempt to clarify the subject.

The discriminators to be discussed fall into six classes: (1) the Round-Travis (2) the Foster-Seeley discriminator (3) the ratio detector (4) the locked oscillator (5) the phase-difference comparator and (6) the counter. Types (3) (4) and (5) have a degree of inherent limiting action.

The types of limiter to be discussed comprise (1) the grid limiter (2) the anode limiter (3) the dynamic limiter and (4) the "clipper."

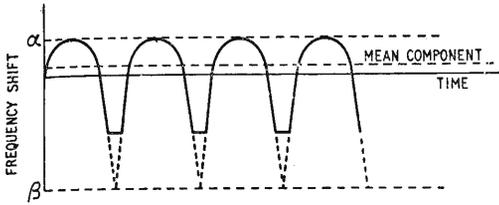


Fig. 4. Clipping of the frequency peaks by the characteristic of Fig. 3 results in a displacement of the average frequency.

going and negative-going portions of the waves are now no longer equal. There is a shift in the average frequency and a d.c. component in the output from the discriminator; it is shown in dotted lines in Fig. 4. If now the unwanted signal is modulated, its frequency swings about the mean value and the difference between the frequencies of the two signals alters correspondingly. The waveform of Fig. 2 now becomes that shown in Fig. 5(a); for comparison the graph of the frequency difference is shown at Fig. 5(b). If now the waveform of Fig. 5(a) is "clipped" as indicated by the dotted line, the d.c. component has superimposed "blips" as shown in Fig. 5(c). These have the same repetition rate as the modulating signal, and have components at multiples of the modulating-signal frequency. This represents cross-modulation between the two received signals accompanied by distortion. With a "wide-band" discriminator there is no clipping and this effect does not occur.

We may summarize the conclusions of the previous paragraphs as follows. In receiving co-channel signals some interference is inevitable because the difference between the frequencies of the two signals must, for part of the time, lie within the audio frequency range; this effect occurs whatever type of discriminator is employed. The peak heterodyne output is given by $af_d(1-a)$ which decreases rapidly as a falls below unity and the stronger signal rapidly "swamps" the weaker as the ratio of the amplitudes of the signals a departs from unity; this is, of course, the well-known "capture" effect.

For signals on adjacent channels the difference between the frequencies of two carriers is always greater than the highest audible frequency; there is no cross-modulation if a wide-band discriminator is employed. This is illustrated in Fig. 6 which

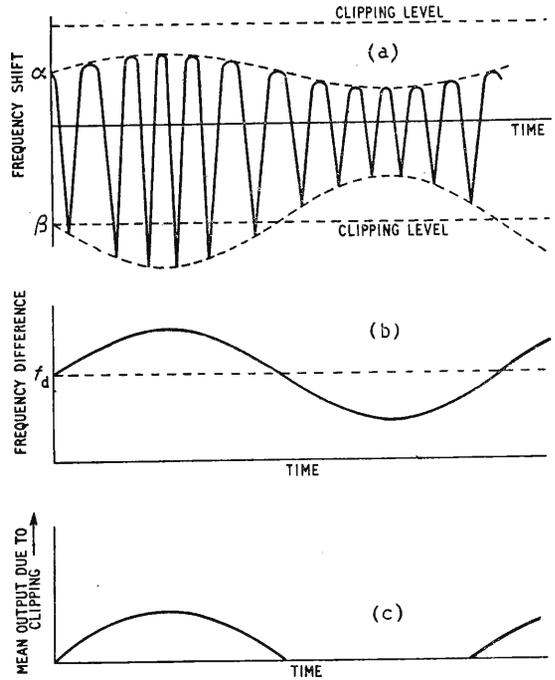


Fig. 5. (a) Waveform when the unwanted signal is modulated by a sine wave. The frequency difference is shown in (b), and the distortion product due to clipping is shown at (c).

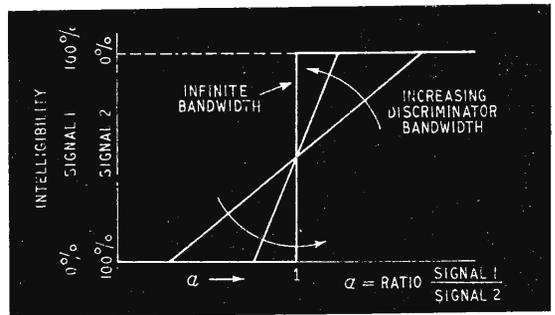


Fig. 6. Interference between signals on adjacent channels as a function of discriminator bandwidth.

shows that for an infinite bandwidth only the stronger signal is received even if its amplitude is only slightly greater than that of the other; but as the bandwidth is made smaller, the ratio of signal strengths for which interference is experienced becomes greater.

The behaviour of a discriminator toward ignition interference can be deduced by similar arguments.

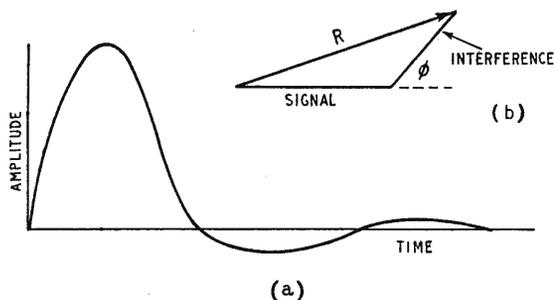


Fig. 7. (a) Waveform of i.f. output due to a pulse of interference and (b) vector relationship of signal and interference.

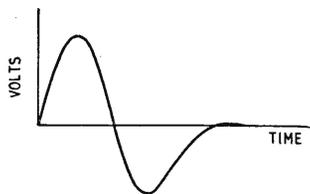


Fig. 8. Frequency shift (and hence discriminator output) due to interference of the form of Fig. 7(a).

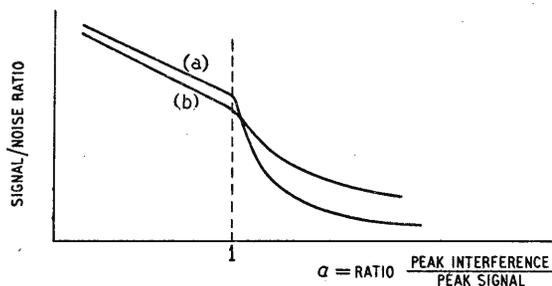


Fig. 9. Signal/noise ratio with impulsive interference for (a) wide-band and (b) narrow-band discriminators.

Fig. 10. Unidirectional double pulse produced in the discriminator output in some cases when the interfering pulse amplitude exceeds that of the carrier.

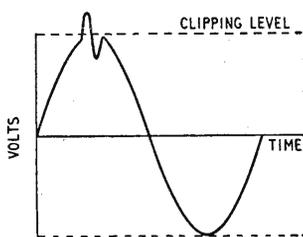
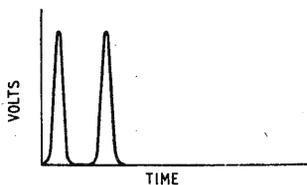


Fig. 11. When the interference pulse coincides with a peak of modulation, clipping may remove part of the pulse and increase noise.

The waveform of a pulse of interference is modified in the i.f. amplifier to a shape similar to that shown in Fig. 7(a). The shape of this pulse varies little with the source of the interference, but depends almost entirely upon the characteristics of the i.f. amplifier itself. The duration of the pulse is very short, approximately 7 microseconds for an i.f. bandwidth of 200 kc/s. The figure shows the envelope, which modulates a "carrier" at the centre frequency of the i.f. amplifier, which we shall assume equal to the signal carrier frequency. The signal carrier and interference carriers may have any phase angle with respect to each other, because the exact moment of incidence of the interference pulse is fortuitous. Thus the signal and interference carriers add as shown in Fig. 7(b); the phase angle between the carrier vectors ϕ has been arbitrarily selected. The interference signal vector grows and decays as shown in Fig. 7(a). Consequently, if the ratio of peak interference envelope to the peak carrier is small, the phase angle of the resultant follows a wave similar in shape to that shown in Fig. 7(a). The rate of change of phase angle, and hence the frequency shift then follow a curve of the type shown in Fig. 8. When the number of tuned circuits preceding the limiter exceeds four, the maximum value of the frequency shift due to the interfering signal is given approximately by $4aF$ where a is the ratio of the peak value of the interfering signal to that of the carrier, and F is the bandwidth measured between 3-dB points. The audible noise output is proportional to the net area under the frequency-shift envelope, and hence to a . However, the area under the positive-going excursion is nearly equal to that under the negative-going excursion and the net area is small. The spectrum of this output rises linearly with frequency, and the output has the sound of a "click." If a succession of constant-amplitude impulses are presented to the receiver, the magnitude of the output pulses varies with the relative phase angle between the carrier and the interfering signal at the occurrence of each impulse. If the amplitude of the interfering signal is less than that of the carrier, a is less than unity and the signal-to-noise ratio falls linearly with a , as shown in curve (a) of Fig. 9. If the amplitude of the interfering signal exceeds that of the carrier, a is greater than unity and a new mechanism comes into play by which some of the output-signals have the form of sharp spikes, each pulse of ignition interference producing two spikes of the same polarity; as shown in Fig. 10. The net area beneath the curve is now no longer small. The spectrum of this waveform is level over the a.f. band and the output has the sound of a "pop." For such high-amplitude interfering signals, as the amplitude of the interfering signal is increased the signal-to-noise ratio falls abruptly and then levels off as shown in curve (a) of Fig. 9.

Consider the effect of reducing the discriminator bandwidth on impulsive interference of this type. If a is less than unity, and the signal is at one extreme of its frequency swing, one of the peaks due to impulsive interference in the discriminator output signal may be clipped as shown in Fig. 11. The net area increases and the signal-to-noise ratio is poorer than for a wide-band discriminator as shown in Fig. 9 curve (b). On the other hand, in the region where a is greater than unity, a reduction in discriminator bandwidth causes the amplitude of the

spikes (Fig. 10) to be reduced and the signal-to-noise ratio is better than for a wide-band discriminator. Thus for impulsive interference a narrow-band discriminator is an advantage because the worsening of the signal-to-noise ratio in the region where this ratio is good in exchange for an improvement in the area where it is bad is in general desirable. Thus we may summarize the conclusions so far reached as follows:

(1) If the principal source of interference is co-channel and adjacent channel, a wide-band discriminator is best.

(2) If the principal source of interference is of the impulsive type, a narrow-band discriminator is best.

In this country co-channel and adjacent channel interference would not appear to present a serious problem, and hence ignition interference may be the principal type of interference to be overcome. In U.S.A., however, ignition interference is probably less troublesome than co-channel and adjacent-channel interference. Thus it would appear that British and American practice in discriminator bandwidth may tend to diverge, with a tendency in Britain to use narrow bandwidth discriminators.

We shall now consider the performance of discriminators in detail and in the subsequent discussion we shall make extensive use of one or other of two equivalent circuit diagrams for the phase-difference discriminator transformer, Fig. 12(a), used in the Foster-Seeley discriminator and the ratio detector. These equivalent diagrams are shown in Figs. 12 (b) and (c), and their derivation is given in the Appendix. Depending on the constants of the original circuit only one of the two equivalents is physically realizable. The equivalent circuit for one special case reduces to two tuned circuits fed with equal currents, and resonant at frequencies equally displaced from the centre frequency of the transformer from which they are derived. Thus the Foster-Seeley and Round-Travis circuits shown in Fig. 13 have identical performances. This circuit transformation simplifies the analysis of the Foster-Seeley discriminator and the ratio detector and we shall analyse the performance of the Round-Travis circuit in detail in order to extend the results to the Foster-Seeley and ratio detector circuits.

Round-Travis Circuit. In this discriminator two

Fig. 12. The basic phase-difference discriminator transformer (a) may be represented by either of the equivalent circuits (b) or (c).

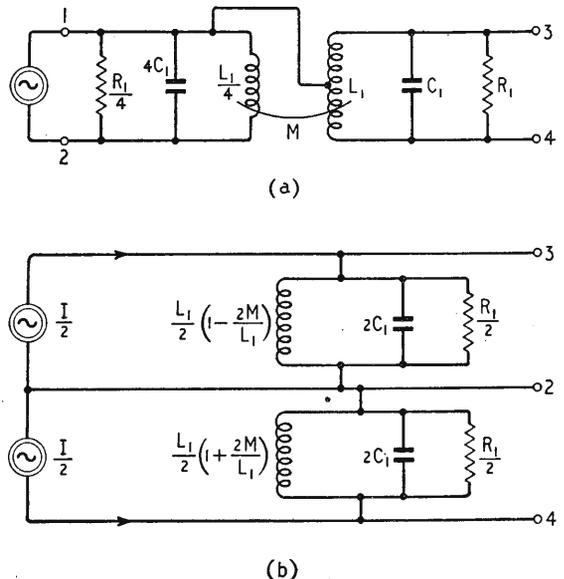
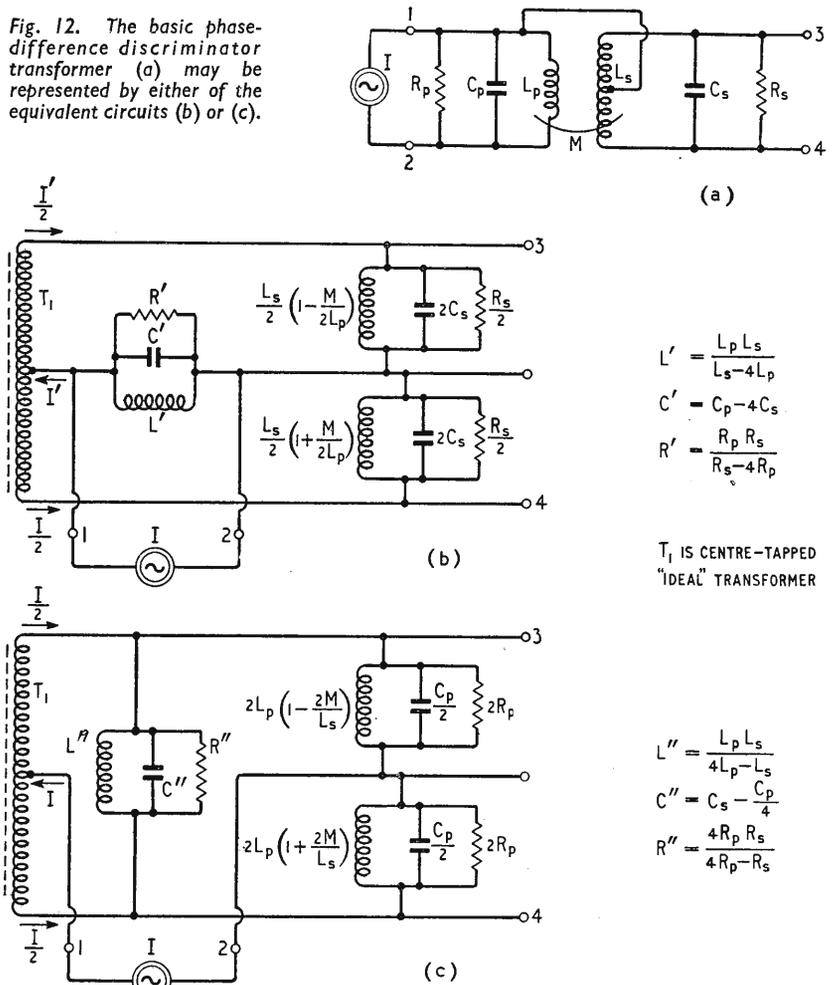


Fig. 13. Identical performances are given by these forms of (a) the Foster-Seeley and (b) the Round-Travis circuits

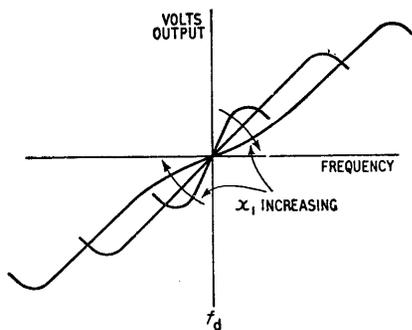


Fig. 14. Dependence of shape of discriminator characteristic on the value of x_1 .

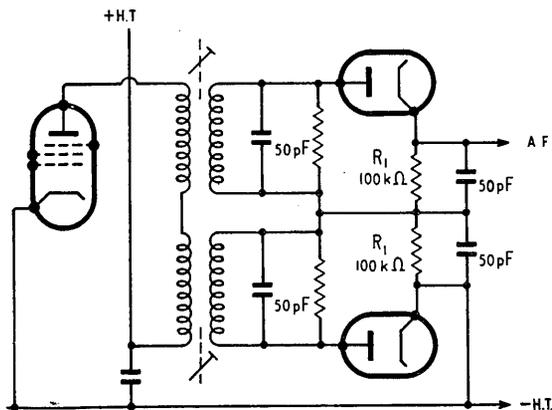


Fig. 15. Basic practical Round-Travis circuit.

tuned circuits are employed, one tuned to a frequency slightly above the centre frequency and the other tuned to a frequency an equal interval below the centre frequency. This circuit has appeared in a wide variety of forms, the variations being principally in the method of applying the signals to the two circuits. We shall consider the circuit in its general form, where the driving stage is represented by a constant current generator, as shown in Fig. 13.

We can write the response of a tuned circuit, comprising L , C , and R in parallel as

$$\frac{1}{Z} = \frac{1}{R} + \frac{1}{j\omega L} + j\omega C$$

In the frequency range near resonance (ω_0) we can write ω as $(\omega_0 + d\omega)$, where $d\omega$ is small compared with ω_0 . Using this substitution we can make the approximation that

$$\begin{aligned} \frac{1}{Z} &= \frac{1}{R} + 2jd\omega C = \frac{1}{R} + 2j \frac{d\omega}{\omega_0} \cdot \frac{1}{\omega_0 L} \\ &= \left(1 + \frac{2jd\omega}{\omega_0} \cdot \frac{R}{\omega_0 L}\right) \frac{1}{R} \end{aligned}$$

If we let $x = 2Qd\omega/\omega_0$, where Q is $R/\omega_0 L$, then

$$Z = R/(1 + jx)$$

in which x is a variable directly proportional to the frequency shift.

If one tuned circuit is tuned above the centre frequency and displaced by an amount $x = x_1$ and the other is tuned below and displaced by an amount $x = -x_1$ we can represent the impedance of the two circuits at any frequency in the neighbourhood of the

centre frequency by $Z_1 = R/[1 + j(x - x_1)]$ and $Z_2 = R/[1 - j(x + x_1)]$ respectively.

The two diodes rectify the voltages developed across each tuned circuit independently, as shown in Fig. 15, and for 100% rectification efficiency, the output voltage is equal to the difference between the peak values of the voltage developed across each tuned circuit. If I is the peak value of the input current the output voltage is given by

$$E = IR\{[1 + (x - x_1)^2]^{-1/2} - [1 + (x + x_1)^2]^{-1/2}\}$$

A family of curves for various values of x_1 , is shown in Fig. 14. These are the output-voltage frequency-shift curves for the discriminator, and ideally should have a linear region about the centre frequency. As shown in Fig. 14, for small values of x_1 the characteristic has continuous curvature and small peak separation. Larger values of x_1 give better linearity and greater peak separation, but above a critical value of x_1 the characteristic develops a kink near the centre frequency. Thus there would appear to be an optimum value of x_1 .

The expression for E given above can be expanded as a series in ascending powers of x . The expansion is symmetrical about $x = 0$, and contains odd powers of x only. We can thus write

$$E = a_1x + a_3x^3 + a_5x^5 \dots$$

The first term represents the required output, i.e., an output varying linearly with frequency shift. The other terms indicate non-linearity, producing harmonic distortion and intermodulation in the output. This distortion can be minimized by making a_3/a_1 , a_5/a_1 , etc., as small as possible.

The evaluation of a_1 , a_3 , a_5 in terms of x_1 is straightforward but tedious. The values of the first three coefficients are:

$$\begin{aligned} a_1 &= 2x_1(1 + x_1^2)^{-3/2} \\ a_3 &= x_1(2x_1^2 - 3)(1 + x_1^2)^{-5/2} \\ a_5 &= \frac{1}{8}x_1(8x_1^4 - 40x_1^2 + 15)(1 + x_1^2)^{-7/2} \end{aligned}$$

From these expressions we have

$$a_3/a_1 = \frac{1}{2}(2x_1^2 - 3)(1 + x_1^2)$$

and

$$a_5/a_1 = \frac{1}{8}(8x_1^4 - 40x_1^2 + 15)/(1 + x_1^2)^2$$

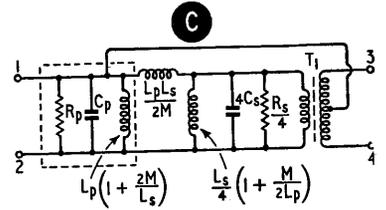
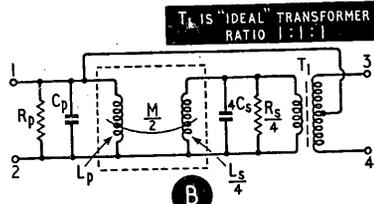
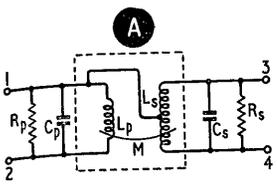
To minimize distortion, we can choose the value of

APPENDIX

THE derivation of the equivalent circuit for a phase difference discriminator transformer, Fig. A on the opposite page, is obtained by the successive manipulation of the portions enclosed by dotted lines. In Fig. B the secondary circuit comprising L_s , C_s , R_s is transferred to the primary side of the "ideal" transformer T1; this transformer has a centre-tapped secondary, providing the two voltages of opposite polarity in series with the primary voltage. In Fig. C, the "T" network is converted to "π" form. In Fig. D1 the terminations of the "π" network are made equal. If the terminations are made equal to the secondary components, the sequence follows through Figs. D1 to H1, and if to the primary components through Figs. D2 to H2.

In Fig. E, the "π" network is translated to a lattice by means of Bartlett's Bisection Theorem. Figs. F show Figs. E re-drawn. Figs. G show Figs. F re-arranged by the introduction of transformer T2, also of 1:1 ratio. Figs. H are Figs. G with transformers T1 and T2 combined into transformer T3. Figs. J show Figs. H re-drawn.

The derivation of these equivalent circuits is an extension of the treatment due to H. Marko (*Frequenz*, January, 1952).



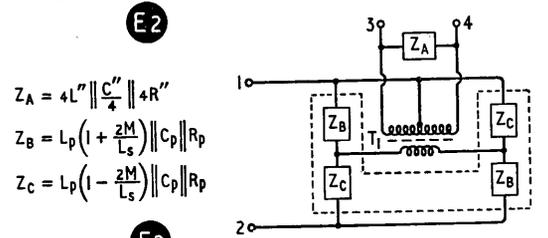
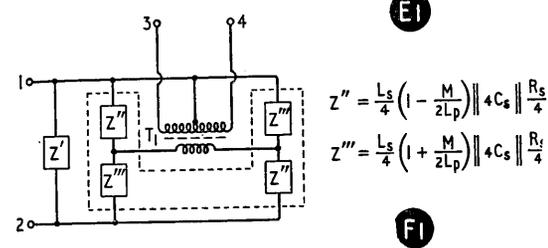
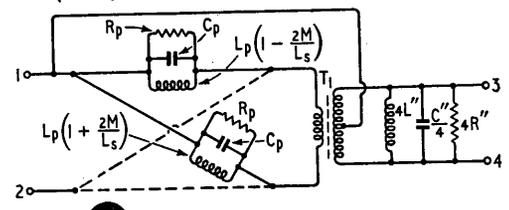
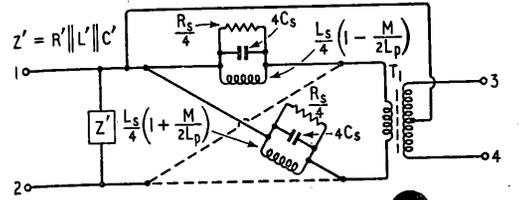
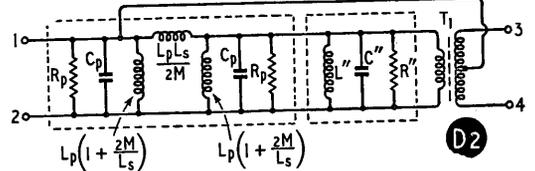
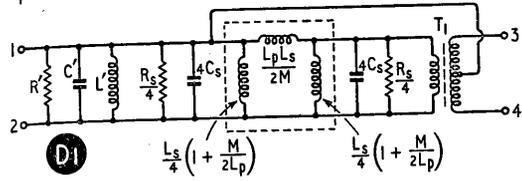
MEANS "IN PARALLEL WITH"

$$R' \parallel \frac{R_s}{4} = R_p \quad L' \parallel \frac{L_s}{4} \left(1 + \frac{M}{2L_p}\right) = L_p \left(1 + \frac{2M}{L_s}\right)$$

$$C' + 4C_s = C_p \quad \text{THIS IS THE SAME AS } L' \parallel \frac{L_s}{4} = L_p$$

$$R'' \parallel R_p = \frac{R_s}{4} \quad L'' \parallel L_p \left(1 + \frac{2M}{L_s}\right) = \frac{L_s}{4} \left(1 + \frac{M}{2L_p}\right)$$

$$C'' + C_p = 4C_s \quad \text{THIS IS THE SAME AS } L'' \parallel L_p = \frac{L_s}{4}$$



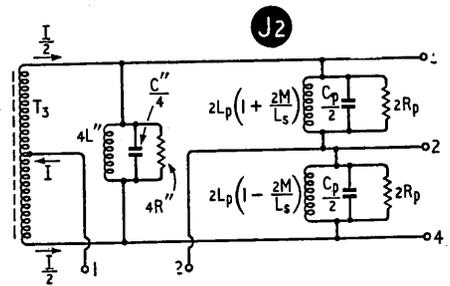
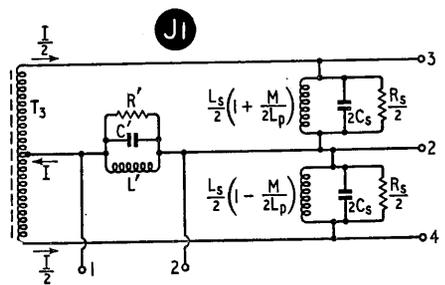
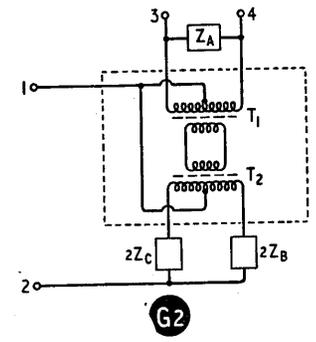
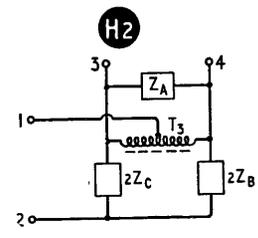
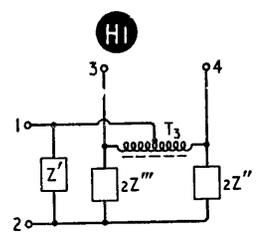
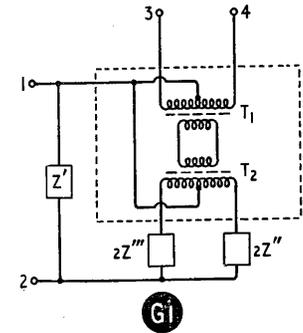
$$Z'' = \frac{L_s}{4} \left(1 - \frac{M}{2L_p}\right) \parallel 4C_s \parallel \frac{R_s}{4}$$

$$Z''' = \frac{L_s}{4} \left(1 + \frac{M}{2L_p}\right) \parallel 4C_s \parallel \frac{R_s}{4}$$

$$Z_A = 4L'' \parallel \frac{C''}{4} \parallel 4R''$$

$$Z_B = L_p \left(1 + \frac{2M}{L_s}\right) \parallel C_p \parallel R_p$$

$$Z_C = L_p \left(1 - \frac{2M}{L_s}\right) \parallel C_p \parallel R_p$$



x_1 which makes one of these ratios zero; it is usual to make $a_3 = 0$, because this is the dominant distortion-producing term for values of x less than unity. This gives $x_1 = \sqrt{1.5}$, and the expression for output voltage becomes

$$E = IR(0.62x - 0.055x^5 \dots)$$

For this value of x_1 , the useful extent of the characteristic is limited to values of x of less than unity. This is illustrated in the calculation below where it is shown that the distortion rises steeply for greater values of x .

To evaluate the distortion likely to be obtained with this circuit arrangement, we shall consider an input signal frequency-modulated by a signal of frequency f_a to a maximum swing of f_s kc/s on each side of the centre frequency. The value of x corresponding to f_s is represented by x_s and is given by $x_s = 2Qf_s/f_0$. Substituting the value $x_s \cos \omega_a t$ for x in the expression above gives

$$E = IR(0.62x_s \cos \omega_a t - 0.055x_s^5 \omega_a t \dots)$$

We can expand $\cos^5 \omega_a t$ by means of the identity $\cos^5 \theta = \frac{1}{16}(\cos^5 \theta + 5 \cos^3 \theta + 10 \cos \theta)$ which gives

$$\begin{aligned} E &= IR[0.62x_s \cos \omega_a t - 0.0034x_s^5 (\cos^5 \omega_a t + 5 \cos 3 \omega_a t + 10 \cos \omega_a t)] \\ &= IR [(0.62x_s - 0.034x_s^5) \cos \omega_a t - 0.017x_s^5 \cos 3 \omega_a t - 0.0034x_s^5 \cos^5 \omega_a t] \end{aligned}$$

The amplitude of the fundamental-frequency component is less for an ideal characteristic but the reduction is small and will be ignored, the values of x_s being limited to approximately unity. The percentage of third-harmonic distortion is then given by

$$\frac{0.017 \times 100}{0.62} x_s^4, \text{ and the percentage of fifth harmonic is one-fifth of this figure. For } x_s = 1, \text{ there is 2.7 per cent third-harmonic and 0.54 per cent fifth-harmonic distortion. The magnitude of the harmonic distortion is proportional to } x_s^4, \text{ and thus falls rapidly if a lower value of } x_s \text{ is considered. Thus reduced distortion can be obtained by using a lower value of } x_s, \text{ but this in turn means a smaller output at the fundamental frequency.}$$

With a broadcast signal, the frequency deviation is fixed at 75 kc/s. If it is desired to operate the discriminator with 75 kc/s corresponding to $x_s = 1$, the parameters of the circuit are determined by the relationship $x = 2Q df/f_0$. With $df = 75$ kc/s at $x = 1$, and a centre frequency (f_0) of 10.7 Mc/s, the value of Q is 71. The resonant frequencies of the two tuned circuits are given by $10.7(1 \pm \sqrt{1.5/142})$ Mc/s, i.e., 10.7 Mc/s ± 92 kc/s. Such a discriminator would have very little margin to allow for oscillator-frequency drift and mis-tuning and a value $x_s = 1$ corresponding to 100 kc/s would be better. The circuit parameters are then $Q = 53$ with the resonant peaks at 10.7 Mc/s ± 123 kc/s. For such a discriminator at 75 kc/s deviation the third harmonic distortion is 0.84 per cent and the fifth harmonic 0.17 per cent. If we assume that the two tuned circuits each employ a capacitor of 50 pF, the dynamic resistance, $R = Q/\omega C$ of the circuits is approximately $53 \times 300 = 16$ k Ω . The input current, I , is the peak value of the fundamental-frequency component in the output of the preceding limiter stage; a typical value is 1 mA. The peak audio output is given by $0.62 IR x_s$ and in the example chosen, x_s for 75 kc/s deviation is 0.75, giving a peak audio output of approximately 7.5 volts. The inductance

required to resonate at 10.7 Mc/s with 50 pF is 4.45 μ H; final adjustment of the resonant frequencies of the two circuits is made by means of dust-iron cores in the inductor formers. To secure the correct value of Q , the usual procedure is to design the coils for a higher value of Q than required and add damping resistors. The diode detectors provide part of this damping equivalent approximately to $R_1/2$, where R_1 is the value of each diode load resistor. The basic practical circuit is shown in Fig. 15; coupling windings to the two inductors are employed to isolate the tuned circuits from the h.t. supply. In practice, additional precautions are necessary to eliminate the effect of the primary circuit capacitance.

The Round-Travis circuit offers no real protection against amplitude modulation. The audio output is proportional to Ix , where I is the input current, and x is a measure of the frequency shift. If there is amplitude modulation the magnitude of I varies, but if $x = 0$, i.e., if the signal is at the centre frequency there is no output due to a.m. For any other value of x , i.e., if the signal is mistuned or frequency-modulated, there is an output due to the amplitude modulation. Because the output is proportional to Ix the a.m. and f.m. signals are multiplied together and there is complete cross modulation. Thus a circuit of this type must be preceded by a limiter stage.

(To be continued.)

References

- "Frequency Modulation," L. B. Arguimbau and R. D. Stuart (Methuen).
- "Les Parasites Artificiels dans les Systèmes de Modulation par Variation de l'Amplitude (ma) par Variation de la Fréquence." R. D. A. Maurice, *L'Onde Électrique*, March 1954.
- "Frequency Modulation Engineering." C. E. Tibbs and G. G. Johnstone (Chapman and Hall).
- "F.M. Distortion." M. S. Corrington, *RCA Review*, December 1946.

Residual Magnetism in Recording Heads

MOST tape recorders incorporate a long-time-constant smoothing circuit in the h.t. supply to the bias oscillator to ensure that the h.f. current in the record/replay head dies away slowly when the instrument is switched off. This is necessary because any "d.c." component of remanent magnetism in the head is known to cause an increase in background noise from the tape.

Unfortunately, the amplitude of h.f. bias for best results from the point of view of either low distortion or high recording level is much less than is necessary to drive the core to a state of magnetic saturation, so that if by any mischance the magnetic state is carried beyond the maximum represented by the bias the head will not be automatically demagnetized.

Fortunately, the head can easily be demagnetized by bringing up a strong (saturating) external alternating field and then removing it slowly. This field can conveniently be provided by a small 50-c/s transformer with an air gap arranged to coincide with the gap in the recording head, but it is not too easy to devise suitable means with conventional components, due to the smallness and inaccessibility of most recording heads.

Wright and Weaire have recently developed a "defluxer" for this purpose in which projecting poles are arranged to give easy contact with the face of the record/playback head. The transformer is housed in a cylindrical case which falls conveniently to hand, and a press-button switch is provided for operation.

The "de-fluxer," which can also be used for selective erasure when editing tape records, costs £2 10s.

Portable Transistor Superhet

Home, Light and Third

With Currently Available Junction Types

By W. WOODS-HILL*

WHEN it was discovered that Standard Telephones & Cables were in quantity production of a 500-kc/s junction transistor, it occurred to the author that if one of these could be made to oscillate up to 750 kc/s, then a medium- and long-wave superhet could be designed along the lines of the American "cigar case" portables. These vary in size from 6in × 4in × 2in to 5in × 3½in × 1½in.

The S.T.C. type TS3 transistors show a serious loss of gain above 450 kc/s, but if a low intermediate frequency of 275 kc/s is used, then sufficient gain can be obtained to drive the output stages. There is no problem about low-frequency amplification at 10 kc/s, and the 50 milliwatts required for normal room listening is within their power rating.

First attempts to make an oscillator of any frequency using some of the circuits described in American literature were disappointing. None of the six transistors available showed the slightest inclination to oscillate with the tuned circuit included in its emitter lead.

At last it was decided to revert to valve techniques, and a good beefy feedback winding was provided from the (output) collector to the oscillatory circuit. The last-mentioned had a direct (a.c.) connection back to the (input) base, and because the base has a rather low impedance this connection was tapped about ¼ from the bottom. There was an immediate improvement, and oscillations were detected (a sound broadcast receiver does a good job as a wave-meter). Apart from altering the feedback tap on the oscillator coil so that it was just oscillating strongly enough at the high-frequency end of the band, and, of course, trimming off turns so that it covered the right frequency, no major alteration has been made to the circuit, which is shown in Fig. 2.

Various tapping points were provided on the coil at 20, 40 and 60 turns, and it was found that all the six transistors provided could be made to oscillate up to 750 kc/s by increasing the feedback (more turns), and two of them above 750 kc/s. The better one of these two was earmarked for use in the receiver.

It is a good idea to build this oscillator on a tagboard and establish that it is functioning correctly and giving the right frequency coverage, rather than build the set "all in one go," because the parts used are small and difficult to alter in confined spaces.

The coil winding data in the table will give a frequency variation from 720 kc/s to 330 kc/s. This coverage, when used with a

275-kc/s i.f., will give the receiver a frequency range on medium waves from 330 + 275 = 605 kc/s to 720 + 275 = 995 kc/s. This includes the Third Programme at 640 kc/s, and the Home Service (Brookmans Park) at 900 kc/s.

Notice that this local oscillator is producing the 275-kc/s i.f. by oscillating below instead of above the signal as in the more conventional superhets. This will introduce a slight complication in the tracking arrangements—but a complication that is well worth while when it is realized that little selection of transistors is needed. In point of fact it is the fundamental reason why a superhet receiver covering most of the medium-wave band can be built using low-frequency currently available transistors.

The frequency changer is a quite straightforward stage consisting of a common (earthed) emitter amplifying stage (Fig. 1), where the signal at the aerial coupling winding is applied to the base, along with a small amount of r.f. from the local oscillator picked up by returning the bottom of the coupling winding to earth via two turns (L_3) wound round the earthy end of the oscillator coil.

Aerial Design

The ferrite aerial needs some explanation because it contributes greatly to overcoming the trouble in tracking.

Very roughly it can be said that the amount of signal picked up by a ferrite aerial is proportional to the bulk of ferrite enclosed by the tuning coil. That is to say, for maximum signal strength measured at the coupling coil the correct number of turns to resonate with the tuning capacitor should be loosely

*The British Tabulating Machine Company.

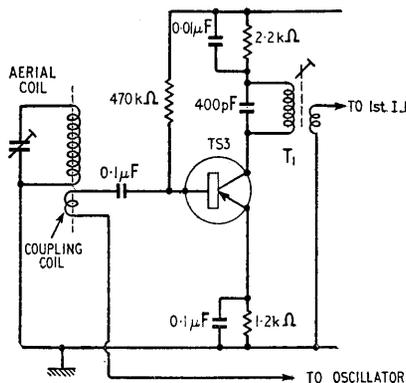


Fig. 1. Frequency changer circuit, showing input from oscillator.

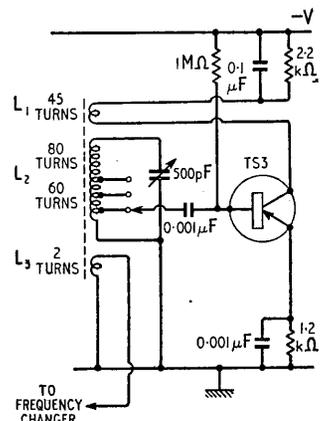


Fig. 2. Oscillator circuit with output to frequency changer.

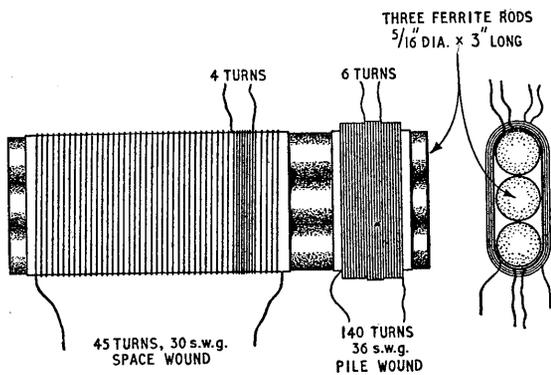


Fig. 3. Construction of the ferrite rod aerial, showing numbers of turns.

wound over the whole length of the rod. To obtain maximum bulk of material without excessive length three ferrite rods are stacked one above the other.

A certain price has to be paid for this increase in signal, inasmuch as the Q and selectivity of the circuit will be considerably reduced. On the other hand, to simplify tracking problems (which in this case can be stated as the aerial circuit failing to stay accurately in step with the local oscillator), what is wanted is a broad-band low-Q circuit which will ensure the signals are not seriously attenuated despite mistuning of the aerial circuit.

The ferrite rod aerial consists of three Ferroxcube rods of $\frac{5}{16}$ in diameter (Mullard type FX1495) and three inches long stacked one above the other and bound with Sellotape to hold them in place.

As shown in Fig. 3, the medium-wave winding consists of 45 turns of 30 s.w.g. insulated copper wire wound reasonably loosely, starting $\frac{1}{4}$ inch from one end and occupying about 2 inches. This forms the tuning coil. The coupling winding consists of 4 turns of the same gauge wire wound in between the turns of the tuning coil, starting about 5 turns up from the bottom.

The last winding is the long-wave coil and is pile wound to cover about half an inch of rod right on the end farthest from the m.w. coil. This winding consists of 140 turns of 36 s.w.g. enamel- and cotton-insulated copper wire. The coupling coil here consists of 6 turns of the same gauge wire.

All these windings should be temporarily held in place and prevented from unwinding by small pieces of Sellotape stuck over the first and last turns of each.

As the electrical properties of ferrite rod vary slightly from sample to sample, adjustments to the number of turns may be necessary to optimize the frequency coverage and the rod should be tested before finally binding the whole length from end to end with tape. If the coils have been wound on a former of cartridge paper, so that the rods are a loose fit inside, then final adjusting of the tuning and tracking can be done by moving the coils along the rods. The centre of the rods gives maximum inductance.

The aerial has been made this shape to fit across the case of the receiver, and as it is possible that lengths this size may not be available, a word on how to cut the ferrite will not be out of place. The rod to be cut should be placed on a flat surface and held by hand. A nick should be made with a hack-

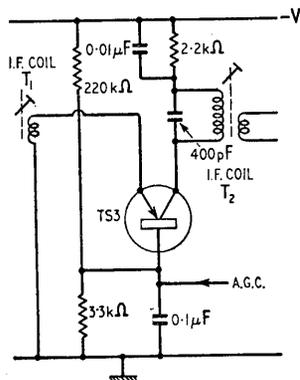


Fig. 4. An i.f. stage, showing the a.g.c. connection.

saw or Abrafle on opposite sides and then the rod broken simply by attempting to bend it by hand. This material is extremely brittle and any attempt to hold it in a vice or pliers will usually cause it to break at any other place but that required.

Coming now to the i.f. section, the frequency of 275 kc/s chosen was the result of a compromise between a high i.f. to

reduce whistles to a minimum and a low one that would give a useful gain from the transistors (which is well down at 500 kc/s).

The transistors were tried in a common (earthed) emitter circuit, which is theoretically capable of higher gain per stage than the common-base circuit finally chosen, but so much trouble was encountered due to instability (feedback within the transistor) and so many components were needed to neutralize this tendency to instability under varying battery voltages and temperature changes, that the loss in gain was considered a small price to pay. The circuit adopted is shown in Fig. 4.

I.F. Transformers

Because the input impedance of the transistors is so low compared with their output impedance, to obtain a correct match from stage to stage the i.f. transformers must give a ten-to-one reduction in

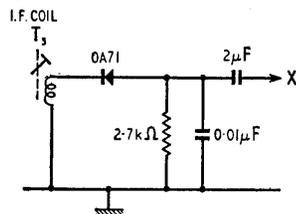
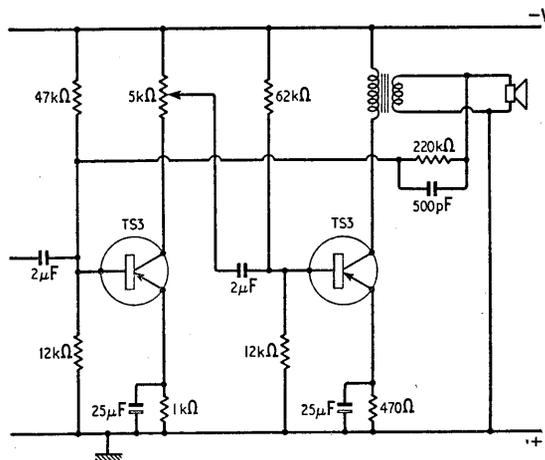


Fig. 5. Germanium-diode detector circuit.

Below: Fig. 6. Audio amplifier and output stages.



turns from primary to secondary. In fact the primaries have 330 turns while the secondaries have 33 turns. A slight increase of stage gain can be obtained by increasing the secondary turns, but above this excessive damping of the previous i.f. resonant circuit may occur and result in a decrease in gain. The secondary should be wound on the former first and the primary on top.

The detector circuit, shown in Fig. 5, is quite straightforward, consisting of a point contact germanium diode, Mullard OA71, connected as a half-wave rectifier.

Because the input impedance to this stage is considerably higher than that of the common-base i.f. transistor stage, the secondary winding of the third and last i.f. transformer is increased from 33 turns to 50, so that a higher stage gain is available on this than the previous ones.

It should be noted that the 2.7-k Ω diode load is returned to earth, but in the full circuit diagram (Fig. 7) it is returned to the base of the first i.f. transistor to provide a.g.c. action. Whilst testing the i.f. stages it is best to return the resistor to earth because confusing results can be obtained with strong signals.

A good way of adjusting the i.f. section is to build it as a separate exercise, complete with detector, and if no signal generator or oscilloscope is available, to connect a pair of headphones to point X and earth in Fig. 5, connect an aerial *via* a 25-pF capacitor to the first i.f. tuned circuit, and trim up on any available signal or noise within the range of the i.f. trimming (about ± 25 kc/s).

The low frequency part of the receiver consists of two common-emitter transistor stages RC-coupled from the diode detector, with negative feedback applied at high and low frequencies.

Notice in Fig. 6 that the coupling capacitors should not be reduced much below 2 μ F or a serious loss

at low frequencies will result. The 5-k Ω potentiometer used as a volume control forms part of the first amplifier collector load.

The negative feedback is taken from the speech coil of the loudspeaker, so that it covers distortion introduced by the loudspeaker transformer as well as that from the two low-frequency stages. Connection of this negative feedback should be left to the last, and if oscillations occur the sense of the transformer speech-coil winding should be reversed.

A miniature speaker transformer of the type usually sold with the 2 $\frac{1}{2}$ -in and 3-in speakers gives a tolerable match to the output stage as soon as the negative feedback is connected, but those patient enough can dismantle this and increase the secondary turns by 20% to improve the match.

Complete Circuit

The complete design has been broken down into four separate stages because, to anyone tackling transistors for the first time, the effects caused by wiring mistakes or faulty components are unfamiliar, and can lead to the disconnection of each main portion as the only means of identifying whence the trouble originates, whilst in a thermionic-valve superhet the nature of the fault gives an immediate clue.

Notice in Fig. 7 how the long-wave coil of the ferrite rod aerial is brought into circuit by the coupling coil and the switch. When this winding is brought into circuit no alteration has to be made to the oscillator. A quick look at the frequencies involved will show why it is not necessary.

If reception is required on long waves of, say, the 200-kc/s Light Programme (which is the main reason for providing this range), then if the local oscillator is tuned to 475 kc/s, it will beat (on the upper side this time) with the 200 kc/s, to once

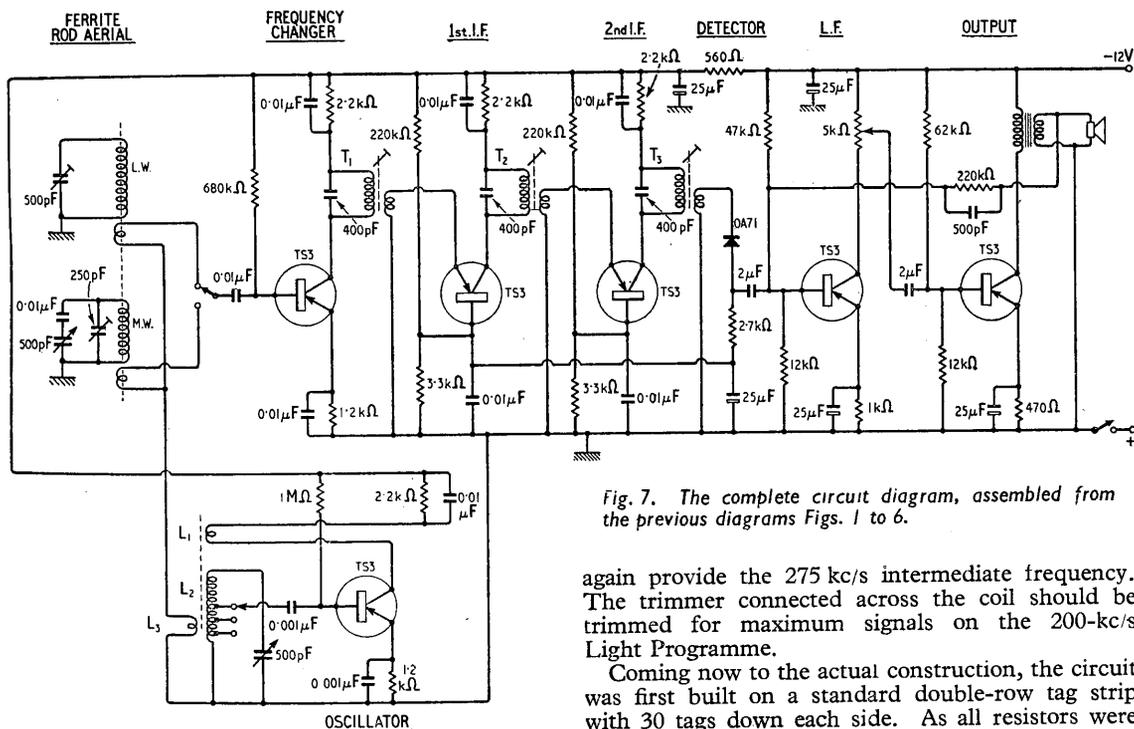


Fig. 7. The complete circuit diagram, assembled from the previous diagrams Figs. 1 to 6.

again provide the 275 kc/s intermediate frequency. The trimmer connected across the coil should be trimmed for maximum signals on the 200-kc/s Light Programme.

Coming now to the actual construction, the circuit was first built on a standard double-row tag strip with 30 tags down each side. As all resistors were

COIL WINDING DATA

Oscillator Coils

Former:— Aladdin $\frac{1}{4}$ in diam., 1 in long with dust core.

- L₁ .. 45 turns 36 s.w.g. cotton covered, wound on first.
L₂ .. 140 turns 36 s.w.g. cotton covered, tapped at 20, 40 and 60 turns, pile wound next.
L₃ .. 2 turns 36 s.w.g. cotton covered, wound on last.

I.F. Transformers

Former:— Aladdin $\frac{1}{4}$ in diam., 1 in long with dust core.

- T₁ & T₂ .. Secondary: 33 turns 36 s.w.g. cotton covered, single layer, wound on first.
Primary: 330 turns 36 s.w.g. cotton covered, pile wound on top.
T₃ .. Secondary: 50 turns 36 s.w.g. cotton covered, single layer, wound on first.
Primary: 330 turns 36 s.w.g. cotton covered, pile wound on top.

1/8 watt (mainly Erie type 16) and the largest fixed capacitor was a 25- μ F miniature cathode bypass, no component short of the tuning capacitor needed any other support than that provided by soldering it into circuit. This enables all the units—i.f. stages, oscillator, frequency changer, output—to be tested under portable conditions before attempting to miniaturize.

Incidentally, if one decided to stop at this stage of development, having, say, built the receiver on two 6 in tag strips, it would make a handy and economical portable, especially if a push-pull output stage using Mullard OC72 transistors were added.* Such an output stage would provide ample output to drive a 6 in loudspeaker.

*See "Transistors for the Experimenter" booklet, obtainable free from Mullard. Note that the OC72s require only 6V. Suitable transformers can be obtained from Sobell.

It is not possible to be dogmatic about the final form of construction possible because this depends so much on each person's access to materials and miniature components. It can be stated, however, that the author has built two versions of the circuit shown. The first is constructed around the magnet of a 6-in loudspeaker utilizing full-size components throughout, with a push-pull output stage. This set is in constant use, and has a cabinet measuring 7 in \times 7 in \times 3 in. The power supply consists of three flat 4.5-V torch batteries connected in series, and as these are designed to supply up to 300 mA to a bulb, the 25 mA average current drawn by the set is a very light load and many months of use can be obtained from three-shillings-worth of batteries.

The second version of the set is in a case measuring 5 in \times 3 in \times 2 in. The loudspeaker is a 2 $\frac{1}{2}$ -in Elac type and the supply battery is a 15-V hearing-aid (or flash-gun) type which drops to about 10V on load. Needless to say, this is the single-ended version of the circuit.

The author would like to advise readers again to be sure they have mastered the intricacies of the circuit before attempting to build it in a 5 in \times 3 in case, as the components will have to be packed side by side and sometimes in layers to get them all in.

Finally, the author was not in a position to evaluate the performance of the set in technical terms, but the following remarks will give readers a clue. Overloading of the output stage was possible in the London area on both the Third and Home Services, so long as the receiver was not used in a metal-framed building. The long-wave Light Programme was considerably weaker, presumably because the transmission originates in Droitwich. On the other hand, reception on this long wave was more consistent and suffered less from the screening effects of buildings. The volume level is more than adequate for listening in a room with no background noise, but if one wishes to hear the set above, for example, the conversation in a crowded room, then it is worth while adding the push-pull output stage.

Resistance - Current - Voltage - Power Nomogram

By B. E. JACKSON, B.Sc.*

PROBLEMS involving the relationships between the parameters resistance, current, voltage and power are constantly having to be worked out in electrical and electronic work. In most cases speed rather than accuracy is required. Therefore, a nomogram or a slide-rule-type calculator can profitably be employed.

Nomograms have had limited usefulness in this field in the past because (a) they have related only three of the four variables or (b) two settings of the rule have been required for a complete solution of the problem.

The nomogram presented here has the advantage that only one setting of the rule on the two known parameters is required to give the solution of the two unknowns.

For the convenience of those engaged in electronic

work the resistance scale is laid out in "preferred" values of resistors in addition to the ordinary logarithmic scale divisions.

Of course, the nomogram can also be used in place of a slide rule for the occasional multiplication or division of numbers not connected with voltage, resistance, etc. For example, the product of two numbers can be read off the V line by setting the rule over the two numbers on the R and I lines respectively.

The use of the nomogram is so straightforward that only one example need be given:—

Q.—What is the current passing through a 10-kilohm resistor and what is the power dissipated when the voltage across it is 150 V?

A.—Lay a rule across the nomogram intersecting the R line at 10 kilohms and the V line at 150 V. Read off the current from the I line equal to 15 mA and the power off the P line equal to 2.25 W.

* Dominion Laboratory, Department of Scientific and Industrial Research, Wellington, New Zealand.

Is Radio Propagation

Non-Reciprocity and Circuit Asymmetry in Short-Wave Communication

THE old-time radio operator used a simple rule for his guidance in the establishment of communication with a distant station: "If I can hear him, he can hear me." To that, of course, should have been added a proviso regarding the necessity for exact similarity between the radiated power of his and the distant station, but, as it was, his rule often worked. Was it then based upon any scientific principle, or was it merely a piece of professional folklore? Some interesting experiments have recently been carried out which throw some light upon this, until lately, largely unsettled question.

Reciprocity in Radio Communication.—The meaning of the reciprocity theorem, as applied by Carson¹ to radio communication, may be expressed as follows: "If an electromotive force of a certain magnitude inserted in one aerial causes a current to flow at a certain point in a second aerial, then the same voltage applied at this point in the second aerial will produce the same current, both in magnitude and phase, at the point in the first aerial where the original voltage was applied." According to the statement of reciprocity by Sommerfeld² this will happen regardless of the electrical properties and geometry of the intervening media and of the form of the two aeriels. From this we should expect radio transmission in opposite directions over a distance to be truly reciprocal, as is the case with electrical phenomena in other forms of network, provided that no change occurs in the intervening medium with time. There is, in fact, no reason to doubt that the reciprocity theorem is true when applied to ground-wave transmission, and it is only when sky-wave transmission occurs, where propagation is *via* an ionized medium in the presence of a magnetic field (the earth's), that it does not really hold. And in this latter case, which is that obtaining for all long-distance short-wave communication, though the possibility of non-reciprocal effects was realized by Carson, it does not seem to have been confirmed by experiment until recently.

It can be shown, however, that in certain special cases the theory of reciprocity should not hold. One of these is that where the wave travels through an homogeneous ionized medium along a magnetic meridian; i.e., along the direction of the magnetic lines of force, in which case the polarization of the wave twists in an anti-clockwise direction as it travels along, and, moreover, twists in the same direction whether going or coming, so to speak. The direction of twist is determined by the direction in which the magnetic force is acting, and not by the direction of propagation of the waves. In this case, if the direction of polarization of the wave when it leaves the transmitting aerial is the same in both the "go" and "come" directions then the propagation is still reciprocal, but if it is different in the two cases propagation is not truly so, there being a phase change at one end as compared with the other. It is even possible to find a case where the polarization changes

are such that propagation is only possible at all in one direction. But these special cases may possibly have small significance in practical communication.

Of course if the "go" and "come" paths by way of the ionosphere were different in practical cases, as has sometimes been postulated, then the possibility of non-reciprocal effects would become more obvious, for there could be a differential factor in the ionospheric absorption for the two directions. However, it does not seem likely that waves travelling in opposite directions would, in fact, traverse different paths, and, therefore, that there would be differences in wave attenuation due to absorption.

In short, the possible effects of non-reciprocity in long-distance short-wave communication are by no means easy to assess, though, from operational data which has accumulated over the past several years, there is now no doubt at all that there can be differences in the performance of a radio circuit in the two opposite directions when the transmitting and receiving equipments at the two ends are similar. In other words, the rule of the old-time radio operator is not, essentially, a good one.

Tests for Reciprocity.—An experiment made to test the reciprocity of the 420-mile transmission path between Slough and Inverness by the D.S.I.R. has been described by Meadows³. Elaborate precautions were taken to ensure that the observed effects were due to the intervening medium, and not to any apparatus contributions. Pulse transmissions were used on a frequency of approximately 5.1 Mc/s, these being transmitted from and received at both terminals, the same aerial at each end being used both for transmitting and receiving, being switched from transmitter to receiver at the pulse repetition frequency. The received pulses were displayed on cathode-ray tubes, and the Inverness display was relayed by line to Slough, so that the two patterns could be visually compared there, and differences between the fading patterns of the ordinary E and F ray echoes observed. This was considered to be a sensitive test for non-reciprocity.

During about 15 hours of observation spread over 13 days definite non-reciprocal effects were observed for only about 1 per cent of the time. It was considered that this being so for this short path more pronounced non-reciprocal effects might occur on long-distance circuits, though probably they would be of short duration.

The results of a test for non-reciprocity over long-distance circuits are given by Laver and Stanesby⁴, who describe those obtained from a carefully controlled experiment conducted by the Post Office Engineering Department. The tests were made separately between the United Kingdom and the United States and between the United Kingdom and Australia on frequencies between approximately 11 and 14 Mc/s. At each end of these two circuits a single aerial was used, switchable to a transmitter or to a receiver tuned to the same frequency. Un-

Always Two-Way?

By T. W. BENNINGTON*

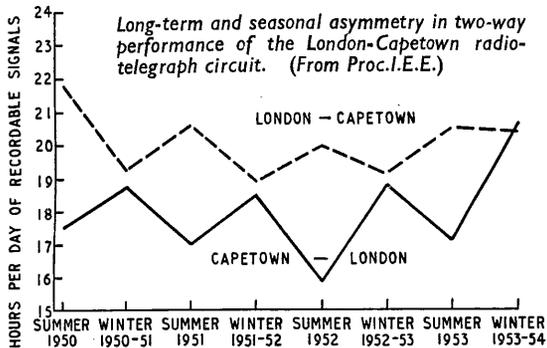
modulated carrier was transmitted alternately for two minutes from either end of the circuit. The output signals from the receivers were recorded and the results were expressed in terms of circuit loss, the aim being to obtain the loss difference between transmission over each circuit in one direction and that in the other. At times there was no significant loss difference, but quite often for periods of a few hours loss differences, indicating non-reciprocal transmission, did occur. On the average the loss was greater for transmission from the United Kingdom to the United States and to Australia, than for transmission from those two countries to the United Kingdom. At times the loss difference for transmission in the opposite directions rose to values of the order of 5 to 10 dB. The reality of the test

performance of a radio circuit would not necessarily be the same in two opposite directions if judged on the basis of the signal/noise ratio at the receiver inputs. Or, to put it into operational terms, the percentage of time for which a long-distance radio circuit was "commercial" or "uncommercial" would not necessarily be the same at the two opposite circuit terminals even if the transmitting and receiving equipments were identical. As has been said, such circuit performance differences have long been noted, and more light has now been thrown upon the subject by a recent study made by Humby and Minnis⁵. In order to distinguish it from the effects of non-reciprocity they have called the phenomenon in question "circuit asymmetry."

In examining the performance of a number of long-distance circuits, in terms of the number of commercial hours per day or days per month, they found that, in the cases where one terminal was in the northern and one in the southern hemisphere, a marked deterioration in circuit performance occurred during local summer. Since the time of local summer in these cases is displaced by six months as between the two opposite circuit terminals, this means that the performance varies in anti-phase at the two terminals over the year. Even if no other difference were present this leads to a differential in the circuit performance as between the "go" and "come" directions; in other words, to a seasonal asymmetry. (See accompanying diagram.) But, superimposed on this, there may be a consistently worse performance in one direction than in the other; i.e., a long-term asymmetry. Where both terminals were in similar latitudes in the northern hemisphere, where the seasons are coincident at the terminals, there was no evidence of seasonal asymmetry, though a component of long-term asymmetry might still be present.

These results are exactly what would be expected from a consideration of the likely signal/noise ratio, taking into consideration the local variations in atmospheric noise. This is, of course, much higher in summer than in winter, and varies geographically in a manner such that, generally speaking, its intensity is an inverse function of latitude. Thus, even with non-directional aerial systems such asymmetrical conditions would occur. But the communication systems in question used relatively sharply directional aerials, "beamed" in the direction of the distant terminal, and the authors have probed the matter further in view of this.

In considering the diurnal variations in circuit asymmetry, over several circuits where one terminal was in the United Kingdom and the others at places near or south of the equator, they found a marked tendency for the asymmetry to increase; i.e., circuit performance at the United Kingdom end to deteriorate, at a certain time GMT for each circuit, which time varied for the different circuits so as to become systematically later as the circuit direction varied from the east towards the west. This



results seems to be well proved by the fact that on some days no appreciable loss difference occurred, though on the previous days, with test conditions exactly the same, considerable loss differences occurred persistently.

These two valuable experiments, one over a relatively short and one over two long transmission paths, do therefore seem to prove that non-reciprocal effects are of some importance in long-distance communication via the ionosphere. They do not fully show, however, to what phenomenon the non-reciprocal effects are due, nor indicate the long-term significance of such effects. We may perhaps tentatively conclude that true non-reciprocity may not be the *major* cause of the operationally observed differences in long-distance circuit performance in opposite directions.

Circuit Asymmetry.—It has for some long time been realized that, since the distribution of atmospheric noise is not uniform over the earth's surface, but tends to be greatest in the equatorial land regions, and to vary at all places with time of day and season, the signal/noise ratio for a signal of given field-strength must vary for different geographical locations. That being so it follows that, quite apart from the effects of non-reciprocity, the

* Research Dept., British Broadcasting Corporation.

was particularly marked in the northern summer. The time of this increase in circuit asymmetry was, in fact, found to be at approximately similar values of local time at the distant terminal; i.e., between about 1850 and 2020 Local Mean Time. The implication was that towards and after local sunset at some place within the main beam of the receiving aerial, in the direction of the distant terminal, there was a significant increase in the atmospheric noise, such that the signal/noise ratio at the United Kingdom end of the circuit sharply decreased, and that as the sunset line moved from east to west over the circuits so the circuit asymmetry increased at increasing values of GMT, according as the direction of the circuit became farther to the west.

Atmospheric noise should be regarded as being primarily a meteorological phenomenon, being due to the lightning strokes in thunderstorms. The conditions for the production of thunderstorms are intimately bound up with the heating of the air by conduction from the earth under the influence of the sun's rays. Thus peak thunderstorm activity occurs in the late afternoon and evening, and, when the ionospheric conditions for the transmission of the noise over a distance are taken into account, it appears that a directional receiving aerial would tend to pick up the highest level of noise from an area lying slightly west of the sunset line. This enabled the authors to locate approximately the position of the noise sources responsible for the deterioration in circuit performances at the United Kingdom end of the circuit, for each of the circuits being examined, and a scrutiny of the receiving

operator's logs confirmed that there was an increase in the atmospherics at about the times expected.

Thus, it may be concluded, there is, at certain times of day, a deterioration in circuit performance over long-distance circuits in the direction in which reception is taking place in local summer, thus leading to a pronounced tendency for circuit asymmetry to occur. In addition, there may be long-term asymmetry, due to consistent differences in the local noise levels and, possibly, to other differences in conditions at the receiving terminals. Of the two effects of non-reciprocity and circuit asymmetry it would seem that the latter is responsible for the *major* differential effects observed in practice for transmission in opposite directions over a circuit, at least when the two terminals are located in widely different latitudes.

REFERENCES

- ¹ Carson, J. R.: "A Generalization of the Reciprocity Theorem," *Bell System Technical Journal*, 1924, 3, P. 393.
- ² Sommerfield, A.: *Zeit für Hochfrequenztechnik*; 1925, 26, p. 93.
- ³ Meadows, R. W.: "An Experiment to Test the Reciprocal Radio Transmission Conditions over an Ionospheric Path of 740km"; *Proc. I.E.E.*, 1956, 103, Part B, No. 8.
- ⁴ Laver, F. J. M., and Stanesby, H.: "An Experimental Test of Reciprocal Transmission Over Two Long-Distance High-Frequency Radio Circuits"; *Proc. I.E.E.*, 1956, 103, Part B, No. 8.
- ⁵ Humby, A.M., and Minnis, C.M.: "Asymmetry in the Performance of High-Frequency Radio Telegraph Circuits"; *Proc. I.E.E.*, 1956, 103, Part B, No. 10.

BOOKS RECEIVED

Vacuum Tube Circuits and Transistors by L. A. Arguimbau. New edition of textbook dealing with the circuitry of radio communications, now including chapters on transistor devices and circuits by R. B. Adler. The treatment throughout is based on fundamental physical principles. Pp. 648+IX; Figs. 612. Price 82s. Chapman and Hall, 37, Essex Street, London, W.C.2.

Quartz Crystals as Oscillators and Resonators by D. Fairweather, A.M.I.E.E. and R. C. Richards, Assoc.I.E.E. Monograph on the types of crystal cuts available and their practical applications in the control of frequency, with particular reference to preferred circuits and their design. Pp. 54; Figs. 52. Price 7s 6d. Marconi's Wireless Telegraph Co., Ltd., Chelmsford, Essex.

Proceedings of the Conference on Radio Interference Reduction (Chicago, December 1954). Subjects discussed include techniques for suppression in motor cars, aircraft and ships; design of screening; susceptibility of receivers to pulse interference; spurious radiation from transmitters; corona interference in aircraft; measurement techniques. Pp. 352+V; Figs. 170. Price \$6.00. Armour Research Foundation, Dept. E, 10 W. 35th Street, Chicago, Illinois.

Television Programming and Production by Richard Hubbell. Revised and enlarged third edition of a handbook on camera technique, staging and sound effects written primarily on the basis of American practice, with a chapter on British television programmes. Pp. 272; Figs. 18. Plates 117. Price 32s. Chapman and Hall, 37, Essex Street, London, W.C.2.

Basic Electricity by P. B. Zbar and S. Schildkraut. Instruction manual for a series of laboratory experiments to familiarize radio technicians with measurements on

simple d.c., a.c., and r.f. circuits. Pp. 84; Figs. 113. Price 13s. McGraw Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4.

Handbook of Basic Circuits by M. Mandl. Selection of 136 basic circuit elements, arranged in alphabetical order for easy reference, indicating their application in sound or television receivers and describing their purpose and function. Appendices give block diagrams of representative complete equipments. Pp. 365; Figs. 164. Price 52s 6d. The Macmillan Company, 10, South Audley Street, London, W.1.

Profitable Radio Troubleshooting by W. Marcus and A. Levy. American treatise on servicing from both the technical and business points of view. Pp. 330; Figs. 153. Price 34s. McGraw Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4.

Commercial Broadcasting in the British West Indies. Detailed account produced by Central Rediffusion Services, Ltd., of the organization and distribution of programmes in the main islands by medium-wave, v.h.f. and wire. Pp. 91; Figs. 31. Price 5s. Butterworth Scientific Publications, 88, Kingsway, London, W.C.2.

Dictionnaire Français-Anglais, by H. Piraux. Complementary volume to the English-French dictionary previously published, giving equivalent terms relating to electronic and electrotechnical subjects. Pp. 186. Price 960 Fr. Editions Eyrolles, 61, Boulevard St. Germain, Paris, 5.

RCA Transmitting Tubes. Manual of valve characteristics covering anode, ratings up to 4kW, with an introduction on circuit design considerations and recommended operating conditions. Pp. 257. Price 12s. RCA (Gt. Britain), Ltd., Lincoln Way, Sunbury-on-Thames, Middlesex.

The Gated-Beam Valve

By
LAWRENCE W. JOHNSON*

Its Use as Limiter and Discriminator
for Frequency Modulation Reception

ADVANCES in the art of frequency modulation reception seem all too often to come about only as a result of advances in allied, higher-powered fields. Exceptions to this rule do exist—for example, the M.I.T. work on multi-path transmission^{1,2}—but it is safe to say that if it were not for radar and television, the low-noise front ends and compact i.f. amplifiers used in modern f.m. receivers would not be available. It is the purpose of this paper to describe the 6BN6 gated-beam tube, a television development which bears out the original contention. To the designer of f.m. tuners and receivers it brings a very useful tool in improving performance or in lowering price, whichever objective may be the more important.

The 6BN6 was developed in the laboratories of the Zenith Radio Corporation, by a group led by Dr. Robert Adler, and was first put into production by the General Electric Company (U.S.). The basic ideas were not new, but Adler's work seems to have been the first to combine them all successfully. The prime purpose of the development appears to have been the simplification of the sound channel of television receivers. When the 6BN6 is so used it takes the place of the limiter, discriminator, and first audio stages, and at the same time eliminates the rather complicated phase discriminator or ratio detector transformer, substituting in its place a simple inductor resonant at the intermediate frequency^{3,4}. The resulting f.m. detector does not meet the requirements set forth for an exceptionally high capture ratio⁵, but its performance equals or surpasses that of the commonly encountered ratio detector or single-limiter/discriminator. In some high-quality f.m. tuners the 6BN6 is employed as a broad-band limiter only, and is followed by a separate broad-band detector to assure a good capture ratio.

Counter Discriminators

Understanding the operation of the 6BN6 is not difficult if one falls back upon previously explained phenomena and circuits. Roddam⁵ and Scroggie⁶ have done much to familiarize readers of this journal with low-frequency versions of the counter type of discriminator, which presents several intriguing advantages, but also imposes limitations on bandwidth because of the necessarily low intermediate frequency. The 6BN6 may be thought of as a way of utilizing the same general principle as that of the counter discriminator, at an almost arbitrarily high intermediate frequency. This last-mentioned property might seem to provide a large advantage over other counter-discriminator systems in that an excellent capture ratio would seem to be within reach. That this is not completely true will be discussed in detail later; envelope for envelope, however,

the 6BN6 still provides several points of superiority over practical counter detectors.

The conventional counter detector utilizes the principles of pulse position modulation (p.p.m.); it is supposed, ideally, to put out one pulse for each cycle of the incoming frequency-modulated voltage. It is assumed that the output pulse will have a standard height, duration, and shape, regardless of the input frequency and amplitude. The resulting train of pulses, identical in all respects save spacing, can be passed through a low-pass filter, at the output of which will appear the desired audio signal representing the demodulated wave. Fig. 1 shows an f.m. wave and an idealized counter detector's action. It is only a simple step to consider instead a system where the "duty cycle" (ratio of pulse duration to the full repetition period) instead of pulse spacing is varied. This is the scheme which the 6BN6 detector employs. Current pulses are formed which have standard height, rise time, and fall time; they vary in both width and spacing, but the significant fact is that the duty cycle, nominally 25% with no modulation, is made to vary in accordance with the deviation of the instantaneous input frequency from the fixed intermediate frequency. As before, the current pulses are passed into a low-pass filter, which yields an output proportional to duty cycle, thus conveying the desired modulation intelligence.

Dual Control Grids

The details of the manner in which the 6BN6 accomplishes these functions are fairly straightforward. For the present let it suffice to say that the 6BN6 has two control grids, well-shielded from each other, both of which are capable of cutting off anode current, and whose dynamic ranges are both quite small. Thus an alternating voltage on either electrode of a few volts amplitude, peak-to-peak, will cause

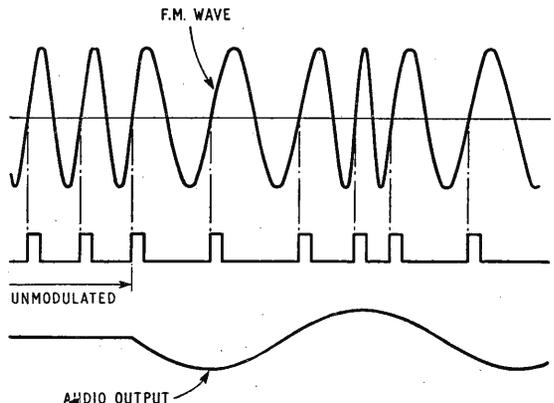


Fig. 1. Principle of the pulse counter detector.

*Hewlett Packard Company, Palo Alto, California.

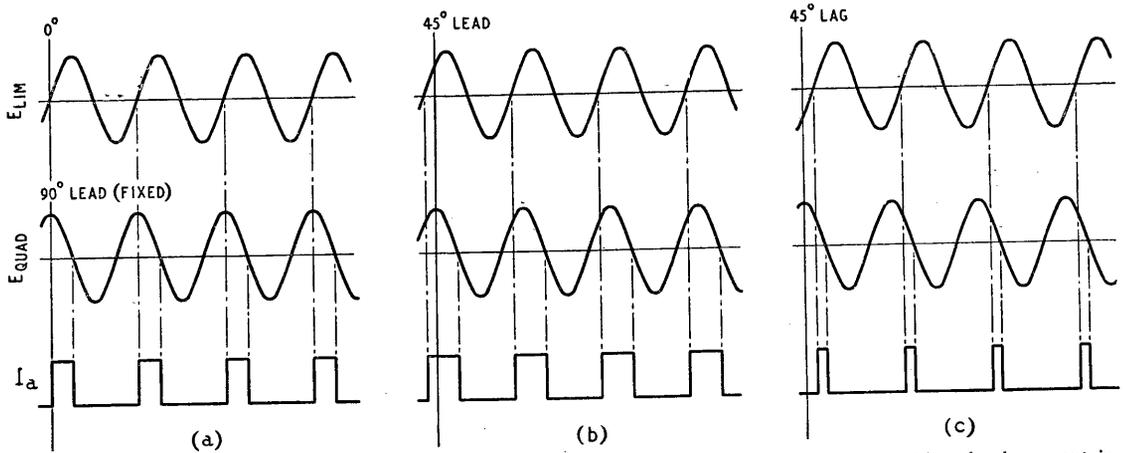


Fig. 2. Variation in pulse duty cycle for changes of phase between the limiter and quadrature grids. Anode current is assumed to flow only when both grids are positive.

pulses of anode current to flow as the electrode voltage is carried from cut-off to saturation and back. For reasons that will be clear later, the closer of the two grids to the cathode is called the limiter grid, and the other is called the quadrature grid.

Suppose now that an unmodulated signal is applied to the limiter grid, and that the same signal, advanced in phase by 90 degrees, is applied to the quadrature grid. (The reason for the name may now be growing apparent.) If the amplitudes of the two voltages are sufficient, either by itself would suffice to form pulses of anode current, and if one or the other were of zero amplitude, the other would cause the anode current duty cycle to be 50%. Fig. 2(a) shows how, with the application of voltages 90 degrees apart, the anode current duty cycle would be reduced to 25%. For simplicity, current is assumed to reach the anode only during the portion of the signal cycle when both grids are positive.

What happens if the phase of the voltage applied to the limiter grid is varied, while that of the voltage applied to the quadrature grid is kept steady as in the initial example? If the phase of the limiter grid voltage is advanced by 45 degrees, the anode current pulses will be as shown in Fig. 2(b); the duty cycle has been increased to 37½%. Alternatively, if the phase of the limiter grid voltage is retarded by 45 degrees, the anode current pulses will be as shown in Fig. 2(c); now the duty cycle has been decreased to 12½%. Bear in mind that Fig. 2 is for a voltage of constant frequency and unchanging phase applied to the quadrature grid, with variation only of the phase of the voltage applied to the limiter grid; these conditions are exactly what might be encountered in a phase detector. That is, such a circuit would provide a d.c. output that would vary in proportion to the phase difference between a variable-phase carrier-frequency input and a fixed-phase carrier-frequency reference input. The line between phase and frequency is a hazy one; if, for example, one speaks of a continuously changing phase, one may equally well speak of a frequency shift. Thus it is that phase detectors and frequency modulation detectors often have very similar circuits.

The 6BN6 phase detector can be used almost without change as a frequency modulation detector; it is necessary only to arrange somehow to supply an appropriate reference voltage to the quadrature

grid. The signal to be detected will be applied to the limiter grid; a convenient result of the narrow dynamic range of the limiter grid is that amplitude modulation of the input signal will have little effect on the timing of the anode current switching.

Practical Circuit

Fig. 3 shows the circuit actually used in the 6BN6 f.m. detector. The representation is drawn in the fashion of a pentode; more physical detail will be given later. The limiter grid is that nearest the cathode, while an accelerator or screen grid is between the limiter and quadrature grids. The signal to be detected is connected to the limiter grid, a moderately-high-Q resonant circuit is connected to the quadrature grid, a typical screen grid voltage is applied to the accelerator, and to the anode are attached a load resistor, an integrating capacitor (to earth), and a coupling capacitor (to the audio amplifier). With this circuit configuration, consider the situation when a signal is applied of the same frequency (the intermediate frequency of the receiver)

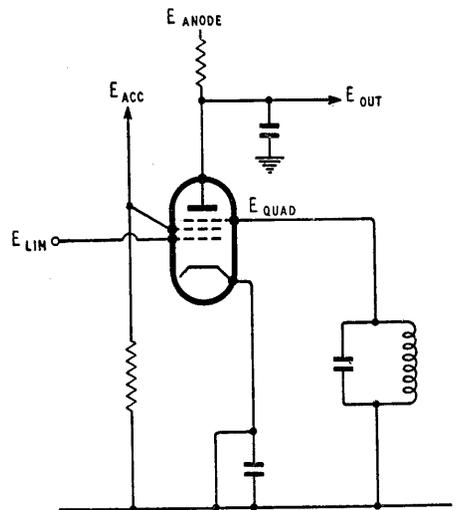


Fig. 3. Basic circuit of gated-beam limiter discriminator.

as that to which the coil in the quadrature grid circuit is tuned. Under these conditions there is space charge coupling to the quadrature grid circuit as a result of the pulses of current passed by the limiter grid. There results a current in the quadrature grid circuit whose frequency is that of the current pulses, and whose amplitude is broadly frequency-dependent. Thus there is produced a voltage from quadrature grid to earth at the input frequency, of amplitude sufficient to carry the quadrature grid considerably past the cut-off and saturation limits, so that the pulses of beam current produced by the limiter grid will be further modified before they become pulses of anode current. Just how they are modified is determined by the phase difference between the limiter and quadrature grid voltages. The quadrature grid circuit situation is analogous to that of a parallel resonant circuit fed through a small capacitive reactance; at resonance the voltage across the resonant circuit leads the current by 90 degrees, and at frequencies near resonance the lead angle is given by an approximation quite accurate for frequency deviations of 75 kc/s or less, and for quadrature inductor Q_s of 35 or less. The approximation states that

$$\phi = \frac{\pi}{2} - 2Q_s \frac{\Delta f}{f_0}$$

where ϕ is the lead angle in radians, Q_s is the figure of merit of the quadrature coil, f_0 is the intermediate frequency to which the quadrature coil is tuned and Δf is the deviation of the input frequency from f_0 .

Linearity

From this relation it is clear that the anode current duty cycle is 25% when the input frequency is equal to the intermediate frequency. And further, as the input frequency is varied, it is clear that the phase difference varies in a linear fashion, producing a linear variation in duty cycle of the anode current pulses, along the lines of what was described earlier for the 6BN6 phase detector; for a frequency above the intermediate frequency, the duty cycle is less

TABLE I 6BN6—Limiter-Discriminator Characteristics and Typical Operation	
Input-signal centre frequency	10.7 Mc/s
Frequency deviation	±75 kc/s
Anode supply voltage	285
Anode voltage	122
Accelerator voltage	100
Cathode-bias resistor (variable)*	200 to 400 ohms
Anode load resistor	330,000 ohms
Anode linearity resistor	1500 ohms
Integrating capacitor	0.001 μF
Coupling capacitor	0.01 μF
Minimum signal voltage for limiting action (r.m.s.)†	2.0
Average d.c. anode current	0.49 mA
Accelerator current	9.8 mA
Input signal level for a.m. rejection adjustment*	2.0 volts
A.M. rejection at $E_{sig} = 2.0$ volts (r.m.s.)	20 dB
A.M. rejection at $E_{sig} = 3.0$ volts (r.m.s.)	29 dB
Total harmonic distortion	1.6 %
Peak audio output voltage	16.6

*The cathode resistor should be adjusted for maximum a.m. rejection in the output of the limiter discriminator stage at the specified signal level. a.m. rejection is measured with an applied signal containing 30% a.m. and 30% f.m.
†At signal levels above specified value, limiting is within ± 2 dB.

than 25%, and for a frequency below the intermediate frequency, the duty cycle is greater than 25%. This fortunate situation has resulted from quadrature circuit phase changes resulting from forced oscillations excited therein by means of space charge coupling from the beam current.

As before, the desired audio signal can be recovered by means of an integrator or low-pass filter. Appropriate choice of low-pass filter components can provide simultaneous de-emphasis, yielding further simplification of the circuit. The values shown in the detailed circuit of Fig. 4 are designed to compensate for the 75-microsecond pre-emphasis, standard in the U.S. Also shown in Fig. 4 is an additional linearity resistor between anode and integrating capacitor. This resistor, by permitting an appreciable component at carrier frequency to exist at the anode, modifies the phase and amplitude of the quadrature grid voltage by feedback through the quadrature-grid-to-anode capacitance in such a fashion as to improve linearity considerably. This resistor also has some effect on the amplitude of the output voltage, and on the a.m. rejection capabilities of the circuit, so that its value represents a compromise between conflicting requirements. Table I gives the characteristics and typical operation furnished in the manufacturer's technical data manual⁷, from which the circuit of Fig. 4 was taken.

Simple Adjustment

Alignment of the circuit turns out to be admirably simple. The quadrature coil is tuned for maximum audio output, and the cathode resistance is adjusted for optimum a.m. rejection. Both these adjustments can be made without a signal generator; in fact the latter is very easily made when receiving a weak station in the presence of impulsive noise interference. It is important to note that symmetry of the tuning characteristic will be adversely affected unless anode current without signal equals anode current with an unmodulated signal. Thus the use of other supply voltages than those listed will require that the value of anode resistor be adjusted. It is desirable in addition that the accelerator be fed from a low impedance source.

A cross section of the 6BN6 electrode structure is shown in Fig. 5. Note that the limiter grid is almost

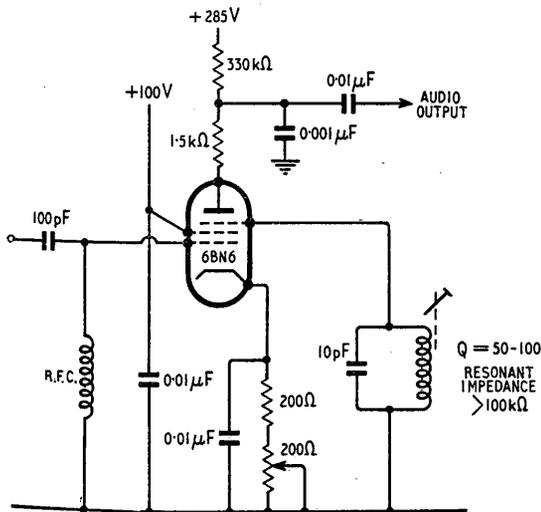


Fig. 4. Practical circuit with component values for the 6BN6 valve.

completely enclosed by a structure at cathode potential, which in turn is almost completely surrounded by the accelerator. Note also that the anode and quadrature grid are almost completely enclosed in another structure at cathode potential. With such a structure it should not be surprising that the direct capacitance between quadrature grid and limiter grid is less than 0.004 pF. The limiting action of both grids is accomplished by means of carefully planned electron-optical conditions. Either grid will draw no more than 0.5 mA no matter how far positive it may be driven, and the box structure, combined with the sheet-beam resulting from careful electrode layout, yields a sharp cut-off characteristic. In fact, as long as the signal applied to the limiter grid is above about two volts r.m.s., the space current which passes out of the accelerator is carried rapidly from zero to the saturation value; consequently the name limiter grid is justified, for any larger amplitude of input voltage will only sharpen the transition from zero to the saturation value.

The Q of the quadrature coil can vary between fairly broad limits. On the one hand, it must not be too sharply tuned, or the amplitude of the quadrature voltage may drop off at large deviations, and the phase deviation may depart from linearity. On the other hand, it should not be too broad, since there is then danger of insufficient quadrature grid voltage as a result of the reduced quadrature coil voltage. As a practical matter to insure continuity of operation with valve replacement, the manufacturer recommends that a total of at least 10 pF of capacitance be used across the quadrature coil. Needless to say, careful shielding of the quadrature circuit is necessary, especially from the input circuit to the limiter grid. Broadening the quadrature coil tuning will aid in broadening the bandwidth of the 6BN6 detector, but it appears that the practical upper limit will still not permit its use in a design which calls for a two- or three-megacycle detector bandwidth. Nevertheless the circuit fits well the requirements of low cost receivers, since it will still provide a greater-than-normal bandwidth while providing a high output voltage, thus contributing to the simplicity and low cost of such a receiver while keeping quality reasonably high.

Use as Limiter

The characteristics of the limiter grid suggest that the 6BN6 can be profitably employed as a pure limiter. This is in fact the case. For use as a limiter the manufacturer suggests that the quadrature grid should be connected to the anode if the maximum amplitude of output voltage is desired, or to earth if limiting on the smallest possible input signal is desired. Particularly desirable in a limiter is the characteristic of the 6BN6 that results from its electron-optical design; limiting does not depend on flow of grid current, nor in any way on biases determined by signal levels. Thus there are no time constants associated with the limiting action, which cannot be said to be true of the familiar pentode limiter, or even of some diode limiters. Thus the 6BN6 provides improved immunity from impulse interference and from rapidly changing signal levels, in contrast to the pile-up effect characteristic of pentode limiters. These several advantages have led to the appearance of the 6BN6 as a limiter in several high-quality f.m. receivers. It may be that

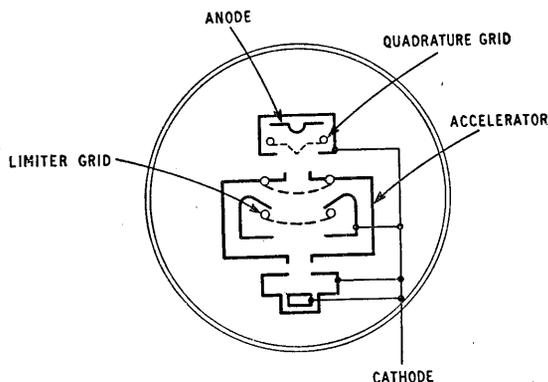


Fig. 5. Cross-section of electrode structure in the 6BN6 valve.

its failure to appear as a limiter-discriminator in inexpensive tuners is attributable to a stigma based on its television cost-cutting background. Such a reluctance is certainly not justified, since the 6BN6 when properly used can out-perform the presently popular ratio detectors and discriminators used in inexpensive equipment.

A detailed study of the gated-beam limiter at M.I.T.⁸ bears out the conclusions stated above about the excellence of its properties. The study recommends separate control of the biases on limiter and quadrature grids for optimum adjustment of limiting characteristics. This appears to be desirable because of variations in characteristics from valve to valve. Cascaded 6BN6 limiters with earthed quadrature grids were used in the Cross-Paananen receiver developed at M.I.T.^{9,10} and mentioned in an earlier article in this journal².

A recently announced R.C.A. development¹¹ seems to be very similar to the 6BN6 detector circuit described above. The circuitry is essentially identical, but the operation differs in that the detector is normally oscillating, and only for strong signals does the oscillation cease. For weak signals the action is along the lines of the locked-oscillator detector, developed and used some years ago¹². There is no indication that the 6DT6, the special pentode developed for this circuit, possesses the electron-optical limiting characteristics of the 6BN6. It is possible that a marriage of the two schemes, combining the good features of both, would prove interesting. Presumably such an approach would involve modifying the 6BN6 circuit so that it would oscillate for low values of input signal.

D.C. Component

There is a characteristic of the 6BN6 detector that may be considered by some to be a disadvantage. There is present at the anode a d.c. voltage which varies in the fashion required for control of an automatic frequency control circuit, except for the fact that the voltage level for centred tuning is not zero but is instead of the order of 100 volts. This makes difficult, but not impossible, the job of designing an a.f.c. circuit, the need for which might better be counteracted by devoting care to the design of the local oscillator.

Tuning meters can easily be used with the 6BN6 circuit; the limiter grid current, never greater than one half milliampere, is a wonderfully sensitive

aid in tuning weak stations, while for strong stations the grid current of the preceding intermediate frequency amplifier stage—which would be the logical source of automatic gain control voltage in a 6BN6 receiver—provides a sensitive indicator. The provision of a zero-centre on-channel indication falls in the same category as providing a.f.c., however.

Modification of existing equipment to employ the 6BN6 as a limiter-detector is quite practical, and in most cases will yield an improvement.

Existing limiters can be converted to additional intermediate frequency amplifier stages by appropriate adjustments of their operating conditions, and the discriminator or ratio detector transformer can often be converted into a driver transformer for the 6BN6 limiter grid. Room for a shielded quadrature coil must be located. The d.c. resistance in the 6BN6 limiter grid circuit should be kept under 200 ohms, lest the flow of grid current upset bias conditions. The results of such a modification will generally be as follows: sensitivity will be increased, noise rejection will be improved, alignment will be easier, and tuning will be easier. This last feature is perhaps as welcome as any of the others. It results from the fact that the broader-than-usual bandwidth of the 6BN6 detector effectively eliminates the three-point detection usually encountered, substituting instead a broad region of smooth tuning with noisy regions on each side which result from slope detection in the intermediate frequency amplifier and consequently present a highly amplitude-modulated signal to the limiter grid. This tuning characteristic makes it convenient to design an inter-station squelch circuit activated by the super-audible components present in the inter-station noise.

In closing it might be noted that many applications other than those mentioned have been found for the 6BN6. It is useful as a clipper, square-wave generator, frequency multiplier, gated amplifier, coincidence circuit, slicer, or multivibrator. And finally, it seems to be the only tube which can be self-biased to anode-current cut-off.

REFERENCES

- ¹ Arguimbau, L. B., and Stuart, R. D., "Frequency Modulation," Methuen and Co. Ltd., 1956.
- ² Johnson, L. W., "F. M. Receiver Design," *Wireless World*, October 1956, p. 497.
- ³ Adler, R., and Haase, A. P., "The 6BN6 Gated-Beam Tube," *Proc. National Electronics Conference, Chicago*, September 1949.
- ⁴ General Electric (U.S.) Engineering Bulletin ET-B28, "The Gated-Beam Tube and its Application in Inter-carrier Television."
- ⁵ Roddam, Thomas, "Why Align Discriminators?" *Wireless World*, July 1948.
- ⁶ Scroggie, M. G., "Low-Distortion F.M. Discriminator," *Wireless World*, April 1956.
- ⁷ General Electric (U.S.) Receiving Tube Manual.
- ⁸ Price, R. A., "A Study of the Gated-Beam Limiter," M. S. Thesis, Department of Electrical Engineering, M.I.T., Cambridge, Mass., 1953.
- ⁹ Cross, H. H., "Head End Design for FM Tuner," *TV and Radio Engineering*, February-March, 1953.
- ¹⁰ Paananen, Roy, "IF and Detector Design for FM," *TV and Radio Engineering*, April-May, June-July, and August-September, 1953.
- ¹¹ Avins, J., and Brady, T. J., "A Locked-Oscillator Quadrature-Grid FM Sound Detector," *RCA Review*, December 1955, p. 648.
- ¹² Bradley, W. E., "A New Detector for Frequency Modulation," *Proc. National Electronics Conference, Chicago, October 1946*.

Modernizing T.R.F. Television Receivers

By P. F. CUNDY, A.M.I.E.E.

FOLLOWING the article by G. J. Conway in the November, 1956, issue, it is worth while considering another method of converting Channel-I "straight" vision receivers to Crystal Palace single-sideband transmissions, and at the same time introducing Band III reception.

In simple terms this method is to change all sound channel circuits and traps from 41.5 Mc/s to 38.15 Mc/s, the vision circuits from 45-48 Mc/s to 34.65-37.65 Mc/s, and to add a multi-channel tuner in front. The previous signal-frequency sound and vision stages are thus converted to the standard recommended British intermediate frequencies, and any tuner with the "standard" i.f. output will do.

This treatment can be applied to "straight" sets in each of the following circumstances:—

- (1) Upper-sideband types.
- (2) Double-sideband types.
- (3) Lower-sideband types when a simply added Band-III converter cannot be used because of 45 Mc/s re-radiation from the receiver or because of direct 45 Mc/s pick-up.

In most cases the existing trimming arrangements on the sound channel cater for the change from

41.5 Mc/s to 38.15 Mc/s (which is about 8%) and this is also true of the sound traps. Sets of type 2 and 3 would have had sufficient sound attenuation in their existing trap circuits to make alterations (other than tuning) unnecessary.

In general, type 1 receivers will need at least one additional sound trap. This can be made and fitted in exactly the same manner as described by Conway, but, of course, designed to resonate at 38.15 Mc/s.

With the vision circuits, the change in frequency required is up to 22% and this is usually well outside the range of the existing trimming facilities. The simplest way to lower the frequency of these circuits is by additional capacitance. A value of 6.8 pF is the best starting point and capacitors of this value should be connected from anode to earth and from grid to earth of each valve handling vision-frequency signals. Care must be taken that these capacitors and the leads to them are positioned so that the anode-to-grid capacitances of the amplifying valves are not augmented by excessive external feedback, or stability will suffer.

During alignment it may turn out that the 6.8-pF capacitor is either too large or too small. In this

case it should be changed for a 4.7-pF or a 10-pF capacitor, but 6.8 pF will be right for at least 75% of the requirements.

The added capacitance increases the selectivity and this could be troublesome. It is not worth while, however, changing damping resistors where they exist and are 10 kΩ or less. To any circuits which in the original condition were not provided with damping resistors, values of 15 kΩ or 22 kΩ may be added.

On the question of alignment procedure it is impossible to give any specific advice. If carried out by somebody who has an instinct for this kind of thing it is not difficult, but in the absence of an oscilloscope and sweep generator it can be tedious. A good starting point is to align all circuits on 34.56 Mc/s and then raise the frequency of two-thirds of them slowly, leaving one-third at about 36.15 Mc/s and pushing the remaining one-third as near 37.65 Mc/s as possible without running into sound-on-vision. It should be borne in mind that the sound rejectors may require some re-adjustment in the process.

Acceptable performance should always be achievable, with bandwidths of 2 Mc/s in all cases and 2.5 Mc/s quite often. Users of the well-known Pye 45 Mc/s strip will find the conversion satisfactory, and because of the large number of tuned circuits it is possible to avoid the use of sound traps. Responses 3 dB down at 37 Mc/s, 15 dB down at 37.5 Mc/s and 30 dB down at sound carrier frequency can be achieved by tuning adjustment alone.

Gain lost in adding capacitors and damping resistors to amplifying stages will be more than made up by the tuner. Since few of the receivers will have provision for any form of a.g.c., adjustment of contrast control on changing channels will usually be necessary.

Good results have been obtained with the conversion of several receivers, both commercially-made and home-constructed. The Cyldon "Teletuner" has been used successfully, and also the G.E.C. type BT205 adaptor and a home-built tuner.

Transatlantic Television

BRIEF mention was made in last month's "World of Wireless" of the successful reception of B.B.C. television transmissions in the United States. Since then, further details of the reception arrangements have been given to *Wireless World* by Dr. H. R. L. Lamont, European technical representative of the Radio Corporation of America.

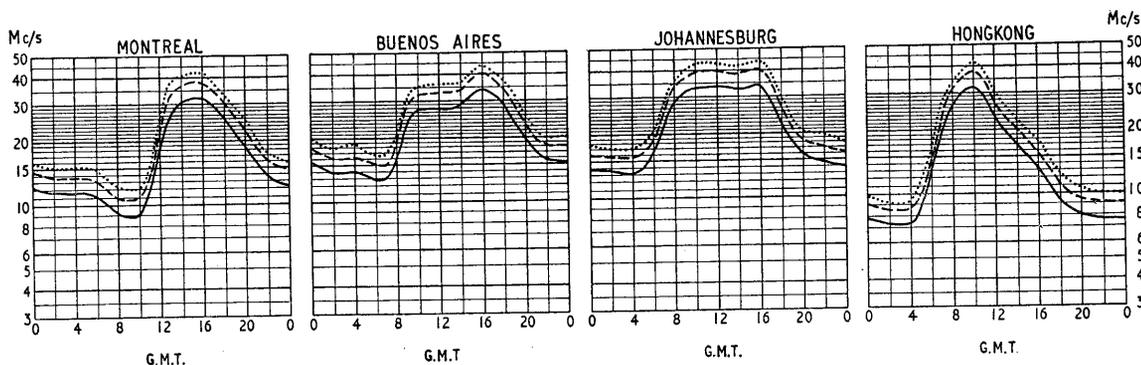
The main receiving aerial is a horizontally polarized rhombic (mounted on 50-ft wooden poles) with an overall length of 329ft. The side angles are 142° and the side lengths 173ft. The aerial is designed for our Channel 1, with the main lobe 7° above the horizon in the great circle azimuth of London. The far end is terminated in 800 ohms with the near end working into a 50-ft length of tapered impedance matching transformer. This feeds through approximately 100-ft of 300-ohm balanced line to the receiving equipment.

From the transmission line a 300- to 75-ohm balun, having less than 1 dB loss, a standing-wave ratio of less than 1:1.2 and a balanced to unbalanced ratio greater than 18 dB, is used. The pre-amplifier has a noise factor of 5 dB or less and a gain of approximately 25 dB. A network designed to reduce interference from strong off-channel stations is in the circuit after the pre-amplifier. Thereafter, the signal is fed to two Ekco T283 receivers. Two receivers are used because, with weak signals and interference, optimum sound tuning does not always correspond to optimum picture tuning. Both receivers have been equipped with cathode-follower output systems, vision being taken from the second detector and sound from the loudspeaker speech coil circuit. The vision signal is then fed to a microwave relay system for transmission to the NBC Laboratory in New York, a distance of 70 miles from the receiving station at Riverhead, Long Island. Sound is conveyed by line.

In New York another Ekco receiver with an additional amplifier having a gain of approximately 10 to 1 is installed. Output from the amplifier is d.c.-restored by means of a diode where it is applied to the regular vision amplifier within the receiver. The received picture is then re-televised by a Vidicon camera chain operating from an RCA sync generator. The camera utilizes a 25-mm, f1.4 lens, and with this lens is capable of 600-line horizontal resolution.

Although recognizable signals have been received there has been considerable interference and multipath effects.

SHORT-WAVE CONDITIONS Prediction for January



THE full 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 January.

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

LETTERS TO THE EDITOR

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

Is Distortion Unpleasant?

AS A. J. Hickman points out (December, 1956, issue), one can get used to anything: vibrato, dominant seventh chords, even deliberately mistuned "jazz" pianos, are sought after and give pleasure if not overworked.

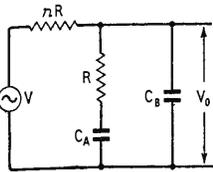
The point is that all these effects are under the control of the musician, but the products of non-linearity are not.

Hindhead.

HENRY MORGAN.

Disc Replay Equalizers

THE article by J. D. Smith on "Disc Recording Characteristics" in the November 1956 issue gives incorrect formulæ for the components of the combined network in Fig. 3. It can be shown that the correct formulæ should be as follows:—

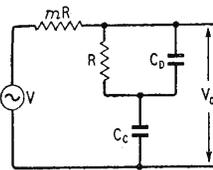


$$n = \left(t_1 + t_3 - t_2 - \frac{t_1 t_3}{t_2} \right) \frac{1}{t_2}$$

$$RC_A = t_2$$

$$RC_B = \frac{t_1 t_3}{t_1 + t_3 - t_2 - \frac{t_1 t_3}{t_2}}$$

Another network which will give an identical frequency response curve is:—



$$m = \frac{t_1 + t_3 - t_2}{t_2 - \frac{t_1 t_3}{t_1 + t_3 - t_2}}$$

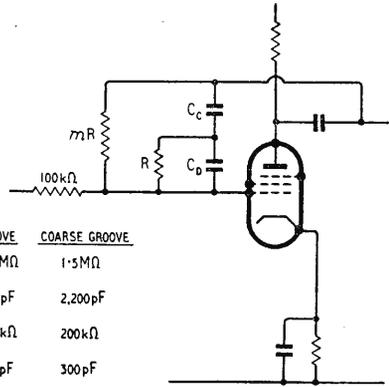
$$RC_C = t_2 - \frac{t_1 t_3}{t_1 + t_3 - t_2}$$

$$RC_D = \frac{t_1 t_3}{t_1 + t_3 - t_2}$$

The error in Mr. Smith's formulæ may explain why his feedback circuit shown in Fig. 4 does not appear to conform to the combined network diagram.

It can be easily demonstrated that the frequency response V_0/V of the combined networks above is exactly the same as the variation with frequency of the impedance seen looking back into the output terminals of the network, so that these networks can be used directly in the feedback loop of an amplifier to get the desired replay characteristic. A third network is also available giving the same impedance variation.

A practical circuit would be:—



FINE GROOVE	COARSE GROOVE
$mR = 3.5M\Omega$	$1.5M\Omega$
$C_C = 860pF$	$2,200pF$
$R = 270k\Omega$	$200k\Omega$
$C_D = 300pF$	$300pF$

If the gain of the valve is not enough to prevent the bass response from flattening off due to the feedback becoming inoperative, then the value of mR may be increased or even omitted.

E.M.I. Studios, London, N.W.8.

W. H. LIVY.

The Author Replies:

YOUR correspondent is quite right in taking me to task for misquoting the formulæ in Fig. 3. It will be noted that the expressions I gave are in fact approximations to the correct ones, since that for n may be rewritten as

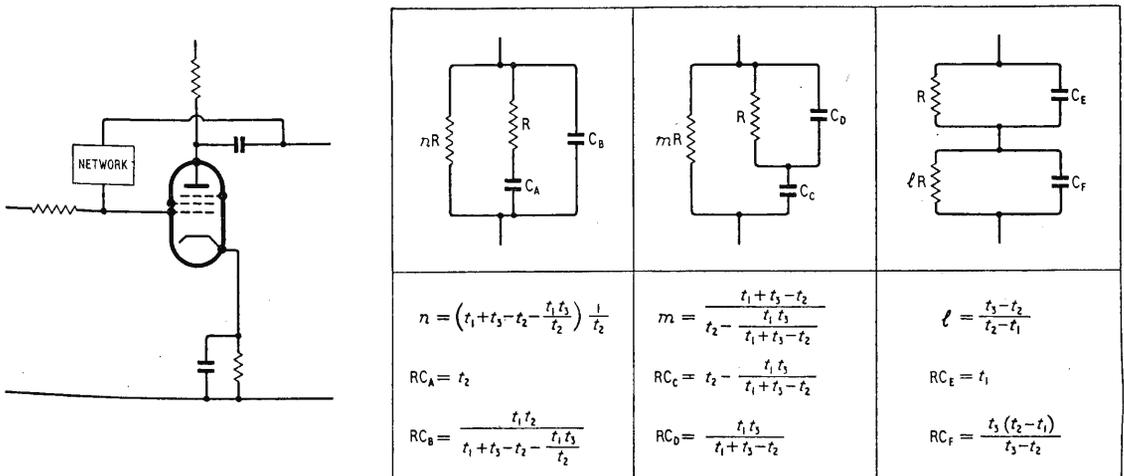
$$n = \left(\frac{t_3 - t_2}{t_2} \right) \left(1 - \frac{t_1}{t_2} \right)$$

which reduces to $\frac{t_3 - t_2}{t_2}$, as given, when $t_1 \ll t_2$. In either case $RC_B = \frac{t_1 t_3}{nt_2}$. Since Fig. 3.

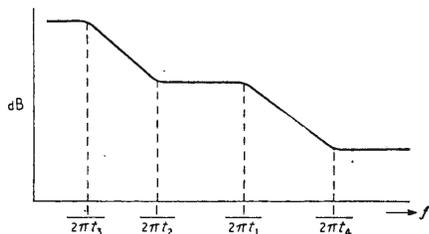
is intended to illustrate formal networks, I must apologise for quoting the approximate formulæ.

The approximation is valid when pre-emphasis is applied sparingly, as has been the practice in the past but which is scarcely true with the B.S.S. characteristics: the approximation is fair for the coarse groove case but somewhat gross for fine groove. The major inaccuracy is in the limitation of bass boost and does not exceed 2 dB, which for many purposes is sufficiently accurate.

The circuit of Fig. 4 of my article is not derived



directly from this combined network. Only two of the required time constants, t_1 and t_2 , are included in the feedback network itself; the third appears by virtue of the finite gain of the valve which limits the bass boost. (If a circuit is to be used for equalizing several characteristics, some of which require less boost, this can be reduced by means of R_3 .) There is a fourth time constant, t_3 , due to the fact that the h.f. cut does not continue indefinitely. Hence, the overall response is of the form:—



In practice, this highest time constant is not observed since it occurs beyond the pass-band of the amplifier. The conditions giving the three plateau regions were shown in Fig. 5. It is clear that the design of the equalizer involves a knowledge of the gain of the stage and even then is not quite straightforward because the feedback network provides frequency-dependent loading on the anode circuit, so modifying the response in a manner which tends to increase both the bass boost and treble cut and should be allowed for (most readily by experiment).

Note that under the bass boost condition the stage is working without feedback so that the maximum mid-band gain is realized. Against this it must be admitted that the limiting boost is dependent on valve parameters and therefore liable to change with ageing, etc.

The two practical circuits cannot be directly compared as they fulfil different operational requirements. The one given by your correspondent employs more feedback and hence gives equalization accurately controlled by the network elements, but at the expense of overall gain. In many instances, greater gain is required and this is achieved by raising the network impedance until the bass boost is limited by the available valve gain and not by the network itself. Under these conditions it is often convenient to include redundant resistors in order to avoid the use of inconveniently large values and the circuit may then take a form similar to that which I gave (which is in fact a derivative of the third network given in Mr. Livy's letter).

Watford.

J. D. SMITH.

Scale Distortion Again

"M. G. L." ends his review of a high-fidelity test record (December issue) by saying of loudness controls that they try "to reproduce an orchestra as it would be heard a long way away with the frequency balance as it would be audible much closer; and this cannot possibly lead to natural results."

The problem of scale distortion (loss in the ear of bass and treble at loudness levels less than natural) cannot be solved by ignoring it. The Fletcher and Munson curves show the loss of bass to approach 14 dB per octave at very low levels, and compensation is essential to hear the bass at all. Reproduction of an orchestra at full volume cannot be tolerated in ordinary rooms, and would be unnatural anyway. Reduction by ordinary (uncompensated) volume-control in effect removes the orchestra "a long way away" with loss of bass and treble, and makes the music thin, monotonous and tiring to listen to.

Reduction by compensated volume—so-called loudness—control effectively leaves the orchestra at its proper distance, but playing quieter (or with fewer members, if you will) as would be expected within the confines of

an ordinary listening room, and therefore IS more natural.

Absolute fidelity in the home cannot be hoped for, due to the many well-known causes, but compensation for scale distortion is a valuable aid to the illusion of naturalness and the pleasure of listening—the real aim.

Walsall, Staffs.

STANLEY MAY.

The Reviewer Replies :

I CANNOT agree with Stanley May's statement that "reproduction of an orchestra at full volume cannot be tolerated in ordinary rooms and would be unnatural anyway." The aim of correct reproduction is surely to produce in the ear the same sound pressures as would be produced in the ear in the concert hall. Subject to the usual distortions this can be achieved, and in the opinion of many people, including myself, leads to the most natural results. Many of us who share a belief in this standard think that music is often reproduced too loud by "hi-fi" addicts.

If an orchestra were to play quietly or with fewer members in the concert hall, owing to the scale distortion Mr. May mentions, the frequency balance heard would be different from that of a normal orchestra. Thus, even if for some reason we wish to reproduce our music as it would be played by such a smaller orchestra at the same distance as usual, it would be unnatural to compensate in the living room for a change which would remain uncompensated in the concert hall.

It is, however, possible that reproduction sounding like an orchestra which is the wrong size and has an incorrect frequency balance may be preferable to reproduction sounding like an orchestra of correct size and balance which is too far away. If we are restricted to these alternatives there may be some justification for Mr. May's use of a "loudness" control, but neither of these alternatives attempts to provide the correct reproduction that can to a large extent be achieved.

M. G. L.

The UL Circuit

I NOTED Grant's application (September, 1956, issue) of the UL circuit to single-sided pentodes with some interest. My company suggested this to a magazine editor here in the U.S. and he turned down the suggestion with the argument that it would not pay commercially since there is a patent licence problem.

A tap is required on a small and low-cost output transformer, and an engineer at one of the transformer companies was of the opinion that the tap cost would exceed that of an RC network for a conventional inverse feedback loop. Hence the UL circuit for a single-sided pentode doesn't seem to appear commercially attractive. However, in my opinion, it should work out better than an RC loop since there should be less trouble with poor "phase bandwidth" produced by a cheap output transformer.

TED POWELL.

Great Neck, L.I., U.S.A.

Audio Demonstrations

THE letters from C. Streatfield and H. Glover published in your October issue criticize the Radio Show demonstrations of sound-reproducing equipment and, in particular, the choice of programme material.

Perhaps the manufacturer who has the listener's ear for only a few minutes can be forgiven for trying to produce impressive rather than natural sounds. But if a test of naturalness is required, I, personally, remain convinced that speech is the best material. When well reproduced at the correct volume level the illusion of reality is, to me at least, greater than with other sounds well reproduced. But equipment which produces impressive bangs, crashes and tinkles doesn't necessarily seem to reproduce speech naturally.

London, N.W.7.

W. J. CLUFF.

High-Quality Sound Broadcasting

By
G. H. RUSSELL
Assoc. Brit. I.R.E.

THE USE AND MISUSE OF V.H.F.

THE main justification for v.h.f. sound broadcasting is the poor reception conditions in the lower frequency bands. At the same time, it offers an unprecedented opportunity for giving sound broadcasting a new lease of life. This can be done only, of course, by taking full advantage of the potentialities of v.h.f. and in particular the wide audio frequency range that it makes possible.

In this context it is illuminating to compare the following separate statements taken from a new report* on v.h.f. sound broadcasting in Europe.

"The programme input throughout is designed for a frequency band of from 30 to 15,000 c/s with all corresponding requirements of quality."

"Nor will any changes be made in the line network; most of the lines at present rented . . . transmit frequencies up to about 8,000 c/s, and the cost of increasing this bandwidth (except in the case of short lines to local transmitting stations) would be prohibitive."

The first comes from the German contribution and is representative of the attitude of all but one of the European broadcasting authorities who have launched v.h.f. broadcasting schemes. Even a small country like Austria is busy improving the studio equipment to extend it to 15 kc/s. The second quotation, one regrets to say, is from the B.B.C. contribution.

The attitude of the B.B.C. to this question of the upper audio frequency limit is incomprehensible. If they had said that a restriction to 8,000 c/s was an unfortunate temporary limitation and efforts to increase this limit substantially would be made as soon as possible, it would have been under-

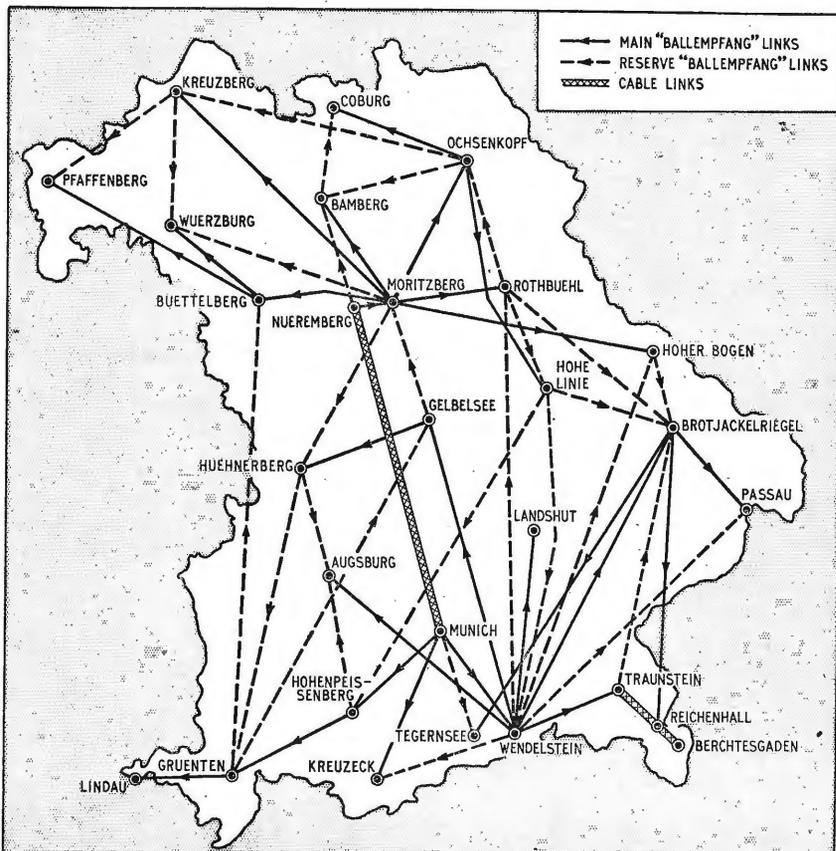
Except for the links between the studios at Munich and Nueremberg, and between three stations in the south-eastern "peninsular" the whole v.h.f. network of 28 stations in the area covered by Bayerischer Rundfunk operates on the system of direct re-broadcasting.

standable. Have the possibilities of unattended microwave links been examined? And has the question of direct re-broadcasting, which can be implemented at the cost of one aerial and one receiver per transmitter, been considered?

This system of direct re-broadcasting is being used extensively in Western Germany where it is known as *Ballempfang*. Indeed, it is also used by the British Forces' Network in that country.† The basis of the system is that signals from the originating station are received at the site of the nearest transmitter(s) where the demodulated signal is used to modulate the transmitter. Alternatively, the signal need not be demodulated but merely frequency transposed and re-radiated; this is called *Umsetzer*. It is self-evident that the cost of such a system will be only a fraction of that incurred by microwave or

* "The Present Position and Prospectives of V.H.F. Sound Broadcasting in Europe," Document Tech. 3068/E, published by the European Broadcasting Union.

† See *Wireless World*, February 1956.



cable links. The quality of the service rests upon that of the receiver at each station and the Germans claim that, with the receivers used, it is impossible to detect any degradation in quality even after six successive transmissions and re-transmissions.

One of the most complicated of these networks is that used by the Bavarian broadcasting authority and this is shown in the illustration. It is obvious that there are limits to the use of this system where a number of networks are used over a wide area involving many transmitters. Under these conditions one could conceivably arrive at the position where interference from another network could become a problem. In fact, this position has already arisen in Germany and, in future, cable links will be resorted to as the networks expand. Even so, all the cable links between transmitting stations and the extensions to the studio centres will eventually be able to transmit frequencies up to 10-11.2 kc/s.

Why Not in This Country ?

It is realized that with its present network of v.h.f. stations it would be impossible for the B.B.C. to employ *Ballempfang*. However, the ultimate aim is for about 30 stations to cover the country with a three-programme service, and it would be encouraging to know that the B.B.C.'s intention was to use direct re-broadcasting and/or radio links to give us the kind of reproduction of which v.h.f. is capable. High-quality transmission might re-create public interest in sound broadcasting and stop the rot to television.

In Italy v.h.f. broadcasting is spreading fast,* but for a rather back-handed reason. Like our own B.B.C., the Italian authorities decided to place the v.h.f. sound and television transmitters on the same sites. Initially, it was proposed to proceed at a fairly leisurely pace determined by the rate at which a coaxial cable network could be laid. However, the public demand for television proved so impatient that it was decided to abandon the coaxial link in favour of microwave radio links. This enabled the authorities to bring into service simultaneously all the television transmitters initially projected and, in addition, the service has been extended to 83% of the population instead of the 54% originally planned.

In order to bring the v.h.f. sound broadcasting service into operation equally quickly, direct re-broadcast links are used in all but a few cases where microwave links are again resorted to. It is interesting to note the operational system evolved on the various transmitting sites. These sites are divided into three categories: main, secondary and satellites, of which there are 19, 16 and 48, respectively. This classification has nothing to do with the importance of the stations but with staffing. Thus, the main stations are fully and continuously manned; the secondary stations have a permanent caretaker with a team of engineers in attendance for short periods; and the satellites, which are automatically switched on and off, have no permanent staff. There is a lovable Latin touch to the monitoring system adopted for the satellite stations. A local big-wig in the nearest town, such as the policeman or postman, is appointed to this task. If the transmission should fail, he can bring in a reserve transmitter by remote control, after which it is his duty to telephone a report to the nearest main station.

While on the subject of radio links, it is notable

* Italy now has 102 transmitters in service.

that Denmark is considering the possibility of combining both sound and television links with those for the multi-channel telephone circuits. This would enable common power supplies to be used with a consequent saving in cost.

Comparative Costs

In the E.B.U. Report a number of countries have given details of actual or probable costs of implementing v.h.f. networks. These are not of general interest except in the case of Sweden where an interesting cost comparison is made between v.h.f. transmission and wire distribution. Three proposals are put forward:

(a) A national f.m. network reinforced by wire distribution where reception is poor;

(b) National wire distribution; and

(c) F.M. transmitters for densely populated areas with wire distribution elsewhere.

The estimated cost for each of these schemes is £56M, £81M, and £52M, respectively. There does not seem to be much to choose between them. However, when the cost to the listener in new receivers or connecting cords for wire distribution is added, the picture becomes very different. This adds a further £115M, £8M and £95M, respectively. In spite of the economic factors, the Swedes have decided to adopt proposal (c), mainly on the grounds that radio distribution would enable a second programme to be brought to the densely populated areas much sooner than if wire distribution only was used.

Without wishing to resurrect the now very dead f.m. versus a.m. controversy, it is illuminating to compare the Swedish and British approaches to alternative systems. The figures presented to our Television Advisory Committee dealt with the capital cost of erecting and maintaining the transmitters only and left out the cost to the listener entirely. As can be seen from the Swedish figures, this cost can represent a substantial charge on the national income. It is to be hoped that on any future similar occasions which may arise this important factor will not again be omitted.

Before leaving the subject of wire broadcasting, it should be mentioned that no reference is made to it in the Swiss contribution despite the fact that Switzerland already has a first-rate network. Nevertheless, a network of f.m. transmitters is to be erected.

Because of the complex network of v.h.f. transmitters in Western Germany, v.h.f. portables and v.h.f. car radio have become popular. A further interesting development in Germany is the marketing by several firms of receivers that are able to receive television sound in addition to Band II transmissions. The purpose underlying this is that the addition of a simple vision-only receiver converts it into a combined sound and television receiver. It should, of course, be noted that the German television system uses f.m. sound and, furthermore, that v.h.f. sound broadcasting came before television in Germany.

A final note with a dreadful warning from Germany. The use of a 10.7-Mc/s intermediate frequency with poorly protected oscillators has resulted in "a critical situation so far as the final development of the v.h.f. network is concerned." There appear to be four million such receivers in use in Western Germany. No further comment is necessary.

Cascode Characteristics

GRAPHICAL METHOD OF CONSTRUCTION

By W. GRANT, B.Sc.

THE derivation of cascode characteristics by the use of the mathematical formulæ is a useful method of estimating the working parameters rapidly. It can, however, be misleading and a graphical approach presents a clearer picture and may lead to a better appreciation of the cascode mode of operation.

The static I_a/V_a curves of "single" valves are drawn with V_a and V_g stated relative to the cathode. The static curves of valves in the cascode connection are likewise stated relative to the cathode of the lower section. Fig. 1(a) shows the connection of two triodes in cascode indicating the voltages to which reference will later be made and the currents which do or may flow. Since the purpose is to derive the static characteristics no anode load is shown. Fig. 1(b) shows the d.c. voltage vectors for the general case.

In straight cascode operation V_{gc} is fixed and for the purpose of measuring the static curves V_{g1} may be fixed at each of several values while V_{ac} is varied in steps over the working range at each fixed value of V_{g1} , or *vice versa*. The curves of Figs. 5(b) and (6b) were measured using the first of these alternatives.

Figs. 2(a) and 2(b) show the I_a/V_a curves of two triodes. Fig. 2(a) will be considered to represent the lower section and Fig. 2(b) the upper section of a cascode pair of which the I_a/V_a curves are displayed in Fig. 3 and are derived as follows.

It will be seen from Fig. 1 that

$$V_{a1} = V_{k2} = V_{gc} - V_{g2} \quad (1)$$

$$\text{and } V_{a2} = V_{ac} - V_{k2} = V_{ac} - V_{gc} + V_{g2} \quad (2)$$

Equation (1) defines the constancy of V_{a1} and V_{k2}

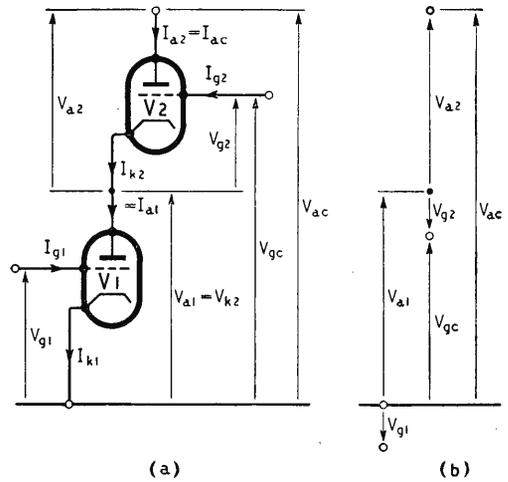


Fig. 1. (a) Cascode arrangement with voltage and current symbols used in the text. (b) Voltage vectors.

(the origin of the I_a/V_a curves of the upper section) for any constant value of V_{g2} . These two deductions from equation (1) make the graphical determination of cascode characteristics rapid and simple. The routine is tabulated below. The "something over" and "somewhat" become self-evident as the tabulation proceeds.

- (1) Set out the I_a axis to a value equal to I_{a1} at V_{a1} equal to the proposed V_{gc} and something over, and the V_a axis to the supply voltage available, say 500 V.
- (2) Erect the I_{a1}/V_{a1} curves (marking them lightly) for all relevant values of V_{g1} up to a value of V_{a1} somewhat exceeding V_{gc} .
- (3) Since $V_{k2} = V_{gc}$ when $V_{g2} = \text{zero}$, erect the I_{a2}/V_{a2} curve for $V_{g2} = \text{zero}$ taking V_{gc} as the origin of the curve.
- (4) Mark off on the curve of step (3) the currents

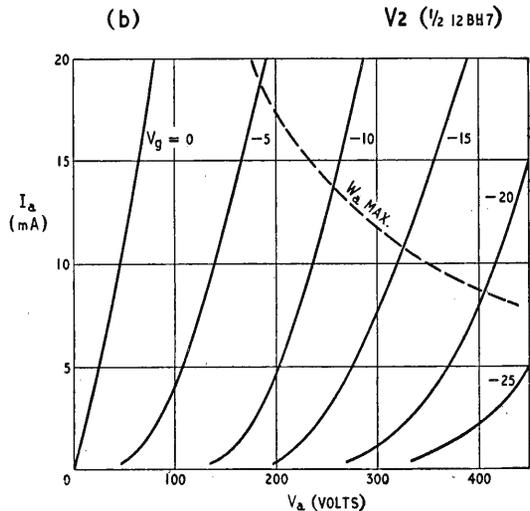
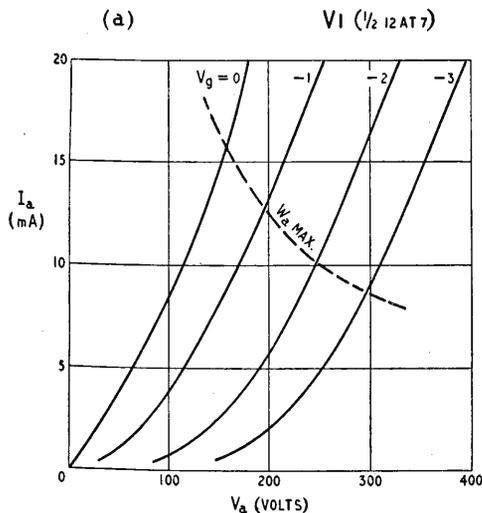


Fig. 2. (a) and (b) Representative characteristics of two dissimilar triodes.

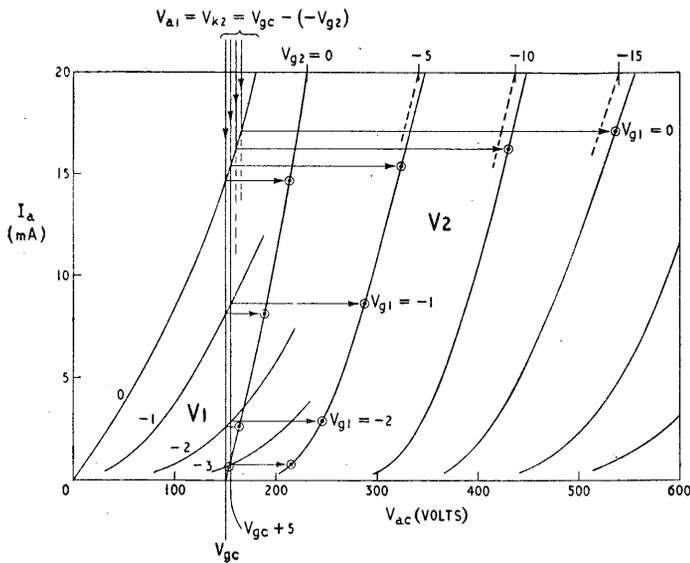
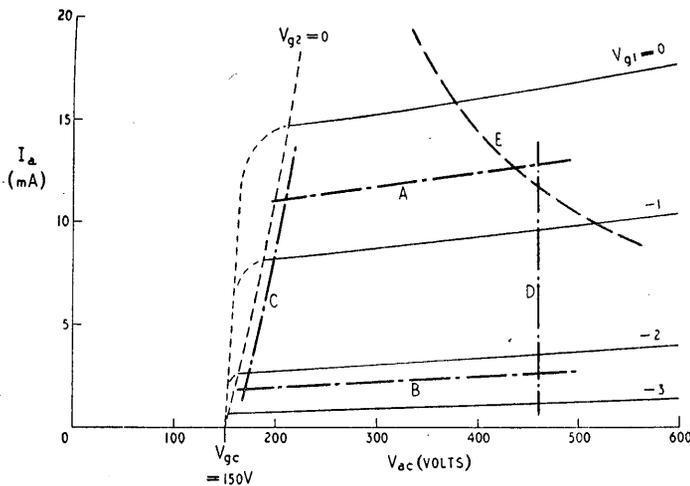


Fig. 3. Construction of cascode characteristics. Note that the curves of V1 are the same as in Fig. 2 (a), but that the origins of the V2 curves are successively displaced to the right by increments equal to the bias V_{g2} .



I_{a1} at $V_{a1} = V_{gc}$ for $V_{g1} =$ zero, -1 , -2 volts, etc.

(5) Choose a convenient value of V_{g2} , say -5 volts, and erect the I_{a2}/V_{a2} curve for $V_{g2} = -5$ taking $(V_{gc} + 5)$ as the origin.

(6) Mark off on the curve of step (5) the currents I_{a1} at $V_{a1} = (V_{gc} + 5)$ for $V_{g1} =$ zero, -1 , -2 , etc. Steps (5) and (6) are to be repeated for larger values of V_{g2} , making the appropriate adjustments in the origins of the I_{a2}/V_{a2} curves, until the defining points are plotted as far as desired or the data allows.

(7) Join up all points corresponding to $V_{g1} =$ zero, those corresponding to $V_{g1} = -1$, and so on.

Carrying the argument to the left of the curve $V_{g2} =$ zero (step 3) it is seen that V_{g2} becomes positive and I_{a2} becomes less than I_{a1} by I_{g2} . Given the I_a/V_a data in the V_g positive region and also the I_g/V_g data for the upper section, the curves may be completed. Such data is published for very few valves so all that can be said is that I_{a2} falls off in some unknown fashion. This is seldom of importance since the area is valueless for linear amplification.

The working boundaries are marked on Fig. 4: they are:—

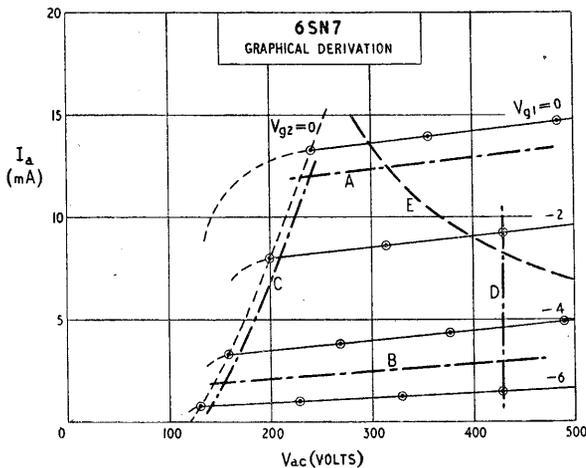
A, the onset of grid current, I_{g1} , in the lower section. This is a strict limit if the grid is returned to chassis through a resistor but may, of course, be relaxed if the return is through a coil of negligible resistance.

B, the limit of linearity of V_{g1} . This is variable and depends on the degree of distortion which can be tolerated.

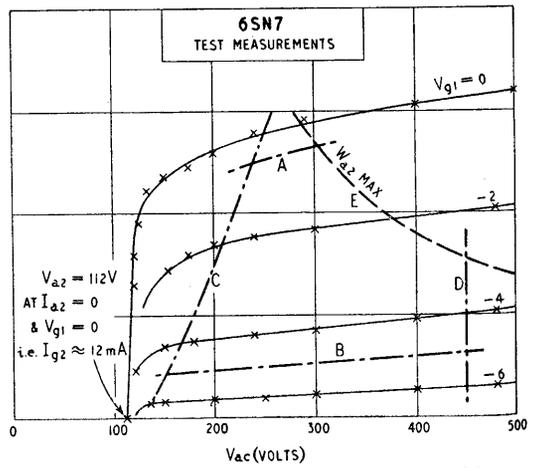
C, the onset of grid current, I_{g2} , in the upper section. This is a limit to be respected as $I_{a2} = I_{a1} - I_{g2}$.

Left: Fig. 4. Complete curves developed by the method of Fig. 3 with the addition of working boundaries for linear operation.

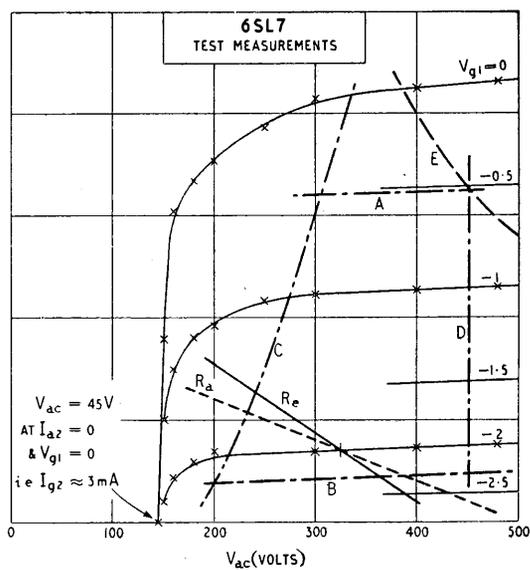
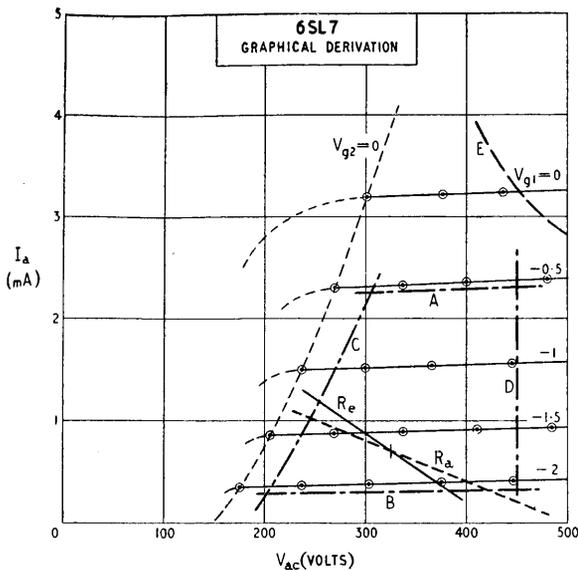
Below: Fig. 5. Characteristics of a 6SN7 cascode stage; (a) graphical construction (b) measured.



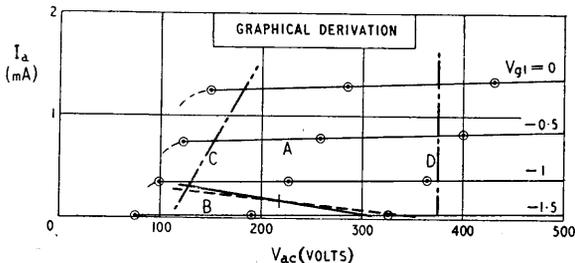
(a)



(b)

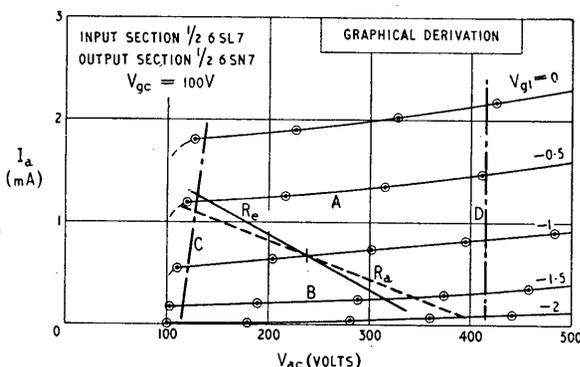


(a) Graphically constructed, and (b) measured characteristics of 6SL7 cascode stage for $V_{gc} = 150V$.



Above: Fig. 7. Cascode characteristics of 6SL7 with $V_{gc} = 75V$.

Right: Fig. 8. Demonstrating the advantage of a low-impedance "upper" section ($V_1 = \frac{1}{2}$ 6SL7, $V_2 = \frac{1}{2}$ 6SN7) $V_{gc} = 100V$.



D, V_{ac} max. = (for all practical purposes) $V_{gc} +$ rated V_{a2} max. which in normal usage denotes the maximum supply voltage. Some liberty can usually be taken with this limit, but on the other hand noise is liable to increase with V_a and this should be taken into account in low-level stages.

E, W_{a2} max. This is for all practical purposes the W_{a2} curve shifted by V_{gc} .

Fig. 5(a) presents the graphical derivation of the characteristics of a 6SN7 cascode stage, and Fig. 5(b) displays the results of test measurements made on a 6SN7 valve of RCA manufacture chosen at random. The agreement of the two curves is good and any load line chosen from the derived curves is satisfactory when transferred to the measured curves, if permissible tolerances are borne in mind.

Fig. 6(a) presents the graphical derivation of the characteristics of a 6SL7 cascode stage, and Fig. 6(b) the results of test measurements. The agreement is good for μ and, although the measured valve runs at a higher current, g_m is only 15% high. Again, any load line chosen from the derived curves is satisfactory when transferred to the measured curves. A load line $R_e = 150$ k Ω , representing the following grid resistor $R_g = 400$ k Ω , in parallel with the anode load $R_a = 250$ k Ω , is drawn on both curves.

This demonstrates the importance of adjusting such critical circuits to designed anode current rather than to grid bias voltage.

Low values of V_{gc} are sometimes useful. Fig. 7 shows the cascode characteristics of a 6SL7 at $V_{gc} = 75$ V when, with an anode resistor of 1 M Ω and following grid resistor of 2 M Ω , the gain is approximately 400 and the safe peak output voltage is at least 60 V.

Fig. 8 shows that there are advantages in using an upper section of low impedance if the largest possible output voltage is required with modest h.t. supply and values of R_a and following R_g appropriate to an output stage.

The graphical determination of the cascode curves, given any pair of triodes, is quickly made and presents a clear picture of the properties and limitations of that cascode pair. The determination of the cascode characteristics by the use of formulæ is less accurate unless tediously repeated for many points from data which have in most cases to be found by measurements made on the triode curves. The formulæ, however, do supply the quickest estimation of the dynamic properties of a cascode pair provided the appropriate values are inserted. It is easy to choose the appropriate values by reference to the foregoing.

The general formulæ are included here for completeness; subscripts 1, 2 and *c* denote respectively lower section, upper section and cascode.

$$\mu_c = \mu_1(\mu_2 + 1) \quad \dots \quad (3)$$

$$r_{ac} = r_{a1}(\mu_2 + 1) + r_{a2} \quad \dots \quad (4)$$

$$g_{mc} = g_{m1} \frac{\mu_2 + 1}{(\mu_2 + 1) + \frac{r_{a1}}{r_{a2}}} \quad \dots \quad (5)$$

It is as plain as an outdoor aerial that the analogy with tetrodes must be neither taken for granted nor pressed too far.

The author wishes to record his debt to the Principal of Woolwich Polytechnic for experimental facilities, and would refer readers to the article by "Cathode Ray" on "The Cascode," W.W., Aug. 1955, p. 397, and to the articles mentioned therein.

Fish-Finding Asdic

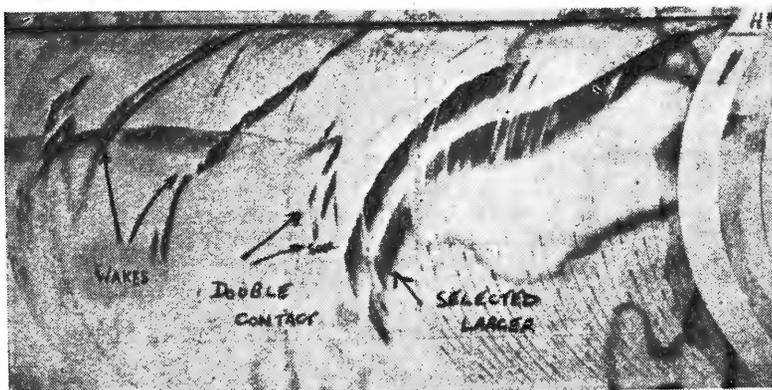
ECHO sounders, designed primarily to show depth of water, have been used extensively in fishing vessels to detect shoals and even individual fish; but many valuable catches must have been missed because there has been no means of revealing fish other than those which pass immediately below the keel. By scanning in a horizontal plane with supersonic pulses, on the same principle as that used in the asdic submarine detection equipment, a much wider sea lane can be swept for fish.

Kelvin Hughes have now produced a prototype fisherman's asdic for this purpose with a range up to 2,000 yards which has given promising results in sea trials.

The pulse transmitter and receiver unit (transducer) is mounted on a vertical column working through a gland in the ship's hull and can be retracted into a fairing when not in use. It can be rotated by remote control in 5° steps and an automatic mechanism can be set to advance the bearing by this amount at each pulse when making a sweep. The beam width is 10° and the pulse train is at 50 kc/s (1kW) with alternative durations of 1 and 10 milliseconds.

A heterodyne receiver circuit may be used with

Shown on the right is the transducer unit which has a beam width of 10° at 50 kc/s. Below is a specimen chart showing two large fish shoals. The discontinuities are the result of alterations in the range scale.

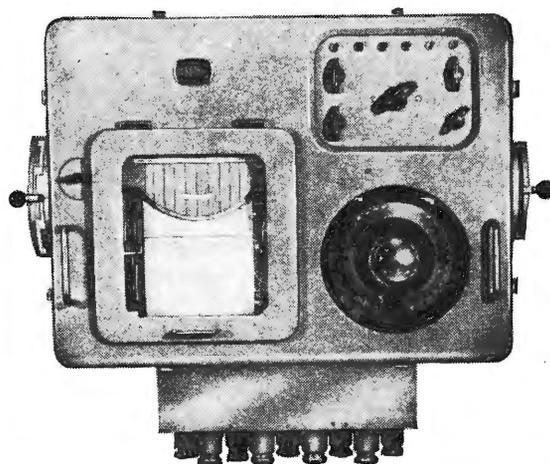


headphones or loudspeaker for watch keeping, and the output can be switched to a recorder for accurate ranging when an echo is to be investigated.

Some degree of skill and experience is required if full advantage is to be taken of the information provided by this equipment. There are many sources of echoes, including scattering from the bottom, the water surface in rough weather, and the wakes of other vessels in otherwise smooth water.

The accompanying specimen record shows, in the left-hand half, the traces of wakes which decrease in range until they are crossed (at the zero line running along the top). The horizontal echo running through the wake traces is from the sea bottom. In the middle of the picture may be seen the first contacts with two shoals followed by a change of range scale as the distance is closed: the difference in size of the shoals can be clearly seen. The curved dotted traces in the bottom right-hand corner are due to interference from the ship's echo sounder which was also working.

Given reasonable weather and intelligent operation, there is little doubt that this new equipment is capable of showing considerable economies in steaming time in search of fish, which will more than offset the initial cost (of the order of £2,500).



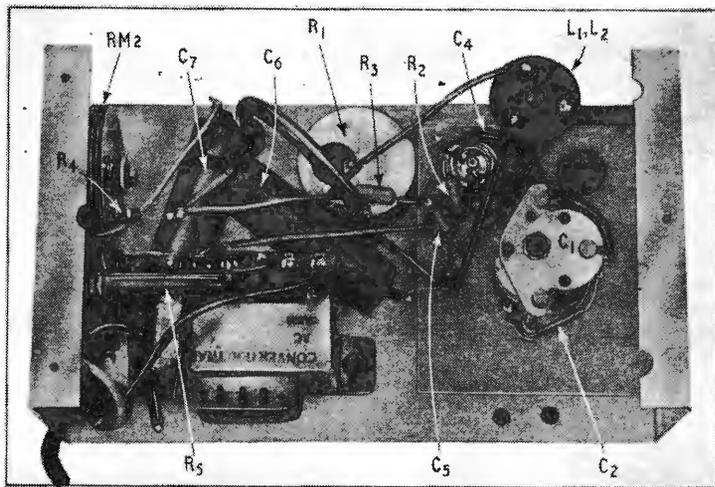
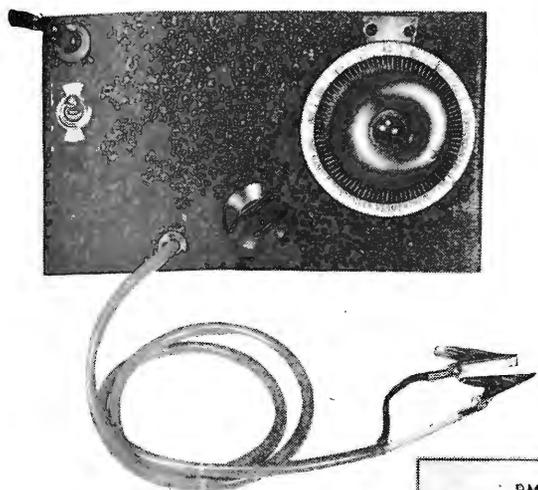
Wheelhouse control unit of the Kelvin Hughes fisherman's asdic. The beam bearing scale is on the right.



Simple V.H.F. Test Oscillator

Minimum Requirement for
Aligning an F.M. Receiver

By BERNARD DRIVER



General view of the oscillator removed from its case. All the components are readily identified.

THE lack of some form of signal generator can be an insuperable difficulty when contemplating the alignment of a v.h.f. receiver. It is, perhaps, not generally realized that a simple oscillator, as described in this article, if judiciously handled will enable a satisfactory alignment to be achieved.

The basis of the circuit, which is shown in Fig. 1, is that described by H. B. Dent in the December 1952 issue of *Wireless World*. Instead, however, of employing separate oscillator coils and valves for signal and intermediate frequencies a single Hartley oscillator is used, the 90-Mc/s range being provided by harmonics. Since modulation was not considered essential, the transitron modulator is omitted, but there is ample space for the additional valve and components inside the case, which measures $7\frac{1}{2}$ in \times $4\frac{1}{2}$ in \times $2\frac{1}{2}$ in, if the refinement is required.

The oscillator coil consists of 38 turns of 26 s.w.g. enamelled wire on a $\frac{1}{2}$ -in diameter former, tapped 7 turns from the earthy end. The r.f. output is taken from a separate pick-up coil, consisting of a further 3 turns, spaced $\frac{1}{8}$ in from the earthy end of the oscillator coil. Full winding details of the coil will be found in the article to which reference has already been made.

The valve is an acorn triode, Type 955, and in order to save space the connecting wires to the valve are soldered direct to the tips of the valve pins, a heat shunt being attached to each pin whilst applying the soldering iron. The writer has found that a sliver of ice is an efficient substitute for the crocodile-clip type of heat shunt, where space does not permit the latter's use.

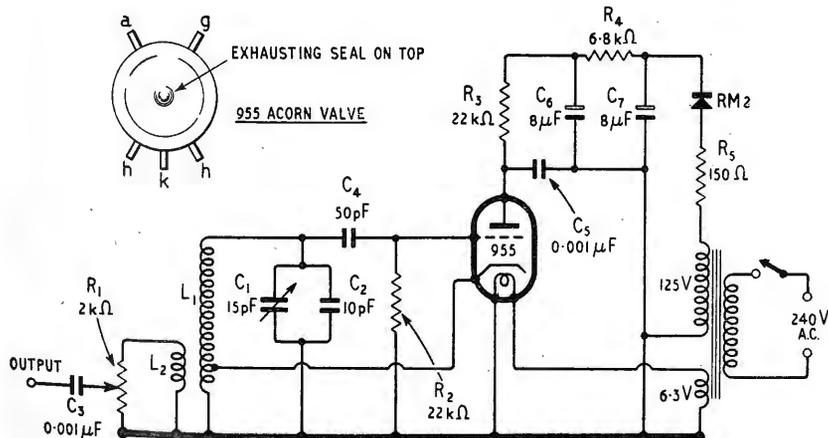


Fig. 1. Theoretical circuit diagram of the v.h.f. test oscillator.

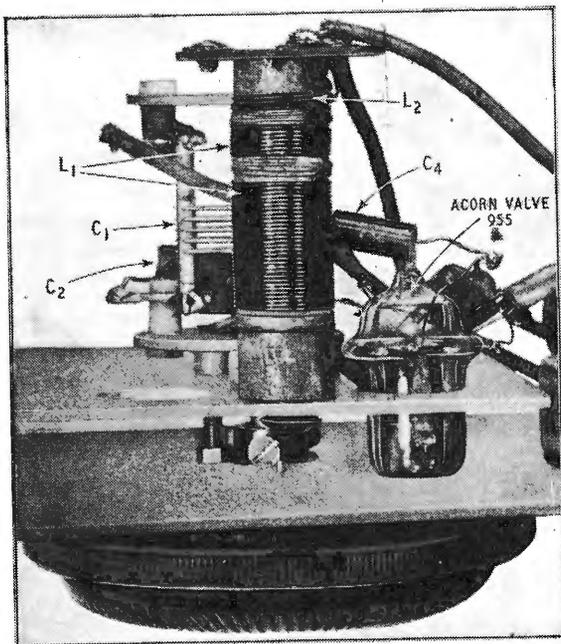
The instrument can be calibrated with a fair degree of accuracy by the following method, which requires only a v.h.f. receiver capable of receiving the B.B.C. transmissions, and whose i.f. stages are tuned, at least approximately, to 10.7 Mc/s.

The first step is to plot the oscillator dial readings against fundamentals in the range 9.5 to 12 Mc/s. Connect the output from the oscillator, with 2-kΩ potentiometer (R_1) at maximum, to the aerial socket of the receiver. If the receiver has an i.f. trap in the aerial circuit, short it out. Upon tuning C_1 , between maximum and minimum capacitance a number of responses will be heard. The i.f. fundamental can be readily identified since manipulation of the receiver tuning control will not tune it out.

The capacitance given for C_2 is approximate only, and if the fundamental cannot be found initially it may be necessary to try a different value capacitor.

In the unit constructed by the writer, the calibrated portion of the scale occupies about 60 degrees only, and it might be found desirable to apply band-spreading by reducing the value of C_1 and increasing that of C_2 . This would facilitate making, for example, a point-to-point measurement of a discriminator characteristic of sufficient accuracy to indicate quite a small degree of non-linearity. Figs. 3 and 4 are actual curves plotted with this oscillator.

Having noted the position of the i.f. fundamental on the oscillator tuning dial,



Close-up of the coil showing the method of construction.

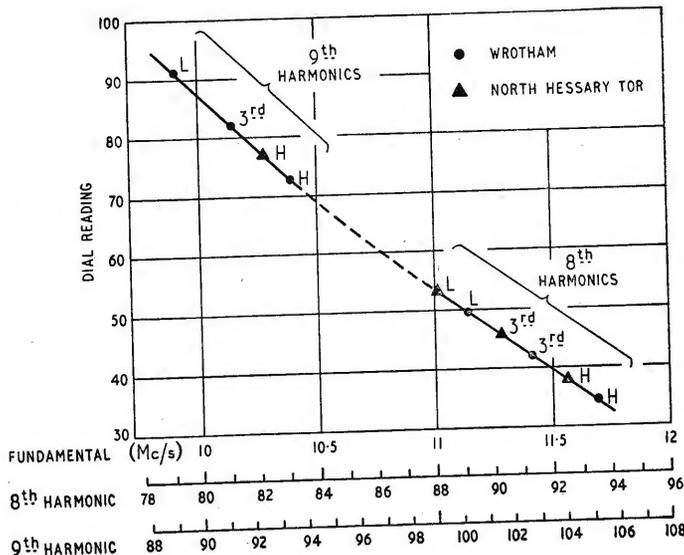


Fig. 2. Frequency calibration curve obtained by plotting the 8th and 9th harmonics of the oscillator beating with the Home, Third and Light programmes of Wrotham and North Hessary Tor. The fundamental is deduced from these readings.

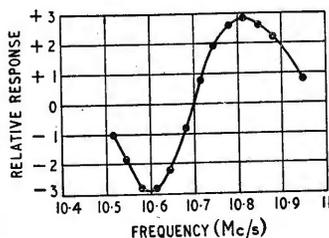


Fig. 3. A ratio-detector characteristic curve plotted with this oscillator.

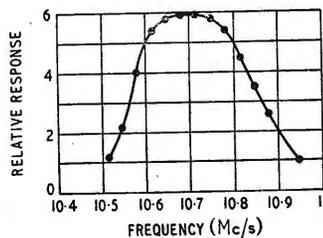


Fig. 4. Overall frequency response of the i.f. amplifier of an f.m. receiver.

with the aerial as well as the oscillator output, connected to the receiver input socket as before, and with the receiver tuned to the Home Service, slowly increase C_1 until a beat note is heard in the loud-speaker. This will be due to the 9th harmonic of the oscillator fundamental beating with the broadcast signal. It is easier to tune the oscillator to the null point of this beat note when the broadcast carrier is not modulated, and it may be necessary to reduce the output from the oscillator to avoid swamping the receiver. Having found the null point, the oscillator dial reading may be plotted against the fundamental, which is $f/9$ where f is the carrier frequency of the test signal.

Then tune the receiver to the Third and Light programmes successively, repeating the process outlined above by slowly increasing C_1 to produce a beat note in each case, plotting the results after dividing the respective carrier frequencies by 9, as before.

Now reset the oscillator dial to the reading originally noted, giving the intermediate frequency of the receiver. Leaving the latter tuned to the Light programme, slowly decrease C_1 until the first beat note encountered above the intermediate frequency is heard. This will be the 8th harmonic of the oscillator fundamental, and when the null point has again been found, the dial reading may be plotted against frequency using the formula $f/8$. Retune the receiver

to the Third and Home transmissions successively, reducing C_1 to produce beat notes and plotting the dial readings as before.

By joining up the three points plotted from the 9th harmonic, and the three points plotted from the 8th harmonic, two curves will now be obtained, and assuming that the receiver has throughout been tuned to one or other of the transmissions from Wrotham, these will probably be similar to the curves shown by solid lines in Fig. 2. Here, however, additional points were obtained from North Hessary Tor.

It now remains to connect the two curves, as shown by the dotted portion in Fig. 2. This, as will be seen, is bound to be an approximation, but assuming a reasonably linear characteristic a fair degree of accuracy will be achieved if the dotted portion is drawn as a straight line. In addition, either end of the completed curve may be extended, if required, either notionally or by using as reference points the

carrier frequencies of any other receivable v.h.f. transmissions. A v.h.f. scale can be added along the base line of the calibration chart as shown in Fig. 2.

The frequency stability of the oscillator is good, apart from a slight positive drift which takes place during the warming-up period. As the extent of this drift depends largely on the nature of the coil former, compensation can be effected by selecting a negative temperature coefficient capacitor for C_2 , or possibly a combination of capacitors having negative and positive characteristics. The direction of drift can readily be ascertained by heterodyning a harmonic of the oscillator with a carrier of known frequency stability in the manner described earlier in this article. If, after setting C_1 to the null point, the frequency of the beat note changes, and it is necessary to decrease C_1 to restore the null point, the temperature coefficient of the circuit is clearly positive, and *vice versa*.

COMMERCIAL LITERATURE

Ferrite Cores for various applications, as well as iron-dust and flake-iron cores, are among the materials and components described in an illustrated brochure devoted to the products of the Chemical and Metallurgical Division of Plessey. Applications as well as physical properties and parameters are discussed. Obtainable from the Company at Wood Burcote Way, Towcester, Northants.

Germanium Diodes and Transistors.—The Telefunken manual mentioned in our last issue can be obtained from Tellux, West Mall Works, 27-29, Rabbit Row, London, W.8, who are agents for these products in Great Britain.

Components and Accessories, including coil packs and turrets, and drilled chassis and kits of parts for popular receivers and amplifiers. A general catalogue, with many detailed drawings, from Denco (Clacton), 357-9, Old Road, Clacton-on-Sea, Essex, price 9d.

Record Changer in which the required speed, record size and appropriate needle are all selected in one movement by a single control device. Improved version of an earlier model, with heavy turntable, new removable pick-up arm with ceramic crystal cartridge, and lower overall height. Brochure on the RTW-6 from Luxor Radio, Motala, Sweden.

Oscilloscope, with 3½-in. p.d.a. tube, suitable for pulse and television work. The Y amplifier has a response to 6Mc/s with no overshoot or ringing and a sensitivity of 50mV per 0.8-cm graticule division. Time base, triggered or repetitive, variable from 0.2sec to 3μsec. Specification and description on a leaflet from Telequipment, 313, Chase Road, Southgate, London, N.14.

Relays by various manufacturers, including aerial, coaxial, polarized, galvanometer and other special types. Illustrated leaflet giving brief specifications of about 70 different models, from Radio-Relais, 18, Rue Crozatier, Paris 12, France.

Low Frequency B.F.O. covering 2c/s to 4kc/s in two ranges, on logarithmic scale, which can be swept automatically at predetermined rate by flexibly coupling tuning capacitor to pen recorder or other motor. Automatic output regulator maintains constant output to within 1 or 2 dB. Output impedance 6, 60, 600 or 6000 ohms. Leaflet from B & K Laboratories, 59, Union Street, London, S.E.1.

Moulded Knobs, Handwheels and Dials.—An illustrated catalogue from the British Electric Resistance Co., Queensway, Enfield, Middlesex.

Television and F.M. Distribution System (Dumec) for hotels, showrooms, etc. A range of accessories, including attenuators, filters and outlet boxes, has been developed for extending the system and is described in a leaflet from Rainbow Radio Manufacturing Company, Blackburn, Lancs.

Equipment Handles of simple design in brass, chromium plated or gold oxidized, with 2 B.A. tapped holes. Leaflet from Harwin Engineers, 101-105, Nibthwaite Road, Harrow, Middlesex.

Instrument Control Knobs and general purpose types. An illustrated leaflet showing the range available from Uncles, Bliss and Co., New Parade, Cherry Orchard Road, East Croydon, Surrey.

Midget Prefabricated Cabinets (Widney Dorlec), made up from basic components of slotted corner rods, thin side panels to fit in the slots and thick top and bottom panels (see our April, 1956, issue, p. 179). Illustrated brochure and price list of the various components from Hallam, Sleigh and Cheston, Oldfield Road, Maidenhead, Berks.

Fractional H.P. Geared Motors for slow speeds between 0.2 and 840 r.p.m. Also centrifugal electric pumps, extraction fans, sump pumps, mains transformers (including variable types), meters, sliding resistors and synchronous timing devices. Illustrated leaflets from M.R. Supplies, 68, New Oxford Street, London, W.C.1.

Tape Recorder, two-speed, with 4-watt amplifier and three loudspeakers—a 6-in elliptical type with two 2½-in treble units. Frequency response 50c/s-9kc/s at 3¼ in/sec and to 13kc/s at 7½ in/sec. Fast forward or rewind time: 1½ minutes. Description and specification of Model TK8-3D from Grundig (Gt. Britain), 39-41, New Oxford Street, London, W.C.1.

Components and Accessories; an illustrated catalogue for November, 1956, from Radiospares, 4-8, Maple Street, London, W.1.

CLUB NEWS

Bradford.—The meeting of the Bradford Amateur Radio Society on January 15th will be held at the Bradford Technical College where Dr. G. N. Patchett will speak on television. On January 1st G. F. Craven will discuss automation, and on the 29th A. Davies (G3INW) will deal with simple receivers. These two meetings will be held at 7.30 at Cambridge House, 66, Little Horton Lane. Sec.: F. J. Davies (G3KSS), 39, Pullan Avenue, Eccleshill, Bradford, 2.

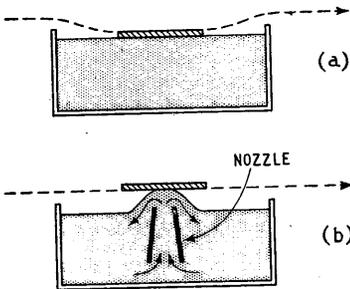
Leicester.—A symposium on mobile operation will be presented at the meeting of the Leicester Radio Society on January 14th. A fortnight later R. Macqueen (G3DVP) will speak about the Clapp V.F.O. on 28 Mc/s. Meetings are held at 140, Highcross Street. Sec.: J. Tranmer, 4, Grotoc Road, Evington, Leicester.

Newbury.—At the meeting of the Newbury & District Amateur Radio Society on January 25th at 7.30 at Elliott's Canteen, West Street, L. A. Parnell (G8PP) will speak on world-wide commercial communication.

Wellingborough.—"Principles of radar" is the title of E. Wright's address to members of the Wellingborough and District Radio & Television Society at their meeting on January 3rd. On the 24th G. A. Wilford will deal with the principles of television. The club meets every Thursday at 7.30 at the Silver Street Club Room. Sec.: P. E. B. Butler, 84, Wellingborough Road, Rushden, Northants.

Technical Notebook

Improved "Dip" Soldering of printed circuits is offered by a new technique in which the work is not actually dipped as at (a) but passed continuously at 2-4ft per minute over a wave of molten solder forced up by a nozzle in the bath (b). This avoids the discontinuity of the dipping or rocking movements normally required and the consequent break in production flow. Fry's Metal Foundry, who have introduced a machine embodying this idea, claim that it allows flexibility in the rate of production and the size of circuit boards. There is positive expulsion of flux gases, freedom from trapped flux which may prevent wetting, and a reduction of "icicles" and "bridging." The stream of solder is consistently clean, and, being continuous, prevents surface cooling, thereby allowing a lower working temperature or a shorter contact period.

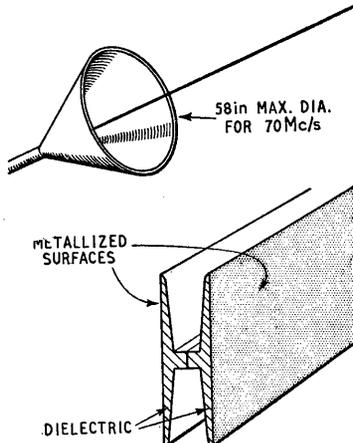


Wide Magnetic Tape, 1 inch across, seen at a recent E.M.I. electronics exhibition, was stated to be suitable for recording television signals. The composition was slightly different from sound-recording tape. An experimental television-on-tape recording equipment is being developed by the B.B.C. Research Department and details can be expected within the next few months.

Symmetrical Transistors are rather rare devices in which the two outside electrodes have interchangeable roles. Each can act as either emitter or collector, depending on the polarity of the applied voltages. Only one commercially available version, the S.T.C. type TS4, appears in *Wireless World* "Radio Valve Data." Curiosity about possible applications was partly satisfied at the

recent I.E.E. Ferrites Convention, when D. S. Ridler and R. Grimmond described a transistor access selector for their new drilled-block ferrite storage device (see Dec., 1956, issue, p. 596). In this selector the symmetrical transistors are used for gating both positive and negative pulses.

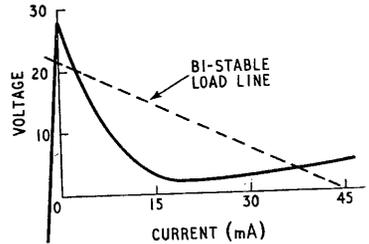
Open-sided Lines are the latest thing for simple and cheap transmission of r.f. energy. One example is a single-wire line connecting a remote aerial to a television distribution system (*Radio and Television News*, Nov., 1956). The characteristics are those of a coaxial cable with its outer conductor at infinity, and wave propagation is largely axial. The line is connected to ordinary coaxial input and output cables by means of large metal cones (see sketch) which make the transition between the "outers" and the infinite spacing. Losses, which increase with bends, are 10-20dB per mile, and intermediate amplifiers are needed to cover the 15-mile stretch. Another example is waveguide of H-shaped cross-section, open at top and bottom (*Electronic Industries*, Nov., 1956). Intended for millimetre waves, it consists of a plastic moulding with metal-



lized coatings on the legs of the H (see sketch). Attenuation decreases with increasing frequency, and less than 0.1% of the energy travels outside of the guide. Fabrication and jointing are simple.

Negative-Resistance Transistor recently introduced by General Electric

in America has a characteristic like a point transistor that will give a regenerative switch-over action in bistable switching and computing circuits (see figure). At the same time it has the uniformity, stability and reliability of a junction type. The Unijunction transistor, as it is called, is made from silicon and so can be operated at high temperatures. Because of its characteristic it will do



the work of the two junction transistors normally required in a bistable trigger circuit. This should make possible a considerable simplification in the design of switching and computing equipments using large numbers of transistors, with consequent reduction of size and cost.

Binary v. Decimal notation was discussed by Dr. M. V. Wilkes at a recent I.E.E. meeting on data processing equipment. Many people have assumed that the decimal form is more suitable for data processing since very little computing is involved, and conversion to and from binary is a waste of time. Dr. Wilkes stressed, however, that a paramount problem in many data-processing systems is that of storing large quantities of information, and this can be done a good deal more efficiently by binary techniques.

Transistor Biological Amplifiers have distinct advantages over those using thermionic valves because of low microphony—normally a source of trouble on biological recordings. Moreover, their compactness allows them to be operated very close to the subject. This avoids the need for long input leads which can pick up interference and mask the required waveform. A four-stage transistor pre-amplifier for electromyography with a noise output of only $15\mu\text{V}$ is described by R. E. George in Vol. 7, No. 1 of the *Proceedings of the Electro Physiological Technologists' Association*.

Telephone-line Television, made possible by slow scanning, illustrates the communication theory principle that you can transmit a lot of information in a narrow-bandwidth channel if only you take sufficient time over it. In one system, developed by Thompson Products for transmitting still pictures of documents (*Electronics*, Nov. 1956), the scanning rate is 2-7 complete



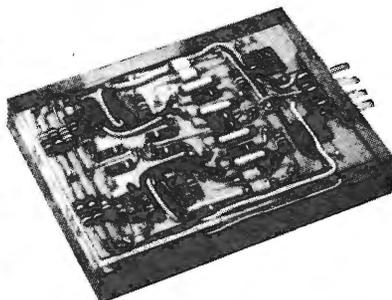
5-in photo-multipliers with colour filters are disposed about the studio, and can be arranged to get "lighting" effects as if they were light sources. During scanning the studio has to be completely dark, but a form of lighting can be provided by pulsing lamps in the frame suppression periods. The system is more suitable for low-cost industrial television, but has certain advantages for broadcasting; e.g., no high-power studio lighting and air-conditioning required, good colour match between different scanners (since the photo-multipliers are common to them all) and short warm-up and adjustment time.

U.H.F. Receiving Valves for Bands IV and V are now coming on to the market—colour television and mobile

radio being two likely future applications. One might expect such valves to look rather unusual. In fact they are just like conventional B7G and B9A miniature types, except for the planar type of electrode structure inside. A recent one from G.E.C. is the A2521, a low-noise triode suitable for use as an r.f. amplifier in the 500-1,000-Mc/s region (see picture). Its slope is notably high at 12 mA/V, and the noise factor varies between 9 and 12 dB, depending on the frequency.

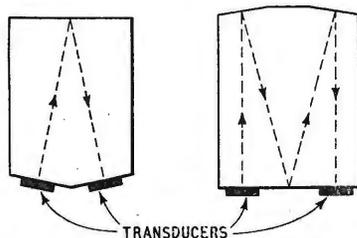


Transistor Decade Counter, made as a ported plug-in unit by Venner Electronics (see photograph) is notable for its small size ($4\frac{1}{2}$ in \times $3\frac{1}{4}$ in \times $\frac{3}{8}$ in) and low consumption (160mW or 100mW, depending on whether it is used as a counter or as a \div 10



frequency divider stage). The circuit consists of four bi-stable trigger circuits with feedback and will operate at pulse input frequencies up to 30kc/s. A resetting facility (to zero or to nine) is included. The 86 components are mounted on a double-sided tagboard in the potting resin.

Folded Delay Lines of the acoustic-wave type are being developed by Bell Laboratories for giving long delays at radio frequencies (around 15Mc/s) in a relatively small space. The advantage over electrical delay lines is simply that acoustic waves travel some 100,000 times slower than electromagnetic waves, and this in itself



makes possible much smaller equipment. Solid blocks of vitreous silica are used, with quartz or barium titanate input and output transducers, and the folding of the wave path is achieved by reflections inside the specially shaped block, as shown in the sketches. One 990- μ sec line utilizes 30 reflections to fold up some 12ft of wave path into a polygon $5\frac{1}{2}$ in in diameter. With a centre frequency of about 15.5Mc/s, this delay line has a bandwidth of over 4Mc/s.

Better reproduction from discs is offered by a tape-recording technique suggested by W. E. Gilson in *Electronics* for July, 1956 (p. 125). Signals initially recorded on magnetic tape are played back at half speed. The upper frequency limit is thus halved. These signals are re-recorded on an ordinary disc recorder which is also run at half speed. Effects such as cutter head resonance which normally cause distortion or loss at the higher frequencies will then occur outside the range to be recorded. On finally playing back the disc at normal speed the original signals are thus reproduced without distortion due to these effects.

Complications may, however, occur at the lowest recorded frequencies. The maximum amplitude that can be recorded on the disc is, of course, limited. Thus either the low-frequency turnover point for recording on the disc will be the same as usual, in which case this frequency will be twice the normal on final playback; or the disc recording must be made at half the usual level and the increase in noise may be troublesome. Distortion at the lowest frequencies on the disc recording must be more strictly controlled as this will be more objectionable on playback when the frequency is doubled. The disc recorder must be free from rumble even when played at half the normal speed, and, due to the re-recording, wow and flutter requirements will also be more stringent.

pictures per second, and to allow for this a long-persistence c.r.t. is used at the receiving end. A horizontal resolution of 300 lines is possible with an 8-kc/s bandwidth. In the Bell Telephones "Picture-phone" system (see illustration) the camera scanning is comparatively fast at 20 pictures per second, but the actual transmission rate is only 1 picture in 2 seconds. The picture selected in each 2-second period is recorded on a magnetic drum, then, by means of gating and timing circuits, is "read" off at 1/40th of the recording speed, taking 2 seconds in transmission. This requires a line bandwidth of only 600c/s. At the receiving end are two storage type of c.r.t.s, one of which builds up the incoming picture while the other displays the previous picture.

Silicon Transistors, capable of working at high temperatures (up to 150°C), are the next thing to watch for on the British market. Meanwhile, two new types have been introduced by Texas Instruments in the U.S.A.—the *n-p-n* 2N117 and 2N118. Suitable for high-gain, low-level applications, they have been designed to meet the stringent requirements of the U.S. Navy. The testing includes heat cycling four times from -55°C to $+150^{\circ}\text{C}$ and storage for 24 hours at 150°C .

R.F. Silicon Transistors of tetrode construction have also been developed by Texas Instruments, for working up to 100°C . In a single-stage amplifier, a gain of 15dB can be obtained at 30Mc/s. Details of gain tests in the 5-30Mc/s region are given by R. R. Webster in the Nov., 1956, issue of *Electronic Industries*.

Flying-spot Scanning, first introduced by Baird in the early days of television, is now coming back for colour television. This is because the development of sensitive photo-multiplier tubes has made it possible to get video signals of good signal/noise ratio at the low light levels given by the scanning c.r.t. In the Du Mont "Vitascan" system, for example (*I.R.E. Transactions* PGBTS-6, Oct. 1956), clusters of

NEGATIVE RESISTANCE

By "CATHODE RAY"

A Mystery of the
Backward Bending Curve

SOME while ago Thomas Roddam posed a very interesting question*. Interesting, that is to say, to those who, like myself, are intrigued by questions which seem at first sight to imply something contradictory in accepted theory, but no doubt irritating to the "practical" folk who regard such things as mere hair splitting and a waste of time. Personally I don't think it is a waste of time, even for a practical man, to look into any apparent contradiction. If there really is something wrong with accepted theory, then the sooner it is put right the better; but if (as is considerably more likely) it is only our view of it that is wrong, then that is a good thing to put right, too.

Suppose we pass various amounts of current through a resistor, and in each case measure the voltage between its terminals; then (provided we take care to keep the temperature of the resistor constant) we usually find that a graph of voltage against current, such as Fig. 1, is a straight line. We conclude, as did Dr. Ohm long before us, that current and

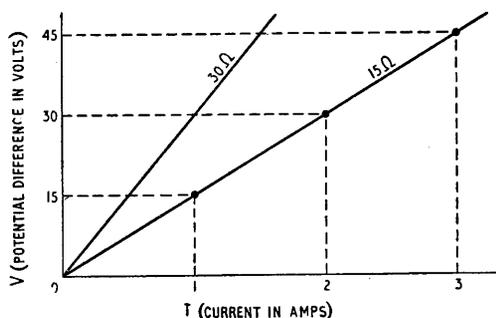


Fig. 1. Graph of voltage drop against current for ordinary linear (ohmic) resistance.

voltage are directly proportional to one another, so that the ratio V/I for any particular resistor is always the same, no matter what the values of V and I . This ratio has become quite well known as "resistance," denoted by R . We can easily see that with any given graph scales it is proportional to the slope of the graph. The line is, in fact, often regarded as representing the resistance. But for ordinary resistors there is really no need to make a graph; the value of R in ohms (i.e., volts per amp) provides all the needed information.

While this "law" established by Ohm still holds good for a sufficiently large number of parts of electrical circuits for it to be extremely useful, the number of parts for which it does not hold good has tended to increase rather noticeably of late. I have it on American authority† that already 7,000,000,000

valves have been manufactured, and every one of them flagrantly disobeys Ohm's law. So far only a very few million transistors have been produced, but Dr. Shockley has predicted an "explosive" increase very soon. And think, if you can, of all the metal rectifiers and neon tubes and Metrosils and much else. For any of these, the value of V/I varies with the values of V and I and also with the starting points from which they are measured; so the resistance is a variable, and a graph is necessary to provide full information about it. This is where the slope of the graph as a measure of resistance comes in useful, for the way in which the resistance varies can be seen at once from the variations in slope of the voltage/current graph, without having to plot from it a resistance/current or resistance/voltage graph. (There is another way of reckoning the resistance at any point—as the slope of the straight line drawn from it to the origin—but that is seldom used in practice.)

It is because of the curvature of their voltage/current graphs that electronic devices are called non-linear. But although their curves may vary from almost horizontal, meaning nearly zero resistance, to almost vertical, meaning nearly infinite resistance, it is usual for the slope to be everywhere upward from left to right‡, meaning that the resistance is always positive. There are, however, a few exceptions in which the slope bends over the other way, as in Fig. 2, so that over a certain range of current and voltage the resistance comes out negative.

Users of valves and other non-linear devices are commonly interested in what can be done with them

‡ Assuming, of course, the standard practice of making the scale numbers increase positively to the right and upwards.

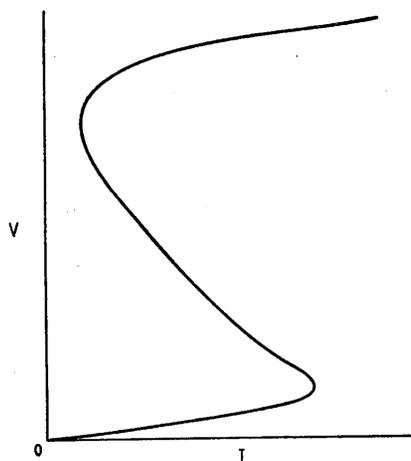


Fig. 2. Graph of voltage drop against current for one kind of non-linear (non-ohmic) resistance. The resistance varies with voltage, and over a certain range is negative.

* "Negative Resistance," *Wireless World*, July 1954, p. 336.
† D. G. Fink, "Transistors v. Vacuum Tubes"; *Proc. I.R.E.*

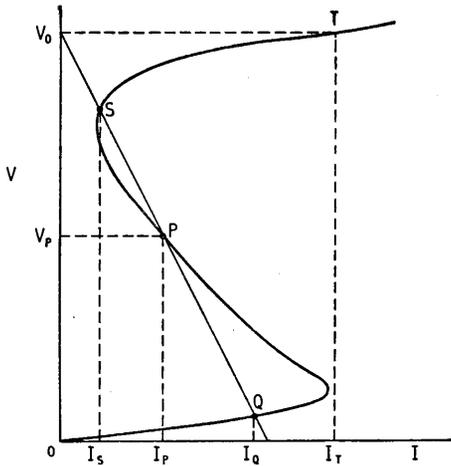


Fig. 3. Diagram combining graphs of non-linear resistance (as in Fig. 2) with linear resistance in series. In this case there are three ways (represented by P, Q and S) in which a total voltage V_0 can be shared between them.

in combination with a linear resistance connected as a load in series with a fixed supply voltage. This situation can conveniently be studied by drawing a "load line" on the same diagram as the valve curve, as for example in Fig. 3. The technique is well known, but for beginners I explained it in the July 1955 issue. The only point I need perhaps repeat here (in view of my having just said that a slope downwards towards the right represents a negative resistance) is that the load line sloping downwards towards the right does *not* mean that its resistance is negative. The apparent contradiction is because the point where the load line cuts the voltage scale (e.g., V_0 in Fig. 3) represents the total fixed voltage applied to it and the valve in series, so the voltage across the load resistance is zero at that point and increases in the opposite direction to the scale numbering.

Because the valve and the load resistance are in series, the same current must flow through both; and so this amount of current on the diagram must apply to both curve and load line. At the same time the voltages across them must add up to the total V_0 . These two facts can apply only to a point which is on both load line and curve at the same time as P in Fig. 3. This point indicates that the voltage across the valve is V_p , the voltage across the resistance is $V_0 - V_p$, and the current through both is I_p .

Three-point Intersection

If this were a normal kind of valve, with resistance positive throughout, there could be only one point common to both its characteristic curve and any other positive resistance load line. But the valve we are considering is one of the exceptions with a stretch of negative resistance, which makes it possible for the load line to cut its curve at three points, as shown. In such cases there are two alternative currents, I_q and I_s , that could be driven through the combination by the same total voltage. At both of these other intersections the valve resistance is positive and the situation is entirely normal; the only question that arises is how the valve and resistor decide between them which point to occupy.

Actually they haven't much choice, because it is

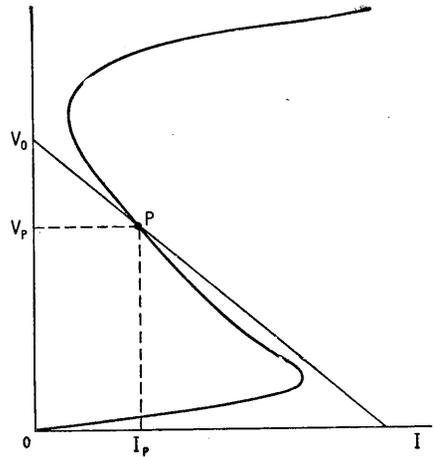


Fig. 4. Here the non-linear negative resistance of Figs. 2 and 3 is in series with a lower resistance, and there is only one way of sharing V_0 .

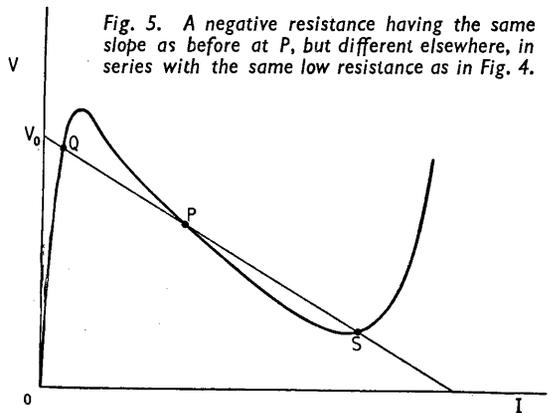


Fig. 5. A negative resistance having the same slope as before at P, but different elsewhere, in series with the same low resistance as in Fig. 4.

imposed on them from without by whoever is responsible for the arrangements for switching on. In the ordinary way, with the current growing from zero, it would rise to Q and stay there. But if now the resistor is short-circuited, changing the load-line slope to zero, the working point becomes unambiguously T. If the resistor is then unshorted the working point slides down to S.

So much for Q and S; but how can one get to P? It is not really very difficult; one just connects the junction of valve and resistor straight to a source of V_p volts. When this connection is broken the working point should remain at P. If we try it, however, we find it invariably flips over to Q or S. Why?

Most treatises beg this question by stating that P is an unstable working point. Before we try to find a real answer let us just look at Fig. 4, where our kinked valve curve appears yet again, this time in conjunction with a lower load resistance. Here, the negative resistance introduces no complication; there is no alternative to P as the working point, and only one value of current (I_p) can cause the total voltage drop to be V_0 .

Clearly, the situation changes from unstable to stable when the slope of the load line changes from greater to less than that of the valve at the point P.

Next, let us give our attention to Fig. 5, where the slope of the load line is less than that of the valve at P, just as in Fig. 4, but where nevertheless there are three alternative points, and the situation is presumably unstable, as in Fig. 3. Experiment confirms this. If in each case the arrangement is switched on in such a way as to start it at point P, with a V/I characteristic as in Fig. 4, it stays there, but in Fig. 5 it flips across to Q or S the moment it is released. The point is—as T. Roddam pertinently asked—how does the circuit know, when it is set to point P, whether it is stable or unstable? If only the parts of Figs. 4 and 5 in the immediate neighbourhood of P are disclosed there is no difference whatsoever between the two diagrams.

The Working Point's Dilemma

I thought this a remarkably intriguing problem. Unfortunately, Mr. Roddam had to hurry on to the kernel of his article, which was the negative impedance converter, and so it appeared that the working point has to find out whether to say at P or not by doing tricks with a piece of string around a stick. The explanation, like most conjurors' explanations of how their tricks are done, left me wondering harder than ever; so, in case there were any other readers in the same state, I will offer my less elegant attempt to find the way.

The first thing is that theoretically a simple combination of positive and negative resistance must stay at P either way. The reason is that the only possible conditions are those represented in the diagrams by points common to both graphs—the valve curve and the load line. It is not possible to get from P to Q or S—or indeed anywhere—in such a way as to be on both graphs all the time. To move from P it would be necessary for the current or voltage or both to have two different values at the same place and the same time—which is absurd.

A way out is to alter the circuit. And perhaps it is high time to see a practical circuit diagram instead of just having to imagine a negative resistance. After my recent expositions you may expect a transistor as example, but point-contact transistors, which are the main ones with inherent negative resistance, are well on the way out. And since there must be many people to whom transistors of any kind are still something new and strange, I am first going back to the dynatron, which may seem a bit archaic to the younger readers, but at least is a valve.

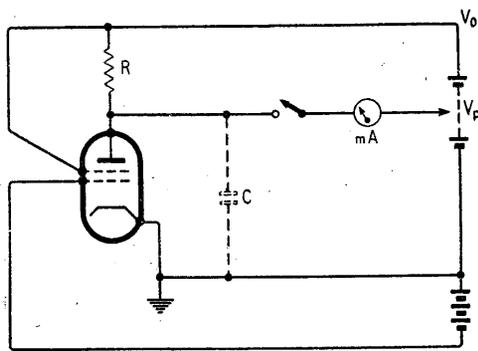


Fig. 6. Dynatron circuit for experimenting with the type of negative resistance graphed in Figs. 2-4.

As Fig. 6 shows it is tetrode, but *not* of the modern "kinkless" variety in which negative resistance is deliberately ironed out; rather, an old-fashioned "screen-grid" tetrode. The screen grid is held at a normal voltage, say 100; and if the anode voltage is varied from 0 to 100 the anode current traces out a curve like Fig. 2. This may not have been recognized as a dynatron curve, even by the old-timers, because it has been drawn with the voltage scale vertical instead of horizontal. The idea of departing from the usual custom was to follow Mr. Roddam in making slope represent resistance rather than conductance.

The reason for the abnormal behaviour of anode current while the anode voltage is varied between about 10 and 90 is that the electrons reaching the anode from the cathode have been given a boost on the way by the relatively high screen-grid voltage. So when they hit the anode they do so with such violence that they knock out some of the electrons already there. These "secondary" electrons are easily gathered in by the high positive screen-grid voltage against the feeble competition of the anode voltage. The result is that the more the anode voltage is increased the more violent the bombardment and the greater the number of secondary electrons, which all subtract from the normal anode current. In fact, it is quite usual for the net anode current to become actually negative over a certain range of anode voltage. When the anode is made nearly as positive as the screen grid, however, the secondary electrons have little or no inducement to leave, and the anode resistance becomes positive again.

One can—and usually does—produce one's negative resistance by means of positive feedback, but for the present purpose the dynatron has the great advantage that its negative resistance is practically constant at all frequencies right down to zero, and the circuit is almost ideally free from complications.

By choosing a suitable resistance for R, we can arrange that its line on the diagram cuts the valve anode characteristic curve in three places, as already discussed. And by joining a wire from the anode direct to a tap on the h.t. battery at the voltage of point P, we can bring the valve to that point. To make sure we are there, we can put a low-range milliammeter (mA in Fig. 6) in this wire and adjust the tap voltage until this meter reads zero. Seeing the wire is carrying no current, we might suppose that breaking the circuit would make no difference; but directly we do so, flip!—the current goes up or down, and we find it is at Q or S. How does it get over the hump in between?

Hidden Component

An explanation can be found in one of those "invisible components"—the capacitance of the anode to other electrodes. Most of it would be to the screen grid, but, since there is a fixed voltage between that and earth, the same results so far as voltage changes are concerned are obtained if all the capacitance (C in Fig. 6) is regarded as direct to earth; and it is rather easier to see what is going on that way.

However carefully we adjusted the voltage tapping, there would always be some current through that path when we opened the switch, if only as a result of the inevitable random fluctuations in circuits and valves. Suppose that just before breaking the meter

(Continued on page 45)

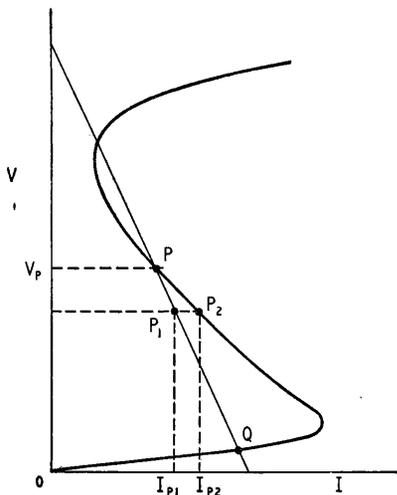


Fig. 7. Explaining the role of C in Fig. 6 in the instability of that circuit.

circuit there was a minute current flowing through it into the valve. The valve current would then be very slightly greater than through R; a condition represented rather exaggeratedly in Fig. 7 by points P_1 and P_2 . The current through R would be I_{p1} ; through the valve, I_{p2} ; and the difference would be coming via the meter circuit. When the switch was opened there would be a sudden call for current to bridge the I_{p2} - I_{p1} gap.

This is where C comes to the rescue. But it can deliver this current only at the expense of its own voltage. Its own voltage is the same as the anode voltage, so that begins to drop, and in so doing widens the gap between P_1 and P_2 . So more current is called for, and the gap widens more quickly. And so there is an accelerating movement towards Q. Directly P_2 gets past the "hump," the call for current, and hence the rate of voltage drop, begins to decline; until finally, at Q, there is no gap and no further drop in voltage.

With C of the order of 10pF, as it would normally be, the whole process is over in something like one microsecond, so it is difficult to follow by eye. This disadvantage can be overcome by augmenting C by a capacitor of say 16 μ F. The slowed-down changes of current from it and also via R can then be observed on suitable milliammeters when the switch is opened after initial setting to as near P as possible. If the error in setting to P is on the other side, the system makes for S instead of Q.

Fair enough; but how about the original problem? How does the system know, at the moment of opening the switch, that the valve curve doesn't bend the other way, as in Fig. 8, which in the region of P is identical with Fig. 7? A rare fool it would look, after rushing madly down as before, to find that Q was non-existent and that the gap, instead of closing up, ever widened, while the scope for filling it by the voltage across C falling was strictly limited—and even reversed!

It appears, however, that this trap would be sprung before the start. For directly we tried to set it to P by connecting the junction of R and the negative-resistance device direct to a source of V_p , as we did in Fig. 6, we would be up against the fact that with

this other sort of negative resistance there would be a Q' and an S', to one of which the system would promptly go and stay. So our problem couldn't actually arise.

You may still feel, as I do, dissatisfied with this outcome, inescapable though it may be. It reminds one of the answer to the old problem of what would happen if an irresistible force encountered an immovable object—that there are no such things. You would like to know, I am sure, whether there is some fundamental difference between the negative-resistances in Figs. 7 and 8 which makes itself felt at or near P, without having to go farther along to see which way the curve ultimately bends, and even without having to remember what kinds of difficulties there may have been in getting to P to start with.

An Odd Situation

We seemed to go some way to solving this mystery when we recognized the existence of C. It provided a most satisfactory explanation of our experimental results with the dynatron (Figs. 6 and 7). But it also seems as if it would lead to an extremely embarrassing situation if the negative-resistance slope happened to bend over the other way as in Fig. 8—a rapidly widening current gap to fill, and C at the end of its ability to supply it.

The best thing to do when theory predicts an absurdity like this is to try it in practice. This is where the old point-contact transistor comes in useful. Thanks to Mr. Berteridge of the G.E.C. I was able to obtain an experimental specimen, which

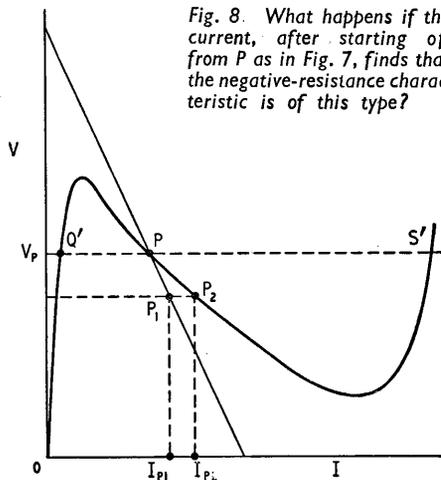


Fig. 8. What happens if the current, after starting off from P as in Fig. 7, finds that the negative-resistance characteristic is of this type?

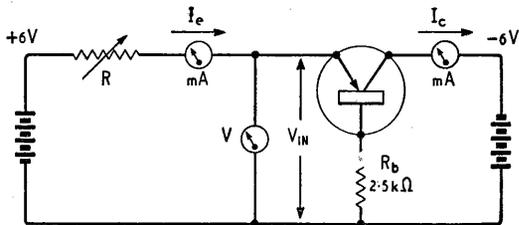


Fig. 9. Point-transistor circuit for providing negative resistance of the Fig. 8 type.

I connected in the simple common-base circuit shown in Fig. 9. Unlike the more usual common-emitter circuit (and the common-cathode valve circuit) its polarities are such that a bias resistance (R_b) causes positive feedback. Because each milliamp change in emitter current causes more than one milliamp change in collector current, the voltage drop in the emitter circuit due to the emitter-to-base positive resistance is more than offset by the reverse voltage drop across R_b due to collector current. By varying R_b , the relationship between input voltage V_{in} (measured on a currentless valve voltmeter V) and input current I_e was plotted, as in Fig. 10. Because the reverse drop across R_b was the main ingredient, V_{in} is wholly negative, but this doesn't matter; the shape of the curve is clearly of the Fig. 5 and 8 variety.

In Fig. 10 the load line for the particular value of R corresponding to 0.85mA and 2.0V is shown, giving the working point P. There is no alternative intersection to flip over to, so not surprisingly (from that point of view) this setting proved to be quite stable. But what, you may ask, about stray capacitance? Seeing that around P the relationship between negative and positive resistances is the same as in Fig. 7, which we found to be unstable, how (yet again!) does the system know itself to be stable?

One difference between the transistor circuit and the dynatron—besides the opposite curvature of the bends—is that the resistances are comparatively low, so very small capacitances have proportionately less effect; and another is that the amplification on which the transistor's negative resistance depends falls off at moderately high frequencies. So just to be sure that there was enough to make the thing unstable and start it off on an impossible journey I connected 300 μ F across the input.

There was no doubt about the effect. The circuit didn't blow up, but all the meter pointers see-sawed violently to and fro!

When I started, it was with the firm intention of arriving at a straightforward answer to the question. But the time is far spent, and so far from having cleared up that mystery we have unearthed another—what happens when the 300 μ F capacitor charge reaches one of the bends and finds it can (theoretically) neither go on nor can turn back, but somehow in practice does keep on turning?

Come to think of it, there is yet another. With the help of Fig. 7 we saw theoretically how capacitance across the dynatron ensures instability when the series resistance is relatively high, by cumulatively widening the slightest current gap

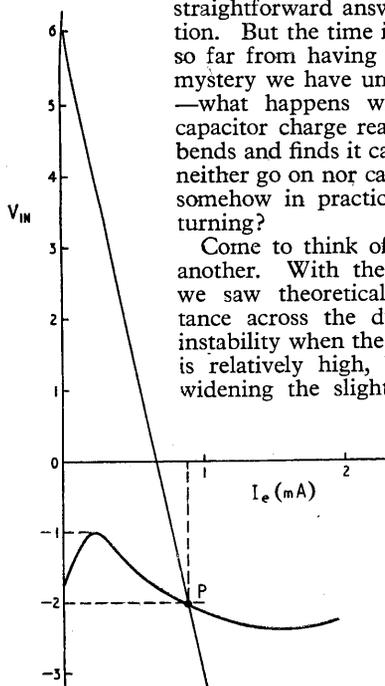


Fig. 10. Actual input characteristic of an experimental circuit as in Fig. 9.

between dynatron and resistance. When the experiment was made with an actual dynatron circuit, it behaved exactly as predicted by this theory. If now we consider in the same way the diagram for a transistor with low resistance, Fig. 5, we find that the current into or out of a capacitance across the transistor necessitates a voltage change which drives the working point P_1 and P_2 towards P, which means that the circuit is stable. In attempting to confirm this by experiment I found it quite a tricky business getting the low-resistance circuit anywhere near P to start with, and the result was invariably the same: it ended up at Q or S. At no time did it show the slightest inclination to be stable. Why did experiment confirm the capacitance theory in a dynatron circuit and contradict it in a transistor circuit?

It looks as if I shall have to get next month's issue to find out!

High-Remanence Tape

A NEW grade of "Scotch Boy" magnetic recording tape has been introduced by the Minnesota Mining and Manufacturing Company which is of particular interest to high-quality enthusiasts. It is known as No. 120 and has a remanence of 0.9 lines compared with 0.6 lines for the No. 111 standard and No. 150 thin-based grades. The coercivity is 240 oersteds in all three cases.

The advantages conferred by the new tape are threefold. There is a 3-dB increase of sensitivity for a given input, the maximum input for a given distortion level (1% 3rd harmonic) can be increased by more than 3 dB giving an overall gain at maximum of 6 to 8 dB, or, alternatively, the input can be reduced to a level which gives the same volume as would be obtained from No. 111, but with harmonic distortion reduced by approximately 12 dB.

Like the standard No. 111 tape, the new "High Output" grade is on 0.002-in cellulose acetate base and is available in four spool sizes between 600 and 2,400ft. The cost is about 10% higher than standard tape.

Dates for Your "Wireless World" Diary

ANNOUNCEMENTS have already been made of the dates of many of this year's exhibitions and conventions, but for the convenience of readers we give below a list of the principal events in 1957.

Television Society Exhibition	March 5-7
Royal Hotel, Woburn Place, London, W.C.1.	
Physical Society Exhibition	March 25-28
Royal Horticultural Society Halls, London, S.W.1.	
Components Show (R.E.C.M.F.)	April 8-11
Grosvenor House and Park Lane House, Park Lane, London, W.1.	
Electrical Engineers' Exhibition (A.S.E.E.)	April 9-13
Earls Court, London, S.W.5.	
Audio Fair	April 12-15
Waldorf Hotel, London, W.C.2.	
Instruments, Electronics and Automation Show	May 7-17
Olympia, London, W.14.	
Scottish Radio Show (R.I.C.)	May 22-June 1
Kelvin Hall, Glasgow.	
Convention on Electronics in Automation	June 28-July 2
(Brit. I.R.E.)	
King's College, Cambridge.	
Institution of Electronics Exhibition	July 10-20
College of Science and Technology, Manchester.	
British Plastics Exhibition*	July 10-20
Grand Hall, Olympia, London, W.14.	
National Radio Show (R.I.C.)	Aug. 28-Sept. 7
Earls Court, London, S.W.5.	
Farnborough Air Show (S.D.A.C.)	Sept. 3-9
Farnborough, Hants.	
British Sound Recording Association Exhibition*	Sept. 20-22
Waldorf Hotel, London, W.C.2.	
Radio Hobbies Exhibition (R.S.G.B.)	Oct. 23-26
Seymour Hall, London, W.1.	

*Conventions are held in conjunction with these exhibitions.

JANUARY MEETINGS

LONDON

8th. I.E.E.—“A theoretical and experimental investigation of anisotropic-dielectric-loaded linear electron accelerators” by R. B. R. Shersby-Harvie, L. B. Mullett, W. Walkinshaw, J. S. Bell, and B. G. Loach at 5.30 at Savoy Place, W.C.2.

9th. Brit. I.R.E.—A programme of films on radio and electronic engineering at 6.30 at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

9th. Radar Association.—“The problems and techniques of high energy physics” by J. R. Atkinson (Glasgow University), at 7.30 at the Anatomy Theatre, University College, Gower Street, W.C.1.

10th. Society of Instrument Technology.—“Electronic automation of machine tools” by F. T. Lett at 7.0 at Manson House, Portland Place, W.1.

11th. Television Society.—“Automatic gain control circuits in television receivers” by S. N. F. Doherty and P. L. Mothersole (Mullard) at 7.0 at 164 Shaftesbury Avenue, W.C.2.

18th. B.S.R.A.—“Hearing aids and audiometers” by S. Kelly at 7.15 at the Royal Society of Arts, John Adam Street, W.C.2.

23rd. I.E.E.—“Junction transistor bootstrap linear sweep circuits” by K. P. P. Nambier and Dr. A. R. Boothroyd; “Design considerations for junction transistor oscillators for the conversion of power from d.c. to a.c.” by F. Oakes; and “Minority carrier storage in semi-conductor diodes” by J. C. Henderson and Dr. J. R. Tillman at 5.30 at Savoy Place, W.C.2.

24th. Television Society.—Fleming Memorial Lecture—“Luminescence” by H. G. Jenkins (G.E.C.) at 7.0 at the Royal Institution, Albemarle Street, W.1. (Admission by ticket only.)

24th. Physical Society.—“Detection and measurement of vibration” by M. L. Parsey at 5.30 at Imperial College, Imperial Institute Road, South Kensington, S.W.7.

25th. R.S.G.B.—Presidential address followed by “Miniature aerials” by F. Charman (G6CJ), at 6.30 at the I.E.E., Savoy Place, W.C.2.

29th. I.E.E.—Discussion on “The performance of d.c. amplifiers with special reference to the use of transistors” opened by K. Kandiah and Dr. G. B. B. Chaplin at 5.30 at Savoy Place, W.C.2.

30th. Brit. I.R.E.—Battery operated equipment: “A.M.-F.M. receivers” by R. A. Lampitt and J. P. Hannifan; and “Radioactivity Instruments” by K. E. G. Perry at 6.30 at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

ABERDEEN

9th. I.E.E.—“Colour television” by Dr. G. N. Patchett at 7.30 at the Caledonian Hotel.

CHELMSFORD

15th. I.E.E. (Students).—“Auto-following radar systems” by J. A. Barber at 7.0 at the Public Library.

DUBLIN

17th. I.E.E.—“The use of radio for communication links” by D. McKenna at 6.0 at the Physical Laboratory, Trinity College.

DUNDEE

10th. I.E.E.—“Colour television” by Dr. G. N. Patchett at 7.0 in the Electrical Engineering Department, Queen's College.

EDINBURGH

11th. Brit. I.R.E.—“Potted components and assemblies” by H. G. Manfield at 7.0 at the Department of Natural Philosophy, University of Edinburgh.

GLASGOW

17th. Brit. I.R.E.—“Industrial applications of high-speed pen recorders” by R. Kasler at 7.0 at the Institution of Engineers and Shipbuilders, 39 Elm-bank Crescent.

HANLEY

18th. I.E.E.—“Digital computers” by Dr. S. H. Hollingdale; and “Power system engineering problems with reference to the use of digital-computers” by C. Robinson and D. H. Tompsett at 7.0 at Twyford Scout Hall.

LEEDS

22nd. I.E.E.—“Germanium and silicon power rectifiers” by T. H. Kinman, G. A. Carrick, R. G. Hibberd and A. J. Blundell at 6.30 at 1 Whitehall Road.

LIVERPOOL

2nd. Brit. I.R.E.—“Instrumentation for frequency modulation” by D. R. Willis and A. G. Wray at 7.0 at 1 Old Hall Street.

23rd. I.E.E.—“The electronic control of machine tools” by N. Milne at 6.0 at the Temple, Dale Street.

LLANDARCY

23rd. Society of Instrument Technology.—“Present and future trends in electronic instrumentation” by R. J. Redding at 7.0 at the Training Centre of the National Oil Refineries, Ltd.

MANCHESTER

3rd. Brit. I.R.E. and Junior Institution of Engineers.—“Projection television receivers” by I. Somers at 6.30 in the Reynolds Hall, College of Technology, Sackville Street.

11th. Institute of Physics.—“Ferromagnetism and magnetic materials” by A. E. De Barr at 6.45 at Bragg Building, Manchester University.

NEWCASTLE-ON-TYNE

21st. I.E.E.—“Electronics and automation: some industrial applications” by Dr. H. A. Thomas at 6.15 at King's College.

PORTSMOUTH

14th. I.E.E. (Students).—“Digital computers and how they may help the engineer” by Dr. M. V. Wilkes at 6.30 at the C.E.A., High Street.

TREFOREST

16th. Brit. I.R.E.—“Radio techniques in Post Office engineering” by C. T. Lamping at 6.30 at the Glamorgan Technical College.

WOLVERHAMPTON

9th. Brit. I.R.E.—“Design and application of magnetic amplifiers” by R. G. Russell-Bates at 7.15 at the Technical College, Wulfruna Street.



TRIX

sound equipment serves the world

Chosen for sound distribution at United Nations Headquarters Building, New York, TRIX equipment, embracing everything in sound reproduction, demonstrates the superior quality which has established its world-wide reputation.



THE TRIX ELECTRICAL CO. LTD.
 MAPLE PLACE, TOTTENHAM COURT ROAD
 LONDON, W.1.
 Tel.: MUS 5817. Grams.: Trixadio, Wesdo, London

P4485

RANDOM RADIATIONS

By "DIALLIST"

Do We Want Colour?

A QUESTION one is pretty well certain to be asked during any conversation about television with non-technical folk is: *When* are we going to get colour TV? Or, the inquirer may put it in the more impatient form: *When are* we going to have colour TV? It was the same, one gathered, in the United States in the days when only the black-and-white picture was available. Everyone professed eagerness to have colour; but when it came along it was to prove just about the greatest flop in the history of American big business. Those who had seemed so ardently to desire it developed a sales resistance that even the most high-pressure salesmanship couldn't break down. Some months ago it was estimated that there were possibly 100,000 colour receivers in use in the whole length and breadth of the U.S.A.; but a recent investigation by an American magazine puts the total no higher than 75,000. It can hardly be the prices of such sets that have been the snag. These have been brought down from about \$1,000 to the neighbourhood of \$750 or so, and there must be plenty of Americans well able to afford that. One hears of coming models which are to be priced at \$500 or less, but I doubt whether even they will get things really going.

Still Too Complicated

No, the trouble has been, and still is, that colour receivers are complicated boxes of tricks, needing constant adjustment. You can't just sit at your ease and watch. You've got to be continually jumping up from your chair to twiddle knobs for the colours to remain anything like right. Nobody wants exasperating "entertainment" of that sort, and I'm sure that if colour television using any system yet developed became a reality in this country it would flop here as monumentally as it has on the other side of the Atlantic. After all, the monochrome picture isn't all that unsatisfactory, or there wouldn't be well over 6,000,000 sets in use here, or some 34,000,000 (I think that's the figure) in the United States. I know I'd far rather have a good black-and-white picture and a set

seldom needing anything but to be switched on and off than a coloured one (rather crude and garish at the best of times) produced by a set which called for constant attention. Them's my sentiments, anyhow; yours, of course, may be quite different.

Basic Inventions Needed

The present position of colour seems to me to be comparable with that of monochrome television when Baird had developed it as far as the scanning disc and neon lamp stage. That had little or no entertainment value and sales were small. For colour to be a success basic new inventions are needed. The flat c.r. tube with its "built-in" frame screen now being developed by Dr. Gabor may be one of these, if, as one hopes, it comes up to expectations when it reaches its final form. But others, too, are wanted if the colour receiver is ever to be as simple to operate as the monochrome and to be as suitable for use by the ordinary non-technical viewer. I've no doubt whatever that such inventions will be made; but when that'll be no one can say. Hence, no one can even attempt to answer the question: *When* are we going to have colour TV?

The Power of Suggestion

Talking of colour television reminds me that many people reported that they had seen colours on their black-and-white screens when the I.T.A. recently tried out a scheme of colour-by-suggestion. When I was last in London, shortly before this was written, two or three friends (whom I shouldn't have thought prone to imagining things) were in no doubt whatsoever that they had received pictures with distinct traces of colour while watching the B.B.C.'s experimental colour transmissions. Perhaps if the powers-that-be suggest hard enough that our present "penny plain" transmissions are really "tuppence coloured" there'll be no need to develop a genuine colour system!

V.H.F. Catching On

FROM what I hear in talks with people of all sorts and conditions, the v.h.f./f.m. broadcasting service seems to be gradually catching on, though it hasn't yet become as popular as it deserves. I don't think that quite enough publicity has been given to the freedom from interference and the silent background that can be given by a good v.h.f. receiver, provided that it's been properly installed. And I think it a pity that more manufacturers remain unconvinced that there's a big potential



"WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
WIRELESS SERVICING MANUAL. W. T. Cocking, M.I.E.E. 9th Edition	17/6	18/6
GUIDE TO BROADCASTING STATIONS 1956-57. Compiled by <i>Wireless World</i>	2/6	2/10
RADIO VALVE DATA: Characteristics of over 2,500 Valves, Transistors and C.R. Tubes. Compiled by <i>Wireless World</i>	4/6	5/1
SECOND THOUGHTS ON RADIO THEORY. "Cathode Ray" of <i>Wireless World</i>	25/-	26/2
THE OSCILLOSCOPE AT WORK. A. Hass and R. W. Hallows, M.A. (Cantab.), M.I.E.E.	15/-	15/10
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition	25/-	26/5
ELECTRONIC COMPUTERS: Principles and Applications Edited by T. E. Ivall	25/-	25/9
RADIO INTERFERENCE SUPPRESSION: As Applied to Radio and Television Reception. G. L. Stephens, A.M.I.E.E. 2nd Edition	10/6	11/1
ADVANCED THEORY OF WAVEGUIDES. L. Lewin	30/-	30/10
ABACS OR NOMOGRAMS. A. Giet	35/-	35/10

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

market for the press-button, or selector-switch set, pre-tuned to the Home, Light and Third Programmes. Nor, again, has sufficient prominence been given to the much superior quality obtainable. In these days, when Hi-Fi is all the rage, one would have thought that first-rate v.h.f. sets would sell like hot cakes. I'm all for omitting the long- and medium-wave ranges altogether; but, as the Editor pointed out a month or two ago, the public generally insists on being able to receive commercial transmissions from the Continent.

The Aerial Problem

Some folk, too, don't like the idea of adding yet another aerial to the not-very-beautiful arrays which already sprout from their roofs. Unless you're in a wireless shadow a simple dipole is all that is needed up to ranges of 45-50 miles at any rate. If your TV transmitter is vertically polarized such a dipole can often be fixed inconspicuously to the mast carrying the H, X, K or what not. In some areas where the television transmissions are horizontally polarized the one aerial array may serve perfectly well for both television and v.h.f. sound. I'm pretty sure that it will in the Norwich area, for instance; but I haven't yet been able to find out for certain, for at the time of writing we're still eagerly awaiting the *début* of Tacolneston as a v.h.f. broadcasting station. Another great help towards solving the aerial problem, at shortish ranges anyhow, may be the use of built-in ferrite rods.

A Spot of Bother

ONE doesn't envy the I.T.A. its job of trying to provide a good service in that TV spot of bother, the Sheffield area. Some parts of it lie in valleys; some are amongst the hills; many are heavily built up. But it's such a populous and important place that the I.T.A. must feel compelled to do everything possible to give it a satisfactory commercial service. The B.B.C. is more fortunate, for the site of Holme Moss is higher and its carriers lower than that of Emley Moor. Even so, there are many Channel 2 black spots in and around Sheffield. On Channel 10 things are much more difficult, for its carriers are so much more liable to be blanketed by hills or tall buildings and to suffer the reflections which give rise to ghosts. It may be that Emley Moor's aerial, 1,250ft above sea level, and its 200-kW e.r.p. won't provide all the answers, and the only thing for some districts will be a "piped" service.

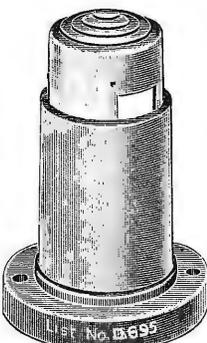


"THE CHOICE OF CRITICS"

BASEBOARD ILLUMINATION

WITH THE PILLAR-SIGNAL-LAMP

This slender fitting is designed to give adequate illumination on baseboards, panels, car-dashboards and similar uses. Manufactured from the finest grade materials and fitted with BS.98/E.10 rolled-thread M.E.S. socket with silver plated solder-tags concealed in base. Two types are available—"D.695/Colour" (White, Brown or Black) with a 30° port for illumination, and "D.696/Colour-body/Colour-lens" which is identical except for the addition of a brilliant transparent lens at the top, in Red, Green, Blue, Amber or Water Clear. Fixing in both models is by two .116in. diameter holes at 1½in. centres; provide single centre hole for cables.



List No. D.695/Colour

Send for the latest
BULGIN CATALOGUE
PRICE 1/- POST FREE



OTHER BULGIN PRODUCTS INCLUDE

- Crocodile-Clips
- Couplers
- Capacitors
- Chokes
- Fuses and Holders
- Control Knobs
- Jacks and Jack-Plugs
- Mains and Low Voltage Connectors
- Resistors
- Pilot Lamp Holders
- Signal Lamps
- Micro Switches
- Toggle, Lever and Slide Action Switches
- Rotary and Semi-Rotary Switches
- Flasher Units
- Thermal Cut Outs
- Terminals
- Test Prods
- Group Boards
- Valve Holders
- Valve Top Connectors
- Potentiometers
- etc.

BULGIN

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

Telephone: RIpleway 5588 (5 lines)

Microromeos

LOVE is a delicate subject which I had always thought to be completely outside the scope of this journal, but the impact of modern technology seems to have altered all that. Love seems well on the way to becoming merely a specialized branch of electronics, and will, I suppose, eventually be measured in microromeos or microcasanovas.

I have already referred to Dr. Grey Walter's recent pronouncement that it would be possible to pick out people who would make compatible marriage partners by examining their encephalograms.

Now we have Gerald Sykes speaking in the Third Programme on the subject of "Technology and Love." Mr. Sykes is an American and therefore would probably be more familiar with wolf whistles than with heterodyne whistles. It appears that, according to Mr. Sykes, to understand what love is we need to study the psychology of Freud and Jung, and this leads us rather away from electronics into the jungle of the "id" and the "superego."

But we are brought sharply back to the electronic fold by the latest suggestion that the electronic computer can solve all problems of love and lead to happy marriages. Apparently all that is needed is to feed into a computer the necessary data about any budding Benedick and his Beatrice and it will decide whether or not they are suited to each other.

I don't think it will be nearly so simple as it is made out to be, for such a lot will depend on the experts who have to decide what is the proper data the computer needs before it can make its calculations. Having decided on the data, the experts then have to turn it into the special binary lingo of the ACE. Personally I would far sooner trust the old-fashioned "Aunty Gertie" who solves love's problems in certain of the more romantic of our women's magazines.

I sincerely hope the day is far distant when *W.W.* publishes some book like "Second Thoughts on Love Theory," by "Cathode Ray."

Fiat Justitia

WE hear of such extraordinary things being accomplished by electronic computers that it surprises me that more attention has not been paid to them by the medical profession.

Surely a machine could be designed which, when fed with the requisite numerical data concerning bodily temperature, blood pressure

and so on, could make a swift calculation and diagnose the complaint. At the same time it might indicate the correct antidote.

Without doubt such a machine is a possibility of the future and I am very surprised that this doesn't seem to be realized in medical circles. Maybe it is because doctors have a vested interest in keeping any form of mechanical medico off the market. Doctors would, however, always be wanted to feed accurate data to the machine.

Another class of person which has neglected its possibilities is represented by the various Mesdames Estelles who haunt our seaside piers and funfairs. An electronic prognosticator would not put them out of business. They would still be wanted to feed all the enquirer's personal details to the machine to enable it to work out the positions of the planets and other heavenly bodies at the precise moment of birth.

A most important potential field of operations for the computer is surely in our magisterial courts. We often read of the great divergence in the penalties imposed by different benches for the same offence. A wife beater, for instance, who is arraigned before a bench of hard-bitten married men may incur little more than a mild "tut-tut" of reproof from the long-suffering chairman. If, however, he has the ill-luck to appear before a women stipendiary or a bench on which women predominate he can thank his lucky stars that the death penalty is *ultra vires* for magistrates. An electronic computer when fed with

the correct data on the crime and the prisoner's previous record would unerringly deliver a just and equitable sentence.

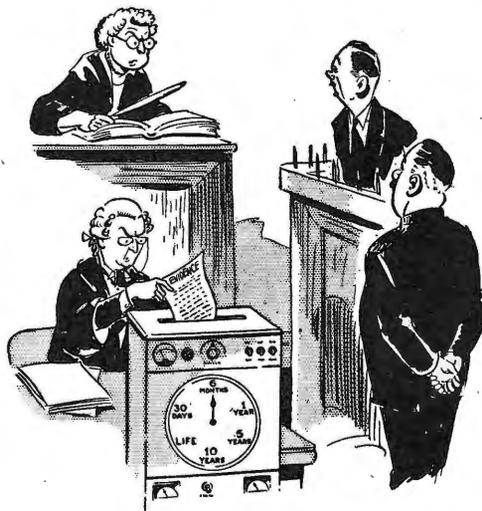
TV on Trains

I WAS interested to read recently of the television demonstration given on two specially equipped excursion trains in Scotland. The programmes in each case came from the Guard's van which had been turned into a small studio. No attempt was made to relay ordinary broadcast TV programmes but the demonstration was none-the-less interesting as showing what we can expect in a few years' time.

It would not surprise me if TV eventually became available on all long-distance trains. Would it be possible to use the adjacent telegraph wires for a carrier-current system? It would, of course, be rather like putting the cart before the horse to have TV on trains, as no serious attempt has yet been made in this country to provide ordinary sound programmes in our expresses; yet it has always seemed to me that it would be so easy to provide each passenger who wanted this service with a pair of headphones at an appropriate fee. A start could be made by having a disc jockey in the guard's van of each train; real radio could come later.

Another thing which is lacking in our trains, despite the electronic age in which we live, is means of making a telephone call. There has not even been an attempt to provide a telegraphic service, and personally I have been compelled to follow the example of castaways on a desert island and enclose a message in a beer bottle obtained from the restaurant car. This I have had to throw out when passing through a station in the hope that some porter might pick it up, and usually I have not hoped in vain.

The method is, however, primitive and I hope that this TV demonstration will open the eyes of the British Railways' authorities to the possibilities of equipping trains with an up-to-date telegraph, telephone and television service. The profits might enable them to reduce fares.



An Unbiased Sentence

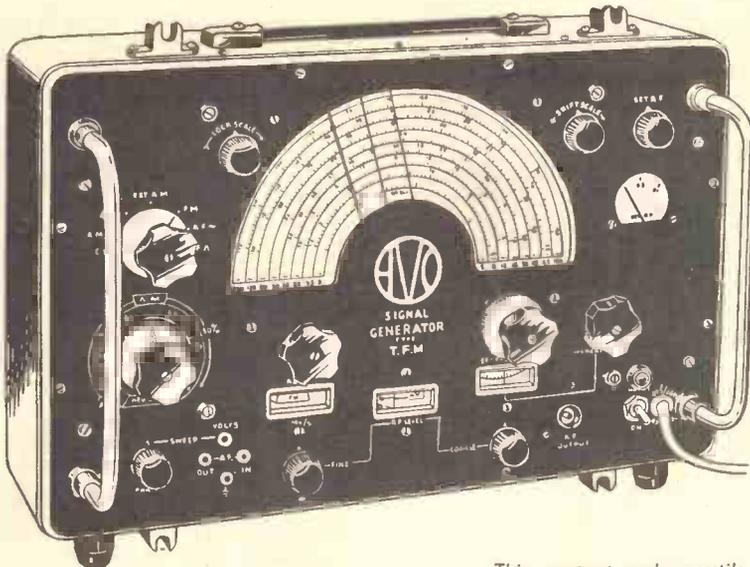


Regd. Trade Mark

WIDE BAND SIGNAL GENERATOR

Type T.F.M.

The design of this new Wide Band Signal Generator, **operating throughout on fundamentals**, is the outcome of considerable research and development work to meet the stringent requirements imposed by new frequency modulation and commercial television stations.



This compact and versatile instrument not only meets all U.K. requirements, but will also prove useful in many other parts of the world.

A M COVERAGE
5-220 Mc/s in 8 ranges, CW or 400 c/s sine/square wave modulation. Accuracy $\pm 1\%$. Provision for spot frequency calibration.

F M COVERAGE
65-120 Mc/s. Accuracy $\pm 1\%$. Maximum deviation ± 150 Kc/s.

OUTPUT:
Minimum (about $2\mu\text{V}$) to 100 mV continuously variable with decade multiplier. Force output 250 mV.

OUTPUT IMPEDANCE:
80 Ω , 200 Ω , balanced 80 Ω and 300 Ω , isolated unbalanced 80 Ω .

The frequency bands have been chosen in such a manner as to ensure maximum convenience when servicing and aligning T.V. and F.M. receivers.

Provision has been made for spot R.F. frequency calibration.

Facilities are provided to ensure adequate discrimination throughout the very wide frequency band covered by the instrument.

Sine and square wave audio frequency modulation provided.

The instrument is fitted with an R.F. carrier level meter.

A double-ratio slow-motion mechanism, together with interpolation dial, enables the instrument to be set with a high degree of accuracy. On the F.M. range an internal phasing control enables the modulating signal to be applied to the X-plates of an oscillograph to produce a picture of a discriminator response curve.

OPERATING VOLTAGES:
100-120, 200-260 V, 50-60 c/s A.C. mains.

DIMENSIONS:
15½ x 10¼ x 10ins. approx. with lid closed.

WEIGHT: 16lbs. approx.
LIST PRICE: £89

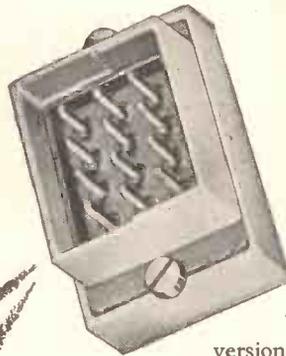
Sole Proprietors and Manufacturers:

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

Fully descriptive brochure available on request

AVOCET HOUSE • 92-96 VAUXHALL BRIDGE ROAD • LONDON • S.W.1
Telephone: VICTORIA 3404 (9 lines)

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

L I M I T E D

P.C. 2



There are times and places...

There are times and places where the importance of trouble-free communications is beyond assessment. Faults, when they do occur, so often happen at precisely the wrong moment and under the most unfavourable conditions.

The choice of the best possible valves is perhaps one of the greatest steps towards reliability. When thinking of valves, avail yourself of Mullard's long experience in and vast resources for the manufacture of nearly every type of valve for mobile reception and transmission. Whether your equipment is old, new or yet undesigned, a technical advisory service is ready to assist you in the choice of types and correct operating conditions of electronic valves.

Mullard



Mullard Limited - Communications and Industrial Valve Department - Torrington Place - London - W.C.1



 MVT 291

for the closest
 approach to the
 original sound

THE criterion, as always, is that the reproduced sound shall be the closest approach to the original—that the enjoyment and appreciation of music may be unimpeded. This is reflected throughout the design of the QUAD II. It is reflected, too, in the straight-forward and logical system of control, achieved without the sacrifice of a single refinement or adjustment capable of contributing to the final objective.

Send for further details and booklet.



QUAD II AMPLIFIER



HUNTINGDON, HUNTS · Telephone: HUNTINGDON 361.

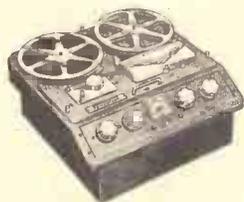
**"NOW THAT'S
WHAT I CALL
GOOD
ENGINEERING"**



FERROGRAPH 2A

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.
(including 1,200 ft. Ferrotape on 7" reel)



FERROGRAPH 66

Model 66N 3 $\frac{3}{4}$ and 7 $\frac{1}{2}$ i.p.s. ... 84 gns.

Model 66H 7 $\frac{1}{2}$ and 15 i.p.s. ... 88 gns.
(including 1,750 ft. Ferrotape on 8 $\frac{1}{2}$ " reel)

Technically, of course, there are no longer any great difficulties to be overcome in the production of a good Tape Recorder. Certainly no more than those which face the manufacturer of any other comparable piece of equipment. Success or failure depends solely upon his interpretation of the word "good".

With us it means, first of all, limitation of output. We do not believe that a highly complex instrument like the Ferrograph can be manufactured on conveyor-belt principles—any more than can a fine watch or a precision camera.

Secondly, experience has taught us that for a Tape Recorder to give lasting satisfaction a great deal of critical and unhurried supervision is essential at every stage of its manufacture. It is, in fact, this liberal expenditure of time and money—this ceaseless search for perfection—that has been so largely responsible for creating the almost legendary reputation enjoyed by the Ferrograph among those to whom performance counts much more than price.

BOTH FERROGRAPH MODELS HAVE THESE FEATURES:

- Three Independent Motors • Synchronous Capstan Drive • Recording Level Meter • Uses 8 $\frac{1}{4}$ " Reels • One-Knob Control • Two Speeds with Lever Change • Bass and Treble Cuts • Tropicalised Components
- Plays British and U.S. pre-recorded Tapes • 2 $\frac{1}{2}$ watts Undistorted Output
- Automatic Motor Cut-off.

The Incomparable **Ferrograph**

switch to *Superspeed!*

In buying solder for manufacturing purposes there is only one sound principle . . . buy the best.

Otherwise you are risking the dependability of your products and the reputation of your firm.

Incorporating Enthoven's unique 6-channel stellate core, *SUPERSPEED* is everywhere recognised as the most efficient cored solder wire for general assembly work on radio, television, electronic and tele-communication equipment. But there is also an Enthoven solder product that is *the best* for every other engineering and manufacturing application. Please write today for the new edition of our brochure "Enthoven Solder Products"—or consult us quite freely on your particular problems.

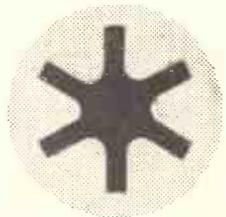


By relying on ENTHOVEN for all your soldering requirements you are banking on the best known name in the industry—a name that represents nearly 150 years experience in non-ferrous metals and an incomparable record in research and development.

ENTHOVEN SOLDER PRODUCTS

ENTHOVEN SOLDERS LTD., 89 UPPER THAMES STREET, LONDON, E.C.4.

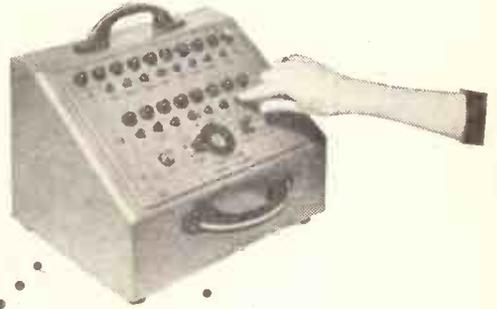
MANsion House 4533



NOW

A CONFIDENTIAL STAFF LOCATION SYSTEM!

Verbal Orders Quickly and Quietly



It's new and it's *unique*—the Multitone Staff Location System. There've been loudspeakers, bells, lights and even buzzers, but not a system in which confidential messages can be delivered to individual members of a staff—whether numbered in tens or hundreds. However compact or scattered an organisation may be, this is going to be the biggest business time-saver yet. Originally developed in conjunction with St. Thomas' Hospital, this system is now far in advance of anything yet made and is sold at a highly competitive price!

HOW IT WORKS. A magnetic induction loop is laid round the building from the Coder/Oscillator unit. Anyone needed to be on call carries a receiver (only 5" long, 1" diameter and it only weighs 5 oz. with battery!). On being alerted by his call signal, which is received by him alone, he can hear a direct speech message without anyone else being disturbed.

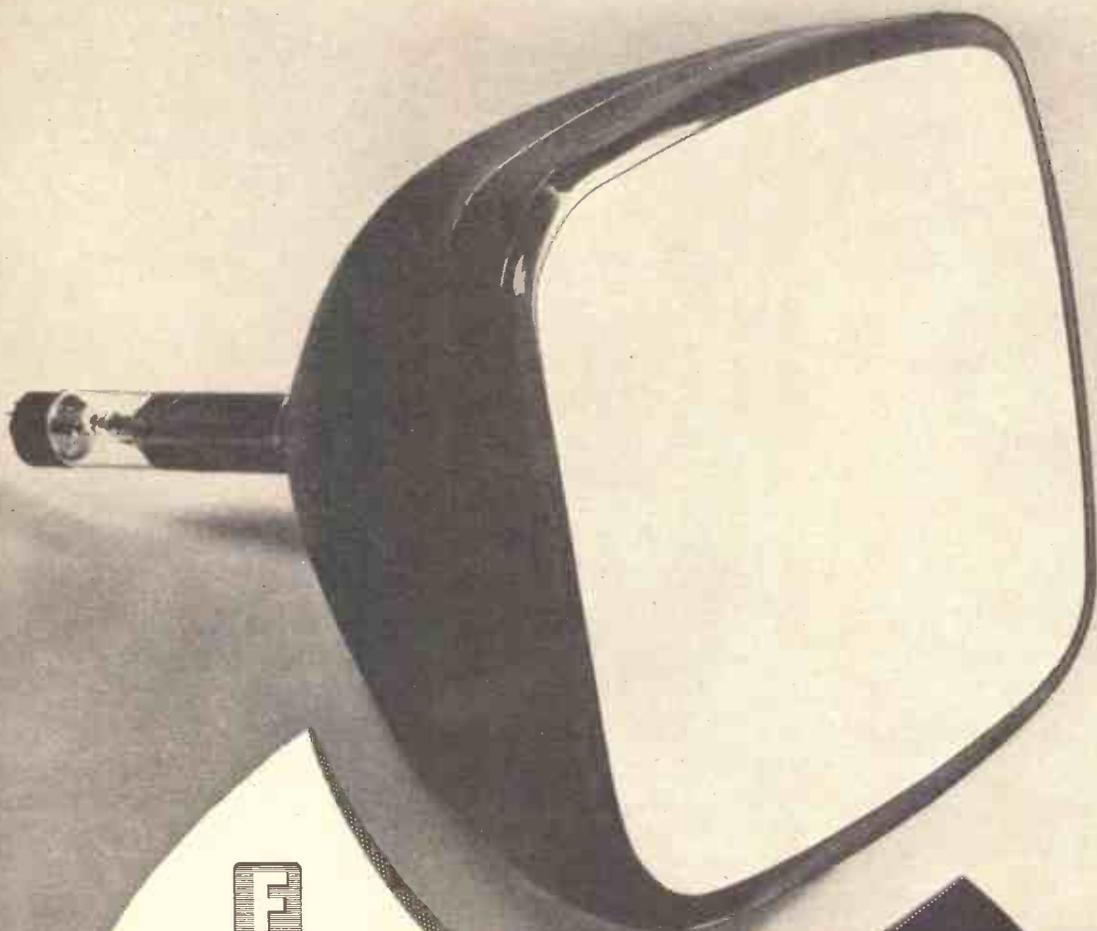
WHAT IT COSTS. The average cost of an installation with 50 receivers would be under £1,500 including the cost of the loop. The receiver incorporates four transistors and is powered by a single cell. Since the quiescent current is less than 0.5 m.a. it will only cost a few shillings a year to run each receiver—considerably less than any other electronic system.

multitone

STAFF LOCATION SYSTEM



Ferranti Cathode Ray Tubes



The Electronics Department of Ferranti Ltd. manufactures a wide range of Valves and Cathode Ray Tubes for Radio and Television receivers. Illustrated is a 17" rectangular tube, one of a range of Cathode Ray Tubes available in all the popular sizes.

17"

FERRANTI LTD · GEM MILL · CHADDERTON · OLDHAM · LANCS

London Office: KERN HOUSE, 36 KINGSWAY, W.C.2

PRINTED CARBON RESISTORS AND POTENTIOMETERS

MORGANITE Carbon Resistors and Potentiometers fit into Printed Circuitry!

Over the years MORGANITE Resistors and Potentiometers have attained a unique reputation for reliability and service. Now with the introduction of printed circuitry they have swiftly proved their worth in this new field.

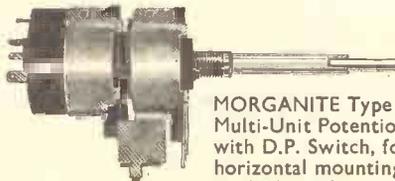
MORGANITE Resistors, with their silver-plated copper wires, are particularly suitable for this type of work, while the MORGANITE Type A Potentiometer, the most popular control for radio and television, has been successfully adapted for both horizontal and vertical mounting.



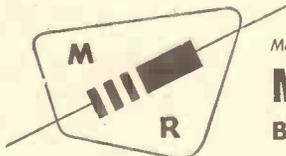
MORGANITE Carbon Resistors. Type R (1 watt) Type T ($\frac{1}{2}$ watt).



MORGANITE Type A Potentiometer, with D.P. Switch, for vertical mounting. Also available without switch, and for horizontal mounting.



MORGANITE Type A Multi-Unit Potentiometer, with D.P. Switch, for horizontal mounting. Also available without switch.



Manufacturers' and export enquiries direct to

MORGANITE RESISTORS LIMITED

Bede Trading Estate, Jarrow, County Durham.

Wholesale and retail distributors' enquiries to

EDISON SWAN ELECTRIC CO. LTD., 155, Charing Cross Road, London, W.C.2.



Germanium

PHOTO ELECTRIC CELLS (Type PG40A)

for sensing
punched card and
perforated tape

Pioneers in the United Kingdom in the manufacture of germanium-junction photo-electric cells, S.T.C. have developed and produced an exceptionally small photo-cell, type PG40A, specifically for scanning operations in punched card and perforated tape machines.

SenTerCel type PG40A germanium-junction photo-electric cells, with a diameter of only 0.093", make possible mass grouping in the minimum space. Hermetic sealing using glass-to-metal seals ensures long life and stable characteristics. Write for technical data sheets GER/101A to:



Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

Designed to protect electronic instruments and other sensitive equipment from **VIBRATION and SHOCK**



Type GB 896 (A.R.B. Ref. No. E3518).
For loads from 2 to 35 lb.



Type GB 770 (A.R.B. Ref. No. E3518).
For loads from 1/4 to 9 lb.



Type GBA 23 (A.R.B. Ref. No. E3696).
(Miniaturised) For loads from 0.1 to 3.0 lb.

“BARRYMOUNT” Air-damped Isolators have been specially developed to provide assured protection for sensitive equipment against vibration and shock. An outstanding feature is their remarkably uniform performance over the full rated load-range.

Over 1,000,000 go into use *every year* for the protection of every type of air-borne equipment, from the lightest and most delicate instruments and electronic devices to apparatus up to 140 lb. weight. The three types illustrated alongside are installed in the Bristol “Britannia.”

DISTINCTIVE FEATURES

- Outstanding in design; simple in construction.
- Superior vibration isolation.
- Improved shock absorption.
- Low permanent set and drift.
- Operation over wide temperature range.
- Minimum side sway.
- Wide load range with uniform performance.

MADE IN ENGLAND UNDER LICENCE

AIR-DAMPED

BARRY B MOUNT

ISOLATORS

FROM BARRY CONTROLS INC. OF U.S.A.

Write for technical bulletins:

CEMENTATION (MUFFELITE) LTD., 20 ALBERT EMBANKMENT, LONDON, S.E.11

CB.6

(REliance 6556)



McMURDO RED RANGE CONNECTORS

FOR BACK RACK MOUNTING

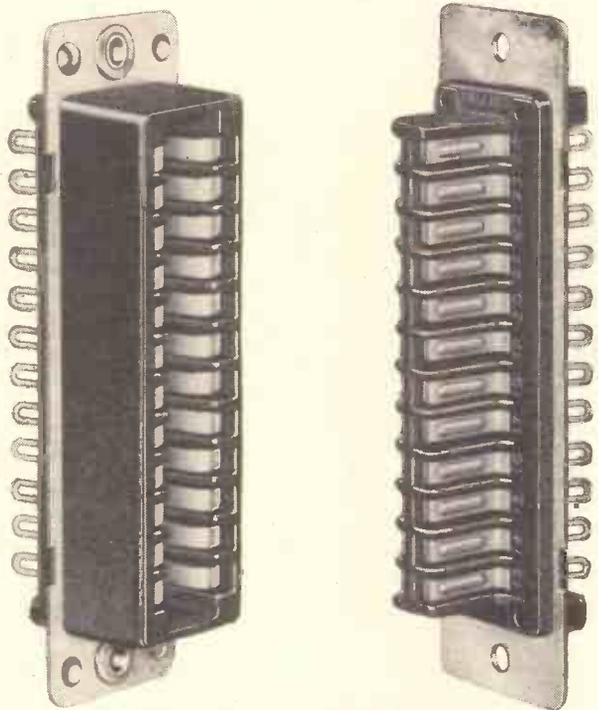
NOW AVAILABLE

8 WAY

16 WAY

24 WAY

32 WAY



24 WAY CONNECTOR

GOLD PLATED CONTACTS

POSITIVE POLARISATION

SELF ALIGNING

EXCEPTIONALLY LOW

INSERTION AND

WITHDRAWAL FORCE

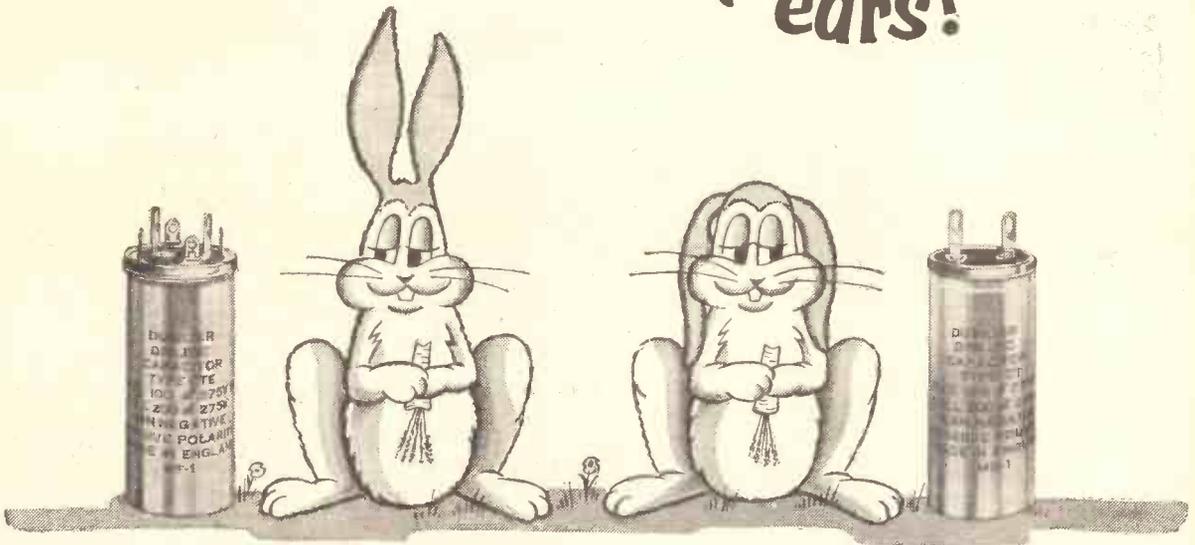
- WORKING VOLTAGE — 750V D.C
- CONTACT RESISTANCE — LESS THAN .005 OHM
- CURRENT RATING — 5 AMPS PER CONTACT
- MOULDINGS — RED NYLON LOADED P.F
- FLOATING BUSHES ON SOCKET MOUNTING PLATES ASSIST SELF ALIGNMENT

SEND FOR FULL TECHNICAL INFORMATION TO

THE McMURDO INSTRUMENT CO. LTD., ASHTEAD, SURREY

Telephone ASHTEAD 3401

With or without ears!



Whether you are a radical and like to use modern methods of assembly or whether you are a conservative and prefer the tried and trusted methods, Dubilier can supply you with the capacitors you require.

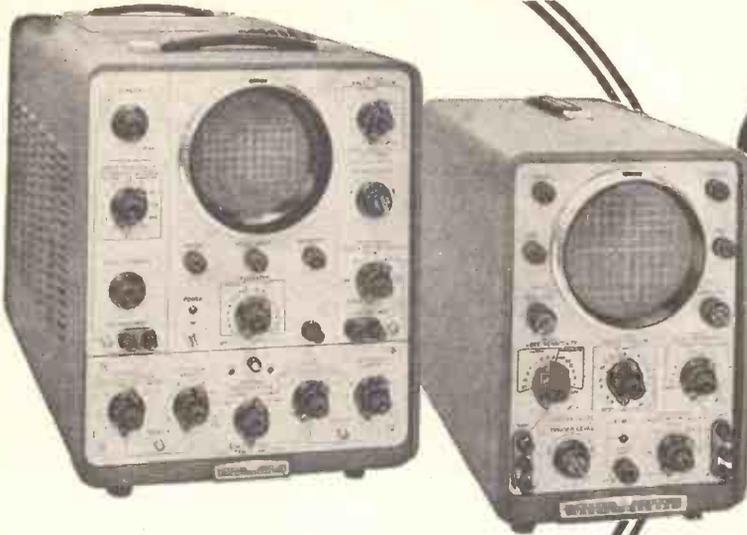
For example, Dubilier can supply you with electrolytic capacitors for television receivers made either for ear mounting* or clip mounting. In either case they are manufactured with the high ripple current sections required for this purpose. These capacitors are assembled and sealed in seamless drawn aluminium cans.

**For fixing ear mounting types, only four slots are required in the chassis. The capacitor is dropped into these slots and a slight twist of the ears secures capacitor firmly. Alternatively, a bakelite mounting plate can be supplied for use in those cases where isolation of the capacitor can from chassis is required.*

Capacitance (μF)	D.C. Wkg. Voltage	Dimensions	Ripple Current (mA)
100—200	275—275	4" x 1 1/2"	700—300
50	280	3" x 1 1/2"	500
100	280	2" x 1 1/2"	550
50—100	350—280	3" x 1 1/2"	500—200
50—100	280—280	3" x 1 1/2"	450—200
200—500	350—350	4" x 2"	700
64—120	350—350	4" x 1 1/2"	500
100—200	350—280	4" x 1 1/2"	900—300
100—200	350—280	4" x 1 1/2"	700
60—100	350—350	4" x 1 1/2"	500—200
60—250	350—350	4" x 1 1/2"	700—400
100—100	350—350	4" x 1 1/2"	550—200
100—200	350—350	4" x 1 1/2"	900—300

DUBILIER

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, W.3
 Telephone: ACOrn 2241
 Telegrams: Hivoltcōn Wesphone, London



Announces

2

all new

OSCILLOSCOPES

BRIEF SPECIFICATIONS

-hp- 130A

Sweep Range: 1 μ sec/cm to 15 sec/cm.

Calibration: 21 sweeps: 1-2-5-10 sequence, 1 μ sec/cm to 5 sec/cm. 5% accuracy.

Triggering: Internal, line voltage or external 2 v or more. Pos. or neg. slope, +30 to -30 v trigger range.

Preset Trigger: Optimum setting for automatic stable triggering.

Input Amplifiers: (Similar Vert. and Horiz. Amps.) Sensitivity 1 mv/cm to 50 v/cm; 14 ranges, continuous vernier. Pass band dc to 300 kc.

Amplitude Calibration: 1 kc square wave. 5% accuracy.

Price: \$450.00.

-hp- 150A

Sweep Range: 0.02 μ sec/cm to 15 sec/cm.

Calibration: 24 sweeps: 1-2-5-10 sequence, 0.1 μ sec/cm to 5 sec/cm. 3% accuracy.

Triggering: Internal line voltage or external 0.5 v or more. Pos. or neg. slope, +30 to -30 v trigger range.

Preset Trigger: Same as -hp- 130A.

Horizontal Amplifier: Magnification 5, 10, 50, 100 times. Vernier selects any 10 cm part of sweep. Pass band dc to over 500 kc. Sensitivity 200 mv/cm to 25 v/cm.

Vertical Amplifier: Pass band dc to 10 Mc. Optimum transient response and rise time less than 0.035 μ sec. Signal delay of 0.25 μ sec permits leading edge of triggering signal to be viewed.

Amplitude Calibration: 18 calib. voltages, 2-5-10 sequence, 0.2 mv to 100 v peak-to-peak. Accuracy 3%. Approx. 1 kc square wave. rise and decay approx. 1.0 μ sec.

Prices: -hp- 150A High Frequency Oscilloscope \$1,000.00.

-hp- 151A High Gain Amplifier, \$100.00.

-hp- 152A Dual Channel Amplifier \$200.00.

Data subject to change without notice.

Prices f.o.b. factory.

-hp- 130A Low Frequency Oscilloscope

High sensitivity, dc to 300 kc. Sweeps 1 μ sec/cm to 15 sec/cm.

-hp- 150A High Frequency Oscilloscope

Dc to 10 Mc. Plug-in preamplifiers. Sweeps 0.02 μ sec/cm to 15 sec/cm.

As a result of a totally new design philosophy, -hp- 130A and 150A Oscilloscopes set revolutionary standards for oscilloscope usefulness, convenience and rugged dependability.

The instruments' wide versatility is indicated in the specifications at left. Their greater convenience and reliability is inherent in such unique features as:

Universal automatic triggering system wherein one preset adjustment provides optimum triggering for almost all conditions. Unitized circuits, easily isolated for testing. Etched circuits, mounted on translucent plastic for "see-through" serviceability. Complete accessibility of all circuits and tubes. Highest quality components.

Ultra-conservative design, with circuits operating well below rating. Concentric, colour-coded controls, grouped by function and simplified. Direct sweep time selection—no mental gymnastics. A new low capacitance clip-on probe (for -hp- 150A) has 10 megohm impedance.

Get complete data on the most important oscilloscope improvements in history! Call your -hp- representative now, or write direct!

HEWLETT-PACKARD COMPANY

Represented by

LITHGOW ELECTRONICS LTD.

198-200 BATH ROAD • SLOUGH, BUCKS

Telephone: Slough 21292

Now, more than ever, -hp- means "Complete Coverage"

LOW NOISE TRAVELLING WAVE TUBES

The range designed by English Electric Valve Company includes low noise, voltage amplifier and power tubes, with outputs from 1mW to 16W.

Type N1005M illustrated is a low noise tube specially designed to operate over a frequency range of 3600-4200 Mc/s. It permits the use of r.f. amplification in radar, tropospheric scatter and other microwave equipment.

Full particulars of this tube and other units specially designed for use in the higher frequency bands are available on application.

E.E.V. Type	Function	Centre Frequency (Mc/s)	Maximum Output	Noise Factor (dB)	Gain (dB)	Helix Volts	Collector Current	Focusing Field (Gauss)
N.1001	Power	2000	16W	-	26	2600	40mA	600
N.1002	Low Noise	2000	1mW	10	24	550	200µA	200
N.1004	Power	4000	4W	-	21	2600	20mA	450
N.1005M	Low Noise	4000	1mW	11	22	360	200µA	350
N.1013	Voltage Amplifier	2000	200mW	20	32	650	4mA	300
N.1017M	Low Noise	1200	1mW	10	20	700	200µA	200
N.1018M	Voltage Amplifier	4000	100mW	20	30	630	2mA	350

'ENGLISH ELECTRIC'

ENGLISH ELECTRIC VALVE CO. LTD.



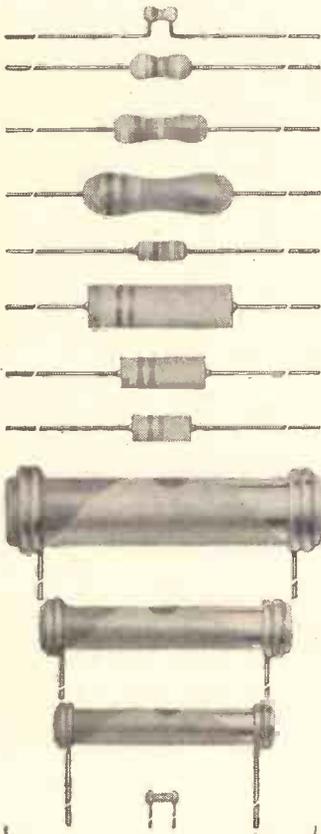
Waterhouse Lane, Chelmsford
Telephone: Chelmsford 3491



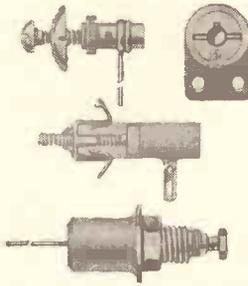
ERIE[★]

... all these
and ALL

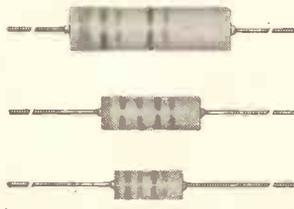
all illustrations two-thirds actual size,



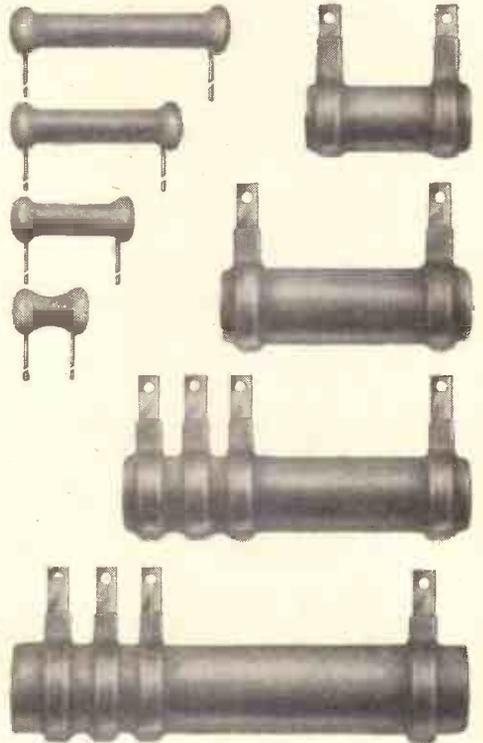
ERIE
SOLID CARBON RESISTORS



ERIE
TRIMMERS



ERIE
HIGH STABILITY RESISTORS

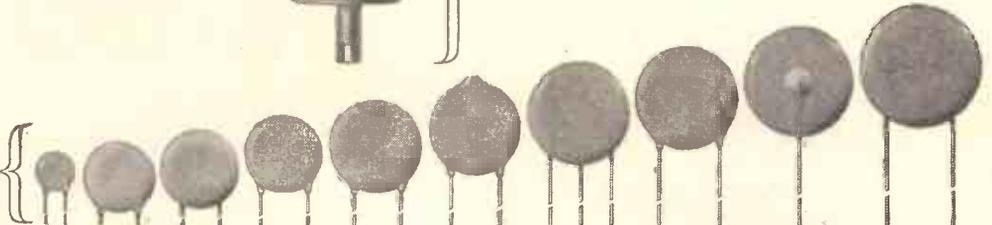


ERIE
SILERTEX[★] WIREWOUND RESISTORS



ERIE
HIGH VOLTAGE
DOUBLE CUP CERAMICONS[★]

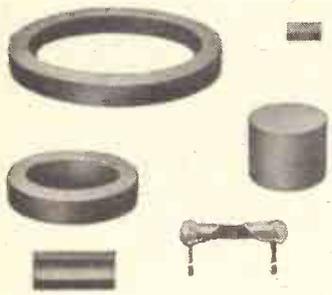
ERIE
DISC
CERAMICONS[★]



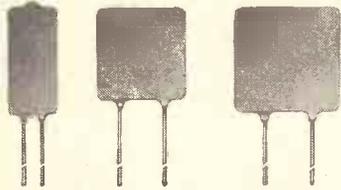
reliable components from a single source

Erie Resistor Limited,
Carlisle Road, The Hyde,
London, N.W.9, England.
Telephone: COLindale 8011.
Factories: London and Great
Yarmouth, England; Trenton,
Ont., Canada; Erie, Pa., and
Holly Springs, Miss., U.S.A.

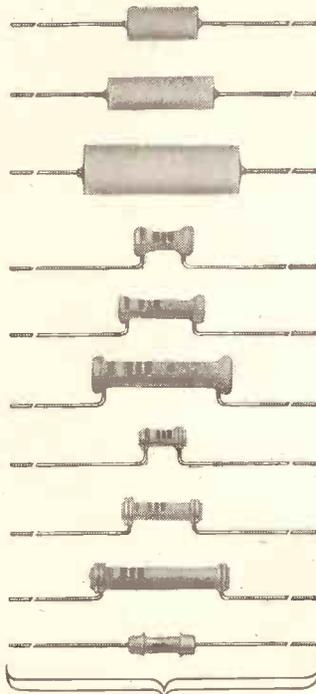
* Registered Trade Marks



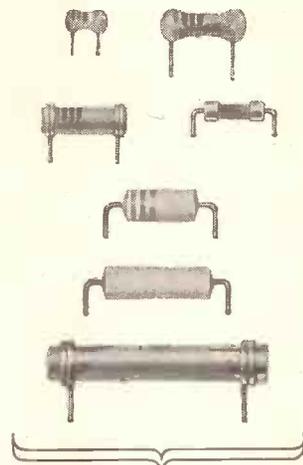
ERIE
SPECIAL CARBON PRODUCTS



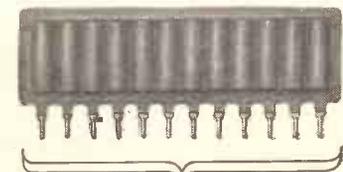
ERIE
PLATE CERAMICONS*



ERIE
TUBULAR CERAMICONS*

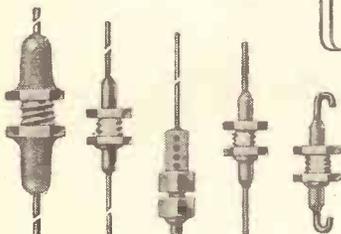
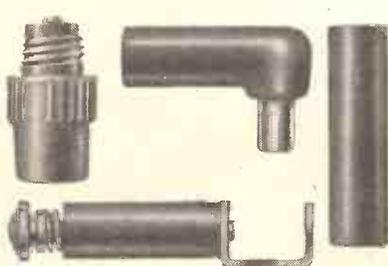


ERIE
RESISTORS AND CERAMICONS*
WITH PREFORMED LEADS
FOR PRINTED CIRCUIT
AND MECHANISED ASSEMBLIES



ERIE PAC
PACKAGED ASSEMBLY CIRCUITS

ERIE
IGNITION INTERFERENCE
SUPPRESSORS



ERIE
STAND-OFF AND
FEED-THRU CERAMICONS*

It pays
to use

Cyldon

**Inductance
Tuners**

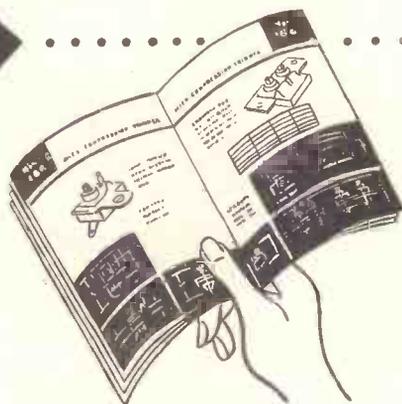
& VARIABLE CAPACITORS

for TELEVISION and AUTO RADIO

**SYDNEY S. BIRD
& SONS LTD.**

for
**Precision,
Stability &
Long Life**

Designers and users of radio and electronic equipment know that they can rely implicitly on the efficiency and dependability of "Cyldon" Capacitors and Tuners. They know too that the exceptionally wide variety of types in the standard "Cyldon" range covers most day-to-day requirements, but that when *special* types are needed the full resources and specialised experience of the manufacturers are entirely at their disposal.



Address for enquiries and sales correspondence:—
LONDON SALES & TECHNICAL LIAISON OFFICE,
3 PALACE MANSIONS, PALACE GARDENS, ENFIELD, MIDDXX.
Telephone: Enfield 2071-2. Telegrams: "Capacity, Enfield."

Head Office: POOLE, DORSET.

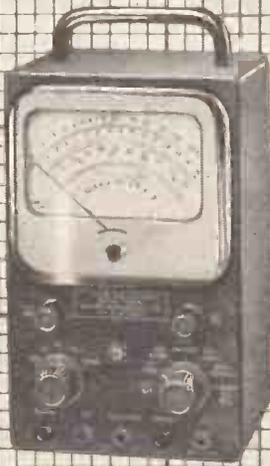
Contractors to Ministry of Supply, Post Office,
and other H.M. Govt. Depts.

Equipment manufacturers are invited to write for literature covering Cyldon "Teletuners" and Cyldon Trimmers, together with details of our complete range of Variable Capacitors and list of Agents for Home and Overseas.

Build these 2 useful instruments from

COSSOR KITS

Valve Voltmeter and Oscilloscope



*Model 1044K
Valve Voltmeter
List price £20 . 0 . 0*



*Model 1045K
Single Beam Oscillograph
List price £36 . 13 . 4*

**Each Kit, in addition to Printed Circuits and all parts,
includes an illustrated comprehensive instruction book
describing the step-by-step assembly.**

Write for leaflets to:—

COSSOR INSTRUMENTS LIMITED

THE INSTRUMENT COMPANY OF THE COSSOR GROUP

(Dept. 1), Cossor House, Highbury Grove, N.5

Telephone: CANonbury 1234 (33 lines)

Telegrams: Cossor, Norphone London

Cables: Cossor, London

MUTUAL & SELF INDUCTANCE BRIDGE



Designed for the accurate measurement of either mutual or self inductance and resistance in the range 0.001 μ H to 30mH and 100 μ Ω to 3000 Ω respectively.

All measurements are made in the form of a four-terminal network and inductance and resistance of leads and clips are not included in the measurement.

Accuracy within $\pm 1\%$ frequency 1592c/s ($\omega = 10\,000$)

Full technical information on this and other 'Cintel' Bridges is available on request.

CINEMA TELEVISION LTD

A COMPANY WITHIN THE RANK ORGANISATION LIMITED

WORSLEY BRIDGE ROAD • LONDON • S.E.26
HITHER GREEN 4600

SALES AND SERVICING AGENTS:

Hawnt & Co., Ltd., 59 Moor Street, Birmingham 4

F. C. Robinson & Partners Ltd., 122 Seymour Grove, Old Trafford, Manchester 16

Atkins, Robertson & Whiteford Ltd., Industrial Estate, Thornliebank, Glasgow

10 to 300 Mc/s DIRECTLY CALIBRATED

The type D1/D is a V.H.F. Signal Generator designed for making measurements in the frequency range 10 to 300 Mc/s. Its outstanding features are:—

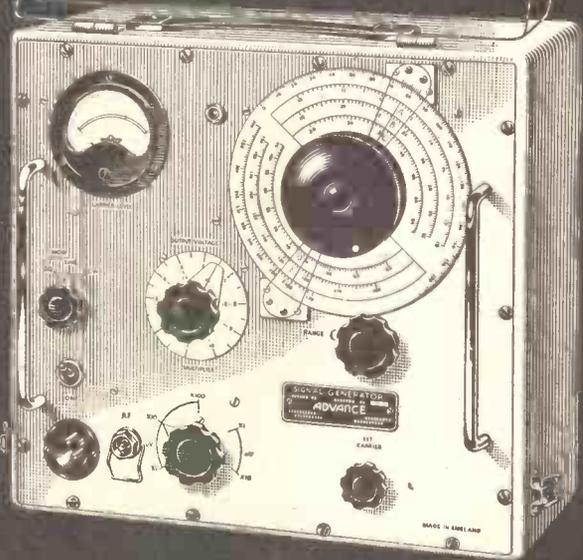
- 50 : 1 slow-motion drive.
- Linear scale and vernier for high resetting accuracy.
- Sine and square wave modulation.
- Attenuator variable over 100 db.
- Negligible stray field.
- Rugged construction and light weight (only 34 lb.).

NETT PRICE IN U.K.

£97

Full technical details available in leaflet W26

the *Advance* V.H.F. SIGNAL GENERATOR



MODEL D1/D

The ADVANCE V.H.F. SIGNAL GENERATOR TYPE DIP/2.

Directly calibrated in six ranges
2 Mc/s to 190 Mc/s.

This is a special version for the alignment of narrow band communication receivers which incorporates:—

- CRYSTAL MODULATOR ELIMINATING SPURIOUS F.M.
- 2 Mc/s CRYSTAL REFERENCE OSCILLATOR.
- BUFFER STAGE.

NETT PRICE IN U.K.

£110

Full technical details available in leaflet W37.

for all indicator purposes

Thorn miniature lampholders

Miniature lampholders in the Thorn range have been made possible by the development of the Atlas Midget Panel bulb.



5 types of midget panel bulbs are available

28 volts	0.04 amps
28 volts	0.08 amps
12 volts	0.1 amps
6 volts	0.1 amps
1.5 volts	0.75 amps

**THORN
ELECTRICAL
INDUSTRIES
LTD.**

Aircraft Components Division
Gt. Cambridge Road, Enfield,
Middlesex.

Thorn



MINIATURE SEALED PANEL LAMPHOLDER—INDICATOR TYPE

Completely waterproof and will withstand conditions of constant vibration and shock, these lampholders are intended for installation on aircraft, armoured fighting vehicles, and marine equipment. They are sealed and insulated from the panel, the thickness of which can vary from 20 S.W.G. (.036") to 10 S.W.G. (.128"). Thicker panels can be counterbored. Rotation is prevented by flats on the body. Mounting is by a single hole. Access to the lamp, for replacement, is from the front of the unit by unscrewing the dome. Lamps may be renewed, without breaking the seal to the equipment. Weight: .420 oz. (11.6 grammes) with bulb. Electrical connections: Two solder tags. Catalogue No. MPL. 20 Red; MPL 21 Green. Catalogue No. MPL. 22 Amber; MPL 23 Opalescent Ivory.

MINIATURE SEALED PANEL LAMPHOLDER—DIMMER TYPE

Identical to the Indicator type, except for the interchangeable cap. This is ribbed for grip, continuously rotatable and contains a light output control from bright to "blackout." Weight: .530 oz. (14.8 grammes) with bulb. Electrical connections: Two solder tags. Catalogue No. MPL. 10 Red (Translucent). Catalogue No. MPL. 11 Green (Transparent). Catalogue No. MPL. 12 Amber (Transparent). Catalogue No. MPL. 13 Clear (Transparent).

THORN MIDGET PANEL LAMPHOLDER

This is the simplest and most economical lampholder designed to accommodate the Atlas Midget Panel lamp. It is extremely effective and easily installed. Available with its transparent top in a variety of colours. Weight: 8.4 gr. (0.3 oz.). Can be supplied with insulated washers and connecting tags where non-earth return is desirable.

FLUSH OR RECESSED LIGHTING UNIT

This lampholder is used as a standard unit in the Plasteck Console panel. The body of the lampholder may be retained in a countersunk hole in the panel by a hexagonal backnut and lock-washer. A small projection under the collar prevents the fitting turning in the panel. The special coloured filter is contained in a moulded screw cap and a soft rubber sealing washer prevents any light from escaping round the edge. Filters in red, green, amber and clear. Weight: .31 oz. with bulb. Terminals: Solder tag and earth return. Catalogue No. PPL90.

Catalogue No. PPL120 (with 6BA terminal screw and earth return, weight: .35 oz. with bulb).

Interservice ref: Type A, No. 1.
Flush type—Solder connections. Ref. No. 5C/X. 5143.

Type A, No. 2.
Flush type—Screw terminals. Ref. No. 5C/X. 5144.
Can be supplied with insulated washers and connecting tags where non-earth return is desirable.

SURFACE TYPE LIGHTING UNIT

An alternative design to PPL90 for Plasteck and other control panels where no room exists immediately behind the metal panel. The bulk of the component projects above the face of the panel. A soft rubber sealing washer under the cap prevents the escape of light from the front of the panel. The lamp is inserted with the cap up. Weight: .49 oz. with bulb.

Terminals: Solder tag and earth return.
Catalogue No. PPL. 100.

Interservice Ref: Type B,
Surface type—Ref. No. 5C/X. 5145.

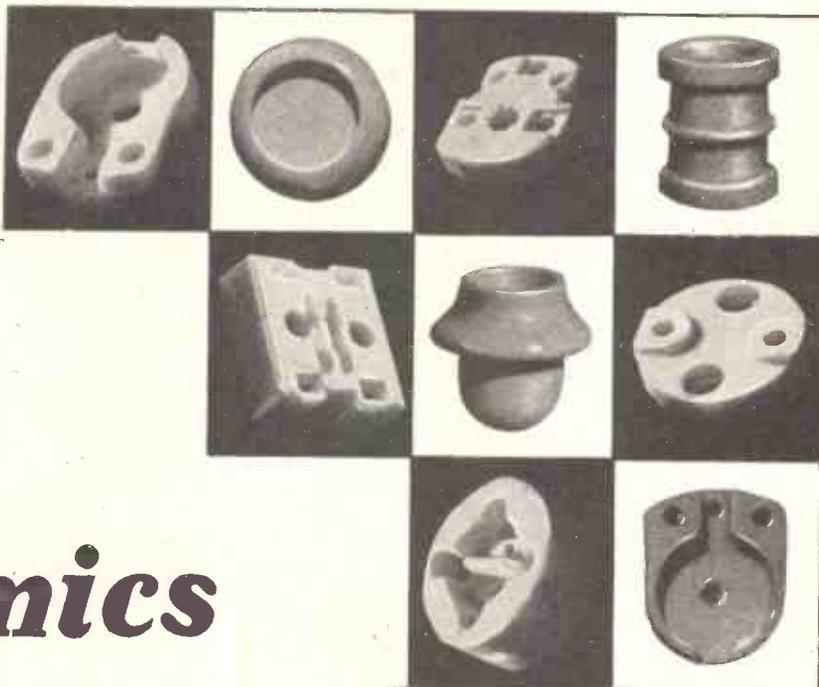
TAYLOR TUNNICLIFF

Makers of Porcelain Insulation

Low

Loss

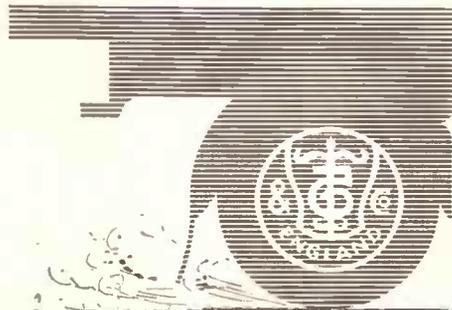
Ceramics



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 33071/2

London Office: 125 HIGH HOLBORN, LONDON, W.C.1. Tel. Holborn 1951/2

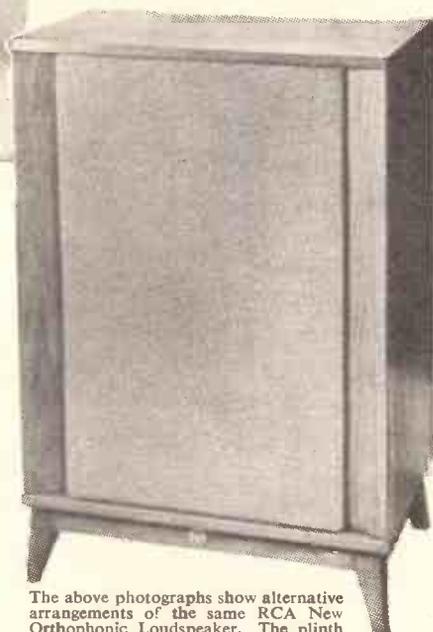


Realism

... is not enough!

You need to be able to live with your high fidelity equipment as well as listen to it.

This RCA New Orthophonic High Fidelity speaker system uses advanced acoustical design to give a liveable size with clean aesthetic lines which will harmonise with any furnishing scheme. The system uses a ported bass reflex type enclosure including the exclusive RCA acoustic curtain damping feature. The special arrangement of the triple speaker assembly ensures even sound distribution to all parts of your room with perfectly balanced bass and treble response. This instrument with its great sensitivity captures those elusive elements of sound which make for completely natural reproduction. The RCA Loudspeaker is the latest addition to a complete range of perfectly matched High Fidelity units designed for studio quality, radio and gramophone reproduction in the home. Send for further details.



The above photographs show alternative arrangements of the same RCA New Orthophonic Loudspeaker. The plinth shown is a separate unit. Speakers can be supplied in light oak or continental dark walnut finish and without plinth if required.



F/M TUNER



TRANSCRIPTION DECK



PRE-AMPLIFIER



MAIN AMPLIFIER



New Orthophonic High Fidelity

st

FIRST

TRANSISTORISED RELAY

The Hermetically Sealed 595HS



- ★ The 595HS can be controlled by ultra sensitive contacts handling 0.4mA. at 2V. Contacts will handle 5A, at 230V. A.C.
- ★ The 595HS is made to withstand exceptionally heavy shock and vibration.
- ★ The 595HS is made to withstand dirt and humidity indefinitely.
- ★ The 595HS can be obtained with various contact assemblies.
- ★ The 595HS is low in price because of its novel design.



MAGNETIC DEVICES LTD., A.I.D. & A.R.B. approved
 EXNING ROAD, NEWMARKET, SUFFOLK.
 TELEPHONE: NEWMARKET 3181-2-3. TELEGRAMS: MAGNETIC NEWMARKET

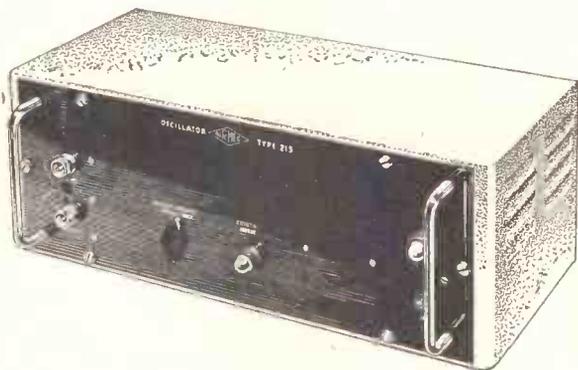
It's NEW!

THE STANDARD OSCILLATOR

TYPE 213

THE Airmec Oscillator Type 213 is a small, compact, crystal controlled frequency standard of low cost, providing standard output signals of 100 kc/s and 1 Mc/s. These signals of exceptionally good sinusoidal waveform are obtained from separate plugs on the front panel and are entirely independent of each other.

The crystal is housed in a temperature controlled oven, similar to that employed in the Airmec Frequency Standard Type 761, thus enabling a short term stability approaching a few parts in 10^7 to be obtained.



SPECIFICATION

FREQUENCY:	Outputs are provided at 100 kc/s and 1 Mc/s.
WAVEFORM:	Sinusoidal waveform of low distortion.
STABILITY:	The long term stability is better than 5 in 10^6 while a short term stability of better than 1 part in 10^6 is obtained over any 2 hour period.
AMPLITUDE:	2 volts r.m.s.
OUTPUT IMPEDANCE:	100 kc/s—500 ohms. 1 Mc/s—1200 ohms.

PRICE £100

IMMEDIATE DELIVERY

Full details of this or any other Airmec Instrument will be forwarded gladly on request.

AIRMEC LIMITED

HIGH WYCOMBE

BUCKINGHAMSHIRE

ENGLAND

Telephone: High Wycombe 2060

Cables: Airmec, High Wycombe

CATHODEON

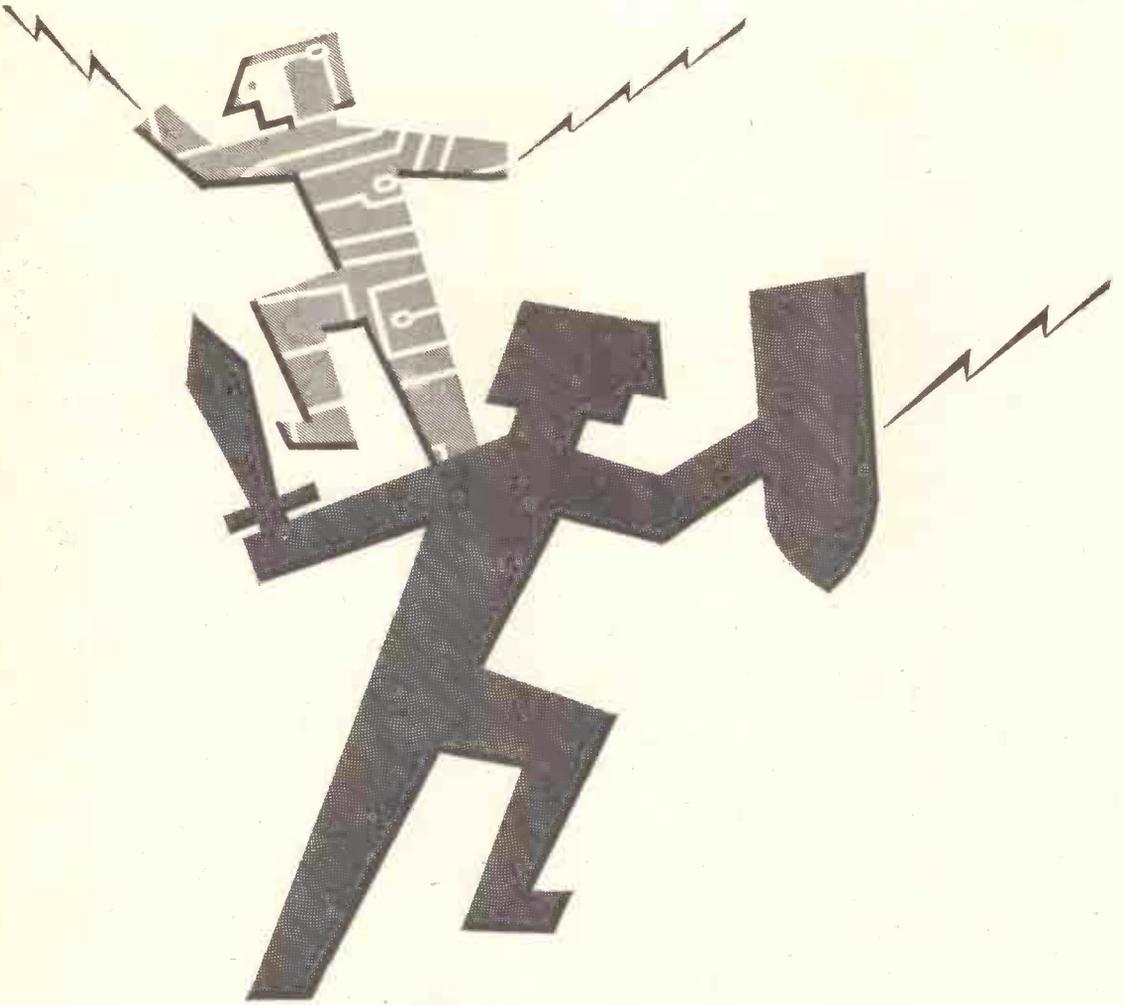


Quartz Crystal Units

Specialists in HIGH STABILITY CRYSTAL UNITS
in the frequency range 2,000-60,000 Kc/s.

CATHODEON CRYSTALS LIMITED
LINTON · CAMBRIDGESHIRE
Telephone: LINTON 223





Delaron

(by De La Rue)

does a double act for you

You already know DELARON as a laminated insulant of precisely known dielectric values and mechanical properties which fully meet all British Standard and Ministry specifications at every grade. It is used as a controller of electricity, from loudspeaker spiders to insulating washers.

But do you know about the second half of the double act by DELARON laminates?

In its copper-clad form it is the basis of most of the printed circuits in radio, television, radar and electronic computers—the new, simpler and cheaper method of circuit manufacture.

You should use DELARON laminates.

For information, advice and service get in touch with *Dept. D8E, Thomas De La Rue & Co Ltd* 84-86 Regent Street, London, W1.

G.E.C.

Valves for

Voltage

A 2293

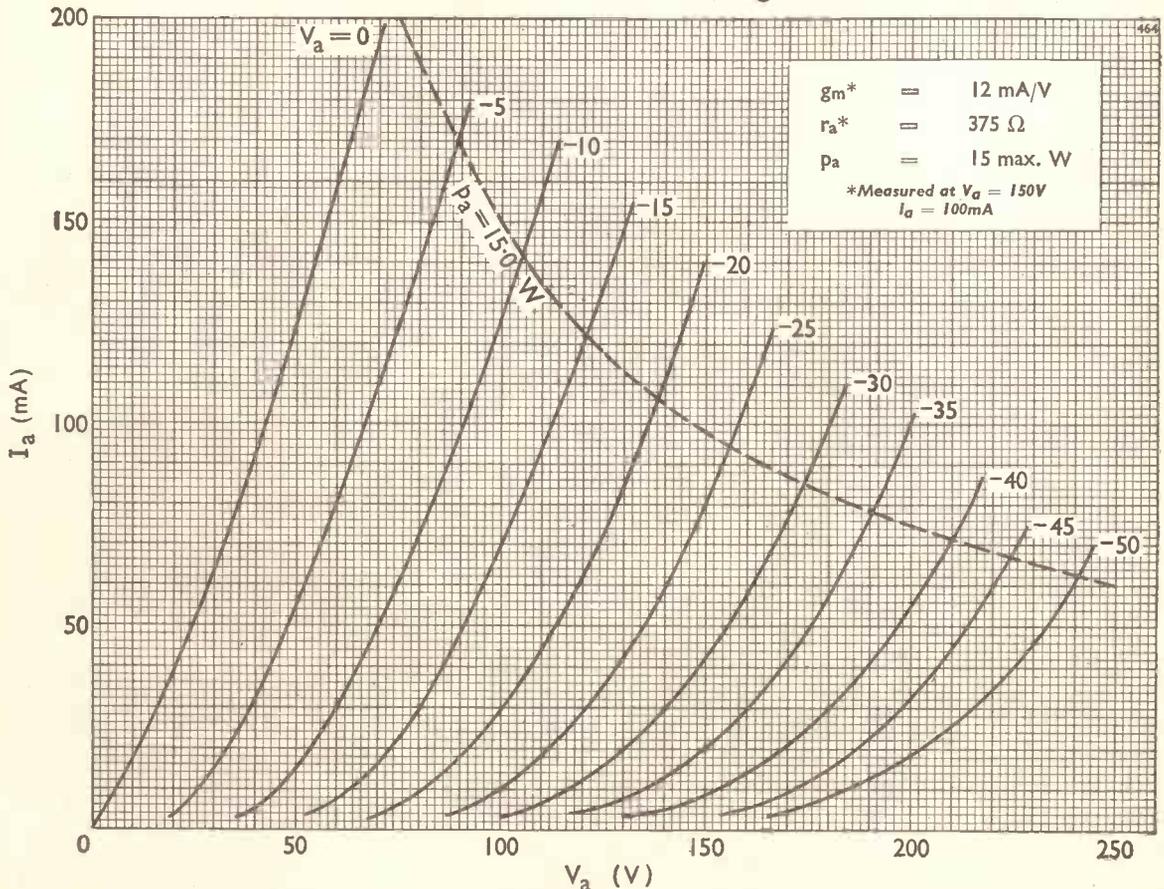
Stabilisation

THE A2293 is a new low impedance triode particularly suitable as the series valve in stabilised power packs. List price 27/-.



RATINGS

V_h	6.3	V
I_h	0.95	A
V_a	300 max.	V
I_a	120 max.	mA
Base	B9A	



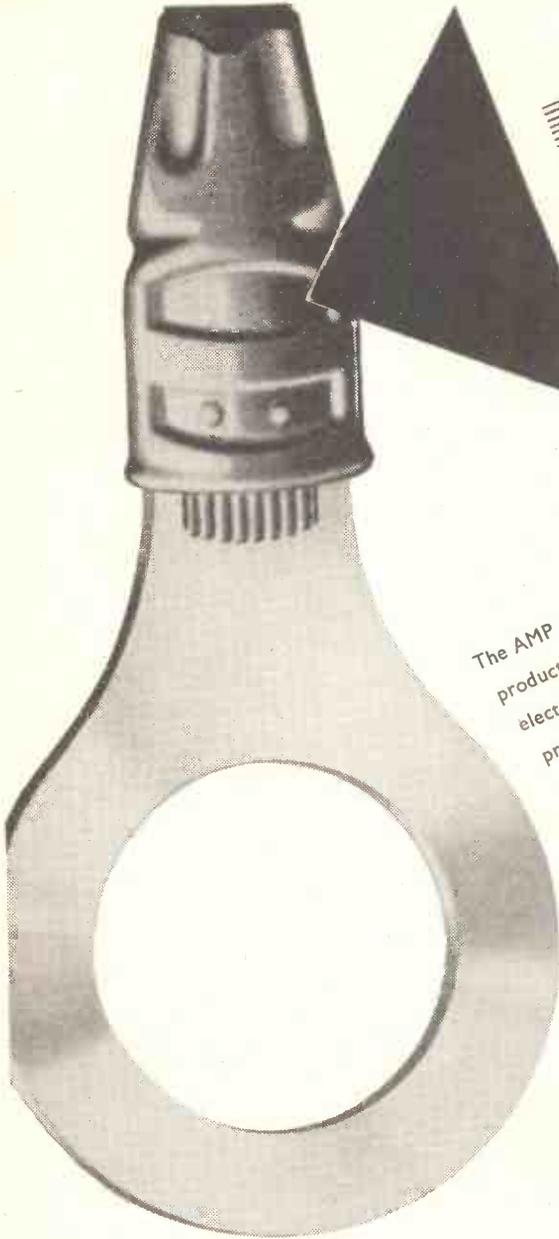
For further details write to the G.E.C. Valve & Electronics Dept.

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



**Solderless terminals
speed assembly
eliminate rejects**

The AMP precision method of wire termination reduces production costs and provides connections of the highest electrical and mechanical efficiency. The use of AMP precision crimping tools and automatic machines achieves exceptionally high rates of output, a uniformly high standard of quality and elimination of human error. AMP terminations and connections are of particular value in electronics and aircraft installations. They withstand vibration, corrosion and provide high tensile strength, with low resistance, and no noise at R.F.



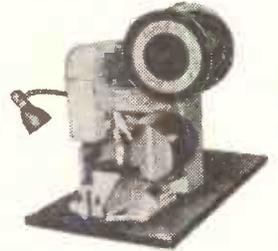
Brochure W.W. sent
or demonstration at
your own works on
request.



Certi-crimp hand tool.
Positive closure ensured.



Pneumatic hand tool.
eliminates operator fatigue.



Automatic wire terminator
operates at up to 4,000 an hour

AMP terminals are made for every
type and size of wire.

AIRCRAFT-MARINE PRODUCTS (GT. BRITAIN) LTD.

London Sales Office: 60 KINGLY STREET, LONDON, W.1. Tel: REGent 2517/8

Works: SCOTTISH INDUSTRIAL ESTATES, PORT GLASGOW, SCOTLAND

Ahead of the present —



— abreast of the future



We again take this opportunity to thank our customers all over the world for their support during 1956.

It has been a difficult year with rising costs and added restrictions everywhere. This has been an incentive to us and we are happy to report that once again our export sales have far exceeded those of previous years.

This has been achieved by decreasing prices, carrying a more comprehensive range now totalling over 2,000 types of receiving, transmitting and special purpose tubes, and, as ever, quick service.

Available on application is our new price list, proof that in a world of rising prices HALTRON Tubes are better value than ever.

Our organisation is A.R.B. approved.

HALL ELECTRIC LTD

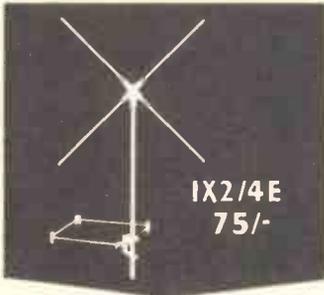
HALTRON HOUSE, 49-55 LISSON GROVE,
LONDON N.W.1.

Tel.: Ambassador 1041 (5 lines)

Cables: Hallelectric, London



ANTIFERRENCE AERIALS



IX2/4E
75/-

BAND I

BAND I

A complete range of Antex (illustrated) Dipole, 'H,' Fringe and indoor models is available. Outdoor models can easily be adapted for Band III by adding Band III Grip-on aerials as 350/1C below.

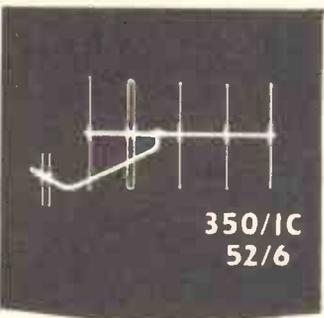


222/6G
115/-

BAND II

BAND II

Indoor and outdoor models to suit all conditions and to provide the very best results for VHF/FM equipment. Models for fitting to existing TV masts are available.



350/1C
52/6

BAND III

BAND III

3, 5, 8, 10 element and Stacked Arrays for outdoor installation and a comprehensive range of indoor models.



HL 402/4K
102/6

HILO

HILO

17 models to provide perfect Band I/Band III reception with only one aerial. All incorporate the patented Electronic Coupling exclusive to Antiferrence.

Specially Designed EXPORT RANGE

Antiferrence offer a specially developed range of competitively priced Television and VHF/FM aerials for export including Horizontally or Vertically Polarised Single or Stacked Yagi Arrays, Broad-Band and All-Band types for International Frequencies including Continental (C.C.I.R.) and American channels. The well-known Antiferrence features of pre-assembly and robust construction combine with specially designed features to withstand the most extreme climatic conditions and to meet the varying technical requirements of countries abroad. Our Export Department will, on request, be pleased to give full details of this specially designed Export Range. Fully detailed literature showing current models and prices available on request.

Standard PLUG & SOCKET



for CO-AXIAL CABLES R. E. C. M. F. Specification. Robust and simple to fit. PLUG TVP/1 SOCKET TVS/1 Both 8d. each.

'Y' BOX



For combining Band I and Band III Television Aerial down leads. OUTDOOR MODEL Y.1. 16/6 INDOOR MODEL Y.2. 12/6

Now BAND III & HILO AUTOMATIC WITH *Click-Mec*

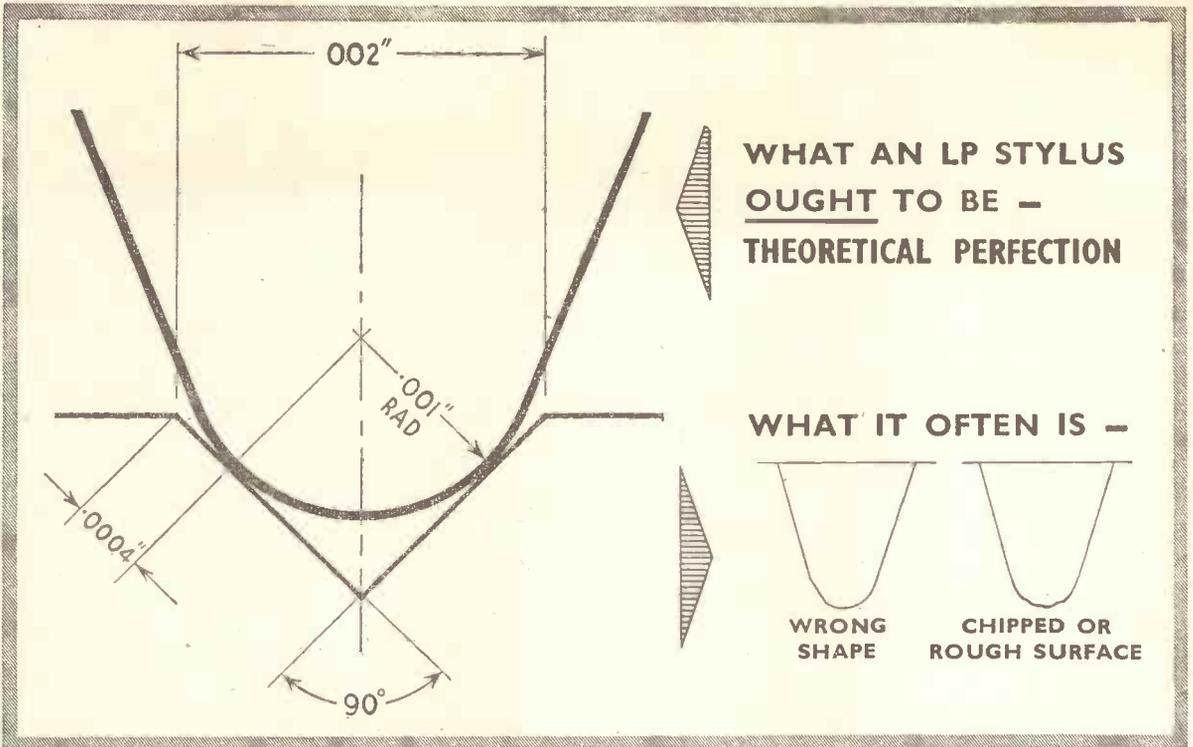
Far in advance of any other form of pre-assembly—'click' and they're fixed!

ANTIFERRENCE LIMITED

THE ANTIFERRENCE GROUP

Antiferrence Ltd., Aylesbury, Bucks and London, W.1.
Antiferrence (Canada) Ltd., Toronto, Canada.
Antiferrence (Australia) Pty. Ltd., Sydney, Australia.
Antiferrence Installations Ltd., London and Branches throughout Great Britain

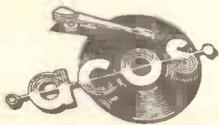
Obtainable only from Appointed Antiferrence Distributors.



acos X 500 *

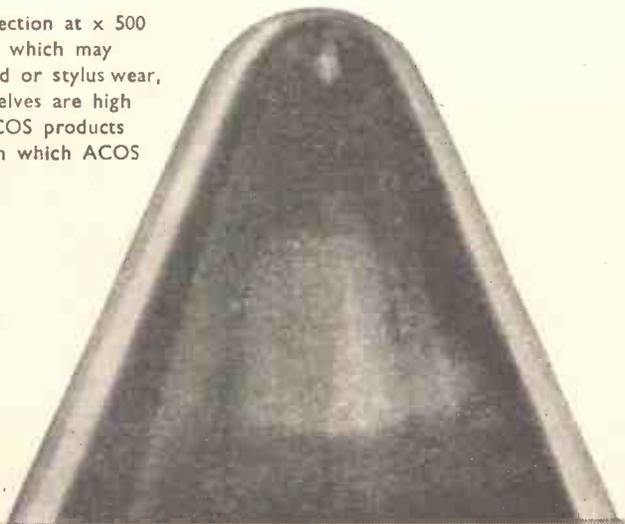
REPLACEABLE STYLI, AS FITTED TO ALL ACOS CRYSTAL AND CERAMIC PICK-UP CARTRIDGES HAVE PERFECT SHAPE, SIZE AND FINISH

* ACOS Styli have to pass a quality inspection at x 500 magnification. Only in this way can some faults, which may have important effects on reproduction or record or stylus wear, be reliably detected. The standards we set ourselves are high but practical. They are reflected not only in ACOS products but also in the record reproducing equipment in which ACOS pick-ups or cartridges are fitted.



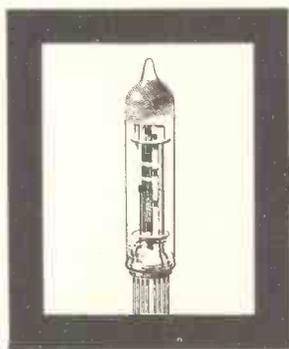
always well ahead

COSMOCORD LIMITED, Eleanor Cross Road, Waltham Cross, Herts. Waltham Cross 5206.

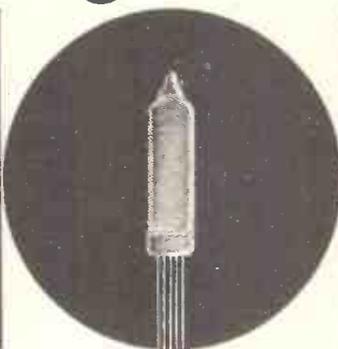


For all portable telecommunications equipment

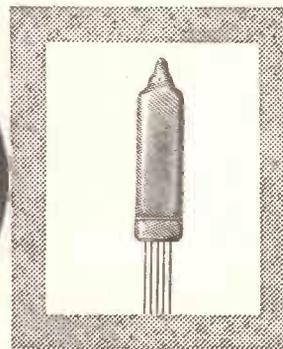
directly-heated



DC 70



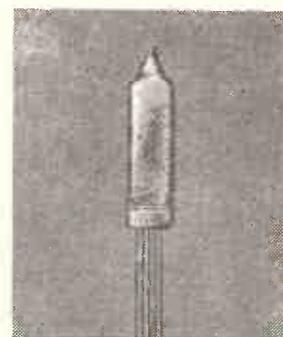
DF 60



DF 61

space saving

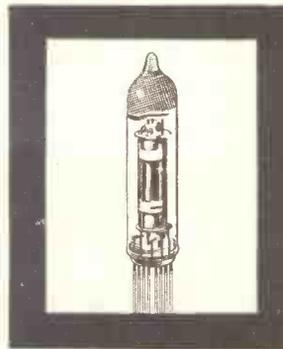
Manufacturers of almost every type of telecommunications equipment in which space is a limiting factor will welcome this newly extended range of Mullard directly-heated subminiatures. Their diameter, which is of the same small order as other components, facilitates tight packing in "sandwich" and other types of assembly.



DF 62

weight saving

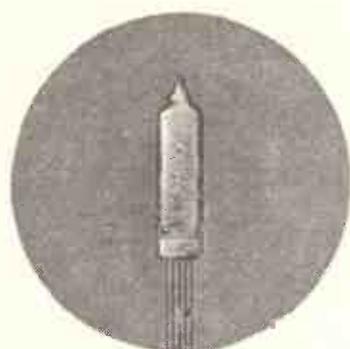
Due to their small size, these robust valves offer special weight saving advantages which are particularly valuable in relation to certain types of specialised battery powered equipment such as 'Hand-Talkie' and 'Walkie-Talkie'. They will operate efficiently from comparatively small battery supplies and so allow the overall weight of equipment to be kept to the minimum.



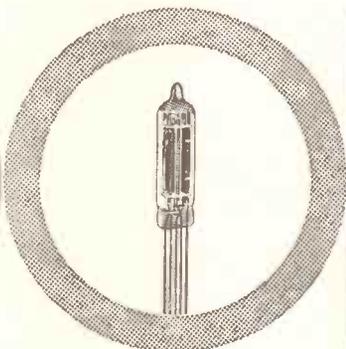
DL 70

Brief technical details are given on the page opposite — more comprehensive information on these and other Mullard subminiature valves is readily available.

subminiatures



DF 63



DL 69



DL 73

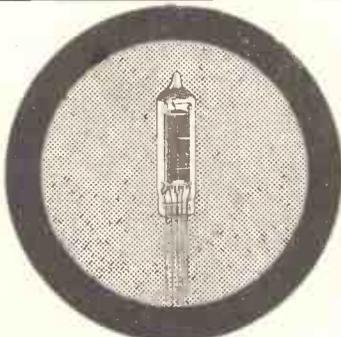
ABRIDGED DATA

Commercial Type No.	Services Type No.	American Equivalent	Description	Filament		Typical Characteristics								Special Notes †
				Vf (V)	If (mA)	Va (V)	Vg2 (V)	-Vg1 (V)	ia (mA)	Ig2 (mA)	gm (mA/V)	μ gl-g2	ra (kΩ)	
DC70	CV2275	—	U.H.F. Triode	1.25	200	150	—	4.5	14.5	—	3.75	15(±)	4.0	P _{out} = 0.55W at 500 Mc/s as class "C" osc.
DF60	CV2254	5678	R.F. Pentode	1.25	50	67.5 45.0	67.5 45.0	0	1.8 0.8	0.48 0.22	1.1 0.82	—	1000 1200	—
DF61	CV2371	—	R.F. Pentode	1.25	25	67.5 45.0	67.5 45.0	0	1.7 0.8	0.45 0.2	0.95 0.75	21 21	1600 1400	4.0 2.6 = -V _{g1} for 100:1 reduction in g _m *
DF62	CV2237	1AD4	R.F. Pentode	1.25	100	45.0	45.0	0 *	3.0	0.8	2.0	—	500	—
DF63*	—	—	Variable- μ Pentode	1.25	25	67.5	67.5	0	1.7	0.49	0.85	—	1600	-V _{g1} = 14V for 100:1 reduction in g _m *
DL69	CV2361	—	A.F. Output Pentode	1.25	25	90	90	2.5	1.75	0.4	0.85	—	800	P _{out} = 50mW.
DL70	CV2105	—	R.F. Output Pentode	1.25	110	135	90	7.5	7.5	1.5	1.9	6.5	150	P _{out} = 0.45W at 200 Mc/s as class "C" amp.
DL73	CV2299	—	R.F. Output Pentode	1.25	200	100	100	9.0	15	3.8	2.5	6.0	16	P _{out} = 1.2W at 200 Mc/s as class "C" amp.
DL620	CV2238	5672	A.F. Output Pentode	1.25	50	67.5	67.5	6.5	3.25	1.1	0.65	—	110	P _{out} = 65mW.

* At present only sample quantities of this type are available.

* With 2MΩ grid resistor.

† The power outputs quoted in the last column are not necessarily under conditions given for Typical Characteristics.



DL 620

Mullard

COMMUNICATIONS AND INDUSTRIAL VALVE DEPARTMENT



MULLARD LIMITED, MULLARD HOUSE, TORRINGTON PLACE, LONDON, W.C.1

MVT302a

Champion

High-Fidelity unit equipment for the home



**Model 853
Power Amplifier**



The complete power amplifier for use with either of the 2 other models (853A or 854). It is supplied in a beautifully finished cabinet which can be placed on a side table or bookshelf and will blend harmoniously in any room.

TECHNICAL DETAILS

The amplifier is based on a circuit developed by Mullards incorporating an ultra linear output-stage and contains a Power Supply for a Pre-amplifier and F.M. Tuner.

Maximum power output 11 watts. Frequency R. sponse 1 watt within 1 db. 10 c/s—20,000 c/s—at 10 watts within 1 db. 30 c/s—15,000 c/s.

Output impedance (Speech Coil): 15 ohm or 3.75 ohm.
Mains Supply: 200-250 volts.
50-60 c/s A.C. or 100-130 volts, 50-60 c/s A.C.
Sensitivity: 40 mV.

**22 gns.
NO TAX**

Champion proudly introduce the latest developments in HI-FI unit equipment

**Model 853A
Pre-Amplifier
Control Unit**



The Pre-Amplifier comprises a low noise, low distortion amplifier with tone controls and low pass filters. The first stage gives balanced compensation for five recording characteristics used by the leading recording companies in England and the U.S.A. This is effected by the use of frequency selective negative feedback. The tone control circuits give continuously variable control of both bass and treble frequencies.

TECHNICAL DETAILS

Input selector.
(1) Tape/Radio Replay.
(2) R.I.A.A.
(3) A.E.S. and R.C.A. ORTHO.
(4) Col. L.P. and F.F.R.R.
(5) N.A.R.T.B. and H.M.V. L.P.
(6) British 78 R.P.M.
(7) Microphone.
Treble and Bass Control.
Volume Control.
Low Pass Filter. Switched 10 K c/s. 7 K c/s. 5 K c/s level. Dimensions 15" x 4 1/2" x 4 1/2".

**18 gns.
NO TAX**

**Model 854
Pre-Amplifier and
F. M. Tuner**

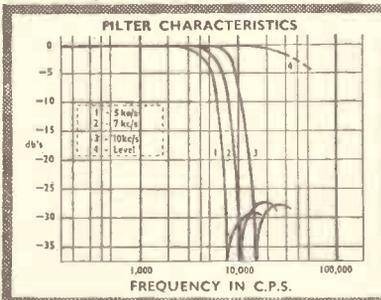
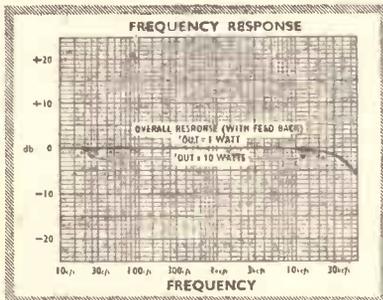


The Master Control comprises a low noise, low distortion tone control pre-amplifier and a sensitive VHF/FM tuner covering the frequency range 88-95 Mc/s, housed in a handsome cabinet matching the Main Amplifier Model 853.

TECHNICAL DETAILS

Input Selector.
(1) Mains OFF Switches off mains to Power Supplies in Model 853.
(2) FM Tuner.
(3) L.P. Records, Sensitivity 50 mV.
(4) 78 Records, Sensitivity 60 mV.
(5) Tape/Radio Replay, 100 mV.
(6) Microphone, Sensitivity 10 mV.
Volume Control.
Treble and Bass Controls.
Tuning Control.
Tuning Indicator,
Magic Eye. Mullard EM 81. Dimensions 15" x 8 1/2" x 9 1/2".
23 gns. + 10 gns. P.T.

**33 gns.
INC. TAX**

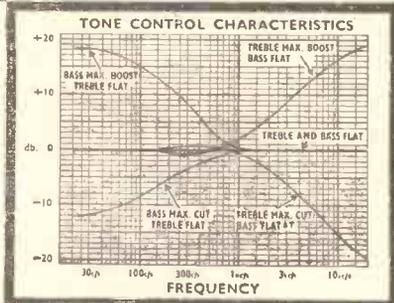


With the Champion High-Fidelity you will become aware of a new excitement in music; surprised and delighted to hear with extraordinary realism your favourite works, which before lacked clarity.

Champion

ELECTRIC CORPORATION

London Office & Showrooms: 8 Eccleston Street, S.W.1. Works: Newhaven, Sussex.



**You're years
ahead.....**

with the



RANGER V.H.F. MOBILE



New channelling and specification standards for mobile radio are being introduced in the United Kingdom and many parts of the world. The "Ranger", Pye's latest V.H.F. mobile, has been designed to anticipate these and will, in fact, meet specifications for the next ten years. The Pye "Ranger" therefore combines superlative performance with the maximum technical life. No matter what your channelling requirements the Pye "Ranger" will meet them.

3 amplitude modulated versions are available

W = 100 Kc/s. channelling for aeronautical and multicarrier schemes.

N = 60 Kc/s., 50 Kc/s. or 40 Kc/s. channelling.

VN = 30 Kc/s., 25 Kc/s. or 20 Kc/s. channelling.

The Ranger has been designed to meet the following leading specifications.

U.S. Federal Communications Commission
Canadian R.E.T.M.A.

Canadian Dept. of Transport
British G.P.O. existing and proposed specifications



Pye Corporation of America,
270, Park Avenue, Building A,
New York 17, N.Y., U.S.A.

Pye Limited, Mexico City.

Pye Limited, Tucuman 829,
Buenos Aires, Argentina.

PYE LIMITED
Phone: Teversham 3131

Pye Radio & Television (Pty.) Ltd.
Johannesburg, South Africa,
Pye Canada Ltd., 82, Northline Road,
Toronto, Canada.

Pye Pty. Ltd.,
Melbourne, Australia.

CAMBRIDGE

Messrs. Telecommunications,
Jamestown Road, Finglas, Co. Dublin.

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

Pye (France) S.A.
29Rue Cambon Paris 1^{er}

ENGLAND

Cables: Pyetelecom, Cambridge



INSTRUMENTS

ADMITTANCE BRIDGE TYPE B.801

1 Mc/s—100 Mc/s

For balanced and unbalanced measurement.

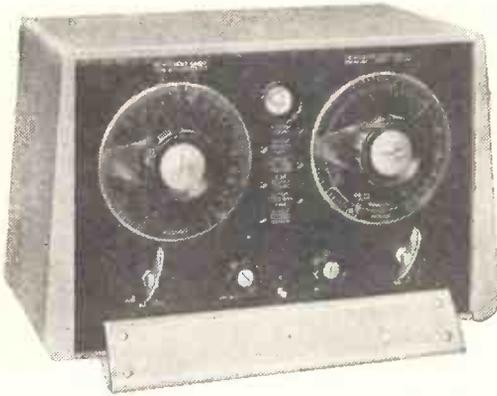
Susceptance: Equivalent to ± 230 pF. | Conductance: 0-100 mmho.

Accuracy: $\pm 2\%$, ± 0.5 pF. | Accuracy: $\pm 2\%$, ± 0.1 mmho.

This is one of a range of bridges for use with external source and detector for the measurement of aeriels, cables, feeders, and a variety of components and materials between 15 kc/s and 250 Mc/s. Bridge sources and detectors are available for use between 1-100 Mc/s and 50-250 Mc/s.



PRICE £150 NET EX WORKS



COMPONENT BRIDGE TYPE B.121

A general purpose 50 cps 3 terminal transformer ratio arm bridge for the measurement of Resistance, Capacitance and Inductance in the ranges 3-100 M Ω , 1 pF-100 μ F and 100 mH-10,000H, accuracy $\pm 2\%$. Direct readings of the resistive and reactive components of impedance and facilities for "in situ" measurements are notable features.

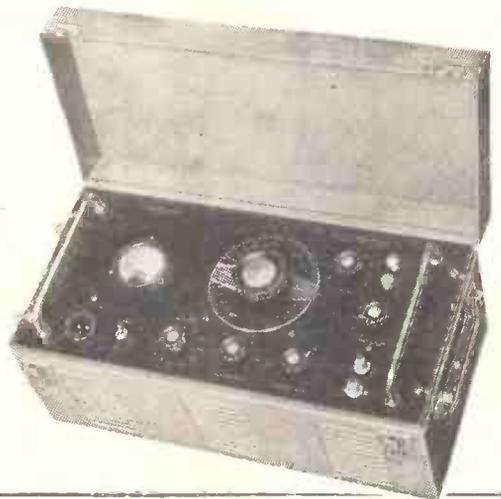
PRICE £60 NET EX WORKS

AUDIO WAVEFORM ANALYSER

TYPE A.321

A portable instrument to measure the relative levels of the components of a complex waveform over a range of 75 db between 50 c/s and 20 kc/s. Input impedance 100K Ω unbalanced or >25K Ω balanced. In transportable case as shown, or for standard 19" mounting.

PRICE £250 NET EX WORKS



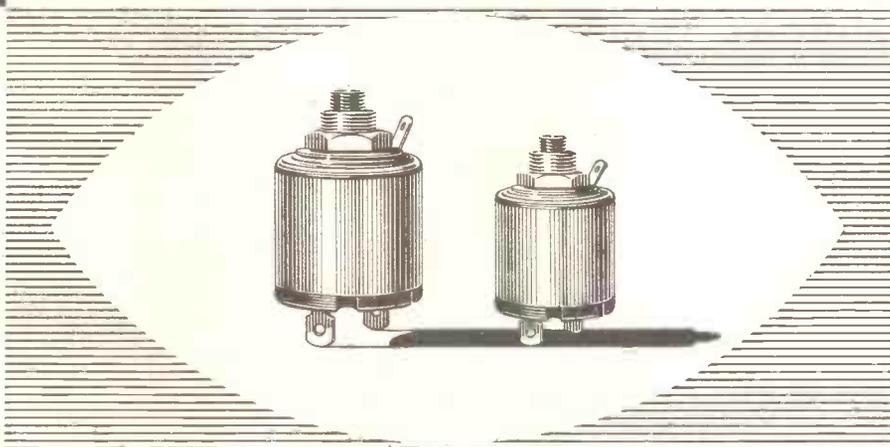
FOR FURTHER DETAILS WRITE OR TELEPHONE

THE WAYNE KERR LABORATORIES LTD · ROEBUCK ROAD · CHESSINGTON · SURREY · LOWER HOOK 1131

HIGH EFFICIENCY POT CORES

CAN NOW BE ADJUSTED.....

AFTER MOUNTING
OVER AN AVERAGE RANGE OF 10%
WITH A SETTING ACCURACY OF .5%



These new Mullard 14mm and 18mm pot cores are completely self contained, simple to mount and easily adjusted after mounting. Unique features include single hole fixing and two or four way terminal plates. Adjustments of inductance are made by means of a screw which varies the position of a magnetic shunt in the centre of the core; in many cases this eliminates the need for trimming capacitors. Designers will see from the brief characteristics listed here that Mullard adjustable pot cores are particularly suitable for use in high grade communications equipment, tuned circuits and filter networks. Those requiring further technical details are invited to write to the address below.

14mm Pot cores

Four types available LA32—35
Air gaps From 0.2mm — 0.5mm
Frequency range 10 Kc/s — 100 Kc/s
Q values in the higher frequency range > 200

18mm Pot cores

Four types available LA42—45
Air gaps From 0.3mm — 1.0mm
Frequency range 10 Kc/s — 100 Kc/s
Q values in the higher frequency range > 300

Mullard



'Ticonal' permanent magnets
Magnadur ceramic magnets
Ferroxcube magnetic cores



RADIO & TELEVISION TEST INSTRUMENTS



LIST PRICE: £30

Prompt delivery

Credit Terms:

9 monthly payments of £3.15.0

Unique Offer: You can part exchange an old TAYLOR instrument for a new one. Write for details.

VALVE TESTER

Model 45C

A comprehensive valve tester to measure the mutual conductance of most types of British, American and Continental receiving valves. Measures over 4,000 different valves, simple and rapid operation. 4in. scale moving coil meter.

Mutual Conductance: Two ranges: 0-3 mA/V. and 0-15 mA/V.

Cathode Leakage: Tests for Heater/Cathode insulation up to 10 megohms.

Emission: Rectifiers and Diodes can be tested for emission.

Inter-Electrode Shorts: Short circuits between electrodes are shown on the meter.

Heater Continuity: Meter indicates continuity of heater or filament.

Gas Tests: Press-button "gas" tests show abnormal positive or negative grid current.

T.V. cathode ray tube adaptor, model 445 available.

Hire Purchase Terms Also Available

INSULATION TESTER *Model 130A*

For workshop tests and component checking

This mains operated ohmmeter covers insulation and medium values of resistance. It is light and portable.

Meter: 4in. scale Taylor Moving Coil meter with knife-edge pointer.

Sensitivity: 50 μ A.

Ranges: (1) 20 ohms to 100K. ohms at test pressure of 50 Millivolts.

(2) 200K. ohms to 1,000 megohms at test pressure of 500 volts.

Accuracy: On each range 10% of centre scale values.

Overload Protection: Instantaneous Meter overload protection on all ranges.

Press Switch: Disconnects meter when rapidly charging capacitors for test.

Power Supply: 115V or 200/250V A.C., 40/100 c/s.

Dimensions: 8 x 5 $\frac{1}{4}$ x 4 $\frac{1}{2}$ in. **Weight:** 5 $\frac{1}{4}$ lb. (2.6 Kg.)



LIST PRICE: £16

Prompt delivery

Credit Terms:

9 monthly payments of £2.0.0

Write for details of these and other models

TAYLOR ELECTRICAL INSTRUMENTS LTD.

Monrose Avenue
Telephone: Slough 21381

Slough, Bucks.
Cables: Taylins, Slough.



DC 10 PRESSURE UNIT

SPECIFICATION

Power Handling Capacity 10 watts peak
 Voice Coil Impedance 15 ohms
 Frequency Response 120-9000 c.p.s.
 Flux Density 12,000 gauss
 Pole Piece 1.5in. diameter

PRICE **£6·10·0**

DIMENSIONS

	DC 10 (without line trs.)	DC 12 (with line trs.)
Diameter	4 $\frac{1}{8}$ in.	4 $\frac{1}{8}$ in.
Length	4 $\frac{1}{2}$ in.	6 $\frac{3}{8}$ in.
Weight	4 $\frac{3}{8}$ lb.	5 $\frac{1}{2}$ lb.

Specially designed and developed to meet the need of the P.A. Engineer requiring a compact, efficient unit combining good tone with average handling capacity, at a price that will make the "small" installation a profitable proposition.

HIGH SENSITIVITY. Heavy cross-sectioned cup with latest anisotropic alloy CP magnet.

PHASE EQUALISING THROAT. One-piece zinc based alloy die-casting.

SELF-CENTRING DIAPHRAGM ASSEMBLY. Can be changed in the field without special tools or soldering iron in 1 $\frac{1}{2}$ mins.

SPRING LOADED TERMINALS. Ensure quick and positive line termination.

WEATHERPROOF. Totally enclosed, ensuring protection when in exposed position, watertight gland cable entry.

Manufactured in Gt. Britain by

DC 12 PRESSURE UNIT (WITH TRANSFORMER)

As DC 10 but fitted with totally enclosed 100 v line transformer tapped 2.5, 5, 8 and 12 watts.
 Price **£7.10.0**

Rola Celestion Ltd.

FERRY WORKS THAMES DITTON, SURREY

Telephone: EMBerbrook 3402

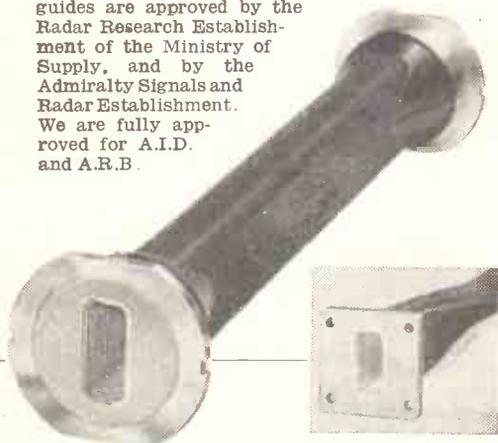
"Waveflex" Flexible Waveguides

FLEXIBLE and TWISTABLE

— Precision built for
long and reliable service

CHECK THESE EIGHT "STAR" POINTS:—

- Two types:—
Flexible—twistable
Flexible—non-twistable
- The high quality of "Waveflex" waveguides is maintained because all production operations from selection of correct materials to final testing are completed within the one organisation.
- Specially produced by an exclusive method of convoluting strip metal.
- The 'Neoprene' rubber sheath which is moulded and bonded to the guide, has been specially produced to give flexibility at extremely low temperatures.
- WG.16 twistable waveguides are designed to take a plus or minus 30 degree twist per foot.
- A standard range of "Waveflex" waveguides is made in lengths from 3" to 36" fitted with standard flanges. We shall be interested to investigate special guides to meet particular requirements.
- "Waveflex" flexible waveguides to match rigid guides in WG. 10, 15 and 16 are in production, the final range will also include WG. 11, 18 and 22.
- "Waveflex" flexible waveguides are approved by the Radar Research Establishment of the Ministry of Supply, and by the Admiralty Signals and Radar Establishment. We are fully approved for A.I.D. and A.R.B.



HERE ARE THE TEST DETAILS

A typical specification of WG. 16. V.S.W.R. .97 minimum per. end termination. Attenuation .15 DB/ft. maximum. Band width 8.2 to 10.7 k.m. c/s. Monitoring tests are carried out on a unique rig which flexes and/or twists the "Waveflex" guides many hundreds of thousands of times to ensure reliability in use.

WAVEFLEX

WAVEGUIDES

Full technical details from:—

GABRIEL MANUFACTURING CO. LTD.
Newton Road, Torquay, Devon.
Phone: Kingskerswell 2174.

One of the Tecalemit Group of Companies.

AND NOW

A

NEW

GRAMPIAN
MAGNETIC

NON-FEEDBACK

CUTTERHEAD

TYPE C



These units are a development from our type "D" feedback cutterhead and have similar mechanical and electrical constants but are operated from a single winding. They may be used in conjunction with any high grade power amplifier.

SENSITIVITY—3 volts input for 1 cm/sec at 78 R.P.M.

IMPEDANCE—15 ohms at 1000 c/s
FREQUENCY RESPONSE— ± 3 db—50 c/s to 10 Kc
6db at 20 Kc

DISTORTION—2% at 1000 c/s
WEIGHT—6½ oz (184 grams)
STYLUS HOLE—0.064" or 0.0625" as required
FITTING—Direct mounting on Presto and similar machines

★ Also available in horizontal form, type CIH

Write for full details

GRAMPIAN REPRODUCERS LTD
17 Hanworth Trading Estate
FELTHAM • MIDDLESEX • ENGLAND
Telephone Feltham 2657

Western Hemisphere. Reeves Equipment Corp., 10 East 52nd St.
New York 22, N. Y.
Australian Agent. Simon Gray Pty. Ltd., Elizabeth St., Melbourne C.I
Australia.

New Low Price HIGH FIDELITY for the home

The Pye HF5/8 is a new, reasonably priced amplifier specially designed for use in the home, with peak output of 8 watts. Features: "loudness control" which correctly accentuates bass and treble at low volume levels; 4 plug-in inputs; 5 pick-up compensators; 4 record replay characteristics; infinite damping factor. Harmonic distortion at 1 Kc/s: less than 0.3% overall at 5 watts output. Noise and Hum: main amp. better than 70 db's—overall, better than 55 db's.



Model HF5/8W

Model HF12BS

The new Pye 12 watt Bookcase Speaker—equally at home in the drawing room or bedsitter—brings high fidelity to the ordinary listener at a price he can afford. Extremely compact, it comprises two matched 8" high flux speakers with special cones, operating in parallel and specially mounted in an acoustically designed chamber to give optimum performance. Fundamental resonance 60 c.p.s. Flux density 9,500 gauss. Frequency range (in Cabinet) 40—13,000 c.p.s. Impedance: 15 ohms. Power handling capacity: 12 watts. Finished in walnut veneers.



- Pye Limited, Auckland, New Zealand; Pye Corporation of America, 270 Park Avenue, New York;
- Pye Canada Limited, Toronto, Canada; Pye Limited, Tucuman 829, Buenos Aires;
- Pye (Ireland) Limited, Dublin, Eire; Pye Limited, Mexico City;
- Pye Radio & Television (Pty.), Limited, Johannesburg, South Africa;
- Pye Pty. Limited, Melbourne, Australia; Pye Limited, Stuttgart, West Germany.



HIGH FIDELITY SYSTEMS

P Y E L I M I T E D O F C A M B R I D G E

Armstrong

SPECIALISTS FOR OVER 20 YEARS IN HIGH QUALITY REPRODUCTION

SONIXGRAM

REGD.

A COMPLETE DOMESTIC HIGH FIDELITY SYSTEM

Truvox TR7U Mk.III Tape Unit

Armstrong FM 56 Tuner
 ● Permeability Tuning ● Freedom from Drift ● Magic Eye Tuning ● 3 position HT Supply Socket ● Automatic Limiting
 £22/1/-

Armstrong Labyrinth Loudspeaker Enclosure
 Revolutionary new design offering hi-fi reproduction from a cabinet small enough to blend into any home. Goodman AUDIOM 60 (Bass Cone). Plessey Aluminium Voice Coil Treble Unit with fully matched Cross-over Network. Complete £30.

PABO-1 Tape Pre-Amp and Erase Unit
 £12/19/-

Colloro 2010 Transcription Gramophone Unit

Armstrong AM44 Tuner
 ● Variable Selectivity ● 4 wavebands ● Magic Eye Tuning ● Infinite Impedance Detector ● Cathode follower Output
 £19/17/-

Armstrong A10 Amplifier & Control Unit
 ● 10-12 watts ultralinear ● 0.1% total harmonic at 8 watts ● Within 1 dB 15-30,000 cps ● 4 input positions ● Equaliser ● Filter ● Separate Bass and Treble controls
 £28/10/-

Price (COMPLETE) £200

All units are available separately, and in various combinations in the Sonixgram

ARMSTRONG WIRELESS & TELEVISION CO. LTD. WALTERS RD., HOLLOWAY, LONDON, N.7. Tel. NORTH 3213/4

PRECISION High Fidelity 4 SPEED TRANSCRIPTION UNITS

WITH VARIABLE SPEED ADJUSTMENT.

MAIN FEATURES

- Speed continuously variable from 29 r.p.m. to 86 r.p.m. Pre-set adjustable "click-in" position for 78, 45, 33½ and 16 r.p.m. Playing old celebrity discs requiring speeds above 78 r.p.m. Tuning record pitch to a musical instrument. Correcting for 'mains frequency variations.
- Accurately balanced heavy precision made turntable eliminates Wow and Flutter.
- Unique VERTICAL EDGE-DRIVE PULLEY principle eliminates Rumble.
- Less than 1% change in speed for up to 13% change in Line Voltage.
- Large resilient 4-pole constant velocity motor.
- Model G.L.50/4 and G.L.56 fitted with weight adjustable precision Pick-up-Arm with plug-in shell, incorporating the Superb Goldring Variable Reluctance Cartridge No. 500.



GL50/4

GL55

TYPE GL50/4 Low Loading velocity operated Automatic Stop Price £15.15.0 P.T. £6.2.10

TYPE GL55. Without Pick-up. FITTED WITH BAND LOCATION DEVICE Price £12.12.0 P.T. £4.18.4

TYPE GL56. Complete with Pick-up. FITTED WITH BAND LOCATION DEVICE Price £16.16.0 P.T. £6.11.0

DIAMOND STYLUS EXTRA £3.15.0 P.T. £1.9.3

Write for technical reports to—

THE GOLDRING MANUFACTURING CO. (GT. BRITAIN) LTD.

486/488, HIGH ROAD, LEYTONSTONE, LONDON, E.11. LEYTONSTONE 8343-4-5



REPLACEMENT ELAC SPEAKER UNITS



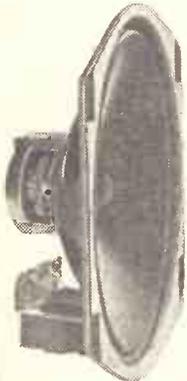
Model
5in. G
Price
25/8
inc. P.T.



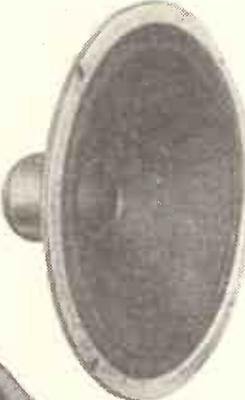
Model
6 1/2 in. G
Price
27/-
inc. P.T.



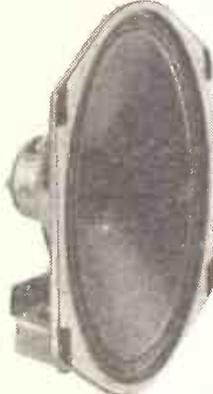
Model
8in. C
Price
31/11
inc. P.T.



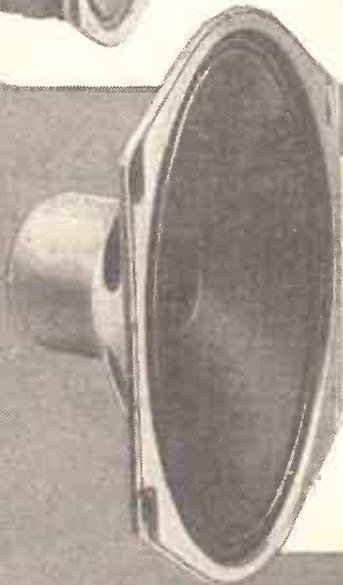
7 x 4 in. G
Elliptical
Price
25/8
inc. P.T.



Model
10in. C
Price
39/9
inc. P.T.



10 x 6 in. C
Elliptical
Price
39/6
inc. P.T.



ELMAG High Fidelity Units

Designed to give good quality at domestic volumes. For a power output stage providing more than 4 watts, 2 or more speakers are recommended.

Flux Density 8,000 gauss (27,500 Maxwells).
Frequency Response 40-12,000 c.p.s.

9 x 5in. Model 59T. Price 38/2 inc. P.T.

All prices are for speakers without transformers.

TRADE TERMS : 33 1/3%

ELECTRO ACOUSTIC INDUSTRIES LTD

STAMFORD WORKS, BRADB LANE, TOTTERHAM, N.15 Tel. Tottenham 0281-4 (5 Lines)

Build yourself a 75gns Radiogram for

£54-7-6 only

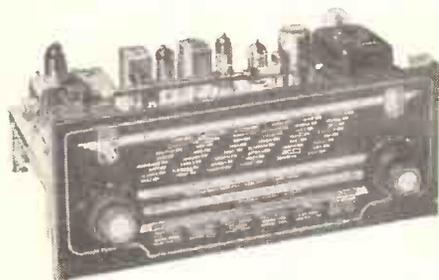


CABINET CAT. NO. CAB/03

A magnificent Bureau-type Cabinet of the very highest quality in specially selected Walnut veneered exterior. Light Sycamore interior with Rexine lining to match. Outside dimensions, length 34in., depth 17½in., height 33in. Sloping control panel on right-hand side approx. 16in. x 10½in. Removable baseboard on right side approx. 15½in. x 15in.
Packing and carriage 25/-.

Or on Credit Terms.

CASH **£17-6-6**



CHASSIS CAT. NO. CR/AFM49/PP

9-valve Superhet with F.M./VHF Band (4 wavebands). Push-pull output. Slow motion tuning drive. Full provision of Automatic Volume Control. Sockets provided for Aerial, Earth, Gram, Pick-up and Extension Speaker. Connections provided to Gram. Motor controlled by Chassis On/Off switch. The tone controls have been given an extra wide range to embrace all types of recordings. A.C. 200/250 volts, 50 cycles only. Special 10inch high flux density loudspeaker included.
Packing and carriage 15/-.

Or on Credit Terms.

CASH **£27-6-0**

AUTOMATIC RECORD CHANGER

CAT. NO. RC/A. The latest multi-speed changer incorporating 16 r.p.m. for "talking-books," and arrangement for manual control. Fitted with high fidelity Crystal Turnover Pick-up Head. A.C. mains 200/250 volts, 50 cycles only.
Packing and carriage 12/6.

CASH **£9-15-0**



CABINET ★

CAT. NO. CAB/02

A well - designed Bureau-type Cabinet in a medium size. Veneered in a highly figured Walnut. Outside dimensions, length 29½in., 32in. Sloping height, depth 16in.,

control panel on right-hand side approx. 13in. x 10½in. Removable

baseboard on right-hand side approx. 13½in. x 13in. Large record compartment inside the cabinet located at the top on left-hand side.

Packing and carriage 20/-.

CASH ONLY 12 Gns.

★ OTHER CHASSIS ★

CAT. NO. CR/A. 5-valve Superhet, 3 wavebands. 12 Gns. Packing and carr. 12/6.

CAT. NO. CR/AFM47. 7-valve Superhet with F.M./VHF Band (4 wavebands), 23½ Gns.

Packing and carriage 15/- Or on Credit Terms.

★ F.M. TUNERS ★

CAT. NO. FMT/A. Complete Unit in Cabinet with Magic-eye tuning. 16½ Gns. Or on Credit Terms. Packing and carriage 12/6.

CAT. NO. FMT/B. Chassis only excluding magic-eye. Unboxed, 11½in. long x 5½in. overall depth x 4in. high. CASH £13/15/- Packing and carriage 12/6.

★ LOUDSPEAKERS, Gram

Amplifiers, Tape Recorder equipment, etc. available at keenest prices. Send for large illustrated catalogue.

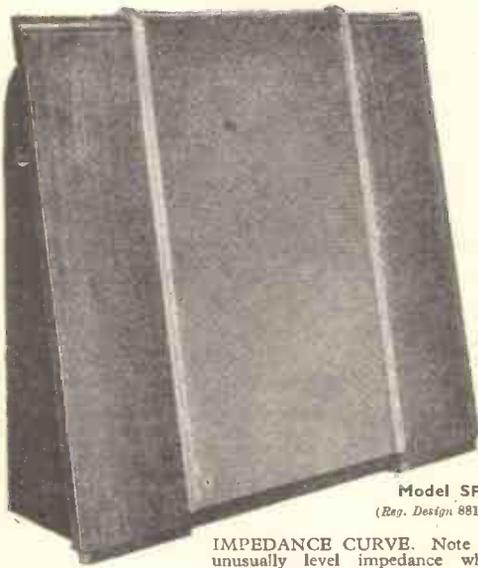
ALL FULLY GUARANTEED Generous extended credit terms on orders exceeding £15. Dealers supplied at full discounts.

DOMESTIC

DIRECT SALES

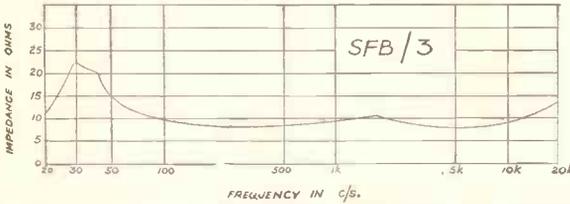
90 JUDD STREET, LONDON, W.C.1.

TEL: TER. 9876



Model SFB/3
(Reg. Design 881557)

IMPEDANCE CURVE. Note the unusually level impedance which typifies the wide frequency response.



Wharfedale

NEW 3-SPEAKER SYSTEM

gives you everything... except resonance

Yes, in Wharfedale's latest model, cabinet resonance is conspicuous by its absence. Low resonance speakers fitted with foam suspension give smooth response over the full frequency range. Visually the SFB/3 is attractive. Structurally it is compact and portable. Technically it is cleverly designed. Acoustically it is amazingly good for its size.

- ★ ATTRACTIVE APPEARANCE ★ FREE-STANDING & EASILY MOVED
- ★ RESONANCE FREE : SANDFILLED BAFFLE ★ OMNI-DIRECTIONAL
- ★ FREQUENCY RANGE : 30 c/s to 20,000 c/s ★ MODERATE PRICE

SPECIFICATION

Size 34" x 31" x 12"
 Weight 64 lb.
 Impedance 8/15 ohms
 Bass resonance 30/35 c/s
 Max. Input 15 watts

NEW PRICE

£39.10.0
 COMPLETE

Tropical model made with resin-bonded plywood can be supplied at £2.0.0 extra.

Made and guaranteed by **WHARFEDALE WIRELESS WORKS LTD . IDLE · BRADFORD · YORKS.**

Phone : Idle 1235/6

METERS

To B.S.89 Calibrated and scaled to your requirements.

**DEVELOPMENT & PRODUCTION PROBLEMS ASSISTED BY
 PROMPT DELIVERY**



Typical 2½" & 3½" Round Flush Pattern

Stockists of:
**ERNEST TURNER, EAC, BALDWIN, WEIR
 and LEADING
 MANUFACTURERS INSTRUMENTS**
 MOVING COIL, MOVING IRON
 THERMO COUPLE, ELECTROSTATIC

**CIRCULAR (Flush or Projecting), SQUARE,
 RECTANGULAR & INDUSTRIAL PATTERNS.**



Typical 4½" square Flush Pattern

Manufacturers of :

ELECTRONIC TEST EQUIPMENT

**NETWORK ANALYSERS
 EDUCATIONAL, GEOPHYSICAL and
 SPECIAL INSTRUMENTS**

**PORTABLE MULTIRANGE TEST SETS
 at 1 megohm per Volt
 ELECTRONIC INSULATION TEST-SETS**

May we quote for your requirements?

ANDERS ELECTRONICS LTD.

91, HAMPSTEAD ROAD, LONDON, N.W.1. Telephone EUSton 1639.

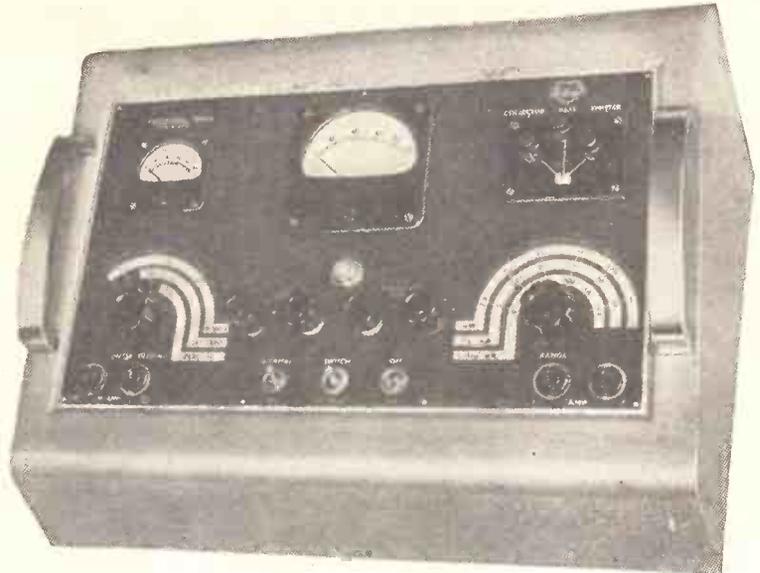
Suppliers to Govt. Depts., B.B.C., Tech. Colleges, Leading Manufacturers & Research Laboratories

from the new Mullard catalogue

Transistor Tester

L264

The Mullard Transistor Tester has been developed to provide a rapid means of checking general characteristics and ascertaining if a transistor has been damaged in circuit. Facilities for measuring the important parameters, α^1 , base-collector short-circuit current gain, as well as I_{co}^1 and the collector turnover voltage are provided. Although designed as a simple testing unit, it has an accuracy of $\pm 5\%$.



Dual Trace Oscilloscope

L101/2

This high grade, general purpose instrument incorporates two identical amplifiers with sensitivities of 20mV/cm over a bandwidth of 4 Mc/s. Calibration accuracies are voltage $\pm 5\%$, and time $\pm 10\%$ by null methods. The time base may be free running or triggered, and sweep speeds are from 0.1 μ s/cm to 10 ms/cm.



Television Line Selector

L196

The L.196 enables any normally triggered oscilloscope to give a jitter-free display of one or more lines from a television video signal. It can be used on transmitter and receiver circuits to display depth of modulation, d.c. levels, bandwidth, blanking, synchronizing pulses and for the examination of similar waveforms in detail.



Regulated Voltage Unit

L193

This is a general purpose laboratory unit which provides a stable low impedance d.c. supply which can be continuously varied between 0 and 300V positive and negative at up to 300mA. Two 4 amp a.c. supplies at 6.3V tapped at 4V are also incorporated and an unregulated e.h.t. supply of 1.2kV at 2mA.

Mullard

Specialised Electronic Equipment



WRITE FOR FULL INFORMATION

MULLARD LIMITED · EQUIPMENT DIVISION · MULLARD HOUSE
TORRINGTON PLACE · LONDON · W.C.1

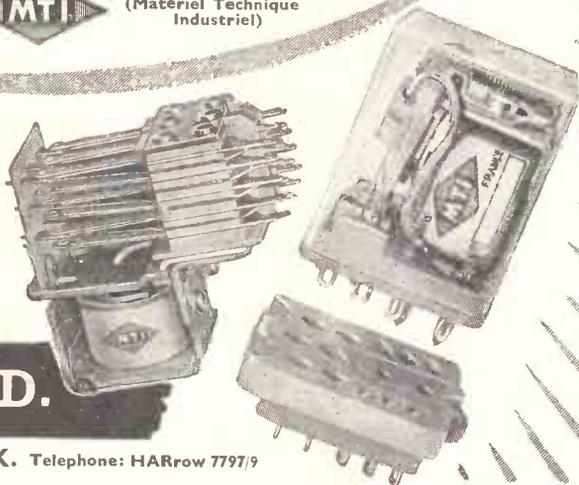
ELECTRO-MAGNETIC RELAYS?..



Send to Simmonds!
who have a range
of 1000 NEW TYPES
by  (Matériel Technique Industriel)

- ★ Operating from 1 Milliwatt to 1 Kilowatt with up to 96 change-overs at 10 amp. per contact.
- ★ Most models can be fitted with dust covers or hermetically sealed.
- ★ Range includes certain models hermetically sealed, all metal gas filled with glass base, and built-in adjustable thermal delay. Delivery 14/21 days for most types.
- ★ Post Office types 3000 and 600 relays of our own manufacture to specification. Guaranteed to full A.I.D. and I.E.M.E. standards.

Sole concessionaires for U.K. and Dominions on behalf of M.T.I.



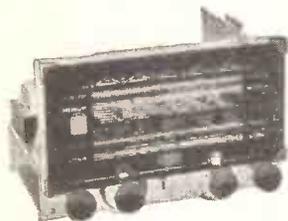
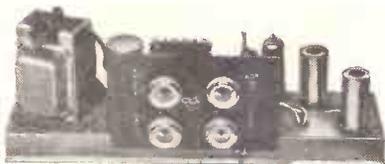
L. E. SIMMONDS LTD.

5 BYRON ROAD, HARROW, MIDDLESEX. Telephone: HARrow 7797/9

A NEW *Dulci* TRIUMPH IN SOUND REALISM

At low Cost— Model G.A.4 HIGH FIDELITY AMPLIFIER

4 watt 4 valve circuit with a frequency response of 40-15,000 c.p.s. Neat Contro Panel size 6in. x 4in. on fly leads for individual mounting (main chassis 14in. x 4in. x 5½in.). Input selector switch matching to Radio, L.P. and 78 r.p.m. records. Separate Bass and Treble Controls giving wide range of cut and lift. Volume Control. Rotatable Mains Transformer for hum cancellation. Price £9/9/-.



PRICE £24.6.6 inc. tax.

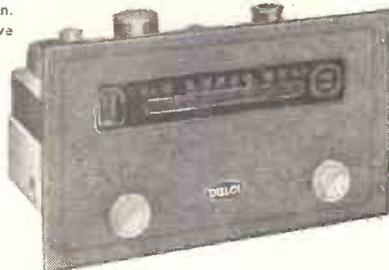
H.4. RADIOGRAM CHASSIS AM/FM

7 valve 4 wave band super-het with F.M. (VHF). Magic Eye tuning indicator. High sensitivity. Bell-clear quality. Dial size 11½in. x 5½in. Sockets to connect Speaker (3 and 15 ohm), Pickup, Aerial, Earth, F.M. Dipole and provide power for Gram. Motor from mains.

F.M. (VHF) TUNER

Outstanding design and performance. Self-powered to work direct into any Amplifier or Radio. Magic Eye tuning indicator. 3-stage I.F. amplifier. Preset output level. Panel size 10½in. x 5½in. (cut out 9½in. x 5in.). Switching incorporated for connection to Pickup sockets, Amplifiers and Tape Recorders. 75 ohm Aerial input. Negligible radiation. Highly sensitive and designed for top quality reproduction.

Price
£17/10/3,
inc. tax



All these Chassis use the latest B.V.A. glass miniature valves and are for use on 200/250 volt A.C. Mains.

H.4.T. (AM/FM.) Tuner Self-powered for Radio or Amplifier. Price £20/17/- inc. tax.

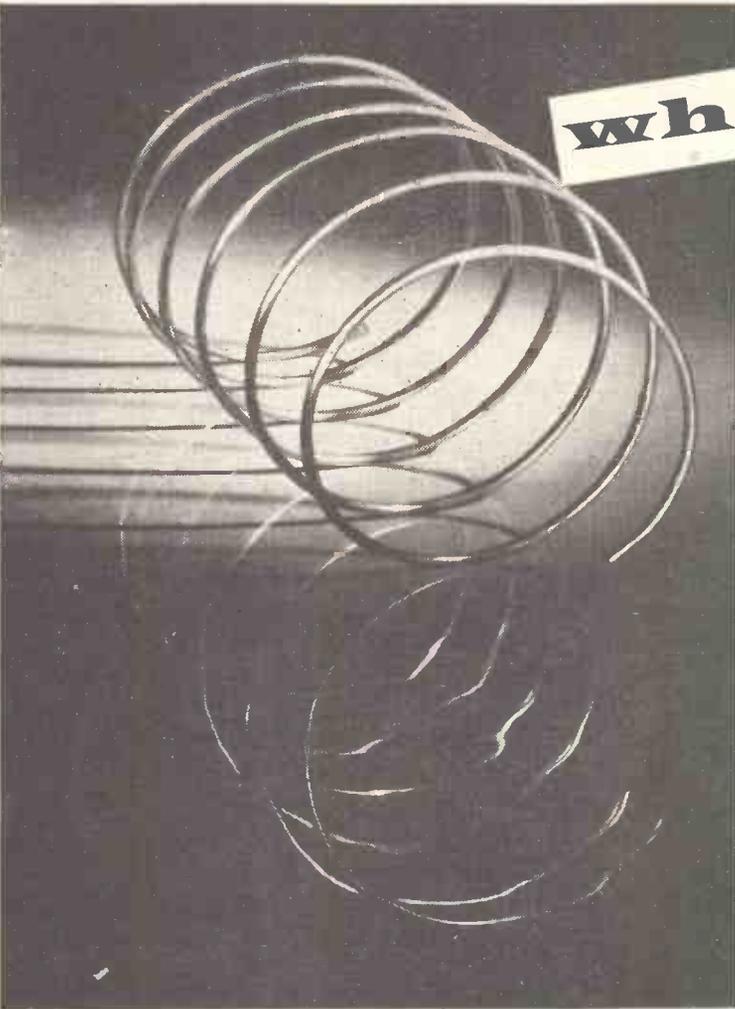
We supply and fit our pre-amplifier to Collaro Tape Transcriptors.

Direct from Manufacturer to all other Enthusiasts

Write for details to Ref. W.W.

THE DULCI COMPANY LTD., 97/99 Villiers Rd., London N.W.2

(WILLESDEN 6678)



what is it?

ALUMINIUM CORED SOLDER—

incorporating a non-corrosive flux. It is used with an ordinary soldering iron in the same manner as conventional rosin cored solders and ensures excellent joints without the use of expensive oxide-removing appliances. It is one of a new group of Enthoven products of outstanding interest to all industries in which the soldering of aluminium plays an important part.

To manufacturers of electric and electronic equipment it is the solution of a familiar and stubborn problem—the satisfactory soldering of aluminium to aluminium, or aluminium to copper, tinned copper, tinned and silver-plated brass and other metals.

ENTHOVEN SOLDER PRODUCTS

ENTHOVEN PRODUCTS FOR SOLDERING ALUMINIUM

- 1** ENTHOVEN ALUMINIUM CORED SOLDER—*a unique product specially designed for use in the electrical, electronic and allied industries.*
- 2** ALUMINIUM SOLDERS & LIQUID FLUX—for dip-soldering and dip-tinning.
- 3** ALUMINIUM SOLDERS & PASTE FLUX—for general hand soldering and tinning operations.

For further information on these products and their applications, please write for our technical publication "T.P.2".

**ENTHOVEN SOLDERS LIMITED, ENTHOVEN HOUSE
89, UPPER THAMES ST., LONDON, E.C.4.
MANsion House 4533.**

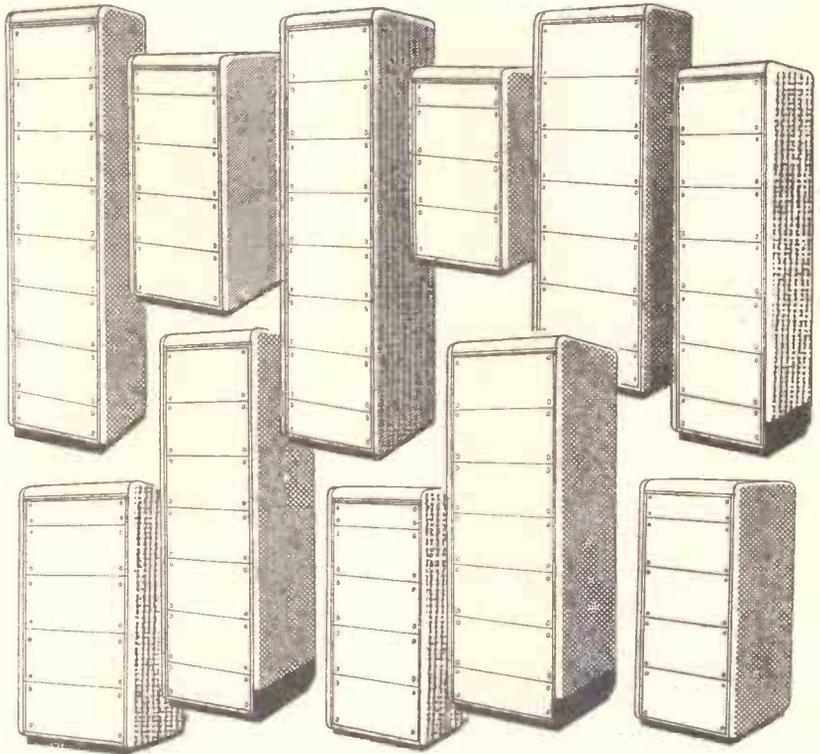
enclosed racks
are now available

in **11** sizes

at fourteen days delivery

please ask us for copies of our new revised catalogue of cases, racks, consoles, etc.

3FT.	3/1919/1	19in Panel	19in Depth
4FT.	4/1919/1	19in	19in
	4/1924/1	19in	24in
	4/2219/1	22½in	19in
	4/2224/1	22½in	24in
6FT.	6/1919/1	19in	19in
	6/1924/1	19in	24in
	6/2219/1	22½in	19in
	6/2224/1	22½in	24in
7FT.	7/1919/1	19in	19in
	7/1924/1	19in	24in



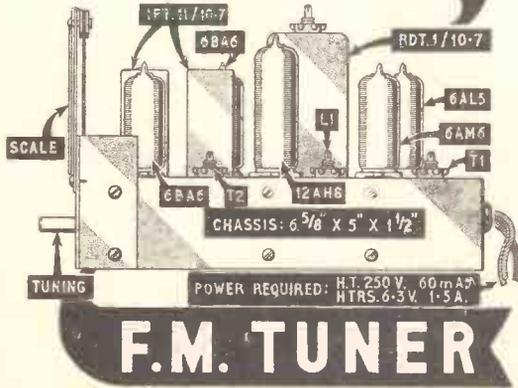
IMHOFS

ALFRED IMHOF LIMITED
Dept. M.1, 112-116 New Oxford St.,
London, W.C.1.

Telephone: MUSeum 7878 (20 lines)

LGB

MAXI-Q



THE GUARANTEED COMPONENTS DESCRIBED BELOW HAVE BEEN ACCLAIMED BY THOUSANDS AS THE FINEST OBTAINABLE.

Full constructional details, point-to-point wiring diagram and alignment instructions for building the complete F.M. TUNER. Also full details for modifying existing tuners to a pre-set version given in Technical Bulletin DTB. 8, price 1/6.

F.M. SCALE. A bronze finished scale with yellow markings (0-20 Log) for use with all types of F.M. tuners or receivers. Consisting of metal scale, pointer, cord drive spindle, pulleys, 2½in. drum, cord and instructions for the assembly of the cord drive. The scale measures 5½ x 3in. and is for a cabinet aperture of 4 x 1½in., price 9/-.

RDT.1/10.7 Mc/s. A transformer for use in ratio discriminator type circuits. Can size 1½in. square x 2½in. high. Secondary winding of bifilar construction, iron dust core tuning. polystyrene formers and silver mica condensers, price 12/6.

PDT.1/10.7 Mc/s. A miniature phase discriminator transformer for use in frequency modulation detector circuits where the limiter/Foster-Seeley type of circuit is employed. Designed for carrier deviation of ±75 Kc/s. Qk=1.5. Screening can 1¼ x 1½in. square, price 9/-.

IFT.11/10.7 Mc/s. A miniature I.F. transformer of nominal frequency 10.7 Mc/s. The transformer is primarily intended for the I.F. stages of frequency modulation receivers and converters. The Q of each winding is 90 and the coupling critical. Dimensions as PDT.1, price 6/-.

IFT.11/10.7/L. As IFT.11/10.7 but with secondary tap for limiter input circuits, price 6/-.

Coil Type L1, T1, and T2. These coils are specially designed for use in the "MAXI-Q" F.M. TUNER, price 3/11 each. Chassis and screens for the above unit, completely punched in aluminium, price 7/6.

Obtainable from all reputable stockists or direct from works. GENERAL CATALOGUE covering technical information on full range of components 1/- post free.

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

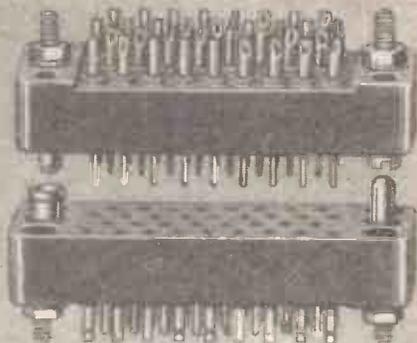
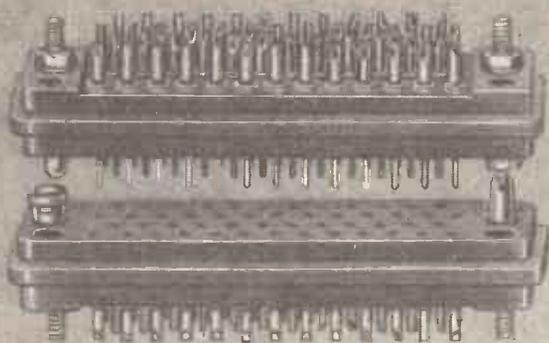
STOP PRESS:

"MAXI-Q" F.M. TUNER UNIT assembled and valved at £9.19.6 inc. P.T. Power Pack at £3. "OSRAM" F.M. TUNER completely assembled and valved at £16.16.0 inc P.T.

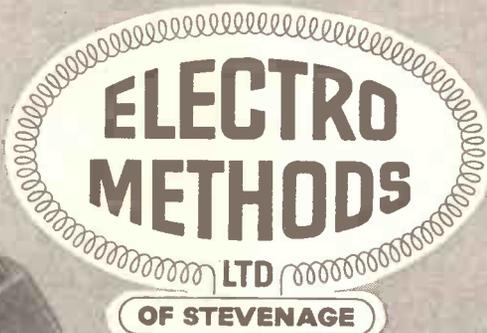
"MULLARD" TAPE RECORDER. Amplifier Chassis, Type 'A'—31/6; Type 'B'—31/6. Power Pack Chassis, 11/6.

"MULLARD" 20 WATT AMPLIFIER. Chassis and Base 34/-. Pre-Amp Chassis 25/-. Transformer Covers (3) 32/-.

"MULLARD" 3 valve 3 watt chassis 10/6.



These Units are
ACTUAL SIZE
—made under
U.S. licence
from
Winchester
Electronics Inc.



**DATA RELATING
TO SERIES 'MRE'
MINIATURE
CONNECTORS**

CURRENT CARRYING
CAPACITY: 7.5 amps

BREAKDOWN VOLTAGE
BETWEEN CONTACTS:
(at sea level)

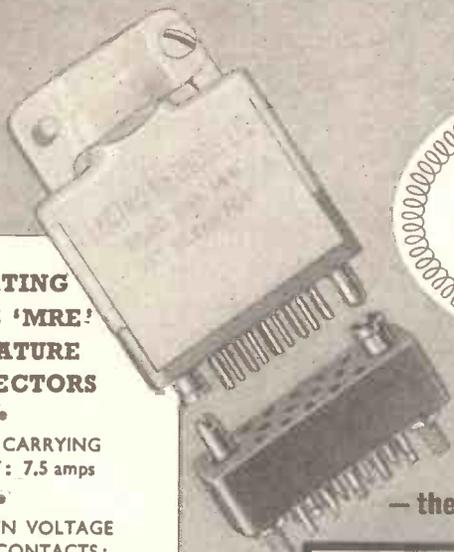
7-contacts: 3.1 kV
14 up to 50-contacts: 4.0 kV

AVERAGE MATING
AND UNMATING FORCE
(per contact): 8 oz.

POSITIVE POLARISATION
BY GUIDE-PINS AND SOCKETS

RIGID ALUMINIUM HOODS
WITH CABLE-CLAMPS
(vibration locks optional)
FOR COMPLETE SERIES

SERIES 'MRE'
with 7, 14, 18, 26, 34 & 50 contacts
**NOW AVAILABLE
FOR
PROMPT DELIVERY**



— the foremost manufacturers of

***miniature
connectors***

GOLD-PLATED CONTACTS
made from spring-tempered phosphor-bronze
provide low contact-resistance,
prevent corrosion and facilitate soldering.

MELAMINE MOULDINGS
conforming to B.S.S. 1322
provide high arc-resistance,
high dielectric and mechanical strength.

Full technical data and illustrated
leaflets forwarded on request:
ELECTRO METHODS LTD.
12-36 Caxton Way, Stevenage, Herts.
Telephone: Stevenage 780

INTRODUCING THE LINEAR 'DIATONIC'

A HIGH FIDELITY ULTRA LINEAR AMPLIFIER WITH INTEGRAL PRE-AMP

A special feature is the compactness of the unit. Full advantage has been taken of latest component miniaturisation developments to produce a 10-watt Hi-Fi push-pull amplifier incorporating tone control pre-amplifier stages within the measurements of 10 x 6 x 6in.

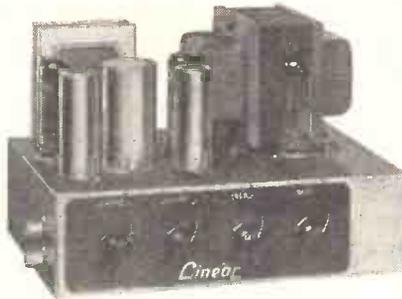
In addition two high impedance input sockets are provided for microphone and gram, etc. Each input has its associated vol. control, five B.V.A. (Mullard) valves are employed, ECC83, ECC83, EL84, EL84, EZ81.

H.T. and L.T. power supply point is included for a radio tuner.

L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER

Size only 6 x 5 x 5½in. high. 12 d.b. Negative Feedback. Sensitivity 30 m.v. for full output. 3 Mullard valves, ECC83 Twin Triode, EL84 Power Output, EZ90 Rectifier. Separate Bass and Treble Controls. Mains switch incorporated in control. For 200—250v. 50 c.p.s. A.C. Mains. An ideal unit for use with Gram. or 'Mike'.

Retail Price £5-19-6



SIZE ONLY 10—6—6ins.

Weight 12½lbs. Power consumption 90 watts For 200-230-250v. 50 c.p.s. A.C. mains. Output suitable for 3 ohm and 15 ohm speakers.

Chassis finish stoved gold
—Bronze hammer.

Retail Price

12 GNS.

Send S.A.E. for descriptive literature.

TRADE AND EXPORT ENQUIRIES

to

FREQUENCY RESPONSE

± 2 d.b., 30-20,000 c.p.s.

MAXIMUM POWER OUTPUT

In excess of 11 watts.

RATED OUTPUT 10 WATTS.

SENSITIVITY

Volume (1) 22 millivolts for rated output.

Volume (2) 220 millivolts for rated output.

TREBLE LIFT CONTROL

Continuously variable + 6 d.b. to 13 d.b. at 12,000 c.p.s.

BASS CONTROL

Continuously variable + 13 d.b. to -18 d.b. at 50 c.p.s.

HUM LEVEL

Referred to maximum output and including integral pre-amp -60 d.b.

HARMONIC DISTORTION

0.25% measured at 6 watts.

NEGATIVE FEEDBACK

Total 32 d.b. including 24 d.b. in main loop.

LINEAR PRODUCTS LTD.

5-9 MAUDE STREET, LEEDS, 2.

Tel. 23116



Feeder Unit—Garrard Transcription Motor, Leak Dynamic Pick-up with diamond stylus. High fidelity "Perth" AM/FM Tuner.

Amplifier Section—Built-in Leak "Point One" TL/10 Amplifier.

Tape Recorder Section—Reflectograph high fidelity Tape Deck, with "Brick" type Pre-amplifier and Erase Unit.

Speaker Cabinets (Two)—Twin Bass Reflex acoustic chambers with Axiom 150 Speakers and Goodmans Acoustic Resistance Units.

Record Storage compartment.

An outstanding product of the
"Perth" High Fidelity division **256 gns.**

Price in U.K. complete inclusive of tax.

PERTH RADIOS LIMITED 90 Judd St., London, W.C.1. Tel: TERminus 9876



Five Valves 3 Wavebands 49½ gns.
Seven Valves 4 Wavebands (AM
FM) 62½ gns.



Five Valves 2 Wavebands 29 gns.
Seven Valves 4 Wavebands (AM/
FM) 42½ gns.



Five Valves 3 Wavebands 31 gns.
Seven Valves 4 Wavebands (AM/
FM) 42 gns.



F.M. Tuner Unit 17½ gns.

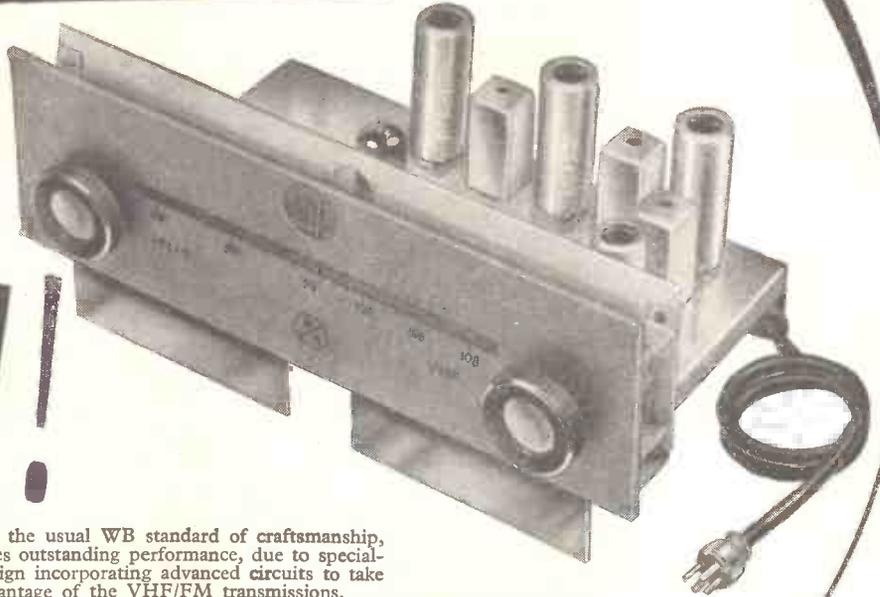


Disc Player 18 gns.

Stentorian

VHF/FM TUNER

NEW!



Built to the usual WB standard of craftsmanship, this gives outstanding performance, due to specialised design incorporating advanced circuits to take full advantage of the VHF/FM transmissions.

Permeability tuning, automatic frequency control, and temperature-controlled circuits give rock-steady tuning with no drift. Foster Seeley discriminator and cathode follower circuit. The wide frequency range—87.5-108 Mc/s.—covers all proposed British stations, and also those on the Continent and in U.S.A. Latest type tuning indicator.

The high sensitivity enables this Tuner to be used in areas where FM transmissions are normally regarded as out of range. No interference with television, due to negligible radiation figure.

Price £25 (inc. P.T.)

High Fidelity at realistic cost

Type H.F. 1012

10" unit, die cast, 12,000 gauss magnet, cambric cone, 10 watts capacity. 30-14,000 c.p.s. Bass resonance 35 c.p.s. £4. 19. 9

Type H.F. 812

8" unit, 12,000 gauss magnet, cambric cone, 5 watts capacity. 50-12,000 c.p.s. Bass resonance 65 c.p.s. Die cast chassis. £4. 3. 6

Type H.F. 816

8" unit, die cast, 16,000 gauss magnet, cambric cone, 6 watts capacity. 50-14,000 c.p.s. Bass resonance 63 c.p.s. £6. 17. 0

Type T. 816

Special 8" mid-range unit for use with H.F. 1214, 16,000 gauss magnet, 15 watts capacity with 1,500 c.p.s. cross-over. Up to 17,000 c.p.s. Impedance 15 ohms. £6. 10. 0

Type H.F. 1214

12" unit, die cast, 14,000 gauss magnet, cambric cone, 15 watts capacity. 25-14,000 c.p.s. Bass resonance 39 c.p.s. £9. 15. 6

Type T. 10

Tweeter unit, m/c pressure type, 14,000 gauss magnet, 2,000-14,000 c.p.s. 5 watts. Recommended for use with H.F. 1012. £4. 4. 0

Stentorian W.B. 12

Quality Amplifier

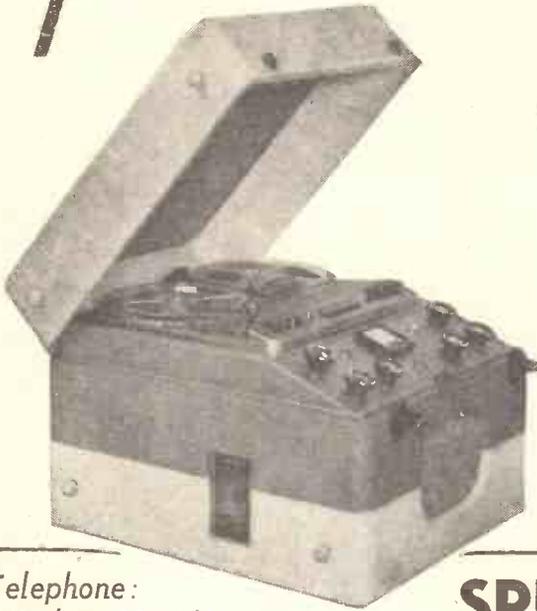
12 watts, low noise input circuit, double triode phase splitter, push-pull output stage giving outstanding reproduction. £25. 0. 0

Ready-to-assemble Cabinets from £5. 10. 0 to £10. 10. 0.

★ See and hear this and all other Stentorian High Fidelity equipment at our London office (109 Kingsway, W.C.2) any Saturday between 9 a.m. and 12 noon. Leaflets on all the outstanding WB products on request.



Spectone



THE RECORDER WHICH SELLS ON THE STRENGTH OF ITS QUALITY

An instrument of professional quality for the high-fidelity conscious, achieving a truly high standard of recording and play-back at a remarkably moderate price. Automatic equalisation of output at each speed ensures perfect reproduction. Incorporating the new Collaro Tape Transcriber, upper and lower track recordings can be made in quick succession without spool reversal while a safety device prevents accidental erasure. Three speeds; 3 $\frac{1}{2}$ in., 7 $\frac{1}{2}$ in. and 15in. per second.

Spectone
The Living Truth in Sound

72 GNS.

Including microphone

Write for Leaflet with Full Specification.

Telephone:
Windsor 1241/2

SPECTO LTD.

**VALE RD.
WINDSOR**

Another DALY Electronic Achievement

Electrolytic CAPACITORS
For use in coarse ELECTRONIC APPARATUS and TELECOMMUNICATIONS

Electrolytic Capacitors

MOTOR START

MOTOR STARTING
DALY CONDENSER LTD
Condenser Specialists for over 20 years
WEST LODGE WORKS, THE GREEN, EALING, LONDON, W.5, ENGLAND
Telephone: EALING 3127-8-9

CAPACITORS IN REDUCED SIZES WITH FULL VALUES AND WORKING VOLTAGES

SEND NOW for new leaflets with up-to-date information on this new range of capacitors.

DALY has succeeded in maintaining full capacity values and working voltages in more compact designs specially suited to ultra-modern equipment.

PHOTO-FLASH EQUIPMENT · DEAF AIDS · PRIVATE TELEPHONE INSTALLATIONS · AMPLIFIERS · D.C. POWER UNITS · SPOT WELDING EQUIPMENT · TEST GEAR · MAGNETISATION EQUIPMENT

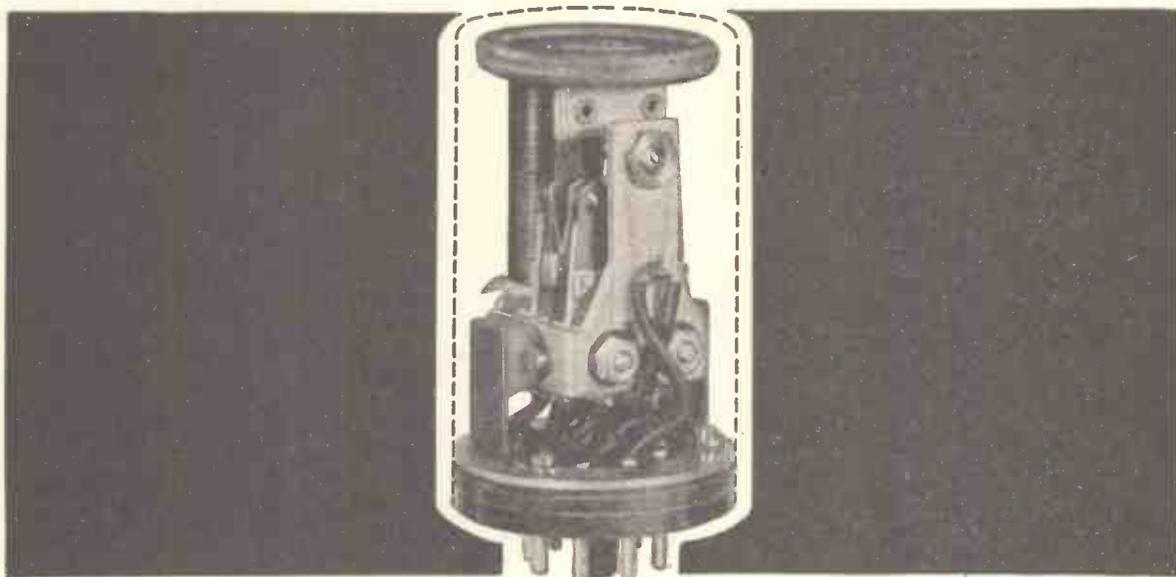
Behind **DALY** capacitors lies 20 years of making only electrolytics, highly specialized experience which engineers throughout the world are finding invaluable. and which is readily available to you.

DALY

ELECTROLYTIC CAPACITORS

CONDENSER SPECIALISTS FOR OVER 20 YEARS

the most efficient means of generating H.T. voltages from low voltage supplies



This is an accurate summary of this latest type heavy duty vibrator by Plessey,
a product widely employed in Services equipment.

It is Design Approved and the supply position is good.

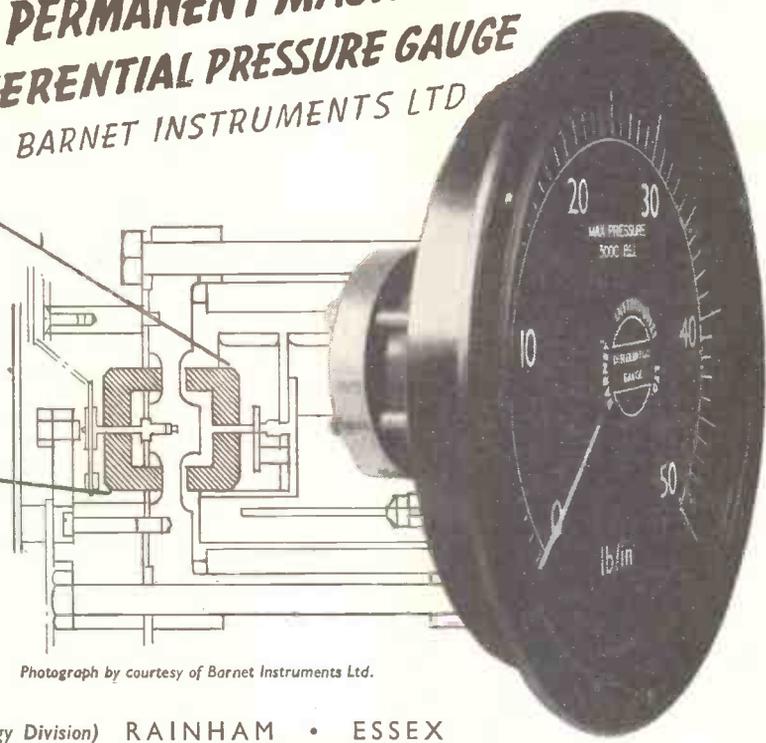
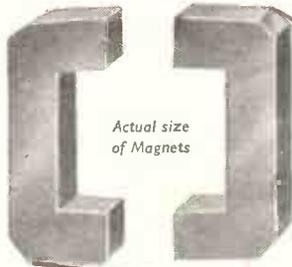
For all equipment where of necessity only a low voltage supply is
available—as in certain electronic equipment, public address
systems and portable transmitters—and for equipment where an
emergency supply *must* be provided against mains supply failure, this
100 watt vibrator is the ideal component.

Equipment manufacturers and Design Engineers are invited to request
a copy of Plessey Publication No. 651 which contains complete technical details
and performance data.

heavy duty vibrators by

Plessey

MUREX 'SINTERED' PERMANENT MAGNETS
are used in this DIFFERENTIAL PRESSURE GAUGE
 made by BARNET INSTRUMENTS LTD



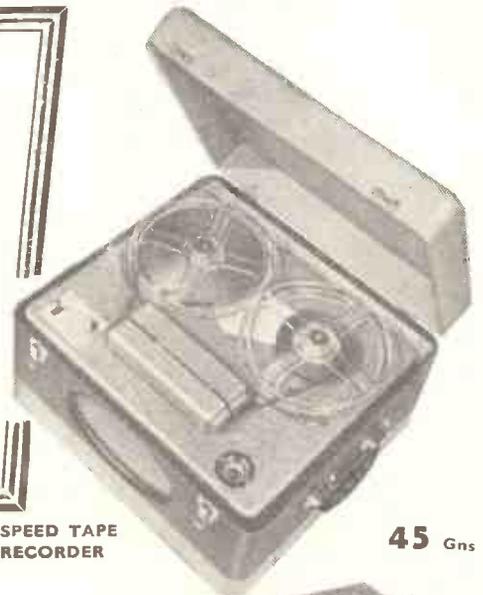
Murex Sintered Magnets supply the high stable flux which provides the drive between pressure chamber and indicator.

Photograph by courtesy of Barnet Instruments Ltd.

MUREX LTD. (Powder Metallurgy Division) RAINHAM • ESSEX
 Telephone: Rainham, Essex 3322 Telex 8632 Telegrams: Murex, Rainham-Dagenham Telex.
 LONDON SALES OFFICE: CENTRAL HOUSE, UPPER WOBURN PLACE, W.C.1. EUSTon 8265

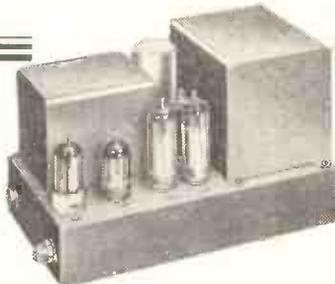


Wish You a Happy
 New Year
 and True Enjoyment
 from the use of Verdik Products



2-SPEED TAPE RECORDER

45 Gns



AMPLIFIER & PRE-AMPLIFIER
 20 Gns. ONLY COMPLETE



VERDIK SALES LTD., 8, RUPERT COURT
 WARDOUR ST., LONDON, W.1 (GERrard 8266)



If you already have our 1956 catalogue, you will automatically get the 1957 edition in the course of the next week or two. The demand for the catalogue is so great that it makes the task of distribution a fairly lengthy one, so please wait patiently. If you have changed your address, or have any other reason to think your copy may not reach you safely, please let us know. The 1957 catalogue brings the record of Marconi electronic instrumentation in the radio communication and industrial fields up to date and provides a comprehensive survey of all Marconi measuring and test equipment.

You'll be getting your new Marconi Instruments Catalogue any day now!



MARCONI INSTRUMENTS

Instruments listed include:

- AM & FM SIGNAL GENERATORS · AUDIO & VIDEO OSCILLATORS
- FREQUENCY METERS · VOLTMETERS · POWER METERS
- DISTORTION METERS · FIELD STRENGTH METERS
- TRANSMISSION MONITORS · DEVIATION METERS
- OSCILLOSCOPES, SPECTRUM & RESPONSE ANALYSERS
- Q METERS & BRIDGES

MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTFORDSHIRE · TELEPHONE: ST. ALBANS 56161

London and the South: Marconi House, Strand, London, W.C.2 Tel: COVent Garden 1234

Midlands: Marconi House, 24 The Parade, Leamington Spa. Tel: 1408 North: 30 Albion Street, Kingston-upon-Hull Tel: Hull Central 16347

WORLD-WIDE REPRESENTATION

SCIENTIFIC  INSTRUMENTS

MORE THAN 6000 'SCALAMPS' NOW IN USE IN INDUSTRY AND RESEARCH



These galvanometers offer:

- Compact Self-contained Unit
- Five range Sensitivity Switch
- Slow-motion zero control
- Automatic Shorting Foot

Four new models now available give added versatility in low resistance circuits.

Please write for our latest leaflet

W. G. PYE & CO. LTD · GRANTA WORKS · CAMBRIDGE · ENGLAND

A NEW

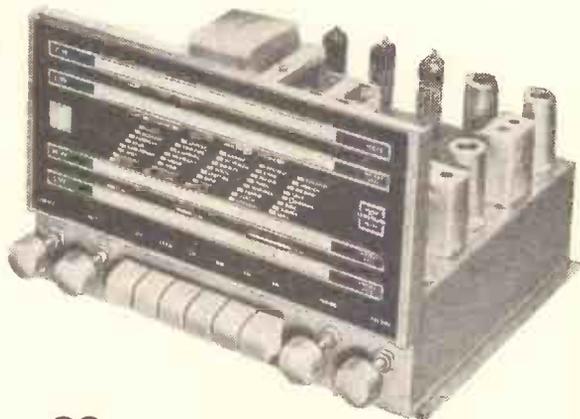
Armstrong
Specialists in high quality reproduction for over 20 years

AM/FM RADIOGRAM CHASSIS

PB 409

ARMSTRONG quality at an economical price

- ★ 9 valves-6 watts peak output within 2dB, 20-20,000 cps at 4 watts (double normal room volume)
- ★ Full VHF band (88-108 Mc/s) plus Long, Medium and Short
- ★ Push-Pull Output with Negative Feedback
- ★ Quick-action "Piano-Key" selectors
- ★ Independent Bass and Treble controls
- ★ "Magic Eye" tuning
- ★ Latest MULLARD preferred-type valves



28 GUINEAS

DIMENSIONS: 13" x 9½" x 8" high

We have been making replacement radiogram chassls for nearly 25 years and have concentrated exclusively on the requirements of those who want the best. This is your guarantee of first class performance and reliability. We shall be pleased to give you a full demonstration of this and other models at our Warlters Road Showroom (open 9-6 weekdays and Saturdays).

We shall be glad of the opportunity to demonstrate these models to you in our factory showrooms in Holloway. If you are unable to visit us please complete and send the coupon.

Post this coupon for descriptive literature and details of Hire Purchase, Home Trial facilities and Guarantee.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.,
Warlters Road, London, N.7. NORth 3213

BLOCK CAPITALS PLEASE

NAME

ADDRESS.....

.....WO

QUESTION "Why don't dealers stock and recommend our Amplifiers and Tuners, etc?"

ANSWER "Because they cannot afford to as we give their discount to YOU (the public)."

This direct trading explains why our products, though in the top class, are so much cheaper than our competitors'.

What we are and what we do.

Firstly we are quite large manufacturers of Audio Amplifiers, Radio Feeder Units, Portable Record Players, Speaker and Amplifier Cabinets and custom built Complete High Fidelity Radio and Record Reproducers.

Secondly we are Retailers of Gramophone Units, Autochangers, Speakers, Tape Recorders, etc., etc.

We recommend only that which we know to be of good performance and of sound construction. We are not in the group of traders who sell job lines at apparently low prices because they are obsolete or faulty. On the other hand our finances are such that we do not have to sell you an expensive article if we know that a less expensive unit will do your job perfectly.

If any reader should have his mind set on a high-priced amplifier of

another make and would like to save money if possible, we should like to make the following clear-cut offer: If he buys one of our "Symphony" Amplifiers or Tuners and is not entirely satisfied with it he may return it for full credit against any other amplifier or tuner on the market. It should be emphasised at this stage that we can supply any Amplifier, Radio Tuner, etc., advertised.

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 quality equipment for modest expenditure. Send two 2d. stamps for your copy now. It may well save you pounds! All our equipment is on demonstration at our showroom in conjunction with a variety of Pickups, Speakers, etc. If you can possibly call we shall be pleased to see and help you. H.P. facilities available.

It is essential to mention "Wireless World" when requesting Catalogue or when ordering.

The New No. 1 "SYMPHONY" AMPLIFIER MARK III is a 3-channel 5-watt Gram/Radio Amplifier with astonishingly flexible tone control. You can lift 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 frequency-response of the amplifier to a curve equal and opposite to the resultant curve of the other items in the chain so what finally registers in the brain is as per original. This flexibility of control is even more important than the nominal linear response of the amplifier, as the pickup 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 78s to new L.P.s, and there is full provision for Radio Tuner. Tape take-off and Playback. It is available to match 2/3 or 15 ohms speakers: Price 12 gns. (carriage 7/6). Fitted in portable Steel Cabinet, 2 gns. extra.

The New No. 2 "SYMPHONY" AMPLIFIER MARK III, as No. 1

but with 10-watt Push-Pull triode output and triodes throughout. Woden mains and output transformers and choke. Output tapped 3, 7.5 and 15 ohms. Provision for Tuner and Tape. Competes with the most expensive amplifiers on the market yet costs only 16 gns. (carriage 7/6). Fitted in portable Steel Cabinet 2 gns. extra.

"SYMPHONY" AMPLIFIERS WITH REMOTE CONTROL

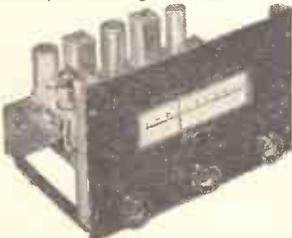


Remote Control Panel

Both the above model Amplifiers are available with all controls on a separate Control Panel with up to 4ft. 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.

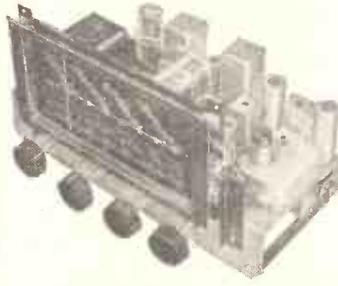
No. 1 "SYMPHONY" F.M. TUNER. High grade Instrument with extremely silent background. Based on the latest type of permeability-tuned Coil Assembly of advanced design housed in anti-radiation shroud giving extreme sensitivity and high music/noise ratio Suitable for amplifiers in the highest fidelity class. £15/8/-.

Power Pack £3/7/6. Magic eye £1 extra if required.



No. 2 "SYMPHONY" AM/FM TUNER.

Combining all the specifications of our Long, Medium and Short wave Superhet AM Tuner and our No. 1 FM Tuner. Separate Coil Assemblies and IFs Fully self-powered on one chassis. 26 gns.



N.R.S. EMPRESS FM/VHF TUNER/ADAPTOR Fine little job, will plug into any radio and add F.M. £13/15/-. Magic eye assembly £1 extra if required. Ditto mounted in beautiful dark walnut cabinet complete with magic eye 17 gns. Carriage 7/6.

"SYMPHONY" AM/FM RADIOGRAM CHASSIS Very high grade radiogram chassis combining Long, Medium and Short and V.H.F. bands. Large engraved dial. Push/pull output for high quality Complete with 10in. Goodmans speaker 26 gns. Carriage and packing 7/6

RECOMMENDED GRAMOPHONE UNITS

All current Collaro Units in stock for immediate delivery.
 GARRARD TA & TB 3/SPEED UNIT £9 0 0
 New model RC88 AUTOCHANGER £15 11 4
 RC98 with variable speed £17 10 3
 Variety of pickup cartridges available in Garrard shell to fit TA, RC88 and RC98. Leaflets on Collaro and Garrard Gram. Units on request.

LENCO GL50, 4-speed continuously variable from above 78 r.p.m. to below 16 r.p.m. Special Autostop. Price with Studio "O" or "P" head or Goldring variable reluctance head, £21/17/10.

LENCO GL55, as above but without pickup and autostop but fitted with Special Device for Groove Location and knob which completely disengages drive-wheel. Suitable for use with any pickup, especially transcription types and B.J. Arm. Price £17/10/4. Immediate delivery guaranteed

LENCO GL56, as GL55 but with Studio or Goldring 500 pickup, £23/7/-.

"SYMPHONY" RJ ENCLOSURE. In polished walnut 24in. x 11in. x 10in., £9. Super 8CSAL Speaker to suit, 7 gns. Real hi-fi in small space.

GOODMANS "VISCOUNT" ENCLOSURES Walnut or mahogany, complete with Acoustical Resistance Unit, 19 gns. or less A.R.U., 16 1/2 gns.

MIDAX/TREBAX CABINET. To match "Viscount" £7/10/-.

"SYMPHONY" BASS REFLEX CABINET KITS. 30in. high, consist of fully-cut 3/4in. 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. Carriage 7/6. Ready built, 15/- extra. As above but fully finished in figured walnut veneer with beautiful moulding and speaker grille. 10in. £11, 12in. £11/10/-. Other veneers to order.

CONSOLE AMPLIFIER CABINETS. 33in. high, lift-up lid with piano hinge, take Tape Deck, Gram Unit or Autochanger, Amplifier, Pre-Amplifier, and Radio Feeder Unit, finished medium walnut veneer. De luxe version, price 12 gns. Oak or mahogany veneers and special finishes to order. Carriage according to area. We will quote by return.

NORDYK CABINETS. Speaker Enclosure £5/17/6. Table Model Amplifier/Gram Unit Cabinet £5/19/6. Table Model Tape Recorder, Tape Amplifier or Radio Tuner Cabinet £5/19/6. Record Storage Cabinet holding 150 records £4/17/6. All above cabinets measure (internally) 19in. wide x 13in. high x 13in. deep and finished in polished walnut, thus enabling a complete installation to be built up unit by unit in matching style cabinets and added to as required. Any of our Amplifiers, Tuners, Gram Units, Tape Decks and Speakers can be supplied in these cabinets for small extra cost. Examples on demonstration.

TAPE RECORDER DEPT.

We are specialists in the supply of tape gear for use in conjunction with High Fidelity Equipment. We are familiar with all worth-while Tape Recorders and Decks on the market and are in a unique position to advise on Tape Recorders. Tape Decks Tape Amplifiers and Tape Pre-Amplifiers and give unbiased opinions and demonstrations. All those intending buying a Tape Recorder or adding Tape facilities to their present systems are advised to consult us before spending money, as we might well be able to save you money and dissatisfaction. Call for a demonstration, or write.

THE "SYMPHONY" DE-LUXE TAPE RECORDER.

2-speed, twin-track, microphone, radio and external amplifier inputs. Facilities for playback through high quality internal elliptical speaker or through external high fidelity speaker outlet or through external high fidelity amplifier. Automatic head demagnetisation. Wide frequency range heads. Housed in handsome polished walnut cabinet. Fantastic value for money at 49 gns. or 9 monthly payments of 6 gns. Plus carr. and pkg. £1. Full details in catalogue.

NORTHERN RADIO SERVICES

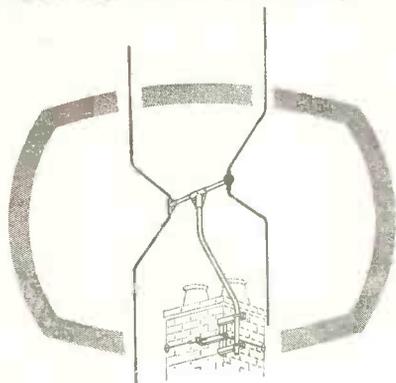
DEPT. WW., 11, KINGS COLLEGE ROAD, ADELAIDE ROAD, LONDON, N.W.3. Phone: PR1mrose 3314

Tubes: Swiss Cottage and Chalk Farm Buses: 2, 13, 81, 115 and 187

New standards of performance!

This new LABGEAR "Vee H"

leads the World



With 8dB gain from a 2-element array, this exclusive Labgear development is the most advanced of its kind in the world. It offers great savings in cost, size and weight compared with other types of aerial of comparable performance.

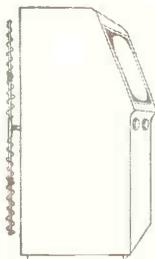
For Band I T/V		
Model 108 (head only)	£3 5 0	
Model 108/X1 (with 9ft. mast and lashings)	£5 9 6	
Model 108/X3 (with 12ft. mast and lashings).....	£7 12 6	
Model 108/Z2 (with cranked arm and lashings)	£4 3 6	

For Band III T/V
Complete with High-Gain Double 5 Array (15-16dB Gain) requiring only one 75 ohm co-axial downlead:

Model C09 (with 12ft. x 2in. mast and lashings)...	£12 17 6
---	----------

First of its kind The Spiral

Another new Labgear development! Designed to meet the demand for a neat, unobtrusive aerial for Bands I and III, the Spiral has a range of approximately 10 miles and is supplied ready to plug into the set.



Labgear Spiral, C10
£1 19 6

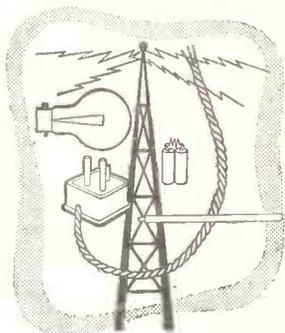
Send now for your copy of the Labgear Wall-Chart giving details of all Labgear aerals for B.B.C., I.T.A. and V.H.F./F.M.

Labgear (Cambridge) Limited

WILLOW PLACE - CAMBRIDGE - ENGLAND

Telephone: Cambridge 2494
Sales Office: - - - - -

Telegrams: Labgear, Cambridge
- - - - - Cambridge 88021



ON THE BEAM

• Stationery and printing can also be supplied by your nearest Smith's branch.

Smith's have books on the newest developments in radio and television circuit design, construction and servicing. No matter what your problems or interests are, you can be sure of getting the books you need through your local branch of Smith's. Books not available on demand can be quickly obtained from Head Office. Lists of standard works on any subject gladly supplied.

W. H. SMITH & SON for technical books

HEAD OFFICE: STRAND HOUSE, LONDON, W.C.2

M. R. SUPPLIES Ltd.

(Established 1935)

Some excellent NEW OFFERS available in limited quantities. Immediate despatch, carefully packed. All prices nett.

WIRE-WOUND POTENTIOMETERS (Colvern). Brand new dual, 5,000/5,000 ohms. 10 watts. 360 deg. rotation, ball bearing. Size 3 1/2 in. dia. by 3 in. deep, with 1/2 in. shaft. Remarkable bargain 7/6 (despatch 1/6). Also Dutilier Miniature Potentiometers, 10K, 20K, or 100K, any one. 2/9 (des. 6d.).

THERMOSTATS. Very timely offer. Small precision units by Maclaren, Glasgow. Range adjustable from 25 to 100 degrees F. Capacity 10 amps A.C. (250 v.). Close differential of 2 deg. Size 3 x 1 1/2 x 1 in. Here is undoubtedly the finest thermostat value we have been able to offer. If calibrated and housed they would cost about 50/-. We offer about 1,000 at only 7/6 each (despatch 6d.). These are brand new.

AMMETERS. 0/5 amps D.C., m/coll, 2 in. square flange. Another rare opportunity. 12/6 (despatch 6d.). Also 2 in. round, 0/500 microammeters D.C. m/coll. 17/6. Also 2 1/2 in. round 0/20 volts A.C./D.C. m/iron. 10/6.

ELECTRIC FANS for light cooling and extraction, still projectors, etc. 200/250 v. A.C. shaded pole motor and 5 in. dia. impeller, quiet running. 26/- (despatch 1/-).

ONE-THIRD H.P. MOTORS by Mewman. Split-phase induction. 230/250 v. 50 c. 1 phase. 1,425 r.p.m. Shaft 1/2 in. dia. by 2 in. prol. 25/10/- (despatch 5/-).

HIGH DUTY AIR BLOWERS. Powered with B.T.H. type CP8 2,615 repulsion-induction motor, 230/250 v. 50 c. 1 ph. Estimated delivery 1,500 c. ft. per min. Overall length 24 in., width 20 in., height 18 in. Inlet 7 in. dia. Outlet 7 in. by 3 in. Weight approx. 1 cwt. Brand new in original cases. 22/10/- (despatch mainland 20/-). Sketch, if required, furnished on request. Many very satisfied industrial users.

ELECTRIC CLOCK MOVEMENTS, synchronous 200/250 v. 50 c. With spindles for hours, minutes and seconds hands. In plastic dust cover 3 1/2 in. dia. by 2 in. deep, with flex, ready for use. 27/6 (despatch 1/-). Set of three hands to suit 5/7 in. dial. 2/-.

SYNCHRONOUS TIME SWITCHES. 200/250 v. 50 c. Brand new Sangamo-Weston. In compact black housing, 4 in. dia. by 3 1/2 in. deep, providing up to three on-off operations per 24 hours, with day-omitting device (use optional). Capacity 20 amps A.C. 25/8/6 (despatch 2/-). Two-circuit model (Smith's Reivon). 26/18/-.

COMPLETE SEWING MACHINE MOTOR OUTFITS. There is no better quality job at any price. 200/250 v. A.C./D.C., fitted radio and TV suppressors, including motor with fixing bracket, foot control, needle light, with switch, belt, etc., with instructions for fixing to any machine. 26/15/- (despatch 2/9).

EXTRACTOR FANS. Very well made new units at much below normal price. 200/250 v. A.C. (induction motor, silent running, no interference). With mounting frame and back grille, ready for easy installation. With 8 in. impeller (12,000 c. ft./hr.). 25/5/- With 10 in. impeller (15,000 c. ft./hr.). 25/12/6 (despatch either 3/-).

SEALED POLE INDUCTION MOTORS (Hoover SP202). Brand new motors for 230/250 v. A.C. mains. 3 1/2 in. by 2 1/2 in., shaft 1 in. prol. Torque 150 gm/cm. The ideal silent running unit for many lab. and domestic applications, stirrers, fans, extractors, etc. 27/6 (des. 1/6).

DRAYTON RQ REVERSIBLE GEARED MOTORS. 230/250 v. 50 c. 1 ph. capacitor/induction. Final speed 10 r.p.m., double ended shaft, constant speed, continuous rating. Very limited quantity. 23/17/6 (des. 2/6). These are new and perfect. We hold large stocks of other FHP geared motors. Our List GM/355 sent on request.

M. R. SUPPLIES, Ltd., 68, New Oxford St., London, W.C.1
Telephone: MUSEum 2958

Photographs of 'Eclipse' magnets are reproduced by courtesy of the manufacturers James Neill & Company (Sheffield) Limited.



All shapes and sizes

The remarkable efficiency of these 'Eclipse' magnets is due to their composite construction, using 'Araldite' to bond the component parts. The manufacturers of these magnets state that they use 'Araldite' because it enables them to produce shapes and sizes otherwise impracticable, to ensure that the magnets cannot be taken apart and to avoid bolted assemblies. 'Araldite' provides a bond which is truly permanent, and its strength is proved by the fact that facing and boring operations and also grinding are carried out after bonding.

'Araldite' epoxy resins have a remarkable range of characteristics and uses.

They are used

- ★ for bonding metals, porcelain, glass etc.
- ★ for casting high grade solid insulation.
- ★ for impregnating, potting or sealing electrical windings and components.

- ★ for producing glass fibre laminates.
- ★ for producing patterns, models, jigs and tools.
- ★ as fillers for sheet metal work.
- ★ as protective coatings for metal, wood and ceramic surfaces.

'Araldite'

epoxy resins

'Araldite' is a registered trade name

Aero Research Limited A Ciba Company · Duxford · Cambridge · Telephone: Sawston 2121

AP. 264-190

For your
Personal
Convenience



Personal Credit Plan

We are proud to represent the products of these internationally famous makers:

This plan provides easy repayment terms and low service charges by two methods of purchase. Credit Sale Agreement, repayment being by 9 equal monthly instalments, the equipment being despatched after receipt of the first payment and signed agreement; or Hire Purchase Terms. The latter can be extended up to 18 months for amounts over £50.

- | | | |
|-----------------|------------------------|-----------------|
| RONETTE | CONNOISSEUR | ROGERS |
| WOOLLETT | LOWTHER | GOODMANS |
| LEAK | GARRARD | G.E.C. |
| COLLARO | ACOUSTICAL QUAD | W.B. |
| BURGOYNE | WHARFEDALE | E.A.R. |

BRITISH MADE EQUIPMENT— Amplifiers (complete)	CASH PRICE	CREDIT SALE 9 monthly pmts. of	HIRE PURCHASE Deposit 50% 12 mthly. pmts. of	EXPORT PRICE nett
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Acoustical Quad Mk. II	42 0 0	103/1	21 0 0	38/11
Leak T4 ID and Point One	28 7 0	70/4	14 3 6	26/3
Rogers RD Junior	26 0 0	68/7	13 0 0	24/2
W.B. 12 H-F1	25 0 0	61/1	12 10 0	23/4
E.A.R. Mollard 510	18 15 0	48/5	9 9 0	18/3

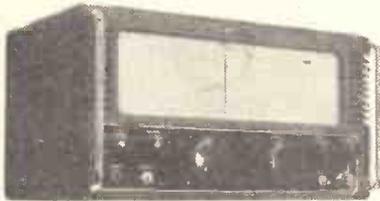
Loudspeakers				
Model	CASH PRICE	CREDIT SALE	HIRE PURCHASE	EXPORT PRICE
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wharfedale W16CS	17 10 0	42/9	8 15 0	17/1
Super 12CSAL	17 10 0	42/9	8 15 0	17/1
W12CS	10 5 0	26/1	5 2 6	11/-
Golden 10	8 0 11	21/8	4 0 6	9/2
Super 3CSAL	7 6 11	19/8	3 18 6	8/7
G.E.C. Metal Cone	9 5 0	23/11	4 12 6	10/2
Goodmans 150 Mk. II	10 15 9	27/4	5 6 0	11/6
Axiom 80	24 4 9	59/8	12 2 6	22/6
Audiom 60	9 2 9	23/8	4 11 6	19/1
Axiom 22	15 9 0	36/6	7 14 6	15/4
Axiom 102	19 7 9	26/5	5 4 0	11/2

Tape Recorders and Decks					
Model	£ s. d.				
Editor 2-speed Standard	50 8 0	123/3	25 4 0	46/8	50 8 0
Editor Super Hi-Fi	65 2 0	159/1	32 11 0	60/4	65 2 0
Playtime (complete)	31 4 6	76/4	15 12 6	29/-	31 4 6
Playtime Plus	36 15 0	89/10	18 8 0	34/-	36 15 0
Sound	57 15 0	143/-	28 17 6	53/-	57 15 0
Sound Cadet	40 19 0	102/-	21 0 0	39/-	40 19 0
Vortexion 2A	84 0 0	208/4	42 0 0	77/10	84 0 0
Vortexion 2B	89 0 0	242/-	49 10 0	91/9	89 0 0
Ferroglyph 2A/N or 2A/NL	79 16 0	198/1	39 18 0	74/-	79 16 0
2A/NH	90 6 0	218/6	45 3 0	83/8	90 6 0
Collaro Tape Transcriber	20 0 0	48/11	10 0 0	19/2	20 0 0
Wearite 2A Tape Deck	35 0 0	85/7	17 10 0	32/5	35 0 0
Truvox Tape Deck	24 3 0	57/1	12 1 6	22/8	24 3 0
Lane Mk. VI Deck	19 10 0	45/3	9 5 0	17/11	19 10 0

The above is only a selection of equipment available on the M.O.S. Personal Credit Plan. In addition Record Reproducers, Refrigerators, Electrical Appliances, Electric Tools, etc., are all available on this plan. Export prices are shown for easy import facilities.

E & G MAIL ORDER SUPPLY CO. 33 Tottenham Court Road, London, W.1. Tel: MUSeum 6667

EDDYSTONE COMMUNICATION RECEIVERS



Model 840A illustrated

Cash Prices and Statutory Terms

Model	Cash Price	Deposit	8 Monthly Payments of
820	£38 0 0	£4 6 8	£4 6 8
840A	£55 0 0	£6 8 4	£6 8 4
750	£78 0 0	£9 2 0	£9 2 0
888	£110 0 0	£13 16 8	£13 16 8
680X	£120 0 0	£14 0 0	£14 0 0

Cash price if paid in 6 months by Banker's order.

Carriage paid per passenger train

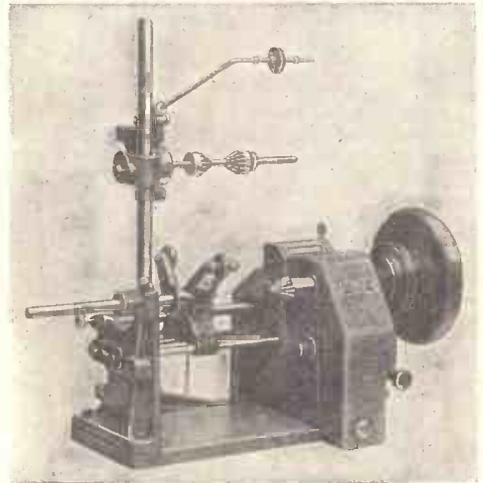
Model 840A is for A.C. or D.C. 110/250 v.; 750 and 680X 110/240 v. A.C. These sets are the choice of the discerning professional and amateur users. Descriptive literature gladly forwarded.

Latest EDDYSTONE Component Catalogue 1/-



The
Eddystone
Specialists
SERVICES LTD.,

55 COUNTY ROAD, LIVERPOOL, 4
Telephone: AINTREE 1445 ESTAB. 1935
Branch address: MARKET CROSS, ORMSKIRK



Model 'Q'

MANUFACTURERS OF
AUTOMATIC & HAND
COIL WINDING
MACHINES

ETA TOOL CO.
(LEICESTER) LTD.

29A WELFORD ROAD, LEICESTER
Phone 5386

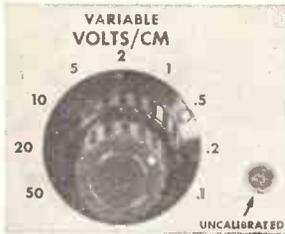


TECHNICAL DATA

on the NEW Type 515 Oscilloscope

DC-TO-15 MC PASSBAND

High in performance, but low in size, weight, and cost, the Type 515 fits a relatively new requirement area. Besides its extra capabilities in applications requiring vertical response out to 15 megacycles, it occupies less space and is easier to handle than most other general-purpose laboratory oscilloscopes.

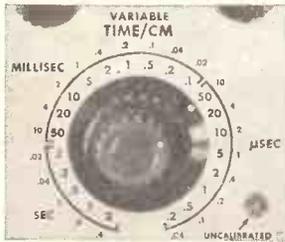


Risetime of the dc-coupled vertical amplifier is less than 23 millimicroseconds. Sensitivity is accurately calibrated, 0.1 v/cm to 50 v/cm in nine steps. A variable control adjusts the sensitivity between calibrated steps and out to 125 v/cm. To help avoid accidental inaccurate readings, a warning light indicates an uncalibrated condition when the variable control is in use. A balanced network delays the signal 0.25 μ sec to permit observation of the leading edge of the waveform that triggers the sweep. Direct input capacitance of approximately 36 μ f is reduced to approximately 10 μ f by use of the 10x attenuator probe supplied with the instrument.

brated condition when the variable control is in use. A balanced network delays the signal 0.25 μ sec to permit observation of the leading edge of the waveform that triggers the sweep. Direct input capacitance of approximately 36 μ f is reduced to approximately 10 μ f by use of the 10x attenuator probe supplied with the instrument.

SIMPLIFIED SWEEP CONTROL

All 22 of the Type 515's accurately calibrated sweeps are selected by the same control knob. This knob also indicates the sweep time-per-centimeter when the 5x magnifier is in use, making mental calculation of time intervals unnecessary. The normal sweep is expanded to 50 centimeters by the magnifier, and the horizontal-position control has sufficient range to display any 10 centimeters of the magnified sweep. To maintain uniform bias on the control grid of the cathode-ray tube for all sweep speeds and repetition rates, the unblanking waveform is dc-coupled.



Calibrated fixed sweeps extend from 0.2 μ sec/cm to 2 sec/cm. A variable control makes the sweep range continuous from 0.2 μ sec/cm to 6 sec/cm. Here again a warning light indicates an uncalibrated condition when the variable control is in use.

AUTOMATIC TRIGGERING

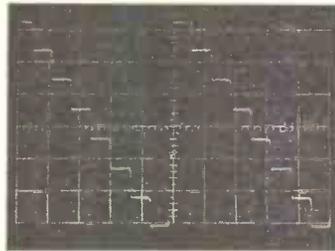
Automatic triggering is a real convenience in a great many oscilloscope applications. This one position, without further adjustment of the triggering controls, permits signals of widely differing frequencies and amplitudes to initiate the sweep, and provides a reference trace on the screen in the absence of an input signal. The automatic circuit operates at a natural rate of about 50 cycles, but synchronizes readily with incoming signals from 60 cycles to 2 megacycles.

Triggering versatility is one of the many highly-useful qualities of the Type 515. You can trigger the sweep from either the positive or negative slope of an internal, external, or line-voltage signal. On any of these signals, you can trigger the sweep at a selected amplitude level. You select

either ac or dc-coupling through the trigger circuitry. You can synchronize the sweep with sine-wave signals up to and beyond 20 megacycles. You can block out the low-frequency component of a composite signal, permitting the high-frequency component to trigger the sweep. These complete triggering facilities make possible a steady display of just about any signal you are likely to encounter.

LARGE DISPLAY AREA

A full 6-centimeter by 10-centimeter linear display can be presented on the screen of the new Tektronix cathode-ray tube, Type T55P, developed especially for this instrument. Characteristics of this new tube help make possible the



wide signal-handling range and excellent transient response of the Type 515. Accelerating potential is 4000 volts. A T55P2 is normally supplied, but a P1, P7, or P11 screen is available on request at no extra cost.

PORTABILITY

It's a bit unusual for higher performance to come in an oscilloscope that's smaller and lighter than previous models. But this combination of compactness and performance makes the Type 515 most convenient for those more-exacting field applications. Handling ease and simplified controls are characteristics also desirable in the increasing number of production-line test stations where high performance is a new requirement. The Type 515 weighs only 40 pounds and measures 9 $\frac{3}{4}$ " wide, 13 $\frac{1}{2}$ " high, 21 $\frac{1}{2}$ " deep.

OTHER CHARACTERISTICS

Many of the other features you'd expect to find in any Tektronix Oscilloscope are part of the Type 515. Square-wave amplitude calibrator, sweep sawtooth and gate available at front panel, illuminated graticule, and electronically-regulated power supply are some of the "standard equipment". New style cabinet with removable sides speeds any maintenance that may be necessary.

TYPE 515 . . . \$750 (F.O.B. Portland, Oregon)
£290.0.0 (Delivered in England)

The above prices are exclusive of duty.



Represented in Great Britain by
LIVINGSTON LABORATORIES, LTD.
Retcar Street, London N. 19
Archway 6251

Tektronix, Inc.

P. O. Box 831D, Portland 7, Oregon, U.S.A.
Phone CYPRESS 2-2611 • Cable: TEKTRONIX
TWX-PD 265

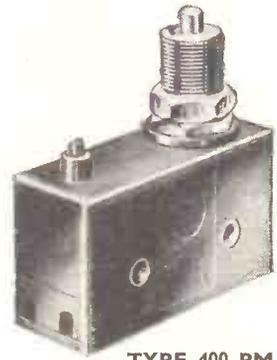


BRITISH DESIGNED MICROSWITCHES

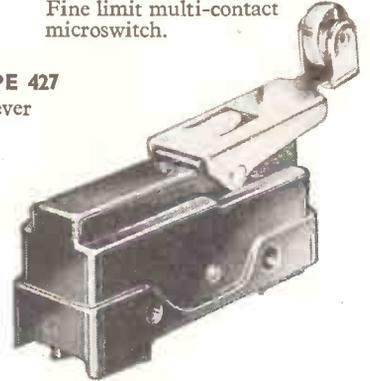
are in step with modern developments, using a specially designed free-hinge movement giving repeatability of switching at exactly the same point of actuator travel. Please write for full details of the complete Pye range of microswitches. Two recent additions to the extensive Pye range:—

PYE LTD SWITCH DIVISION

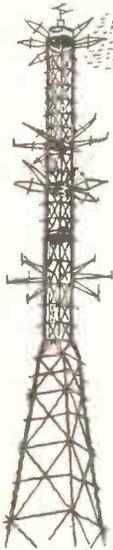
OTEHALL WORKS, BURGESS HILL, SUSSEX



TYPE 400 PM
Fine limit multi-contact microswitch.



TYPE 427
Protruding lever microswitch.



A SPARK OF GENIUS!

I.C.S. training supplies the spark you need to further your career. The Courses I.C.S. offer are practical and up to date, they recognise the present emphasis on Frequency Modulation, and they can help you attain one of the many well-paid posts that exist today in the radio world. Prepare yourself now, at home and in your own time, with the expert help of I.C.S. tutors.

The cost of an I.C.S. Course is moderate and includes all books.

Among the I.C.S. Courses available are:

- FREQUENCY MODULATION ENGINEERING
- T/V ENGINEERING
- RADIO SERVICING
- RADIO ENGINEERING
- RADAR ENGINEERING

Basic Electronics • Industrial Electronics
Electronic Engineering.

Complete the coupon below and post it to us today for further details of the Course which interests you. Write to: Dept. 223E, I.C.S., 71 Kingsway, W.C.2

INTERNATIONAL CORRESPONDENCE SCHOOLS
Dept. 223E, International Buildings, Kingsway, London, W.C.2.

Please send FREE book on Age.....

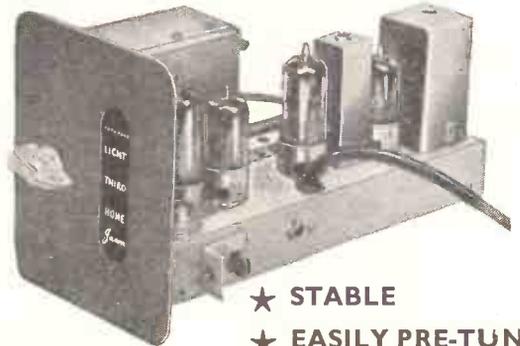
Name.....
(Block letters please)

Address.....

1.57

INTERNATIONAL CORRESPONDENCE SCHOOLS

JASON *switch-tuned* F.M. UNIT



- ★ STABLE
- ★ EASILY PRE-TUNED
- ★ EASILY INSTALLED

The introduction of this stable and dependable 4-valve F.M. Tuner in which the desired programme is tuned-in by a 3-position switch marks a logical development in F.M. technique. Pre-tuning is very easy and once set no further adjustment becomes necessary. With Automatic Frequency Control. External power source required. Details and name of your nearest supplier on request.

£19. 16. 2
inc. P.T.

JASON ELECTRONIC & MOTOR CO.

328, CRICKLEWOOD LANE, LONDON, N.W.2

Telephone: SPEdwell 7050

ORYX

MINIATURE SOLDERING INSTRUMENTS

The elements of ORYX instruments are mounted at the tip of the stainless steel shafts. No loss of heat and maximum efficiency are the result. Strictly controlled heat (not too little, not too much), giving exact soldering temperature. Robust construction without mica, ceramics, pins, etc. Simple, push-on spare bits, easily replaced. Finger-tip control.

Model 6

Designed for soldering hair-springs, transistor work and miniature instruments. The only model with a non-replaceable bit. For 6 volts only.

Model 6A

Designed for production and maintenance of hearing-aids, printed circuit-work and transistor-assemblies. For 6 volts only.

Model 9

Designed for miniature radio and instrument work, relays, switches, small assemblies, etc. Available for 6 v., 12 v. or 24 v.

Model 11

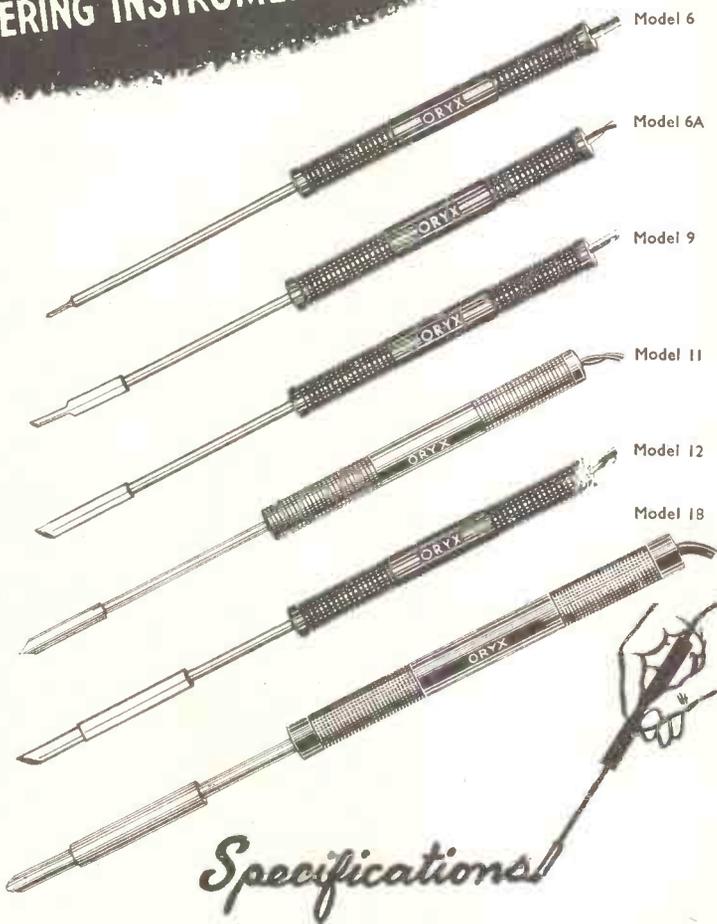
Designed for special high-temperature work, soldering temperature approx. 100° above normal. For 6 volts only.

Model 12

Designed for maintenance work on television, and radio sets, aircraft work, electronic instruments. Available for 6 v., 12 v., 24-28 v. or 50 v.

Model 18

Designed for high-speed soldering on production lines. Prevents fatigue by operators and damage to surrounding components. For 6 volts only.



Specifications

Mod.	Consumption	Bit Dia.	Weight	Length	Price	Sp. Bits
18	18 watts	$\frac{3}{16}$ in.	$\frac{3}{8}$ oz.	7 $\frac{1}{2}$ in.	35/-	3/6
12	12 watts	$\frac{3}{16}$ in.	$\frac{1}{2}$ oz.	6 in.	25/-	2/-
9	8.3 watts	5/32 in.	$\frac{1}{4}$ oz.	6 in.	25/-	2/-
6A	6 watts	3/32 in.	$\frac{1}{4}$ oz.	6 in.	25/-	2/-
6	6 watts	$\frac{1}{16}$ in.	$\frac{1}{4}$ oz.	6 in.	25/-	—
11	10 watts	5/32 in.	$\frac{1}{2}$ oz.	6 in.	35/-	7/6

SOLE DISTRIBUTORS

ANTEX

3 TOWER HILL
LONDON E.C.3

Telephone Royal 4439

Cables ANTEXLIM

FORTIPHONE MINIATURE COMPONENTS

FOR CONSTRUCTING THE Mullard

Circuits in the Booklet "TRANSISTORS FOR THE EXPERIMENTER"

Circuit 11, page 29	miniature transformers larger type	A203, A204 P203, P204	15/6 each post free 17/6 "
Circuit 4, page 27	driver transformer multi-ratio experimental types	P291 MM-1 Matchmaster PM-1 Powermaster	17/6 " 25/- " 30/- "
Circuit 5, page 27	coupling transformers slide switch socket cord earphone eartip special earphone (250 ohms)	N22, N23 SW/5 SK/4 14/-/14 "long large" L	10/- " 4/- " 1/6 " 5/- " 2/9 " 18/- "
Circuit 7, page 28	special earphone (600 ohms)	D two dot	22/- "

for further details of these and other subminiature components, write to

FORTIPHONE LTD., COMPONENT DIVISION, 92, MIDDLESEX STREET, LONDON, E.1



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

PRE-SET CONTROL LOCK

Designed to lock the spindles of pre-set potentiometers or trimmers without rotational or lateral displacement of shaft.

Will accept wide range of panel thicknesses.

TYPE P

TYPE C

Very attractive appearance for panel mounting.

Send for leaflet A.1



"KNOB LOCK"

The ideal method of locking panel mounted controls. Positive guard against vibration, etc.

This development of our popular pre-set control lock is finished in black plastic and embodies control knob and instantaneous finger-tip locking knob.

Send for List No. A.5

SUTTON COLDFIELD ELECTRICAL ENGINEERS

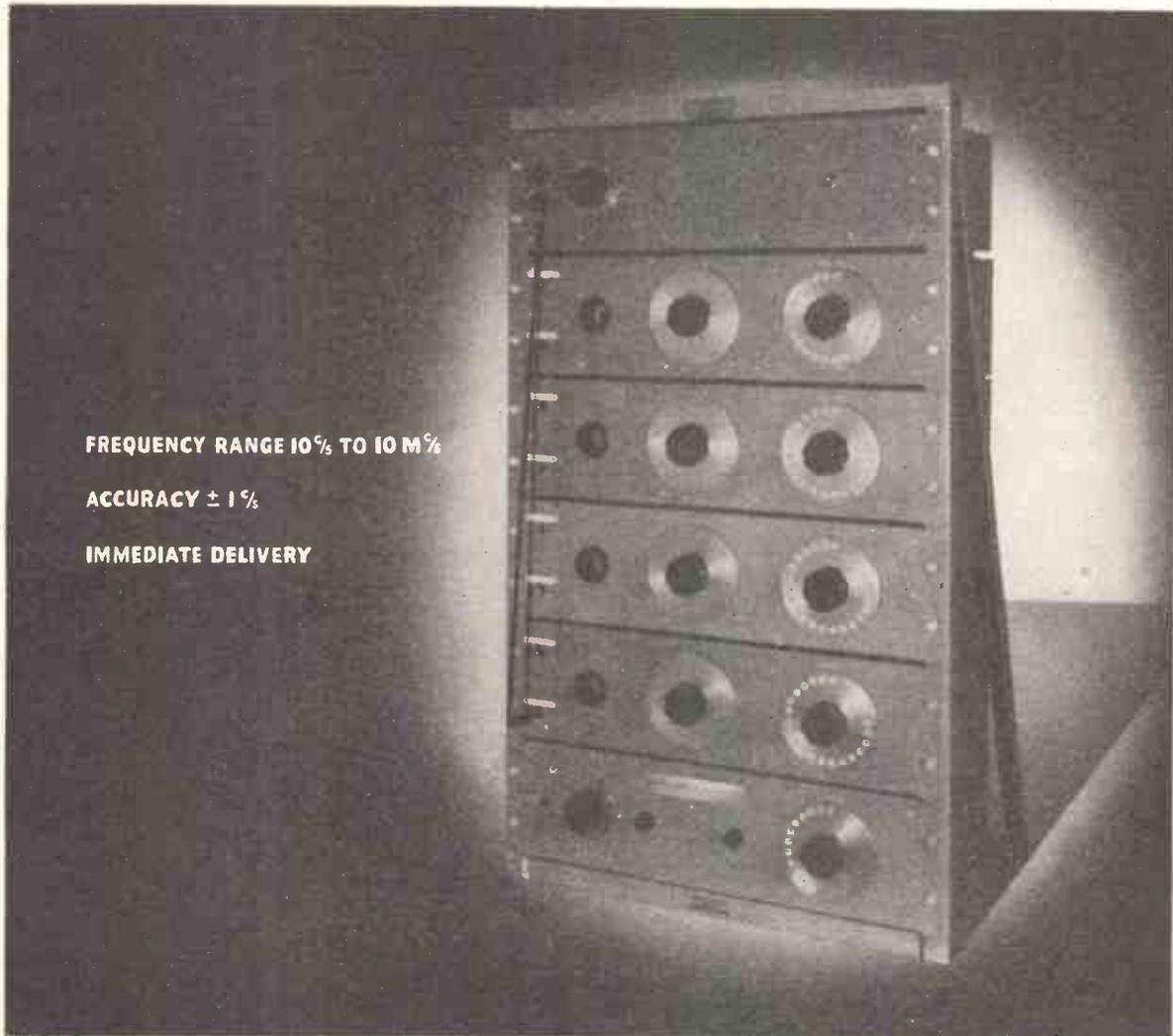
Reddicap Trading Estate, Sutton Coldfield. 'phone SUT 3038 & 566

G.E.C.

DIRECT READING

PRECISION FREQUENCY MEASURING EQUIPMENT

For rapid operation by unskilled staff



FREQUENCY RANGE 10% TO 10 M%

ACCURACY $\pm 1\%$

IMMEDIATE DELIVERY

For full details write to

SALFORD ELECTRICAL INSTRUMENTS LIMITED
PEEL WORKS · SILK STREET · SALFORD 3 · LANCs.
A SUBSIDIARY OF THE GENERAL ELECTRIC CO. LTD. ENGLAND

New!

WIDE BAND TRANSFORMERS

TYPE AT.23

3 Mc/s to 300 Mc/s

TYPE AT.25

100 Kc/s to 100 Mc/s

DELIVERY
EX STOCK

- ★ Less than 2dB Insertion Loss.
- ★ Balance ratio better than 20dB rising to over 60dB at low frequency end of band.
- ★ Input impedance 75 ohms unbalanced.
- ★ Output impedance 75 ohms balanced.
- ★ Hermetically sealed and fully tropical.

Send for descriptive leaflet "W" giving details of the above and many other types.

BALUN LIMITED

CRAWLEY ROAD • HORSHAM • SUSSEX

TELEPHONE : HORSHAM 3232/3

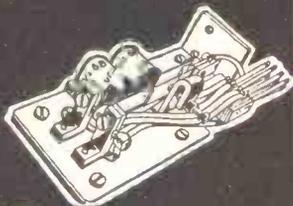
RELAYS

P.O. TYPES
MANUFACTURED
TO YOUR
SPECIFICATION
**PROMPT
DELIVERY**



3000 TYPES

COILS up to 80,000Ω.
CONTACTS up to 8 c/o's
Tropicalizing and impreg-
nating to order.
600 and HIGH-SPEED
TYPES also Supplied.



**LARGE
STOCKS
OF
KEYSWITCHES**

THE KEYSWITCH CO.
ALL POST OFFICE EQUIPMENT

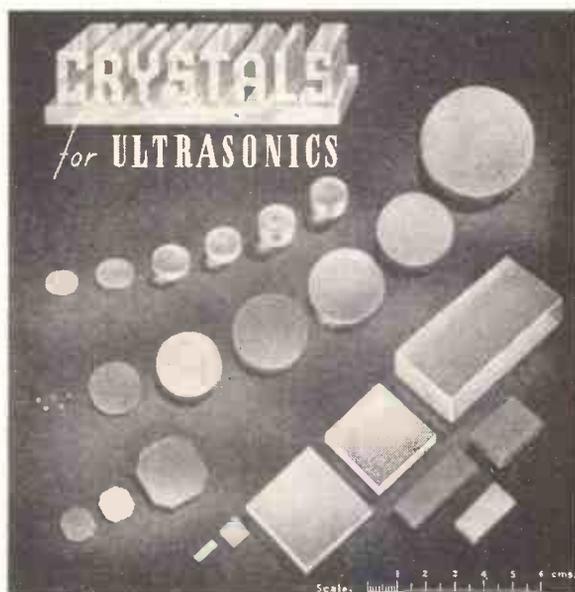
Enquiries to Sales Manager

126 KENSAL ROAD, LONDON, W.10

Telephone: LAD. 0666, 4640

Grams: "Fonequipt", London, W.10

Contractors to Home & Overseas Governments & H.M. Crown Agents



Quartz Crystals of any shape and size cut and ground precisely to specification and coated, if required, with Gold, Silver or Aluminium, etc.

BROOKES CRYSTALS LTD

Suppliers to Ministry of Supply, Home Office, B.B.C., etc.

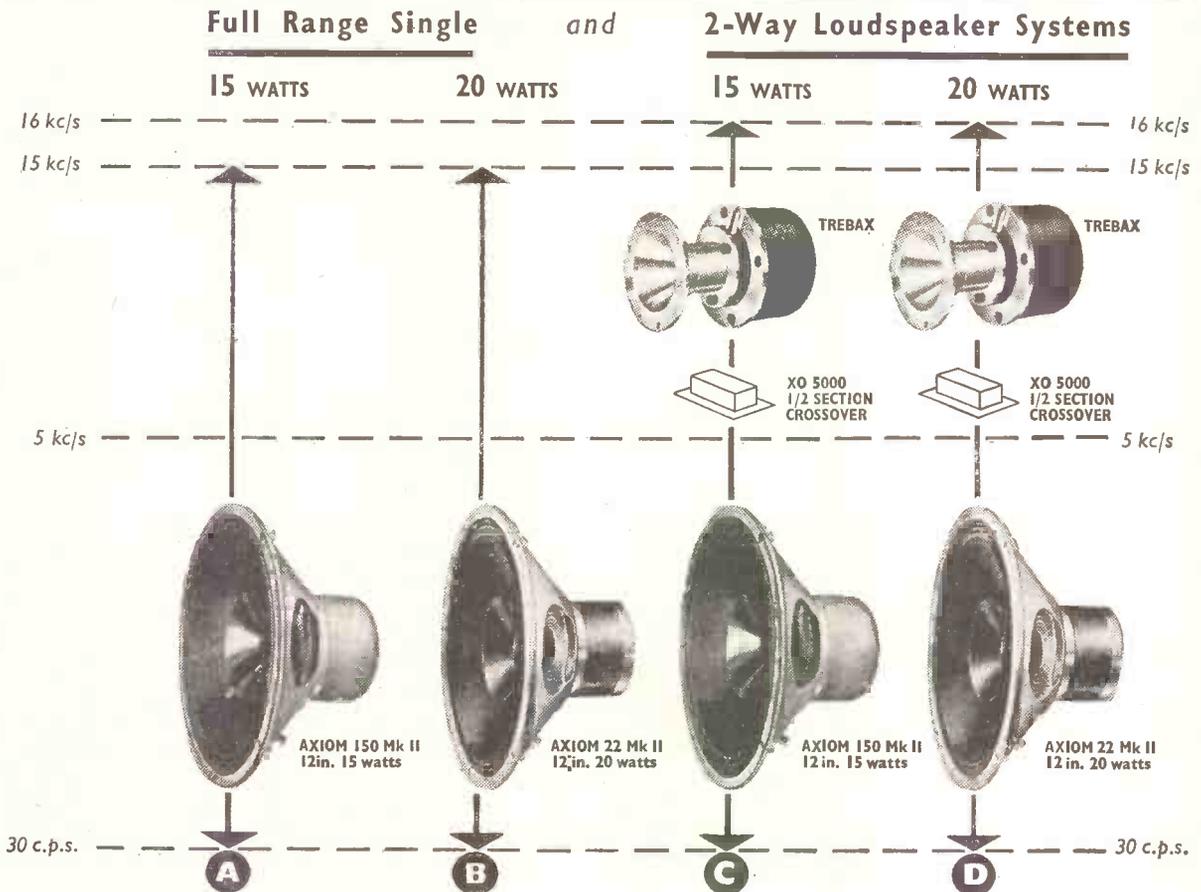
181/3 TRAFALGAR ROAD, GREENWICH, LONDON, S.E.10

Phone: Greenwich 1828

Grams: Xtals, Green, London.

Cables: Xtals, London

No other range of HIGH FIDELITY LOUDSPEAKERS offers you such a choice...



FULL RANGE LOUDSPEAKERS (A & B)

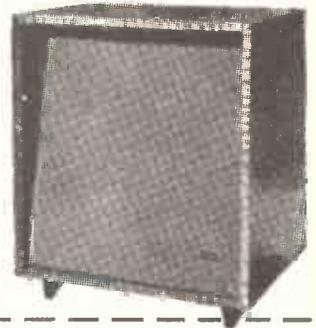
The Axiom 150 Mk II and Axiom 22 Mk II represent the most practical low-cost approach to high fidelity sound reproduction. These speakers have an acoustically smooth response over an exceptionally wide frequency range.

FOR MULTIPLE SPEAKER SYSTEMS (C & D) you may start with the full range Axiom 150 Mk II or Axiom 22 Mk II and add as you go along.

TREBAX is a highly efficient pressure driven treble unit with response extending to the upper limits of audibility.

XO/5000 twin 1/2 section crossover network.

The "Sherwood" Enclosure is designed to house any one of these four systems. This enclosure incorporates the Acoustic Resistance Unit and is only two thirds the volume of a conventional Bass Reflex enclosure.



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

Telephone: WEMbley 1200 Cables: Goodaxiom, Wembley, England.

SOUTH AFRICAN AGENTS : TECHNICAL & INDUSTRIAL SERVICES, P.O. BOX 2652, CAPE TOWN

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

Full details and prices please.

Name

Address

-towards perfection-

LOWTHER LINEAR AMPLIFIERS

Exclusive Lowther Design and Build



Lowther Linear Amplifier
LL.10 £25

The new range "Lowther Linear" amplifiers surpass all previous multi-loop feedback or basic ultra linear technique by the utilisation of the suppressor grid of the Mullard power pentode EL34 into the distributed load circuit which enhances the performance in all detail.

Generous in design, the amplifier's performance will remain at its high laboratory test specification throughout many years of use.

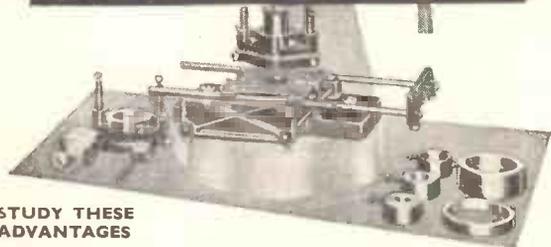
THE LOWTHER MANUFACTURING COMPANY,

LOWTHER HOUSE, ST. MARK'S ROAD, BROMLEY, KENT, ENGLAND.

Tel.: RAVensbourne 5225

HUNTON will cut your press tool costs for **PROTOTYPE** and **PRE-PRODUCTION RUNS!**

THE UNIVERSAL BOLSTER OUTFIT USING STANDARDISED PUNCHES AND DIES FOR SHEET METAL PIERCING AND BLANKING ON FLY PRESSES



STUDY THESE ADVANTAGES

- Specialised range of Chassis Piercing and Forming Tools for the Radio and Electronics industries.
- To get you started—standardised Punches and Dies $\frac{1}{16}$ in. to $3\frac{1}{2}$ in. dia. in 1/32in. sizes from stock.
- At short notice, Standardised Tools of square, oblong and other shapes.
- Adjustable Gauges for exact location of work. Automatic and Positive Stripping of material from Punch.

in London and Home Counties ask for a practical demonstration in your own works. Alternatively, write for illustrated price list W.W.

HUNTON LIMITED

PHOENIX WORKS, 114-116, EUSTON RD., LONDON, N.W.1.
Tel.: EUSton 1477 (3 lines). Grams: Untonexh, London.

EXECUTIVES REQUIRE CRISP, CONCISE REPORTS—DICTATE THOSE DETAILS IN YOUR CAR! VALRADIO DC/AC CONVERTERS MAKE DICTATING MACHINES AND TAPE RECORDERS MOBILE



For use too with Record Changers, Radiograms, Electric Gramophones, Television Receivers, and T.V. from country house lighting plants. (Prices according to instrument.)

INPUTS . ENTREES . ENTRADA :

6, 12, 24, 32, 50, 110 or 200/250 v.

OUTPUTS . SORTIES . SALIDAS

110 v. or 230 v. AC, 50 or 60 c/s., 30 to 300 w.

Prices DC/AC Converters:

From £8.16.0—for Small Motors

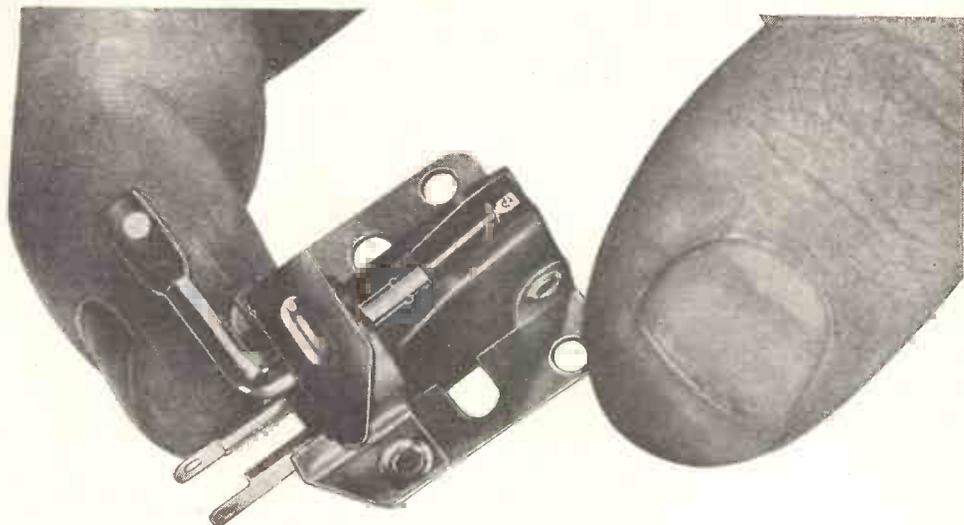
From £11.16.0—for Radiograms (including 3-speed Types).

Units complete and ready for use. **VALRADIO.** Write for descriptive folder, WW/C. ACCEPTED AS THE STANDARD by RADIO MANUFACTURERS, the Trade and the Aircraft Industry.

Les rapports destinés aux chefs de service doivent être rédigés d'une façon bien concise—ditez-les donc dans votre voiture! Les convertisseurs C.C./C.A. "VALRADIO" consentent la mobilité aux machines à dicter et aux enregistreurs sur bandes. Ils peuvent également être utilisés pour changeurs de disques, appareils combinés, électrophones, téléviseurs etc., partant d'installations d'électricité particulières.

Las relaciones destinadas a los jefes tienen que redactarse de modo muy conciso—dictenlas en el coche! Los inversores C.C./C.A. "VALRADIO" les prestan movilidad a las máquinas de dictar y a los grabadores de cinta. También pueden utilizarse para cambiadores de discos radio-combinados, gramófonos eléctricos, aparatos de televisión etc., aprovechando las instalaciones eléctricas privadas.

Specialists in converters since 1937. **VALRADIO LIMITED.**
BROWELLS LANE FELTHAM MIDD. Phone: Feltham 4242/4837
OVERSEAS ENQUIRIES TO: DEMANDES D'OUTRE-MER A:—
TODA INFORMACION DE EXPORTACION HA DE PEDIRSE A:—
E.M.I. SUPPLIERS LTD. HAYES MIDDLESEX ENGLAND.



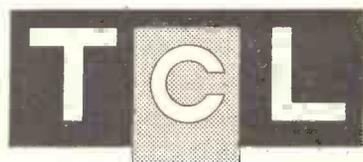
“Put this on record”

The Sonotone Pick-up Cartridge is virtually accepted as a criterion for operation in all climates and is now available in Gt. Britain from Technical Ceramics Ltd.



Design engineers and radiogramophone manufacturers are invited to contact Technical Ceramics Ltd. for further information regarding this outstanding product.

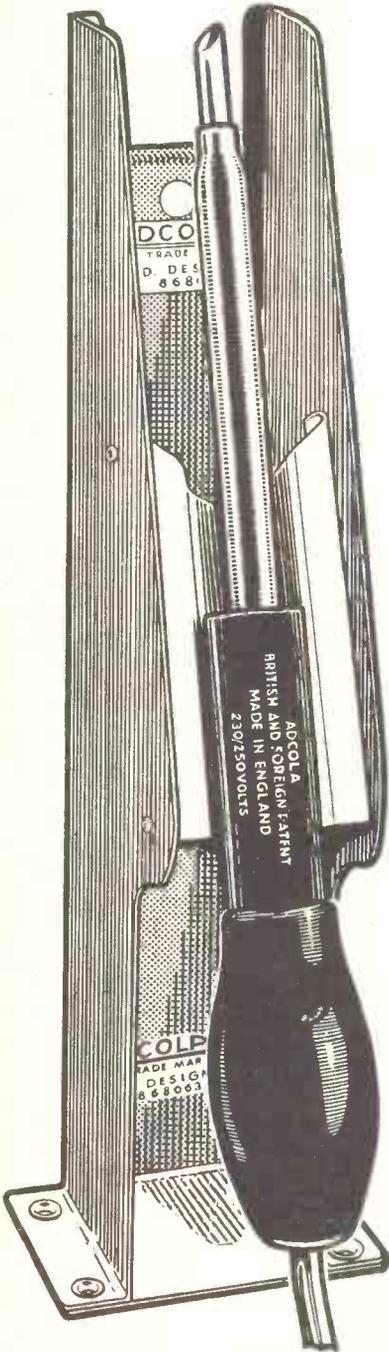
Technical Ceramics Limited, Wood Burcote Way, Towcester, Northants



ADCOLA

(Regd. Trade Mark)

SOLDERING INSTRUMENTS
& ALLIED EQUIPMENT



ILLUSTRATED

DETACHABLE
 $\frac{1}{8}$ " BIT MODEL
LIST No. 64

Protective
Shield
List No. 68

CATALOGUES HEAD OFFICE SALES & SERVICE

ADCOLA PRODUCTS LTD.,
GAUDEN ROAD,
CLAPHAM HIGH ST.,
LONDON, S.W.4.

TELEPHONES :
MACaulay 3101
& 4272



STL

*Transformers
incorporating
"C" cores or
conventional
construction*

STL TRANSFORMERS

based on sound design and are manufactured to the highest standards called for in the electronic and communication fields. Consult us for your next transformer requirements.

N.B.: MANUFACTURERS AND TRADE ONLY

STEWART TRANSFORMERS Ltd.

75, KILBURN LANE, LONDON, W.10 · LADbroke 2296/7

BK

SPECIALISED LOUDSPEAKER ENCLOSURE

New!



Introducing an amazing new dual unit loudspeaker system for less than £25. The enclosure, the BK-LPR103, incorporates the new Wharfedale Acoustic Filter and closely follows the recent design by Mr. G. A. Briggs. Price (including HF leve' Control and filter condenser), £12/8/6.

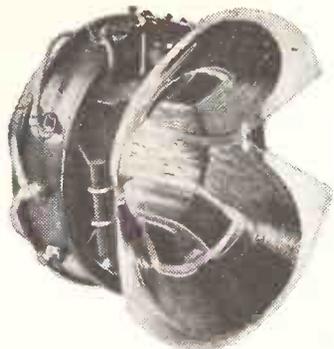
LOUDSPEAKERS. Wharfedale Bronze 10/CSB
A new 10in. unit of remarkable specification and performance at £5/11/3.
Wharfedale Super 3. One of the best HF units available. £6/19/11.

- Reasonable Price
- Modest dimensions 20 in. w. x 29½ in. h. x 11 in. d. at base
- Real high quality reproduction
- All the advantages of dual speaker systems
- Ideal for stereophonic sound

It is impossible to give full details of this magnificent enclosure here . . . send for literature, or, better still, call and hear it demonstrated at our showrooms on a wide range of amplifiers, including the new Goodsell PRESIDENT and MA5UL/C. Demonstrations daily. 10.30 a.m.—5.30 p.m. Saturdays 10.30 a.m.—12.30 p.m. Trade enquiries invited.

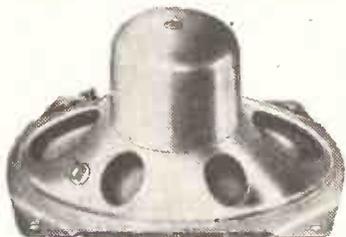
B. K. PARTNERS LTD.

229 REGENT ST., LONDON, W.1. (Entrance Hanover St.) Phone: REG 7363

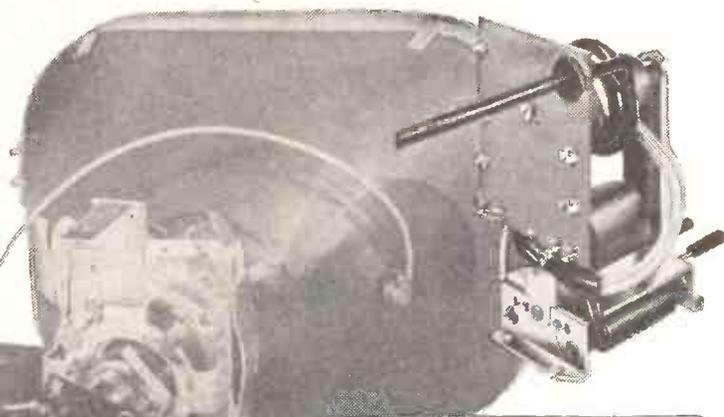
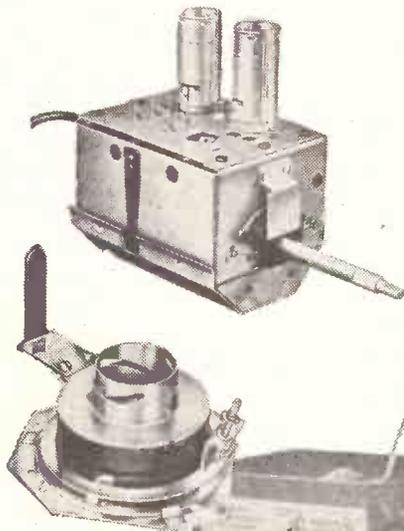


Plessey makes available to Overseas Industry a range of superior components, including many interesting developments for 90° scanning angle receivers.

for American and Continental high definition systems...



This range incorporates not only many new items, but also improvements on established designs, and a continuation of research into basic materials and methods of production has resulted in components of high performance at economic cost. Overseas Design Engineers and Equipment Manufacturers are invited to write for full information.



... T.V. components by

Plessey



THE RD JUNIOR



FM UNIT

with

Automatic Frequency Control

PRICE **£24.17.0.** INCL.

PART OF A

COMPLETE HIGH FIDELITY SYSTEM

Literature available post free on request; send also for details of companion equipment in the RD JUNIOR Home High Fidelity System—the RD JUNIOR Amplifier and Control Unit and the RD JUNIOR Corner Horn enclosure.

NEW FACTORY: In order to be able to meet the steadily increasing demand for our products we have now moved to a larger and better equipped factory. Our sole address, to which all enquiries should be sent, is now as below.

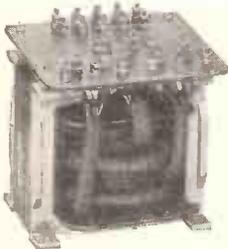
ROGERS DEVELOPMENTS (ELECTRONICS) LTD.

"RODEVCO WORKS," • 4-14 BARMESTON ROAD, • CATFORD, • LONDON, S.E.6
Telegrams: RODEVCO, LONDON, SE6 Telephone: H1Ther Green 7424

ELECTRONICS CUSTOM BUILT EQUIPMENT FOR INDUSTRY & RESEARCH

Prototypes, Development, Production

TRANSFORMERS



For power distribution and electronic application: Ranges from small electronic types, up to 50 kVA, orthodox and C cores. 1-Phase and 3-Phase Oil and Air Cooled Phase conversion, etc. Special types for Furnace and Rectifier Control.

A.I.D. AND A.R.B. APPROVED
Contractors to H.M. Government

YOUR ENQUIRIES ARE INVITED

ANDEC LTD

Formerly Avis & Baggs, Ltd.

BENNET ROAD, READING

Telephone: READING 82401

ADAPTATAPE

is the name of the new SONOMAG Pre-Amplifier recommended on page 238 of the November "Hi-Fi News" to those already owning Hi-fi equipment and wishing to add tape reproduction of the same quality.

This is the **ONLY** pre-amp. at present available designed specially for the new Collaro Transcripator, and rigidly fixed as a unit to it.

Demonstrations to all hi-fi enthusiasts of our pre-amp used in conjunction with the Collaro Transcripator Tape Unit, Collaro Transcription Motor, Leak Dynamic Pick-up and Diamond stylus, Leak Trough-line F.M. Tuner, Wharfedale Baffle 3-speaker system and Leak main amplifiers, will convince you of the fine standard of recording possible. Day, or evening, (by appointment).

Price 32 gns.

(Power pack, if required, 4 gns. extra.)
Fitted into Fireside Console cabinet, oak, walnut or mahogany finish, 40 gns.

Your own Collaro Unit fitted, aligned, tested and guaranteed (at our factory only) for 16 gns.

Complete Tape Recorders, including Collaro Microphone and 1,200ft. tape. Portable 48 gns. Console (with extra large speaker) 58 gns.

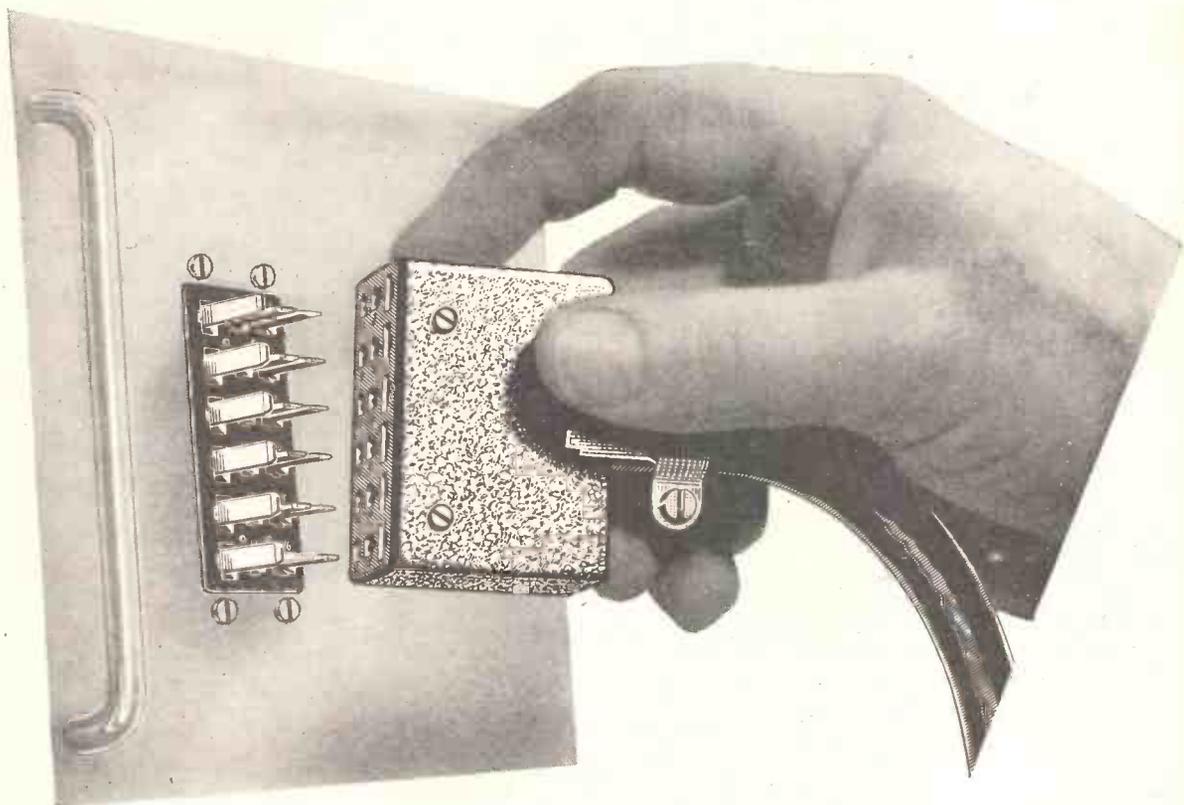
Leaflet on request.

Credit facilities from:

H. C. Harridge, 8, Moor Street, Cambridge Circus, W.1.
Holleys Radio, 315, Camberwell Road, Camberwell Green, S.E.5.
Jackson Radio, 163, Edgware Road, W.2.
London Radio Supply Co. Ltd., Balcombe, Sussex.
Readings Music Stores, 11, Station Approach; Clapham Junction, S.W.11.
Sound-Tape-Vision, 71, Praed Street, Paddington, W.2.
Woods Radio, 198, Lavender Hill; Clapham Junction, S.W.11

SONOMAG Ltd.,

2 St. Michael's Road, Stockwell, S.W.9
(Minute from Stockwell Tube) Telephone: BRI 5441



'MULTICON' PLUGS AND SOCKETS

The reliability of the connectors used can determine the dependability of electrical and electronic equipment.

In the range of Painton 'Multicon' Plugs and Sockets are types suitable for most applications, whether used as cable connectors, for linking cables to panels or chassis, or as unitors.

In addition to the type of cover illustrated, there is a similar range with die-cast covers allowing checking of the connections without interrupting the operation of the circuit.

Please ask for full details of Painton 'Multicon' Plugs and Sockets.

PAINTON
Northampton England

Wrinkles can't be removed...



MASTER SOUND
WISDOM

don't make them!

Recording tapes which have an abrasive action produce wrinkles on your head, thus reducing the quality of the recording. Mastertape has a high polish which remains so. Make sure that your recordings are good and stay so. Mastertape can be used on any tape recorder.



Mastertape

If your dealer has no stock, write direct to
M.S.S. Recording Co. Ltd., Colnbrook, Bucks. Tel. Colnbrook 430

True Hi-Fidelity

LISTEN!

to

VORTEXION

Tape Recording Equipment

in use with latest WHARFEDALE
& GOODMAN'S HI-FI Speakers

● SPECIAL DEMONSTRATIONS
on 1st and 3rd Saturdays of each month
BY INVITATION ONLY

Times: 11 a.m.-12.15 p.m. ● 2.30-3.30 ● 3.45-4.45 p.m.

NO SALES FACILITIES ON THESE DAYS

Write or phone for invitation to
London's Leading Agents:

GRIFFITHS HANSEN (RECORDINGS) LTD.
32/3, GOSFIELD ST., LANGHAM ST., W.1

Phones :
MU8cum 0642 2771.

Grams :
GRIFHANO · WESDO · LONDON

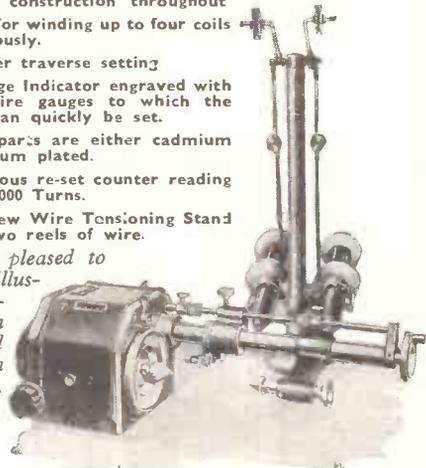
AUTOMATIC COIL WINDING MACHINE

Type A1/1. (25-50 S.W.G.) Type A1/X. (19-46 S.W.G.)

This machine is the most modern on the market and it possesses many exclusive refinements including:

- Dustproof construction throughout
- Provision for winding up to four coils simultaneously.
- Micrometer traverse setting
- Wire Gauge Indicator engraved with various wire gauges to which the machine can quickly be set.
- All steel parts are either cadmium or chromium plated.
- Instantaneous re-set counter reading up to 100,000 Turns.
- Entirely new Wire Tensioning Stand to hold two reels of wire.

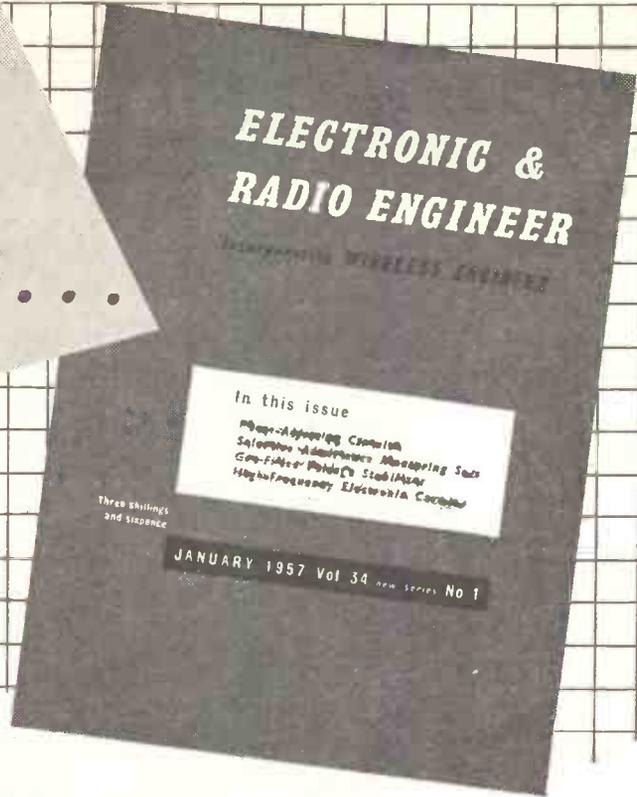
We will be pleased to
send you an illus-
trated leaf-
let giving a
full technical
specification
on request.



KOLECTRIC LTD

73 UXBRIDGE ROAD, EALING, LONDON, W.5
Ealing 8322

**WIRELESS
ENGINEER
becomes...**



Important news for electronic engineers

For 33 years WIRELESS ENGINEER has served the world's leading engineers, designers and technicians, publishing original work of eminent physicists and research engineers. Now, under the new title of ELECTRONIC & RADIO ENGINEER, and with a 40% increase in content, its influence is to be extended to include information of *more immediate application* in both electronics and radio. With the continued support of an advisory board representing Universities, the D.S.I.R., the B.B.C. and the Post Office, and with an enlarged Abstracts section, the new ELECTRONIC & RADIO ENGINEER will prove indispensable to all concerned with design, development, production and industrial application of electronic and radio apparatus. To be certain of beginning your readership with the first issue—out in January—complete the coupon NOW.

A representative selection from the contents of the January and subsequent issues:

- PHASE-ADJUSTING CIRCUITS:** A review of the characteristics of simple-type phase-adjusting circuits.
- SELECTIVE ADMITTANCE MEASURING SET:** Specifically for measurement of aerial admittance, but of general application wherever measurements must be made under conditions of interference.
- GAS-FILLED VOLTAGE STABILIZERS:** The results of a series of measurements in tubes.
- NON-LINEAR CIRCUIT EQUATIONS:** Solution of some non-linear problems.
- TRANSISTOR PULSE GENERATOR:** A simple generator using complementary transistors.
- CALCULATION OF CAPACITANCE:** Geometrical method of computing capacitance.
- STANDARDIZATION OF CIRCUITS:** A critical review of an American National Bureau of Standards publication.
- SOLENOIDS FOR AIRBORNE APPLICATIONS:** Designing magnet coils for minimum total weight taking into account the effective weight of the power supply.

POST THIS COUPON TODAY

TO LILFFE & SONS LIMITED, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

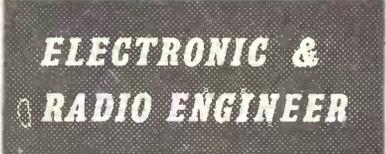
Please enter my subscription for 1 year (12 issues) to ELECTRONIC & RADIO ENGINEER. Remittance value £2.9.0 enclosed *

Please send me a specimen copy of ELECTRONIC & RADIO ENGINEER.

SIGNED

ADDRESS

* *Overseas Readers.* Take advantage of our introductory offer of 3 years' subscription for the price of 2. Remit £4.18.0 by International Money Order or Banker's Draft today.



incorporating Wireless Engineer

*For a regular
smooth response curve*

You need a PHILIPS dual-cone loudspeaker

(Made in Holland)



PHILIPS ELECTRICAL LTD

Musical Equipment Department · Century House · Shaftesbury Avenue · London · W.0.2.



A special dual-cone design distinguishes Philips high fidelity speakers, resulting in energy transmissions that are almost independent of frequency. This ensures that, in an ordinary room, sound pressure within an angle of 90 degrees does not vary by more than six decibels; while the excellent spatial distribution of acoustic energy — even at the highest frequencies — is obtained by Philips choice of coupling factor between high-range and low-range cones.

The small cone acts as a high note radiator for frequencies above 10,000 cycles and also as a diffuser for frequencies below 10,000 cycles from the large cone. The large cone itself acts as a low note radiator below 10,000 cycles, and as a reflector for the high notes above this frequency. The distribution of sound over the entire frequency range is thus much wider than on a normal loudspeaker. These loudspeakers have a very smooth response curve combined with a low resonance frequency.

The Philips dual-cone loudspeaker comes in two sizes: 8" and 12", price 6½ gns. (tax paid) and 10 gns. respectively. There is also a single-cone loudspeaker, available in the same two sizes: price £6.2s.6d. (tax paid) and £10.0s.0d. respectively.

N.B. Any of these speakers may be used on their own or with another suitable loudspeaker using a crossover unit.

For full details write to:

(PR437)

SEE THE

HEWLETT- PACKARD

524 B ELECTRONIC
COUNTER
WITH THE
540 A TRANSFER
OSCILLATOR
MEASURE TO 12KMC
ALSO

THE 130 A—L.F. OSCILLOSCOPES
AND 150 A—H.F.

NOW BEING
DEMONSTRATED
AT THE OFFICES OF

**LITHGOW
ELECTRONICS**
198-200 BATH RD. LTD

Write or phone
for appointment

SLOUGH
TEL.: 21292

1.5 VOLT STABILIZERS



THE A.E. RANGE OF HERMETICALLY SEALED LOW VOLTAGE STABILIZERS

Max. operating currents: 20 mA to 1 A.
A.C. Resistances (pulsating D.C.): 1Ω to .05Ω.
Ambient temp. limits: -5°C to 70°C.
Useful frequency range: up to 10 Mc/s.

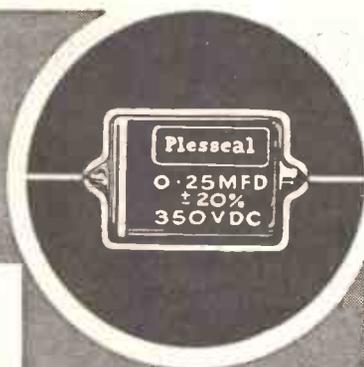
Also available with small "emergency" storage capacity. Suitable for operation in series and parallel. "Filter action" of 400 mA type at 50 c/s equivalent to 60,000μF. "Fixed Bias" operation of valves possible without separate supply; eliminate need for cathode by-pass capacitors.

Brochure from Sole Concessionaires:
MERCIA ENTERPRISES LTD.

30 Silver St., Coventry

Plesseal

climate- proof paper capacitors



There has long been a need for a superior type of paper capacitor—one which is completely reliable and able to withstand every extreme of climatic variation. **Plesseal** meets this need. Its flattened shape enables greater capacitance with higher working voltage to be contained in a given volume, while saving space on group and tag-panels.

A hard lacquer final coating completely shrouds the capacitor and gives physical protection to the special hard wax housing, thus completely excluding moisture.

Plesseal exceeds the requirement of specification RCS11 Grade H2 for tropical storage and is therefore comparable in this respect to many metal cased paper capacitors, with the additional advantage of costing much less.

note these **Plesseal** features

- *Improved shape saves space
- *Capacitances from .0005 μ F to 1 μ F, in popular and logarithmic values.
- *Voltage ranges, 150, 250, 350, 500, 750, 1000 volts D.C.
- *Insulation resistance greater than 4000 M Ω μ F at 20°C.
- *Non-inductive.
- *Breakdown voltage in excess of 6 times working voltage.
- *Complete protection against all conditions of humidity.
- *Working temperature up to 85°C.
- *Electrostatic screening

- shape
new
standards
in
capacitor
performance

Plessey

Design Engineers are invited to ask for further details

THE PLESSEY COMPANY LIMITED · KEMBREY STREET · SWINDON · WILTS · Telephone: SWINDON 546L

"YOU CAN RELY ON US"

Stockists of all Radio and Electronic components for manufacturers, laboratories, Educational authorities, and the amateur.

MULLARD 510 AMPLIFIER AND G.E.C. 912 AMPLIFIER—ALL PARTS STOCKED AND AVAILABLE ON H.P.



INCLUDING ELCOM, BULGIN, TCC, HUNTS, DENCO, ETC.
DETAILED LISTS ON ABOVE AVAILABLE
ALL AVO, TAYLOR, INSTRUMENTS FROM STOCK
NEW CATALOGUE AVAILABLE 2½d. STAMP.

RADIO SERVICING COMPANY

82, SOUTH EALING ROAD, LONDON, W.5.

Telephone : EAL. 5737

Next to South Ealing Tube (TURN LEFT) 9 to 6 p.m., Wed. 1 o'clock.

Quicker Servicing
THE B.P.L. UNIVERSAL TEST SET
(20,000 ohms/volts)

Resistance:
0—10,000 ohms
0—1 megohm



AC/DC
Volts
10
50
100
500
1,000

DC
Current
100 ua
1 ma
10 ma
100 ma

PRICE:
£11 10s. 0d.
with test leads

BRITISH PHYSICAL LABORATORIES

RADLETT, HERTS.

Tel: RADLETT 5674/5/6

London: Stockist: M.R. SUPPLIES LTD., 68, New Oxford St., W.C.1

dmBP40

WALMORE ELECTRONICS LIMITED

PHOENIX HOUSE, 19/23 OXFORD STREET,
LONDON, W.1.

Telephone : GERrard 0522 Cables : Valvexpor
For immediate response Telex London 8752.

EXPORTERS OF RADIO, TELEVISION AND
INDUSTRIAL TUBES, HAVE PLEASURE IN
INTRODUCING THEIR BRAND



AND INVITE ENQUIRIES FROM BUYING
AND CONFIRMING HOUSES EXCLUSIVELY
FOR EXPORT

SUPPLIERS OF RADIO COMPONENTS
ELECTROLYTICS, AND CATHODE RAY
TUBES.



FLEXIBLE REMOTE CONTROL OUTFITS

Our experience in the industrial field has indicated that there is a definite need for this type of outfit offering facilities for making prototype flexible remote controls as required.

The two gauges of Remote Control flexible shafts in these outfits cover the range of torque loadings required for • volume controls • all types of wave change switches • condensers • all controls likely to be met in electronic, radio and television equipment.

The outfits are reasonably priced and comprise :

- No. 130 (.130 in. dia.) for remote controls up to 4 in. length.....£7. 0.0
- No. 150 (.150 in. dia.) for remote controls up to 6 in. length.....£7.10.0

(For use without flexible casing)



BRITANNIA WORKS, 25-31 ST. PANCRAS WAY,
LONDON, N.W.1.

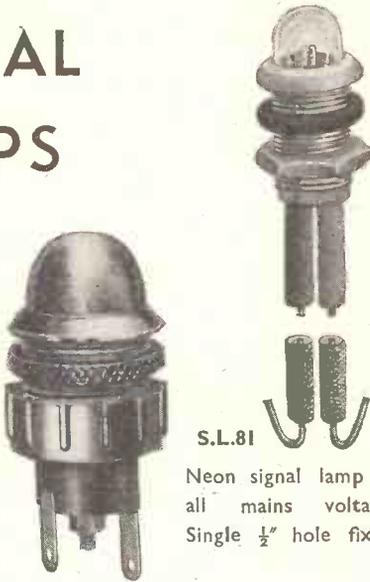
Telephone : EUSton 5393



The S. S. White Company will be pleased to advise which Outfit is most suitable for specific applications.

A detailed Parts List is available upon request. Apply Dept. W.

ARCOLECTRIC SIGNAL LAMPS



S.L.90/SB

Low voltage
signal lamp
for M.E.S. bulbs

S.L.81

Neon signal lamp for
all mains voltages.
Single $\frac{1}{2}$ " hole fixing.



S.L.100

Mains voltage
signal lamp
for 15 watt B.C.
pigmy lamps.

Write for Catalogue No. 129

**ARCOLECTRIC
SWITCHES · LTD**

CENTRAL AVENUE, WEST MOLESEY, SURREY

THE
**BRITISH NATIONAL
RADIO SCHOOL**
ESTD. 1940

NOW IN OUR SIXTEENTH YEAR
AND STILL

**NO B.N.R.S. STUDENT
HAS EVER FAILED**

to pass his examination(s) after completing
our appropriate study course

**GIVE YOURSELF THE BEST
NEW YEAR PRESENT EVER—
A B.N.R.S. Study Course**

A.M.Brit.I.R.E. and CITY and GUILDS Radio and
Telecommunications Exams., etc., etc.

PRINCIPAL,
BRITISH NATIONAL RADIO SCHOOL
2, CANYNGE ROAD, CLIFTON, BRISTOL, 8
Tel. BRISTOL 34755

ASK ARTHURS FIRST

Valves and C.R.T.s in great variety

AVO METERS IN STOCK

Avo Model 7	£19 10 0
Avo Model 8	£23 10 0
COSSOR Oscilloscope Model 1035	£120 0 0
COSSOR Oscilloscope Model 1052	£104 0 0
ADVANCE AND TAYLOR Meters always in STOCK	
LEAK TL/10 Amplifier and "Point One" Pre-Amplifier. Complete.....	£28 7 0
LEAK F.M. Unit with built-in Power Supply	£33 15 0
JASON F.M. Unit with Power Pack.....	£19 7 0
CHAPMAN F.M.81 Unit	£21 0 0

VALVE MANUALS

Mullard	10 6
Osram	5 0
Osram Part 2	10 0
Brimar No. 6	5 0
Mullard Replace- ment Guide	2 6
Art and Science in Sound Reproduc- tion by F. H. Brit- tain, D.F.H.	2 6
Postage 6d. extra.	

**LOUDSPEAKERS, RADIO,
TELEVISION, RECORDERS
AND RECORD PLAYERS OF
LEADING MAKES**

Goods offered subject to being
unsold and to price alteration

● WE WELCOME YOUR
ENQUIRIES on Radio and
Electrical

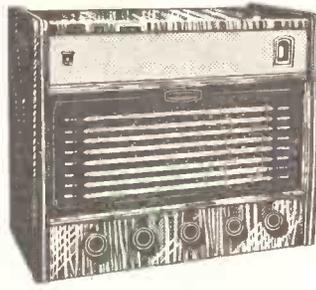
Arthur's EST.
1919

PROPS: ARTHUR GRAY, LTD.

GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.G.2
TEMPle Bar 5833/4 and 4765 Cables: TELEGRAY, LONDON

** We style the sets
that set the style
most wanted overseas*

Superbly presented "Continental" cabinet stylings in rich, dark walnut with ebony and gilt reliefs and large glass dials. High performance, long range and new design speaker capable of very wide frequency response producing a realism of sound reproduction hitherto unknown.

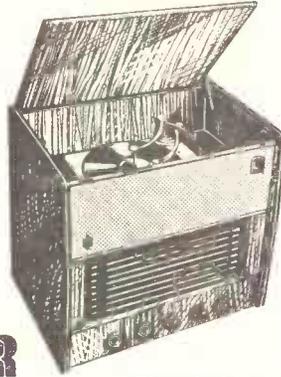


MODEL No. 7856

With High Fidelity sound. Seven valves, eight wavebands.— Six electrically band-spread Twin speakers A.C. mains.

MODEL No. 5656

With High Fidelity sound. Six wavebands, five valve superheterodyne with electrical band-spread on 4 short wavebands.



MODEL No. 9856

Radiogramophone with 3-D sound! Push-pull output. Nine valves— electrical bandspreading on six ranges. Three speakers A.C. mains. Garrard 4-speed record changer.

AMBASSADOR

AMBASSADOR RADIO & TELEVISION LTD.,

PRINCESS WORKS,

The choice of quality minded people
BRIGHOUSE, YORKSHIRE, ENGLAND.

The **EDDYSTONE '820'**

HAS SUCH EXCELLENT EFFICIENCY AND STABILITY IT CAN BE USED SUCCESSFULLY IN MANY BADLY SCREENED OR EXTREME FRINGE RECEPTION AREAS.

V.H.F.

F.M. Radio Unit

SPECIALLY DESIGNED TO PRECEDE HIGH FIDELITY EQUIPMENT

Built by Britain's leading manufacturers of V.H.F. communications equipment and of superb construction and workmanship. The fully tuned pre-amplifier, separate limiter and Foster Seeley discriminator combine to ensure the highest performance.

Self-powered, easy to mount and install, the '820' adequately meets the needs of the enthusiastic and discriminating music lover.

List Price £39/18/0 (including purchase tax)

Please write for fully descriptive brochure



STRATTON & CO LTD - BIRMINGHAM 31

Recapture the atmosphere
of the
Festival Hall
in your own home
with **Classic HI·FI**

The expectant murmur of the crowd, mingled with the discordant wail of tuning violins. The hush as the conductor raises his baton. And then—the beauty of a Mozart symphony or a Beethoven concerto floods your room with its magnificence. No matter where you live a Hi-Fi sound system can bring the Festival Hall right into your home. A Hi-Fi gramophone or radio is an instrument refined and improved almost beyond belief. And Hi-Fi is not particularly expensive. We send sound systems and components of various kinds to all parts of the world, so write today for our fully illustrated brochure "WHAT IS HI-FI?" to



CLASSIC

ELECTRICAL COMPANY LTD.
"THE HIGH FIDELITY SPECIALISTS"

352/364 Lower Addiscombe Road, Croydon, Surrey. Telephone: ADDiscombe 6061/2. Telegrams: Classifi, Croydon, Surrey.
Bus services: 59a, 54, 12 and Green line—725. Nearest stations: Woodside, Addiscombe, East Croydon.

90 FT. AERIAL!
MASTS!

WITH 30FT. DERRICK

COMPLETE WITH ALL STAYS AND
HAULING TACKLE INCLUDING :

9-10 ft. x 2½ in. dia. Seamless Tubular
Steel Mast Sections.

3 ditto Derrick Sections.

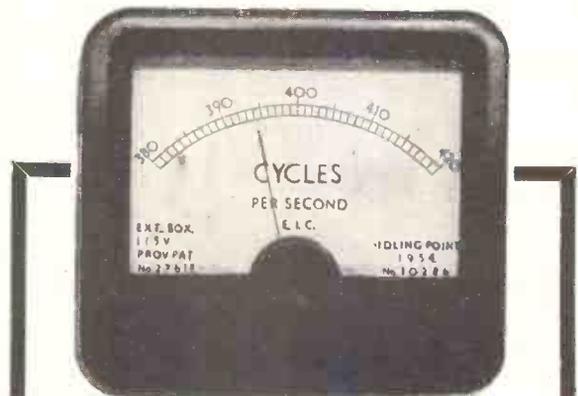
16 Coppered Steel Stays.
Rope Hauling Tackle, Anchor
Pegs, etc., etc.

COMPLETE IN MAKER'S CASES.
TOTAL WEIGHT APPROX. 8½ CWT.

Carriage paid within 30
miles of London.
Provinces Carriage extra.

£22'10'0
COMPLETE

A. PRESTON & SONS
186, SUSSEX WAY, LONDON, N.19.



FREQUENCY METERS

2½-8" up to 10,000 cycles

DIFFERENTIAL A.C. CURRENT METERS

COMPARING THE MAGNITUDE
OF TWO CURRENTS.

PHASE SEQUENCE INDICATORS AND
SYNCHROSCOPES UP TO 5 Kc

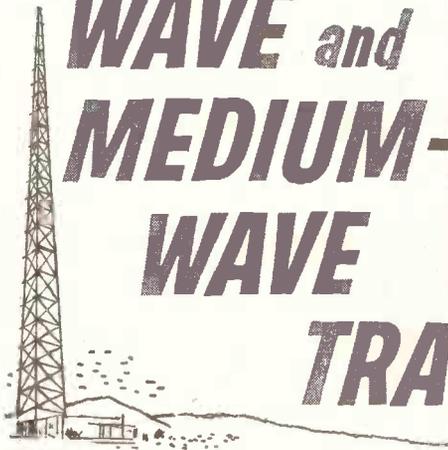
A Full Range of Switchboard and Portable
Instruments

THE ELECTRICAL INSTRUMENT CO. (HILLINGTON), LTD.

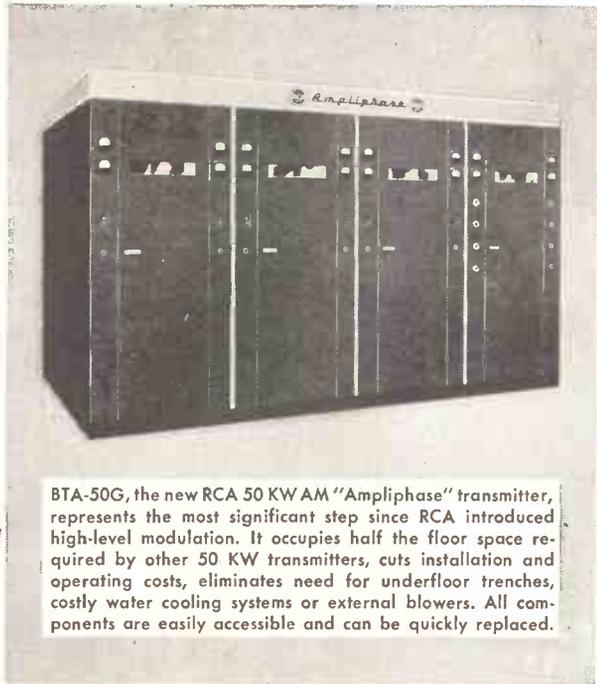
Boswell Square Industrial Estate, Hillington,
Glasgow, S.W.2. Halfway 1166 and 2194

**World-Famous for Proven
Reliability and Performance**

**RCA
SHORT-
WAVE and
MEDIUM-
WAVE**



TRANSMITTERS



BTA-50G, the new RCA 50 KW AM "Ampliphase" transmitter, represents the most significant step since RCA introduced high-level modulation. It occupies half the floor space required by other 50 KW transmitters, cuts installation and operating costs, eliminates need for underfloor trenches, costly water cooling systems or external blowers. All components are easily accessible and can be quickly replaced.

Since its formation in 1919, Radio Corporation of America has been in the forefront of major advances in radio communications of every type. In virtually every corner of the globe RCA short-wave and medium-wave broadcast transmitters are providing day-in, day-out dependability under all extremes of climatic and operational conditions.

As the producer of the finest in transmitters, its experience in the radio industry is unparalleled.

At its research and engineering laboratories, RCA engineers conceive and develop the most advanced and improved circuits and mechanical components.

New RCA electron tubes and semi-conductors are being developed and produced to meet the changing needs of the entire industry, as well as specific RCA equipment.

For over a quarter of a century, RCA scientists have provided a constant flow of technical knowledge to the expanding radio and electronic industry ...and products, facilities, and services to the world.

The RCA monogram is universally recognized as

a symbol of the radio age, that has brought new pleasures in entertainment, new techniques of communication, and new opportunities to millions of people throughout the world. It is a mark of quality and superior craftsmanship.

RCA broadcast transmitters have proven their economy and dependability in many years of long service for many types of broadcasters, such as the National Broadcasting Company network, the Finnish Broadcasting Company, Radio Pakistan, Radio Istanbul, and hundreds of private broadcasters.

RCA short-wave communications transmitters are preferred by many governmental and private communications organizations. Transmitters up to 1.2 megawatts of output have been built by RCA, and are used around the world to provide every type of radio communications.

For the best investment in short and medium-wave transmitters see your RCA Distributor or write to Dept., RCA International Division, Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y., U. S. A.



**RCA INTERNATIONAL DIVISION
RADIO CORPORATION OF AMERICA
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y., U. S. A.**

TRADEMARK © REGISTERED



* Makers of High Voltage Test Sets and other Electronic Equipment for H.M. Government.

Sole Manufacturers

INTRODUCING a new range of HETERODYNE FREQUENCY METERS

... for Laboratory, Field & Factory

Designed and built to rigid Services Specification, these instruments are Crystal-controlled, portable heterodyne-type Frequency Meters used for Field testing and measurement of pulsed, modulated, or C.W.R.F. transmitters, receivers and signal-generators.

TYPE 7475.

Frequency Range: 85 to 1000 megacycles.

TYPE 7474.

Frequency Range: 20 to 250 megacycles.

Frequency Calibration accuracy: .002% at 25°C.
(or .01% between -20° to +70°C).



Complete Specifications on application to:—

TELEMECHANICS LTD

(Instrument Division Dept. W.W.1)

3 Newman Yard, Newman Street, London, W.1, England.
Telephone: LANGHAM 7965. Cables: 'Teleset' London.

E.H.T. POWER UNITS

AS SUPPLIED TO LEADING UNDERTAKINGS

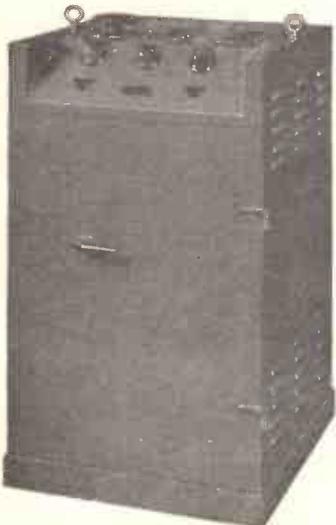


ILLUSTRATION SHOWS A UNIT WITH AN OUTPUT OF 750mA. D.C., CONTINUOUSLY VARIABLE FROM ZERO TO 9.5 kV

RUGGEDLY CONSTRUCTED AND MOUNTED ON CASTORS.

MILAR UNITS AVAILABLE FOR HIGHER VOLTAGES, WITH AUXILIARY SUPPLIES IF REQUIRED

WEST LANCASHIRE ELECTRONIC PRODUCTS LTD.

OAKHILL WORKS : LYDIATE

Nr. LIVERPOOL

Phone: MAGHULL 1755/6

A new book for technicians engineers and students

By T. E. Ivall

An
introduction
to the
mechanism
and
applications
of
computers

A non-mathematical introduction to the mechanism and application of computers employing valves and transistors. Both digital and analogue computers are covered, the bulk of the book being devoted to describing their circuitry, while their rapidly developing applications in industry, commerce and science are also outlined. In a final chapter the future evolution of computers is discussed. 165 pp. Illustrated.

ELECTRONIC COMPUTERS

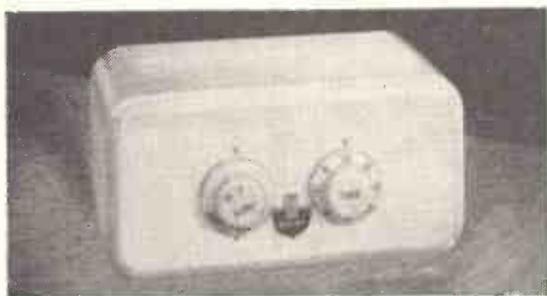
Published by
Liffé & Sons Ltd.
Dorset House,
Stamford Street,
London. S.E.1

PRINCIPLES AND APPLICATIONS

25s. net By Post 25s. 9d.

from your bookseller

The WOLSEY BAND III Convertor



The Wolsey Convertor is a self-contained unit complete with power pack, comprising transformer with tapped primary for mains voltage selection, together with metal rectifier and R.C. smoothing.

Though employing the popular valve line-up of cascode coupled P.C.C. 84 and P.C.F. 80 as mixer and output amplifier, the circuit otherwise departs completely from the conventional.

Aerial input circuit has an input of 80 ohms over the Band III range this being achieved by critical resistance damping of the input transformer, from which the signal is fed to a neutralised cascode coupled R.F. amplifier. The cascode potential of this valve being adjustable so as to afford gain control.

Coupling between the cascode and the mixer grid of the oscillator section of the P.C.F. 80 is made by a choke capacity arrangement which is constant over the whole of the Band III range.

The oscillator section employs turret tuning of the eight channels and careful selection of component valves ensures minimum of drift.

I.F. output from the pentode section of the P.C.F. 80, which is of course the local B.B.C. frequency, is fed via a stepped-down transformer to the low impedance output socket.

Gain from input to output in excess of 20 dB may be easily obtained and no Convertor is passed on test unless it has at least this gain.

WOLSEY TELEVISION LIMITED · CRAY AVENUE · ST. MARY CRAY · ORPINGTON · KENT

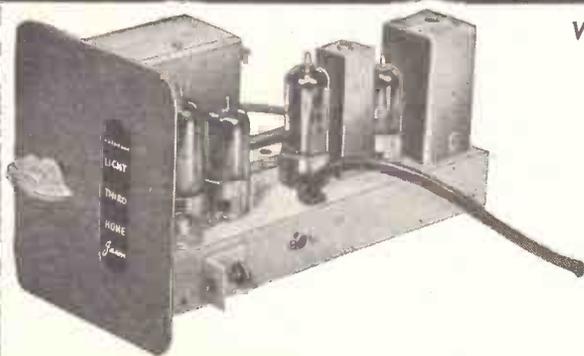
Telephone: ORPINGTON 26661/2/3/4

(Electronics Division, Gas Purification & Chemical Co. Ltd.)

W33

CITY SALE & EXCHANGE LTD

*The High Fidelity
Specialists*



THE NEW JASON F.M. TUNER 3-STATION SWITCH-TUNED

An excellently designed unit of great appeal with its single three-position switch for selecting the desired B.B.C. programme. Complete stability and ease of installation are but two of the many outstanding features of this latest Jason Tuner. For building into cabinet. Hammered-gold finished front panel. Supplied tested and ready tuned. External power source required. Suitable for use with all quality amplifiers.

£19-16-2

WE OFFER THE FOLLOWING FROM STOCK :-

Leak TL/10, 10 watt amplifier and Point One pre-amp.	£28	7	0
R.D. Junior Amp. and Control Unit, 8-10 watts push pull	£26	0	0
Lowther LL/16, 16 watt amplifier with master control unit mark II will reproduce direct from the tape head	£64	0	0
The New B.J. Reproducer, for use with two speakers and Lorenz tweeter, cabinet only	£25	4	0
Wharfedale FSB/3, free standing 3-speaker reproducer	£37	10	0
Lowther TP/1, corner reproducer	£96	0	0
B.D. Junior FM Unit, with auto frequency control	£24	17	0
Dynatron Ether Pathfinder, AM/FM tuner	£60	16	4
Chapman FM/81, Mark II, with magic eye	£22	1	0
Lenco, transcription gram unit, 4 speed with Goldring 500 cartridge	£21	17	10
Collaro 2010, transcription motor, complete with P/U	£19	10	0

SPECIAL OFFERS :-

Leak VS Tuner, immaculate condition	£15	0	0
R.D. Senior Amp.	£9	0	0
Lowther OT/4L Tuner Unit	£10	0	0
Acoustical Quad, pre-set 4-station tuner	£7	10	0
R.D. Control Unit, with 5 selector positions	£3	0	0
Decca Corner Speaker, perfect condition	£19	0	0
Dynatron T/57A, 10 valve radio chassis and amp. In perfect order	£37	10	0
Elizabethan Tape Recorder, 2-speed twin track	£37	10	0
Soundmirror Tape Recorder with mike	£27	10	0
R.D. Senior Radio Tuner Unit, 3 waves, variable selectivity, magic eye, complete in cabinet	£12	0	0
R.D. Junior Amplifier, also in cabinet with pre-amp.	£15	0	0

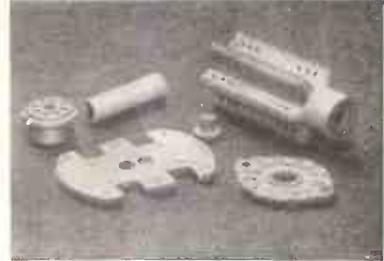
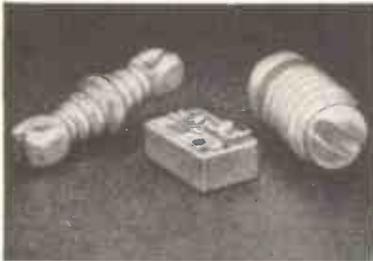
**PART EXCHANGE & EASY
PAYMENTS ARRANGED**

93-94 FLEET STREET, LONDON, E.C.4

Phone: *FL*Eet St. 9391/2

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 · STOKES-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

RECHARGEABLE CELLS



-hermetically sealed too!

DISC, CYLINDRICAL & RECTANGULAR CELLS

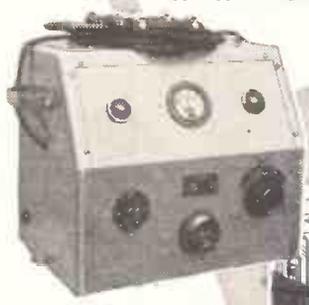
from 50 mAh to 7.5 Ah cap.

DEAC
PERMA-SEAL
fully patented



DETAILS FROM SOLE CONCESSIONAIRES:
G. A. STANLEY PALMER LTD
Maxwell House · Arundel Street · Strand · London · WC2
Telephone: Temple Bar 3721/2/3

THE IDEAL *Portable*
HIGH VOLTAGE TEST SET



FOR EVERY TEST LABORATORY

CUBICLE
Strongly constructed portable steel case with lifting handles, adequate, ventilated, finished in attractive grey "hammer" finish enamel.

DIMENSIONS
Height 17in. by length 20in. by width 12in.

WEIGHT 34 lb.

CONTROL
Continuous and smoothly variable from zero to 2,500 volts by means of continuously variable regulating transformer.

The test voltage is applied smoothly without high stress from voltage surge.



PROTECTION
A miniature magnet circuit breaker in the primary circuit and double pole on-off switch with double pole mains fuses provide perfect protection.

VOLTMETER
A high-grade instrument connected in the primary circuit but sealed to read output voltage.

**2.5 KV at 500 VA
INSULATION TEST SET**
Price £40.8.6
Complete with test prods.

DAVENSET

FARTKIDGE WILSON & CO. LTD., Davensel Elect. Wks., Leicester

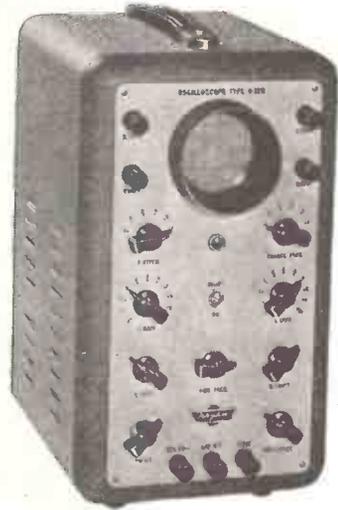
Versatile Portable Oscilloscope?

What he needs is this
FURZEHILL O.120A



- Frequencies up to 250kc/s ▶
- 10 millivolts to 1,000 volts/cm ▶
- X and Y amplifiers ▶
- Symmetrical deflection both axes ▶

£71.10.0 ex works
- immediate delivery



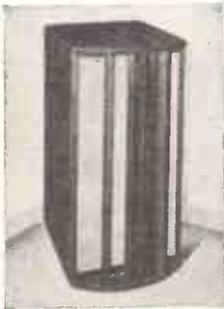
Furzehill Laboratories Ltd.

FURZEHILL LABORATORIES LTD., 57 CLARENDON ROAD, WATFORD, HERTS. TELEPHONE: GADEBROOK 4686

SOUND SALES

PHASE INVERTER SPEAKER

£18.10.0
Complete



JUNIOR AMPLIFIER MK. II

- Output 12 Watts.
- Separate Bass and Treble Controls.

Complete with Pre-Amplifier £25.0.0



FULLY ILLUSTRATED
CATALOGUE 6d Post free

GILSON TRANSFORMERS

Osram 912
W0710, 912 output..... £2 12 6
W0741, 912 mains, 150 mA. £3 0 0
W0724, 912 choke 10 H.,
150 mA. £1 15 0

Mullard 5/10
W0696A 8K output..... £2 7 6
W0696B 8K output..... £2 7 6
W0710 8K. dist. load £2 12 6
W0710 6K. dist. load £2 12 6
W0892 8K output disc.
load £3 2 6

Mullard 3 watt
W0767 output..... £1 5 6
W0839 mains..... £1 15 0

Mullard 20 watt
W0866 Output £5 12 6
W0755 Mains £4 0 0

Mullard 200 mW. Trans. Amp
W0929 Driver..... £1 0 0
W0930 Output 3 or 15
ohms £1 0 0
(Specify 4.5 or 6v. circuit)

ALL COMPONENTS FOR
OSRAM 912 PLUS
MULLARD 5/10
ALSO LAB & WELWYN
HI-STABS & TCC
PRECISION CONDENSERS

SIDE-BY-SIDE COMPARISON

IN OUR DEMONSTRATION ROOM
OF ● ACOS ● ACOUSTICAL
● ARMSTRONG ● CHAPMAN
● COLLARO ● CONNOISSEUR
● GARRARD ● GOODMAN'S
● LEAK ● LENCO ● ROGERS
● R.C.A. ● TANNAY ● W.B.
● WHARFEDALE.

TRANSISTORS

Full range of Transistors including all
Components for Mullard 200 mW.
Amplifier and TCC Midget Capacitors.

"Q-MAX" CHASSIS CUTTERS

STILL the easiest and quickest way of cutting
holes in SHEET METAL.

each
1" (a) 12/9
" or 1 1/8" (a) 13/9
1 1/8" (b) 16/-
" or 1 3/8" (b) 18/-
1 3/8" (b) 20/6
2" (c) 33/6
2 1/8" (c) 38/6
" square
(b) 25/6
Keys (a)-1/-;
(b)-1/6; (c)-
2/3.



Patent No. 619178

BERRY'S

(SHORT WAVE) LTD.

25, HIGH HOLBORN, LONDON, W.C.1
Tel.: HOLborn 6231/2

ARMSTRONG PB 409 AM/FM RADIOGRAM CHASSIS

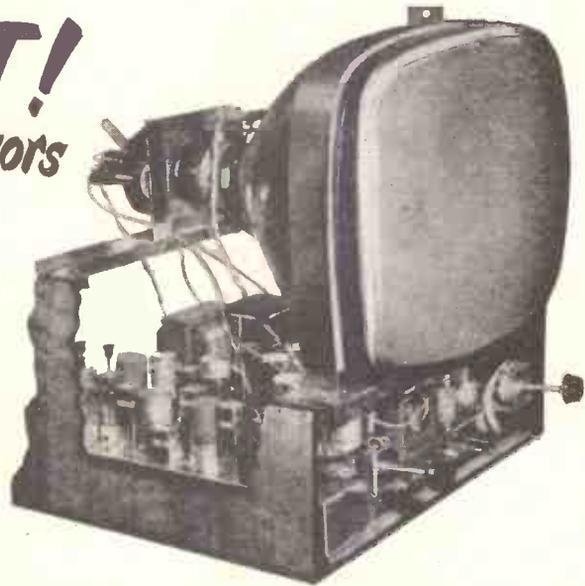
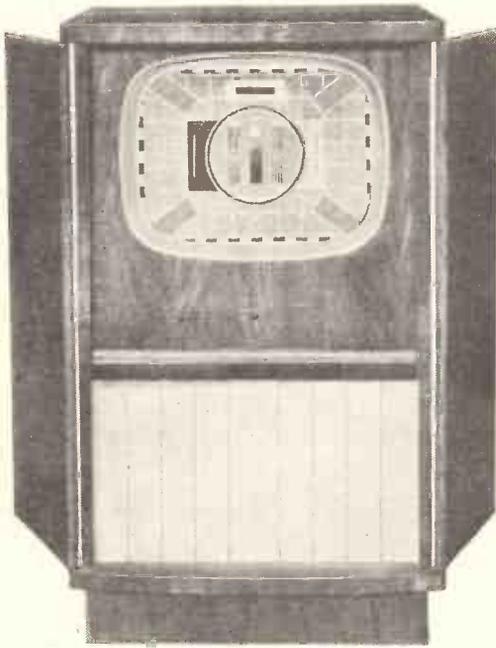
- 9 valves
- L., M., S., and F.M.

28gns.

You'll do better

SAFETY FIRST!

Build these **PREMIER** Televisors



... which give complete safety to the constructor

These Televisors use a double wound mains transformer which gives you complete safety from contact with the mains supply when handling the chassis or controls.

★ **B.B.C. & I.T.A. DESIGN No.1 with NEW TURRET TUNER**
MAY BE BUILT FOR £33-7-11 PLUS COST OF C. R. T.

★ **B.B.C. (ALL CHANNELS) DESIGN No.2**
MAY BE BUILT FOR £27-9-4 PLUS COST OF C. R. T.

CONSOLE CABINETS with full length doors for 14in., 16in. and 17in. tubes PRICE £14/14/-. H.P. Terms: Deposit £7/7/6 and 9 monthly payments of 18/6. CONSOLE CABINETS. Half door, previously advertised, still available at £12/12/-. H.P. Terms: Deposit £6/6/- and 8 monthly payments of 18/3.
On above cabinets add 2/- for pkg. and carr.

BUILD IN 5 EASY STAGES. FULL CONSTRUCTION DETAILS AVAILABLE. INSTRUCTION BOOK 3/6 POST FREE INCLUDES BOTH DESIGNS.

The NEW "PREMIER" TAPE RECORDER

- ★ Case finished in Brown and Antique Fawn. Size 15in. x 12½in. x 7½in., with the very latest type continental gill fittings. For A.C. mains 200-250 volts 50 cycles.
- ★ Two speeds 7½ and 3½ in. per sec., playing time of 1 hour and 2 hours.
- ★ Standard 7in. reels 1,200ft.
- ★ Drop-in tape loading.
- ★ Positive brakes, no tape "spilling" after braking.
- ★ Fast rewind forward or reverse without removing tape.
- ★ One knob for deck operation.
- ★ Amplifier may be used for gramophone or microphone purposes giving high-quality reproduction.
- ★ Superb reproduction of pre-recorded tapes.
- ★ Microphone compartment.
- ★ Complete with reel of Scotch Boy Tape (1,200ft.), and spare reel.
- ★ Acos type 33-2 microphone with on/off switch.
- ★ Latest type Lane Mark 6 Tape Deck.
- ★ Dual input channels providing mixing facilities.
- ★ Detachable lid and control cover.
- ★ Control panel finished in matching colours with the tape deck.
- ★ Elliptical speaker of the latest type 7in. x 4in.
- ★ Magic eye recording level indicator.

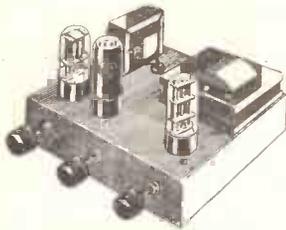
£5 DEPOSIT & 8 MONTHLY
PAYMENTS OF £4.18.6 or
CASH PRICE £40 plus 21/- pkg. & carr.



H.P. Terms: Deposit £20 & 12 monthly payments of £1.17.1

PREMIER RADIO COMPANY,

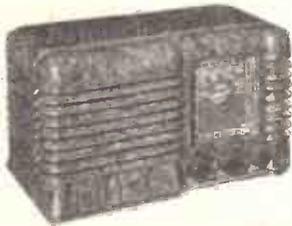
with PREMIER



4 WATT AMPLIFIER

MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pkg. & Postage
Instruction Book 1/- post free.

A steel case is now available, complete with engraved panel, for 15/6 extra. The amplifier may be supplied complete for £5/5/- plus pkg. and post 3/6, or fitted in case at £6 plus pkg. and post 3/6. Engraved panel 3/6. Post Free.



2-BAND TRF RECEIVER MAY BE BUILT FOR £5.15.0

plus pkg. & post 3/-

3 BAND SUPERHET RECEIVER

MAY BE BUILT FOR **£7.19.6** Plus 3/- Pkg. & Postage

These two receivers use the latest type circuitry and are fitted into attractive cabinets 12in. x 6½in. x 5½in. in either walnut or ivory bakelite or wood. Individual instruction books 1/- each, post free.

T.S.L. LORENZ SOUND SYSTEM

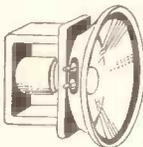
Type LP 312-2

Consists of a 12in. Unit and two LPH65 Treble Units. Co-axially placed to give the widest listening angle. Bass and treble Units have magnetic systems of the highest efficiency. This speaker system gives a frequency response that is not excelled by any speaker that is at present available. Leaflet available giving full details. Price £14/19/6. H.P. Terms available. Postage and packing 7/6 extra.



Cross-over Unit designed for the LP 312-2 £2/2/- plus p. & p. 1/6.

SINGLE TREBLE UNITS available separately at 39/6 each plus packing and postage 1/- extra. Improve your existing Speaker system with this Unit which will give added brilliance to the higher frequency.



A range of High Fidelity Amplifiers, Speakers and Record Players the following makes in stock:—Leak, E.A.R., Rogers, Goodmans, Wharfedale, W.B. Stentorian, Lorenz, B.S.B., Collaro, Garrard, Lenco, Connoisseur. We shall be only too pleased to demonstrate any of the above equipment.

THE NEW "WHARFEDALE" SFB/3

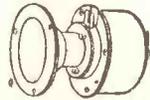


3-SPEAKER SYSTEM

Consists of 3 Speakers W12CS, Bronze 10CSB, Super 3HF and a special Crossover Unit fitted into a very attractive Cabinet, size 34in. x 31in. x 12in. Weight 60 lb. Cash £37/10/- Credit

deposit £4/14/- and 8 monthly payments of £4/12/3, or H.P. deposit £18/15/- and 12 monthly payments of £1/14/9. Packing and carriage 21/-.

New GOODMAN TREBLE UNIT THE TREBAX



At £5/9/3 is a high efficiency pressure driven reproducer covering 2,500 c.p.s. to 16 kc/s. It makes an excellent 2-speaker system when used with the Axiom

150 Mark II at £10/15/9. A special Crossover Unit type X05000 is available at £1/19/-. The complete system £18/4/- cash. Credit terms deposit £2/5/6 and 8 monthly payments of £2/4/10, or H.P. Terms deposit £9/2/- and 9 monthly payments of £1/2/6. Packing and carriage 7/6.



THE NEW TSL FM TUNER HIGH STABILITY MODEL

6 Valves including Magic Eye and Power Supply using the latest type Gorrler permeability Unit complete with first audio stage and preset output volume control. Maximum radiation less than 10 microvolts per metre. Sensitivity better than .5 microvolts. Cash price £17/10/- (inclusive) or on H.P. terms, deposit £8/15/- and 9 monthly payments of £1/1/8. Credit terms deposit £2/3/9 and 8 monthly payments of £2/3/4. Postage and packing 5/- extra.

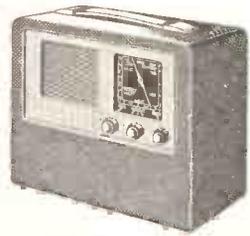


Why not make the best!

MULLARD AMPLIFIER KIT

NOW SUPPLIED WITH ULTRALINEAR OUTPUT TRANSFORMER.

All the components for model 510, PLUS pre-amplifier on one chassis (total six valves) chassis gold hammer finished. May be purchased for £12/12/- plus pkg. & post 7/6, or pre-amplifier and tone control in a separate unit £14/14/- plus pkg. and post 7/6.



ALL DRY BATTERY PORTABLE RADIO RECEIVER

MAY BE BUILT FOR **£7.8.0** Plus 3/- Pkg. & Postage

4 Miniature valves in a superhet circuit covering medium and long waves, Rexine-covered cabinets 11½in. x 10in. x 5½in., in two contrasting colours, wire with grey panel. Instruction book 1/6 post free, which includes full construction details and list of priced components.

WILLIAMSON AMPLIFIER

MAY BE BUILT FOR **£15.15.0** Plus 7/6 Pkg. & Postage

Supplied completely wired and tested for £20, or available on H.P. or Credit terms, postage and packing 10/-.

PRE-AMPLIFIER & TONE CONTROL UNIT

Available completely constructed, £5/5/- plus 2/6 packing and postage.

SPECIAL OFFER—Limited Quantity.

The Imperial AM/FM Radiogram Chassis

CASH

£16.19.6

or H.P. Terms—£8/9/9 deposit and 8 monthly payments of £1/3/9. Credit Terms £2/2/6 deposit and carriage charge in each case 7/6. This latest type Chassis is made by a leading Continental Manufacturer, it has 5 valves plus a Metal Rectifier, piano type push buttons for long, medium, F.M. and Gram, separate tuning on F.M. and A.M. Output 4 watts. Dial size 12in. x 2½in., overall size 13in. long, 7½in. deep and 7½in. high.



SPECIAL OFFER! GOODMAN'S AUDIOM 50. £4/17/6 plus pkg. & post 5/-.

AM/FM RADIOGRAM CHASSIS

The latest "Dulci" Model H.4

7 Valves (including Magic Eye). Ferrit Rod Aerials on medium and long "Gorrler" permeability Unit on F.M. A.C. mains 200/250 volts. Cash price £27/18 or on H.P. or Credit Terms Plus packing and carriage 7/6 extra.



AM/FM TUNER CHASSIS

DULCI MODEL H4T (Self Powered)

4 Wavebands. V.H.F. Short, Med., Long. "GORLER" F.M. Unit. Preset output Volume Control. Cash Price £20/17/- or on Hire purchase or credit terms. Plus packing and postage 5/- extra.

PREMIER RADIO COMPANY

PORTABLE TAPE RECORDER CABINETS

All Rexine Covered			
Tape Deck	Amplifier	Type	Price
Lane Mk. VI	Premier	Mi. VI	£4 19 6
Lane Mk. VI	Premier	de Luxe	£4 19 6
Truvox Mk. III	Truvox C	T.D.S	£4 4 0

Plus Postage and Packing 5/-.

ILLUSTRATED LIST AVAILABLE GIVING FULL DETAILS OF BUREAU TYPE CABINETS

BARGAIN OFFER
LATEST TYPE RUBBER ESCUTCHEON SUITABLE FOR 17in. RECTANGULAR TUBES AT A SPECIAL PRICE OF 10/- PLUS PACKING AND POST 1/6.

THE NEW COLLARO TAPE TRANSCRIBER
SPEEDS 3 1/2, 7 1/2 & 15 inches per Second £20 plus pkg. post 7/6

We carry a comprehensive stock of components by all leading manufacturers.

CABINETS—PORTABLE

MODEL PC/2
Grey Lizard Rexine covered. 45/-
Overall dimensions 15in. x 15in. x 6in. Clearance under lid when closed 8in.

MODEL PC/2 DE LUXE
Two colours, wine and grey, with cutout for speaker and amplifier. 55/6
Dimensions as above.

MODEL PC/3
Grey Lizard Rexine covered. 69/6
Overall dimensions 16 1/2in. x 14 1/2in. x 10 1/2in. Clearance under lid when closed 6 1/2in.

MODEL PC/3 DE LUXE
As above but with cutouts for Speaker and Amplifier 79/6
Dimensions as above.

THE ABOVE CABINETS ARE COMPLETE WITH CARRYING HANDLE, FASTENERS AND PANEL.
Packing and Postage 3/- each.

A RANGE OF BAND 3 AND F.M. AERIALS IS NOW AVAILABLE

Air spaced co-axial wire, 1/9 per yard.

Teletron Ferrite Rod Aerials. Medium Wave 8/9. Medium Long Wave 12/9.

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/-.

PREMIER MAINS TRANSFORMERS

All primaries are tapped for 200-230-250 v. mains 40-10 cycles. All primaries are screened.

SP175B, 175-0-175, 50 mA., 4 v. @ 1 a., 4 v. @ 2-3 a.	15/-
SP350A, 350-0-350, 100 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a.	21/-
SP351A, 350-0-350, 150 mA., 4 v. @ 2-3 a., 4 v. @ 3-6 a., 4 v. @ 1-2 a., 4 v. @ 1-2 a.	30/-
SP352, 350-0-350 150 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a., 6.3 v. @ 2-3 a.	30/-
SP425A, 425-0-425, 200 mA. 6.3 v. @ 2-3 a., 6.3 v. @ 3-5 a., 5 v. @ 2-5 a.	59/6
250-0-250, 80 mA., 6.3 v. @ 4 a., 5 v. @ 2 a.	22/6
350-0-350, 80 mA., 6.3 v. @ 4 a., 5 v. @ 2 a.	22/6
200-230-250 output 3 v.-30 v. @ 2 a.	17/6

PUSH-PULL OUTPUT TRANSFORMERS. 2x6V6 into 2/3 ohms, 5/6 post free.

JUNCTION TRANSISTORS 10/- EACH
Equivalent of the OC70 Type

★ IT WILL PAY YOU TO VISIT OUR NEW HI-FI DEMONSTRATION ROOM.

MAKE YOUR OWN ROD AERIAL

Ferrite rod 6in. x 5/16in., complete with descriptive constructional details. These aerial rods are suitable for medium and long wave reception. Price 5/3, post free.

THE JASON "ARGONAUT" MW/FM DESIGN

All Premier Components are designer approved



The very latest FM Receiver design PLUS a medium waveband, as described in "The Radio Constructor." ALL components to build the complete Receiver, including output stage, may be purchased for £15/5/-, or all components less output stage but including Power Supply, for £13/19/6, plus packing and postage 3/6 on each. The chassis, front plate, dial flywheel drive assembly special tuning condenser and wavechange switch (which includes main switch) supplied completely assembled. This is also available separately at £4/4/- plus packing and postage 2/6.

SEND 2 1/2d. STAMP FOR OUR NEW STOCK LIST

COMPACT GRAM AMPLIFIER

Complete, ready to connect to any Type of Pick up and Speaker (3 ohms A.C. Mains 200/250 volts. Volume and tone control fitted with knobs. Overall size 7 1/2in. long x 3 1/2in. wide x 2 1/2in. high.
£2. 19. 6
Plus packing and postage 2/6

WHY BUY SURPLUS OR RE-CONDITIONED TUBES WHEN THESE FULLY GUARANTEED WIDE ANGLE TUBES ARE AVAILABLE? THE LATEST TYPE 17" RECTANGULAR TUBE MW43/64 BY TELEFUNKEN AT £17 (INC. TAX) POST AND PACKING 21/- EXTRA.

A LARGE RANGE OF TEST METERS IN STOCK

PREMIER PERSONAL PAYMENTS PLAN	CASH PRICE	CREDIT TERMS			H.P. TERMS		
		DEPOSIT	MONTHLY PAYMENTS		DEPOSIT	MONTHLY PAYMENTS	
Premier Bureau Cabinet.	12 12 0	1 12 0	(8) 1 12 6	6 6 0	(8) 18 3		
Premier Bureau de Luxe Cabinet	17 6 6	2 3 4	(8) 2 10 8	8 13 0	(12) 16 1		
Rogers Amplifier and Pre-amp.	26 0 0	3 4 6	(8) 3 4 0	13 1 3	(12) 1 4 0		
Mullard EAR/5/10	18 18 0	7 7 3	(8) 2 6 6	9 9 3	(8) 1 6 3		
Mullard EAR/5/10P	24 3 0	1 0 6	(8) 2 19 5	12 2 0	(12) 1 2 4		
Leak TL10	28 7 0	3 11 0	(8) 3 9 9	14 3 0	(12) 1 6 4		
Garrard Transcription Type 301 less P/U	26 8 3	3 6 0	(8) 3 5 0	13 4 0	(12) 1 4 6		
Garrard Transcription Type TA/AC Unit	11 6 7	1 8 7	(8) 1 8 6	5 12 7	(6) 1 2 4		
Garrard Transcription Type TA/AC/DC Unit	19 10 5	2 9 2	(8) 2 8 0	9 15 0	(10) 1 1 9		
Garrard Changer Type RC80M AC/DC	26 3 5	3 5 5	(8) 2 10 1	13 1 9	(12) 1 4 3		
Garrard Changer Type RC98H AC	19 17 7	2 9 1	(8) 2 9 0	9 19 4	(9) 1 4 6		
Lenox-Transcription Unit Model F50-2 complete with P/U	21 16 2	2 14 6	(8) 2 13 3	10 18 8	(12) 1 0 2		
Goodmans Axiom 102 Speaker	10 7 9	1 5 0	(8) 1 6 6	5 3 9	(6) 1 0 8		
Goodmans Axiom 150 MK. 1	10 15 9	1 7 1	(8) 1 7 4	5 7 9	(6) 1 1 4		
Goodmans Axiom 22 Mk. 2	15 9 0	1 10 0	(8) 1 1 8	7 14 4	(8) 1 1 10		

T.S.L. ELECTROSTATIC SPEAKERS

Type LSH75	Price 12/6
Type LSH100	Price 21/-
Type LSH1518	Price 17/6

LATEST B.S.R. MONARCH 4-SPEED AUTOCHANGER

Designed to play 12in., 10in. and 7in. Records intermixed in any order at 16, 33 1/3, 45 or 78 r.p.m. Capacity 10 Records. New reversible Dual Stylus Crystal Pick-up for use on 100/250 v. 50 cycle A.C. mains, £9/15/- plus packing and postage 5/-. Deposit 25/- and 3 monthly payments of 25/-.



B.S.R. TUB 3 speed Record Player £24/12/6 plus 2/6 post and packing.



LATEST TYPE 3-SPEED SINGLE PLAYER

By famous manufacturer with crystal turnover head, for use on 100-250 v. 50 cycle A.C. mains. £6/19/6. Plus pkg. and carr. 5/-.



LOUDSPEAKERS

ELAC ELLIPTICAL 7in. x 4in.	21/10
ELAC—8in. dia. Moving Coil 3 ohms imp.	21/-
PLESSEY 8in. dia. Mains Energised, 3 ohms imp. (600 ohms field) with Pentode Transformer	12/6
PLESSEY—8in. dia. Mains Energised, 3 ohms imp. (600 ohms field)	10/6
PLESSEY—10in. dia. Moving Coil, 3 ohms imp.	23/6
GOODMANS—Axiom 60	29/2/9
GOODMANS—Axiom 150	£10/15/9

Plus 5/- packing and carriage.

TUNING CONDENSERS (SMALL TYPE)

2-gang .0005 mfd. with trimmers, 5/-.

METER RECTIFIERS

Miniature type with leads 1-5 mA. 5/- post paid.

WEYMOUTH MINIATURE COIL PACK
Covering Med./Long/Short Wave Bands. Iron Cored Coils. Dimens: Ht. 1 1/2", length 3 1/2", width 2 1/2". Price 29/6

TERMS OF BUSINESS:

Cash with order or O.O.D. over £1. Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, unless otherwise stated.

ALL GOODS OFFERED ARE NEW AND UNUSED

PREMIER BUREAU DE LUXE

A superb cabinet in finely figured walnut veneer. Interior light sycamore, with red-line matching lining. Overall dimensions 33in. high, 34in. long, 17in. deep. Uncut control panel on

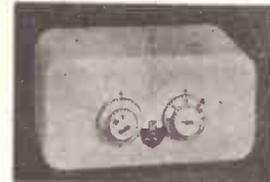


right hand side approximately 16in. x 10in., uncut baseboard on left hand side 15in. long, 13in. deep. Two full size felt-lined storage cupboards in the lower part of the cabinet.

Cash price 16½ gns. H.P. Terms, deposit £8/13/6 and 12 monthly payments of 16/1. Credit Terms, deposit £2/9/10 and 8 monthly payments of £2/2/10. Packing and Carriage 2s/- extra.

THE WOLSEY BAND III CONVERTER

This Converter has been designed to receive alternative programmes on Band 3 Channels 6 to 13, selection of Channel being made by rotation of Switch Knob. Mains supply 200/250 v. A.C. only. The high



gain of this Converter (minimum 20dB) together with low noise factor ensures good picture quality. A variable gain control makes it possible to balance a Band 1 and Band 3 signal inputs to the receiver. Any single channel Receiver of either T.H.F. or Superhet design may be fed from the Converter. Separate input sockets are provided for Band 1 and Band 3 inputs. Cash price £9/10/6. Credit Terms deposit £1/5/6 and 8 monthly payments of £1/5/6. IMPORTANT, please state your Band 1 station. Packing and Postage 3/- extra.

IS THERE A BABY IN THE HOUSE?

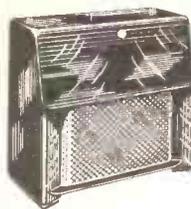


The famous Premier Baby Alarm which is a device to enable Baby's cries, or even breathing, to be heard in any selected room in the house. May be left permanently connected. Extra Microphones in different rooms may be used. The microphone may be positioned up to 100ft. from the main unit. Suitable flexible lead can be supplied at 5d. per yard extra.



Completely wired 90/- and tested at 90/- Plus 2/6 post and pkg.

JUNCTION TRANSISTORS 10/- EACH.



BUREAU CABINET

A well designed medium size cabinet in highly figured walnut veneer. overall dimensions 29in. long, 32in. high, 16in. deep. Control panel on right hand side, approximately 13in. x 13in. Removable baseboard on left hand side approximately 13in. x 13in. Large record

compartment inside cabinet at the top on left hand side. Cash price 12 gns. H.P. Terms deposit £6/6/- and 8 monthly payments of 18/3. Credit Terms deposit £1/12/- and 8 monthly payments of £1/12/6.

Packing and Carriage 20/- extra.

A NEW SPEAKER ENCLOSURE



A really elegant cabinet in well figured walnut veneer. Suitable for housing Goodmans Audiom and Axiom speakers. The baffle is cut to accommodate a TREBAX High Frequency Unit if required. A suitable cut-out is provided in the cabinet back to receive the Goodmans Acoustical Resistance Unit. Cabinet dimensions, overall 27in. high, 23in. wide, 20in. deep. Cash price £13/19/6. H.P. Terms, deposit £6/19/9 and 9 monthly payments of 17/9. Credit Terms, deposit £1/15/6 and 8 monthly payments of £1/15/6.

Packing and Carriage 20/- extra.

GOODMANS ACOUSTICAL UNIT. Type 172ARU £2/15/3 postage and packing 1/6 extra

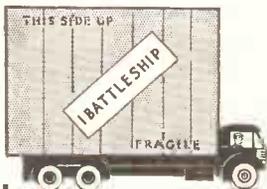
PREMIER RADIO COMPANY

20 EDGWARE RD., LONDON, W.2

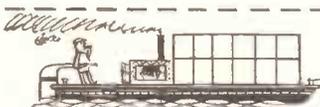
TELEPHONE : AMBASSADOR 4033 & PADDINGTON 3271

If you despatch...

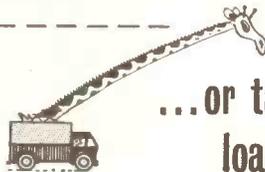
Large loads...



...or small loads



Barge loads...



...or tall loads...

ABC GOODS TRANSPORT GUIDE

will tell you how they can be delivered!

Essential to transport managers, despatch managers and consignors in all industries, the ABC GOODS TRANSPORT GUIDE provides up-to-the-minute, accurate information about the nearest and quickest means of despatching all kinds of goods to any part of the country.

Act now to be sure of getting your copies of the January-December GOODS GUIDE. Simply fill in the order form and post it TODAY.

JAN.—JUNE issue ready NOW.

Half-yearly issues; Jan.—June 1957 and July—Dec. 1957

5s. each POST FREE

ORDER FORM

Hiffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

Please enter my order for copies of the Jan.—June 1957 and the July—Dec. 1957 issues of the ABC GOODS TRANSPORT GUIDE (at 10s. per set) for which I enclose remittance of

NAME _____

ADDRESS _____

WW

How to solve after-sale worries!

Let us say straight away, we do not claim to be able to solve all your after-sale problems. But if they include gramophone record players, then we do know the answer—as many leading set makers will affirm; for their problem disappeared the day they discovered the Monarch Auto-changer.

At the B.S.R. works, teams of highly-trained inspectors eliminate after-sale problems before sale. At every manufacturing stage each single component must pass their exacting tests; then, after assembly, pass even more stringent tests.

Thus, many manufacturers report that not only is the Monarch free of after-sale worries, but it has also minimised their own inspection problems.

Why not let our technical representative show you how much easier your day could be? He is at your service



Monarch **UA8**

*Worlds finest
four Speed Autochanger*



Wireless World

ELECTRONICS, RADIO, TELEVISION

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

Editor: H. F. SMITH

Assistant Editor: F. L. DEVEREUX, B.Sc.

JANUARY 1957

In This Issue

- 1 Editorial Comment
- 2 Single Beam Colour Tube
- 4 World of Wireless
- 8 Limiters and Discriminators for F.M. Receivers. *G. G. Johnstone*
- 15 Portable Transistor Superhet. *W. Woods-Hill*
- 18 Resistance-Current-Voltage-Power Nomogram. *B. E. Jackson*
- 20 Is Radio Propagation Always Two-way? *T. W. Bennington*
- 22 Books Received
- 23 The Gated-Beam Valve. *Lawrence W. Johnson*
- 27 Modernizing T.R.F. Television Receivers. *P. F. Cundy*
- 28 Short-wave Conditions
- 29 Letters to the Editor
- 31 High-Quality Sound Broadcasting. *G. H. Russell*
- 33 Cascode Characteristics. *W. Grant*
- 36 Fish-Finding Asdic
- 37 Simple V.H.F. Test Oscillator. *Bernard Driver*
- 40 Technical Notebook
- 42 Negative Resistance. "Cathode Ray"
- 47 January Meetings
- 48 Random Radiations. "Diallist"
- 50 Unbiased. "Free Grid"

VOLUME 63 No. 1

PRICE: TWO SHILLINGS

FORTY-SIXTH YEAR
OF PUBLICATION



Editorial, Advertising and Publishing Offices:

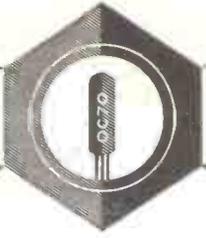
Dorset House, Stamford Street,
London, S.E.1

Telephone:
WATERloo 3333 (60 lines)

Telegraphic Address:
"Ethaworld, Sedist, London".

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Iliffepres, Sedist, London." Annual Subscription: Home and Overseas, £1 12s. 6d. U.S.A. and Canada \$5.00. BRANCH OFFICES: BIRMINGHAM: King Edward House, New Street, 2. Telephone: Midland 7191. COVENTRY: 8-10, Corporation Street. Telephone: Coventry 5210. GLASGOW: 26B, Renfield Street, C.2. Telephone: Central 1265. MANCHESTER: 280, Deansgate, 3. Telephone: Blackfriars 4412. OVERSEAS OFFICES: U.S.A.: 111, Broadway, New York, 6, N.Y. Telephone: Digby 9-1197. CANADA: 74, College Street, Toronto 2 Ontario. Telephone: Walnut 4-5631

200mW Transistor



amplifier operated from a 6V supply

In a previous advertisement (June 1956) details were given of an audio amplifier using transistors, which derived its power from a nominal 4.5 volt battery. In portable equipment such as record reproducers, it is convenient to operate the amplifier from the same supply as the turntable motor, and since most portable motors operate from a 6 volt battery, the 200mW amplifier circuit has been adapted for use with this higher voltage.

The 4.5 volt and 6 volt versions are very similar in performance, except for the greater sensitivity of the latter. Both are capable of an output of just over 200mW with 10% total harmonic distortion. In the 6V amplifier, the gain at 8kc/s and 50c/s falls 3dB below level response at 1kc/s.

The sensitivity of the 6V version is slightly higher than that of the original in spite of a higher series input resistance of 330kΩ. This can be attributed to the higher supply voltage. Since the output stage requires a lower driving current, and a higher voltage is available for the driver, a higher turns ratio can be used for the interstage transformer T1 and thus the stage to stage gain can be increased. The basic sensitivity across the low impedance terminals YY is 3mV, compared with 6mV in the original, and across the high impedance terminals XX it is 400mV compared with 500mV.

The circuit and component values are given in the accompanying diagram. Alternative high or low impedance inputs for crystal pickups or a radio tuner are available at XX and YY respectively. The input and driver stages (each using an OC71) are R-C coupled, and the driver stage is transformer-coupled to the output stage which is a Class B push-pull arrangement of two OC72's (sold in matched pairs as Mullard type 2-OC72).

Interstage Transformer

The turns ratio of the interstage transformer, T1, which is rated at 2mW, is 3.5 : 1+1. The inductance of the primary should be 10H with a current of 15mA d.c. flowing, and its d.c. resistance should be less than 200Ω. The resistance of each half of the secondary should be kept below 50Ω and the leakage inductance should be as low as possible. The d.c. currents in the secondary windings are balanced.

Output Transformer

The output stage is matched to the load by a push-pull transformer, T2, rated at 250mW. For a 3Ω load the turns ratio is 4.9+4.9 : 1, for a 5Ω load, 3.8+3.8 : 1, and for a 15Ω load, 2.2+2.2 : 1. Each half primary should be capable of handling peak currents of 83mA.

The currents in each half of the primary will only be balanced if the transistors in the output stage are perfectly matched. At large-signal currents it is possible for the OC72's to be mismatched by as much as 35%, consequently the output

transformer should be constructed to allow for unbalanced currents.

The d.c. resistance of each half of the primary winding of T2 should be less than 3Ω and the total inductance should be greater than 0.5H.

The dynamic load for each collector of the push-pull stage should be 72Ω. The d.c. resistance of the secondary winding should be less than 5% of the load resistance and the leakage inductance should be low.

The turns ratio of the output transformer, and the value of the feedback resistor R13 for various loudspeaker impedances are shown in the top left hand corner of the diagram. The loudspeaker impedance must be quoted when the output transformer is ordered from the manufacturer.

Stabilisation

Potential dividers R3, R4 and R7, R8 and emitter resistors R6 and R9 provide stabilised d.c. bias for the input and driver stages.

The effects of changes in the temperature of the surroundings, production spreads in the transistors, and deterioration of the supply battery on the performance have been minimised by careful choice of the value of R11. The optimum value is 8.2kΩ, giving satisfactory performance under the conditions

likely to be encountered. Slightly lower distortion can be obtained by presetting the value of R11 to give quiescent currents of 0.5mA for each transistor at 20°C. The amplifier can be used safely in ambient temperatures as high as 45°C.

Negative feedback from the secondary of the output transformer is applied to the collector of the first OC71 by R13, whose value must be

chosen to match the loudspeaker load, as shown in the table.

Filter Components

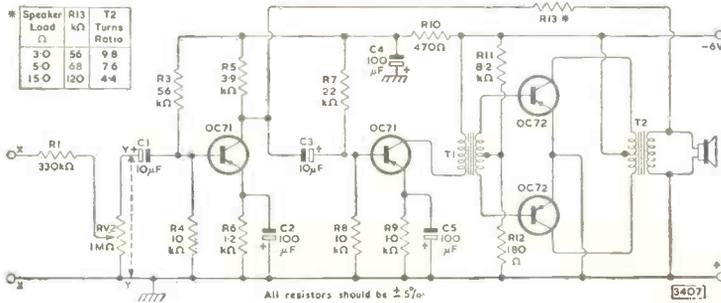
An increase in battery impedance causes undesired feedback through the supply to the earlier stages and it results in considerable distortion in the output. This unwanted feedback is prevented by the filter network C4-R10.

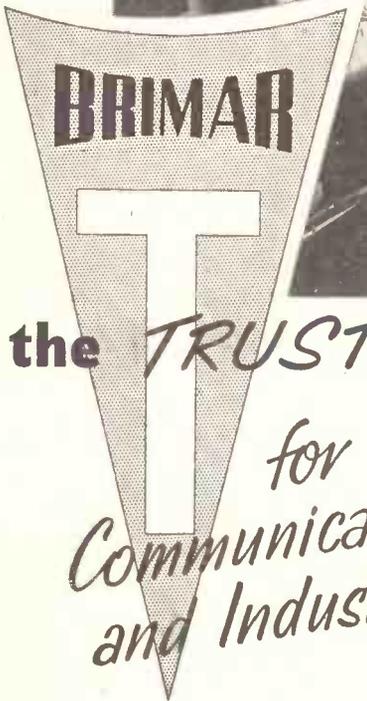
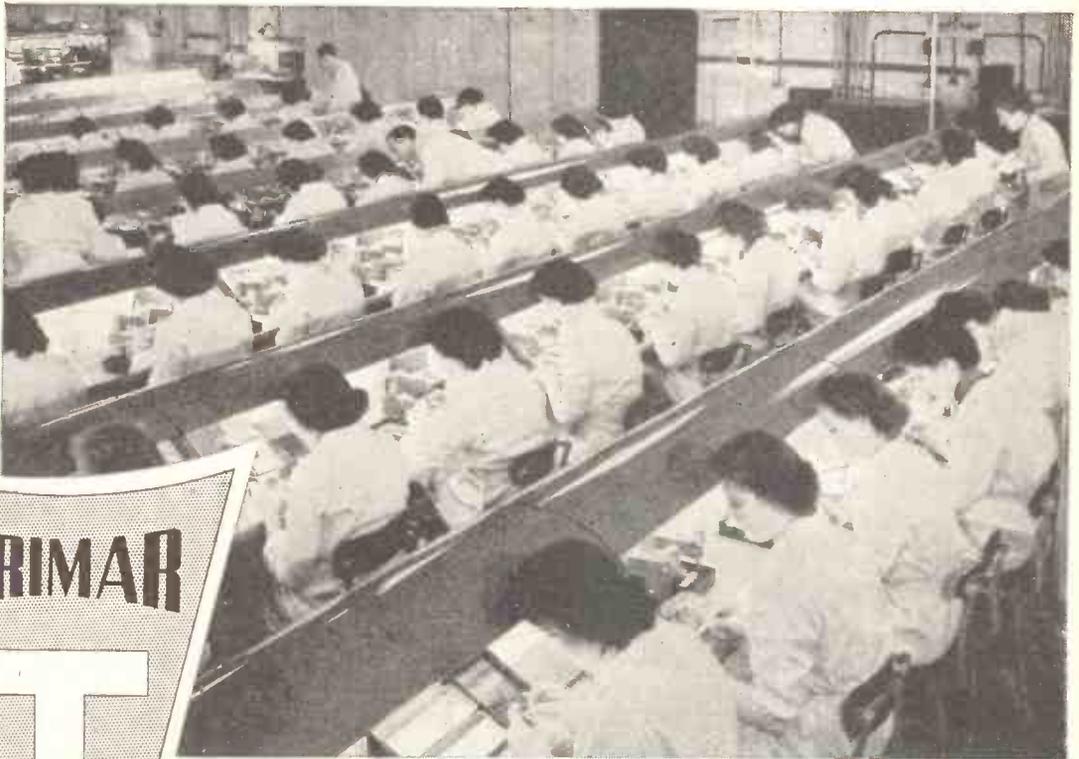
Performance

- Output Power**
215mW at 10% total harmonic distortion
- Frequency Response**
Gain, at 50c/s and 8kc/s, is reduced 3dB below the response level at 1kc/s
- Sensitivity** (with nominal transistors)
3.0mV at the low impedance terminals YY
400mV at the high impedance terminals XX
- Current Drain**
5 to 6mA at zero signal
15mA with average music
76mA at maximum output with sine wave drive

MULLARD COMPONENTS

Mullard pot cores and other Ferro-cube components, air-space trimmers, Varite thermistors etc. are now available in small quantities for experimenters. For information regarding the nearest source of supply please enquire of Mullard Valve Sales Dept. at the address below.





the **TRUSTWORTHY** safeguard

for
*Communications
and Industry*

The special Trustworthy high quality valves have been designed to give maximum efficiency with reliability —most valuable in equipment required to operate for lengthy periods unattended. Primarily established to meet Service requirements, the Trustworthy techniques, including shock and vibration tests, have been extended to include many commercial types. The accompanying table shows the range of industrial "T" valves. These can also be supplied with flying lead, or flying lead valve assemblies for chassis mounting, the information on which can be obtained on application.

Most types are available within a reasonable period. In many instances additional types can be made available for special applications.

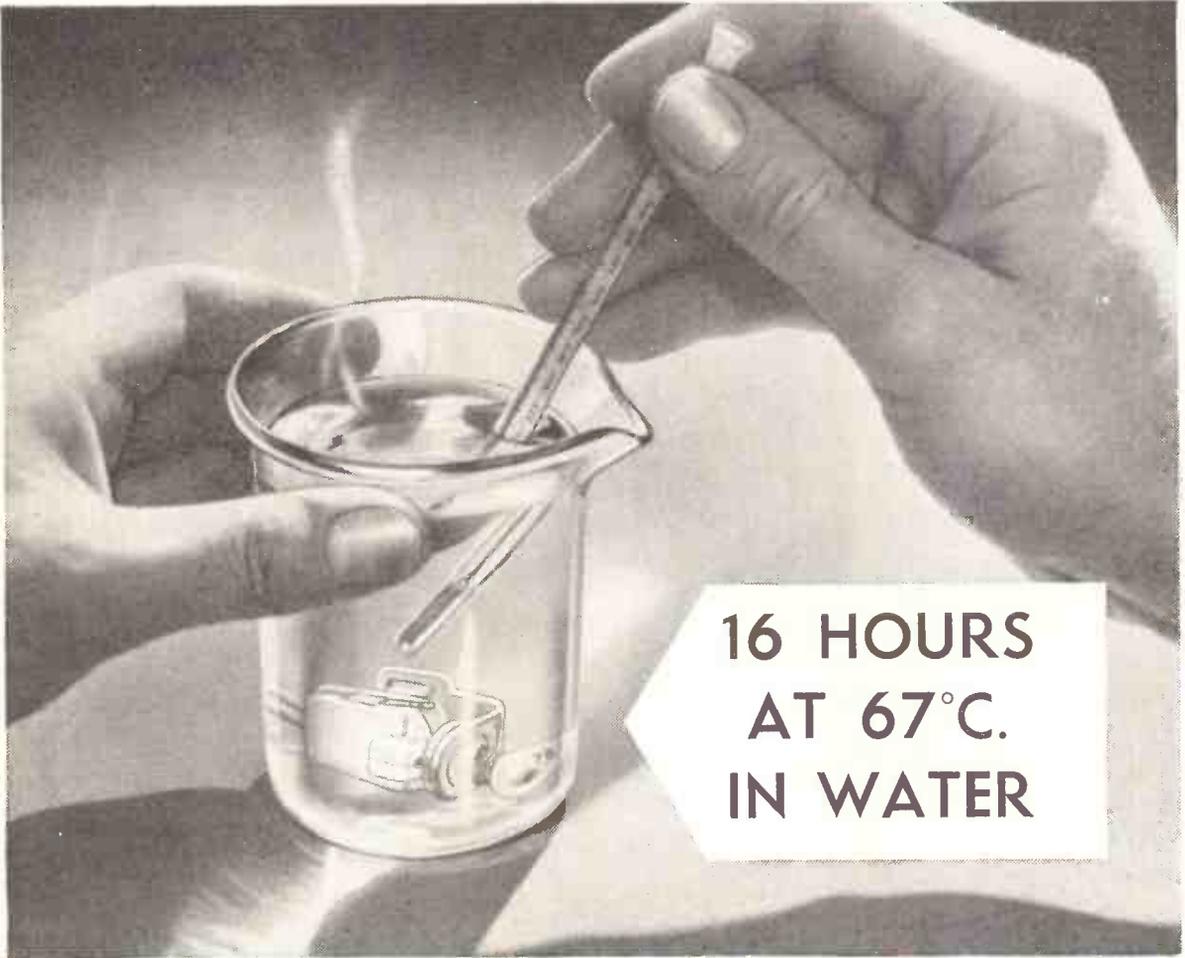
INDUSTRIAL  RANGE			
 Code	Equivalent Commercial Type Code	Function	Base
5726	6AL5	Double Diode Short Bulb	B7G
6058	6AL5	Double Diode	B7G
6516	6AM5	Power Pentode	B7G
6064	6AM6/8D3	High Slope R.F. Pentode	B7G
6066	6AT6	Double Diode Triode	B7G
5749	6BA6	Vari Mu R.F. Pentode	B7G
5750	6BE6	Heptode Mixer	B7G
6059	6BR7	Low Noise A.F. Pentode	B9A
6061	6BW6	Output Beam Tetrode	B9A
6132	6CH6	Video Output Pentode	B9A
6100	6C4	Triode Amplifier	B7G
6180	6SN7GT	Low Mu Double Triode	Octal
6063	6X4	Full Wave Rectifier	B7G
6065	9D6	Vari Mu R.F. Pentode	B7G
6060	12AT7	High Slope Double Triode	B9A
6067	12AU7	Low Mu Double Triode	B9A
6057	12AX7	High Mu Double Triode	B9A
6158	13D3	Special Purpose Double Triode	B9A
6062	5763	V.H.F. Beam Tetrode	B9A
6157	R17	Half Wave Rectifier	B9A
6443	R18	Half Wave Rectifier	B9A
6LGA	6L6GA	Output Beam Tetrode	Octal
25L6GT	25L6GT	Output Beam Tetrode	Octal
6042	25SN7GT	Low Mu Double Triode	Octal
50C5	50C5	Output Beam Tetrode	B7G



Standard Telephones and Cables Limited

Regd. Office: Connaught House, 63, Aldwych, London W.C.2

FOOTSCRAY · SIDCUP · KENT · FOOTSCRAY 3333

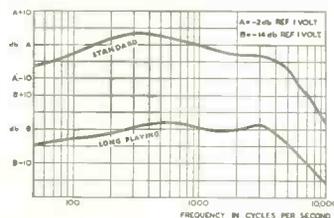


**16 HOURS
AT 67°C.
IN WATER**

In a previous announcement we showed how ACOS GP61 Ceramic Pick-up Cartridges had passed the official BSI Test No. BF.2011, Class 112, "Basic Climatic and Durability Test for components for radio and allied equipment". Now our own laboratories have gone even further with climatic tests—and added a punishing mechanical test too. These new tests, which covered a batch of GP61s, gave average results as follows:—

	SENSITIVITY	RESPONSE SHAPE
16 hours at Minus 10°C (14°F) in water	No change	No change
16 hours at 67°C (152.6°F) in water	No change	No change
Vertical drop from 2in. 10,000 times (at 50 times per minute) ..	No change	No change

Manufacturers who fit the GP61 Ceramic know where they are. It is, demonstrably, a most robust cartridge for all climatic conditions. It has a smooth response, low harmonic and intermodulation distortion, high needle tip compliance, replaceable "X500" styli and very good output.



The ACOS GP61 CERAMIC pick-up cartridge fitted with 'X500' styli is the high performance cartridge for manufacturers with world markets.



always well ahead

ACOS devices are protected by patents, patent applications and registered designs in Great Britain and abroad.

"BELLING LEE" NOTES

Why do "Belling-Lee" T.V. aerials stand up straighter longer than most? Because after they leave the laboratory with the desired electrical characteristics, mechanical engineers set to and build them so that they will withstand the extreme rigour of our climate, and so that the factory is able to make them at a fair price. We do not expect a physicist specialising on aerial designs to be as good at mechanical designs as an engineer who specialises in that work.

Pre-production samples are tested by the laboratory and by a field research team and not until the results compare favourably with the original laboratory model do we go ahead.

But what a lot of "know-how" is employed at every stage; windage, weight (plus ice and snow) and resistance to corrosion. How many users know that dangerous corrosion is retarded by the use of identical metals, and where dissimilar metals have to be used; in the choice of those with a low potential difference?

"Belling-Lee" try to avoid the use of steel parts, and where they must be used they are suitably treated. It is common knowledge that the component parts of an aerial lock together after a few weeks in the open. The white powdery coating that forms is generally aluminium carbonate or aluminium oxide and is in itself generally harmless. It only takes a minute to rub some grease on to mating parts to ensure easy dismantling at any time.

"Belling-Lee" do aim to strike a happy balance between electrical and mechanical performance, and that is why some of our aerials cost a few shillings more, but what is so galling is to know that production is sometimes held back to achieve one or two dBs improvement, and that only an infinite percentage is installed with the knowledge and care to take advantage of this extra efficiency. For example, neighbours in identical houses using identical aerials and receivers can easily get widely different results because one of them is receiving an out-of-phase reflected signal, giving a weak picture. Even moving the aerial a few feet might help. This is another example of "probing the roof" for optimum results.

Advertisement of
BELLING & LEE LTD.
Great Cambridge Rd., Enfield, Middx.
Written 19th Nov. 1956

"BELLING - LEE" T.V. INTERFERENCE FILTERS

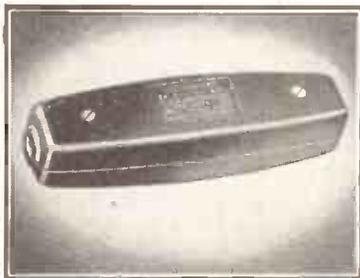
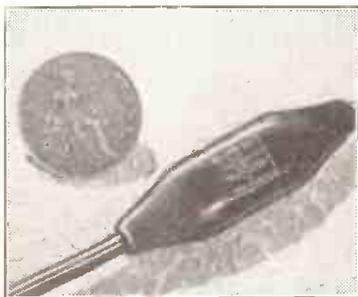
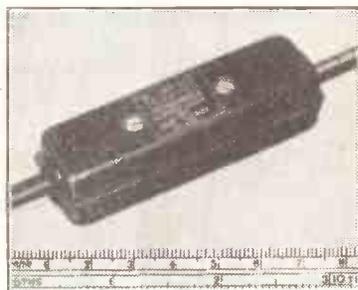
FLEX LEAD FILTERS

L.1314 For 2-core cables 2 amp. 250 v. a.c./d.c.

L.1316 Complete with 6ft. 2-core cable 2 amp.

This small flex lead filter (L.1314) is designed for the suppression of interference at television frequencies only, and for insertion in the flex lead *within 6in.* of the offending component of an appliance. The most convenient form of filter which can be readily serviced, it is complete with terminals and cord grips, etc. Three-core cables may be fitted, by-passing the earth lead.

The type moulded into a 6ft. 6in. length of cable (L.1316) is intended for use by electrical appliance manufacturers as an integral part of the apparatus, although it may be used to replace an existing cable. These flex lead filters may be used in conjunction with the plug L.1308 which has a built-in filter efficient on the medium and long wavebands.



L.1308 5 amp 3-pole Mains suppressor plug 200-250 v. a.c./d.c.

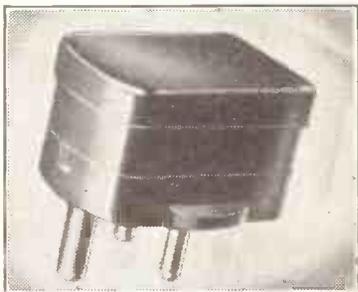
Where an appliance is suspected of or known to be creating electrical interference on the long and medium wavebands, the interference can usually be filtered or reduced by the insertion of this mains plug. This is designed for fitting to the free end of the flex lead, replacing the normal type of 5 amp 3-pole plug generally used.

Appliances likely to cause mains-conducted interference are hair dryers, refrigerators, washing machines, food mixers, fans, small motors, small drills, grinders, lathes, etc., actuated by commutator motors.

L.799 (2- or 3-core) 2 amp. Inductor and capacitor filter 250 v. a.c./d.c.

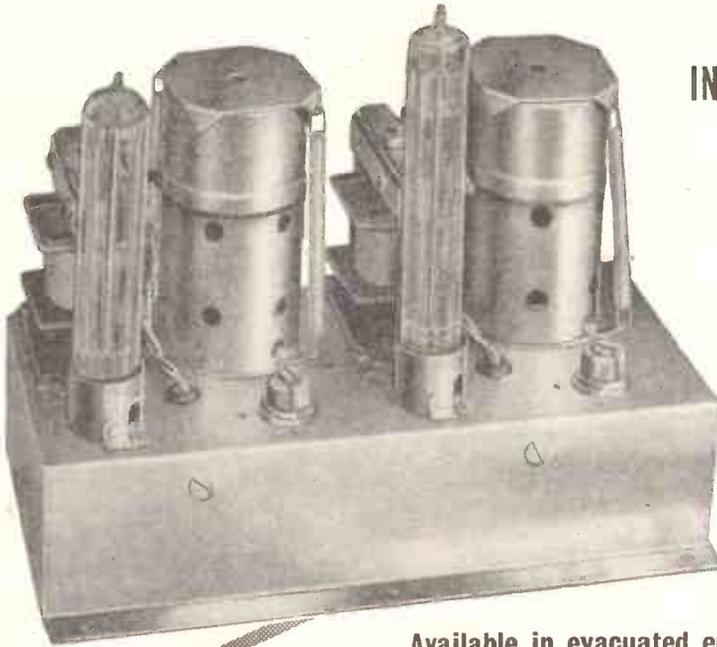
Effective at band I television frequencies and short and medium wavebands.

This is designed for connection in the lead of domestic electrical equipment such as hair dryers, vacuum cleaners, sewing machine motors, electric fans, etc., and to be truly effective must be fitted *within 6in.* of the connections of the motor in the appliance.



BELLING & LEE LTD
GREAT CAMBRIDGE ROAD, ENFIELD, MIDDX., ENGLAND
Telephone: Enfield 3322 • Telegrams: Radiobel, Enfield

MARCONI LOW FREQUENCY CRYSTALS



IN THE RANGE 1.6-50 Kc/s

The illustration shows a 1.6 and 3 Kc/s Carrier Oscillator Unit for transmitting information to a remote bearing indicator as used in the Marconi V.H.F. Direction Finder Type AD200.

Available in evacuated envelopes with B7G base or with flexible leads for connection into the circuit

Among the many uses for this type of crystal are the following:—

**SPEECH INVERSION
OSCILLATORS**

•

**CARRIER CHANNELLING
EQUIPMENT**

•

RANGE CALIBRATORS

•

TIMING APPLICATIONS ETC.

Flexure mode crystals are suitable for a wide variety of applications where an oscillator of good stability and small size is essential. They cover the frequency range 1.6 to 50 Kc/s with a point of zero temperature coefficient in the range 0°-40°C. The bar in XY flexure used between 1.6 and 12.0 Kc/s has the great advantage of a low temperature coefficient in the region of room temperature.



Lifeline of Communication

MARCONI

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
CHELMSFORD, ESSEX. Telephone: CHELMSFORD 3221



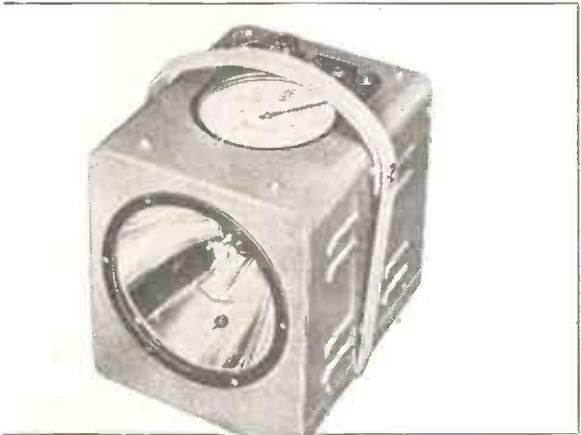
STROBOSCOPES

For all applications

HIGH POWER STROBOSCOPES for the measurement of speed and observation of rotary and reciprocating mechanisms.

GENERAL PURPOSE TYPE 4

Range 250-15,000 flashes per minute. Accuracy 5% of scale reading. Duration of Flash 15 microsecs. (approx.) Lamp Peak Axial Intensity 100,000 candle power at 1,500 F.P.M.



HAND STROBOSCOPE TYPE 5

A new inexpensive strobe for use in workshops, garages, and factories. A simple and robust instrument. It has a range of 300-6000 r.p.m. and operates from 220/240 volt AC mains.

OTHER PRODUCTS

Electronic Tachometers · Photo-electric Transducers
 Dynamic Balancing Machines · H.F. Heating Equipment
 Electromagnetic Vibrators with associated control equipment (up to 3,000 lbs.)

PRECISION TYPE 3c

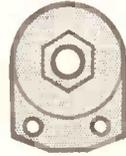
Direct Reading 200-6000 r.p.m. Accuracy 1% full scale. Light intensity 100,000 candle power at 25 flashes per sec. The lamp may be detached from the body for remote working as shown. Also type 3c/P, same specification as model 3c, but fitted with Photo-electric Transducer for easy synchronisation.



E.M.I. ELECTRONICS LTD.

INDUSTRIAL PRODUCTS DIVISION (Dept. 127)

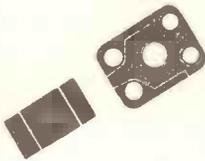
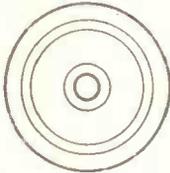
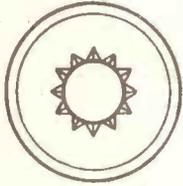
HAYES · MIDDLESEX · ENGLAND · Tel: Southall 2488 Ext. 475



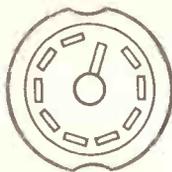
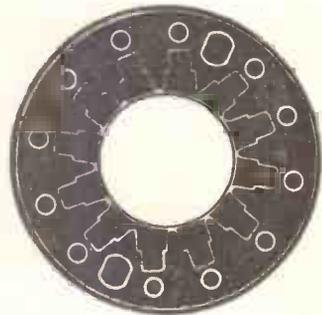
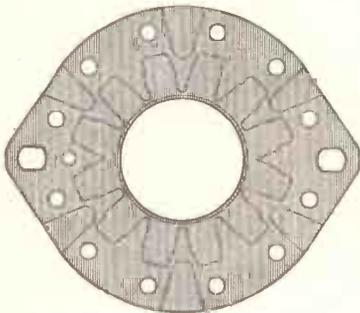
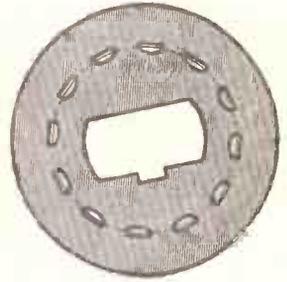
An outstanding range of

Plessey

Ceramics



For high frequency, radio and T.V. components, whenever good insulation under extreme climatic conditions is a major consideration, you would do well to incorporate Plessey Ceramic insulators. The range includes bases for valves, switches and trimmer condensers together with stand-off insulators, bushes and washers. In addition consideration and advice is given on customers' specific requirements.



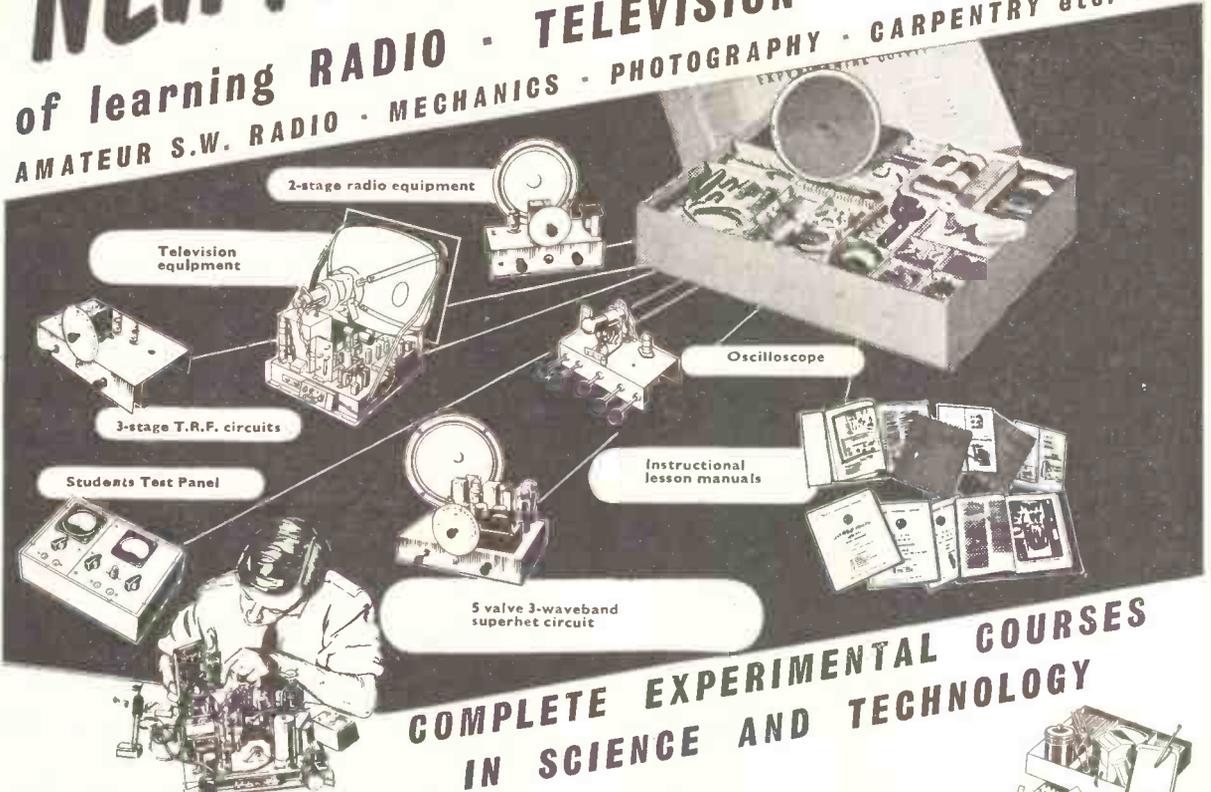
Design engineers are invited to request further information regarding these and other products in the Plessey Ceramic range.

CHEMICAL AND METALLURGICAL DIVISION

THE PLESSEY COMPANY LIMITED • WOOD BURCOTE WAY • TOWCESTER • NORTHANTS

NEW! — THE PRACTICAL WAY

of learning **RADIO · TELEVISION · ELECTRONICS**
AMATEUR S.W. RADIO · MECHANICS · PHOTOGRAPHY · CARPENTRY etc. etc.



COMPLETE EXPERIMENTAL COURSES IN SCIENCE AND TECHNOLOGY

NEW —completely up-to-date methods of giving instruction in a wide range of technical subjects specially designed and arranged for self-study at home under the skilled guidance of our teaching staff.

NEW experimental outfits and lesson manuals are despatched on enrolment and remain the student's property. A tutor is allotted to each student for personal and individual tuition throughout the course.

In the case of radio and television, specially prepared components are supplied which teach the basic electronic circuits (amplifiers, oscillators, detectors, etc.) and lead, by easy stages, to the complete design and servicing of modern commercial radio and television receivers.

If you are studying for an examination, wanting a new hobby or interest, commencing a career in industry or running your own full-time or part-time business, these practical courses are ideal and may be yours for moderate cost. Send off the coupon to-day for a free Brochure giving full details. There is no obligation whatsoever.

*The only Home Study College
run by a World-wide
industrial organisation*

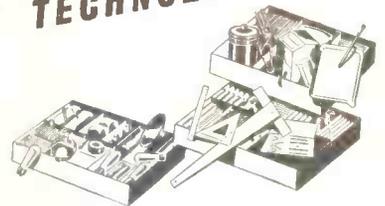
E.M.I.
Factories at
Hayes.



EMI INSTITUTES

SUBJECTS INCLUDE:-

- RADIO · SHORT WAVE RADIO
- TELEVISION · MECHANICS · CHEMISTRY
- PHOTOGRAPHY · ELECTRICITY · WOODWORK
- ELECTRICAL WIRING · DRAUGHTSMANSHIP
- ART, etc.



**COURSES FROM 15/-
PER MONTH**



E.M.I. INSTITUTES, Dept. 127, London, W.4

NAME Age
(if under 21)

ADDRESS

BLOCK
CAPS
PLEASE

I am interested in the following subject(s) with/without equipment

We shall not worry you with personal visits

IC85

-Part of "His Master's Voice", Marconiphone, etc. etc.

absolute frequency control

*adjustment
by
evaporation*

Adjustment of frequency by evaporation of a minute quantity of gold on to the existing electrodes enables accuracies of a few parts in a million to be achieved.

Standard
High Grade
QUARTZ CRYSTALS



A long history of research and development; craftsmen skilled in the art of crystal production; exact manufacturing and testing techniques; an intimate knowledge of field applications... these are some of the factors which ensure that the finest quartz crystals are *Standard*.

Cut from only the highest grade raw quartz, *Standard* quartz crystals are produced in a modern factory where methods involving the greatest precision, such as the example illustrated, are production routines.



Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, W.C.2

QUARTZ CRYSTAL FACTORY: HARLOW · ESSEX

Wanted!

QUALIFIED MEN AND WOMEN

Industry & Commerce offer their best posts to those with the necessary qualifications—such posts that will bring personal satisfaction, happiness, good money and security. As part of a modern industrial organisation, we have skilled knowledge of what is required in industry to-day and the best means of training personnel for its present day and future requirements. We specialise also in teaching for hobbies, new interests or part-time occupations in any of the subjects listed below. Make your own choice and write to us to-day for further information. There is no obligation of any kind.

OUR BACKGROUND



Part of The E.M.I. Factories at Hayes, England, occupying over 150 acres.

PERSONAL & INDIVIDUAL TRAINING IN—

- | | | | |
|---------------------------------------|----------------------------|------------------------------|----------------------------------|
| Accountancy | Customs Officer | Languages | Refrigeration |
| Advertising | Draughtsmanship | Management | Sales Management |
| Aeronautical Eng. | Economics | Maintenance Eng. | Sanitary |
| A.R.B. Licences | Electrical Eng. | Mathematics | Engineering |
| Art (Fashion, Illustrating, Humorous) | Electrical Installations | M.C.A. Licences | Salesmanship |
| Automobile Eng. | Electronics | Mechanical Eng. | Secretaryship |
| Banking | Electronic Draughtsmanship | Metallurgy | Shorthand & Typing |
| Book-keeping | Eng. Drawing | Motor Eng. | Short Story Writing |
| Building | Export | Painting & Decorating | Short Wave Radio |
| Business Management | Heating & Ventilation Eng. | Photography | Sound Recording & Reproduction |
| Carpentry | High Speed Oil Engines | P.M.G. Certs. | Telecommunications |
| Chemistry | Industrial Admin. | Police | Television |
| City & Guilds Exam | Jig & Tool Design | Production Eng. | Time & Motion |
| Civil Service | Journalism | Production | Study |
| Commercial Subjects | | Planning | |
| Commercial Art & Drawing | | Radar | Tracing |
| | | Radio Amateurs (C&G) Licence | Welding |
| | | Radio & Television Servicing | Workshop Practice |
| | | | Works Management and many others |

Also courses for GENERAL CERTIFICATE OF EDUCATION, A.M.I.H.&V.E., A.M.S.E., A.M.Brit.I.R.E., A.M.I.Mech.E., A.M.I.E.D., A.M.I.M.I., A.F.R.Ae.S., A.M.I.P.E., A.M.I.I.A., A.C.C.A., A.C.I.S., A.C.C.S., A.C.W.A., City & Guilds Examinations, R.T.E.B. Serv.Cert., R.S.A. Certificates, etc.

NEW! Courses with PRACTICAL EQUIPMENT in RADIO · TELEVISION · MECHANICS

CHEMISTRY · ELECTRICITY · DRAUGHTSMANSHIP · PHOTOGRAPHY, etc., etc.



COURSES FROM 15/- PER MONTH

POST THIS TODAY

Please send, without obligation, your FREE brochure, E.M.I. INSTITUTES, Dept. 127, London, W.4.

NAME _____ AGE _____
(if under 21)

ADDRESS _____

I am interested in the following subject(s) with/without equipment

(We shall not worry you with personal visits)



BLOCK CAPS PLEASE

EMI INSTITUTES

-Part of "His Master's Voice", Marconiphone, etc., etc.

From on the map to on the air



through Marconi's experienced hands

Broadcasting and television authorities all over the world look to Marconi's for much more than the supply of equipment. The company has been called on for every aspect of the provision of a broadcasting service, from the survey of propagation problems in the area to be served, through the complete building of the transmitter stations and the installation of the programme input equipment, to the erection of the aerials, maintenance, and the training of technical staff. No other company in the world tackles such matters with the experience, research facilities, skill and resourcefulness of Marconi's.



*Seventy-five per cent of the world's broadcasting authorities rely on Marconi equipment.
Marconi equipment is installed at all B.B.C. and I.T.A. television stations.*

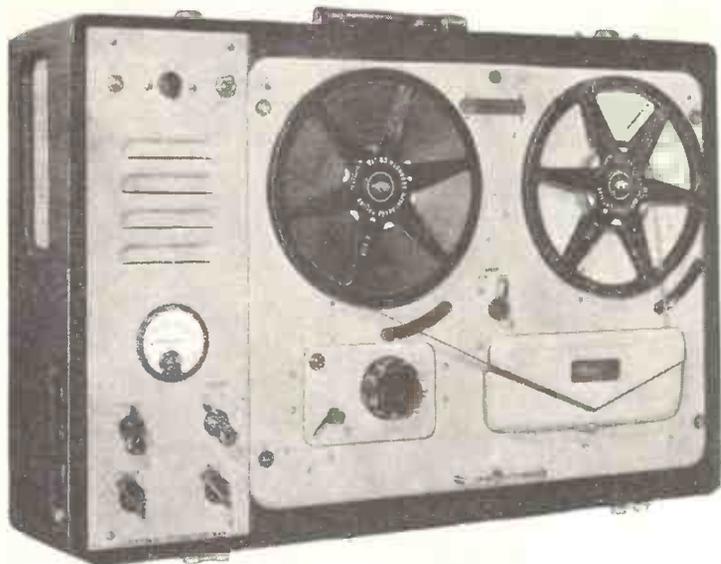
Lifeline of Communication

MARCONI

Complete Sound and Television Broadcasting Systems



Vortexion TAPE RECORDER



The amplifier, speaker and case, with detachable lid, measures 8½ in. x 22½ in. x 15¾ 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 1,750 ft. reels, with the lid closed.

- ★ The total hum and noise at 7½ inches per second 50-12,000 c.p.s. unweighted is better than 50 dbs.
- ★ 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.

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 packs. 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."



**WESTON
PORTABLE
INSTRUMENTS**

Weston Portable Instruments include D.C. moving coil, A.C. rectifier and H.F. thermocouple types, and instruments of the A.C./D.C. moving iron type; high grade dynamometer models are also available.

Illustrated above is the Model S.82—a permanent magnet, moving coil instrument in the Portable range. This is primarily a Precision Grade instrument but can also be supplied with Industrial Grade accuracy. Details of this Model, together with others in this series, are available on request.

SINGLE PHASE AND POLYPHASE
WATTHOUR METERS
SYNCHRONOUS TIME SWITCHES
SYNCHRONOUS MOTORS
AND MOTOR UNITS



PANEL & SWITCHBOARD INSTRUMENTS
D.C. Moving Coil, A.C. Rectifier, H.F. Thermocouple.
A.C./D.C. Moving Iron

PORTABLE INSTRUMENTS
D.C. Moving Coil, A.C. Rectifier, H.F. Thermocouple,
A.C./D.C. Moving Iron, A.C./D.C. Dynamometer

LABORATORY STANDARD INSTRUMENTS
D.C. Moving Coil, A.C./D.C. Dynamometer

CURRENT TRANSFORMERS · FREQUENCY
METERS · ALL-PURPOSE TEST SETS
AIRCRAFT INSTRUMENTS · RATIO METERS
TACHOMETERS · WESTON STANDARD
CELLS · ELECTRICAL THERMOMETERS
"PHOTRONIC" PHOTO ELECTRIC CELLS
PHOTOMETERS

SANGAMO WESTON LIMITED

ENFIELD · MIDDLESEX

Telephone: 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 upon Tyne, Newcastle 26867
Leeds, Leeds 30867; Liverpool, Central 0230
Wolverhampton, Wolverhampton 21912
Nottingham, Nottingham 42403
Bristol, Bristol 21781
Southampton, So'ton 23328
Brighton, Brighton 28497

sw/2s

Train for a wonderful future in
ELECTRONICS...

...with E.M.I

Every day the demand for the expert in electronics grows. Radio, television, radar and the whole field of industrial automation are rapidly expanding and the trained specialist assures for himself a well-paid career in this quickly developing profession. Here is your opportunity to enter for:—

3 YEAR COURSE TELECOMMUNICATIONS—Entrance standard G.C.E. Ordinary level or equivalent. This course trains Assistant Development Engineers to City and Guilds' Full Technological Certificate level. Next course commences in September, 1957.

1 YEAR COURSE Full-time day course in the Principles and Practice of Radio and Television. Mainly designed for the training of Radio and Television Servicing Engineers. Next courses commence in May and September, 1957.

THE E.M.I. COLLEGE OF ELECTRONICS

Dept. 127, 10 Pembridge Square, London, W.2. Telephone: BAYswater 5131/2

The College is part of the E.M.I. Group which includes "His Master's Voice", Marconiphone, E.M.I. Electronics Ltd.



1C80A

Olympic Honour for Britain...

**LEAK TL/12 Amplifiers were
chosen for use at the Olympic Games.**

It was in 1945 that H. J. Leak revolutionised the performance standards for audio amplifiers by designing the original "Point One" series, and we became the first firm in the world to market amplifiers having a total distortion content as low as 0.1 per cent. This claim was received with incredulity, but it was subsequently confirmed by the National Physical Laboratory and since then hundreds of TL/12 amplifiers have been used by the B.B.C., and Commonwealth and foreign broadcasting authorities, and thousands have been used by recording studios, leading musicians and music-lovers throughout the world.

Further development work resulted in our producing, at a much lower price but with the same high performance standards, the TL/10 amplifier. The output of the TL/10 is ample for high fidelity home music systems, and the quality of reproduction obtained is equal in every respect to that of the TL/12. We always use the TL/10 amplifier and "Point One" pre-amplifier for our public demonstrations of high fidelity reproduction of gramophone records and radio. The TL/10 amplifier, when used with the best available complementary equipment, gives to the music-lover a quality of reproduction unsurpassed by any equipment at any price. Even when the complementary equipment falls below that of the best obtainable the use of these amplifiers will enable one to obtain very marked improvements in reproduction.

We shall be pleased to send you full details of



HIGH FIDELITY EQUIPMENT

Below:

**LEAK TL/10 10-watt Amplifier, 17gns.
and "Point One" Pre-amplifier, 10gns.**

Prices made possible only by world-wide sales

Harmonic Distortion 0.1%, 1,000 c/s, 7.5 watts output.



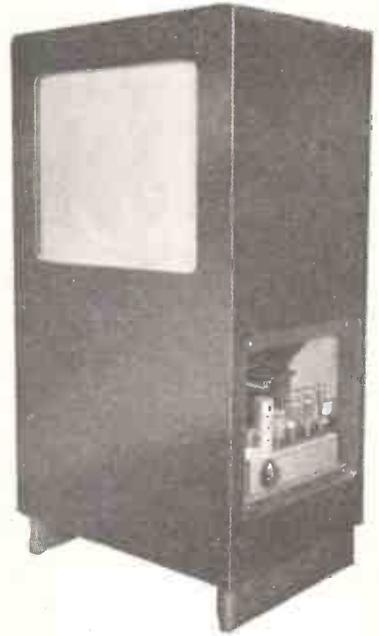
FREL is the trade name of the Leak Full-range Electrostatic Loudspeaker which will be available to the public in 1957. The design is original and has great theoretical and practical advantages over previously described electrostatic loudspeaker systems. It is the result of intensive research and development work carried out by H. J. Leak, M. Brit. I.R.E., and A. B. Sarkar, M.Sc., who are the authors of a paper, describing the basic design principles of this loudspeaker, which was published in the Wireless World, October 1956. A reprint of this paper will be supplied on request.

The
**B.B.C. MONITOR
LOUDSPEAKER UNIT**

uses a

**LEAK TL/12
AMPLIFIER**

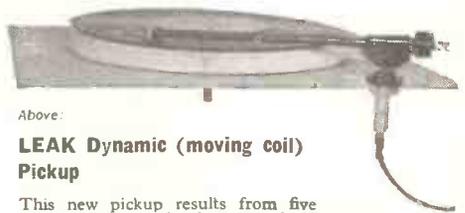
**Price
£28.7.0**



On Left:

LEAK TROUGH-LINE F.M. Tuner, £25
plus 10 gns. P.T.

A Trough-line inductor and AFC eliminate drift. Very high sensitivity for fringe area listening. Quieting control plus high fidelity discriminator. Cathode-follower output. Self powered to operate with any amplifier.



Above:

**LEAK Dynamic (moving coil)
Pickup**

This new pickup results from five years' continuous development of our first moving-coil design. Reports from users have justified our earlier belief that the pickup might earn recognition as the best in the world.

Leak dynamic pickup: Arm ...	£2.15.0	p.t. £1.3.1
LP head with diamond stylus	£5.15.0	p.t. £2.8.4
78 head with diamond stylus ...	£5.15.0	p.t. £2.8.4
Mumetal cased transformer ...	£1.15.0	

*The first name
in High Fidelity ...*



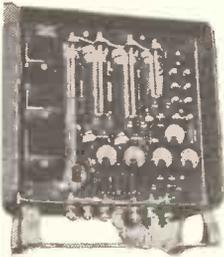
H. J. LEAK & CO. LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3., ENGLAND

Telephone: SHEpherds Bush 1173/4/5

Telegrams: Sinusoidal, Ealux, London

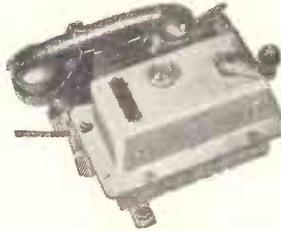
Cables: Sinusoidal, Landon

MAINLY FOR EXPERIMENTS AND INDUSTRIAL USERS
EX-ROYAL NAVY SOUND POWERED TELEPHONE



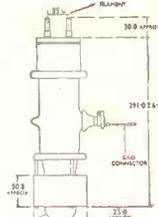
CHARGING SWITCHBOARD

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 550 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 £4/10/- carriage 10/- We can supply a 12 volt, 50 amp. Mains Transformer at £4/5/- plus 5/- carriage.



These require no batteries and will go for long periods without attention. Complete with generator and sounder which gives a high pitched note easily heard above any other noise. Also fitted with an indicator lamp which in quiet situations can be used instead of the sounder, or where several telephones are used together, will indicate which one is being called. Size 7 1/2 x 9 x 7 1/2 in., wall mounting, designed for ships' use but equally suitable for home, office, warehouse, factory, garage, etc. Price 57/6 each, plus 4/6 carriage.

SPECIAL PURPOSE VALVES



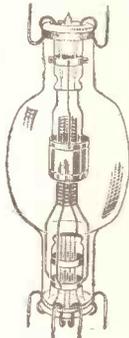
Triode Type CV 1098. This is a high-powered air-cooled triode. Specification of which is as follows: Filament voltage 8.2 v., filament current 35 amps., anode dissipation 750 watts, Anode volts 25 kv. This valve is very suitable for R.F. heating at high frequencies and two of these in push-pull under Class C conditions would have an output of approximately 2 kilowatts. Brand new, still in original shockproof packing, price £5 each. Carriage and insurance 10/-.

TETRODE TYPE VT31

MANY OTHER TYPES IN STOCK/PLEASE STATE YOUR REQUIREMENTS

This is a high-powered air-cooled tetrode. Specification of which is as follows—heater volts 11.25, heater current 8 amps., maximum anode voltage 5 kv., anode dissipation 250 watts, size approximately 14 1/2 in. long and 6 1/2 in. across the bulb.

Limited quantity only at £4 each, still in original packing. Carriage and insurance 10/-.



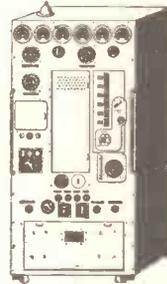
TRANSMITTER NAVY MODEL TCK-7

Seen at Eastbourne by appointment

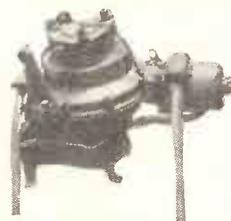
We have a few only American transmitters still in original packing cases. Designed for the Navy, these are really beautifully made and most impressive, standing 5ft. high by 2ft. wide and finished in instrument crackle. All meters and controls are on the front panel. The transmitter tunes over the range of 2 megacycles to 18 megacycles and it is designed for high speed precision communication without preliminary calling. Frequency control and stability is particularly good, being better than .005% under the worst conditions. Power output is 400 watts on C.W. and 100 watts on phone. Tuning is very simple—a unit control mechanism—gives a direct reading in frequency.

Complete with valves and instruction manual. Price £95 ex works.

NOTE.—The transmitter will work off A.C. or D.C. with the appropriate power unit. Power units are not available at present.



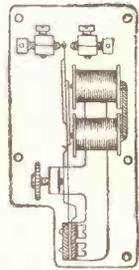
UNITS FOR CONTROLLED AUTOMATIC ROTATION



We have brand new, still in original unopened packing cases as shipped from America two items of equipment which form part of the radar system RC84. These two units work together to form a Tower rotating device, with remote control. Item 1, known as Tower 24A, is in fact the geared driving motor which rotates the mast. This is quite a heavy construction and would rotate a heavy scanner, reflector, beam array, etc., etc. Item 2, known as Indicator I-221-A is the remote controller which enables the azimuth position of Tower 24A to be controlled from a remote point. Conversely, it enables the

azimuth position of the tower to be known at any time. Both the Tower and the Indicator contain selenium transmitters/receivers and it is these that provide the impulses which cause the aerial to rotate backwards or forwards. The equipment intended for 117 volt A.C. mains but will operate from our mains if connected through step down transformer of 1 K.W. rating. Prices I-221-A £25 plus carriage. TR24A £35 plus carriage. Special discount of £5 for cash with order or C.O.D. if both units purchased together.

HIGH SPEED RELAY



This is a miniature type relay with change-over platinum contacts. Bobbins are 250 ohms each. Brand new—limited quantity—7/6 each, post 1/6.

THERMAL DELAY SWITCH

Hermetically sealed with 4-pin base, heater resistance approx. 1,500 ohms. This can be used for overload protection. Approximately 17 milliamps through the heater coil will cause the contacts to close. Useful for many applications such as delaying anode volts until the heaters are properly warmed up. Limited quantity—7/6 each, post and insurance 1/6.

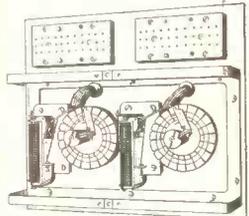


AUTOMATIC MOTOR STARTER



For remote control of D.C. motor between 1 and 3 kw., adjustment for 100v. or 230v. Unused and in first-class condition, complete with metal and wired glass cover. Price £10, carriage 5/-.

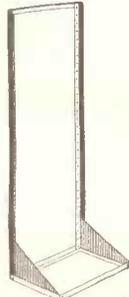
TOWARDS AUTOMATION



Rotary switch—Ministry Ref. No. AP57579, this is a motor-driven switch, the driving motor being a synchronous type for working on 110 volts 50 cycles. The two switches have 20 positions each and are enclosed by a Perspex fronted lid. Separately operated relays providing interlocks. Price £4/17/6 each.

RACKING EQUIPMENT STANDARD OPEN RACK

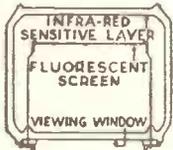
6ft. high and 19in. wide, heavy steel construction. Holes drilled and tapped at 7in. spacings. Price £3/15, plus carr.



MICA PANELS

Pure mica panels size 2in. x 3in., 3/- per dozen.

"SNIPER-SCOPE"



"Cats eye" need for seeing in the dark. Will work burglar alarms, counting circuits, smoke detectors and the hundred and one other devices as will the simpler type of photo cell. Price 5/- each. Post and ins. 1/-. Data will be supplied with cells if required.

VACUUM RELAY



American made type No. C61610, this is a relay completely sealed in a glass envelope. It will close in a strong magnetic field or by a coil placed close to or round one of its arms. Price 49/6. Operating coils 25/- each.

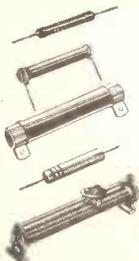
WESTINGHOUSE (U.S.A.) METERS



All moving coil flush mounting type, outside diameter of face 3 1/2 in.

- 0-500 v. D.C. 25/-
- 0-1.5 kv D.C. external multiplier 35/-
- 0-2.5 kv D.C. external multiplier 35/-
- 0-15 v. A.C. 30/-
- 0-1 mA. 25/-
- 0-50 mA. 25/-
- 0-100 mA. 25/-
- 0-150 mA. 25/-
- 0-250 mA. 25/-
- 0-500 mA. 25/-

RESISTORS

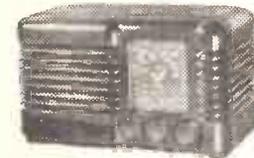


High stability types from 1-watt to 2-watt. Wire wound vitreous covered wire ended up to 20-watt. High powered types up to 150-watt mostly clip-in. Insulated and non-insulated carbon types preferred valves. High and low powered variable types. Big stocks available—send details of your requirements.

FLUORESCENT LIGHTS



These are a complete fluorescent lighting fitting. Built-in ballast and starters—store enamelled white and ready to work. Ideal for the kitchen, over the work-bench and in similar locations. Single 40. 4ft. 3in. long, uses a 40 watt tube. Price 39/6 complete with tube. Carriage and ins. 5/6. Twin 80. Uses 2 20-watt standard tubes. Price 29/6 less tubes. Carriage and ins. 4/6.



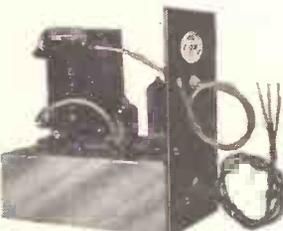
NEW CIRCUIT

OCCASIONAL 56. We have evolved a new T.R.F. circuit and have had really good results, equal in fact to many superhets. You really should try this circuit. All parts including valves (6K7, 6J7, 6F6 and 6X5) and bakelite case with back cost only 25/10/-, plus 2/6 post and insurance. Data included with the parts is also available separately, price 2/-.

ELECTRIC BLANKET WIRE

Waterproof P.V.C. covered, so blanket washable, 16½ ohms per foot—1/8 per yard. 14 yards. Ideal for average blanket. £1 post free.

H.T. GENERATOR



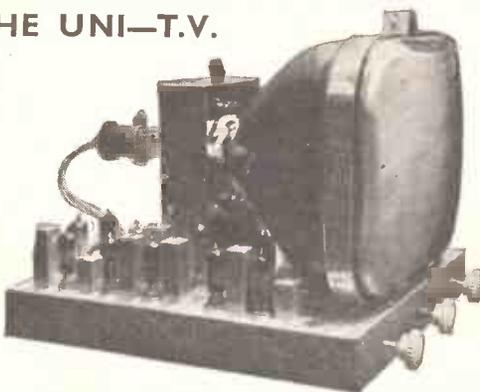
This is a made-up unit, power consumption (6.3 volt 8 amp. filament and approx. 58 mA. H.T.). Contains three BVA valves. Output from 6 kV to 9 kV rectified with normal H.T. rail input but somewhat higher outputs can be obtained with higher H.T. supply. Dimensions are 6½ x 4½ x 7in. Price 69/6, post, packing, etc., 5/-.

BAND III CONVERTER

ADDDTA—Many hundreds in use. Any television receiver, whether superhet or straight A.C. or A.C./D.C., home constructed or factory built, which at present will receive B.B.C., will also receive I.T.A. if this converter is added. No modifications at all are necessary to the receiver. Simply plug in aerial leads and connect to A.C. mains. The converter is in a neat metal case with provisions for fixing to side or the back of the set. Price 26/10/- or H.P. terms available on request if required.



THE UNI—T.V.



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

- Made up units if required
- All miniature valves
- Metal rectifier
- No expensive transformers
- 13-channel circuitry
- Multi-vibratof time bases
- Ferroxcube, E.H.T. and scan coils
- 34/38 mc/s. I.F.
- Suitable for any modern 12, 14 or 17in. tube

Modern contemporary cabinet if required. The building cost (less tube) is only £29/10/- plus 10/- carriage and insurance. All parts guaranteed twelve months. Full information and data free with parts or available separately, price 3/6.

CABINETS FOR ALL

The CONTINA



Another addition to our range of cabinets. This is of new revolutionary design, styled after the best of continental radios. Externally, it is finished in highly polished dark walnut veneer, with panelling picked out in gold. Interior is of same very high standard, its veneer being light mahogany which contrasts nicely with the dark walnut and generally gives a very pleasing appearance. The doors slide on metal runners and are fitted with gold insert finger plates. A really excellent cabinet for any home—size 3ft. 1½in. long, 1ft. 3in. deep, 2ft. 1½in. high, including legs which are 10in. from floor. Motor board 12½ x 17in., equipment aperture 17½ x 9½in. gives ample space for 8in. speaker. Ample storage space for recordings. Price £19/19/-, carriage and insurance 20/-.

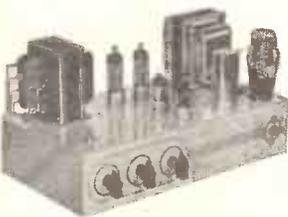
POCKET TRANSISTOR RECEIVER

To readers wishing to make up the set described on page 538 of November, 1956, issue we offer the following components:

Resistors—set of eight	3/6
Capacitors—C5 to C8—set of four	6/6
Compression Trimmers—C1 & C3	2/6
Ceramic Trimmers—C2 & C4	2/6
Earpiece Type L (Fortiphone)	18/-
Transformers—N.22 and N.23 (Fortiphone)	10/-
Hearing Aid Cable	2/6
Slide Switch SWS	4/-
Transistors Mullard OC71	24/-
Aerial Coil on Ferroxcube wound to specification	7/6

Alternatively we will supply all the parts to build the set, but substituting certain lower priced alternatives, the total cost being £2/17/8 which does not include the following items: earpiece, sockets, battery or case.

THE MULLARD 510 AMPLIFIER



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 16 to 20,000 C.F.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, completely made up and ready to work is £12/10/-, 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.

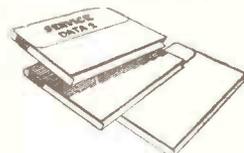
CROYDON BRANCH OPEN

We have taken the Lease of 266, London Road, Croydon, and we are now open at this address.

COMPONENT BARGAINS

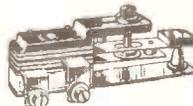
1 mid. 350-volt metal cased condenser by Dubilier—small size 3/6 doz. or 38/- gross. Philips Trimmers 0-30 pf. 1/- each or 11/- doz. Moulded Mica Condensers, well mixed assortment 3/- doz., 30/- gross. Silver Mica, well mixed assortment, 3/- doz., 30/- gross. 50 mid. 50 v. Bias Condensers TCC 1/6 each, 15/- per doz. Ceramic Trimmers, 5 to 30 pf. 6d. each, 5/- doz. 20 to 60 pf. 9d. each, 8/- doz. 20 to 100 pf. 1/3 each, 12/- doz. Earpiece-microphone, American midget type 3/6 each, 36/- doz.

SERVICE DATA



100 service sheets, covering British receivers which have been sold in big quantities and which every service engineer is ultimately bound to meet. The following makes are included: Aerodyne, Alba, Bush, Coswor, Ekco, Eveready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster-Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder. Our Folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers "all dry", etc., which have been imported into this country. Names include Sparton, Emerson, Admiral, Crosley, R.C.A., Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc. Price for the folder of 100 sheets is £1. Post free.

THERMOSTATS



2½in. x 1in. x 1½in. high. Useful for the control of appliances such as convector, glupots, vulcanizers, hot plates, etc., which have been imported into this country. Names include Sparton, Emerson, Admiral, Crosley, R.C.A., Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc. Price for the folder of 100 sheets is £1. Post free.

CHASSIS ASSEMBLY

Three-colour 3-waveband scale 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 14½ x 3½in. Chassis size 15 x 5 x 2½in. deep. Price 15/- plus 1/6 post. Note: We can supply cabinet for this, 39/6 and 5/- p. and T.

The "ESTRONIC" Band III Converter



To-day's best value in Band III converters suitable for your T.V. or money refunded. Complete ready to operate, 49/6 non-mains or 69/6 mains, post and insurance 3/6.

ELECTRONIC PRECISION EQUIPMENT LTD.

266 London Road, Croydon. Phone: CRO. 6558. Half-day Wednesday.

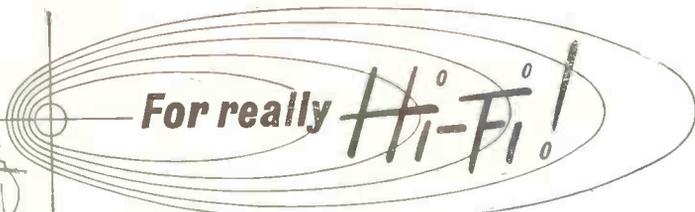
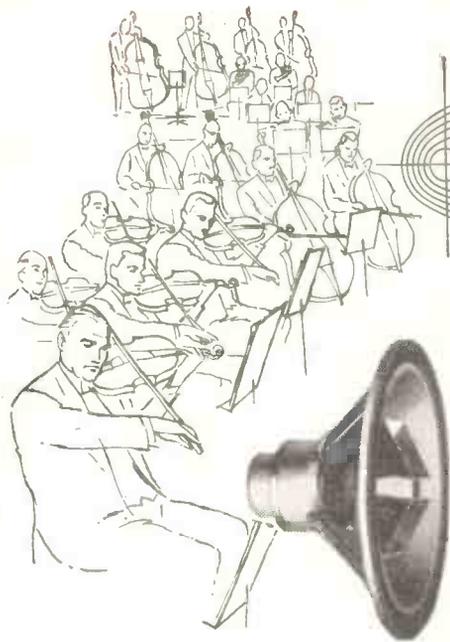
249 Kilburn High Road, Kilburn. Phone: MAI 4921. Half-day Thursday.

42-46 Windmill Hill, Ruislip, Middlesex. Phone: RUISLIP 5780. Half-day Wednesday.

152-153 Fleet St., E.C.4. Phone: FLEET 2833. Half-day Saturday.

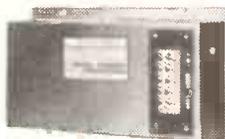
29 Stroud Green Road, Finsbury Park, N.4. Phone: ARCHWAY 1049. Half-day Thursday.

Post orders should be addressed to E.P.E. LTD., M.O. Dept. 2, SUTTON ROAD, EASTBOURNE. All enquiries to Eastbourne address and please enclose S.A.E., terms are cash with order.



The BTH Dual Channel Loudspeaker

To those striving for perfect sound reproduction, the new BTH K10A SPEAKER is an essential component. Designed to meet an exceptionally exacting specification, the unit is now available with or without cabinet to the keen enthusiast. The equipment comprises an 18-inch cone for low frequencies, with a co-axial pressure-type unit and horn for high frequencies, and is complete with cross-over network.



The matching impedance is 15 ohms; the cross-over frequency is 1700 c.p.s.; and the total weight of unit and filter is 38 lbs.

List Price (less cabinet) : £45



BRITISH THOMSON-HOUSTON

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED · RUGBY · ENGLAND

Member of the AEI group of companies

A.5006

Estd.

L·R·S

1925

EASY

TERMS

THE SPECIALISTS IN QUALITY EQUIPMENT

LEAK TL/10 and POINT ONE PRE-AMPLIFIER
 VARISLOPE PRE - AMPLIFIER
 F.M. TUNER, DYNAMIC PICK-UP etc.

Lowther • Chapman Tuners
 Wharfedale • Goodmans • Kelly Loudspeakers
 Connoisseur • Garrard • Collaro
 Transcription Motors, etc.

All the above—in fact all QUALITY EQUIPMENT is available on EASY TERMS. Immediate delivery on most items.

SMALL DEPOSIT secures, balance plus 5% interest payable in 9 equal monthly instalments

or

50% DEPOSIT and balance plus 10% interest payable over 18 months or 24 months if required.

We pay carriage and cratage on all items.

Send us your requirements. We will quote by return.

The L·R·S SUPPLY COMPANY, LTD.
 BALCOMBE (Tel: 254) SUSSEX.

RCA TRANSMITTERS. Type ET-4331. 1 kW. (telephone); 1.4 kW. (telegraph). Frequency range 3 Mc/s to 20 Mc/s.

RCA TRANSMITTERS. Type ET-4336. Complete with original speech amplifier, crystal-multiplier and VFO units. Unused and re-conditioned. Can be supplied with very large quantity of spares.

COLLIN'S T.C.S. 6, 9, 12, 13. Complete equipment:— Transmitter, Receiver, Rotary Converter (12 v.), Remote Control, Aerial Coupling Unit, Microphone, Key and Connecting Cables.

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.

40 Line F & F TELEPHONE SWITCHBOARDS (complete).

V.H.F. TRANSMITTER Type 1131B or J. Frequency coverage 100/156 Mc/s. 50 watt output. Tropicalised. New.

A.R.88Ds, AR88 LF's, R.109.

METAL RECTIFIERS Type 1B, D.C. output 10 amps at 22 v., input 200/250 v., 50 c/s.

PETROL GENERATOR Type P.E. 95 G (10 k.w.).

All above items in excellent working condition. Working demonstration upon request.

SPARES A large selection available for SCR399 (BC610), ET4336, SCR610, EEB 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.

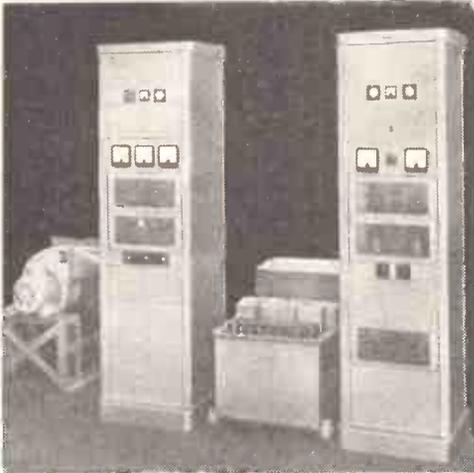
P.C.A. RADIO

Offices and Works

BEAVOR LANE, HAMMERSMITH, LONDON, W.6

Telephone : RIV 8006/7

variable high power Amplifiers



V L F AUDIO L R F

For the past 20 years, W. Bryan Savage Ltd. has specialised in a wide range of high power amplifiers for use in various branches of industry. This experience has been more recently successful in the wide and varied field of fatigue testing.

TYPE 10 10 KILOWATT AMPLIFIER

This is the latest addition to the Savage range of amplifiers—it is suitable for driving the Goodman Vibrator VG108 or VG109 and the American MB C25H.

OUTPUT: 10 kVA when Power Factor of load exceeds 0.8.

OUTPUT VOLTAGES: From 41½ V to 330 V.

FREQUENCY RANGE: 40 c/s-10,000 c/s at 10 kW. 30 c/s-6.5 kW. 20 c/s.-2.5 kW.

HARMONIC DISTORTION: Less than 3% at 10 kW at 1 kc/s.

SENSITIVITY: 160 mA at 600 ohm for 10 kW output.

OUTPUT VOLTAGE REGULATION: 33%.

NOISE: 70 dB below 10 kW.

MAINS SUPPLY: 350-450 volts 50 c/s. 3 phase.

Range of
Amplifiers

Power	Type	Frq. Range
100 Watts	"VLF"	3 c/s to 6 c/s
1 kW	"VLF"	6 c/s to 2,000 c/s
1 kW	Mark II Star	50 c/s to 10 kc/s
1 kW	"LRF"	5 kc/s to 100 kc/s
10 kW	Type 10	40 c/s to 10 kc/s



W. BRYAN SAVAGE LIMITED

FOR FATIGUE TESTING
for Guided Missiles, aircraft and all forms
of Industrial components

Vibrators



TYPE V 1000 — This vibrator is designed to produce a peak alternating thrust of ± 500 lbs. (unblown) at 1 kW. A forced draught into the vents provided in the base will allow increased input current for a correspondingly increased thrust. Unit construction has been adopted and careful attention to detail has produced a vibrator that can quickly and easily be stripped and reassembled should repairs become necessary—the design is such that no routine maintenance is required.

17, STRATTON STREET, LONDON, W.1

Telephone: GROsvenor 1926

Reflectograph

RR series 102

METAL CASED RECORDER

Incorporating the "BRICK" type construction of Record/Playback units. This instrument permits continuous monitoring from the tape during recording, the Playback Amplifier delivering an output power of up to 3 watts, either to the built-in speaker, or to an external (15 ohms) output socket, while a 600 ohms balanced output of 1 mW is also available. A "Breakin" switch is provided, so that the incoming signal can be sampled and directly compared with the outgoing recorded signal. The recorder measures 21½ in. × 15½ in. × 13 in. deep and weighs 56 lbs. It can be supplied fully tropicalised if so required. The RR. Series 102 supersedes the Reflectograph Series P Recorders.



For specification and full information on the Reflectograph range please write to the manufacturers.

RUDMAN DARLINGTON (ELECTRONICS) LTD
Wednesfield, Staffs. Tel: Wolverhampton 31704

JW.Ad 3978

"Don't forget

your Teletet"

The COMPLETE
TELEVISION
SERVICING
INSTRUMENT

Write now for
full details to

AIRMEC LTD
HIGH WYCOMBE
BUCKINGHAMSHIRE

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

TELEVISION AERIAL COMPONENTS

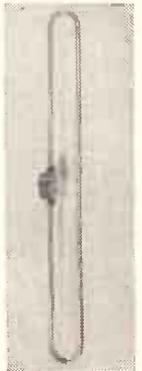
DESIGNED FOR CONSTRUCTING BAND I & BAND III T.V. AERIALS
ELEMENT DIMENSIONS SUPPLIED FOR ALL CHANNELS

Selecting at random from our new multi-page catalogue:

- ★ Band III Folded Dipoles (As illustrated)
- ★ Mast Coupling units for 2" Masts
- ★ Reflector and director rod holders
- ★ Insulators, both Rubber and Plastic (As illustrated)
- ★ Masthead Fittings for ¾", 1", 1½" and 2" Masts
- ★ Alloy Tubing for Elements, Cross-boom and Masting

Send 1/- P.O. for the revised, fully illustrated catalogue to:

FRINGEVISION LTD., Marlborough, Wilts. Phone 657/8



REALISM

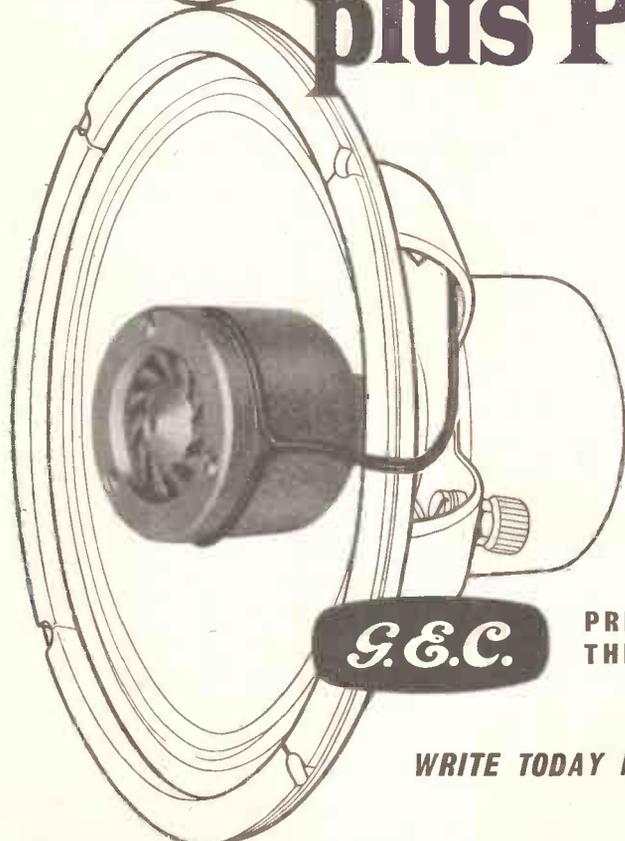


OVER THE 9 OCTAVE RANGE

Here is a simple unit to give life-like reproduction of any type of sound over 9 octaves—including the entire musical fundamental range with overtones. Home constructors will delight in the true tonal quality, the unequalled transient and low frequency response and the negligible inter-modulation of the G.E.C. Metal Cone Loudspeaker.

METAL CONE LOUDSPEAKER £9.5.0
TAX PAID

plus PRESENCE



WITH ADDED LIFT TO THE MEDIUM UPPER REGISTER

Taking advantage of the exceptional bass performance and smooth response of the metal cone loudspeaker, this unit adds “presence” to the reproduction of music—brings the sound right into the room with you. Specially designed as an accessory to the loudspeaker, it’s a music lover’s “must”.

PRESENCE UNIT FOR USE WITH £3.19.6
THE METAL CONE LOUDSPEAKER TAX FREE

WRITE TODAY FOR DETAILS

TELCON CELLULAR POLYTHENE INSULATED DOWNLEADS

This range of 75 ohm coaxials has been especially designed for the reception of Band II (FM sound 87.5 - 100 Mc/s.) and Band III (Television 174 - 216 Mc/s.)

Attenuation db/100 ft.	ET.5.M	ET.6.M	ET.7.M	ET.8.M	ET.10.M
10 Mc/s.	1.3	1.5	1.0	1.1	0.6
50 "	3.0	3.4	2.3	2.6	1.5
100 "	4.3	4.8	3.2	3.6	2.2
200 "	6.3	7.2	4.9	5.3	3.3

Dimensions (inches)	ET.5.M	ET.6.M	ET.7.M	ET.8.M	ET.10.M
Centre Conductor	1/0.022	7/0.0076	1/0.029	7/0.010	1/0.044
Over Cellular TELCOTHENE	0.093	0.093	0.128	0.128	0.200
Over Wire Braid	0.117	0.117	0.152	0.152	0.230
Over TELCOVIN Sheath	0.157	0.157	0.202	0.202	0.290

Please ask for a copy of Publication TV5

TELCON CABLES

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD.
MERCURY HOUSE, THEOBALD'S ROAD,
LONDON, W.C.1. HOLBORN 8711

BRANCHES: BIRMINGHAM, CARDIFF, MANCHESTER, NEWCASTLE AND NOTTINGHAM



MAINS TRANSFORMERS

Primaries, 200/250 v. Half Shrouded.

HSM63. 250-0-250 v. 60 m/a., 6.3 v. 3 a., 5 v. 2 a. (Midget) ...	16/3
HS2. 250-0-250 v. 80 m/a., 0-4-6.3 v. 4 a., 0-4-5 v. 2 a.	19/-
HS3. 350-0-350 v. 80 m/a., 0-4-6.3 v. 4 a., 0-4-5 v. 2 a.	19/-
HS3X. 350-0-350 v. 100 m/a., L.T. as above	23/-
HS150. 350-0-350 v. 150 m/a., 6.3 v. 3 a., 5 v. 3 a.	27/9

Fully Shrouded

FSM63. 250-0-250 v. 60 m/a., 6.3 v. 3 a., 5 v. 2 a. (Midget) ...	16/9
FSM66. 250-0-250 v. 60 m/a., 6.3 v. 3 a., 6.3 v. 2 a (Midget)	17/3
FS43. 425-0-425 v. 200 m/a., 6.3 v. 4 a., C.T., 6.3 v. 4 a., C.T. 5 v. 3 a.	47/6
F36. 250-0-250 v. 100 m/a., 6.3 v. 6 a., 5 v. 3 a.	29/5
FS150X. 350-0-350 v. 150 m/a., 6.3 v. 2 a. C.T., 6.3 v. 2 a. C.T., 5 v. 3 a.	31/6

FILAMENT TRANSFORMERS

Primary 230 v F3X 6.3 v. at 1.5 amps	5/9
Primaries 200/250 v	
F.3. 6.3 v. at 3 amp., 8/11. F6. 6.3 v. 2 a	7/6
F12X. 12 v. 1 a., 7/9. F12. 0-6.3-12.6 v. 3 a.	16/6
F24. 0-12-24 v. 3 a.	23/6
F34. 0-4-9-15-24 v. 3 a.	26/6

C.W.O. Postage 1/3 extra under 10/- 1/9 extra under £2.
2/9 extra under £3.

Lists, etc., stamped addressed envelope please.

H. ASHWORTH (Dept. W.W),
676, Gt. Horton Road, Bradford 7, Yorks.

THE WORLD'S GREATEST BOOKSHOP

FOYLES

★ ★ FOR BOOKS ★ ★

FOR ALL YOUR

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.2

Gerrard 5660 (20 lines) ★ Open 9-6 (Thurs. 9-7)

Nearest Station: Tottenham Court Road

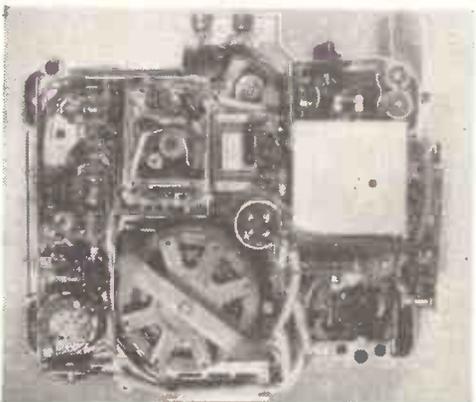
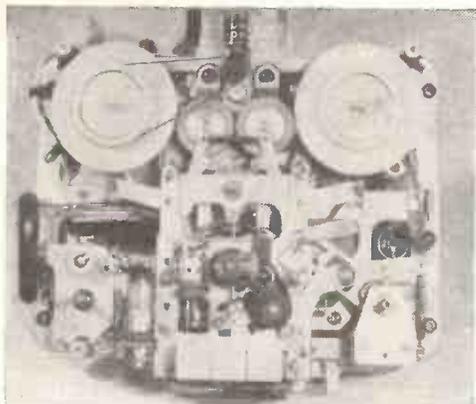
TESTOSCOPE MAINS TESTER



For high and low voltage testing. Standard Model: range 100/850 volts A.C. or D.C. Dual Model: range 1/30 and 100/850 volts A.C. or D.C.

Write for interesting leaflet 30F. APPLY FOR 16 PAGE BOOKLET, POST FREE 1/.

Runbaken
MANCHESTER 1



Something to be proud of...

There is much more in a tape recorder than just circuitry. Try a TK8 out, and you'll agree that anybody could be proud of it!

Just take a look at the specification...

Mains Voltages:	Suitable for A.C. only, 105-115, 190-210, 210-230, 230-250 volts, 50 c/s.
Consumption:	Approximately 60 watts (rising to 118 watts when Fast Winding).
Fuses:	2 amps. (for 105-115 V.) 1 amp. (for 190-250 V.) Both fuses are of the surge resisting type.
Valves:	EF86, ECC81, EL42, EL84, EM81 + 2 metal rectifiers.
Recording Level Indicator:	Magic Eye.
Loudspeakers:	Elliptical 6 ins. High Flux permanent ceramic magnet type plus two 2½ in. treble units.
Amplifier Output:	4 watts approximately.
Tape Speed:	3½ ins. per second, and 7½ ins. per second.
Frequency Response:	50-9,000 c.p.s. ±3 db at 3½ ins/sec. 50-13,000 c.p.s. ±3 db at 7½ ins/sec.
Recording Sense:	Twin Track, recording on the top track (British and International standard).
Maximum Tape Length:	1,200 feet.
Running Time per Tape:	30 minutes each track at 7½ ins/sec. (1 hr. total). 60 minutes each track at 3½ ins/sec. (2 hrs. total).
Fast Forward/Fast Rewind Times:	Approximately 1½ minutes.
Automatic Stop Switch:	Electro-magnetic.

The **GRUNDIG** TK8-3D — for Price & Performance

GRUNDIG (GREAT BRITAIN) LIMITED

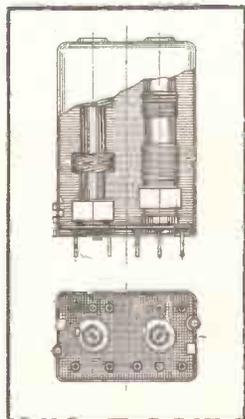
Advertising Dept. & Showrooms: 39/41 NEW OXFORD ST., LONDON, W.C.1

Trade enquiries to:—KIDBROOKE PARK ROAD, LONDON, S.E.3.

(Electronics Division, Gas Purification & Chemical Co. Ltd.) G12

WEYRAD

I.F. TRANSFORMERS AND RATIO DETECTORS FOR AM AND FM.



TYPE P.23/1R

COMBINED AM/FM TRANSFORMERS 470 KC/S AND 10.7 MC/S. AM BANDWIDTH 8 KC/S AT -3DB. FM BANDWIDTH 200 KC/S AT -1.5 DB.

TYPE P.23/2R

COMBINED AM I.F. TRANSFORMER AND FM RATIO DETECTOR. THE R/D PROVIDES A PEAK-TO-PEAK BANDWIDTH OF 340 KC/S WHICH IS LINEAR OVER 220 KC/S.

BOTH ASSEMBLIES ARE MOUNTED IN SCREENING CANS SIZE 1 x 1½ x 2½ in. THE TRANSFORMERS ARE DESIGNED FOR USE WITH EF89 AND EABC80 VALVES OR THEIR EQUIVALENTS. THE P.23/1 AND P.23/2 CAN BE EMPLOYED WITH FRONT-END TUNERS INCORPORATING THE FIRST I.F. STAGE, ALTERNATIVELY WEYRAD P.22/4 FM I.F. TRANSFORMER CAN BE USED.

THESE COMPONENTS ARE USED IN OUR AM/FM RECEIVER-CONSTRUCTIONAL CATALOGUE OF INDIVIDUAL COMPONENTS 6d. BOOKLET 2/6.

WEYMOUTH RADIO MANUFACTURING CO., LTD.,
CRESCENT STREET, WEYMOUTH, DORSET.

Aerialite

Products for the ELECTRONIC INDUSTRY

Number



HIGH FREQUENCY CABLES

Aeraxial cables have a unique five air cell construction which provides a high ratio of air to Polythene insulation—resulting in lower losses, particularly at higher frequencies

AERAXIAL

Cat. No. 597

Specification

Conductor	7/010in
Polythene Dia	.123in
Braid	.006in
Dia. over braid	.147in
Overall dia.	.210in
Sheathing Colour	Brown

Electrical Characteristics

Characteristic Impedance	66-67 ohm
ATTENUATION db/100ft.	at 45 MC/S 2.3
	at 60 MC/S 2.6
	at 200 MC/S 5.0

Capacitance pF/ft.	18 pF
Power handling capacity 200 mc/s	100 watt
Velocity ratio V/C	.74

Catalogue No 598 As Catalogue No. 597 but with 1/.022 solid conductor
Other details as Catalogue No 597



SUPER AERAXIAL

Cat. No. 499

Specification

Conductor	1/.048in.
Polythene dia.	.195in.
Braid	.006in.
Dia. over braid	.219in.
Overall dia.	.275in.
Sheathing Colour	Brown

Electrical Characteristics

Characteristic impedance	66-77 ohms
ATTENUATION db/100ft.	at 45 MC/S 1.2
	at 60 MC/S 1.5
	at 200 MC/S 2.6

Capacitance pF/ft.	18.0 pF
Power handling capacity 200 mc/s.	300 watts.
Velocity ratio V/C	.75

This type supersedes the previous Cat. 499 Coaxial
Flat twin feeders are also available



BROADCAST, RELAY & SOUND DISTRIBUTION CABLES



Double Screened Aeraxial (Cat. 625)
Supplied with a 1/048 high conductivity annealed copper conductor. The electrical characteristics as Super Aeraxial (Cat. 499)



Aeraxial for Overhead Suspension. (Cat. 626) With a 1/048 galvanised steel catenary wire as an integral part of the P.V.C. sheath, the specification and electrical characteristics are the same as for Aeraxial (Cat. 597).

AERIALITE LIMITED

Head Office & Cable Div.—
Castle Works, Stalybridge, Cheshire
Television & Electronics Div.—
Hargreaves Works, Congleton, Cheshire

BAND III CHANNELS 8-9-10

A new CONVERTOR KIT is now available for LONDON—MIDLANDS—NORTH

Fit this new convertor not to your set but inside your set, even 9in. table models, and retain that professional look.

This convertor has been evolved since the I.T.A. transmission began, and is based upon experience gained in the conversion of very many Band I sets in the London area.

- IT will convert any set, any age, TRF or Superhet
- IT includes station switching
- IT provides pre-set contrast balancing
- IT uses only one aerial input for both bands
- IT provides manual tuning on Band III
- IT is totally screened
- IT completely rejects unwanted signals
- IT requires no additional power supply where either 6.3V or 3 amp line is available.

CONVERTOR wired and aligned with fitting instructions	£4 2 6
KIT complete in every detail, less knobs	£2 12 6
KNOBES each	1 0
CIRCUIT and instructions in detail (free with kit)	3 6
BAND III AERIALS (send for list), from	12 6
CROSS-OVER UNITS—Outdoor (printed circuit)	15 0
AERAXIAL feeder cable per yard	10

When ordering please state present B.B.C. Station and I.T.A.
Orders over £2 post free.

C. & G. KITS
285, LOWER ADDISCOMBE ROAD,
ADDISCOMBE, CROYDON, SURREY
Phone: ADDiscombe 5262

We want to buy:-

BC 312, BC 342, BC 348R
AND
BC 610

ALTHAM RADIO CO.,

Jersey House, Jersey St., Manchester, 4.
Telephone: Central 7834/5/6

Largest stocks in Europe of Government surplus material.

TRANSFORMERS COILS LARGE OR SMALL QUANTITIES CHOKES 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., I.F.B., ETC
123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY
LIVINGSTONE 2261 EST. 1933

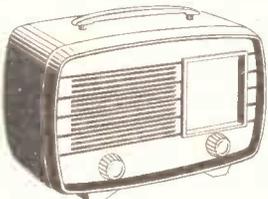
S.R. 3-4 WATT AMPLIFIER



PRICE **£5.15.0** Plus 3/6 postage and packing.

High quality three valve three watt amplifier for A.C. Mains 200/250 volts. Four controls give a wide tone variation. 3ohm speaker output. Chassis fully isolated. Valve line-up: 6SG7, 6V6, 6X5. Bronze finished chassis size 8in. x 4in. x 5in. high. Supplied built and tested, and guaranteed for twelve months (90 days valves).

BAKELITE CABINET



PRICE **15/6** Plus 3/- p.p.

Ideal for midget construction. Available in Walnut or Green. Size 12in. long, 7in. high, 5½in. deep. Complete with handle, back, dial and two knobs.

TERMS: Cash with order or C.O.D. (U.K. and N. Ireland only).

THE SUPEREX "55" BATTERY PORTABLE

FOUR VALVE SUPERHET

LONG WAVE MEDIUM WAVE

LARGE ELLIPTICAL SPEAKER

MINIATURE 87G VALVES



CABINET SIZE 10½" x 8½" x 4½"

BUILDING COST **£7.15.0**

plus 4/- carriage

SEND 1/6 FOR CONSTRUCTION BOOK

REPLACEMENT CHASSIS. Complete A.M. and A.M./F.M. Radiogram Chassis and Tuner Units. Ready built and fully guaranteed. Only require connecting to speaker and mains. A cheap way of modernizing your old radiogram.

RECORD PLAYERS. Latest four speed autochangers and single play units by Collaro, BSR and Garrard.

HIGH FIDELITY AMPLIFIERS. We can supply any of the high-quality amplifiers and pre-amplifiers by LEAK, QUAD, ARMSTRONG, GRAMPIAN and WHITELEY; also home construction kits suitable for OSRAM 912 and MULLARD 510.

QUALITY SPEAKERS. A good quality speaker is an essential part of any radio or sound system. Always in stock, speakers from 3½in. to 12in. by GOODMAN'S, WHITELEY, WHARFEDALE, G.E.C. and ELAC.

SUPERIOR BUREAU



An elegant cabinet in richly figured walnut veneer, internal panels in polished sycamore. A drop front lid covers a sloping, uncut control panel (16in. long x 10½in. high) alongside which is an uncut base-board (15½in. long x 13½in. back to front). The inside of the drop front lid is panelled in beige leatherette. In the lower part of the cabinet are two large storage cupboards (13½in. high, 7½in. wide, 16½in. deep). The lid and cupboard handles are in chased Florentine bronze. Overall dimensions (33in. high, 34in. long, 16½in. deep). **16 GNS.** PRICE Plus 25/- carriage.

Superior Radio supplies

37 HILLSIDE, (HARROW ROAD) STONEBRIDGE, N.W.10. *Elgar 3644*

SHOP OPEN: 9 a.m. to 6 p.m. Monday to Saturday; 1 p.m. Thursday.



Type P 50 Plug
Cylindrical bakelite case. Nickel plated metal parts. Ideal for amplifiers and other applications where concentric cable is used.

Midget Jack. P 73
Moulded bakelite. Suitable for switching-in high frequency circuits. Capacity between springs eliminated. Silver contacts, one hole fixing, perfect contact.



reliability PLUS delivery

Igranic Plugs and Jacks have always had a justifiable reputation for dependability. For radio, television, office appliances and the hundred and one industrial plug-in applications demand has hitherto outstripped supply. NOW, with increased production facilities, Igranic Plugs and Jacks are available again for manufacturers to whom only the best is good enough.

Type P 40 Plug
Moulded bakelite. Nickel plated metal parts. Especially suitable for extension speakers, headphones and similar application.



IGRANIC ELECTRIC COMPANY LIMITED HEAD OFFICE & WORKS BEDFORD

London and Export Office VICTORIA STATION HOUSE 191 VICTORIA STREET LONDON SW1 GRAMS IGRANIC LONDON
Branch Offices BIRMINGHAM BRISTOL CARDIFF EAST ANGLIA GLASGOW LEEDS MANCHESTER NEWCASTLE SHEFFIELD

A METAL INDUSTRIES GROUP COMPANY

BRIMAR. *D15 10/-; DAF91 18/-; DAF96 18/-; DFP91 16/-; DFP98 18/-; DK92 19/-; DK98 18/-; DL93 16/-; EBC41 14/-; ECC94 20/-; ECC95 20/-; ECP93 23/-; ECH42 18/-; ECL90 19/-; EF41 16/-; EF42 24/-; EF90 19/-; EF91 24/-; ELA1 16/-; EL42 18/-; EL64 16/-; EM71 24/-; *O02 17/-; OZ4 17/-; PC084 20/-; PC085 24/-; PC089 23/-; PL41 21/-; PL820 24/-; PY81 17/-; PY82 14/-; PY83 17/-; R2 14/-; R3 14/-; R10 34/-; R11 27/-; R12A 18/-; R16 27/-; *R17 17/-; R19 20/-; R52 14/-; UB041 14/-; UCH42 23/-; UF41 16/-; UL41 16/-; UY41 11/-; *VR75/30 17/-; *VR105/30 17/-; *VR150/30 15/-; *VA7GT 20/-; 1AC6 18/-; 1D5 14/-; 1D6 14/-; 1LA 8 18/-; 1LD5 18/-; 1R5 18/-; AS4 16/-; AS5 18/-; 1T4 16/-; 1U5 18/-; 2A3 20/-; 2D6 16/-; 3Q4 16/-; 3Q5GT 16/-; 3S4 16/-; 3V4 16/-; 4D1 13/-; 4U4G 20/-; 5V4G 14/-; 5Y3GT 14/-; 5Z3 20/-; 5Z4G 14/-; 6A7 25/-; 6A8G 22/-; 6AGT 23/-; 6AG5 24/-; 6AK3 18/-; 6AL5 19/-; 6AM5 18/-; 6AM6 24/-; 6AG5 18/-; 6AT6 14/-; 6AU3 24/-; 6B4 20/-; 6B8 20/-; 6B8T 20/-; 6B8A 16/-; 6BE8 18/-; 6BG6 24/-; 6BH 16/-; 6B18 16/-; 6BW6 18/-; 6BW7 19/-; 6C4 13/-; 6C8 21/-; 6C0 21/-; 6C0G 31/-; 6C8 27/-; 6D6 21/-; 6E5GT 18/-; 6E93 18/-; 6E7 23/-; 6G06 18/-; 6HGT 19/-; 6IGT 13/-; 6J7G 13/-; 6J8GT 18/-; 6KGT 18/-; 6K7 18/-; 6K7G 18/-; 6K8GT 18/-; 6K9 22/-; 6K9T 22/-; 6L6 24/-; 6L7 22/-; 6N7GT 21/-; 6G7G 16/-; 6Q7GT 18/-; 6R7G 16/-; 6S7 22/-; 6S7 18/-; 6S7GT 24/-; 6SN7GT 24/-; 6S7GT 18/-; 6U4GT 17/-; 6U5 68 18/-; 6U5 18/-; 6U6 18/-; 6U7G 18/-; 6V8 18/-; 6V8GT 18/-; 6X4 11/-; 6X5GT 14/-; 7A2 (5/7) 23/-; 7A3 23/-; 7B6 16/-; 7B7 18/-; 7C5 18/-; 7D3 22/-; 7D5 22/-; 7D6 22/-; 7D8 22/-; 7D9 18/-; 7E7 18/-; 7E7 16/-; 7E7 20/-; 7E7 23/-; 7Y4 14/-; 8D2 21/-; 8D3 24/-; 9BW6 16/-; 9D2 21/-; 9D8 18/-; 10D1 12/-; 11D3 23/-; 11D5 23/-; 12A6 18/-; 12A8 18/-; 12AT6 14/-; 12AT7 19/-; 12A7G 24/-; 12A7G 16/-; 12A7 19/-; 12BA6 16/-; 12BB6 16/-; 12BH7 22/-; 12C8GT 20/-; 12J5GT 13/-; 12J7GT 18/-; 12K7GT 18/-; 12K8 24/-; 12K8GT 23/-; 12Q7GT 16/-; 12SL7GT 24/-; 12S7GT 16/-; 12S7GT 18/-; *13D1 17/-; 14B6 16/-; 14H7 18/-; 14S7 22/-; 15A2 25/-; 15D2 25/-; 18 22/-; 19AQ5 18/-; 19BGG6 24/-; 20D9 25/-; 25A6G 18/-; 25L6GT 18/-; 25U4GT 17/-; 25Z4G 14/-; 35A5 18/-; 35L6GT 18/-; 35W4 11/-; 35Z3 14/-; 35Z4GT 14/-; 42 22/-; 43 22/-; 50A5 18/-; 50D5 18/-; 50D9G 21/-; 50L6GT 18/-; 75 23/-; 77 21/-; 80 14/-; 803 14/-; *83 15/-; *807 34/-; 1629 18/-

COSSOR. DD4 12/-; DD7 23/-; N14 18/-; MP/Pen (7/22)/; MVS/Pen (5/7) 21/-; MVS/Pen B 21/-; OM1 14/-; OM4 16/-; OM8 18/-; OM10 22/-; PT4 22/-; SD8 13/-; SD81 19/-; SUE150 27/-; SUE150A 27/-; 1CG8T 16/-; 2P 20/-; 4100B 20/-; 4TH 20/-; ATSA 27/-; 6A8 19/-; 6A8 18/-; 6AK3 18/-; 6A8 20/-; 6B5 16/-; 6B5 18/-; 6E7 19/-; *6F33 17/-; 6J8 24/-; 6S7 14/-; 6SH7 18/-; 6SL7GT 24/-; 6SN7GT 24/-; 6S7 14/-; 6V4 14/-; 7A7 20/-; 12G7 18/-; 13SP 24/-; 14U7 20/-; 52K 14/-; 53K 20/-; 54K 20/-; 61BT 24/-; 61ST 24/-; 62T 34/-; 62D7 14/-; 62T 18/-; 62VP 16/-; 62S 24/-; 65ME 18/-; 66KU 11/-; 67PT 16/-; 141T 18/-; 142B 18/-; 171DD 18/-; 185BT 34/-; 185TA 34/-; 202D7 23/-; 202ST 23/-; 202VP 21/-; 202VPE 21/-; 210DD7 16/-; 210D 12/-; 210PG 24/-; 210SP7 (7/20)/; 210VPA (7/20)/; 210VTP (7/20)/; 21P 8/-; 220T 24/-; 225DU 24/-; 220TA 23/-; 311SU 11/-; 332Pen 18/-; 405BU 27/-; 451PT 16/-

MAZDA. AC/HL 17/-; AC/HL D 25/-; AC/P4 24/-; AC/Pen (5/7) 24/-; AC/SG 24/-; AC/SG/VM 24/-; AC/TH1 27/-; AC/TP 27/-; AC/VP1 (5/7) 24/-; AC/VP2 24/-; AC2/Pen 24/-; AC2/Pen D 27/-; AC4/Pen 27/-; AC5/Pen 24/-; AC6/Pen D 27/-; D1 10/-; DD41 14/-; DL810 17/-; HL23 16/-; HL32DD 18/-; HL41 17/-; HL41DD 20/-; HL48DD 20/-; HL133DD 20/-; ME41 18/-; ME41 18/-; P61 17/-; PP250 27/-; Pen 25 18/-; Pen 45 27/-; Pen 45 24/-; Pen 45DD 24/-; Pen 46 27/-; Pen 383 24/-; Pen 384 20/-; Pen DD 4020 27/-; Pen DD 4020 27/-; PP25 23/-; SP41 24/-; SP41 24/-; SP181 24/-; SP210 20/-; T41 18/-; TH41 24/-; TH833 24/-; TP23 24/-; TP25 23/-; TP280 27/-; U22 27/-; U24 27/-; U25 24/-; U26 20/-; U31 20/-; U601 17/-; U251 24/-; U281 17/-; U282 20/-; U301 20/-; U403 17/-; U404 11/-; U801 24/-; U4020 17/-; UC92 13/-; U05 17/-; U08 17/-; U07 17/-; U08 24/-; U09 11/-; VP23 18/-; VP41 24/-; VP133 24/-; VP210 23/-; VP1322 24/-; 1C1 18/-; 1C2 18/-; 1F2 16/-; 1F3 16/-; 1F9 18/-; 1P1 16/-; 1P10 16/-; 1P11 16/-; 6C9 18/-; 6C10 18/-; 6C31 24/-; 6D1 10/-; 6D2 12/-; 6D3 23/-; 6F1 24/-; 6F11 18/-; 6F12 24/-; 6F13 24/-; 6F14 24/-; 6F15 16/-; 6K25 14/-; 6L1 24/-; 6/30L2 19/-; 6L18 16/-; 6L19 24/-; 6L24 16/-; 6L3 14/-; 6LD20 16/-; 6M1 18/-; 6M2 18/-; 6P1 20/-; 6P25 20/-; 6P26 18/-; 6P28 24/-; 10C1 18/-; 10C2 24/-; 10F1 24/-; 10F3 24/-; 10F9 16/-; 10L3 14/-; 10L11 16/-; 10L13 20/-; 10P4 20/-; 20D1 13/-; 20F2 24/-; 20L1 24/-; 20P1 24/-; 20P3 24/-; 20P4 24/-; 20P5 18/-; 30C1 23/-; 30F3 23/-; 30L1 20/-; 30P1 18/-

MARCONI. B36 25/-; B65 25/-; B152 19/-; B309 19/-; B319 20/-; B329 19/-; B339 19/-; B719 20/-; D42 13/-; D43 18/-; D63 19/-; D77 13/-; D152 12/-; *DA30 37/-; DAF91 18/-; DH63M 20/-; DH76 16/-; DH77 14/-; DE81 24/-; DE101 29/-; DE107 14/-; DE142 14/-; DE147 16/-; DE148 16/-; DE149 16/-; DE150 16/-; DE151 16/-; DE152 16/-; DE153 16/-; DE154 16/-; DE155 16/-; DE156 16/-; DE157 16/-; DE158 16/-; DE159 16/-; DE160 16/-; DE161 16/-; DE162 16/-; DE163 16/-; DE164 16/-; DE165 16/-; DE166 16/-; DE167 16/-; DE168 16/-; DE169 16/-; DE170 16/-; DE171 16/-; DE172 16/-; DE173 16/-; DE174 16/-; DE175 16/-; DE176 16/-; DE177 16/-; DE178 16/-; DE179 16/-; DE180 16/-; DE181 16/-; DE182 16/-; DE183 16/-; DE184 16/-; DE185 16/-; DE186 16/-; DE187 16/-; DE188 16/-; DE189 16/-; DE190 16/-; DE191 16/-; DE192 16/-; DE193 16/-; DE194 16/-; DE195 16/-; DE196 16/-; DE197 16/-; DE198 16/-; DE199 16/-; DE200 16/-; DE201 16/-; DE202 16/-; DE203 16/-; DE204 16/-; DE205 16/-; DE206 16/-; DE207 16/-; DE208 16/-; DE209 16/-; DE210 16/-; DE211 16/-; DE212 16/-; DE213 16/-; DE214 16/-; DE215 16/-; DE216 16/-; DE217 16/-; DE218 16/-; DE219 16/-; DE220 16/-; DE221 16/-; DE222 16/-; DE223 16/-; DE224 16/-; DE225 16/-; DE226 16/-; DE227 16/-; DE228 16/-; DE229 16/-; DE230 16/-; DE231 16/-; DE232 16/-; DE233 16/-; DE234 16/-; DE235 16/-; DE236 16/-; DE237 16/-; DE238 16/-; DE239 16/-; DE240 16/-; DE241 16/-; DE242 16/-; DE243 16/-; DE244 16/-; DE245 16/-; DE246 16/-; DE247 16/-; DE248 16/-; DE249 16/-; DE250 16/-; DE251 16/-; DE252 16/-; DE253 16/-; DE254 16/-; DE255 16/-; DE256 16/-; DE257 16/-; DE258 16/-; DE259 16/-; DE260 16/-; DE261 16/-; DE262 16/-; DE263 16/-; DE264 16/-; DE265 16/-; DE266 16/-; DE267 16/-; DE268 16/-; DE269 16/-; DE270 16/-; DE271 16/-; DE272 16/-; DE273 16/-; DE274 16/-; DE275 16/-; DE276 16/-; DE277 16/-; DE278 16/-; DE279 16/-; DE280 16/-; DE281 16/-; DE282 16/-; DE283 16/-; DE284 16/-; DE285 16/-; DE286 16/-; DE287 16/-; DE288 16/-; DE289 16/-; DE290 16/-; DE291 16/-; DE292 16/-; DE293 16/-; DE294 16/-; DE295 16/-; DE296 16/-; DE297 16/-; DE298 16/-; DE299 16/-; DE300 16/-; DE301 16/-; DE302 16/-; DE303 16/-; DE304 16/-; DE305 16/-; DE306 16/-; DE307 16/-; DE308 16/-; DE309 16/-; DE310 16/-; DE311 16/-; DE312 16/-; DE313 16/-; DE314 16/-; DE315 16/-; DE316 16/-; DE317 16/-; DE318 16/-; DE319 16/-; DE320 16/-; DE321 16/-; DE322 16/-; DE323 16/-; DE324 16/-; DE325 16/-; DE326 16/-; DE327 16/-; DE328 16/-; DE329 16/-; DE330 16/-; DE331 16/-; DE332 16/-; DE333 16/-; DE334 16/-; DE335 16/-; DE336 16/-; DE337 16/-; DE338 16/-; DE339 16/-; DE340 16/-; DE341 16/-; DE342 16/-; DE343 16/-; DE344 16/-; DE345 16/-; DE346 16/-; DE347 16/-; DE348 16/-; DE349 16/-; DE350 16/-; DE351 16/-; DE352 16/-; DE353 16/-; DE354 16/-; DE355 16/-; DE356 16/-; DE357 16/-; DE358 16/-; DE359 16/-; DE360 16/-; DE361 16/-; DE362 16/-; DE363 16/-; DE364 16/-; DE365 16/-; DE366 16/-; DE367 16/-; DE368 16/-; DE369 16/-; DE370 16/-; DE371 16/-; DE372 16/-; DE373 16/-; DE374 16/-; DE375 16/-; DE376 16/-; DE377 16/-; DE378 16/-; DE379 16/-; DE380 16/-; DE381 16/-; DE382 16/-; DE383 16/-; DE384 16/-; DE385 16/-; DE386 16/-; DE387 16/-; DE388 16/-; DE389 16/-; DE390 16/-; DE391 16/-; DE392 16/-; DE393 16/-; DE394 16/-; DE395 16/-; DE396 16/-; DE397 16/-; DE398 16/-; DE399 16/-; DE400 16/-; DE401 16/-; DE402 16/-; DE403 16/-; DE404 16/-; DE405 16/-; DE406 16/-; DE407 16/-; DE408 16/-; DE409 16/-; DE410 16/-; DE411 16/-; DE412 16/-; DE413 16/-; DE414 16/-; DE415 16/-; DE416 16/-; DE417 16/-; DE418 16/-; DE419 16/-; DE420 16/-; DE421 16/-; DE422 16/-; DE423 16/-; DE424 16/-; DE425 16/-; DE426 16/-; DE427 16/-; DE428 16/-; DE429 16/-; DE430 16/-; DE431 16/-; DE432 16/-; DE433 16/-; DE434 16/-; DE435 16/-; DE436 16/-; DE437 16/-; DE438 16/-; DE439 16/-; DE440 16/-; DE441 16/-; DE442 16/-; DE443 16/-; DE444 16/-; DE445 16/-; DE446 16/-; DE447 16/-; DE448 16/-; DE449 16/-; DE450 16/-; DE451 16/-; DE452 16/-; DE453 16/-; DE454 16/-; DE455 16/-; DE456 16/-; DE457 16/-; DE458 16/-; DE459 16/-; DE460 16/-; DE461 16/-; DE462 16/-; DE463 16/-; DE464 16/-; DE465 16/-; DE466 16/-; DE467 16/-; DE468 16/-; DE469 16/-; DE470 16/-; DE471 16/-; DE472 16/-; DE473 16/-; DE474 16/-; DE475 16/-; DE476 16/-; DE477 16/-; DE478 16/-; DE479 16/-; DE480 16/-; DE481 16/-; DE482 16/-; DE483 16/-; DE484 16/-; DE485 16/-; DE486 16/-; DE487 16/-; DE488 16/-; DE489 16/-; DE490 16/-; DE491 16/-; DE492 16/-; DE493 16/-; DE494 16/-; DE495 16/-; DE496 16/-; DE497 16/-; DE498 16/-; DE499 16/-; DE500 16/-; DE501 16/-; DE502 16/-; DE503 16/-; DE504 16/-; DE505 16/-; DE506 16/-; DE507 16/-; DE508 16/-; DE509 16/-; DE510 16/-; DE511 16/-; DE512 16/-; DE513 16/-; DE514 16/-; DE515 16/-; DE516 16/-; DE517 16/-; DE518 16/-; DE519 16/-; DE520 16/-; DE521 16/-; DE522 16/-; DE523 16/-; DE524 16/-; DE525 16/-; DE526 16/-; DE527 16/-; DE528 16/-; DE529 16/-; DE530 16/-; DE531 16/-; DE532 16/-; DE533 16/-; DE534 16/-; DE535 16/-; DE536 16/-; DE537 16/-; DE538 16/-; DE539 16/-; DE540 16/-; DE541 16/-; DE542 16/-; DE543 16/-; DE544 16/-; DE545 16/-; DE546 16/-; DE547 16/-; DE548 16/-; DE549 16/-; DE550 16/-; DE551 16/-; DE552 16/-; DE553 16/-; DE554 16/-; DE555 16/-; DE556 16/-; DE557 16/-; DE558 16/-; DE559 16/-; DE560 16/-; DE561 16/-; DE562 16/-; DE563 16/-; DE564 16/-; DE565 16/-; DE566 16/-; DE567 16/-; DE568 16/-; DE569 16/-; DE570 16/-; DE571 16/-; DE572 16/-; DE573 16/-; DE574 16/-; DE575 16/-; DE576 16/-; DE577 16/-; DE578 16/-; DE579 16/-; DE580 16/-; DE581 16/-; DE582 16/-; DE583 16/-; DE584 16/-; DE585 16/-; DE586 16/-; DE587 16/-; DE588 16/-; DE589 16/-; DE590 16/-; DE591 16/-; DE592 16/-; DE593 16/-; DE594 16/-; DE595 16/-; DE596 16/-; DE597 16/-; DE598 16/-; DE599 16/-; DE600 16/-; DE601 16/-; DE602 16/-; DE603 16/-; DE604 16/-; DE605 16/-; DE606 16/-; DE607 16/-; DE608 16/-; DE609 16/-; DE610 16/-; DE611 16/-; DE612 16/-; DE613 16/-; DE614 16/-; DE615 16/-; DE616 16/-; DE617 16/-; DE618 16/-; DE619 16/-; DE620 16/-; DE621 16/-; DE622 16/-; DE623 16/-; DE624 16/-; DE625 16/-; DE626 16/-; DE627 16/-; DE628 16/-; DE629 16/-; DE630 16/-; DE631 16/-; DE632 16/-; DE633 16/-; DE634 16/-; DE635 16/-; DE636 16/-; DE637 16/-; DE638 16/-; DE639 16/-; DE640 16/-; DE641 16/-; DE642 16/-; DE643 16/-; DE644 16/-; DE645 16/-; DE646 16/-; DE647 16/-; DE648 16/-; DE649 16/-; DE650 16/-; DE651 16/-; DE652 16/-; DE653 16/-; DE654 16/-; DE655 16/-; DE656 16/-; DE657 16/-; DE658 16/-; DE659 16/-; DE660 16/-; DE661 16/-; DE662 16/-; DE663 16/-; DE664 16/-; DE665 16/-; DE666 16/-; DE667 16/-; DE668 16/-; DE669 16/-; DE670 16/-; DE671 16/-; DE672 16/-; DE673 16/-; DE674 16/-; DE675 16/-; DE676 16/-; DE677 16/-; DE678 16/-; DE679 16/-; DE680 16/-; DE681 16/-; DE682 16/-; DE683 16/-; DE684 16/-; DE685 16/-; DE686 16/-; DE687 16/-; DE688 16/-; DE689 16/-; DE690 16/-; DE691 16/-; DE692 16/-; DE693 16/-; DE694 16/-; DE695 16/-; DE696 16/-; DE697 16/-; DE698 16/-; DE699 16/-; DE700 16/-; DE701 16/-; DE702 16/-; DE703 16/-; DE704 16/-; DE705 16/-; DE706 16/-; DE707 16/-; DE708 16/-; DE709 16/-; DE710 16/-; DE711 16/-; DE712 16/-; DE713 16/-; DE714 16/-; DE715 16/-; DE716 16/-; DE717 16/-; DE718 16/-; DE719 16/-; DE720 16/-; DE721 16/-; DE722 16/-; DE723 16/-; DE724 16/-; DE725 16/-; DE726 16/-; DE727 16/-; DE728 16/-; DE729 16/-; DE730 16/-; DE731 16/-; DE732 16/-; DE733 16/-; DE734 16/-; DE735 16/-; DE736 16/-; DE737 16/-; DE738 16/-; DE739 16/-; DE740 16/-; DE741 16/-; DE742 16/-; DE743 16/-; DE744 16/-; DE745 16/-; DE746 16/-; DE747 16/-; DE748 16/-; DE749 16/-; DE750 16/-; DE751 16/-; DE752 16/-; DE753 16/-; DE754 16/-; DE755 16/-; DE756 16/-; DE757 16/-; DE758 16/-; DE759 16/-; DE760 16/-; DE761 16/-; DE762 16/-; DE763 16/-; DE764 16/-; DE765 16/-; DE766 16/-; DE767 16/-; DE768 16/-; DE769 16/-; DE770 16/-; DE771 16/-; DE772 16/-; DE773 16/-; DE774 16/-; DE775 16/-; DE776 16/-; DE777 16/-; DE778 16/-; DE779 16/-; DE780 16/-; DE781 16/-; DE782 16/-; DE783 16/-; DE784 16/-; DE785 16/-; DE786 16/-; DE787 16/-; DE788 16/-; DE789 16/-; DE790 16/-; DE791 16/-; DE792 16/-; DE793 16/-; DE794 16/-; DE795 16/-; DE796 16/-; DE797 16/-; DE798 16/-; DE799 16/-; DE800 16/-; DE801 16/-; DE802 16/-; DE803 16/-; DE804 16/-; DE805 16/-; DE806 16/-; DE807 16/-; DE808 16/-; DE809 16/-; DE810 16/-; DE811 16/-; DE812 16/-; DE813 16/-; DE814 16/-; DE815 16/-; DE816 16/-; DE817 16/-; DE818 16/-; DE819 16/-; DE820 16/-; DE821 16/-; DE822 16/-; DE823 16/-; DE824 16/-; DE825 16/-; DE826 16/-; DE827 16/-; DE828 16/-; DE829 16/-; DE830 16/-; DE831 16/-; DE832 16/-; DE833 16/-; DE834 16/-; DE835 16/-; DE836 16/-; DE837 16/-; DE838 16/-; DE839 16/-; DE840 16/-; DE841 16/-; DE842 16/-; DE843 16/-; DE844 16/-; DE845 16/-; DE846 16/-; DE847 16/-; DE848 16/-; DE849 16/-; DE850 16/-; DE851 16/-; DE852 16/-; DE853 16/-; DE854 16/-; DE855 16/-; DE856 16/-; DE857 16/-; DE858 16/-; DE859 16/-; DE860 16/-; DE861 16/-; DE862 16/-; DE863 16/-; DE864 16/-; DE865 16/-; DE866 16/-; DE867 16/-; DE868 16/-; DE869 16/-; DE870 16/-; DE871 16/-; DE872 16/-; DE873 16/-; DE874 16/-; DE875 16/-; DE876 16/-; DE877 16/-; DE878 16/-; DE879 16/-; DE880 16/-; DE881 16/-; DE882 16/-; DE883 16/-; DE884 16/-; DE885 16/-; DE886 16/-; DE887 16/-; DE888 16/-; DE889 16/-; DE890 16/-; DE891 16/-; DE892 16/-; DE893 16/-; DE894 16/-; DE895 16/-; DE896 16/-; DE897 16/-; DE898 16/-; DE899 16/-; DE900 16/-; DE901 16/-; DE902 16/-; DE903 16/-; DE904 16/-; DE905 16/-; DE906 16/-; DE907 16/-; DE908 16/-; DE909 16/-; DE910 16/-; DE911 16/-; DE912 16/-; DE913 16/-; DE914 16/-; DE915 16/-; DE916 16/-; DE917 16/-; DE918 16/-; DE919 16/-; DE920 16/-; DE921 16/-; DE922 16/-; DE923 16/-; DE924 16/-; DE925 16/-; DE926 16/-; DE927 16/-; DE928 16/-; DE929 16/-; DE930 16/-; DE931 16/-; DE932 16/-; DE933 16/-; DE934 16/-; DE935 16/-; DE936 16/-; DE937 16/-; DE938 16/-; DE939 16/-; DE940 16/-; DE941 16/-; DE942 16/-; DE943 16/-; DE944 16/-; DE945 16/-; DE946 16/-; DE947 16/-; DE948 16/-; DE949 16/-; DE950 16/-; DE951 16/-; DE952 16/-; DE953 16/-; DE954 16/-; DE955 16/-; DE956 16/-; DE957 16/-; DE958 16/-; DE959 16/-; DE960 16/-; DE961 16/-; DE962 16/-; DE963 16/-; DE964 16/-; DE965 16/-; DE966 16/-; DE967 16/-; DE968 16/-; DE969 16/-; DE970 16/-; DE971 16/-; DE972 16/-; DE973 16/-; DE974 16/-; DE975 16/-; DE976 16/-; DE977 16/-; DE978 16/-; DE979 16/-; DE980 16/-; DE981 16/-; DE982 16/-; DE983 16/-; DE984 16/-; DE985 16/-; DE986 16/-; DE987 16/-; DE988 16/-; DE989 16/-; DE990 16/-; DE991 16/-; DE992 16/-; DE993 16/-; DE994 16/-; DE995 16/-; DE996 16/-; DE997 16/-; DE998 16/-; DE999 16/-; DE1000 16/-

MULLARD. AZ1 17/-; AZ21 14/-; AZ21 14/-; CBL1 27/-; CBL3 122/-; CCR35 22/-; CL4 22/-; CY1 17/-; CY31 14/-; DAC32(M/CL) 18/-; DAF91 18/-; DAF96 18/-; DCC90 24/-; DFC3(M/CL) 18/-; DFP91 16/-; DFP92 18/-; DFP96 16/-; DFP97 16/-; DFP98 18/-; DFP99 18/-; DKA0 22/-; DKB1 18/-; DKB2 18/-; DKB3 18/-; DKB4 18/-; DKB5 18/-; DKB6 18/-; DKB7 18/-; DKB8 18/-; DKB9 18/-; DKB10 18/-; DKB11 18/-; DKB12 18/-; DKB13 18/-; DKB14 18/-; DKB15 18/-; DKB16 18/-; DKB17 18/-; DKB18 18/-; DKB19 18/-; DKB20 18/-; DKB21 18/-; DKB22 18/-; DKB23 18/-; DKB24 18/-; DKB25 18/-; DKB26 18/-; DKB27 18/-; DKB28 18/-; DKB29 18/-; DKB30 18/-; DKB31 18/-; DKB32 18/-; DKB33 18/-

Connoisseur 3 SPEED MOTOR

The turntable with a 4% variation on all three speeds.

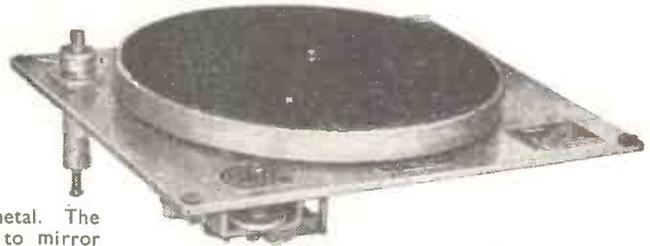
The Connoisseur motor is made for the perfectionist. It is one of the finest turntables in the world.

The speed change is arranged mechanically and gives a 4 per cent variation on all speeds. A synchronous motor, which is virtually vibrationless with low noise level and hum induction, maintains a constant speed at all settings. There is no braking action to obtain speed change.

The 12in. turntable is lathe turned in non-ferrous metal. The main spindle, which is precision ground and lapped to mirror finish, runs in phosphor bronze bearings.

A sound, precision engineering job, the Connoisseur motor provides the foundation for perfect reproduction.

Price £20, plus P. Tax £8/11/-.



Matching Connoisseur Pick-up Mark II with a frequency range from 20-20,000 cycles:

Pick-up complete with 1 head fitted with Diamond armature £8/19/- plus P. Tax £3/16/6.

A. R. SUGDEN & CO. (ENGINEERS) LTD.

WELL GREEN LANE, BRIGHOUSE, YORKSHIRE. Phone: Halifax 69169. Grams: Connoisseur, Brighouse.

OVERSEAS AGENTS:

SOUTH AFRICA: W. L. Proctor (Pty.) Ltd., 63, Strand Street, Cape Town. **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.

MAIN DISTRIBUTORS:

AUSTRALIA: British Merchandising Pty. Ltd., 183, Pitt Street, Sydney, and J. H. Magrath (Pty.) Ltd., 208, Little Lonsdale Street, Melbourne. **EAST AFRICA:** International Aeradio (East Africa) Ltd., P.O. Box 3133, Nairobi. **MALAYA:** Eastland Trading Co., 1, Prince Street, Singapore.

MODERN ELECTRICS LTD.

164 Charing Cross Road, London, W.C.2.

Tel.: TEMple Bar 7587. Covent Gdn. 1703.

Cables: Modcharex, London. Prompt attention to post orders.

Export enquiries invited.

Correspondence in French or English.

TAPE RECORDERS	
GRUNDIG TK5	46 gns.
GRUNDIG TK8	72 gns.
GRUNDIG TK820/3D	98 gns.
SIMON	75 gns.
FERROGRAPH 2A/N	76 gns.
FERROGRAPH 2A/N/H	86 gns.
VORTEXION 2A	80 gns.
VORTEXION 2B	£99
BRENNEL 3 SPEED	48 gns.
ELIZABETHAN	65 gns.

Recording Tapes from stock.	
	1,200ft. 600ft.
FERROGRAPH	45/- 26/9
GRUNDIG BASF	40/- 25/-
SCOTCH BOY	35/- 21/-
EMI 77	48/-
EMI 88	35/- 21/-
AGFA	37/6 22/6
GEVAERT	35/- 21/-
PURETONE	20/-
SCOTCH BOY, EMI, BASF, LONG PLAY TAPES	

TAPE DECKS	
WEARITE	£35 0 0
COLLARO Transcripator	£20 0 0

GARRARD AUTO UNITS	
RC98 4 speed	£19 17 7
RC88 4 speed	£17 18 8
RC121D 4 speed	£13 13 10

TRANSCRIPTION UNITS	
Connoisseur	£28 11 0
Garrard 301	£26 8 3
Lenco	£17 10 4

SPEAKERS	
W.B. STENTORIAN	
HF816	£6 17 0
T816	£6 10 0
HF812	£4 3 6
HF912	£4 8 6
HF1012 Universal coll	£4 19 9

GOODMANS	
Axiom 150 Mk. II	£10 15 9
Axiom 22	£15 9 0
Axiette	£6 18 6

WHARFEDALE	
W15CS	£17 10 0
Super 12CS/AL	£17 10 0
W12/CS	£10 5 0
Golden 10 CSB	£8 14 11
Super 8CS/AL	£7 6 11
Super 3	£7 0 11
W.B. Tweeter 10in.	£4 17 3
Bronze 8in.	£3 10 0
W.B. Crossover Unit	£1 10 0
W.B. Tweeter Unit...	£4 4 0
Kelly Ribbon Tweeter	£12 12 0

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 Mk III	£75 0 0
D.C. Minor	£5 5 0
10kV Multiplier for Model 8	£3 5 0
Carrying Cases for Models 7, 8 and 40	£3 0 0

ADVANCE	
H.1. (Sig./Gen.)	£28 0 0
E.2. (Sig./Gen.)	£32 10 0
P.1	£22 5 0
J.2	£45 0 0

COSSOR	
Oscilloscope 103S	£120 0 0
Oscilloscope 1052	£104 0 0
Volt: Calibrator 1433	£18 5 0

TAYLOR	
All new Taylor Test Gear in stock.	

PICKUPS AND PLAYERS	
ACOS, DECCA, COLLARO, CONNOISSEUR, LEAK, FERRANTI, B.J., GARRARD PHILIPS.	

MICROPHONES	
ACOS	
Mic 22 (Crystal)	£4 4 0
Mic inserts for above	£1 0 0
Mic 33-1	£2 10 0
Mic 35-1 (Crystal)	£1 5 0

LUSTRAPHONE	
M/C High Imp.	£5 15 6
LFV59 Dynamic	£8 18 6

RESLO	
VMC (low imp.)	£6 0 0
RBL/T	£8 15 0

FILM INDUSTRIES	
Ribbon	£8 15 0

MICROPHONE STANDS	
Floor, 3 extensions	£3 12 6
Table Stand	£1 5 0

LEAK AMPLIFIERS	
TL10 complete	£28 7 0
Point 1, TL12	£28 7 0
Point 2, TL25	£34 7 0
RCA	£48 0 0

QUAD, Mk. II	
MULLARD	£18 18 0
E.A.R. 4 watt	£9 9 0
TRIX 4 watt	£16 10 0

ALL GARRARD, CONNOISSEUR, DECCA and COLLARO HEADS. SAPPHIRE and DIAMOND STYL! for the above HEADS NOW AVAILABLE.

R. S. C. BATTERY CHARGING EQUIPMENT

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

ASSEMBLED CHARGER

6 v., or 12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use with mains and output leads. Double Fused. Only **46/9** carr. 3/6.



ASSEMBLED CHARGERS

6 v. 1 amp. 19/9
6 v. or 12 v. 1 amp. 25/9
6 v. 2 amps. 29/9
6 v. or 12 v. 2 amps. 38/9
6 v. or 12 v. 4 amps. 56/9
Above ready for use. Carr. 2/9.

HEAVY DUTY KIT

12 v. 30 amp. Suitable for garage or firm with a number of vehicles. Mains input 200/250 v. 50 c/s. Outputs 12 v. 15 amp. twice. Consists of Mains Trans. 2 Metal Rectifiers. 2 Meters. 4 Fuses. 4 Terminals. 2 Rheostats and Circuit. Only 9 gns. carr. 15/..

BATTERY CHARGER KITS

Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse-holders, Grommets, panels and circuit. Carr. 2/6 extra.

6 v. or 12 v. 1 amp. 22/9
6 v. 2 amps. 25/9
6 v. or 12 v. 2 amps. 31/6
6 v. or 12 v. 4 amps. 49/9

BATTERY CHARGER KIT

Consisting of F.W. Bridge Rectifier 6/12 v. 5 a. Mains Trans., 0-9-15 v. 6 a. output, and variable charge rheostat with knob. Only 45/9. Post 3/-



Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge selector. Also selector plug for 6 v. or 12 v. charging. Double fused. Well ventilated steel case with blue hammer finish. **69/6**
Ready for use with mains and output leads. Carr. 3/9.

SELENIUM RECTIFIERS

L.T. Types	6/12 v. 6 a. 19/9	6/12 v. 10 a. 25/9
2/6 v. 1/2 a.h.w. 1/9	H.T. Type H.W.	
6/12 v. 1/2 a.h.w. 2/9	120 v. 40 mA. 3/9	
F.W. Bridge Types	250 v. 50 mA. 5/9	
6/12 v. 1 a. 4/11	250 v. 80 mA. 7/9	
6/12 v. 2 a. 8/9	250 v. 150 mA. 9/9	
6/12 v. 3 a. 11/9	300 v. 275 mA. 12/11	
6/12 v. 4 a. 14/9		

CO-AXIAL CABLE. 75 ohms, 1/4 in., 8d. yard. Twin screened feeder, 11d. yard.

5 CORE FLEX. Henleys circular rubber 14/36. Each lead colour coded. 1/6 yd.

DIAL BULBS, M.E.S., 8 v. 0.2 a., 6/9 doz. 6.5 v. 0.3 a., 6/9 doz.

ELECTROLYTICS (current production). NOT EX Govt.

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

Many others in stock.

VOLUME CONTROLS with long spindles, all values, less switch, 2/9; with S.P. switch, 3/9.

EX GOVT. STEP UP/STEP DOWN TRANSFORMERS. Double wound 80/100 watts. 10-0-100-200-220-240 v. to 5-0-75-115-125-135 v. or Reverse. Only 11/9, plus 2/9 post.

EX GOVT. METAL BLOCK PAPER CONDENSERS

4 mfd. 500 v. 2/3	8 mfd. 500 v. 4/-
4 mfd. 1,000 v. 3/9	10 mfd. 500 v. 4/9
4 mfd. 1,500 v. 5/9	8 mfd. 500 v. 5/11
4 mfd. 400 v. plus 2 mfd. 250 v. 1/11	

EX GOVT. VALVES. VR137, EA50, EB34, 11d.; SP61 2/3; 4SH4 1/3; EL32 3/9; VS110 1/11; KT44 4/9; 6J5 3/9; 6V6G, 5U4G 5/9; 6K7G, 2/11; 35Z4, 6X4 5/9; EZ90, EF80 7/9.

EX GOVT. UNITS, type RDF1 in original sealed cartons with 14 valves including 5Z4G, etc., trans., L.F. choke, Rectifier, etc., etc. We cannot enter into correspondence regarding these units which represent a really exceptional bargain at 29/9. Carr. 7/6.

OIL FILLED BLOCK CONDENSERS

Bryce 11-7 mfd. 500 v. New unused Govt. surplus, only 5/9 each.

THE SKY FOUR T.R.F. RECEIVER



A design of a 3 valve 200-250 v. A.C. Mains receiver with selenium rectifier. For inclusion in cabinet illustrated above or walnut veneered type. It employs valves 6K7, SP61, 6F6G, and is specially designed for simplicity in wiring. Sensitivity and quality is well up to standard. Point-to-Point wiring diagrams, instructions and parts list, 1/9. This receiver can be built for a maximum of £4/19/6 including cabinet. Available in brown or cream bakelite or veneered walnut.

EX GOVT. MAINS TRANSFORMERS

All 230 v. 50 c/s. input	
120-0-120 v. 40 mA. 5/9	
300-0-300 v. 150 mA., 4 v. 3 a. 9/9	
250-0-250 v. 80 mA., 6.3 v. 3 a., 6.3 v. 1 a. Potted 4 1/2-3 1/2 in. 11/9	
460 v. 200 mA., 6.3 v. 5 a. 22/9	

MANUFACTURERS SURPLUS TRANSFORMERS

Fully shrouded upright. Primary 200-230-250 v. Sec. 425-0-425 v. 150 mA. 6.3 v. 3 a., 5 v. 3 a., 33/9. Clamped type 325-0-325 v. 100 mA., 6.3 v. 3.5 a., 5 v. 2 a. Wearite 19/9. 230-0-230 v. 60 mA., 6.3 v. 2.5 a. Midget, 2 1/2 x 3 x 2 1/2 in. approx., 11/9. Post 2/9 on any of above.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 in. approx. Completely replaces batteries supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s. is available. Suitable for all battery portable receivers requiring 1.4 v. and 90 v. This includes latest low consumption types. Complete kit with diagrams 39/9, or ready for use, 46/9.



MINIATURE MOTORS. 24/28 v. D.C. or A.C. Size only 2 1/2 x 1 1/2 in. Spindle 1 1/2 in. long, 1/4 in. diam. Made by Hoover Ltd., Canada. Price only 9/11.

VIBRATORS. Oak 2 v. 7 pin. synchronous, 7/9.

EX GOVT. SMOOTHING CHOKES

250 mA., 5 H., 50 ohms 12/9
250 mA., 3 H., 50 ohms 8/9
150 mA., 10 H., 50 ohms 10/11
150 mA., 6-10 H., 150 ohms, Tropicalised 6/9
100 mA., 10 H., 100 ohms, Parmeko 6/9
100 mA., 5 H., 100 ohms, Tropicalised 3/11
50 mA., 5 H., 1,000 ohms 6/9
L.T. type 1 amp., 2 ohms 2/9

SPECIAL OFFERS. Small 2 gang variables .0005 mfd., 4/9. 8-8 mfd., 450 v. Electrolytics (midget) in lots of six, 1/6 ea. 32-32-32 mfd. 250 v. 2 x 1 1/2 in. In lots of six, 2/3 ea.

MAINS ENERGISSED SPEAKERS R.A. 2-3 ohms. 8 in. Field 600 ohms, 10/9.

T.V. CABINETS. For 15, 16 or 17 in. tube. Table model with doors, 79/6, carr. 7/6.

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, 2 1/2-3 1/2 in. 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 v. 4 a., c.t., 0-4-5 v. 3 a. 25/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a. 25/9
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 v. 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
300-0-300 v. 130 mA., 6.3 v. 4 a., c.t., 6.3 v. 1 a., suitable for Mullard 510 Amplifier 33/9
350-0-350 v. 100 mA., 6.3 v.-4 v. 4 a., c.t., 0-4-5 v. 3 a. 26/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a. 33/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a. 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

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 v. 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. 3 a. 22/9
350-0-350 v. 100 mA., 6.3 v.-4 v. 4 a. c.t., 0-4-5 v. 3 a. 23/9
350-0-350 v. 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., 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	0-2-4-5-6-3 v. 16/9
6.3 v. 2 a. 7/6	4 a. 17/6
0-4-6-3 v. 2 a. 7/9	6.3 v. 6 a. 17/6
6-6.3 v. 3 a. 8/11	12 v. 3 a. or 24 v. 1.5 a. 17/6

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s. Primaries: 0-9-15 v. 1 1/2 a., 11/9; 0-9-15 v. 3 a., 16/9; 0-3.5-9-17 v. 3 a., 17/9; 0-9-15 v. 5 a., 19/9; 0-9-15 v. 6 a., 23/9.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.	
120 v. 40 mA., 5-0-5 v. 1 a. 14/9	
90 v. 15 mA., 6-0-6 v. 250 mA. 9/11	

OUTPUT TRANSFORMERS

Midget Battery Pentode 661 for 3S4, etc. Small Pentode 5,000Ω to 3Ω 3/6
Standard Pentode, 5,000Ω to 3Ω 3/9
Standard Pentode, 8,000Ω to 3Ω 4/9
Multi-ratio 40 MA. 30:1, 45:1, 60:1, 90:1, Class B Push-Pull 5/6
Push-Pull 8 Watts 6V6 to 5 ohms 8/9
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω 15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω 16/9
Push-Pull 15-18 Watts, sectionally wound, 6L6, KT66, etc., to 3 or 15 ohms 21/9
Push-Pull 20 Watt high-quality sectionally wound, 6L6, KT66, etc., to 3 or 15Ω 47/9
Williamson type exact to spec. 85/-

SMOOTHING CHOKES

250 mA., 5 H., 100 ohms 11/9
150 mA., 7-10 H., 250 ohms 11/9
100 mA., 10 H., 200 ohms 8/6
80 mA., 10 H., 350 ohms 5/6
60 mA., 10 H., 400 ohms 4/11

R.S.C. A6 ULTRA LINEAR 30 WATT AMPLIFIER

NEW 1956 DESIGN. HIGH FIDELITY PUSH-PULL UNIT EMPLOYING SIX VALVES. Tone Control Pre-amp stages are incorporated. Sensitivity is extremely high. Only 30 millivolts minimum input is required for full output. THIS ENSURES THE SUITABILITY OF ANY TYPE OR MAKE OF MICROPHONE OR PICK-UP. Separate Bass and Treble controls give both "lift" and "cut" with ample tone correction for long playing records. AN OUTPUT SOCKET WITH PLUG IS INCLUDED FOR SUPPLY OF 300 v. 20 mA. and 6.3 v. 1.5 a. FOR A RADIO FEEDER UNIT. Price in kit form with easy-to-follow wiring diagrams. 9 GNS.

Only 9 carr. 10/-

Or Factory built with 12 months' guarantee, 50/- extra. TERMS ON ASSEMBLED UNITS with extra input. DEPOSIT 28/9 and 9 monthly payments of 28/9. If required an extra input with associated vol. control can be provided so that two separate inputs such as "mike" and gram, etc. etc., can be simultaneously applied for mixing purposes. Extra cost of this 13/- . Cover as illustrated 17/6 extra.



Type 807 output valves are used with High Quality Sectionally wound output transformer specially designed for Ultra Linear operation. Negative feedback of 17 D.B. in main loop. CERTIFIED PERFORMANCE FIGURES ARE EQUAL TO MOST EXPENSIVE UNITS AVAILABLE. Frequency response \pm 3 D.B., 30-20,000 c/c.s., 12 D.B. "lift" at 50 c/c.s., 12 D.B. "lift" at 12,000 c/c.s., Hum and noise 70 D.B. down. Good quality reliable components used. Chassis finish blue crackle. Overall size 12 x 9 x 9in. approx. Power consumption 150 watts. For A.C. mains 200-230-250 v. 50 c/c.s. Outputs for 3 and 15 ohm speakers. EQUALLY SUITABLE FOR THE CONNOISSEUR OR FOR LARGE HALLS, CLUBS, or OUTSIDE FUNCTIONS. IDEAL FOR USE WITH MUSICAL INSTRUMENTS SUCH AS STRING BASS, ELECTRONIC ORGAN, GUITAR, etc. FOR DANCE

BANDS, GARRISON THEATRES, etc. etc. We can supply Microphones, Speakers, Rotary Converters, etc., at keen cash prices or on terms with amplifiers.

EXPORT ENQUIRIES INVITED

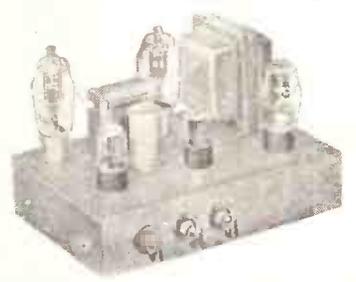
R.S.C. TA1 HIGH QUALITY TAPE DECK AMPLIFIER

FOR ALL DECKS WITH HIGH IMPEDANCE RECORD/PLAYBACK AND ERASE HEADS. Such as Lane, Truvox, etc., or matched to low impedance erase heads as fitted latest COLLABO TAPE TRANSCRIBER. Chassis size 12-7-3in. Overall size 12-7-6in. For 230-250 v. 50 c/c.s. A.C. mains. Output for standard 2-3 ohm speaker. Only 15 millivolts input required for full recording. Only 2 millivolts minimum input required from recording head. Magic Eye recording level indicator. Provision for feeding P.A. amplifier. Can be used as gram. amplifier with input of 0.75 v. R.M.S. Negative feedback equalisation. Linear frequency response \pm 3 D.B. 50-11,000 c/c.s. Facilities for recordings at 15in., 7in. or 3in.

11 Ready for use per second. Automatic equalisation at the turn of a knob. When switching from record to playback position automatic demagnetisation of heads is assured. PERFORMANCE IS COMPARABLE WITH UNITS AT OVER TWICE THE COST. LEAFLET 64.



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



NEW 1956 MODEL A8 HIGH-FIDELITY PUSH-PULL AMPLIFIER WITH "BUILT-IN" TONE CONTROL, PRE-AMP STAGES

High sensitivity. Includes 5 valves (807 outputs). High Quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut" Frequency response \pm 3 db. 30-30,000 c/c.s. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs. FOR STANDARD OR LONG PLAYING RECORDS. FOR MUSICAL INSTRUMENTS such as STRING BASS, GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 20 mA. and 6.3 v. 1.5 a. For supply of a RADIO FEEDER UNIT. Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/c.s. Output for 3 and 15 ohm speakers. Kit is complete to last unit. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied.

Unapproachable value at £7/15/- or factory built 45/- extra. Carriage 10/- . If required louvred metal cover with 2 carrying handles can be supplied for 17/6. Where an extra input socket with associated volume control is required for mixing purposes this can be provided for 13/- extra. TERMS ON ASSEMBLED UNITS with extra input as mentioned above. DEPOSIT 25/6 and nine monthly payments of 22/4.

LINEAR "DIATONIO" 10-WATT HIGH FIDELITY AMPLIFIER. Incorporating pre-amp. For A.C. Mains input 200-230-250 v. 50 c.p.s. A compact attractively finished unit with two separately controlled inputs, and outputs for 3 and 15 ohm speakers. Separate Bass and Treble controls. Five latest type miniature Mullard valves. Only 12 Gns. Carr. paid. Send S.A.E. for leaflet.

W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS. 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, £4/10/6. Please state whether 3 ohm or 15 ohm required.

SUPERHET FEEDER UNIT

Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). A Triode Heptode P/Changer is used. Pentode I.F., and double Diode Second Detector. Delayed A.V.C. As/Grnd F/C Coupling is by bottom end Condenser Coupling giving freedom from alignment troubles when Ae. of varying lengths and capacity are used. Both Frequency Changers and I.F. valves are A.V.C. controlled from the very low distortion Double Diode so arranged that very high Percentage modulation of the Transmitter can be handled without distortion. The Feed for the delayed A.V.C. is arranged so that A.V.C. distortion is avoided. The W. Ch. Sw. incorporates Gram. position. Controls are Tuning W., Ch. and Vol. Output will load most Amplifiers requiring 500 M.V. input depending on Ae. location. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Send S.A.E. for illustrated leaflet. Total building cost is £4/15/- . Point-to-point wiring diagrams and instructions 2/6.

GARRARD 3-SPEED AUTOMATIC RECORD CHANGERS.

Lates! Model Mixer Type RCL10. Fitted high fidelity turnover crystal pick-up head with dual point sapphire stylus. Baseboard size 14 x 12 1/2 in. height above, 4in. Below, 2 1/2 in. For 200-250 v. A.C. mains. Limited number. Brand new cartoned. Only £7/19/6, plus 3/6 carriage.

LINEAR MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with Garrard B.S.R. or any other record playing unit, and most microphones. Total negative feedback 18 db. Separate Bass and Treble Controls. For convenience when mounted in cabinet, mains switch is incorporated in control. For A.C. mains input of 200-250 v. 50 c.p.s. Output for 2/3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6 x 3 x 5 1/2 in. high. Chassis is fully isolated from mains. Guaranteed 12 months. Only £5/19/6.

MICROPHONES. High fidelity crystal types. Acos 33-1 hand or desk type. 50/- . Piezzo with heavy floor base and telescopic stem. £6/19/6.

ROTARY CONVERTERS. 200 watts. Input 12 v. D.C. Output 230 v. 50 c/c.s. A.C. Only 7 gns. Carr. 7/6.

PLESSEY DUAL CONCENTRIC 12 in. P.M. SPEAKERS

(15 ohms), consisting of a high quality 12in. speaker, of orthodox design supporting a small elliptical speaker ready wired with choke and condensers to act as tweeter. This high fidelity unit is highly recommended for use with our A8 or any similar amplifier. Rating is 10 watts. Price only £5/17/6.



H.M.V. LONG PLAYING RECORD TURNTABLE COMPLETE WITH CRYSTAL PICK-UP (SAPPHIRE STYLUS). Speed 3 1/2 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. 26 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/c.s. Output for 2-3 ohm speaker. Chassis is not airtight. Kit is complete in every detail and includes fully punched chassis (with baseplate) with the blue hammer finish, and point-to-point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use 25/- extra, plus 3/6 carriage.

R.S.C. AT 3-4 WATT QUALITY AMPLIFIER

A highly sensitive 4-valve amplifier using negative feedback and having an excellent frequency response. Pre-amplifier and Tone Control stages are incorporated with separate Bass and Treble controls giving full tone compensation for Long Playing records. Suitable for any kind of pick-up including latest high fidelity types. H.T. of 250 v. 20 mA. and L.T. 6.3 v. 1.5 a. available for supply of Radio Feeder Unit, etc. ONLY 40 millivolts input required for full output. Fully isolated chassis with baseplate. For A.C. mains 200-230 v. 50 cycles. Output for 2-3 ohm speaker. Complete kit of parts with point-to-point wiring diagrams and instructions. Only £3/15/-, carr. 3/6 or factory built 22/6 extra.

P.M. Speakers recommended for use with above amplifiers. Plessey 10in. 8 ohm with high flux density magnet. Only 28/9.

P.M. SPEAKERS. 2-3 ohm, 5in. Goodmans 17/9, 7 x 4in. Elliptical 19/6, 6in. R.A. 15/9, 8in. Rola 19/9, 10in. R.A. 26/9, 12in. Plessey, 29/11. 12in. Plessey 15 ohms. 10 watt 3 gns.

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 1/9 extra on all orders under £2, 2/9 extra under £5 unless carriage charge stated. Full Price List 6d. Trade List 5d. Open to Callers: 9 a.m. to 5.30 p.m. Saturday until 1 p.m.

CLYNE RADIO LTD.



18, TOTTENHAM COURT ROAD, LONDON, W.1

MUSEUM 5929/0095

(50 yards only from Tottenham Court Road Tube)

All post orders please to:—24-26, HAMPSTEAD RD., LONDON, N.W.1

EUSton 5533/4/5

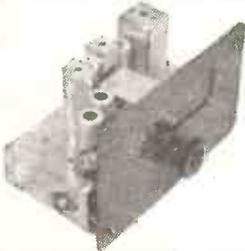
THE R.C. GRAM REPLACEMENT CHASSIS KIT

Still available. Our very popular Gram Chassis replacement kit. For long, medium and short waves and provision for gram. Valves 6K3, 6K7, 6Q7, 6V8 and 6X5. For A.C. Mains 200/250 v. Chassis size: 13 1/2 in. x 5 1/2 in. x 2 1/2 in. Dial size: 10 in. x 4 1/2 in. Assembly is simplified by use of ready assembled coil pack. Illustrated booklet with full assembly instructions, with itemised price list, is 1/6 post free—or the kit complete to last nut and bolt at 28/6, plus 2/6 P. & P.

ACOS TYPE 7 Crystal Microphone Inset. Brand New, 7/6 each, post free.

THE JASON FM TUNER

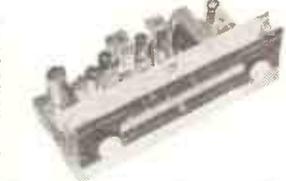
Based on the booklet by Data Publications Ltd., 2/- post free, including our individually priced Parts List. Highly sensitive free from drift. Incorporates 4 valves 6AM6 and 2 specially graded G.E.C. Crystals. The kit supplied includes drilled chassis with tuning condenser, scale calibrated in m/c/s., and attractive bronze stove-enamelled front plate already mounted (illustrated). Front plate size 8 in. x 6 in. chassis 7 in. x 4 1/2 in. x 1 1/2 in. Complete standard kit 26/15/- plus 2/6 P. & P. Fringe area kit 27/15/-, plus P. & P.



FM POWER PACK KIT. We can now supply complete kit for power pack suitable for the above F.M. tuner or any other similar type. Price for the complete kit is 37/6 only, or 52/6 for ready assembled unit. This pack is extremely small, incorporating valve rectifier type 6X4 and built on chassis size only 6 x 4 x 1 1/2 in. Optional extra for power pack. Bulgin Octal Plug 2/3.

THE T.S.L. FM TUNER!

We can now supply this FM/VHF adaptor either in kit form or fully assembled, wired and tested. Our price for the ready-built unit, which incorporates its own power supply is 13/15/- only, tax paid, plus 5/- P. & P. or H.P. terms. Magic eye tuning indicator, just plug in, 19/- extra. Or the kit complete as specified 10/19/6 plus 3/6 P. & P. The booklet "FM TUNER CONSTRUCTION" (32 pages) with full technical data and point-to-point wiring diagrams together with our separately priced parts list, is available at 2/6 post free.



THE T.S.L. AM/FM CHASSIS!

Exceptional value. Covers L.M. and S.W. plus FM! 8-valve push-pull output. Ferrite rod aerial. Valve line-up ECC85, ECH81, EP89, EABC80, ECC82, two 6BW6s plus 5Y3 large full-vision dial, size 14 1/2 x 6 in. Chassis size, overall: 15 x 7 1/2 x 8 in. high. Tax paid, 26 guineas, plus 5/- packing and carriage. A supplementary extra is magic eye EM34, complete with esutcheon and fixing cable at 26/- H.P. terms available. Demonstrations at 18 Tottenham Court Road!

INTRODUCING THE NEW T.S.L. FM TUNER UNIT.

This compact unit with built-in power supplies has been designed by craftsmen to standards which will satisfy the most critical enthusiast. Brief specifications: Valve line-up: ECC85, 2-EP89, EABC80, 6X4 and EM30. Overall size: 10 1/2 in. W. x 5 1/2 in. H. x 6 1/2 in. D. Dial size 10 1/2 in. x 5 1/2 in. Attractive plastic dial in Black and Gold with easy-to-read calibration. Controls: switch OFF FM & GRAM, and tuning. Pre-set gain control at rear of chassis. Connections Co-Axial output socket, 300 ohm aerial input socket and pick-up input socket on rear of chassis. Price 17/10/-, plus 5/- P. & P.

THE DULCI FM TUNER. Incorporates own power supply, suitable for use with any amplifier. Valve line-up: ECC85, two EP89, EABC80, 6X4 and EM30 indicator. Overall size: 9 x 6 x 5 1/2 in. high. Pre-Budget price 16/11/6, plus 5/- P. & P. Illustrated leaflet available, also H.P. terms.

THE R.E.P. 1-VALVE RECEIVER. All-drift battery operation, for use with headphones. The complete kit is available at 42/-, less batteries plus 2/- P. & P. or full instructions at 9d. post free.

COIL PACKS. Manufacturers' Surplus. Miniature size, only 2 1/2 in. x 2 1/2 in. x 1 1/2 in. deep iron-cored. For L.M. and S.W. with gram position. Switch has 2 in. spindle. Absolutely brand new, complete with circuit. Price only 27/6, plus 1/6 P. & P. A snip!

TELEVISION TURRET TUNERS 12 CHANNEL—"TELENG"

We have six types now available from stock, to cover Bands I and III—fully illustrated and descriptive leaflet available on request. Each unit is fully aligned and thoroughly tested before despatch. Valves employed are PCF80, PCC84 for AC/DC and ECF80 and ECC84 for A.C. Price complete 27/7/-, plus P. & P.

Type	Sound MC/s	Vision MC/s	Series
TT34S	38.0	34.5	Series
TT34P	38.0	34.5	Parallel
TT16S	18.5	16.0	Series
TT16P	18.5	16.0	Parallel
TT13S	10.5	14.0	Series
TT13P	10.5	14.0	Parallel

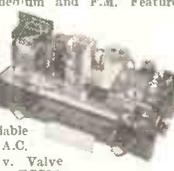
We have a large selection of in-built converters for all areas from 92/6; also aerials low-loss co-axial cable at 9d. per yard. Are you on our mailing list?

THE FAMOUS INVERTER—COMPARE THE PRICE

Handsome walnut cabinet. Suitable all areas. Contains own power supply. Simply connect to aerial. Four-valve circuit. Complete with all instructions. 26/19/6 plus 3/6 P. & P.

JUST ARRIVED!

The "Imperial" AM/FM Radiogram Replacement Chassis. Overall measurements 13 in. x 6 in. x 7 in. high. Dial cut-out required only 10 1/2 in. x 2 1/2 in. Covers long, medium and F.M. Features include very attractive black and gold dial, 4-button, push-button unit, gram position, separate FM tuning, continuously variable tone control, A.C. mains 110/230 v. Valve line-up EL41, ECC85, EABC80, EP89, ECH81, plus metal rectifier. Price complete 16/19/6 tax paid. H.P. terms available.



6v. VIBRATOR PACK RCA

Input 6 v. Output 300 v. at 80 ma. D.C. fully smoothed. Incorporates 6-pin Vibrator, 024A Rectifier, heavy duty transformer, etc. Variable output. Dimensions 4 x 4 1/2 x 6 in. Brand new. Limited quantity only. 35/- plus 2/- P. & P.

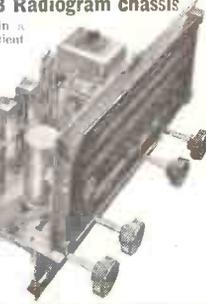
SPECIAL PURCHASE! MANUFACTURER'S SURPLUS

Owing to favourable purchase we can offer strictly limited quantity of these handsome chassis. AC/DC 200/250 v. for Medium and Long Waves, plus gram position. Incorporates own frame aerial. Valve line-up: U107, N108, DH107, W107 and X109. Overall chassis size 12 x 5 1/2 x 7 1/2 in. high. Attractive bronze dial with gold and cream lettering. Dial size 11 x 4 1/2 in. Scale length 7 1/2 in. Logging scale provided. Price 27/19/6 only, tax paid, plus 3/6 P. & P. H.P. terms, 24 deposit plus four monthly payments of 22/-.



Splendid unrepeatable offer!! Dulci F.3 Radiogram chassis

We have been very fortunate in being able to obtain a limited quantity of this well known and highly efficient chassis which we are able to offer at a greatly reduced price.



Specification:
Three waveband: long 1,000-2,000 metres; medium 187-400 metres; short 16-50 metres. Valve line-up: X79, 6BA6 or WTA7, 6AT6 or DH77, EL84 or N709, 6X4 or U78.
Four controls, tone/on-off.
Volume wavechange.
Tuning: output 4 watts matched to 3-5 ohms. Incorporates latest Ferrite Rod Aerial. Pick-up sockets and mains supply for Gram motor. Overall dimensions: 12 in. L. x 7 in. D. x 7 1/2 in. H. Attractive dial with red, gold and green lettering on black background. Size 11 1/2 in. x 4 1/2 in. Price only 15/10/- plus 3/6 P. & P.

MINIATURE CRYSTAL/TRANSISTOR RECEIVER!!!

A kit for building this very sensitive receiver employing the very latest miniature transistor and Germanium Diode, powered by a small torch battery, for headphone reception, is now available. Assembly is very simple and NO EXPERIENCE IS required to be under 40/- absolutely complete including a pair of suitable high resistance headphones. A stamp will bring full details.

TRANSISTORS!!! (Special Offer)
Now available, manufacturers surplus transistors. Suitable for use in Audio stages, etc., and for experimental purposes. P.N.P. type. Only 10/- each, post free.

AM/FM KIT

Introducing the JASON AM/FM KIT for medium waves and F.M.I.
As illustrated this is a very high quality chassis incorporating 5 of the latest miniature valves, plus DM70 magic eye. Kits are available for chassis complete with output stage at 15/5/-, Also less output stage but with own built-in power pack at 21/19/6 only. These are high fidelity units and exceptional value at these prices which include all required components and full constructional details. Fully illustrated Data Booklet with full construction details, plus individually priced component list, available per return of post at 2/- post free. Both plus 3/6 P. & P.



DULCI H4T AM/FM TUNER

This unit has been designed for Quality Reproduction and built to the highest technical standards. Contains own power supplies. Brief specifications: four wavebands: VHF 87-101 mcs. Short, 16-50 metres. Medium, 187-540 metres. Long, 1,000-2,000 metres

THE R.C.3/4 WATT AMPLIFIER KIT

Compare the advantages!
Trebles bass. AND middle controls! For crystal or magnetic pick-up! A.C. Mains 200/250 v. Valve line-up: 6V6GT, 6SD7 metal 6X5GT. Negative feedback. Built on stove enamelled steel chassis, measuring only 8 in. x 4 in. x 1 1/2 in. Four engraved cream knobs are included in the price of the complete kit with all necessary practical and theoretical diagrams at 24/5/- only, plus 2/6 packing and post or instruction Book, fully illustrated for I.C. Post free! This amplifier can be supplied assembled, tested, and ready for use at 25/5/- plus P. and P. Hearing is believing.



Our advantageous H.P. terms are available on any single item over £5. Let us have your enquiries. Please add postage under £1, or Cash with order. C.O.D. charge extra—open 9 a.m. to 6 p.m. Monday to Friday. Sorry but we close 1 p.m. on Saturday

THE "ECONOMY FOUR" T.R.F. KIT. A three-valve plus metal rectifier receiver. A.C. mains 200/250 v. Medium and Long waves. We can supply all required components right down to the last nut and bolt. Valve line-up 6K7, 6J7 and 6V6. Chassis ready drilled. Cabinet size 12in. long by 6in. high by 5in. deep—Choice of ivory or brown Bakelite, or wooden walnut finish cabinet. Complete instruction booklet with practical and theoretical diagrams. Each component brand new and tested prior to packing. Our price £5/10/- complete—Remember this set is being demonstrated at our shop premises! We proudly claim that our fully illustrated instruction booklet is the most comprehensive available for this type of receiver—Booklet available at 1/6 post free. This is allowed if kit is purchased later. Plus 2/6 packing and carriage for complete kit.



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 as supplied. Valve line-up: 2 6S6T, 6 X66T and 6 V6GT. Chassis ready drilled. Cabinet size 10 1/2in. x 10in. wide. Maximum depth at base 5in. tapering to 3 1/2in. 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! Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wave-change 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.

N.B.—All our T.R.F. Kit circuits now include specially wound Denoc "Max-Q" coils on polystyrene formers, improved performance! Price remains the same.

SURPLUS BARGAINS
METERS

F.S.D.	Size	Type	Fitting	Price
50 microamp	D.C. 2 1/2in.	M.C.	Rectangular	50/-
50 microamp	D.C. 5in.	M.C.	Rectangular	120/-
50 microamp	D.C. 4in.	M.C.	Rectangular	110/-
50 microamp	D.C. 3 1/2in.	M.C.	F.R.	95/-
100 microamp	D.C. 2 1/2in.	M.C.	F.R.	45/-
200 microamp	D.C. 2in.	M.C.	F.R. (Tropicalised)	30/-
200 microamp	D.C. 3 1/2in.	M.C.	F.R.	85/-
500 microamp	D.C. 2 1/2in.	M.C.	F.R.	18/6
1 mA.	D.C. 2in.	M.C.	F.R.	17/6
1 mA.	D.C. 2 1/2in.	M.C.	F. Sq.	22/6
1 mA.	D.C. 2in.	M.C.	F. Sq. (1954 manufacture by Elliott)	25/-
1 mA.	D.C. 2 1/2in.	M.C.	Desk Type	30/-
50 mA.	D.C. 2in.	M.C.	F. Sq.	8/6
500 mA.	D.C. 2 1/2in.	M.C.	F.R.	10/-
.5 amp.	R.F. 2in.	Thermo	F. Sq.	6/6
1 amp.	R.F. 2 1/2in.	M.C.	F.R.	10/-
120-0-120 amp.	D.C. 2in.	M.C.	F. Sq. (shunt required)	15/-
150 amp.	A.C. 4in.	M.I.	R.P.	45/-
1 amp.	R.F. 2 1/2in.	Thermo	R.P.	7/6
3 amp.	R.F. 2in.	Thermo	F. Sq.	6/-
20 amp.	D.C. 2in.	—	R.P. (with shunt)	10/6
25 amp.	D.C. 2 1/2in.	M.I.	F.R.	6/6
30 amp.	D.C. 2 1/2in.	M.I.	F.R.	12/6
15 volt	A.C. 2 1/2in.	M.C.	F.R.	10/-
15-0-15 volt	D.C. 2 1/2in.	M.C.	F.R.	17/6
300 volt	A.C. 2 1/2in.	M.C.	F.R.	35/-
300 volt	A.C. 3 1/2in.	M.I.	F.R.	30/-

SPECIAL U.S. 0-1 mA. 2 1/2in. taken from equipment but perfect, 22/6 each. R.P. = Round Projection. M.C. = Moving Coil. Thermo = Thermo-coupled. F. Sq. = Flush Square. F.R. = Flush Round. M.I. = Moving Iron.

METER RECTIFIERS. 1 mA. by G.E.C., at 6/6, also 5 mA. by G.E.C., at 6/6.

METER SPECIAL. We have a limited quantity of aircraft electrical thermometers. Brand new, by Weston, 2in. moving coil meter, flush square fitting. These meters have a luminous scale graduated 10-140 degrees centigrade, but the full scale deflection is approximately 150 microamps! Price 12/6 each, only 1/- P. & P.

24 VOLT ROTARY CONVERTOR. Input 24 v. D.C. Output 200/250 v. A.C. 100 watts. Complete in black steel box 18 1/2in. x 11 1/2in. x 8in. Weight approx. 30lb. Completely smoothed, incorporates Sodium Lamp transformer. Brand new, 92/6.

HEADPHONES. Low resistance. Brand new ex-W.D. type CLR. 7/6 per pair, plus 1/6 p. & p. Brand new ex-W.D. type DHR, 4,000 ohms, 15/- per pair. High resistance, 4,000 ohms brand new lightweight, 15/- per pair plus 1/6 p. & p.



SPECIAL PURCHASE from Ministry
BRAND NEW No 17 Mk. II
TRANSMITTER/RECEIVER

Built into strong wooden cabinet 15in. x 14in. x 9in. Complete with headphones and microphone. Range 5-8 miles with simple aerial. Frequency coverage: 44-61 mc/s. (5-7 metres). Uses standard 120 v. H.T. and 2 volt L.T. batteries. Complete with full operating instructions. 59/6, plus 3/6 C. & P.

No. 17 Mk. II, as above, but secondhand, in good condition and complete, 45/- plus 3/6 C. & P.

HEAVY DUTY VARIABLE AUTO TRANSFORMER. Input: Variable from 110 to 250 volts. OUTPUT: 110 and 250 v. at 1.2 kVA. Contained in grey metal case with carrying handle. Overall size: 10in. W x 8in. D. x 12in. H. Weight 1 qtr. 10lb. Brand new! £8/10/- plus 7/6 carriage and packing

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 and long waves. A cream plastic top 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 attache-case type cabinet measuring only 9in. x 7in. x 5 1/2in. Weight less batteries 4 1/2lb. with batteries 6 1/2lb. This set really has everything. Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the 5in. speaker. Valve line-up 3V4, 1R5, 1B5, 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. and p. (less batteries). Uses Ever-Ready 90 v. H.T. type B126 at 10/-. Also L.T. 1.5 v. A.D. 35 at 1/6.



RAMBLER MAINS UNIT! At last we are able to offer our special mains units kit for using our popular all-dry "Rambler" on A.C. Mains. Complete kit, which when assembled fits snugly into battery compartment, can be supplied at 47/6 plus 1/6 packing and postage. Price includes all required components, and full assembly instructions. N.B.—This unit is completely self-contained in a metal box measuring 7in. x 2 1/2in. x 1 1/2in. and is ideally suitable for ANY all-dry battery portable requiring 90 v. H.T. and 1.5 L.T.

THE R.C. 2 AMP. BATTERY CHARGER KIT. Our new 2 amp. charger kit is now available. Includes handsome well-ventilated black stove-enamelled steel box, size 7 1/2in. x 3 1/2in. x 3 1/2in. Fully shrouded first quality transformer, brand new G.E.C. rectifier. Mains use, etc., or charging 6 or 12 v. batteries at 2 amp. Absolutely complete kit with full practical and theoretical instructions. Price 33/6 plus 2/6 P. & P. Can be supplied assembled and tested at 41/6 plus P. & P. Heavy duty crocodile clips suitable for car battery lugs, optional extra at 1/6 per pair.

POWER PACK. By leading manufacturer. Input 200/250 v. Output 350-0-350 280 mA., 6.3 v., 8 a., 6.3 v., 2 a., 4 v., 7 a., 5 v. 2 a. Fully smoothed. Incorporates valve rectifier. Chassis measures 6in. x 7in. x 5 1/2in. Wt. 22lb. Few only at £24/19/6, plus 3/6 p. and p.

MAINS TRANSFORMER SPECIAL! Primary: 10-0-200-220-240 v. Secondary windings: 375-200-0-200-375 v. at 250 mA. Double wound 230 v. at 6 amp. 6.3 v. at 3 amp., 6.3 v. at 3 amp., 8 v. at 0.25 amp. Unshrouded, fully impregnated drop-through type. 50/-, plus 1/6 p.p.

FOUR-SPEED CHANGERS! The new B.S.R. 4-speed auto-changer in attractive cream and gold finish, now available from stock at £9/15/- only, plus 3/6 p. and p. H.P. terms available.

RC.54. Special Purchase! Latest type 3-speed incorporating "T" type turnover head. Cream finish. Original manufacturer's cartons. Definitely the last few £8/19/6 only, plus 3/6 p. and p. H.P. terms available.

GARRARD 120H !!! 3-speed, mixer, auto-changer unit with crystal to head and sapphire stylus. Provided with Manual control for single records. Finished in Cream and Brown. Brand new in sealed manufacturers carton with fitting and operating instructions. £7/10/6 plus 5/- P. & P.

VALVES

We have perhaps the most up-to-date valve stocks in the trade. A stamp will bring complete list but the following is a selection only of brand new imported valve types, fully guaranteed. Purchase tax paid.

EABC50	10/-	DAP96	10/6	PL83	11/6
EAF42	10/-	DP96	10/6	PY80	10/6
EB41	7/6	DK92	10/6	PY81	10/6
EB91	7/6	DK96	10/6	PY82	9/6
EBCA1	10/-	DL6	10/6	PY83	9/6
EBF80	11/6	or 39/Sperat	UBC41	10/6	
EOC81	9/-	of four	UC42	11/6	
EOC82	9/-	DM70	9/-	UF41	10/6
EOC83	9/-	EL41	10/6	UL41	10/6
EOC84	15/-	EL84	11/6	UV41	9/6
EOC85	10/-	EM80	9/-	VAQ5	6/6
ECP82	15/-	EY51	12/-	6AT6	8/-
ECH42	11/6	EY86	14/6	6AU6	9/6
ECH81	11/6	EZ40	8/6	6BA6	8/6
ECL80	11/6	EZ80	8/6	6BE6	9/6
EP41	10/6	PCF80	12/6	6BW6	8/6
EP80	10/6	PCF82	12/6	6CX4	7/6
EP85	10/6	PCC84	12/6	6SW4	7/6
EP86	12/6	PL81	13/6	60B5	10/-
EP89	10/-	PL82	10/6	60C5	10/-

In addition we naturally have all usual surplus types available such as 6V6GT etc. All in our valve price list!

TELETRON BAND III CONVERTOR! SHIP AVAILABLE! This very popular converter kit as illustrated and fully described in previous issues of the "W.W." For use with most T.R.F. or Superhet Band I T.V. receivers. Construction details only, with separate individually priced parts list, 6d. post free. Kit complete as specified 48/6 plus 2/- P. & P. Mk. II Fringe area version kit complete 59/6, plus 2/- P. & P. Power pack kit for either of above 25/-.

We carry comprehensive stocks of all Band III Convertors by leading manufacturers. Also aerials, cross-over boxes, air-spaced low-loss co-axial cable at 10d. per yard. Let us have your enquiries. Any brand's converter supplied on H.P. terms!

MAINS TRANSFORMER BARGAINS. Limited quantities. Manufacturer's Surplus 350-0-350, 80 mA., 6.3 v. 3 a., 5 v. 2 a. Half shrouded, drop-through, 14/6 only, plus 1/6 P. & P. 230 v. Input, 300-0-300 80 mA., 6.3 v. 3 a., 4 v. 2 a. Tropicalised drop-through type, 9/6 only, plus 1/6 P. & P. Input 110/250 v. Auto load 230 v. 750 mA., 350-0-350 130 mA. Tapped filament winding 6 v. 3 a., 15 v. 3 a., 215 v. 3 a., also 5 v. 2 a. Tropicalised drop-through type, 21/- plus 2/6 P. & P. 270-0-270, 100 mA., 6.3 v. 3 a., 5 v. 2 a. 200/250 v. Input universal mounting, 16/6 plus 1/6 P. & P.

LOOK !!! A first class SIGNAL GENERATOR that you can afford. The "Weyrad" type S.G.M.I. covers 100 kc/s to 70 mc/s in 6 bands, on Fundamentals, with an accuracy better than ± 2%. Switched Audio Mod. 500 c/s. For use on A.C. Mains 200/250 v. 50 cycles. Fully illustrated leaflet available. Price ONLY £12/10/- plus 2/6 P. & P. H.P. available.

RECORD PLAYERS CABINETS—To suit all types of single record and auto-changer units. Priced from 45/- Send stamp for fully illustrated list.



Another Cabinet Bargain! Special purchase of walnut trolley-type cabinets originally intended for use in projection T.V. Easily recognised as being of leading High Quality manufacturer's stock. Can be easily adapted to house tape recorder, amplifier, radio gram, etc., etc. Measurements external 24in. x 16in. x 29in. The whole is mounted on castors. Unrepeatable bargain at £5/19/6 plus 10/- packing and carriage. We have a large selection of all types cabinets. A stamp will bring list.

CLYNE RADIO LTD.
18, Tottenham Court Road,
London, W.1.

Stern's NEW!! "fidelity"

A TAPE RECORDER WITH EVERYTHING EXCEPT A HIGH PRICE

BEFORE CHOOSING YOUR RECORDER YOU MUST HEAR THIS NEW "fidelity" MODEL . . . IT HAS . . . The BRENELL 3-speed Tape Deck and a "fidelity" Tape Amplifier, based on a new design by the MULLARD TECHNICIANS and which we consider to be one of the best now available . . . Truly HIGH FIDELITY RECORDINGS are obtainable.



If you cannot call and hear this Recorder send a stamped addressed envelope for fully descriptive leaflet

PRICE of COMPLETE RECORDER £46'0'
INCLUDING MOVING COIL MIKE and 1,200ft. REEL of TAPE

(Plus £1 carriage and insurance of which 10/- refunded on return of packing case.)
CREDIT TERMS. Deposit £11/10/- and 9 monthly payments of £4/4/4.
HIRE PURCHASE. Deposit £23 and 12 monthly payments of £2/2/8.

HOME CONSTRUCTORS

YOU CAN BUILD THE COMPLETE RECORDER FOR £42'10

(Plus £1 carriage and insurance of which 10/- refunded on return of packing case.)
CREDIT SALE TERMS. Deposit £10/12/6 and 9 monthly payments of £3/17/11.
HIRE PURCHASE TERMS. Deposit £21/5/- and 12 monthly payments of £1/19/5.
The BRENELL TAPE DECK and the "fidelity" TAPE AMPLIFIER are supplied tested and ready for use and the actual assembly of the recorder is extremely simple involving only a few connections for which a step-by-step chart is supplied.

- ★ High Quality Output Transformer by Gilson
- ★ 3 Speeds, 3 $\frac{1}{2}$, 7 $\frac{1}{2}$ and 15in., TWIN TRACK
- ★ Position provided for use as straight amplifier
- ★ Efficient Tone Control arrangement
- ★ High-grade Components throughout
- ★ Two position equaliser for 3 $\frac{1}{2}$ and 7 $\frac{1}{2}$ in.
- ★ Monitor and Extension Speaker Sockets are provided
- ★ Beautiful styling of cabinet

IF YOU HAVE YOUR OWN CABINET WE WILL SUPPLY . . . ALL FOR £36'0'0

THE BRENELL TAPE DECK, the "fidelity" TAPE AMPLIFIER, MATCHED P.M. SPEAKER and 1,200ft. REEL PLASTIC TAPE.
CREDIT SALE TERMS. Deposit £9 and 9 monthly payments of £3/6/-.
HIRE PURCHASE TERMS. Deposit £18 and 12 monthly payments of £1/13/5.
(Plus £1 carriage and insurance of which 10/- refunded on return of packing case.)

TAPE RECORDER EQUIPMENT—IN STOCK . . .

- | | |
|--|---|
| (a) The BRENELL 3-SPEED TAPE DECK (from) £24/3/- | (a) The "fidelity" TAPE AMPLIFIER (as used in above Tape Recorder), including matched P.M. Speaker £16/16/- |
| (b) The TRUVOX MK. III and MK. IV DECKS | (b) The TRUVOX MODEL "C" TAPE AMPLIFIER £17/17/- |
| (c) The COLLARO TRANSCRIBOR "TAPE DECK" £20 (see note below) | (c) The ARMSTRONG P.A.B.O. TAPE PRE-AMPLIFIER £12/10/- (suitable for nearly all tape decks) |
| (d) The LUSTRAPHON MOVING COIL MIKE, HIGH IMPEDANCE, £3/7/6 | |
| (e) The ACOS CRYSTAL MIKE, HIGH IMPEDANCE, £2/10/- | |

All types of PLASTIC TAPE by E.M.I., SCOTCH BOY and GRUNDIG, Standard and Long play ARE IN STOCK.
NOTE. We recommend that a CORRECTLY MATCHED PREAMPLIFIER is purchased with the COLLARO Transcriber. We can supply it with the preamplifier actually assembled on Tape Deck. £37/10/-.
HIRE PURCHASE and CREDIT TERMS are available on all above equipment.

STERN'S "COMPACT 5" AMPLIFIERS

EXPRESSLY DEVELOPED FOR VERY HIGH QUALITY, REPRODUCTION OF GRAM RECORDS AND PARTICULARLY SUITABLE FOR HIGH QUALITY TRANSMISSIONS



The "Compact 5-2"

A 2-stage high sensitivity amplifier having SEPARATE BASS and TREBLE CONTROLS and designed to give up to approx. 5 watts with very pleasing quality. PRICE £5/15/-.

The "Compact 5-3"
A 3-stage version of the "5-2" model but in this case having an additional stage and incorporating negative feedback. PRICE £6/16/-.

The Amplifiers are compact and very attractively designed having a "Hammered/Gold" finish with a fully engraved front panel by which the entire Amplifier is conveniently mounted into a Cabinet, occupying no more space than a conventional Tone Control Unit. Send S.A.E. for illustrated leaflet.

POWER SUPPLY. Is obtainable from a small separate Unit which apart from supplying power to either Amplifier, also has additional supply available for a Radio Tuning Unit. PRICE (additional to above), £2/10/-.

STERN'S "fidelity" F.M. TUNING UNIT

A 5 Valve Tuner incorporating the latest Mullard Permeability Tuned Unit. Price assembled less Power Supply: **£14/10/0**

(Plus 7/6 carr. & ins.)
TERMS: (a) H.P. Deposit £7/5/- and 9 monthly payments of 18/5/-
(b) Credit Deposit £3/12/6 and 9 monthly payments of £1/6/7.
Provides "Hi-Fi" reproduction with any make of Amplifier and many Radio Receivers. It incorporates: ● The latest Valve Line-up—ECC85, 2 type EP85, EF91 and EM80. ● A "Magic Eye" Indicator ● Power consumption is 1.7 amps. at 6.3 volts and 25 m.a. at 250 volts.



THE LEAK "TL/10" AMPLIFIER and "POINT ONE" PRE-AMPLIFIER



Provides a maximum output of 10 watts, maintains in every respect the renowned Leak reception for precision engineering, fine appearance and fastidious wiring. PRICE COMPLETE **£28/7/0**

(Plus 7/6 carr. and ins.)
TERMS: Credit: Deposit £7/7/- and 9 monthly payments of £2/11/4. H.P. Deposit £14/4/- and 12 monthly payments of £1/6/-.
Send S.A.E. for fully illustrated leaflet.

STERN'S "fidelity" COMBINED A.M. and F.M. TUNING UNIT

This is IDENTICAL to the Stern's F.M. Tuner illustrated above, but in addition incorporates the MEDIUM WAVE-BAND and thereby also provides a selection of foreign stations. Price **£18/18/0** (Plus 7/6 carr and ins.)
TERMS:—(a) H.P. Deposit £9/9/- and 10 monthly payments of £1/1/-; (b) Credit Deposit £4/15/- and 9 monthly payments of £1/14/7. Send S.A.E. if further data required.

Open Monday to Friday 9 a.m.—6 p.m. Saturday 9 a.m.—1 p.m.

STERN RADIO LIMITED

AMPLIFIERS PRE-AMPLIFIERS

HIGH FIDELITY FOR THE HOME CONSTRUCTOR

TUNING UNITS RADIO RECEIVERS

COMPLETE KITS OF PARTS FOR THE "Hi-Fi" ENTHUSIAST

QUALITY OF THIS NATURE HAS NEVER BEFORE BEEN OFFERED AT SUCH LOW COST.

THE MULLARD '5-10' MAIN AMPLIFIER



This is the very latest design and needs no recommendation from us. Our Kit is complete to Mullard's specification, including the latest GILSON ULTRA LINEAR OUTPUT TRANSFORMER and the entire MULLARD Valve line up. ALL SPECIFIED COMPONENTS are supplied. **PRICE OF COMPLETE KIT OF PARTS £11/1/0** (Plus 5/- carr. and ins.)

THE full SPECIFICATION and BUILDING INSTRUCTIONS for these three Units are available for 1/6 each. THEY include COMPONENT PRICE LISTS and simple "wire-to-wire" PRACTICAL DIAGRAMS.

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

"A design for the music lover"



Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL, (b) STEEPCUT FILTER, (c) Continuously variable BASS and TREBLE CONTROLS and a variable OUTPUT CONTROL which enables its use with any type of Amplifier. **PRICE OF COMPLETE KIT OF PARTS WE ALSO OFFER IT ASSEMBLED READY £6/6/0** FOR USE, £8/- (Plus 5/- carr. and ins.)

A COMPLETE KIT OF PARTS STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER



Has power supply available for Radio Tuning Unit. **PRICE OF COMPLETE KIT OF PARTS (plus 5/- carr. and ins.) £7/10/0**

WE ALSO OFFER IT ASSEMBLED **£9/10/0** and READY FOR USE for (plus 5/- carr. and ins.) This amplifier has proved one of the most popular models yet offered to the HOME CONSTRUCTOR. It provides really excellent reproduction up to 8 watts, employing 8V3's in push-pull and incorporating negative feedback. Provides for the use of both 3 and 15 ohm Speakers. The Complete SPECIFICATION and BUILDING INSTRUCTIONS are available for 1/6. "Wire-to-Wire" Diagrams are included and all Components are available separately.

SPECIAL PRICE REDUCTIONS . . . FOR PURCHASERS OF A COMPLETE "Hi-Fi" AMPLIFIER

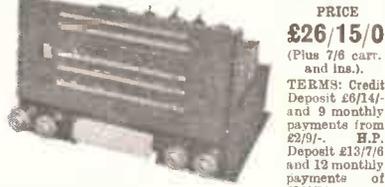
WE WILL SUPPLY (a) COMPLETE KIT OF PARTS to build THE MULLARD "5-10" MAIN AMPLIFIER and the STERN'S "fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT for £16/16/- or we will supply THE TWO UNITS MADE UP and READY FOR USE for £19/19/-. Terms: Deposit £9/19/6 and 12 monthly payments of 18/7, or £5 Deposit and 9 monthly payments of £1/16/7.

"MODERNISE YOUR OLD RADIOGRAM" IT IS MUCH CHEAPER THIS WAY!!

THE LATEST DESIGN OF COMBINED AM/FM REPLACEMENT RADIOGRAM CHASSIS and a NEW 4-SPEED RECORD PLAYER

STERN'S NEW "Fidelity" COMBINED AM/FM RADIOGRAM CHASSIS

A genuinely hand-made chassis providing really high quality on both Radio and Gram.



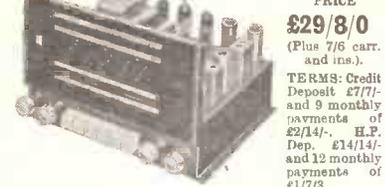
PRICE £26/15/0 (Plus 7/6 carr. and ins.) **TERMS:** Credit Deposit £6/14/- and 9 monthly payments from £2/9/-. **H.P. Deposit £13/7/6** and 12 monthly payments of £1/4/10.

BRIEFLY IT HAS:-
An 8 valve line up incorporating the latest MULLARD preferred-type valves. ● Provides complete coverage of the VHF/FM waveband plus the SHORT, MEDIUM and LONG waves. ● Has EL84's in Push-Pull, with negative feedback of 6 watts output. ● Employs "Piano Key" Selector Switch and a Variable Tone Control. ● Contains Gram input socket for both Crystal and Magnetic Pick-ups. ● Provides for use of either 3 or 15 ohm Speakers. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9 1/2in. x 8in. high, Dial size 1 1/2in. x 5 1/2in.

SEND S.A.E. IF FURTHER INFORMATION IS REQUIRED ON THESE CHASSIS. We recommend THE NEW COLLARO MODEL 456 4-speed Autochanger . . . and if a LOUDSPEAKER is required . . . WE recommend THE 8- or 10-inch W.B. STENTORIAN "Hi-Fi" MODELS. We have SPECIALLY REDUCED PRICES for purchasers of a CHASSIS and RECORD PLAYER (and SPEAKER if required). SEND S.A.E. FOR DETAILS.

THE NEW ARMSTRONG P.B. 409 AM/FM RADIOGRAM CHASSIS

A "de luxe" Chassis for those who want the highest possible quality



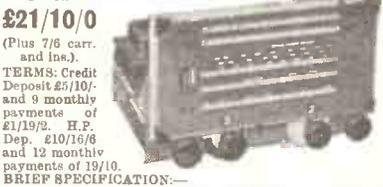
PRICE £29/8/0 (Plus 7/6 carr. and ins.) **TERMS:** Credit Deposit £7/7/- and 9 monthly payments of £2/14/-. **H.P. Dep. £14/14/-** and 12 monthly payments of £1/7/8.

BRIEF SPECIFICATION:-
A 9 valve line up employing the latest MULLARD preferred-type valves. ● Provides complete coverage of the VHF/FM Transmissions, plus the SHORT, MEDIUM and LONG waves. ● Has Push-Pull output, with negative feedback, for 6 watts Peak output. ● Quick action "Piano Key" Selectors and separate Bass and Treble Controls. ● Has "Magic Eye" Tuning Indicator. ● Two Gram Inputs are provided, one for Crystal Pick-ups and the other for Magnetic types. ● Dimensions 13in. x 9 1/2in. x 8in. high, Dial size 1 1/2in. x 5 1/2in.

SEND S.A.E. IF FURTHER INFORMATION IS REQUIRED ON THESE CHASSIS. We recommend THE NEW COLLARO MODEL 456 4-speed Autochanger . . . and if a LOUDSPEAKER is required . . . WE recommend THE 8- or 10-inch W.B. STENTORIAN "Hi-Fi" MODELS. We have SPECIALLY REDUCED PRICES for purchasers of a CHASSIS and RECORD PLAYER (and SPEAKER if required). SEND S.A.E. FOR DETAILS.

THE NEW MODEL "H" COMBINED AM/FM RADIOGRAM CHASSIS

Designed for first rate reproduction of Radio and Gram Records.



PRICE £21/10/0 (Plus 7/6 carr. and ins.) **TERMS:** Credit Deposit £5/10/- and 9 monthly payments of £1/19/2. **H.P. Dep. £10/16/6** and 12 monthly payments of 19/10.

BRIEF SPECIFICATION:-
Full AVC on LONG, MEDIUM and SHORT wavebands and amplitude limitation on FM bands. ● Incorporates internal aerial (Ferrite Rods) for local station reception on MEDIUM and LONG WAVES. ● Coverage is FM 87 to 101 Mc/s, Short 16 to 50 metres, Medium 187 to 340 and Long Waveband 1000 to 2000 metres. ● Recently developed Valve line up of ECC85, ECH81, EP89, EA8C90, EL84, EZ80 and EM80 Tuning Indicator. ● Output is 4 watts and any 3 or 15 ohm P.M. Speaker can be used. ● Connection Sockets on the Chassis (a) Pick-up, (b) Extension Speaker, for 3 or 15 ohm types. ● Overall size 12in. x 9in. x 7 1/2in. high, Dial, 1 1/2in. x 6in.

SEND S.A.E. IF FURTHER INFORMATION IS REQUIRED ON THESE CHASSIS. We recommend THE NEW COLLARO MODEL 456 4-speed Autochanger . . . and if a LOUDSPEAKER is required . . . WE recommend THE 8- or 10-inch W.B. STENTORIAN "Hi-Fi" MODELS. We have SPECIALLY REDUCED PRICES for purchasers of a CHASSIS and RECORD PLAYER (and SPEAKER if required). SEND S.A.E. FOR DETAILS.

CASH ONLY OFFER!!

This latest B.S.R. MONARCH 4-SPEED AUTOCHANGER



£7/19/6 (Plus 5/- carr. and ins.) ● These units will autochange on all three speeds, 7in., 10in. and 12in. ● They play MIXED 7in. 10in. and 12in. records of same speed. ● They have separate sapphire for L.P. and 78 r.p.m., which are moved into position by a single switch. ● Minimum baseboard size required 14x12 1/2in., with height above 5 1/2in., and height below baseboard 2 1/2in. A bulk purchase enables us to offer these BRAND NEW UNITS at this exceptional price.

SEND S.A.E. IF FURTHER INFORMATION IS REQUIRED ON THESE CHASSIS. We recommend THE NEW COLLARO MODEL 456 4-speed Autochanger . . . and if a LOUDSPEAKER is required . . . WE recommend THE 8- or 10-inch W.B. STENTORIAN "Hi-Fi" MODELS. We have SPECIALLY REDUCED PRICES for purchasers of a CHASSIS and RECORD PLAYER (and SPEAKER if required). SEND S.A.E. FOR DETAILS.

RECORD PLAYERS

THE VERY LATEST MODELS ARE OFFERED AT GREATLY REDUCED PRICES

● TRANSCRIPTION UNITS. ● 3- and 4-SPEED AUTOCHANGER ● AUTOCHANGERS with MANUAL CONTROL POSITION. Send S.A.E. for ILLUSTRATED and DESCRIPTIVE LEAFLET.

SPECIAL CASH OFFER

A good quality 2 Stage (plus Rectifier) GRAM AMPLIFIER together with a 6in. P.M. Speaker and this attractive PORTABLE CASE.

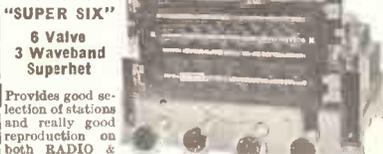
ALL FOR ONLY £9/7/8. The Amplifier incorporates the latest R.V.A. Valves, types ECC85, EL84 with EZ80 Rectifier and has separate BASS and TREBLE CONTROLS. The CASE is attractively finished in Rexine, maroon and grey, and has space for almost any make of Autochanger.

We also sell the two separately:
(a) AMPLIFIER and 6in. SPEAKER £4 12 6
(b) PORTABLE CARRYING CASE £3 17 6

FOR CALLERS ONLY

We have in stock various KITS OF PARTS including F.M. Tuners, AM/FM Tuners, Midget Battery Portable and Mains Units, etc., etc. We also have the most comprehensive stock of WIRELESS and ELECTRICAL COMPONENTS.

STERN'S "SUPER SIX"



6 Valve 3 Waveband Superhet
Provides good selection of stations and really good reproduction on both RADIO & GRAM.

PRICE ONLY £14.0.0 (p/us 7/6 carriage and ins.)

CREDIT TERMS: Deposit £3/10/- and 9 monthly payments of £1/5/8. **H.P. TERMS:** Deposit £7 and 10 monthly payments of 16/-.

BRIEF SPECIFICATION . . .
★ Delayed AVC on all wavebands
★ Preselection feedback
★ Latest valve line-up: 12AH5, 6BA6, 6AT6, two 6AQ5 and 5Z4 (or equivalents)
★ Push-pull output gives approx. 6 watts
★ Connections on chassis for extension speaker, gram and mains supply to gram.
★ Coverage 18-50 metres, 190-560 and 800-2,000
★ Overall size 11 1/2 x 8 1/2in. high, dial 8 1/4 x 4 1/2in.
★ A bronze dial escutcheon is available for 4/6.

**109-115 FLEET ST.,
LONDON, E.C.4.**

Phone: FLEet Street 5812-3-4.



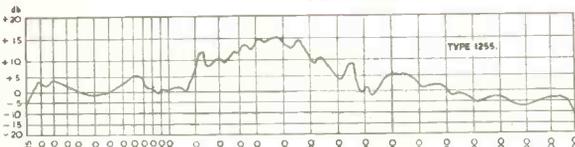
... you will realise that Gramplan high fidelity equipment gives you the nearest approach to "Concert hall listening" in your own home. You will, for instance, appreciate the extraordinary delicacy of reproduction achieved by their new 12in. loudspeaker. A great deal of research and new manufacturing methods were necessary to produce a speaker unit with such an extended audio frequency coverage at such a reasonable cost.

**GRAMPIAN
12" SPEAKER UNIT**
Type 1255/15

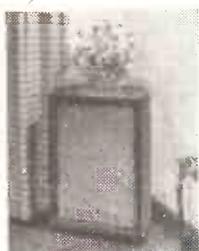


Frequency Range 20-15,000 c.p.s.
Voice Coil Diameter 1 1/2 in.
Voice Coil Impedance: 15 ohms.
Fundamental Resonance: 40 c.p.s.
Power Handling Capacity: .. 10 watts.
Flux Density: 14,500 lines per sq. cm.
Total Flux: 130,500 lines per sq. cm.

£9



RESPONSE CURVE for speaker unit 1255/15



A specially designed reflex cabinet suitable for either corner or side of room is now available as an easy-to-assemble kit of parts, complete with grille material ready to assemble, stain and polish. Although it is primarily intended for use with the Type 1255/15 speaker the cabinet will give excellent results with other units of similar specifications. Price £11

Deferred terms available if desired for both speaker and cabinet kit!

Full details from:

**GRAMPIAN
REPRODUCERS LIMITED**

Makers of quality high fidelity equipment
17 HANWORTH TRADING ESTATE, FELTHAM, MIDDLESEX
Telephone Feltham 265718

**All your TV Components
from one source**

**including Pinnacle
Valves - guaranteed
for One Year**



Types available for				SAME DAY despatch			
Pinnacle No.	Type	List Price	P.T.	Pinnacle No.	Type	List Price	P.T.
104	6CD6G	22/6	8/2	542	EF91	17/6	6/4
227	GZ32	15/-	5/5	545	HL41	11/6	4/2
340	B36	17/6	6/4	546	EL42	11/6	4/2
370	EF39	13/-	4/9	551	EY51 (small)	13/6	4/11
371	EF50	17/6	6/4	552	EY86	15/-	5/5
514	R19	15/-	5/5	553	EZ40	8/6	3/1
517	EB41	9/-	3/3	555	PCC84	15/-	5/5
518	EB91	9/-	3/3	557	PCF80	16/6	6/-
522	EBF80	13/-	4/9	558	PCF82	16/6	6/-
524	BCC81	14/-	5/1	559	PCL83	18/6	6/9
525	ECC82	14/-	5/1	560	PL81	15/6	5/8
527	ECC84	15/-	5/5	561	PL82	11/6	4/2
529	ECC91	17/6	6/4	562	PL83	15/6	5/8
530	ECF80	16/6	6/-	563	PY80	9/6	3/6
531	ECF82	16/6	6/-	564	PY81	12/6	4/7
534	ECL80	14/-	5/1	565	PY82	8/6	3/1
536	EF41	11/6	4/2	566	PY83	12/6	4/7
537	EF42	14/-	5/1	578	UL41	11/6	4/2
538	EF80	14/-	5/1	580	UY41	8/6	3/1

Send headed paper for Trade Terms, C.W.O. or C.O.D.

Please add postage and packing (1/6 up to 10/-, 2/- up to £1, 2/6 up to £2). Ordering a number of items at one time will show a considerable saving. The minimum rate for postage and C.O.D. made by the G.P.O. is 2/6. All orders over £5 Packing and Postage Free.



REPLACEMENTS

134/136 LEWISHAM WAY, NEW CROSS, S.E.14
TIDeway 3696-2330.

Telegraphic: FLIBAK, London, S.E.14

BUILD A RADIO FOR 37/6 or 47/6!



Build this
**POCKET
RADIO**
for
37/6



Build this exceptionally sensitive twin triode radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6 1/2 in. x 5 in. x 3 in. Covers all Medium and Long waves, works off throwout aerial (about 6ft. long)—uses one only "Ever-Ready" all-dry battery which lasts many months, as H.T. consumption is only 1 to 1.5 m.A. Ideal for Bedroom, Garden, Holidays, etc. Many unsolicited testimonials. Mr. Woods, of Boston, writes: "I am quite pleased with the little set I purchased from you. I can get the "Home," "Regionals," "A.F.N." and lots of Foreign Stations. I am very satisfied—it is worth every penny of the price." Building cost—all parts—everything down to last nut and bolt, 47/6, including post, packing, etc. Uses personal phone. Set of "Easy-to-Follow" plans, priced parts list, etc. 2/- (Optional extra stage with speaker and button base valve. All fit inside case—costs only 38/6. Post free.). Note: We stock complete range of components and valves.

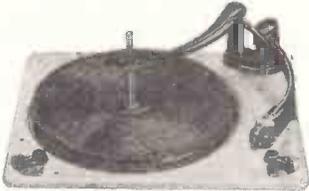
ORDERS DESPATCHED BY RETURN Limited Quantity—**SEND TODAY!** ALL PARTS AVAILABLE SEPARATELY

In response to many requests we now present the double-triode "SKYPOCKET," a beautifully designed precision POKCKET RADIO. Can be built by anyone without any radio knowledge whatever—EVERY SINGLE PART TESTED BEFORE DESPATCH; our simple, pictorial plans take you step-by-step. This set has a remarkable sensitivity due to painstaking design and careful choice of component values. Covers all medium waves 200 to 550 Metres, including "Home," "Light," Luxembourg, etc. Size only 6 1/2 in. x 3 in. x 3 in. in strong plastic case with panel, cover and station-printed ivory dial. A really personal pocket-radio WITH OWN DETACHABLE ROD AERIAL, uses personal phone. Ideal for Bedroom, Garden, Holidays, Second-set, etc. Completely all-dry low consumption battery operation. Specially chosen high-efficiency coil. Average building time 1 hour. Total Building Cost—including Case, Double-Triode valves, etc., in fact, everything down to the last nut and bolt—ONLY 37/6 with plans. Postage, etc., 2/- C.O.D. 1/6 extra. (Parts sold separately. Priced Parts Lists, etc. 1/6). Demand is certain to be heavy—**SEND TODAY!**

CONCORD ELECTRONICS (Dept. W.W.1)
69, Preston Street, BRIGHTON, I

RADIO · TELEVISION · HI-FI · ELECTRONICS · RECORDERS

3-SPEED AUTO-CHANGERS
BRAND NEW IN MAKERS' CARTONS



GARRARD RC.120/H. 3 speed. Complete with t.o. crystal pick-up. Incorporates manual and auto control enabling records to be played singly if desired. Cabinet space required: 14 x 12½ x 4½ in. above and 2½ in. below. Cream/brown finish. Limited number only. List £12/15/-.
LASKY'S PRICE £7.19.6
Carr. 3/6. Cabinets available.

GARRARD RC.80. Full length arm with two XMS heads or GC2 t.o. crystal head. List £20/15/-.
LASKY'S PRICE £13.19.6
Carr. 5/-.

B.S.R. 4 Spd. with t.o. crystal pick-up. Incorporates auto and manual control enabling records to be played singly.
LASKY'S PRICE £8.15.
Carr. 5/-.

T.O. CRYSTAL CARTRIDGES
B.S.R. complete with two styli.
LASKY'S PRICE 18/6, post free.

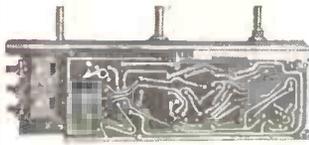
ACOS type HGP.37, as used in latest radiograms. L.P. and standard. Complete with styli, 22/-, Post 1/-.

DECCA PICK-UPS
3-speed with t.o. crystal head HI/G, and rest. Brown plastic.
LASKY'S PRICE 32/6. Post 2/6.

The New **WEARITE "DE-FLUXER,"** 50/-, Post 2/6.

LASKY'S BATTERY PORTABLE FOR HOME
CONSTRUCTION ON PRINTED CIRCUIT

You can build it complete with valves and case for only
£7.7.0
Post 3/6 extra.



10 STAR FEATURES make this the finest portable radio ever offered to the home constructor. Peak value for money has been achieved without any sacrifice of quality or design.

SIMPLICITY OF CONSTRUCTION. The use of all the latest innovations gives maximum simplicity of construction combined with fine quality performance. In particular, the **PRINTED CIRCUIT** greatly simplifies construction and completely eliminates the possibility of wiring errors. The veriest novice can build this portable radio easily and quickly and the cost complete, less batteries, is only £7/7/-, Plus 3/6 postage.

Demonstration models at both our addresses.

SEND FOR CIRCUIT DIAGRAM
with assembly data, all instructions, illustrations and full shopping list. Price 1/6 post free.

YOU CAN BUILD A POWER SUPPLY UNIT FOR THIS PORTABLE.
For 200-250 v. A.C. mains. Made for the new low consumption valves. **COMPLETE KIT** containing printed circuit, brand new TCC condensers, latest STC metal rectifiers, all components, and full instructions, 45/-, Post 2/-. Also suitable for most other portables. Full details on request.

SEND 3d. STAMP FOR OUR LATEST BARGAIN LIST.

CONTINENTAL AM/FM RADIOGRAM CHASSIS



Very special offer of a limited number only at wonderful bargain price! Built throughout of latest high grade components. 5 valve plus metal rect., gram socket and switch, piano key wavechange, tone control, independent AM/FM tuning. Covers med., long and V.H.F. wavebands. Valve line-up: ECC85, ECH81, EF89, EABC80, EL81. For A.C. mains 100-250 v.

LASKY'S PRICE £16.19.6
Carr. 10/6.

SPECIAL P.A. OFFER!



TRUVOX "SENIOR" SPEAKER DRIVING UNIT
(Pressure type)
WELL BELOW HALF PRICE!

New and unused in makers' cartons. A P.M. moving coil loudspeaker driving unit with a power handling capacity of 15 watts peak. Provides substantially linear response from 200 to 10,000 c.p.s. With a 12ft. cinema horn the unit will reproduce down to 17 c.p.s. The Throat has an 18 t.p.i. thread with an external diameter of 1½ in.

LISTED AT £7/15/-, LASKY'S PRICE 59/6 Carr. 5/-.

LASKY'S RADIO

TAPE DECK CASES ALMOST HALF-PRICE



Strongly made and finished with light grey leatherette with black/silver bands, finger-shaped handle for easy carrying, strong hinges and clasps. Pocket in lid for tapes and spools, door for microphone, etc. Overall dim.: 15½ in. long, 13 in. wide, 9 in. deep. Inside dim.: 14 in. x 12½ in. x 5½ in. A real general purpose job! will take almost any type of Deck including Collaro Tape Transcriber, also almost any type of Record Changer including RC.80, etc.

LASKY'S PRICE 59/6
Post 3/6.

LARGE SELECTION OF CABINETS for TV and radiograms, carrying cases for record players, tape recorders, etc. Your enquiries invited.

SINGLE RECORD PLAYERS



B.S.R. type TU.8, as illustrated. 3-sp. motor and pick-up with HGP.59 t.o. crystal complete with styli.

LASKY'S PRICE 92/6
Post 3/6.

Above motor and turntable less pick-up, 57/6. Post 2/6.

COLLARO RC.3/554. 3-sp. Single Record Player with Studio t.o. crystal pick-up and styli.

LASKY'S PRICE £6.10.
Post free.

HI-FI SPEAKERS

Large stocks. Goodmans, Wharfedale, G.E.C., Lorenz, etc., including the new Wharfedale 3-speaker system SFB/3.

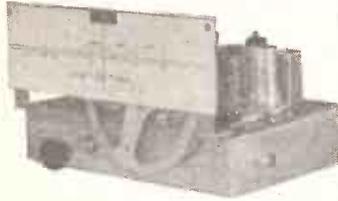
HI-FI AMPLIFIERS

Full range in stock. Quad, Rogers, Leak, R.C.A., Pamphonic, Unitelex, W.B., etc. Demonstrations at Tottenham Court Road.

IGRANIC JACK PLUGS, 2/6.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

LASKY'S RADIO



A REALLY FIRST CLASS F.M. TUNER FOR HOME CONSTRUCTION ON A PRINTED CIRCUIT

Note these star features:-

- ★ HIGH SENSITIVITY.
- ★ ALL BRAND NEW T.C.C. CONDENSERS.
- ★ AERIAL COIL AND R.F. COUPLING COIL PRINTED ON CIRCUIT.
- ★ 5 VALVES AND 2 GERMANIUM DIODES.

By the use of a printed circuit the I.F. and R.F. amplifiers are extremely stable at maximum gain and results are consistent on all tuners.

Valve line-up:-

- R.F. Amplifier, Z719 or EF80.
- Mixer and Osc., B719 or ECC85.
- 1st I.F. amp., W719 or EF85.
- 2nd I.F. amp., W719 or EF85.
- 2 Germanium Diodes GEX.34.
- Driver Limiter, Z719 or EF80.

CAN BE BUILT FOR 8 GNS.
(Including Valves)

Write for full instructions data and illustrations, 2/6 post free.

All parts available separately



JASON "ARGONAUT" AM/FM TUNER

A super-sensitive Tuner for F.M. and medium waves. The complete parcel with power supplies, £13/19/6. Post 3/6 Data Book, 2/- post free. All components available separately. Send for itemised price list. Chassis Assembly, 57/9, post 2/6. I.F. and Coil Set, 78/-, post 1/6.

5-Valve RADIO CHASSIS

Ideal as radio receiver for inclusion in a TV set. Brand new and unused. A.C./D.C. 200/250 v. I.F. 465 kc/s. A.V.C. 4 watts output, 3-station pre-set, frame aerial, fully aligned, chassis 10 x 5 1/2 in., max. height 5 1/2 in. 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 UF14, 10LD11, 10P14, U404 or UY41. **LASKY'S PRICE 52/6** less valves. Post 3/6.

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

FAMOUS MAKE TURRET TUNER



Complete with 12 Coil Sets.

99/6
Post 2/6
Knobs 3/6

Covers all Channels, Bands 1 and 3. Valves used: PCC84, R.F. double triode, cascade R.F. amplifier, PCF80, triode pentode, f.c. and mixer. I.F. output 33-38 Mc/s. Easily modified to other I.F. outputs. Full instructions and circuit diagram supplied.

12 CHANNEL TUNERS

Famous make. Covers Bands I and III. Complete with valves EF80 and ECC81. Ceramic valve holders, finest quality components. Switch and fine tuning. I.F. output 20-23 Mc/s. Freq. coverage 50-87 Mc/s. and 175-215 Mc/s. Full details and circuit diagram supplied.

LASKY'S PRICE 79/6
Post 3/6. KNOBS 2/9 extra.



BAND III CONVERTERS BELOW HALF-PRICE!

COMPLETE WITH POWER SUPPLIES

Brand new, manufactured by one of the well-known Pye group. In attractive plastic case complete with three brand new Mullard valves: Cascade R.F. Amp PCC84, Osc. Mixer ECC81, Rectifier EZ90. Not a kit but complete with valves, ready for use. Original list price £9/9/-.

LASKY'S PRICE 79/6 Post and Pkg. 5/-.

JASON F.M. TUNER

Special parcel containing data book, chassis, front panel, dial, drive tuning condenser full set of coils. I.F.'s ratio detector, etc.

DATA BOOK with price 68/9
list 2/- post free. Post 2/6

Note: This tuner uses 4-6AM6 and 2 crystals and can be built for £8/15/-, plus 3/6 post.

DULCI F.M. TUNER

Incorporates its own power supply and provides complete F.M. coverage. Operates with most radio receivers and any make of Amplifier. Valve line-up: EABC80, ECC85, two EF89, 6X4 (Rect.), EM99 magic eye indicator. Dial 10 1/2 x 6 in. Overall size 9 x 6 x 5 1/2 in. Complete **£17.10.0**
Carr. & Pkg. 7/6.
DULCI AM/FM TUNER £20/17/-

METER BARGAIN

2 1/2 in. moving coil. Brand new micro-ammeters F.S.D. 0-750 micro-amps., 15 ohms. resistance 15/- Post extra.

BUILD THIS FIRST-CLASS TAPE RECORDER AT MANY POUNDS SAVING

LASKY'S PORTABLE TAPE RECORDER KIT

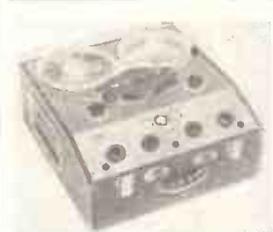
Comprises:-

- ★ Fully fitted portable case 59/6
- ★ Latest type Truvox Deck 23 gns.
- ★ Tape Recorder Amplifier 12 gns.
- 7 x 4 Elliptical Speaker, 19/6
- ★ 1,200ft. E.M.I. Tape, 35/-
- ★ 7in. Plastic Spool, 4/6

LASKY'S PRICE COMPLETE KIT



36 GNS. Carr. & Pkg. 25/-.



LATEST BRENELL TAPE EQUIPMENT

Deck. 3-speed, 3 motors, record and play back. 18 gns.
Amplifier Mk. II. 5 watts, for use with 3 ohm speaker. Magic eye. 18 1/2 gns.
Carrying Case £4/18/-
Complete equipment less mike, with tape, in carrying case ready for use.

Full details on request. **48 GNS.**

LASKY'S RADIO CONSTRUCTOR PARCELS



PARCEL No. 1

Contains everything to build a 4-valve 3-wave superhet for 200/250 A.C. mains. Uses 6K8, 6K7, 6Q7, 6V6 valves. Attractive wood cabinet, walnut veneer, or plastic cabinet as illustrated. Size 12 x 6 1/2 x 6 1/2 in. deep. **CAN BE BUILT FOR £7.19.6**
Carr. and packing 2/6.

PARCEL No. 2

Contains everything to build a T.F.F. 3-valve set for 200/250 A.C. mains, medium and long wave. Uses 6K7G, 6J7, 6V6 and metal rectifiers. Neat plastic cabinet, wood or ivory finish, or wood cabinet. Size 12 x 6 1/2 x 6 1/2 in. deep. **CAN BE BUILT FOR £5.10.0**
Carriage and packing 2/6

INSTRUCTION BOOK for either above sets 1/- post free.
CABINETS ONLY, plastic or wood, 17/6. Carriage 2/6. All components available separately.

ALUMINIUM CHASSIS

18 S.W.G. undrilled, 4 sides, reinforced corners. Depth 2 1/2 in.
6 x 4 1/2 in.; 12 x 8 7/8 in.; 16 x 10 8/3 in.;
8 x 6 5/8 in.; 14 x 9 7/6 in.; 12 x 3 4/9 in.;
10 x 7 6/8 in.; 16 x 9 8/8 in.; 12 x 6 6/6 in.
Post 1/- per chassis extra.

LARGE RANGE OF TAPE DECKS

Collaro "Tape Transcrip-ter," £20.
Truvox 23 gns.
Lane £18/10/-.
Brenell 18 gns.
Wearite £35 and £40.

SPECIAL OFFER TAPE DECK MOTORS

Anti-clockwise, shaded pole. Col-laro 25/- Garrard 26/6. B.T.H. 29/6. Post extra.

NEW PLASTIC RECORDING TAPE

"Ferrovoice," on plastic spool, 1,200ft. Listed at 32/6.
LASKY'S PRICE 25/-
Post 1/-.
Spare 7in. spools, 3/6.

Special Offer! Magnetic Recording Tape, kraft base. On Cyldon metal spools: 1,200ft. 11/6; 600ft. 7/6
On plastic spools: 1,200ft. 12/6; 600ft. 9/6.
PURETONE Tape on plastic spool, 1,200ft. 14/11 Post 1/- extra.
All makes of Tape including thin long-playing. Also spools.

GERMANIUM CRYSTAL DIODES

GEX.00 1/6
GEX.34 3/6
GEX.54 and OA71 5/-

FERRITE ROD AERIALS

Med. and long waves, wound ready for use. Each 6/9, post 1/-.

FERRITE ROD

5in. long, 1/2 in. diam., with full instructions for making a Ferrite rod aerial, 2/6, post 1/-.

STANDARD 2-GANG CONDENSERS

.0005 mfd., with fixing feet. Each 5/11. Post 1/6.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

EVERYTHING FOR HOME CONSTRUCTOR & SERVICEMAN

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. 19/6.
 MBA/7. 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. 19/6.
 AT/3. Auto trans. 0-10-120, 200-230-240 v. 100 watts. 19/6.
 MT/340. Tapped input 200/250 v. 300-0-300, 100 mA., 5 v. 3 amp., 6.3 v. 1.5 amp. 16/6.
 MT/341. Tapped input 250-0-250, 120 mA., 6.3 v. 5 amps., fully shrouded. 27/6.

6-VALVE RADIOGRAM CHASSIS COMPLETE WITH VALVES

Famous Manufacturer's Surplus 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, 465 Kcs. I.F. tone control, three-colour dial. Overall size 13 1/2 x 5 1/2 in. height 12 1/2 in. Aperture required for dial and controls 11 x 3 1/2 in. Complete with valves, output trans., knobs, etc.

LASKY'S PRICE £10.19.6

Carriage and Packing 7/6 extra

5-VALVE RADIOGRAM CHASSIS complete with valves, £9/19/6. Carr. & Pkg. 7/6.

HI-FI ELECTROSTATIC SPEAKERS ("TWEETERS") AT REDUCED PRICES

For high fidelity sound reproduction. Easy to fit to any radio, TV receiver or amplifier. Full data and circuit diagram supplied with each.

LSH75. For outputs up to 6 watts, 8/-.

LSH518. For outputs of 10-12 watts, 12/6.

LSH100. For outputs up to 20 watts 14/-.

LPH65. Moving coil Tweeter. Imp. 5.5 ohms, freq. range 2,000-2,200, 50 c/s. For outputs up to 6 watts. 2 1/2 in. diameter, 39/6. All post free.

MOVING COIL P.M. SPEAKERS

3in. and 3 1/2in., 19/6.

5in. | 6 1/2in. | 8in. | 10in. | 12in.
 16/6 | 17/6 | 25/- | 32/6 | 29/6
 6 1/2in. with trans. 21/-
 7 x 4in. Elliptical. 19/6
 10 x 6in. Elliptical. 32/6

GOODMANS 12in. AUDIOM 50 P.M. SPEAKERS

10 watts. Limited number only. Listed at £6/15/-.

LASKY'S PRICE 97/6
 Post free

16" METAL CONE C.R.T. AT ENORMOUS SAVING!



BRAND NEW AND PERFECT

Convert to big picture television at a price you can afford. Note especially that these are not "seconds" but perfect tubes without fault, and supplied in original cartons. Brief specification: 6.3 v. heater, ion trap, 14 Kv. E.H.T., wide angle 70 deg., standard 38 mm. neck, duodecal base, magnetic focus and deflection. Maximum length 17 1/2 in. Gives large 11 x 14 1/2 in. black and white picture. **GUARANTEED BY US FOR 3 MONTHS.**

Full data, connections and suggested time bases supplied with every tube.

LISTED AT £23.9.10 LASKY'S PRICE £8.9.6

Carr. and Insur. 22/6 extra.

Masks, Anti-Corona, Bases and Ion Traps available.

FEW ONLY 17IN. C.R. TUBE.

Type C17FM, rectangular, aluminised, 6.3 heater. Brand new and unused.

LASKY'S PRICE £14.19.6

Also, 14in. at £12/19/6. Carr. and ins. 22/6.

TRANSISTORS

Special Offer. Junction type suitable for use in local station receivers, amplifiers and pre-amplifiers, etc.

Each **10/-**
 Post free.

MULLARD TRANSISTORS

OC70, 21/- OC71, 24/-
 OC72, 30/-

BRIMAR TRANSISTORS

TS1, 18/- TS2, 21/-
 TS3, 24/- TP1 or TP2, 40/-

TRANSCRIPTION TURNTABLES

by Lenco, Garrard, Collaro.

RIISS RECEIVERS

Available on Easy Terms. In original wood transit cases. Used, Grade 1, £9/19/6. Used, Grade 2, £7/19/6. Carr. 12/6.

Power Pack and Output Stage with 6 1/2 in. Speaker, 5 gns.

Not a Kit but built ready for use



FAMOUS "912" AMPLIFIER AT BARGAIN PRICE

A high fidelity radio and record Amplifier based on the 912 circuit of the G.E.C. with the following controls: Volume, Bass, Treble, Treble Slope, Presence.

PERFORMANCE

Power output: 12 watts. Peak, 15 watts. Sensitivity: 100 millivolts for 12 watts. Noise and hum level: -85 db. on 12 watts. Freq. Response: ±1 db. 30 cps. to 25 kc/s. Distortion: 2nd Harmonic—7 watts output 0.1%, 10 watts 0.14%, 12 watts 0.2%.

Negative Feedback Applied: 12 db. Output Impedances: 3.75 and 16 ohms. Valve line-up: Z729, B309, two N709 U709.

LASKY'S 16 GNS. PRICE Complete with Osram valves

Carr. extra.

Demonstrations at Tottenham Court Road. Full details on request.

★ LASKY'S ANNOUNCE A NEW PORTABLE GRAM AMPLIFIER KIT

Of very small dimensions and suitable for any type of mains operated portable Record Player. All brand new components, latest circuit technique. The price of the Kit, complete with valves, rectifier and 6 x 4in. elliptical speaker, will be under £4.

Full details on request.

DATA BOOK and shopping list, 1/6 post free.

LASKY'S RADIO

FILAMENT TRANSFORMERS

All 200-250 v. 50 c.p.s. primary, finest quality, fully guaranteed.
 6.3 v. 1.5 amp. 5/11
 6.3 v. 3 amp. 9/6
 6.3 v. 1 amp. 4/6
 0-30 v. 2 amp. tapped voltages 19/6

MAKERS' SURPLUS TV COMPONENT BARGAINS

WIDE ANGLE 38 mm.
 Line E.H.T. trans., ferro-cube core, 9-16 kV. 25/-
 Scanning Coils, low imp. line and frame 25/-
 Ferro-cube cored Scanning Coils and Line Output Trans., 10-15 kV, EY61 winding. Line Trans. incorporates width and linearity control. Complete with circuit diagram the pair 50/-
 Frame Output Transformer 6/6
 Scanning Coils low imp. line and frame 17/6
 Frame or line blocking osc. transformer 4/6
 Focus Magnets Ferro-cube 19/6
 P.M. Focus Magnets, Iron Cored. 19/6
 Duomag Focalsers 22/6
 300 m/a. Smoothing Chokes 15/-
 Electromagnetic focus coil with combined scan coils. 25/-

STANDARD 35 mm.
 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 12/6
 Ditto by Ignitec 14/6
 Frame or line blocking oscillator transformer 4/6
 Frame output transformer 7/6
 Focus Magnets:
 Without Vernier 12/6
 With Vernier 17/6
 Focus Coils, Electro-magnetic. 12/6
 200 m/a. Smoothing Chokes 10/6

LASKY'S FOR VALVES 20,000 IN STOCK

Here are a few examples of brand new surplus and imported valves:

ER91	7/8	EV41	10/6	EY51	12/6
EB41	7/6	EF80	10/6	EC84	11/8
EABC80	10/-	EF85	10/6	EY86	14/6
EAF42	10/-	EF86	12/6	EZ40	8/6
EB41	10/-	EF89	10/-	EZ80	8/6
ECC85	10/-	6K8	10/6	PCF82	12/6
ECC84	15/-	6V6	8/6	PCC84	12/6
ECC83	9/-	6K7	5/6	PL81	13/6
ECC82	8/-	6Q7	10/6	PL82	10/6
ECC81	9/-	6E7	6/6	PL83	11/8
12AT7	8/6	6Z4	9/-	PT30	12/6
12AU7	8/6	DAF96	10/-	6AT8	7/6
12AX7	9/6	DL96	10/-	6AT7	7/6
ECF82	15/-	DK96	10/-	185	7/8
ECH42	11/8	DF96	10/-	354	7/8
ECH81	11/8	Set of 4 32/6	124	414	7/8
EOL80	11/6	DM70	9/-	115	7/8

Also full stocks of B.V.A. Valves and C.B. Tubes at the new lower list prices. WRITE FOR COMPLETE LIST

H.P. TERMS AVAILABLE
 Write stating requirements.

BAND III AERIALS. All types, outdoor or indoor, also Duplexes, Crossover Boxes, Co-axial Plugs, Socket and Cable.

TWO ADDRESSES FOR PERSONAL CALLERS
 OPEN ALL DAY SATURDAY EARLY CLOSING: THURSDAY

42 TOTTENHAM COURT ROAD, W.1.

Nearest Station: Goodge Street, MUSEUM 2605

370 HARROW ROAD, PADDINGTON, W.9.

(Opposite Paddington Hospital) LAD 4075 and CUN 1979

ALL MAIL ORDERS TO HARROW ROAD PLEASE

LASKY'S RADIO

LASKY'S (HARROW RD.) LTD.

There is always a fine selection of equipment at

A room - to - room telephone . . .

Ideal for two-way conversation, house-to-garage or internal communication.

- No batteries required
- No soldering required
- Just connect it up and it works

The sets consist of 2 high-quality microphone/receivers (new and boxed) and 15 yards of twin wire.

COMPLETE FOR 8/6
plus 1/- postage



INVERTERS

Miniature 3-phase (ex-compass unit) 24V input with 17V 3-phase, 400 c/s output. These have been used by model makers as motors and are known as the "5/- Motor." Will run quite successfully on 12 volts. 5/- plus 2/- p.p.



AN/APN.1 TRANSDUCER

This Unit consists of Magnet, and Coil which is attached to an aluminium diaphragm suspended freely and perforated to prevent air damping. Mounted on a Ceramic cover which sits over the diaphragm is a form of 2-Gang capacitor which has a swing from 10-50 pF.

The above unit is used as part of Wobbulator described on page 252 of the June "Wireless World." PRICE 7/6 p.p.

RECTIFIERS

Chassis cooled, brand new, 125 volt, 80 mA., 4/9 p.p.; 250 volts, 50 mA. 8/3 p.p.

BATTERY CHARGING LEADS

2 yds. of cab tyre twin cable, and 2 large crocodile clips; new and boxed. 3/- p.p.

HEATER TRANSFORMERS

6.3 volt, 1½ amp. Brand new, 6/6 each plus 1/- p.p.

THROAT MICROPHONES

Type T30. U.S. Manufacture. Complete with elastic strap. Lead terminating at 2-pin plug PL.291, and socket JJ-048. New and boxed, 3/- each, post paid.



SMALL MAINS TRANSFORMERS

Input 230 volt 50 cycles, output 250 volt 40 mA., 6.3 volt 1.5 amp. Size 3.9in. x 2.4in. x 2in. Ideal for TV converters. Price 12/6 each, plus 1/- p.p.

CHARGER TRANSFORMERS

For 6 or 12 volt. 230 volt 50 cycles input, 9 and 17 volt 3 amp. output. Price 15/6 each, plus 1/- p.p.

TRANSMITTER Type T1131-L

Frequency 100 to 156 Mc/s. Output 50 W. Crystal controlled. 200-240 v., 50 c.p.s. Power supply. Housed in 6ft. standard on 19in. rack. In new condition complete with valves.

Send for full details.

MAINS POWER UNIT Type 234

(For use with Receiver R1392)
Double Smoothed 200-250 v. 50c Input. 240 V. 100 mA. 6.3 at 6 amps. with Volt Meter reading input and output voltages. Size: 19in. x 10in. x 6½in. Standard Rack Mounting. Price £4/10/- each, plus 7/6 carriage.



BENDIX TRANSMITTERS

TYPE T.A. 12B Master oscillator type transmitter. 4 channel 40 W. operation provide telephone, CW or MCW in frequency ranges of 300-600 kc/s, 3-4.8 Mc/s, 4-6.4 Mc/s, 4.37-7 Mc/s. Each of the 4 channels has its own oscillator and uses a 12.SK.7. The IPA stage consists of an 807, while the PA is two 807's in parallel. Size 10½in. x 6½in. x 15½in. Price £3/15/-, plus 10/- carr.

2in. MAGSLIPS

50 V. 50 cycle transmitter and receiver units. Accurate to 1/10th deg. Guaranteed good working order, 35/- a pair, plus 3/- p.p.

STUD STITCHES

20 segment 5/16in. studs, base 5in. square with handle and housing. New and boxed. 5/- each, plus 1/6 p.p.

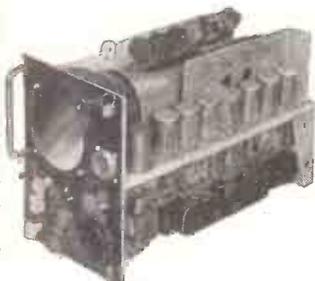
SPECIAL OFFER

MALLORY VIBRATOR PACKS

12 volt, 150 volt 40 mA. Brand new and boxed, size 5½in. x 5½in. x 3in., 12/6 each p.p.

TYPE 62A INDICATORS

Ideal for conversion to osciloscopes, T.V. units, etc. Containing VCR.97, 12 VR.91 (EF.50), 2 VR.54 (EB.34), 3 VR.92 (EA.50), 4 CV.118 (SP.61). Slow-motion dial, 13 Pots and scores of useful components. Size 8½ x 11½ x 18in. In wooden packing case, £3, carriage 7/6.



CATHODE RAY TUBE TYPE 3.BP.1

With Mumetal screen and base. 3in. short persistence tube. 2/- plus 2/6 p.p.

POST OFFICE COUNTERS

500 ohm, 4 figure, no reset; size 5 x 1½ x 1in. 5/- each, p.p.

EARPIECES

2,000 ohm C.H.R. or balanced armature type, low resistance single units 3/6 each, plus 6d. p.p.

INDICATOR LAMPS

American panel type complete with 6V bulbs in set of 4, 3 green jewels and 1 red jewel, 10/6 post paid.

All these fine offers are on display at ➔

PROOPS BROS. LTD. —

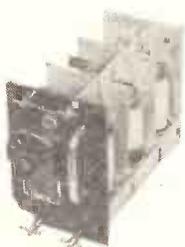
The Walk-around Shop

R.F. UNITS

R.F.24 20-30 Mc/s. Switched Tuning.
Valved 9/6 each.

R.F.25 40-50 Mc/s. Switched Tuning.
Valved, 9/6 each.

Packing and postage 3/- each.



CR.300/1 RECEIVER & POWER SUPPLIES

Available for callers only.

2 METRE RECEIVER Type R1392

Air Tested

15 Valve Superhet

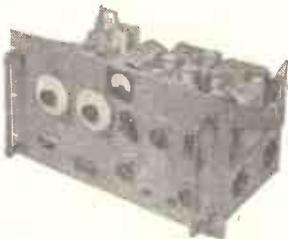
Frequency 95-150 Mc/s

(2 to 3 metres)

Valve line-up: 1st and 2nd R.F. Amp. VR.136 (EF.54), 1st Local Oscillator VR.65 (SP.61), 2 Oscillator Multipliers VR.136 (EF.54), 3 I.F. Amp. VR.53 (EF.39), A.G.C. 6Q7, Output 6J5, Muting VR.92 (EA.50), Noise Limiter VR.92 (EA.50), B.F.O. 6J7, Mixer VR.136 (EF.54), De Mod. 6Q7.

Slow motion tuning, normally crystal controlled, or tunable over 95-150 Mc/s. Power supply required: 240-250 volts at 80 mA. 6.3 volts at 4 amp. Size 19in. x 10in. x 10in. Standard Rack Mounting.

£6/19/6 Complete with valves and circuit diagram, checked and Air Tested. Packing and carriage 17/6, 10/- returnable on packing case.



APQ.2. RADAR/JAMMING UNIT

Freq. 450-710 Mc/s. Containing 931a Photo Multiplier Cell complete with resistance network and light proof box. Wide band amplifier 2 6AC7. 1 6AG7. 2 388a. This unit is similar to the A.P.Q9 Jamming Unit. Brand new £5 plus 10/- carriage.

MORSE SIGNALLING LAMPS

(Aldis type) 5in. dia. with sighting arrangement, 2 handles, keying switch, and 2 yards cable. In wood carrying case, 10/- plus 3/- p.p.

MINIATURE I.F. STRIPS

Size 10½ x 2½ x 3in. Frequency 9.72 Mc/s. 2 EF.92s and 1 EF.91 I.F. amps. EB.91, DET/AGC. EF.91 AGC. Amp. and EF.91 Limiter. Circuit supplied.

Price 8/- less valves.

Post paid.

BUZZERS

6 volt A.C. with tone adjuster, size 2 x 1 x 2½in., 4/- p.p.

BOOST GAUGES

2in. dia.; suitable after minor adjustment as car induction manifold meter. 2/6 p.p.

RIIIS RECEIVERS

Air Tested, in good secondhand condition. Price £6/5/-, plus 10/- packing and carriage.



3 cm. TEST SET

TYPE 263

Containing transmission type w/meter complete with detector unit 9280-9480 Mc/s, attenuator unit, 2 coaxial to waveguide feeders, impedance matching unit, medium power dummy load, standing wave indicator with lock using CV.263 indicator valve, metered indicator unit, various connectors. Suitable for testing medium and low power radar installations. Price £20 carriage paid.



WAVEMETER TYPE W.1310

Coverage 155 to 230 Mc/s. continuous, complete with Test Prod. Input 230 v. 50 cycles. New condition, £3/10/-, plus 7/6 carr.

BLOCK CONDENSERS

8 mfd. 600 v. W., 5/6 each, post paid. 4 mfd. 400 v. W., 4/- each, post paid.

DESYNN TYPE Antenna or Beam position indication

This comprises a Transmitter unit and Indicator which will operate on 12 or 24 volts D.C. and will indicate with instantaneous and smooth pointer movement. The Transmitter is a specially designed potentiometer and will operate the Receiver on a simple three-wire system and the receiver in this instance is calibrated in Gallons but dial could be easily altered to indicate a 360 Deg. sweep. Transmitter and Receiver with full instructions. Price 12/6 post paid.

I.F. AMPLIFIER UNIT

460 Kc/s with IT4. Brand New and Boxed. Fully Screened in plug-in Box. Size 2½in. x 1in. x 4½in.

Price, with circuit, 10/- ea., plus 1/- p.p.



RADIO ALTITUDE METERS

5 mA. Basic movement, 3in. dia. circ. scale with approx. 300 deg. sweep. 6/- each, plus 2/- p.p.

TWIN COUNTERS

(Gallons gone) 24V, reading 4 figures and reset contained in housing, size 4in. dia. by 5in. long, 15/- plus 2/- p.p.

NICKEL IRON CELLS

1.2 volt, size 3½in. x 2½in. x 1in., unfilled 5/- each, plus 1/- p.p.

OCTAL PLUGS

(Bulgin bakelite type), 2/6 each p.p.

POWER UNIT Type 173

24 Volt D.C. Input, 120V, 60 mA. Output. Containing Vibrator Transformer, 12 Volt Vibrator, two 120 Volt Selenium Rectifiers, Chokes and Condensers. Size 10½in. x 6in. x 3in. Price 12/6 post paid.



NOTE: Carriage prices quoted apply only to England and Wales.

PROOPS

NOTE: Orders and Enquiries to Dept. "W". Shop hours 9 a.m. to 6 p.m.—Thurs.: 9 a.m. to 1 p.m.

BROS. LTD.

OPEN ALL DAY SATURDAY.

Telephone: LANGHAM 0141

52 TOTTENHAM COURT ROAD, LONDON, W.1

DEPENDABLE RADIO SUPPLIES LTD

12A TOTTENHAM ST. NEAR GOODGE STREET STATION (OPPOSITE HEALES) LONDON W.1
 PHONE—LANGHAM 7391-2 HOURS of BUSINESS—9-6



**HEAD-
PHONES
DLR No. 2**
 Low Res.
Balanced
Arm.tur3s.
 10/6 per
pair.
P. & P. 1/6.

SPECIAL OFFER
**D.L.R. No. 5 BALANCE ARMATURE
 INSETS.** Brand new. Price 3/6 each or
 £2 per doz.
 These can be put to many uses, i.e.,
 microphones, intercom., etc.

25 ohm 25 w. wire wound POTS (U.S.A.). Price 4/6 ea.
 Post and packing 9d.

**BRAND NEW TAPE RECORDER MOTOR
 AT HALF MANUFACTURER'S COST**



Single phase motors
 suitable for tape
 recorders, radiograms,
 workshops, etc., etc.
 Has many uses. Reversible
 290-280 v.,
 5in. oz torque
 1,400 r.p.m. Cap-
 acitor start. Weight
 4½lb. Length over-
 all 5in., spindle both
 ends. ½in. x ½in.
 ½in. x ½in. Price,
 Inc. P. & P. and
 capacitor, 55/-.

COLLINS CHOKE. 8 Henrys 160 ohms impedance
 100 m.a., completely shrouded. Price 9/- each. Post
 and packing 2/6.

TUNEON INDICATOR NEON LAMPS. 200/260
 G.E.C. Worked in series with 300 K. res. Price 2/6
 each or 24/- per doz. Post and packing 6d. each.

AIRCRAFT LANDING BUCCS. 10 wired-in series, ideal
 for home photography. Total wattage output 2,000 w.
 Price 4/6 each or 48/- per doz. Post and packing 1/- each.

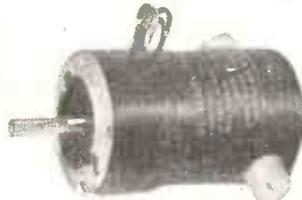
PILOT LAMP HOLDERS. M.B.C. fitting U.S.A. Similar
 to Bulgin type. Price 30/- per doz. or 2/9 each.

SPECIAL OFFER
**American Bulbs 6-8 v. .25 amp., M.Bc.,
 6/- per dozen. 12-16 v. .1 amp., M.Bc.,
 7/6 per dozen. Post free.**

807 VALVES
 Brand new. Individually boxed. 5/- each,
 P. & P. 6d. Special prices for quantities.

SIZE

3in. in Length 1½in. dia.	100th H.P.	Spindle Length 1 x ¼in. dia.
------------------------------	------------	---------------------------------



27 v. input output 7,000 r.p.m. at 0.63 amp.
 12 v. input. output 2,800 r.p.m. at 0.57 amp.
 6 v. input. output 380 r.p.m. at 0.5 amp.
 Price 17/8. P. & P. 2/-.

TYPE 3.000 POST OFFICE RELAYS

Surplus to Ministry Requirements, the
 following are a few of the relays which we
 can supply ex stock. We build relays to
 your specification and would be pleased to
 receive enquiries for prompt quotation
 and delivery. Prototypes 7/14 days.

Coil Resistance		Price Each
6.4	2M	8/-
100	2M, I.M.P.	12/-
100	3M	10/6
100	4B.P.	22/-
200	2C.	11/6
200 1½in. H.S.	4C.	14/6
200 1½in. H.S.	1C.P.	12/-
200	4C.P.	12/-
200+200	4C.	12/-
300 1½in. T.S.	2M, 1C, I.C.P.	20/-
310 1in. T.S.	2K.	9/-
335 ½in. H.S.	1B.P., 1B.	12/6
500	Adjustable Residual 6C.	16/6
500	Anode trip relay	12/6
500	2M, 2C.	12/6
500	2I.	9/6
500	1B.T., 3M.T.	14/6
500 1½in. T.S.	2K.	13/6
500	4C.P.	32/6
500	4M.T.	12/6
500+500 ½in. H.S.	4C.	15/-
500+500	1M, I.M.P.	13/6
765	3M, 3B.	13/6
1,000	I.M.P.	13/6
1,000	2C.H.N.	Price on application
1,000	3M, 2C.	15/-
1,000	2M, H.V.	13/6
1,000	3C.P., 3K.P.	Price on application
1,000	2M, 1B, 1C, 2C.P.	25/6
1,000	2B, 2M.	13/6
1,000	3M.T.	13/6
1,000	1B, 1M.	11/-
1,000	1M, 1B.	11/-
2,000	2M.T.	13/6
2,000	1M.P.	15/6
2,000	2C.	13/6
4,000	2M.	14/6
6,500	1C.	17/6
20,000	6C.	25/-

For orders under £2 please send postage.

SIEMENS HIGH SPEED RELAYS.
 250 ohm. double coil. Price 8/6 each.



**HEAVY DUTY SLIDING
 RESISTORS**
 250 watts at 25 amps.
 Resistance 0.4 ohms.
 Suitable for charging
 board, etc.
 Both brand new. Price 12/6. Post 3/-.

1 ohm at 125 watts
 12 amps.

ROTARY TRANSFORMER TYPE 47



20 watts, 9 volt input, gives 450 v. out at
 50 mA. Spindle both ends. Brand new
 and boxed. Price 35/- including post and
 packing.

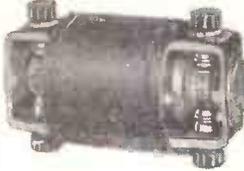
AMERICAN MICA CONDENSERS

Description	Per doz.	Each
.001 350 v. V.D.C. Faradon	3/4	4d.
.01 1,000 v. V.D.C. Cornell Dubiiler	10/6	1/1
.001 1,200 v. V.D.C. Faradon	10/6	1/1
.01 1,200 v. V.D.C. Faradon	12/-	1/3
.0001 2,500 v. V.D.C. Faradon	12/-	1/3

Post and packing 1/- per doz. or 3d. each.
 Please enquire for sizes not stated as we have
 many in stock.

ROTARY TRANSFORMERS

Delivery Ex Stock. Quotations on application



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. 11, 11.5v. in., out 365 v.-310 v., 30 mA.
 Fully tropicalised if required.

MICROPHONE ADAPTORS. In 3½ x 3½ x 1½in. polished
 steel case complete with 6-pin interior Jones plug and
 socket. Price 5/- Post and packing 1/6.

PHILLIPS CONCENTRIC TRIMMERS. 2-8 P.F. Price
 per doz. 6/6, and 3-30 P.F. Price per doz. 9/8. Post and
 packing 1/- per doz.

HEADPHONES. Type H.F.38. American lightweight
 Western Electric, Inc. lead with P.L.354 plug. Price
 9/- Inc. post and packing.

BELLING LEE INSULATED TERMINALS. With caramot
 washer. Price 1/6 each or 15/- per doz. Post and pack-
 ing 1/- per doz.

G.P.O. JACK SOCKETS. In brass: price 1/- each or
 9/- per doz. Post and packing 1/6 doz. or 6d. each.

T.V. CONVERTOR CABINETS. For the Eko Patent,
 Dulcie Kenton, etc. Highly polished walnut. Price
 12/6 each. Post and packing 2/6.

**DYNAMOTOR
 ROTARY
 TRANS-
 FORMER**



Price 37/6 ea. P. & P. 2/- D.C. Input 27 volts at 1.75
 amps. D.C. Output 285 volts .075 amps. Can be
 supplied in 12 volt at extra cost.

PLEASE SEND FOR LISTS All the above special prices quoted for quantities. Please call and see our varied stock.

MAINS TRANSFORMERS

Primary, 200-250 v. P. & P. 2/- 300-0-300 100 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' 350-0-350 v. 70 mA., 6 v. 2.5 amp. 5 v. 2 amp. 14/6.

Chassis mounting or drop thro'. Pri. 110-150 v. Sec. 350-0-350, 250 mA., 6.3 v. 7 amp., 6.3 v. 0.5 amp., 5 v. C.T., 0.5 amp. 4 v. 3 amp. P. & P. 3/6. 32/6.

Chassis mounted and fully shrouded, 80 mA. 6 v. 3 amp., 5 v. 2 amp. 14/6.

Drop thro' 270-0-270 60 mA., 6 v. 3 amp. 11/6.

250 v. 350 mA., 6.3 v. 4 a., twice 2 v. 2 a., 19/6.

Auto-trans. Output 200-250 H.T. 600 v. 250 mA., 6 v. 4 a., twice 2 v. 2 a., 19/6.

Auto-trans. Input 200-250. H.T. 350 v. 350 mA. Separate L.T. 6.3 v. 7 a., 6.3 v. 1 1/2 amp., 5 v. 3 amp. 25/- P. & P. 3/-.

Mains transformer, fully impregnated. Input 210, 220, 230, 240. Sec. 350-0-350 100 mA., with separate heater-transformer. Pri. 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. & P. 5/-.

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. 4 a., 4 v. C.T. 5 a., 4 v. C.T. 4 a., 39/6.

R. & T.V. Energised 6 1/2 in. Speaker, with O.P. trans. field coil, 175 ohm, 9/6. P. & P. 2/6.

R. & A. 6 1/2 in. M.E. Speaker, with O.P. trans. field 440 ohms, 10/6. P. & P. 2/6.

Volume Controls. Long spindles, less switch, 50K, 500K, 1 meg., 2/6 each. P. & P. 3d.

Volume Controls. Long spindle and switch, 1/2, 1 and 2 meg., 4/- each. 10K and 50K, 3/6 each. 1/2 and 1 meg., long spindle, double pole switch, miniature, 5/- P. & P. 3d. each.

Trimmers. 5-40 pf., 5d. 10-110, 10-250, 10-450 pf., 10d.

Twin Gang .0005 Tuning Condensers 5/- With trimmers, 7/6.

Twin Gang .0005, with feet, size 3 1/2 x 3 x 1 1/2 in., 6/6.

3-gang .0005, with feet, size 4 1/2 x 3 x 1 1/2 in., 7/6.

T.V. Coils, moulded former, iron-cored wound for re-winding purposes only. All-can 1 1/2 x 1 1/2 in., 1/- each. 2 iron-core All-can 2 1/2 x 1 1/2 in., 1/6 each. The above coil formers are suitable for the "Wireless World" F.M. tuner.

Used Metal Rectifier, 250 v. 150 mA., 6/6. Metal Rectifier, 250 v. 45 mA., 6/-.

Metal Rectifier, RM2, 125 v. 100 mA., 3/6.

Valve Holders, moulded octal Mazda and octal, 7d. each. Paxolin, octal Mazda and octal, 4d. each. Moulded B7G, B8A and B9A, 7d. each. B7G moulded and B9A with screaming can, 1/6 each.

GARRARD RC/110



3-SPEED AUTOMATIC MIXER CHANGER

Will take 10 records, 7in., 10in. or 12in Mixed, turnover crystal head, brand new, current model. A.C. mains 200/250 v. (list price £14/10/-).

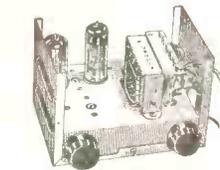
£7-19-6 P. & P. 3/6.

COMMERCIAL TELEVISION

CONVERTER SUITABLE ANY T.V. using lower side band NO ALTERATIONS TO SET

Complete with built-in power supply, 230-250 v. A.C. mains. Case 6 1/2 in. long, 3 1/2 in. wide, 4 1/2 in. high. Incorporating gain control and band switch.

£3-19-6 Plus Post & Packing 2/6.



Illustrated with cover removed.

AC/DC MULTI-METER KIT

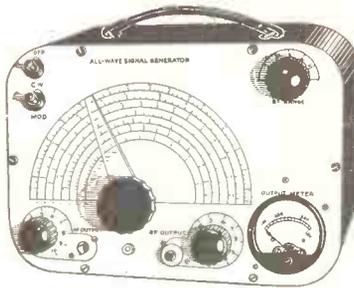
Comprising 2in. moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milliamps. Voltage range A.C./D.C. 0-10, 0-100 and 0-500. Milliamps 0-10, 0-100; ohms 0-10,000. Front panel, range switch, wire wound pot (for ohms zero setting), two toggle switches, resistors and meter rectifier. Point-to-Point wiring diagram 1/- Free with complete kit.



Complete in case, grey hammer finish. **19/6** P. & P. 1/6.

COMPLETELY BUILT SIGNAL GENERATOR

Coverage 120 Kc/s.-230 Kc/s., 300 Kc/s.-900 Kc/s., 900 Kc/s.-2.75 Mc/s., 2.75 Mc/s.-8.5 Mc/s., 8 Mc/s.-28 Mc/s., 18 Mc/s.-56 Mc/s., 24 Mc/s.-84 Mc/s. Metal case 10in. x 6 1/2 in. x 4 1/2 in. Size of scale, 6 1/2 in. x 8 1/2 in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 50 per cent., modulated or unmodulated R.F., output continuously variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finish case and white panel. Accuracy plus or minus 2%. £4/19/6. or 34/- deposit and 3 monthly payments 25/-. P. & P. 4/6 extra.



T.R.F. KIT IN PLASTIC CABINET

3 valve plus metal rectifier, A.C. mains 200-250 v. Medium and long waves. In pastel blue or brown. Valve line-up: 2 VR658 and VT52. Size 15 1/2 in. long by 9 in. high by 7 in. deep.

£3-19-6 P. & P. 4/6

A point-to-point wiring diagram, 1/6. Free with complete kit.

All parts supplied separately.



SIGNAL & PATTERN GENERATOR

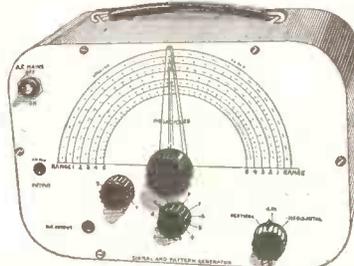
Coverage 7.6 Mc/s.-210 Mc/s. in five bands, all on fundamentals, slow motion tuning, audio output, 8 vertical and horizontal bars, logging scale. In grey hammer finished case with carrying handle. Accuracy ± 1%. A.C. mains 200-250 v.

£6-19-6

P. & P. 5/6.

Or £3 deposit. P. & P. 5/6 and

3 payments of 30/-.



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

23 ACTON HIGH STREET, LONDON, W.3

GOODS NOT DESPATCHED WHERE CUSTOMS DECLARATION IS APPLICABLE

Terms of Business: Cash with 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.

Germanium Crystal Diode, 1/6, post paid.

Line O.P. Transformer in aluminium can mounted in rubber, 12/6.

Line and E.H.T. Transformer, 14 Kv., using ferrocart iron, complete with line and width control, and corona shields U37 rectifier winding, 35/-.

Line and E.H.T. Transformers, 9 Kv. using ferrocart core, complete with built-in line and width control. Mounted on small all-chassis. Overall size 4 1/2 x 1 1/2 in. EV51 rec. winding, 27/6.

Scan coils, low line low impedance frame, complete with frame transformer to match above 27/6. P. & P. 2/-.

Line and E.H.T. Transformers, 9 Kv. ferrocart core, EV51, heater, winding, complete with scan coils and frame output transformer, and line and width control, 35/- P. & P. 3/-.

As above, but complete with line and frame blocking transformers, 5 Henry 25 mA. choke, 100 mfd. and 150 mfd. 250 wkg. 380 mA. A.C. ripple, £2/0/6. P. & P. 3/-.

P.M. Speaker, 6 1/2 in. closed field, 18/6. 8 in. closed field, 20/6. 10 in. closed field, 25/- 12 in. closed field, 25/- P. & P. on each 2/-.

Extension Speaker, in polished walnut complete with 8 in. P.M. P. & P. 3/- 24/6.

COLLARO RC54

3-speed automatic changer, current model. Brand new, 10 records mixed. Studio "Q" pick-up. A.C. mains, 200-250 v.

£7-19-6 Plus P. & P. 5/6.

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. & P. 3d.

Ion Traps for Mullard or English Electric tubes, 5/-, post paid.

Standard 465 Kc. Iron-cored I.F.s, 4 x 1 1/2 x 1 1/2 in., per pr., 7/6.

1,200ft. High Impedance Recording Tape on plastic spool, 12/6. Plus 1/- P. & P.

Miniature wire ends moulded. 100 pf. 500 pf. and .001, each 7d.

Combined 12in. mask and esctoneon in lightly tinted Perspex. New aspect edge in brown. Fits on front of cabinet, 12/6. As above for 15in. tube, 17/6.

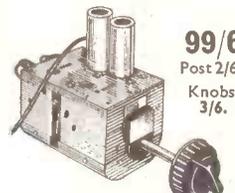
Frame Oscillator Blocking Trans., 4/6.

Line Osc. Blocking Trans., 4/6.

Wide Angle P.M. Focus Units. Vernier adj. state tube, 15/-.

P.M. Focus Unit for Mullard tubes with vernier adjustment. P. & P. 2/- 15/-.

FAMOUS MAKE TURRET "TELETUNER"



99/6 Post 2/6. Knobs 3/6.

Covers all Channels, Bands 1 and 3. Valves used: PCC84, R.F. double triode, cascade R.F. amplifier. PCF80, triode pentode f.c. and mixer. I.F. output 33-38 Mc/s. Easily modified to other I.F. outputs. Full instructions and circuit diagram supplied. Complete with 12 Coil Sets.

PAMPHONIC AB-FI EQUIPMENT

TO SUIT YOUR FURNITURE

PAMPHONIC were the first and only company at the last Radio Show to feature Absolute Fidelity equipment fitted neatly into furniture.

All wires, amplifier, gramophone turntable and radio equipment were housed without any alteration whatever in standard G. Plan furniture.

The neat way in which this can be done is shown in the illustration, where Pamphonic latest push-button pre-amplifier and amplifier 1002/1002B are fitted into a G. Plan Librenza.

Absolute Fidelity equipment for fitting in furniture can be selected from the following models:

1. Amplifier 1002 with pre-amplifier 1002A control unit High Fidelity, 25-watts output. 28 gns., and pre-amplifier 12 gns.
2. Push-button pre-amplifier 1002B to incorporate with type 1002. 24 gns.
3. Amplifier 1003. Output 10 watts. 27 gns.
4. F.M. Radio Tuner. 12 gns. plus £4/17/- P.T.

Pamphonic loudspeakers are created for the discriminating ear and are designed to achieve perfect tonal balance.

- Victor Senior—15 w., 55 gns.
- Victor Junior—10 w., 35 gns.

TWO OTHER UNITS in the popular Pamphonic range are the Westcott and Pandora record reproducers. The Westcott contemporary in design, price oak finish £49/10/11 and sapele mahogany £50/13/- tax paid.

The Pandora table model price £44/0/10 tax paid.

Full technical leaflets sent on request.



If you are in any difficulty with your local dealer, contact our head office. Just fill in this coupon and post

Name

Address

WW157

PAMPHONIC REPRODUCERS LTD.

17 Stratton Street London, W.1

Phone : GROsvenor 1926

THE NEW AXIOM ENCLOSURES built to the specification of GOODMANS.

Completely Fitted comprising 12in. Axiom No. 150 Mk. II Speaker. The Acoustic Resistance Unit and Cabinet to Messrs. Goodmans specification. Lined and Quilted with lin. cotton felt and constructed of 3/4in. Weyrock.

Cash price £28/9/6 or £4/4/6 deposit and 9 payments of 58/1 monthly. Cabinet only £14/18/6 or £2/5/- deposit and 9 payments of 30/4 monthly. Delivery 12/6 cash or terms.

In oak, walnut or mahogany veneers, finished to required shade.

Also in Corner Cabinets 20/- extra. Write for catalogue of cabinets for Records—Equipment—Speakers.



The Dunster

A. L. STAMFORD

(Dept. H4). 20 College Parade, Salusbury Road, London, N.W.6.

FOR SOUND WITH FILM

the world famous



high fidelity magnetic tape recorder

IS UNIQUE

Send for details.

Excel Sound Services Ltd. (Dept. W.D.J.)

Garfield Avenue, Bradford, Yorkshire.

Tel: 45027

METAL SPINNING OUR SPECIALITY

PARABOLIC REFLECTORS up to 9ft. dia. **LOUDSPEAKER HORNS**, Etc., Etc.

POWER PRESSWORK to 250 ton capacity, including Hydraulic

GENERAL SHEET METAL WORK, ARGON, ARC & OXY-ACETYLENE WELDING

SHAWE METAL SPINNING WORKS

SWINTON STREET, KING'S CROSS, LONDON, W.C.I.

Phone : TERminus 7422/3

Grams : Allpryde Phone London



Henry's
RADIO COMPONENTS
ELECTRONIC & TELEPHONE EQUIPMENT

(RADIO) LTD.

5, Harrow Road, Paddington W.2
PADdington 1003/9 and 0401
OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock

SEND STAMPS FOR NEW 1957 28-PAGE CATALOGUE

TRANSMITTER/RECEIVER

ARMY TYPE 17 MK. II

This well-known R/T Transceiver is offered complete with Valves, High Resistance Headphones, No. 3 Handmike and Instruction Book giving complete details and circuit, contained in strong cabinet. Variable tuning.

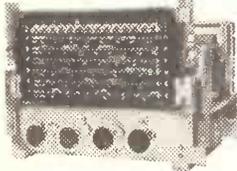
Frequency Range: 44.0 to 61 Mc/s
Range approximately: 3 to 8 miles.
Power requirements: Standard 120 v. H.T. and 2 v. L.T.

Ideal for Civil Defence and communications

BRAND NEW **59/6** CARR. 3/6.

Calibrated Wavemeter for same 10/- extra.

5-VALVE 3-WAVEBAND SUPERHET



16-50 metres short wave.
187-550 metres medium wave.
900-2,000 metres long wave.
Flywheel Tuning.
Negative Feed Back.
Valves 6BE6, 6AT6, 6BW6, 6X4.
Wave change and Gram.
Chassis 1 1/2 in. x 7 1/2 in. x 8 1/2 in.

£9 - 5 - 0d.
Carr. 5/-.

Manufactured by well-known manufacturers.

LIMITED SUPPLIES ABSOLUTE BARGAIN

GARRARD 3-SPEED AUTO-CHANGER

Plays mixed records. Complete with turn-over Crystal pick-up. Cream & Brown Enamel finish. Brand new in original cartons. (List price £14/13/0.)

£7.19.6 carr. 3/6

B.S.R. 3-SPEED AUTO-CHANGER

Plays mixed records. Complete with H.G.P. 37 Crystal Pick-up. Finished in Hammered Gold.

£7.19.6 carr. 3/6

B.S.R. LATEST TYPE 4-SPEED AUTO-CHANGER

£8.15.0

p.p. 3/6

OVER 50,000 VALVES IN STOCK

SPECIAL REDUCTION FOR SETS OF VALVES

1A7GT, 1N5GT, 1H5GT, 1A5GT (or 1Q5GT or 9Q5GT)	37/6	Set
10 BF50 (Ex-Brand New Units) 5/- each	45/-	"
10 BF50 (Red Sylvania, ex-new units) 6/- each	55/-	"
6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G	35/-	"
1R5 1R5, 1T4, 1R4 or (3R4 or 3V4)	27/6	"
TP25, VP23, HL23/DD, PEN25 (or QP25)	25/-	"
DK96, DF96, DA96, DL96	32/6	"
6K8G, 6K7G, 6Q7G, 25A6G, 25Z5 (or 25Z6G)	37/6	"
12K9GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT (or 50L6GT) ..	37/8	"
128A7GT, 128K7GT, 128Q7GT, 35Z4GT, 35L6GT or 50L6GT ..	35/-	"

TRANSISTORS

JUNCTION TYPE (Red-Spot) (P.N.P.)
OFFERED AT LESS THAN HALF-PRICE.

Designed for A.F. application up to 800 Kc/s and are suitable for use in amplifiers, Signal Tracers, Local Station Receivers, Radio Control, Oscillators, Transistor Voltmeters, Baby Alarms, Microphone Pre-Amplifiers, etc.

10/- each.

(Tested and complete with Data & Circuits)

N.B. These Transistors may be used in place of Mullard OC71 or similar Transistors.

Please note that these Red Spot Transistors are ideal for most circuits including "W.W." Pocket Transistor Receiver and Transistor Amplifier. All Transistors are British Manufactured and Guaranteed. Send for Circuits and Data.

PRE-SELECTED TRANSISTOR SIX PUSH-PULL PORTABLE SUPERHET

Just switch to your favourite Station. No tuning, no aerial or earth. Pre-select 3 stations. Complete with all components and six Transistors 7 x 4 Elliptical speaker. Teletron Superhet Coils and I.F.T.s. Powered by 7 1/2 v. Dry battery which lasts for months. 150 Milliwatts output. All the above with circuits, etc. **£9 - 0 - 0** Carr. paid.

Or with Matched Mullard OC72's (200 Milliwatts Output) and 7 x 4 Elliptical High Resistance Speaker **30/-** extra.

Suitable Plastic Cabinet easy to assemble 18/6.

Call and hear demonstration model working. Ideal as a car radio.

SPECIAL OFFER

Set of four Transistors including one R.F. Transistor... **42/6**
Set of six Transistors including one R.F. Transistor... **60/-**

TRANSISTOR SIGNAL TRACER

Complete Kit with 2 Transistors, Components, 'Phones with Circuit. **42/6.**

TRANSISTOR SQUARE WAVE GENERATOR

Ideal for signal tracing. Complete Kit with 2 Transistors, Components and Circuit. **25/-.**

62A INDICATOR UNIT

Containing VCR97 with Mu-Metal Screen 21 Valves: 12-EF50, 4-SP61, 3-EA50, 2-BB34. Plus Pots, Switches, H.V. Cond., Resistors, Muirhead B/M Dial, Double Deck Chassis and Crystal. BRAND NEW ORIGINAL CASES, 67/6. Carr. free.

INDICATOR UNIT TYPE 182A

Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-Metal screen, 3 EF50, 4SP61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Offered BRAND NEW (less relay) at 67/6. Plus 7/6 carr. "Radio-Constructor" scope circuit included.

CRYSTAL MICROPHONE INSERTS

Ideal for Tape Recording, Gramophone Amplifier, etc. Very sensitive. Guaranteed and Tested, 5/- (ex-units), or 8/6 Brand new and boxed.

TRANSMITTER/RECEIVER SCR 522

Comprising the well-known BC625 and BC624A. Units complete with 17 valves types: 2-832, 3-12A6, 3-12SG7, 3-9003, 9009, 6G6G, 12L6GT, 12A7GT, 12C8, 6SS7. The Complete unit is in very good condition having very useful parts including Relays, Transformers, Condensers, etc. Less valves, 63/10/- carr. paid. With valves, 67/10/- carr. paid.

TRANSISTOR PUSH-PULL AUDIO AMPLIFIER (150 MILLIWATTS OUTPUT)

Build this Push-Pull Amplifier which is ideal for Crystal or Magnetic Pick-up Amplification, Baby Alarm, Microphone Amplifier, etc. Powered by 6-volt Dry Battery lasting for months. Complete Kit of Parts including 4 Transistors and all Components with Circuit (less speaker), **£4/10/-.**

F.M. CONVERTER UNIT 88/100 Mc/s.

Containing 6 valves—2-6BA6, EB91, VR137, 2-EF54. Two I.F. stages and separate local oscillator, graduated Vernier tuning. Just plug in to your radio and obtain good listening on F.M. Voltage required 250v. 50M/A. and 6.3 a. 2 amps.

£7. 19. 6

CATHODE RAY TUBES

VCR188A WITH SCREEN.....	£1 15 0
VCR189A. 2 1/2 in. C/R Tube.....	£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.....	10 0
VCR97. Slight-cut-off. Carr. 2/-.....	15 0
3BP1. Brand new.....	£1 10 0

1355 RECEIVER

Complete with 11 valves 5-SP61, 5U4G, VU120, VR92. As specified for inexpensive T.V. In absolute new condition, 27/6. carr. 5/-.
R.F.24 10/- R.F.25 12/6 R.F.26 25/-
Brand new with valves, carr. 2/6.

MINIATURE TRANSMITTING STRIP "TYPE 81"

Size 7 1/2 in. x 6 in. x 3 in. Complete with Valves Type CV415, VC909, 2-6AM6, 2-7D9 and Quartz Crystal, 4,860 Kc/s. Fully wired with circuit. **£4/10/-** complete.

MINIATURE I.F. STRIP TYPE "373" 9-72 MEG.

Brand new miniature I.F. Strip size 10 1/2 in. x 2 1/2 in. x 3 in. high. Valve line-up: 2-EF92 3-EF91 and EB91. With circuit. With valves, 45/- (less valves 8/- Post free). This I.F. Strip is part of above equipment.

RADIO-GRAM CHASSIS 5 VALVE SUPERHET, LATEST B.V.A. MIDGET SERIES VALVES

3 WAVEBANDS—L.W. 800 n-2000 n, M.W. 200 n, 550 m, SW. 16 n-50 m. Chassis size 131 x 51 x 2 1/2 in. Attractive Glass Dial 10 x 4 in. 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. sock-its. Modern circuitry, all coils adjustable, dust cored and only quality components used throughout. De-jed A.V.C. and neg. feedback. A.C. mains 200-250 v. Double wound transf. isolates A.C. from mains. Aligned and calibrated ready for use.

BRAND NEW & GUARANTEED £9.19.6 Carr. and ins. 4/6.
8" and 10" speakers suitable for this chassis available.

7-Valve De Luxe, push-pull version 7-watt output £12.10.0 Carr. & ins. 5/-

RECORD PLAYER BARGAINS

3-speed COLLARO Gram unit with Studio Hi Fi pick-up, £5/19/6. carriage 3/-
Latest 4-speed COLLARO ditto, 8 cms., carriage 3/6
Latest 3-speed GARRARD autochanger with manual or auto stop position, 81 cms. Carr. 3/6
Leading manufacturers, 4-speed autochangers as available from 9) gns.

ELECTROLYTICS Leading Makes New Stock

TUBULAR	CAN TYPES	80 ohm CO-AXIAL
25/25 v. 50/12 v. 1/9	8+8/450 v. 4/6	SPECIAL. —Semi-air spaced polythene standard 1/2 in. diam. Stranded core. Feeder losses out 50%. 9d. yard.
50/50 v. 4/500 v. 2/-	8+16/500 v. 5/6	Standard 1/2 in., Grade A, 8d. yard.
100/25 v. 2/-	16+16/275 v. 4/6	COAX PLUGS 1/2" SOCKETS 1/-
8/500 v. 2/6	16+16/450 v. 5/6	COUPLERS 1/3" OUTLET BOXES 4/6
8+8/500 v. 4/6	16+16/450 v. 6/-	BALANCED TWIN FEEDERS per yd. 6d.
8+16/450 v. 5/-	16+32/350 v. 4/6	Special 300 ohm TWIN FEEDER 1/3"
16/350 v. 3/-	32+32/350 v. 4/6	TWIN SCREENED FEEDER per yd., 1d.
16/450 v. 3/6	32+32/275 v. 4/6	50 OHM COAX CABLE 8d. per yd., 1in.
16+16/450 v. 5/-	50+50/350 v. 6/6	ATTENUATORS 6db, 12db, etc. from 3/6.
32/350 v. 4/-	60+350 v. 6/6	Band 1-3 Cross-over filter unit from 7/6.
32/500 v. 5/-	60+250/275v. 12/6	
32+32/350 v. 5/6	84+120/275v. 11/6	
32+32/450 v. 6/6	100+200/275 v. 12/6	

CONDENSERS—Mica, Silver Mica. All pref. values, 3 pf. to 1,000. 6d. each. Ditto ceramics 9d. each. Tubulars, 450 v. Hunts and T.C.C. .001 mfd.-.01 and 1/350 v. 9d. each. .02-1/500 v. 1/- each. .25 Hunts, 1/6. .5 Hunts, 1/9.

JASON F.M. TUNER UNIT 87-105 m/cs

Kit of parts to build this modern and highly successful unit complete with drilled chassis and J.B. dial, wound coils and screening cans, 4 BVA miniature valves and all necessary quality components, etc. for only £6/10/- post free. Superior dial calibrated m/c.s. edge lit by 2 pilot lamps, 12/6 extra, as illustrated. Power Pack components kit including double wound mains transformer, £2/5/- extra. Tested and approved by "Radio Constructor," etc. Illustrated handbook with full details, 2/-, post free.



MULLARD "3-3" QUALITY AMPLIFIER

An ideal companion unit to the JASON Tuner. A really first-class 3-valve 3-watt Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line up: EF86, EL84, EZ81. Extra HT and LT available for Tuner Unit addition. Variable treble cut and bass boost controls sensitivity 100 MV. for 3-watt output. Frequency response + or - 1 db, 40 c/s to 25 kc/s. Complete amplifier wired and tested with quality sectionalised output transformer to Mullard specification (less speaker) £8/8/-. Carr. and ins. 4/6.

RESISTORS

Carbon type. Pref. values 10 ohms-10 megohms, 20% Tol. ± w. 3d.; ± w. 5d. 1 w. 6d.; 2 w. 9d.; 10% Tol. ± w. 9d. 25% Tol. ± w. 1/-; 1% Hi-stab. ± w. 2/-

WIRE WOUND TYPES

Wire ends. Silicons coated. 25 ohms-10,000 ohms, 5 w., 1/3. 10 w. 1/6, 15 w. 2/-
LINE CORD .3a. 60 ohms per ft. 2s 100 ohms per ft. 2 way 6d. per ft. 3 way 7d. per ft.

LOUDSPEAKERS

P.M. 3 OHM. 5in. Celes. 17/6; 6in. Celes., 19/6; 7x4in. Goodman's Elliptical, 18/6; 8in. Elac., 20/-; 8in. Goodman's special, 21/6; 10in. R. and A., 25/-; 12in. Fessy, 35/-; 8in. M.E. 215k ohms field, tapped O.P. trans., 24/6; 3in. Elco, 17/6.

S.T.C. RECTIFIERS

E.H.T. types. K3/25 2 Kv., 4/3; K3/40 3.2 Kv., 6/-; K3/45 3.8 Kv., 6/6; K3/50 4 Kv., 7/3; K3/100 8 Kv., 12/6, etc. Mains types. RM1 125 v. 60 mA., 4/-; RM2 125 v. 100 mA., 4/9; RM3 125 v. 120 mA., 5/9; RM4 250 v. 250 mA., 16/-
RM4B type 250 v. 275 mA., 17/6. LT types F/W bridge 6-12 v. 1 1/2 a., 5/9; 3 a., 15/6; 4 a., 18/6; 8 a., 21/6 each.

PRE-SET W/W POTS

T.V. knurled slotted knob type. 25 ohms to 30,000 ohms, 3/-; 50,000 ohms, 4/-; 50,000 ohms to 2 Megohms (carbon), 3/-

VOLUME CONTROLS

Midget log type, long spindles, all values 10,000 ohms to 2 Megohms. Less sw., 3/-; S.P. sw., 4/-; D.P. sw., 4/9. Linear types all values 10 ohms to 2 Megohms less switch 4/-. Guaranteed 12 months.

TRS RADIO COMPONENT SPECIALISTS

70 BRIGSTOCK RD., THORNTON HEATH, SURREY

Phone: THO 2188. Hours 9 am.—6 pm., 1 pm. Wed. Open all day Saturday, BY THORNTON HEATH STATION. BUSES 130A, 133, 169, 166, 190.

Terms: C.W.O. or C.O.D. Kindly make cheques, P.O.s, etc., payable to T.R.S. Post & Packing up to 1lb. 7d., 1lb. 1/1, 3lb. 1/6, 5lb. 2/-, 10lb. 2/9. Bargain Lists, 3d.

TELEPHONE SETS

IN ATTRACTIVE BAKELITE CASE
BRAND NEW EX-GOVT. "F" TYPE

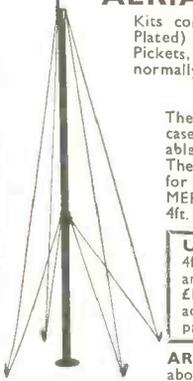


Ideal between 2 or more positions up to five miles. STORES, FACTORY AND OFFICE; FARM BUILDINGS; GARDEN SHED AND HOUSE. 2 sets in individual carrying cases, complete with long life batteries, bells, ringer and 100ft. telephone cable.

£7.10.0 per pair Carr. (G.B.) 7/6
TELE "H" SOUND POWERED. In metal case, requires no batteries. Price per pair £9/10/-, carr. (G.B.) 7/6.

SOUND POWERED HANDSETS, direct communication between two points without batteries. Just connect up and speak. 45/- per pair, plus 2/6 carriage.

SPECIAL OFFER OF R.A.F. TYPE 50 AERIAL MASTS 36ft HIGH



Kits comprise:—9 2in. dia. Tubular Steel (Copper Plated) Sections of 4ft. length, top-section and base, Pickets, Guys and Fittings. YOU can purchase this normally expensive MAST for a fraction of its cost, i.e.

£7.10.0 ONLY (Carr. 7/6)

These are supplied in a returnable wooden carrying case, against which 1/- deposit is charged, (refundable) in addition to price and carriage as listed. The MAST is particularly suitable to take aerials for Tx., Rx., F.M. and T.V. (especially COMMERCIAL), and has many other uses. Extra 4ft. sections can be supplied at 11/6 per section.

U.S.A. 45ft. AERIAL MAST (10 sections 4ft.-6in. x 2in., guys, etc.) This entirely new and complete set in canvas carrying bag £12/10/- each. Carr. 12/6 or 2 sets with additional low and high frequency antenna £25 pair. Carr. extra.

ARMY TYPE 32FT. MASTS similar to above but 10 lin. screw-sections, lightweight, suitable for temporary installation. Kit in canvas bag, £5/10/-, carriage 7/6.

ROTARY CONVERTERS. IN METAL CASES. Input 24 volt D.C. Output 230 volt A.C. 50 cycle 100 watt. At only 92/6. Carr. 7/6.

APQ9 CENTIMETRIC RADAR TRANSMITTER, brand new, and containing 931A Photo-multiplier with resistor network; push-pull pair of matched 8012; 2-307; 2-6AC7; 1-6AG7. £4/19/6, plus 7/6 carriage.

U.S.A. BEACON TRANSMITTER RECEIVER AN/PPN-2 214/238 m/cs. Operated from 2 v. battery. Components include 5-3A5; 3-155; 1-1R5 (all 1.4 v. B7G miniature valves); 2-2 v. synchronizers 7 pin; H.S. 30A Super lightweight headset; 10ft. collapsible aerial. All weather haversack, etc. New, complete and unused, 99/6, plus 7/6 carriage.

BRAND NEW TELEPRINTER EQUIPMENT

CREED AUTOMATIC TRANSMITTER No. 654/N for telegraph working, in original cases.
RECTIFIER UNITS 26B. Input 110/230 v A.C. Output 80 + 80 volts. In original cases.
TERMINAL UNITS 80-80. Can be used with above 26B units.
TELEGRAPH RELAYS 299 AN.
Also other equipment.

TELEPHONE SWITCHBOARDS

- Rectifier Supply Unit
- 10 years' spares
- Fused Protector
- Head and Breast Set
- SWITCHBOARD A. D. 1240

The complete installation as manufactured for the Air Ministry has 2 exchange lines + 14 extns. + operator. Easily modified. Data sheets and photos will be sent for 20/- (returnable).

G.P.O. SWITCHBOARD TL1305 10 lines, thru' connexion switchboard with lever keys (key switches) and drop-indicators for up to 10 lines on two simultaneous circuits, £12/10/-, carriage 15/-.

F. & F. ARMY TYPE SWITCHBOARDS complete for 40 or 60 line operation up to approximately 100 miles or for internal communication. Brand new and unused.

Quantity and Export enquiries are invited for above items, also other Electronic Component parts.

HATTER & DAVIS (RELAYS) LTD.
126, KENSAL ROAD, LONDON, W.1. LADbroke 0666.

Best Buy at Britain's

WIRELESS SETS NO. 17, Mk. 2. A portable 2 valve transmitter for R/T communication, freq. 44-61 Mc/s. Easily converted to the new 70 Mc/s band! Complete with valves, HR headphones and microphone. Requires 120 v. H.T. and 2 v. accumulator. Brand new ex-Govt. surplus, tested. With circuit diagram and operating data. In wooden cabinet, with carrying handle. 15½ in. x 14 in. x 9 in. Wt. app. 35 lb. **ONLY 59/6.**

I.F. STRIP TYPE 373. 9.72 Mc/s. 2 EF92 and 1 EF91 I.F. Amps., EB91 Det./A.G.C., EF91 A.G.C. Amp. and EF91 Limiter. Size 10½ in. x 2½ in. x 3 in. high. Price, less valves, 7/6. Circuit supplied.

LORAN INDICATOR UNIT CHASSIS. Complete with SCPI C.R.T. and screen, but less valves and crystal. New condition, price 29/6.

PANORAMIC ADAPTORS. Visual display of signals on 3 in. C.R. Tube 3BP1 Band width 200 Kc/s. Suitable for receivers with IF's of 450-475 Kc/s, e.g., CR 100 and CR 150. Operates from 115-230 v. A.C. mains. BRAND NEW as shipped ex-U.S.A. With instruction manual, £30.

TBY8 SPARES. Brand new U.S.A. equipment, including 10 piece whip aerials, 4 v. vibrator packs, 4 v. 40 AH accumulators, 3 v. relays, and hundreds of other really beautiful items. For list send 2½ d. S.A.E.

RI155 RECEIVERS. Thoroughly checked and tested. From £5/19/6 according to condition. S.A.E. for details or 1/3 for booklet.

A.C. MAINS POWER PACK AND OUTPUT STAGE. These enable the RI155 to be used on A.C. mains WITHOUT ANY MODIFICATION. Three types available, £4/10/-, £5/5/-, or de Luxe model with 8 in. speaker, £6/10/- . ALL power packs guaranteed SIX MONTHS.

COMMUNICATIONS RECEIVER CR100. Covers 60 Kc/s to 30 Mc/s in 6 ranges. 2 RF's and 3 IF's, variable selectivity, B.F. Osc., etc. Operates from 210-250 v. A.C. mains. Size 16 in. x 12½ in. x 16½ in. deep, wt. 82 lb. S.A.E. for illustrated details. Overhauled, first class condition, £21. CR100/2 with side-tone facility, superb condition, £25. Naval version with noise limiter, unused, £30. Plus £2 carr. and pkg. (£1 refund when pkg. case returned).

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.

MODULATION TRANSFORMERS. Bendix type, for TA-12, push-pull 807's to plate and screen modulate two 807's in parallel, 15/- . Collins type, 20 watts, 807 to 807, 12/6.

CHOKES. Collins, potted, 160 ohms, 8 Hen., 100 mamp., 8/6; S.T.C. potted, swinging approx. 5 Hen., 300 mamp., 12/; Universal mtg. type, 300 ohms, 30 Hen., 150 mamp., 10/6; Parmeko, fully shrouded, swinging, 3.6-4.2 Hen. at 250 mamp., 20 Hen. at no D.C., 10/6; Parmeko, fully shrouded, 8 Hen. 250 mamp., 10/6; Bryce open type, 1.5 Hen., 200 mamp., 3 Hen., 100 mamp., or 10 Hen., 200 mamp. (mtg. feet slightly damaged) 8/6 each; Upright mtg., 6 Hen., 70 mamp., 6/9.

SOUND-POWERED HANDSETS. Similar to telephone handset. Balanced armature microphone and earpiece. No batteries required, 10/6 each. Breast mike and headphones, as above, 12/6 set.

FIELD TELEPHONES. Army type D, Mk. 5. Buzzer calling. Ideal for building sites, farms, workshops, etc. Complete with handset and batteries. Tested, 39/6 each.

MARCONI SIGNAL GENERATORS. Brand new, in original transit case, complete with spares, instruction manual and calibration charts. Type TF390G, 4-32 and 50-100 Mc/s. £25.

CRYSTALS. 200 Kc/s American GEC, 10/- each. 100 Kc/s R.C.A. bars, 19/6 each.

5FT. P.O. TYPE 19in. RACKS. "U" channel, heavy angle base, 59/6.

RCA SPEAKERS. 8 in. P.M. unit in handsome black crackled cabinet. For AR88's, CR100's, etc. BRAND NEW, 45/- .

WIRELESS SET No. 19, Mk.2.
Two transmitter-receivers and an intercom. amplifier in one case. "A" set covers 2-8 Mc/s R/T and CW, and "B" set 240 Mc/s R/T only. Complete with dynamotor for 12 V DC operation, 6 6K7G, 2 6K8G, 2 6V6G, 6B8G, 807, EF50, EB34 and 500 microAmp check and tuning meter. S.A.E. for full details and specification. Technical data available. Made in Canada, in first class condition £5.10.0 plus 15/- Carr. and Pkg.

RCA AMPLIFIERS



MODEL MI-11220. Employs 2 6L6, 4 6J7, and 1 5U4. Output 12 watts at 5-7.5-15-600 ohms. For 190/250 v. A.C. mains. In grey crackled case, 17 in. x 11 in. x 9 in., wt. 38 lb. Brand new and boxed. Price, less valves, £9/19/6. Circuit supplied. Set of new boxed valves, 59/6.

RT37/PPN2 BEACON TRANSMITTER-RECEIVER. 214-234 Mc/s. Size 13 in. x 10 in. x 5 in. Contains 5 3A5, 3 1S5, 1 IR5, and 2 2V. synchronous vibrators. Operates from 2 v. accumulator via 2 built-in vibrapacks. Complete with telescopic mast antenna system (9½ ft.), lightweight headphones. Technical Manual, super quality carrying haversack, cords, co-ax. cables, plugs, etc. Total wt. 28 lb. BRAND NEW, boxed, American equipment, 72/6.

COMMAND RECEIVERS
Complete with 6 valves: 3 12SK7, 1 12K8, 1 12SR7, and 1 12A6. Size 5 in. x 5½ in. x 11½ in. deep. In very good condition. Less dynamotor. **FREE CIRCUIT WITH EACH SET.**
BC453 (the famous Q5'er), 190-550 Kc/s, 59/6.
BC454, 3-6 Mc/s, 27/6.
NEW, BOXED BCXXX (Trawler band), 1.5-3 Mc/s, 75/- .
COMMAND TRANSMITTERS. Complete with 2 1625 (12 v. 807). 1 1626, 1 1629 and Crystal.
BC457, 4-5.3 Mc/s (Xtal 4600 Kc/s), 22/6. New, .. 29/6.
BCZZZ 2.1-3 Mc/s (Xtal 2500 Kc/s). Unboxed, .. 29/6.

TWO-WAY MORSE TRAINING SETS, W/T Mk. 3. Consists of 2 valve oscillators (ARP12's) (one with pitch control), for 1 or 2 operators. Has provision for creating "atmospherics". In polished cast case 12½ in. x 10 in. x 8 in., wt. 16 lb. Complete with valves, leads, 2 keys, 7-way terminal board, circuit and instructions, but less batteries and phones. Ideal for Cadets, Scouts, etc. SNIP, 19/6.

METER BARGAINS

RANGE	TYPE	SIZE	PRICE
50 Microamp.	D.C. M/C	2½ in.	59/6
100 Microamp.	D.C. M/C	2½ in.	59/6
500 Microamp.	D.C. M/C	2½ in.	27/6
500-500 Micro-amp.	D.C. M/C	2½ in.	25/-
1 Milliamp.	D.C. M/C	2 in.	22/6
10 Milliamp.	D.C. M/C	2½ in.	32/6
100 Milliamp.	D.C. M/C	2½ in.	10/6
150 Milliamp.	D.C. M/C	2½ in.	7/6
200 Milliamp.	D.C. M/C	2½ in.	10/6
1 Amp.	Thermo-couple	2½ in.	6/9
4 Amp.	Thermo-couple	2½ in.	6/9
20 Amp.	D.C. M/C	2 in.	7/6
30-0-30 Amp.	D.C. M/T	2 in.	5/-
15 Volts	A.C. M/T	2½ in.	8/6
300 Volts	A.C. M/T	2½ in.	30/-
300 Volts	D.C. M/C	2 in.	10/6

METER RECTIFIERS. Salford Instruments, 1 mA., 8/6; 5 mA., 6/9; S.T.C., 2 mA., as used in E.M.I. Output Meter, 5/6. All are full wave bridge and brand new.

CALLERS CORNER

VCR97's from .. 2/6
Indicator chassis .. 5/-
10 mFd. paper .. 2/6
8 mFd. paper .. 3/-
8 mfd. 500 v. Electro. 1/3
EF50's, from .. 2/6
EA50's, NEW .. 6d.
EB34's, NEW .. 6d.
12H6's, NEW .. 6d.
RL155's, Gas. led 25/-
Unmarked S.M. Conds. 100 asst. 2/6

INDICATING UNIT 277. Case size 5½ in. x 7 in. x 12 in. deep. Contains lin. C.R. tube type VCR522 (same as that used in G.E.C. "Miniscope"), 4 VR91, 2 VR92, and a host of useful modern components. Fitted with "Focus" and "Brightness" controls, etc. Should convert to useful miniature oscilloscope. All tubes tested. 39/6.

HIGH VOLTAGE POWER PACKS ex-U.S.A. Brand new. Input 115 volts A.C. output 1,000 volts at 250 mA. Complete with 2 1616 valves and 1 spare. Double choke and paper smoothing. £5/5/-.

EDDYSTONE ROTARY POWER UNITS. In grey metal case. Input 12 v. D.C. Output 180 v. at 60 m/a. Complete with all smoothing and filtering. Size 12 in. x 6 in. x 5 in. Wt. 16 lb. BRAND NEW, 19/6.

BLOCK PAPER CAPACITORS, T.C.C. 3 mFd., 1 kV. wkg., upright mtg., size 4 in. x 2½ in. x 5 in. high. Brand new and boxed. TWO for 15/-.

THREE-CORED CABLE. 23/36, rubber ins., circular, padded, cotton covered, maroon. 12 yds., 9/-, or 100 yds., 59/6.

AR7 MAINS TRANSFORMERS. Fully shrouded, drop-through, 3½ in. x 3½ in. Primary 110/125/150/210/240 v. 50-60 c/s. Secs., 325-0-325 v. 100 mamp., 6.3 v., 3.5 amp., and 5 v. 2 amp. BRAND NEW ex-U.S.A., 29/6.

REPLACEMENT MAINS TRANS. for R.C.A. Amplifiers, Pri. 105/115/125 v., 50-60 c/s, Secs., 380-350-0-350-380 v., 170 mamp., 6.3 v., 3 amp., C.T. and 5 v., 3 amp. 4½ in. x 4½ in. x 4½ in. high. Fully shrouded, 16/6.

TRANSFORMER BARGAINS. Brand new ex-manufacturer's surplus drop-through. Primary 200/250 volts 50 cps. Secondary 310-0-310 v. 70 mA., 6.3 v. @ 3 a., 4 v. @ 2 a. Can be used with either 4 v. or 6.3 v. rectifier. Only 9/6 plus 1/6 post. A similar type transformer 325-0-325 100 mA., 6.3 v. 4 a., 4 v. 3 a. only 12/6.

INSTRUMENT TRANSFORMERS. Parmeko, 230 v. A.C. input. 0-65-130-195 v. 85 m/Amp. 6.3 v. 5 amp. and 6.3 v. 3 Amp. Shrouded, 3½ in. x 3½ in. x 3½ in. high. 15/-.

HEAVY DUTY LT TRANSFORMERS. 230 v. A.C. mains input. Secs. 5-0-5 v., 5-0-5 v., and 5-0-5 v., all at 5 amps., each winding. 5, 10, 15, 20, 25, or 30 v. at 5 amps., or other possible combinations. 4½ in. x 4½ in. x 6 in. high. Wt. 12 lb. BRAND NEW, 29/6. ANOTHER, 230 v. A.C. mains input. Two separate secondary windings, each 14 v. C.T. 12 amps. 7, 14, 21, or 28 v. at 12 amps., or other possible combinations. Wt. 24 lb. Ex-Admiralty. Brand new, 42/6.

G.E.C. 200-250 v. A.C. mains input. 30 v. (tapped at 10 v.) 36 amps. output. 5½ in. x 6 in. x 7 in. high. Wt. 24 lb., 55/-.

U.S.A. potted type, input 210/220/230 v., 5 secondaries, 7.5 v. 4 a., 7.5 v. 4 a., 7.5 v. 8 a. and 2.5 v. 5 a., ALL centre tapped, and 6.3 v. 4 a. These can be connected to give many useful voltages up to 31 v. 4 a. Size 6 in. x 5 in. x 4 in. Wt. 14½ lbs. price 35/-.

SELENIUM BRIDGE RECTIFIERS. Funnel cooled, A.C. input 45 v. R.M.S. D.C. output 30 v. 10 amp. 47/6 each.

HEAVY DUTY SLIDER RESISTORS. 250 watts. Rated to carry 25 amp. 4 ohm resistance. For charging boards, etc. Worm drive. On metal stand 9 in. x 4 in. x 6 in. high. BRAND NEW 7/6 each. ANOTHER, 12 amps., 1 ohm. 150 watts, 6/6. ALSO 14 ohms, graded I to 4 amps., 7/6.

RESISTORS. Latest miniature insulated Dubilier ½ watt type B.T.S. Wire ends. Useful values. ONLY 10/- for 100 assorted! Erie, etc., ½ and ¼ watt, 1 gross assorted, 10/-.

WIREWOUND POTS. 100 ohms, 3 watt. Colvern, lin. spindle, NEW, 2/6. All other values in stock.

METAL RECTIFIERS. 250 v. 100 m/amps., 6/9; 230 v. 60 m/amps., 5/- . Many other types in stock.

PLEASE ADD POSTAGE OR CARRIAGE ON ALL ITEMS

CHARLES BRITAIN (Radio) Ltd.

11 UPPER SAINT MARTIN'S LANE, LONDON, W.C.2. Temple Bar 0545

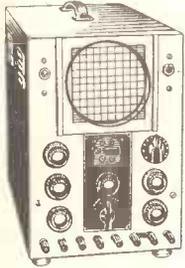
One minute from Leicester Square Station (up Cranbourn Street)
Shop Hours: 9-6 p.m. (9-1 p.m. Thursday). Open all day Saturday

UNIVERSAL ELECTRONICS

22/27 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2

Inspection and laboratory test available at this address.

COSSOR Double Beam Oscilloscope



Type 339. **IMPROVED VERSION** of the **OBSOLETE** Type 3339

Time Base Frequency. 6 to 250,000 c.p.s.
Amplifier. 43 mV RMS/mm. 10 to 100,000 c.p.s. 3dB. 1.3 mV RMS/mm. 10 to 100,000 c.p.s., 3dB (2 stage).
10 mV RMS/mm. 10 to 2,000,000 c.p.s., 3dB (2 stage).

Deflector Coils. 2 mm/mA RMS.

Power Supply. 110-250V A.C. 120 watts.
Sensitivity. Y1, Y2, 3.IV D.C. 1.IV RMS (volt/mm). X 2.25V D.C. 0.8V RMS (volt/mm).
Screen Diameter. 114 mm

In good working condition **PRICE £30**

Also supplied Rebuilt to Laboratory standard and guaranteed for 3 months. Prices on request.

MANUALS for Communication Receivers £1.7.6 each,

for AR88D-LF, AR77E, R107, S20R, SX24, SX28, B2, TX/RX, HRO's, etc,

TEST EQUIPMENT

AVO model 7 meter, £15; Model 40 meter, £12/10/-, G.E.C. type BW232 Signal Generator 500-1,000 Mc/s., £85. MARCONI type TF144G range 85 kc/s-25 Mc/s., £85; TF390G range 16-150 Mc/s., £25; TF517 range 150-300 Mc/s., £35; "Q" Meter type 329C, £85; Output Meter, type TF340, £35. **GENERAL RADIO** type 740 Capacity Bridge; type 726A Valve Voltmeter; type 916A R.F. Bridge; type 804 Signal Generator, 30-300 Mc/s., £65. **EVERSHED MEGGERS**, Bridge and Wee types. U.S.A. "Standing Wave" Measurements Instrument. Sliding rule from 0-15 cm.; probes for detection with Amplifier. NEW £40 each. U.S.A. Brand New Hicock Valve Voltmeters; unused, Ranges 2.5-250 A.C.V. 2.5 1,000 D.C. V. 2.5-1,000 mA D.C. Resistance 0-1,000 megohms. Frequency up to 100 Mc/s. Voltage 110 A.C. Price £30 each.

BC 221

FREQUENCY METERS

Range 125 kc/s—20 Mc/s

In perfect condition

BRITISH & U.S.A. VHF/UHF - 10cm 3cm 1.5cm TEST EQUIPMENT

TS-3/AP Power and frequency meter S-band
TS-14/AP Signal Generator frequency meter S-band
TS-15/AP Fluxmeter 1.2-4.5K Gauss
TS-33/AP Frequency meter X-band
TS-34/AP Portable oscilloscope Fast sweep
TS-35/AP Sig. gen. pwr. and freq. mtr. X-band
TS-36/AP Power meter X-band
TS-45/APM-3 Power and freq. meter X-band
TS-47/APR Signal generator 40-500 Mc/s

TS-56/AP Standing wave ind. L-band
TS-61/AP Echo box S-band
TS-62/AP Echo box X-band
TS-89/AP Voltage divider X and S-bands
TS-120/UII Sign. gen. pwr. meter X-band
TS-127/U Frequency meter 375-725 Mc/s
TS-174/U Frequency calibrator 20-280 Mc/s
TS-175/U Frequency Calibrator 85-1,000 Mc/s
TS-226/AP Wattmeter to K KW 400-425 Mc/s

RECEIVERS

G.E.C. BRT400, £95. RCA AR88D and LF from £55. EDDYSTONE 640, 740, 840, 680, 680X. HALLICRAFTERS SX71, £95, SX28 £45. 840, SX24, SX17, S20B, S20, S38 A.C./D.C. NATIONAL HR07, Senior and Junior models from £28. MARCONI CR100 from £20. CR150, Range 2-60 Mc/s., 5 band dual superhet, PRICE £50. Power supply £10. Completely checked. Carriage £2. HAMMARLUND HQ120 and HQ129X.

Write, call or Telephone GERrad 8410.

Shop hours, 9.30 a.m. to 6 p.m.

Thursday 9.30 a.m. to 1 p.m.

OPEN ALL DAY SATURDAY

HANNEY OF BATH OFFERS

VIEWMASTER 3 STATION T.V. TUNER (P. Television)

Denco coilset with screens, can and screws 30/-; Denco switch, Fine Tuner, Coil mounting plates and tag panel 27/-; Kit of resistors 7/6; TOC condensers kit with two printed circuits, valve holders etc. 43/-; Gain controls 3/3 each; Co-ax P/Skt. 2/6; Valve caps 1/3 each. Complete kit of parts for the TUNER, with the two Genuine MULLARD Valves, nuts, bolts, wire coxax, etc. £8/19/6. Denco Coilset for conversion of the V-Master S/V chassis to the I.F. amplifier 20/-. OR Complete kit of S/V conversion components 39/6. All Standard V-Master items in stock. Full list available.

MULLARD 3 VALVE 3 WATT AMPLIFIER

Punched chassis 10/6; Gilson Trans. Mains 35/-; Output 25/6. Blstone Trans. Mains 35/-; Output 21/-; Condenser kit 20/-; Resistor kit with 3 pots. 22/6. Complete kit with Genuine MULLARD VALVES £8/19/6. Full list available.

MULLARD 510 AMPLIFIER.

Erie Resistors 27/-; TOC Condensers 45/-; Blstone Mains Trans. 36/- (100 ma.); 42/6 (120 ma.); Output Trans. 45/- (6K or 8K); Gilson mains trans. 60/- (140 ma.); Output Trans. 47/6 (6K or 8K); Ultra linear type 52/6; Partridge Mains Trans. 65/6; Output Trans. P.3667 55/6; Partridge Ultra Linear type P.4014 98/6. Denco, punched chassis 19/6 with base plate; Printed front panel 6/6; Type 'A' and 'B' Chassis (panel not printed) 8/6 and 12/6 respectively. Condensers 'A' 15/6 'B' 24/6; Resistors 'A' 17/6. 'B' 35/6 (with pots). Full list available, giving details of complete kits.

OSRAM 912 PLUS AMPLIFIER

Erie resistor kit, 17/4; Erie 1 meg. pots, 4/6 each; TOC condenser kit, 55/-; PARTRIDGE components with loose lead terminations (includes packing charge), Mains trans., 65/6; choke, 34/6; output trans., 85/6; W.B. components, Choke 18/9; output trans., 32/-; Denco drilled chassis, 14/6; Denco 912 Plus printed panel, 7/6; pre-amp. or passive chassis, 6/-. Full list available.

COMPONENTS are still available for the following P.M. TUNERS:—Wireless World, Mullard, Osram 912; Denco Maxi-Q. List available.

WIDE ANGLE COMPONENTS. ALLEN. Telemeking Chassis, 50/-; Coils (TK and Super-Visor), 44/6; LO.308, 40/-; FO.305, 21/-; D.C. 300c., 38/6; FC302, 31/-; GL16 and 18, 7/6 each; SC312, 21/-; AT.310, 30/-; OE.117, 9/-; BT.314, 15/-; DENCO Chassis Magnaview, 37/6; Chassis, Super-Visor, 51/6; Coils Magnaview 41/2; WA/DCAL, 43/-; WA/FCAL, 31/-; WA/LCL and WCL, 7/6 each; WA/FMAL, 21/-; WA/LOT, 42/-; WA/FBTL, 16/-.

Send stamp for lists. Please add 2/- postage to all orders under £3 (excess refunded).

L. F. HANNEY

77 LOWER BRISTOL ROAD, BATH

Tel.: 3811

A.W.F. Radio Products, Ltd.

SPECIALIST SUPPLIERS TO THE TRADE

are now
in London

Between Earls Court & Olympia.

170-172, WARWICK ROAD, LONDON, W.14

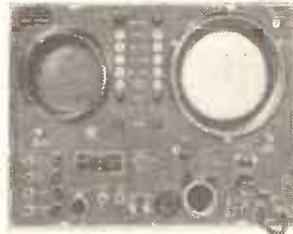
Phone-Office-WESTern 5201 — Counter-WES. 5202.

Also at
BRADFORD,
YORKS.

INDICATOR UNITS ID-16/TPS-1A

PART OF RADAR Type AN/TPS-1A. BRAND NEW

Supplied complete with



Tray of spares including a high sensitivity (20,000 ohms per volt and 60 megohms) NINE RANGE Universal Test Meter type TS-96/TPS-1 or Voltage Divider type TS-98/AP in specially made chests and in original packing.

Also available any American or U.K. Govt. Surplus Equipment for Navy, Army and Air Force.

Full details and prices from:

ELECTRICAL & WIRELESS SUPPLY CO.
69 Church Road, Moseley, Birmingham 13

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

TRADE ENQUIRIES
INVITED

FOR ALL RADIO BARGAINS

WE PURCHASE ALL TYPES OF
RECEIVERS AND TEST GEAR

PANORAMIC ADAPTORS

Brand new and boxed Ex-U.S.A. For use with receivers having an I.F. of 455/475 kc/s., giving a bandwidth of 200 kc/s. 110/230 volt A.C. operation. Price £30 each.

A.R.88 WAVECHANGE SWITCHES. Ceramic, 8 bank 6 position, complete with screens, BRAND NEW, 17/6 each.

MODULATION TRANSFORMERS. Collins type, potted. Push-pull 807 to parallel 807, 20 watts audio, brand new, 12/6 each.

BENDIX COMMAND RECEIVERS Brand new and boxed, with circuit. Top band model, 1.5-3 mc/s., 75/- each.

BENDIX COMMAND TRANSMITTERS. Complete with all valves and crystal. Coverage 2.1-3 mc/s. 29/6 each.

BARGAIN MAINS TRANSFORMERS All new and unused.

L.T. TYPES

- a. Input 220/240 v. Output 6.3 v. 1.5 a., 5/9.
- b. Input 200/250 v. Output 6.3 v. 3 a., 8 v. 1.5 a., 9/6.
- c. Input 200/250 v. Output 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24 or 30 v. 2 a., 18/6 each.
- d. Input 200/250 v. Output 3, 6, 9, 12, 24, or 36 volts 5 a., 35/-.
- e. Input 230 v. Output 5, 10, 15, 20, 25 or 30 v. 5 a., 29/6.
- f. Input 200/250 v. Output 4 v. 14 a., 6.3 v. C.T. 1.5 a., 10/6.

INSTRUMENT TYPES

- a. Input 220/240 v. Output 200 v. 25 ma., 6.3 v. 1 a., 10/6.
- b. Input 230 v. Output 195 v. 95 ma., tapped 130 v., 6.3 v. 5 a., 6.3 v. .3 a., 14/6.

H.T. TYPES

- a. Input 200/250 v. Output 250/0/250 v. 60 ma., 6.3 v. 3 a., 5 v. 2 a., 18/6.
- b. Input 200/250 v. Output 250/0/250 v. 80 ma., 6.3 v. 4 a., 5 v. 2 a., 18/6.
- c. Input 200/250 v. Output 350/0/350 v. 80 ma., 6.3 v. 4 a., 5 v. 2 a., 18/6.
- d. Input 110/230 v. Output 250/0/250 v. 175 ma., 6.3 v. 5 a., 5 v. 3 a., potted, 35/-.
- e. Input 230 v. Output 500/0/500 v. 250 ma., 4 v. C.T. 3 amps., 19/6.

AUTO TRANSFORMER 110/200/250 volts, 150 watts, 21/-.

CHARGING TYPES

- a. Input 200/250 v. Output 9 or 15 v. 1 a., 9/9.
- b. Input 200/250 v. Output 3.5, 9 or 17 v. 2 a., 14/3.
- c. Input 200/250 v. Output 3.5, 9 or 17 v. 4 a., 16/6.

SELENIUM CHARGING RECTIFIERS Full wave and bridged. 12 v. 1 a., 6/3; 12 v. 2 a., 9/3; 12 v. 4 a., 13/9; 12 v. 10 a., 32/6; 24 v. 8 a., 49/6.

CHARGING RHEOSTATS 1 ohm 12 amp., 6/6; 14 ohm 4 amp., 7/6; 8 ohm 2.5 amp. 7/6.

460 KC/S B.F.O. UNIT

Supplied brand new and complete with 1S5 valve, fully screened in aluminium case, size 2½ x 1 x 4½in. Price 8/6 each.

MORSE BUZZERS. Brand new and boxed. Operation from 3 volt D.C. Price 2/6 each.

CRYSTAL MICROPHONE INSERTS. Extra sensitive, ideal for amplifiers, etc., 4/6.

POWER UNIT 285

230 volt 50 cycle input. Outputs E.H.T. 2 kv. 5 ma., H.T. 350 volts 200 ma., L.T. 6.3 volts 17 amps. E.H.T. and H.T. supplies are fully smoothed, double choke and paper condenser, etc., and complete with valves 5U4g, VU120 and EF50. A genuine bargain at only 59/6 each.

TRANSMITTER/RECEIVER No. 19 Mk. II

Equipment comprises 3 separate units built into one chassis and separate power pack. Specification: "A" set. Transmitter/receiver. Frequency coverage 2-4.5 mc/s. and 4.5-9 mc/s. For R.T., Q.V. or M.G.W. Range on R.T. 15 miles, G.W. 60 miles. Superbet receiver, 485 kc/s. I.F. B.F.O., etc. Rx. Valve line-up: 6K7 R.F., 6K8 mixer, 2 6K7 I.F., 6B8 det. A.F. phone output. Tx.: 6K8 mixer, BFO, EF50 buffer, EB34 ADC, 807 P.A. "B" set. Transmitter/receiver 229/241 mc/s. Local use up to 1 mile. Valve line-up: CV6, 2 6K7 and 6V6. Inter Com. set. 2 valve A.F. amplifier for vehicle crew inter-communication. Valve line-up: 8K7 and 6V6. A 2½in. meter is built in reading L.T. and H.T. voltages, drive, etc. POWER UNIT. 12 volt D.C. input. Output 276 volts 110 ma./a. and 500 volts 50 m/a. Equipment is of Canadian manufacture and is supplied in good condition. Price, complete with power pack only £5/10/- each. plus 15/- carriage.

AMERICAN GEARED MOTORS



American 24 volt D.C. motors with built-in precision gearbox giving twin outputs 20 r.p.m. and 6 r.p.m. Will also operate on 12 v. giving reduced outputs. Size 7in. x 1½in. Shaft dia. ½in. Supplied brand new only 29/6 each.

MARCONI U.H.F. SIGNAL GENERATOR TF.517, MODULATION GENERATOR TF.675. Complete station comprising TF.517 signal generator, frequency coverage 16-58 mc/s and 150-300 mc/s, and TF.675 pulse modulator, repetition speed 50-3,000 cycles, pulse width 2-12.4µ sec. Supplied brand new in original transit case with full instruction book and full complement of leads, £42/10/- each.



MODULATOR TYPE 67

These bargain instruments contain a COMPLETE A.C. MAINS POWER PACK, input 230 volts 50 cycles. Outputs 350 volts 120 ma. and 6.3 volts 5 amps. Choke and condenser smoothed and uses 5Z4 rectifier. (Transformer actually 200 ma.). Also included in the unit are 11 other valves, 5 SP61, 1 VR116, 2 EB34 and 3 EA50, and many other useful components, pots, resistors, switches, etc. Size of case 18 x 9 x 7in., which is finished in grey. Supplied brand new, 49/6 each.

RCA A.R.88 L.F. RECEIVERS. Offered in first class condition, re-aligned and thoroughly tested. Continuous coverage from 75 to 550 kc/s and 1.5 to 30 mc/s. Built-in A.C. mains power pack, phone or speaker output, variable selectivity, B.F.O. etc., Price £45 each.

AMERICAN ROTARY GENERATORS

Input 12 volt D.C. Output 250 volts 80 ma. Fitted with blower attachment which can be easily removed if desired. Brand new 22/6 each. Ditto with 6 volt input 22/6 each.



50 MICROAMP METERS

2½in. scale flush mounting meter housed in grey instrument case with chrome handle. Brand new and tested, 59/6 each.



FIELD TELEPHONES

Type Don Mk. 5. Buzzer calling. Ideal for inter office or house communication. Supplied complete with two 1.5 volt cells, tested and ready to operate. Price only 39/6 each.

MODEL-MAKERS' MOTORS

Permanent magnet type, reversible. Size only 2in. long, 1½in. dia. with ½in. long spindle. Operation from 4.5 to 24 volt D.C. Thoroughly recommended for launches, etc. Supplied brand new only 8/6 each.

JUNCTION TRANSISTORS

Suitable for receivers, amplifiers, radio control, oscillators, etc., similar to Mullard OC71. Supplied individually tested, only 10/- each.

GRAM MOTORS

Special offer. Garrard 200-250 volt A.C. gram. motors complete with turntables. Speed adjustable from 0-45 r.p.m. A real bargain at only 22/6 each.

MARCONI CRYSTAL CALIBRATORS. Frequency coverage 170 to 240 mc/s. Directly calibrated accuracy 0.001%. Operation 200/250 volt A.C. Supplied complete with 5 mc/s. crystal and spare set of 5 valves in original transit case, brand new with instructions, £4/19/6 each.

AMERICAN BEACON TRANSMITTER/RECEIVER RT 37/PPN-2.

Brand new and boxed, complete with instruction book. Equipment comprises transmitter/receiver with 9 valves (5 3A5, 3 1S5 and 1 1R5), with built-in 2 v. vibrator power pack, spare vibrator, headset, connector leads and 10ft. collapsible aerial. Frequency coverage 214/238 mc/s. Price 72/6 each.

ROTARY CONVERTORS. Input 24 volt D.C. Output 230 volt A.C. 50 cycles, 100 watts. Price 92/6 each.

JACK PLUG LEADS. Brand new 6ft. leads, screened, fitted with two standard P.O. jack plugs, 3/- each.

SUB-STANDARD VOLTMETERS

Six ranges: 7.5, 15, 30, 60, 150 and 300 volts D.C. 6in. mirror scale with knife edged pointer calibrated 0-150 volts. 0.3% accuracy. Price £4/19/6 each.

SOUND POWERED EARPIECES. Can be used as earpiece or mike. No batteries required to operate. Brand new 3/6 each. Brand new sound powered telephone handsets, 19/6 each.

SMOOTHING CHOKES

G.B. 20 henries 175 ma.	10/6
Parmeko 8 henries 25 ma.	10/6
Parmeko 9 henries 100 ma.	7/6
Parmeko C core 4H. 22.5 ma.	4/6
Parmeko swinging choke 3.6-4.2 henries 250 ma. 20 H. no D.C. ...	10/6
Collins 8 henry 100 ma.	8/6
All new and unused.	

DEAF AID EARPIECES. Brand new, 30 ohms D.C., 3/6. Leads 1/-. Deaf aid valve CK505, new, 2/6. 1 meg. pots with switch, 1/-, Switch, 1 pole 4 way, 1/-, Output transformer, 2/6.

METER BARGAINS

50 m/amps. 2in. F.M.M.C.	7/6
150 m/amps. 2in. F.M.M.C.	6/9
200 m/amps. 2½in. F.M.M.C.	9/6
1 amp. R.F. 2½in. Pj. T.C.	5/-
4 amp. R.F. 2in. F.M.T.C.	5/-
300 volt D.C. 2in. F.M.M.C.	10/6
300 volt A.C. 2½in. F.M.M.I.	25/-
500/0/500 microamp. 2½in. F.M.M.C. 25/-	25/-
50/0/50 amps. 2in. F.M.M.C.	8/6
ALL BRAND NEW AND BOXED.	

HOURS OF BUSINESS: 9 a.m.-6 p.m. Thursday 1 p.m. Open all day Saturday. Please print name and address clearly. Also include postage on all items.

GEE RADIO LTD.

AIRCRAFT RADIO RECEIVER (BY RCA Model No. CRV. 44151). Freq. 195 kc/s. to 9050 kc/s. (33-1500 metres) continuous. For 28 v. D.C. input with built-in dynamotor. This 6-volt receiver with 2 R.F. stages and 2 I.F. stages with B.F.O. and C.W. is in our opinion one of the finest sets so far released by the Air Ministry. With instruction diagram to convert for mains. For the very modest price of £10/10/-, carr. paid. In good working order.

VITAVOX PRESSURE UNITS. Heavy duty. P.M. 20 watt. Brand new, £4/9/6. Also ditto, second-hand, in good working order, 40/-, carr. 7/6.

723AB KLYSTRONS. Guaranteed, 50/-.
B.C. 929ACRT INDICATOR UNIT. Containing 1-3PBI 3in. C.R.T. 6-6SN7s, 2-6H6s, 1-6G6, 1-6X5, 1-2X2; 7 valves in all. Ideal for 'scope conversion. New, in original sealed cartons. 70/-, carr. 5/-

15 WATT 12 v. D.C. AMPLIFIER (BY PARMEKO, ex-ADMIRALTY). Fitted for mike and gram. with "Fader" control. With 2-EL35s in push-pull output. Speaker output 15 ohms. Housed in metal case, size 14in. x 9in. x 9in. Ready to use, guaranteed in perfect order. £12/10/-, carr. 10/-.

PARMEKO MOVING COIL HAND MICROPHONE. 200 ohm imp. Fitted on/off switch, complete with 12 yds. flex, 25/-, p.p. 2/6.

RE-ENTRANT LOUD HAILERS. Heavy duty 20 watt all-metal. 15 ohms. By Parmeko. £5/10/-, carr. paid.

PARMEKO TWIN BAKELITE LOUD HAILERS (ex-Admiralty), complete on metal base. 10 watts. 45/-, carr. 7/6.

RCA BRAND NEW. 15in. 15ohms 30 watt P.M. speakers. £9/19/6, carr. 12/6.

C.M.G. 25 PHOTO CELLS (OSRAM). Brand new, 15/-, p.p. 1/-.
AC/DC POWER SUPPLY UNITS. 230 v. A.C. 50 cycles input. 100 v. D.C. at 1 amp. out. Housed in strong metal case, ex-G.P.O. New and unused £4/10/-, carr. 7/6.

TRANSFORMERS. 110-230 v. Primary. Sec. 26 v. tapped to 41 v. at 14 amps. New and boxed, £3/10/-, carr. 5/-.

P.E. 103 H.D. POWER SUPPLY UNIT. New and boxed. Complete with connecting cables and mounting rack, £15, carr. extra.

APQ9 TRANSMITTER. Containing 931a Photo Electric cell (complete with network). 2-6AC7's, 1-6AG7, 2-807's and 2 blower cooled 8012's. With rev. counter. Brand new, 79/6, carr. 7/6.

SELENIUM METAL RECTIFIERS. FULL BRIDGE

6 or 12 v. 1 amp.	7/6	24 v. 1 amp.	13/6
12 v. 2 amp.	10/-	24 v. 2 amp.	20/-
12 v. 2½ amp.	15/-	24 v. 2½ amp.	25/-
12 v. 4 amp.	16/6	24 v. 4 amp.	30/-
12 v. 6 amp.	23/6	24 v. 6 amp.	35/-
12 v. 10 amp.	40/-	24 v. 10 amp.	80/-

SPEEDY DELIVERY OF LT. RECTIFIERS TO ORDER.

ELECTRIC LIGHT SLOT METERS. 200/250 v. A.C., 5-10 amps. 1/- in slot. 6d. or 7d. per unit. By Measurement Ltd. All Bakelite case, in very good condition, 50/-, p.p. 3/-.

SOUND POWERED HEADPHONES. Can be used for speaking or receiving. 15/- per pair, p.p. 1/6.

BC.454. 3-6 Mc/s. New and boxed, £1/10/-, p.p. 3/-.
BC.455. 6-9 Mc/s. (Command set). New and boxed, £1/10/-, p.p. 3/-.

3A5 VALVES. Brand new (DCC.90), 12/6, p.p. 9d.
CONDENSERS. 2 mfd. 7.5 kv. wkg. at 15 kv. Test (Dubilier). Brand new in original crate, £2/10/-, carr. 5/-.

VARIABLE VOLTAGE REGULATOR TRANSFORMERS. Input 230 v. A.C. at 21 amps. Output 57.5 volts in 16 equal steps to 230 v. at 21 amps. Ex-Govt., in perfect condition. £12/10/-, carr. extra.
DON "8" TWIN TELEPHONE CABLE, on 1 mile and ½ mile drums. £5 per mile, 25/- per ½ mile, carr. extra.

WAVEMETER CLASS D. Freq. band, 1,900 kc/s. to 8,000 kc/s. (158-37.5 metres) in two ranges, 1,900 kc/s.-4,000 kc/s. Also 4,000 kc/s.-8,000 kc/s., in perfect working order. Supply 6 v. D.C. input, £5/19/6, carr. 5/-.

VALVE TESTER (by Radio City Products, U.S.A.), model 314. Brand new, unused with instruction manual. 110-220 v. A.C. 50 c/s. Will test most American valves from 1.1 v. to 200 v. £10, carr. 5/-.

ROTARY CONVERTERS, Ex-Govt. 12 v. D.C. input 230 v. A.C. Output 50 cycles at 125 watts. Complete in carrying case, with voltage control, sliding resistance, mains switch and 0-300 v. A.C. flush meter. In perfect working order, £8/10/-, carr. extra.

ROTARY CONVERTERS. 24 v. D.C. to 230 v. A.C. 50 cycles. 100 watts. Fully tested, £4/12/6, carr. 7/6.

10in. P.M. LOUDSPEAKER in PORTABLE CARRYING CASE. Complete with handle, back and flex lead compartment. Cases slightly soiled. Speakers 100%, 45/-, carr. 5/-.

HEAVY DUTY TWIN 12in. P.M. 15 ohms SPEAKERS. Housed in H/D lin. thick Cabinet, (slightly soiled). Size 36in. x 18in. x 12in. Felt padded inside. As used by the Admiralty P.A. Ideal for portable amplifier, etc. Limited quantity only. £12/10/-, carr. 10/-.

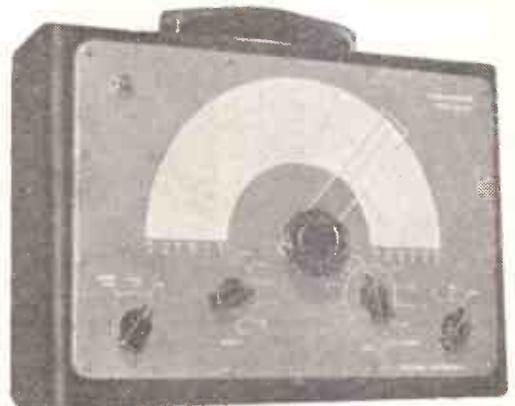
METERS (new and unused)

0-1 m/a., 2½in. flush mounting	25/-
0-30 m/a., ditto	15/-
0-300 v. A.C. ditto	25/-
"S" meter, 2in., as used in AR-77 receiver	25/-
2½in. D.C. pocket voltmeter 0-15 v., 0-250 v.	15/-

ACCUMULATORS. Bakelite cased. 2 v. 100 ampere. 75 actual. Ex-Govt. New and unused. Complete with carrying handle. Ideal for coupling 6 or 12 v. storage batteries. Size 6½in. x 6½in. x 3½in. 15/- each. Carr. 3/6 each, or 3 sent for 7/6 or 6 for 12/6.

15, LITTLE NEWPORT ST., LONDON, W.C.2.

GERrard 6794/1453



SG50 SIGNAL GENERATOR covers 100 kc/s to 80 Mc/s in six continuous ranges on fundamentals (not harmonics) either modulated 400 cps. or CW. Frequency accuracy 2%. Uses EP91, 6C4 and 8M1 with double wound mains transformer. The scale is directly calibrated on all ranges with total scale length over 60 inches. Housed in de luxe olive green metal case with carrying handle with scale of engraved Perspex. Size 9in. x 15in. by 4in. deep. Only £8/10/- plus 6/- carriage and packing.
VV50 VALVE VOLTMETER measures up to 250 volts A.C., R.P., and A.F. with input impedance of 11 Megohms. Complete with probe unit ready for mains operation at £7/19/6, plus 4/6 carr. packing.
CR50 BRIDGE measures from 10 pF to 100 mF and from 1 ohm to 10 Megohms in fourteen ranges, having total scale length of over 120 inches. Indication of balance is given by a range eye fed from a high gain pentode amplifier. Leakage test for condensers. Internal standards are "Constanta" 1% resistors. In case specially designed for bench use with sloping panel. Complete and ready for operation from A.C. mains. ONLY £7/18/- plus 4/6 carr. packing.
Further details sent by return of post on receipt of self addressed, stamped envelope. Trade supplied direct.

RUSH your order now to:-

GRAYSHAW INSTRUMENTS

126 SANDGATE HIGH STREET, FOLKESTONE, KENT.

'Phone : Folkestone 78618

5mm. & 7.5mm. Pea Bulbs

CAP. L.E.S. to British Standard 98/E5.
Diameter 5mm. Length 8mm.
BALLOONS. Tubular 5mm. Spherical 7.5mm. **OVERALL LENGTH.** Tubular 15mm. ± 1mm. Spherical 16mm. ± 1mm.
RATINGS. Voltages up to 24 volts.



VITALITY BULBS

Subminiature and all other indicator types.

Vitality Bulbs Ltd., Neville Place, London, N.22

Phone : BOWes Park 0016

CABINETS!

Many and varied designs in Bureau, Piano, Console & Table Models
The BEAU-BUREAU Mk. III
THIS magnificent bureau-type cabinet is in specially selected walnut veneer exterior, with a light sycamore lining. It gives you two large-sized storage compartments.
Overall dimensions:
Length 32" Height 34"
Maximum depth 16"
Minimum depth 11"
Motor board size: 15½" x 13"
Scale aperture size: 10½" x 14½"
Send for our Cabinet List.



Send also for our detailed wholesale list for cabinets, wire chassis FM/AM. Complete T.V.s, Radio Aerials, converters & sundry electrical components. E.C. shavers, etc.

V.E.S. WHOLESALE SERVICES Ltd.
Dept. (W.W.), 11, Gunnersbury Lane, Acton, W.3. Tel.: ACOrrn 5027

C.R.T. ISOLATION TRANSFORMERS

For Cathode Ray Tubes having Heater/Cathode short circuit for C.R. 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
 Ditto with mains primaries 12/6 each.
 Type B. Mains input 230/240 volts. Low Capacity. Multi Output 2, 4, 6.3, 7.5, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. This transformer is suitable for all Cathode Ray Tubes. With Tag Panel 21/- each.
 Type C. Low capacity wound transformer for use with 3 volt Tubes with falling emission. Input 220/240 volts. Output 2-21-21-21-3 volts at 2 amps. With Tag Panel 17/6 each.
 All Isolation Transformers are individually boxed, labelled and clearly marked with relevant data.
 NOTE—It is essential to use mains primary types with T.V. receivers having series connected heaters.

RESISTORS. All values. 10 ohms to 10 meg., 1/4 w., 4d.; 1/2 w., 6d.; 1 w., 8d.; 2 w., 1/-.
HIGH STABILITY. 1/4 w., 1/2 w., 2/-.
 All preferred values 100 ohms to 10 meg.
WIRE-WOUND RESISTORS 1/3
 1 watt 25 ohms—10,000 ohms 1/6
 15 watt 2/-
 15,000 ohms—50,000 ohms, 5 w., 1/9; 10 w., 2/3
WIRE-WOUND POTS, 3 WATT LAB. COLVERN, ETC.
 Pre-set Min. T.V. Type Standard size Pots, 2 1/2in.
 Knurled Slotted Knob Spindle High Grade. All
 All values 25 ohms to 200 k. 100 ohms to 50 K.,
 K. 3/- ea. 50 K., 4/0 5/6; 100 K., 6/6.
 Ditto Carbon Track 50 K. W/W EXT. SPEAKER
 2 Mez. 3/- CONTROL 10 Ω 3/0
O/P TRANSFORMERS. Heavy Duty 60 v., 4/6. Multi-
 ratio push pull, 6/6. Tapped small pentode, 3/9. Hygrade
 Push Pull 7 wts. 15/6.
L.F. CHOKEs 15/10 H. 60/85 mA., 5/-; 25/20 H. 100/120 mA.,
 11/6; 20/15 H., 120/150 mA., 12/6; 5 H. 250 mA., 15/-
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v., 4 a.,
 5 v. tapped 4 v., 2 a., ditto 250-0-250 80 mA., etc., 21/-

I.F. TRANSFORMERS 7/6 pair

465 Kcs/Sing tuning Miniature Can 2 1/2 x 1 1/2 in. x 1 in. High Q and good band width. By Pye Radio. Data sheet supplied.

HEATER TRANS. Tapped 200/250 v. 6.3 v. 1 1/2 amp., 7/6
COPPER PLATED AERIAL RODS. 1/2 x 12 in. push fittings,
 3/- ea. Post 1/-.
ALADDIN FORMERS and cores. 1/2 in., 9d.; 3/4 in., 10d.
 3/4 in. FORMERS 5637/9 and Cans TV1/2, 1/2 in. sq. x 2 1/2 in.
 and 1/2 in. sq. x 1 1/2 in. 2/- complete with core.
SLOW MOTION DRIVES. Epicyclic ratio 8:1, 2/3.
TYANA. Midget Soldering Iron, 200/220 v. or 230/250 v.,
 13/9. SOLON MIDGET IRON, 25 w., 24/-
MIKE TRANS. Ratio 60:1, 3/9 ea., new and boxed.
MAINS DROPPERS. 3 x 1 1/2 in. Three A.C. Sliders, 3 amp.
 7/5 ohms 4/3. 3 amp. 100 ohms 4/3.
LINE CORD. 3 amp. 60 ohms per foot, 3 amp., 100 ohms,
 per foot, 2 way, 6d. per foot, 3 way, 7d. per foot.

CRYSTAL MIKE INSERT by Acos
 Precision engineered. Size only 1 1/2 x 3/16 in. Bargain.
 Price 6/6. No transformer required.

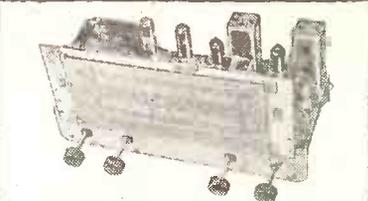
SOUND SPEAKERS P.M. 3 OHM.
 1 in. R.A., 17/6. 7 in. x 4 in. Goodmans, 21/-.
 3 1/4 in. square, Eiac, 21/-.
 4 in. Goodmans, 15/6. 10 in. R.A., 30/-
TSL "CREEPER" LSHTS, 8/6. 12 in. Plessey, 30/-
 8 in. M.E. 2.5 k. field, tapped O.P. transformer, 24/6.
CRYSTAL DIODE, G.E.C. 2/-. GEX34, 4/-
CRYSTAL SET CONSTRUCTION 1/-.
H.R. HEADPHONES 4,000 ohms brass cone, 16/6 pair.
SWITCH CLEANER Fine, squirt sprout, 4/3 tin.
TWIN GANG TUNING CONDENSERS. .0005 mfd. midget
 less trimmers, 6/6; .0005 Standard size with trimmers,
 9/-; less trimmers, 8/-; solled 2/6; 3-gang 500 p.f., 7/6.

SUPERHET COIL PACK 27/6
 Miniature size 2 1/2 x 2 1/4 in. High Q dust coated coils.
SHORT, MED, LONG. GRAM switching with connection
 diagram and circuit.

VALVE HOLDERS. Pat. Int. Oct. 4d. EF50, EA50 6d.
BIG2A, CRT 1/3. Eng. and Amer. 4, 5, 6, 7 and 9 pin. 1/-
MOUNTED Bases and Int. Oct. 6d. B7E, B8A, B8G, B9A,
 9d. B7G with can, 1/6. VCR57, 2/6. B9A with can, 2/6.
CERAMIC, EF50, B7E, Int. Oct. 1/-. B7G with can, 1/9.
SPEAKER PRET. Gold Cloth 1 1/2 in. x 2 1/2 in., 5/-.
 2 1/2 in. x 3 1/2 in., 10/-. Expanded metal, Silver 1 1/2 x 9 1/2 in., 2/- each.
 6 1/2 in. Speaker Baffle, silk covered, 1/- each.

WAVECHANGING SWITCHES.
 2 p. 2-way 3 p. 2-way, short spindle 2/6
 5 p. 4-way 2 wafers, long spindle 6/6
 2 p. 6-way 2 p. 2-way, 4 p. 3-way, long spindle 3/6
 3 p. 4-way, 1 p. 12-way, long spindle 3/6
TOGGLE SWITCHES. 3 p., 2/-; D.P. 3/6; D.P.D.T. 4/-
NUTS, BOLTS. 12 of each, 2, 4 or 6 BA 1/-

KNOBs, GOLD ENGRAVED. Walnut o. Ivory. 1 1/2 in.,
 diam., 1/6 each. "Focus", "Contrast", "Brilliance",
 "Brilliance—On/Off", "On-Off", "Volume", "Vol-
 On-Off", "Tone", "Tuning", "Tretels", "Bass", "T-
 Wavechange", "Radio Gram", "S.M.L. Gram",
 "Record-Play", "Brightnes" Ditto, not engraved, 1/-



1957 RADIOGRAM CHASSIS
THREE WAVEBANDS FIVE VALVES
 S.W. 16 m.—50 m. ECH42, EF41, EB41.
 L.W. 800 m.—2,000 m. EL41, EZ40
 12 month Guarantee. A.C. 200/250 v., 4-way switch.
 Short-Medium-Long-Gram. A.V.C. and Negative
 feedback. 4.2 watts. Chassis 13 1/2 in. x 5 1/2 in. x 2 1/2 in.
 Glass Dial 10 x 4 1/2 in., horizontal or vertical available.
 2 Pilot Lamps. Four Knobs, Walnut or Ivory, aligned
 and calibrated. Chassis isolated from mains.
 T.S.L. Tweeter supplied free.

BRAND NEW £10.10 Carr. 4/8.
 TERMS: Deposit 65/- and 6 monthly payments of 21.
MATCHED SPEAKERS FOR ABOVE CHASSIS:
 8 in., 19/6; 10 in., 25/-; 12 in., 30/-.

RECOMMENDED FOR ABOVE CHASSIS

Collaro Autochanger RC51 for 78 R.P.M. 10in. and 12in. Records. Brand new in maker's boxes! High impedance, lightweight pickup with sapphire needle, will match any amplifier or radio. **5 GNS.** Less than half price. **Sorry, no C.O.D.** Carr. 5/6

Plessey



BARGAIN £7.19.6
TELEMS: Deposit £4 and 6 monthly payments of 15/-
 Brand new Plessey 3-speed Autochange Mixer Unit for 7, 10 and 12in. Records. Twin Hi-Fi Xial Head with Dupoint sapphire stylus. Plays 4,000 records. Spring mounting. Baseboard required 1 1/2 in. x 12 in. Height 5 1/2 in. Depth 2 1/2 in. Super quality. Post free. A.C. 200/250 v.
 Walnut Veneered Playing Desk cut out ready for Plessey 10/6 each.

GARRARD 3-SPEED AUTO-CHANGER

BRAND NEW IN MAKER'S CARTONS
GARRARD RC.120H.—Complete with turnover crystal pick-up. Incorporates automatic record size selection (mixer). Cabinet space required: 14 in. x 12 1/2 in. x 4 1/2 in. above and 2 1/2 in. below motor board. Cream and Brown enamel finish, limited quantity only. **OUR PRICE £8.15.0**

B.S.R. MONARCH. 3-speed Motor and Turntable with selecting switch for 33, 45 and 78 r.p.m. records. 100-120 v. and 200-250 v. A.C. 50 cps. Also B.S.R. MONARCH Lightweight Pick-up with Acos Xial turnover head, separate Sapphire stylus for L.P. and standard records. **SPECIAL OFFER, THE TWO £4.12/6.** post 2/6. **Plaver Cabinet 49/6** post 2/6.

Teletron Band III Converter

London, Midland and Northern for all T.V. makes. T.R.F. or Superhet Ready wound coils, two EF80 valves, all components, punched chassis, circuit diagram, wiring plans. **COMPLETE KIT** for mains operation. 200-250 v. A.C. £3/10/- **AS ABOVE less POWER PACK.** Requires 200 v. 20 mA. H.T. 6.3 v. 0.6 a. L.T. £2/5/-.

ALDRY UNIT POWER PACK. Replaces Battery B114, etc., 69 v. plus 1 1/2 v. Size 4 1/2 in. x 3 1/2 in. x 1 1/2 in. 4-pin Socket. Same as battery. Only 1/- a year to run on A.C. 200-250 v. **FAMOUS MAKE.** LIST PRICE 65/-. **OUR PRICE 39/6.** Ready to use.

T.V. PRE-AMP. (McMICHAEL)
 Will amplify output of your Band 3 Converter. Tune-able Channels 1 to 6. Midget size. High gain triode model. B.V.A. Valve. Full instructions supplied. **READY FOR USE.** (H.T. 200V., L.T. 6.3V., 3 amp. output). **PRICE 25/- each.** **BRAND NEW SPECIAL MAINS POWER PACK** for above, 25/- extra.

Volume Controls 80 ohm CABLE Coaxial

Midget size
 Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2.5 meg. No. Sw. 3 P.S.W. D.F.Sw. 3/9, 4/9, 4/9
 Lin or Log Tracks

Semi-air spaced Polythene insulated 1/2 in. dia. Stranded core. Ideal Band III. Losses cut 50%.... 9d. yd. **STANDARD** 1/2 in. Coaxial..... 8d. yd.

COAXIAL PLUGS 1/- **DOUBLE SOCKET** 1/3
SOCKETS 1/2 **OUTLET SOCKETS** 4/6
BALANCED TWIN FEEDER per yd. 8d. 80Ω or 200Ω
TWIN SCREENED BALANCED FEEDER 1/- yd. 80 ohms
TRIMMERS, Ceramic, 50, 70, 100 pf., 9d. 100 pf., 150 pf., 1/3. 250 pf., 1/6., 600 pf., 750 pf., 1/9.

ALUMINIUM CHASSIS. 18 s.w.g. Plain, drilled, with 4 sides, riveted corners and lathe fine hole, with 2 1/2 in. sides. 7 x 4 in., 4/6; 9 x 6 in., 5/9; 11 x 7 in., 6/9; 13 x 9 in., 8/6; 14 x 11 in., 10/6; 15 x 14 in., 12/6 and 18 x 16 x 3 in., 16/6.

CHROMIUM PEN TORCHES with battery and bulb, 2/6.
BLACK CRACKLE PAINT. Air drying 3/- tin.
P.V.C. COGN. WIRE, 10 colours, single or stranded, 2d. yd.
5 in. RADIUM SOREWDRIVERS, 4d. each.
NEON MAINS TESTER SCREWDRIVERS, 5/6.
MULTICOER SOLDER 60/40, 13 s.w.g., 3d., 16 s.w.g., 4d. yd.

PURETONE RECORDING TAPE, 12/6

1,200ft. on standard fitting 7 in. Plastic reels
 Brand new, boxed, 12/6
 Spools 5 in. metal, 1/6. 7 in. Plastic, 4/3

FERROVICO PLASTIC TAPE

First Quality. Highly Recommended. Bargain Offer 1200ft. 7 in. Reels. 25/-.

SENTECEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGES. K3/25 2 kv., 5/-; K3/40 3.2 kv., 7/-; K3/45, 3.6 kv., 7/6; K3/60 4 kv., 9/-; K3/100 8 kv., 14/6;
MAINS TYPES. RM1, 125 v.; 60 mA., 5/-; RM2, 150 mA., 6/-; RM3, 120 mA., 8/-; RM4, 250 v., 275 mA., 18/-
COILS. Weatrite, "P" type, 3/- each. Ormox Midget "O" type adj. dust core, 4/- each. All ranges.
TELETRON. L & Med. T.R.F. A.H.R., 7/- pair.
TELETRON. H.F. Chokes EFC4 2/6 each.

JASON F.M. TUNER COIL SET. 22/6. H.P. coil, aerial coil, Oscillator coil, two I.F. Transformers 10.7 Mc/s, Detector transformer and heater choke. Circuit and component book using four 6AM6, 3/-.
J.B. Chassis and Dial, 19/6. Complete Kit, 25-18/-.

CONDENSERS. New stock. .001 mfd. 7 kv. T.O.G., 5/6. Ditto 20 kv., 9/6; 100 pf. to 500 pf. Miesas. 6d.; Tubular 500 v., .001 to .01 mfd., 1d.; .05, 1, 1 1/2, 2.5, 15/6; 5, 1/9; 1/250 v., 9d.; 1/600 v., 1/3; 1 mfd., 2/000 v., 4/-
CERAMIC CONDS. 500 v. 3 pf. to .01 mfd., 10d.
SILVER MICA CONDENSERS. 10%, 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. DITTO 1% 1.5 pf. to 500 pf., 1/9; 515 pf. to 5,000 pf., 2/-.

NEW ELECTROLYTICS. FAMOUS MAKES.

TUBULAR	TUBULAR	CAN TYPES
1/500 v. 2/-	100/25 v. 3/-	8+16/450 v. 5/-
2/450 v. 2/3	8+8/500 v. 4/6	16-16/500 v. 6/-
4/450 v. 2/8	16+16/800 v. 6/6	16-16/600 mfd. 6 v. 6/6
8/450 v. 2/9	CAN TYPES	32-32/350 v. 4/6
8/500 v. 2/3	CHPS	32-32/450 v. 6/6
16/450 v. 3/6	16/450 v. 3/6	64-120/275 v. 7/6
16/500 v. 4/-	32/350 v. 4/6	60-100/350 v. 11/6
32/450 v. 5/6	64/350 v. 5/6	100+200/257 v. 10/6
25/25 v. 1/9	100/275 v. 5/6	1,000+1,000/6 v. 6/6
50/25 v. 1/9	50+50/350 v. 5/6	
50/50 v. 2/-	50/12 v. 3/-	

FULL WAVE BRIDGE SELECTION RECTIFIERS. 2, 6 or 12 v. 1 1/2 amp., 8/9; 2 a., 11/3; 4 a., 17/6
CHARGER TRANSFORMERS. Tapped input 200/250 v. (or charging at 2, 6 or 12 v. 1 1/2 amp. 13/6; 4 amp. 21/-)
ALL BERNARDS books in stock.
VALVE MANUALS II & III, 5/- each part.
ACID HYDROMETER. New ex. Govt. Unbreakable. Packed in metal case 7 x 1 1/2 in. 4/6.

VALVES

A SMALL SELECTION FROM OUR STOCKS		New & Guaranteed	
All Boxes			
8/6	5/6	EA50	6/6
4B5	4B5	954	6/6
174	9D2	2/6	6/6
155	EF50	E1148	6K6
384	Equip.	BB34	6X7G
3V4	SP61	3/6	EB91
579A	SP41	3D6	HVR2
6AM6	EF92	6H6M	(near)
6AT8			EP36
6K8			EL41
68L7	7/6	7/6	7/6
68N7	6BE6	6V6G	EL32
68GT	6BW6	6X4	HVR2A
6EC33	6F6	6X5	PRN35
EP50	6K6GT	807	VP23
EP91		EP39	
EZ80		11/6	
		EY51—U25	PL51
			3524
			6Q7
			Z79

We have no connection with any other firm. Please address all Mail Orders correctly as below
RADIO COMPONENT SPECIALISTS 307 WHITEHORSDR., WEST CROYDON
 OPEN ALL DAY—(Wed. 1 p.m.) 10-page list 3d.
 Tel. THO 1645. Buses 133 or 68 pass door. S.R. Stn. Selhurst. 48-hour postal Service. P. & P. 1/- £2 orders post free (Export extra). C.O.D. Service 1/6

RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.1. (Coventry Street end)
Phone No. GERard 3977/8 Grams: "Radiotrade"

B.T.H. CRYSTAL DIODES, 1/3. Very special price for large quantities.
RESISTORS. ½ watt, 2/6 doz; ¼ watt, 3/- doz; 1 watt, 4/- doz; 2 watt, 6/- doz.

MANUFACTURERS PLEASE NOTE YOUR ENQUIRIES ARE INVITED FOR ERIE RESISTORS TYPES 0, 1, 2, 8, 9, 16, 7b AND 5b.

WW RESISTORS. 5 watt, 1/6; 10 watt, 2/6; 15 watt, 3/-; 20 watt, 3/6. We carry stocks of resistors from 2 watt to 150 watt W.W. Your enquiries invited.

HIGH STABILITY RESISTORS. ½ watt 5%, 6d.; ¼ watt 5%, 9d.; 1 watt 5%, 1/- . 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 types, 2/6; Spindle types, 3/-; Carbon type, less switch spindle and pre-set, 2/- . With switch, 3/6 each.

SEMI-MIDGET 2-GANG. .0005 Condenser, size 2½ x 2 x 1½in., 6/9 each.

SPECIAL OFFER OF CURRENT MANUFACTURE ELECTROLYTIC CONDENSERS

8 mfd. 450 v., 2/6 each; 16 mfd. 450 v., 3/-; 32 mfd. 450 v., 4/-; 8 x 8 mfd. 450 v., 3/9; 8 x 16 mfd. 450 v., 4/-; 16 x 16 mfd. 450 v., 4/6; 32 x 32 mfd. 350 v., 5/- . Bias Condensers: 25 mfd. 25 v., 1/6; 50 mfd. 50 v., 1/9. Please note we can offer special discounts for quantities.

ELECTROLYTIC CONDENSERS. Manufacturers' Surplus, in perfect condition.

16 mfd. 375 v., 2/-; 24 mfd. 350 v., 1/6; 24 mfd. 450 v., 2/3.

BIAS CONDENSERS: 1,000 mfd. 12 v. 1/6; 25 mfd. 25 v., 1/3; 50 mfd. 12 v., 1/-.

BLOCK PAPER CONDENSERS. 12 mfd. 250 v., 7/6; 8 mfd. 600 v., 7/6; 4 mfd. 400 v., 3/6. We carry a large stock of block paper type condensers. We invite your enquiries.

MIDGET MICA CONDENSERS. .0001, .0002, .0003, .0004, .0005, 5/- per dozen.

200 Assorted Moulded Mica Condensers, popular values..... £2 10 0
200 Assorted Silver Mica Condensers, popular values..... £2 10 0
200 Assorted Carbon Resistors, ¼, ½ and 1 watt. Good selection £1 10 0

PAXOLIN SHEET. 18 v., 4½ x ½in., 1/6; 10 x 10 x ½in., 1/6; 20 x 10 x ½in., 3/-; 10 x 10 x ½in., 2/-; 20 x 10 x ½in., 4/- . Minimum P. & Pkg. 1/6.

BARGAIN OFFER OF BATTERIES

4½ v. Heavy Duty Bell Battery. Size 6½ x 4½ x 2½in..... 2/6
7½ v. H.T. 1.5 v. L.T. Size 6 x 5 x 1½in..... 2/6
150 v. H.T. Size 2½ x 5½ x 1½in..... 5/6
67½ v. Size 2½ x 3½ x 2½in..... 6/6
60 v. H.T. 1.5 v. L.T. 3½ x 3½ x 1½in..... 4/6
All batteries sealed and unused. All plus 1/6 post and pkg. Special reduction for quantities.

4-way Push Button Units, 2/6 each. Knobs for same, 3/- per doz.
5-way Push Button Units, 5/6 each, complete with knobs.

WEARITE COILS. PA4, PO4, PA5, PO5, 1/3 each..... doz. 12/-

VALVE HOLDERS. Moulded B9A, 7/6; B7G 6/-; Int. Oct., 9/-; Eng. Oct. doz. 4/6

VALVE HOLDER FITTED WITH LOWER CAN, 1/6 per doz. extra. Screening Cans for B7G and B9A..... doz. 6/-

Paxolin V/H Int. Oct. B9A, B7G, 5/- per doz.; Eng. Oct., 5-pin, 7-pin doz. 3/-

BELLING-LEE PLUGS AND SOCKETS, 5-pin, 1/9; 7-pin, 2/-; 10-pin each 2/6

AIR-SPACED TRIMMERS, 5, 10, 15, 20, 25, 50; and 75 of pre-set and spindle types, 2/- each..... doz. 21/-

PYE PLUGS AND SOCKETS, 1/6 per pair, " Tee " pieced..... each 1/9

GROMMETS, 1 grs. assorted grommets, ½in. to 1 in..... gross 8/6
GROTT OFFICE LAMP JACKS No. 10 1/- each..... doz. 9/-
Lamp Covers for same..... doz. 3/-

P74 2-pin plugs and sockets are now available, 3/6 each

OUTPUT TRANSFORMERS. Multi-ratio, 5/- each; Pentode or power each 4/-

WESTECTORS. WX6, WX12, W12, W4, 1/- each..... doz. 9/-

SIGNAL LAMP HOLDERS. Panel mounting, complete with adjusting lampholder, 2/- each..... doz. 21/-

TAG STRIPS. 3-way, 2/-; 4-way, 2/6; 5-way, 3/-; 7-way, 4/-; 28-way doz. 12/-

Please send S.A.E. for complete list of components available.

POINTER KNOBS. Small black with white line, standard ¼in. spindle doz. 7/6

WANDER PLUGS. Red and black..... doz. 2/-

PHILIPS TRIMMER TOOLS. 1/- each..... doz. 10/6

CASH WITH ORDER OR C.O.D. ALL ORDERS DEPT. W.1 ALL ORDERS FOR LESS THAN £2 ADD POSTAGE

We invite your enquiries for items not listed
Trade Counter open 9 to 6 Monday to Friday
Also 9 to 1 Saturdays. Callers Welcomed.

WHOLESALE MANUFACTURERS' AND EXPORT ENQUIRIES INVITED

All good Labs' use Radiospares
quality components for design development and prototype work

Service Engineers!

Remember - Radiospares components are delivered absolutely "by return"

CHAS. H. YOUNG, LTD.

GLASS AERIAL INSULATORS. 1/6 ea., small shell porc. 4½d. ea., or 4/- doz. Plus post.

CONDENSERS. TCC type III, 8 mfd. 1,000 v. List over £3. Only 10/6. Post 1/9. 8 mfd. 750 v. 5/6 ea. Post 1/6.

SHADED POLE MOTORS. Heavy duty type totally enclosed made for professional tape deck. 35/- ea. Post 2/6.

MINIATURE ROTARY TRANSFORMERS. 12 v. input, output 360 v. 30 m.a. Cont. or 310 v. 70 m.a. intermittent. 21/- ea., or 2 for £2. Post 1/6.

AMERICAN 807 VALVES. New, boxed, 7/6 ea.; 4 for 25/-.

ELECTRON MULTIPLIERS. Type 931A. Only 35/- ea. or 2 for £3. Holders available at 2/- ea.

CRYSTAL HAND MICROPHONES with polished grille and handle, four foot of screened lead. Only 21/- . P. & P. 1/- . WORTH DOUBLE.

POWER UNITS IN BLACK METAL CASE. 200/260 v. input, 200/250 v. 60/80 m.a. output, fully smoothed and filtered, also gives 31 v. D.C. and 6.3 v. .3 a. A.C., fitted with 6X5 rectifier. Only 50/- ea. Carr. paid.

COPPER AERIAL WIRE. 14 g. H/D 140ft., 17/- . 70ft. 8/6. P. & P. 2/- . Stranded 7/25, 140ft. 10/- . 70ft. 5/- . P. & P. 2/- .

CERAMIC FORMERS. 2½ x 1½. Ideal for V.F.O. or currets. 1/9 ea., or 17/6 per doz.

RACK MOUNTING PANELS all 19in. long by 5½in., 7in., 8½in. or 10½in., 5/9, 6/6, 7/6, 9/- respectively. Post 2/-.

ABSORPTION WAVEMETERS. 3 to 35 mc. in 3 switched bands, complete with Indicator bulb. 15/- . Post 1/-.

TRANSMITTER TUNING CONDS. by Johnson, U.S.A. 500 pf. 1,550 v. rating, ceramic insulation. 15/- ea. Post free

HEADPHONES. High resistance (4,000 ohms.), very sensitive. Bargain price only 12/6 pr. P. & P. 1/6.

AMERICAN BREAST MIKES. Swivel Head. Push to talk and lock on switch. Beautiful job. Only 12/6. P. & P. 1/6.

BRITISH BREAST MIKE UNIT complete with pr. of 4,000-ohm phones in strong wooden carrying case, 8½ x 4½ x 7½. Ideal for mobile operators. Only 17/6. P. & P. 2/-.

LOW RESISTANCE HEADPHONES. New ex-W.D. stock. C.L.R. type. Only 8/6 pr. P. & P. 1/6. Special Terms Quantities.

NO C.O.D. UNDER £1.
All Mail Orders to Dept. "W" Please print your name and address.
CHAS. H. YOUNG LTD., 110 DALE END, BIRMINGHAM, 4.
Phone: CENTRAL 1635

AMERICAN "COMMAND" RECEIVERS

Huge purchase from the Air Ministry. These famous compact receivers which can be used for a variety of purposes are offered at ridiculously low prices while stocks last. Complete with 6 metal type valves, 1 each of 12K8, 12SR7, 12A6, and 3 of 12SJ7, in aluminium case size 11in. x 5½in. x 5in. Circuits supplied. Choice of Models. BC454 (3-6 Mc/s.), 27/6; BC453 (190-550 kc/s, the renowned "Q Fiver"), 59/6. OR BRAND NEW IN MAKER'S CARTONS, 69/6. Trawler Band Model (1.5-3.0 Mc/s), 65/- OR BRAND NEW IN MAKER'S CARTONS, 75/-. Medium wave coil unit for BC454 with instructions, 13/3.

27'6

BC.610 MODULATION TRANSFORMERS. Brand new spares for this famous American Transmitter. In Maker's Original Cases. ONLY 15 each.

CONSTANT VOLTAGE TRANSFORMERS. Manufactured by SOLA of CHICAGO, U.S.A. Primary 90-125 v. or 190-250 v. Secondary 115 v. precisely at 2 KVA. Can be adjusted for 50 or 60 cycles operation. Primary and secondary are completely isolated, and for 230 v. output two can be used in series. Fully guaranteed. ONLY £21 each or £40 per pair.

RF UNITS TYPE 26. For use with the R.1355 or any receiver with a 6.3 v. supply. This is the variable tuning unit which uses 2 valves EF54 and 1 of ECS2. Covers 65-50 Mc/s. (5-6 metres). Complete with valves, and BRAND NEW IN MAKER'S CARTONS. ONLY 29/6 each.

MARCONI BAND III CRYSTAL CALIBRATORS. Frequency range 170-240 Mc/s. Incorporates 5 Mc/s. crystal for better than .001 per cent. accuracy. Directly calibrated dial, internal A.C. mains pack. Complete with spare set of valves and instruction manual in maker's transit cases. BRAND NEW. ONLY 14/19/6.

CLASS D WAVEMETER
Another purchase of this famous crystal-controlled wavemeter which has been repeatedly reviewed and recommended in the "R.S.G.B." Bulletin as being suitable for amateur transmitters. Covers 1.9-8.0 Mc/s., and is complete with 100/1,000 kc/s. crystal, 2 valves ECH35, two 6-volt vibrators and instruction manual. Designed for 6 v. D.C. operation, but simple mod. data for A.C. supplied. BRAND NEW IN MAKER'S TRANSIT CASES. ONLY 15/19/6. Transformer for A.C. modification, 7/6.

COLLINS TCS TRANSMITTERS
Special offer of these famous American Transmitters. Frequency range 1.5-12.0 Mc/s. in 3 bands. Employs 7 valves, 2 of 1625 in P.A. Stage, 1625 buffer and 1625 modulator stage, 3 of 12A6 in oscillator stage. Radio telephone or radio telegraph. Provision for VFO or Crystal Control. 4 crystal positions. Has plate and aerial-current meters. IN BRAND NEW CONDITION. ONLY 112/10/-. Matching receivers Type 46159 available 18/10/-. OR THE PAIR £20.

POWER UNIT TYPE 3. Primary 200/250 v. 50 cycles. Outputs of 250 v. 100 mA., and 6.3 v. 4 amps. Fitted with H.T. current meter, and voltmeter. For normal rack mounting, and has grey front panel size 19in. x 7in. ONLY 90/- (carriage etc. 7/6).

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. ONLY 111/19/6. These are "BRAND NEW IN MAKER'S TRANSIT CASES" and in perfect working order, fully tested before despatch.

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 6½in. P.M. speaker, 15/5/-, LESS speaker, 14/10/-. With Bin. P.M. speaker, 16/10/-. 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.

FREQUENCY METERS TYPE L.M.



The United States Navy version of the BC221. Frequency range 125-20,000 kc/s with better than 0.01% accuracy. Contains a Crystal Controlled Oscillator, a Heterodyne Oscillator, and an Audio Frequency Amplifier. Can be used as Signal Generator, having CW-MCW control. BRAND NEW and UNUSED. Quotation on request.

METERS

F.S.D.	SIZE AND TYPE	PRICE
50 microamps	D.C. 2½in. Flush circular	59/6
500 microamps	D.C. 2in. Flush square	27/6
1 m.a. D.C.	2in. Flush square	22/6
10 m.a. D.C.	2½in. Flush circular (blank scale)	10/6
150 m.a. D.C.	2in. Flush square	7/6
200 m.a. D.C.	2½in. Flush circular	12/6
4 amp. D.C.	2½in. Flush circular	15/-
20 amp. D.C.	2in. Proj. circular	7/6
40 amp. D.C.	2in. Proj. circular	7/6
30-0-30 amp. D.C.	Car type moving iron	5/-
15 volts A.C.	2½in. Flush circular moving iron	9/6
2 Kilovolts A.C.	2½in. Proj. circular electrostatic	22/6
300 volts D.C.	2in. Flush square	10/6

Enquiries invited for types not listed, 7-14 days delivery on "specials".

L.T. HEAVY DUTY TRANSFORMERS. Ex-Admiralty, with 20 v. 50 cycles primary. 1. Secondaries 5, 10, 15, 20, 25, 30 volts at 5 amps. ONLY 29/6. 2. Secondaries 7, 14, 21, 28 volts at 12 amps. ONLY 42/6. (postage on either 2/9).

EHT TRANSFORMERS. 5.5 kV. (Rect.) with 2 v. 1 a., 79/6. 7 kV. (Rect.) with 2 v. 1 a., 89/6. 2.5 kV. (Rect.) with 2-0-2 v. 1.1 a., 2-0-2 v. 2 a. (for VCR 97 tube etc.), 42/6 (postage 2/- per trans.).

TRANSFORMERS. H.T. Fully shrouded upright mounting, 250-0-250 v. 60 mA., 6.3 v. 3 a., 5 v. 2 a. ONLY 21/-, 250-0-250v. 100 mA., 6.3 v. 6 a., 5 v. 3 a. ONLY 37/6. 350-0-350 v. 180 mA. 6.3 v. 5 a., 5 v. 3 a. ONLY 37/6 (postage 2/- per trans.).

MARCONI SIGNAL GENERATORS TF-390G

Frequency coverage 16-150 Mc/s. BRAND NEW IN MAKER'S ORIGINAL TRANSIT CASES, with instruction manual. For normal A.C. mains operation. A unique opportunity to acquire Laboratory Equipment at a fraction of original cost. ONLY 127/10/-.

159 RECEIVER UNIT. Contains 1 each valve, types EF50, EA50, SP61, RL37 and 24 v. selector switch. ONLY 7/6.

RCA 8in. P.M. SPEAKER, mounted in heavy black cracked metal cabinet with chromium grill, and padded feet. Size 11½in. w. x 10½in. h. x 6in. d. Ideal for use with receivers or as an extension. BRAND NEW IN MAKER'S CARTONS. ONLY 45/-.

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.

"PYE" 45 MC/S I.F. STRIP. Ready made for London Vision Channel, this 5-stage strip contains 6 valves EF50 and 1 EA 50. BRAND NEW ONLY 59/6 or less valves 39/6.

100-0-100 VOLTS METERS by Sangamo Weston. 2½in. circular, basic movement being 500-0-500 microamps. A really first-class centre zero meter for hundreds of uses. BRAND NEW IN MAKER'S CARTONS. ONLY 27/6.

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.

WALKIE TALKIE TYPE 18. Covers 6.0-9.0 Mc/s. Transmitting and receiving units in metal case, complete with valves in excellent condition. ONLY 79/6.

CRYSTALS. British Standard 2-pin 500 kc/s. 15/-. Miniature 200 kc/s and 465 kc/s. 10/- each.

AMERICAN 14v. DYNAMOTORS. Output 225 v. 60 mA. Ideal for car radio or running electric shaver from car battery. ONLY 45/-.

CHOKES. 10H 60 mA., 4/-; 5H 200 mA., 7/6.

12-WAY SCREENED CABLE. In 10ft. lengths, fitted with plugs, originally made for use with the 19 Set. UNUSED. ONLY 17/6 per lead.

TR1196 TRANSMITTER SECTION, complete with valves EL32, EF50, CV501, and all components. BRAND NEW. Price ONLY 12/6.

Cash with order please, and print name and address clearly

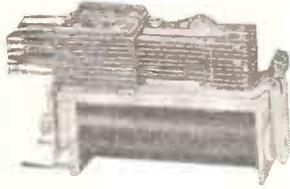
PLEASE ADD POSTAGE OR CARRIAGE COSTS ON ALL ITEMS

U.E.I. CORPORATION

Radio Corner, 138 Gray's Inn Road, London, W.C.1. Phone: TERMINUS 7937

(Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross)

RELAYS P.O. TYPE 3000



BUILT TO YOUR SPECIFICATION
 QUICK DELIVERY
 KEEN PRICES
 CONTACTS UP TO 8 CHANGE OVER

METERS GUARANTEED

F.S.D.	Size	Type	Price
100 Microamp	2½ in.	MC/FR	50/-
250 " (multirange scale)	3¼ in.	MC/FR	55/-
500 "	2 in.	MC/FS	27/6
500 " (scaled 0/16 KV)	2 in.	MC/FR plug type	18/6
1 Milliamp	2 in.	MC/FS Elliott 5Q/87	27/6
30 "	2½ in.	MC/FR	12/6
100 "	2½ in.	MC/FR	12/6
200 "	2½ in.	MC/FR	12/6
500 "	2½ in.	MC/FR	12/6
20 Amp.	2½ in.	MI/FR	25/-
25 "	2½ in.	MI/FR DC	7/6
50 "	5 in.	MI/PR	60/-
50-0-50 Amp.	2 in.	MC/FS	12/6
15 Volt	2½ in.	MI/FR	15/6
10 "	2½ in.	MCR/FR	30/-
20 "	2 in.	MC/FS	10/6
300 "	2 in.	MC/FS	10/6
300 "	2½ in.	MI/FR	25/-
300 "	5 in.	MI/PR	60/-
2,000 volt	2½ in.	ES/FR	40/-

INSTRUMENT RECTIFIERS. Full Wave Bridge 1 m/a. 8/6, 5 m/a. 7/6, 50 m/a. 5/-, Post 6d.
TELEPHONES—SOUND POWERED—NO BATTERIES REQUIRED. Just connect with twin flex for clear speech. Transmitter/receiver units 9/- per pair. Twin flex 4½d. yard. Post 1/-.

If 2 units are connected in series and one used for speaking and one for listening, perfect 2-way conversation can be made.
 Alternative offer. 2 similar units connected in series and fitted with cord and plug. 12/6. Sockets for plug 1/3. Post 1/6.

RADIATION MONITORS. Philips Type 1092c. A portable self-contained unit in haversack, measuring Gamma Radiation. Scaled 0 to 10 millirontgens per hour, using Mu'ard Geiger Counter MX115. £25.

INSTRUMENT LAMPS. 3 volt miniature, for Aircraft Inst., Sextants, etc. 25 in box, 36/- doz.

JACK PLUGS and Sockets, 2 Contact, 5/6 per pair, post 9d.
HEADPHONES. Sensitive Balanced Armature Type DHR, 17/6 per pair Post 1/6.

HEADPHONES. High resistance 4,000Ω Type CHR new 12/6 pair, post 1/6.
TRANSFORMERS. Normal primaries, 350-0-350 v. 120 m/a. 2x6.3 v. 4 and 5 v. tropicalized. 25/-, Also 150 m/a. with extra 6.3 v. 30/-, Post 2/6.
VARIAC TRANSFORMERS. 80 CO 7.5 amps enables mains to be kept constant. 130/-, Cge. 7/6.

RACKS—POST OFFICE STANDARD. 6ft. high with U-channel sides drilled for 19in. panels, heavy angle base. 4ft. 10in. also in stock.

INSPECTION LAMP. Fits on forehead leaving hands free, battery case clips on belt 7/6. Post 1/6. Takes E.R. Battery No. 1215 2/9 post 9d.

PHOTOMULTIPLIER No. 931A. Ideal for film scanning, spectography, Alpha counting, colorimetric measurement, etc., supplied complete in lightproof chamber with lamp, wired with the resistor network, 70/-.

AMPLIFIERS. A high-fidelity unit with separate Bass and Treble controls, constant impedance attenuator for setting volume level. 15 watt output, for 200/250 v. A.C. mains operation. Ideal for P.A. work, dances, etc.

LESS VALVES, £12/10/-. Complete with valves, £15/12/6. Cge. 12/6.
45 Mc/s PYE I.F. STRIP. These vision units are brand new and complete with 6 EF50 valves and EA50. Our price only 65/-, Post 3/-.

TELEPHONE SETS. For perfect communication between 2 or more positions. Wall Type, one, pair of units, £5. Batteries 5/6. Twin wire 5d. yard. Desk Type, now available, latest mod-rn style. Two complete units ready for use, £3/47/6. Wire 5d. per yard. Post 3/-.

ROOM THERMOSTAT. Adjustable between 45 and 75 deg. Far. 250 v. 10 amp. A.C. Ideal for greenhouses, etc., 35/-, Post 2/-.

GEARED MOTORS. 4 R.P.M. at 12 v., 8 R.P.M. at 24 v. 35/-, Post 2/-.

VENT-AXIA FANS—EXTRACTION OR INTAKE. 230/250 volts A.C. 6in diam. blades 130/-, 12 volt D.C. 90/-, post 2/9.

RATIO ARM UNITS. Sullivan. 600 ohms + 600 ohms, 50/-, Post 2/-.

WHEATSTONE RESISTANCE BRIDGE. 1 to 10,000 ohms. Plug type £5.

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.

ROTARY CONVERTERS. Input 24 volt D.C. Output 230 volt A.C. 50 cv., conservatively rated at 100 watts, 92/-. Also available in a strong ventilated metal case with switch, input plug and output socket, 105/-, Cge. 7/6.

CHARGING RECTIFIERS. Full wave Bridge 12 volts 2 amps., 13/6, 4 amps., 22/6, suitable transformers 2 amp. 24/-, 4 amp., 27/3, post 2/-.

VARIABLE RESISTANCE. 160 ohms, 2 amps., on 10½ in. Twin formers, gearing with control handle. Suitable for dimming, 35/-, post 2/9.

TERMINAL BLOCKS 2-way fully protected. No. 6C/430. 4/- doz. or box of 50 for 15/-, 3-way, 8/- doz., post 1/6.

L. WILKINSON (CROYDON) LTD.
 19, LANSDOWNE ROAD, CROYDON

Phone : CRO. 0839

Telegrams : "WILCO," CROYDON



introduce
NEW

FREQUENCY RECORDS

E.M.I. STUDIOS LTD. announce the release of new frequency records with recording characteristics to British Standard 1928 : 1955.

33½ r.p.m. MICROGROOVE. Constant frequency bands 18,000 to 30 c.p.s. Cat. No. RLPS 4. Price £1 8s. 6d. + 12s. 10d. Purchase Tax.

78 r.p.m. STANDARD GROOVE. Constant frequency bands 18,000 to 30 c.p.s. Cat. No. JGS 81. Price 10s. 6d. + 4s. 9d. Purchase Tax.

(In order to obtain accurate performance figures for pickups this record is supplied in shellac or L.P. material.)

Postage and packing :— 3s. 0d. on 1 to 4 records.
 3s. 6d. on 5 to 9 records.

Obtainable only from :

E.M.I. STUDIOS LTD.

(Special Recordings Dept.)

3 ABBEY ROAD, LONDON, N.W. 8

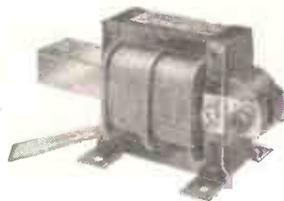
ANY IDEAS ?

Well-known manufacturers of electronic equipment are willing to manufacture and place on the market:

THAT NEW IDEA OF YOURS

(Our own staff is aware of this advertisement). Royalty will be paid on all sales. For further details write Wireless World Box No. 4236.

A.C. SOLENOID TYPE SBM/T GREATLY INCREASED PERFORMANCE



Continuous 3½ lbs. at 1" Instantaneous to 16 lbs. Same dimensions as Type SB. Smaller sizes available. Greatly increased discounts for quantities. Also transformers to 7kVA 3 phase

R. A. WEBBER LTD.

18 FOREST ROAD, KINGSWOOD, BRISTOL PHONE 74065

Telephone: MUSEUM 9594.

H. FRANKS

58-60 New Oxford Street,
London, W.C.1

One min. from Tottenham Court Rd. Stn.

NEW NEGRETTI & ZAMBRA. 200/250 v. A.C. operated control units, fitted rectifier unit giving 12 volts D.C. which operates two relay operated single pole change-over 10 amp mercury switches, housed in metal cabinet $9\frac{1}{2} \times 8\frac{1}{2} \times 3$ in. 55/- each.

A.C. MAINS SOLENOIDS. 200/250 v. 4lb. per $\frac{1}{4}$ in. pull. D.C. resistance 200 ohms. Ditto $\frac{3}{16}$ in. pull. D.C. resistance 300 ohms. 10/6 each. Discount given for large quantities.

FRACTIONAL MOTORS. 1/100th H.P. 200/250 v. A.C./D.C. $\frac{1}{2}$ in. double-ended spindle. Length $3\frac{1}{2}$ in., diam. $2\frac{1}{2}$ in. Unused. 27/6.

"CARPENTER" POLARISED RELAYS in screening cans. 110+110 ohm coil, type 4142 E/TF6, new. 18/6 each.

"HOOVER" BLOWER MOTORS. 220/250 v. A.C./D.C. 300 watts. $\frac{1}{2}$ in. diam. outlet. Unused. 55/2/6.

"DRAYTON" TYPE R.G.R. CAP INDUCTION MOTOR UNITS. 230 volts A.C., 50 cycles, 25 watts. Cont. rating, final speed 37 r.p.m. Unused. 55 each.

DOUBLE-WOUND STEP-DOWN TRANSFORMERS. Ex-A.M., Ref. 5P/284. Input 200/250 v. A.C., 50 cycles, output 100/110 v. A.C., 750 watts, fitted in metal case, with carrying handle, size $8\frac{1}{2} \times 7\frac{1}{2} \times 7\frac{1}{2}$ in., unused. 57/12/6.

"CREED" MOTOR-OPERATED TAP-WINDERS. Type No. S.2885. Fitted 230 v. A.C. 1/100 H.P. motor, coupled to gearbox, with slipping clutch. Final speed 25 r.p.m. approx. New. 65/- each.

TELEPHONES TYPES TELE-F. A table type field telephone in Bakelite moulded case with bell magneto ringing generator, operated from internal 3 to 4 volt battery (not supplied); suitable for 2-way communication up to a mile distance when used in prs., overall dimensions $9\frac{1}{2} \times 6\frac{1}{2} \times 5\frac{1}{2}$ in. 53/19/6 each.

8 in. DIAM. VENT-AXIA EXTRACTOR FANS. 24 v. D.C. or 36 v. D.C., fitted suppressor units. Ideal for caravans, yachts, etc. Unused, complete in transit case. 54/7/6 each.

PRESSURE PUMP UNITS. Operated by 24 volt A.C./D.C. motor develops 10lb. pressure or vacuum. Complete with 10ft. length of pressure hose, cables and connectors, etc. Compact unit fitted in metal case, 6 x 4 x 4 in. Made in U.S.A. Ideal for laboratory use, etc. New, in maker's cartons. 54 each.

"VENNER" SYNCHRONOUS CLOCK MOTORS. 200/250 v. A.C. 3 watts. Final speed 30 r.p.m. 16/6.

METROVIC SYNCHROCK. HOUR RECORDING METERS. 200/250 volts A.C., 50 cycles, operating voltage, 1/10 to 10,000 hrs., recording ideal for life test, etc., unused. 52/7/6.

CHARGER UNITS. Type 58. 200/250 v. A.C., 50 cycles, output 20/24 v. D.C., 3 amps, smoothed, continuous tropical rating, fitted in metal case 18 x 12 x 7 in. 55/12/6.

WESTERN ELECTRIC BLOWER MOTORS. Fitted centrifugal fan, available 12 volts D.C. or 110 volts A.C./D.C. Suitable for car heaters, projectors or miniature vacuum cleaners, etc. Size $4\frac{1}{2} \times 3\frac{1}{2}$ in. approx. Price 29/- each.

Sigma pattern high-speed relays, coil 1950 ohms. Operates on 10/12 v. D.C., 5 mA. S.P.C.O heavy duty contacts. 10/6 each.

WESTINGHOUSE RECTIFIER SETS. Style 288 G.P.O. Input 200/250 volts A.C., 50 cycles, output 50 volts D.C., 1 1/2 amps. 80/-.

S.T.C. METAL RECTIFIER SETS. Input 200/250 volts A.C., 50 cycles, output 220 volts D.C., 1 1/2 amps., type 10D/1786, housed in metal cabinet, 12 x 13 x 11 in. 105/5/-.

STAINLESS STEEL AERIAL WIRE. Gauge 7/015in., 1,600ft. reels. Ideal for electrifying fences, etc. 37/6 per reel.

CONTROL UNITS. Type R.A., Mk. I, Ref. BR./2975. Contains Carpenter type 5xA24 relay, 700+300 ohm coil, two G.E.C. type M.1095 relays, 670 ohm coil. 2 make 2 break contacts, resistors, condensers, etc. Fitted in sealed container, 4in. diam., 4in. high. Unused. 28/- each.

HENDRY RELAY UNITS. Fitted Sangamo model S.7 synchronised clock units, 100/125 volts A.C., 50 cycles, 2 1/2 watts. Final speed 1 r.p.m., micro switch, relay, etc. 32/6 each.

NEW SOUND-POWERED TELEPHONE HAND-SETS, G.P.O. pattern, will make efficient 2-way intercom., no batteries required. 50/- per pair.

ZENITH HIGH-GRADE TOTALLY ENCLOSED SLIDING RESISTANCES. 384 ohms, 1.2 amps. New in maker's cartons. 53 each. DITTO. 270 ohms, 0.8 amps. 52 each.

NEW 36-HOUR CLOCKWORK-DRIVEN TIME SWITCHES. Incorporating 7-day high-grade lever watch movement, length 3 1/2 in., diam. 2 1/2 in. 14/- each; less winding key.

STEP-DOWN TRANSFORMERS. Input 180/230 v. A.C., 50 cycles, output 2 windings 4.2, 4.2 v. 10 amps., ideal for soil heating, etc. 22/6.

ROTHERHAM CLOCKWORK-DRIVEN 7-DAY MOVEMENT. As fitted to Barograph units, with 3 1/2 in. drum, winding key, etc., unused. 55/- each.

CLOCKWORK-DRIVEN TIMERS. Variable, 5 to 30 mins. Fitted 15 amp. A.C. contacts. Totally enclosed, crackle finish. 17/6 each.

"SATCHWELL" AIR THERMOSTATS. Type WTO, 15 amps. A.C. contacts, three-contact type (single pole changeover) length of tube 17in., 3 1/2 in. diam., 150/250 F., unused. 41/- each.

SPERRY'S CONSTANT-SPEED. 115 v. 50 cycles motors, 2,400 r.p.m., 3 1/2 in. diam., 6in. long, 3 1/2 in. spindle, 1 1/2 in. long. No. LB1931. 27/6.

TWO-INCH MAGSLIP RECEIVERS, MK. II. Ref. No. AP6459, unused. 19/- each.

MINIATURE 12/24 V. D.C. MOTOR GEARBOX UNITS. Final speed 6 to 10 r.p.m., overall size 4 1/2 in. x 2 x 3 in. 32/6.

FULL MAILING PRICE LIST 6d.

17in. RECTANGULAR 14in.
£7.10.0 T.V. TUBES £5.10.0

USED BUT WITH 6 MONTHS GUARANTEE
"SAVE PETROL. PHONE FIRST"

16in. - 15in. - 14in. ROUND £5
USED BUT WITH 3 MONTHS GUARANTEE
15/6 INS. CARR. ON ALL TUBES

Some types of 12in. Tubes have a waiting list. REMEMBER, MANY RECEIVERS will take a 15in. Tube with little or no alteration to the set.

T.V. CHASSIS 97/6

Complete chassis by famous manufacturer, R.F. E.H.T. unit included. Drawing FREE with order. Being in three separate units (Power, Sound & Vision and Time Base) interconnected these chassis can easily be fitted into existing table or console cabinets. THIS CHASSIS IS LESS VALVES AND TUBE. Channels 1-2, 3-5, I.F.s 16.5 Mc/s.-19.5 Mc/s. vision. Easily converted to I.T.V. channel. Insured carr. 10/6.

T.V. CHASSIS £19.19.6

Complete with Valves and 14in. Tube

BARGAIN CHASSIS by famous manufacturer, complete ready working. 3 months guarantee on tube, valves and chassis. These are demonstrated to personal callers and a free speaker given with each order. Ins. carr. on complete chassis and tube, 25/-.

T.V. CHASSIS UNITS

SOUND AND VISION STRIP, 27/6. S/het. Complete v/strip (uses EF91 valves, etc.). Less valves. FREE drawing. Post 2/6.

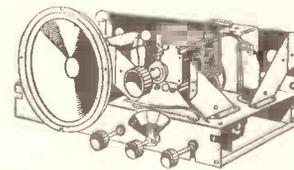
TIME BASE, 10/6. Complete scanning coil, focus unit, line trans. etc. FREE drawing. Post 3/6.

POWER PACK AND AMP, 22/6. 325 v. 250 mA. 4 v. at 5 a., 6 v. 5 a., at 4 v. at 5 a., centre tapped. Output Pen.45. Carr. 5/6. Less valves.

CONVECTOR HEATERS 99/6

2 K. watt (1 or 2 units per hour) switched, gilt finish, illuminated grille' size 26in. x 18in. x 7 1/2 deep. 200-250 v. A.C./D.C. Famous manufacturer. Ideal for home, office, works. Buy now. Avoid that cold spell rush. Ins. Carr. 10/6.

RADIO OR RADIO-GRAM CHASSIS 39/9



IDEAL M. 3/wave band s/het and gram. 5 valve International Octal. Ideal for table gram, but still giving high quality output. 4 knob control. 8" P.M. speaker 7/9, with order. Set of knobs 2/-, Chassis 12in. x 6in. x 7in. less valves. Carr. 4/6.

12-VOLT CONVERTOR. Ex-W.D., 12/6. 275 v. and 500 v. out. Used, needs cleaning, but believed to be in working-order. Carr. 3/6.

1466 V.H.F. RECEIVER. 27/6. Complete with valves. Receives TV and amateurs. Slow motion tuning. Carr. 2/6.

165 RECEIVER 5/9. Ex-W.D. Contains conds. resist.; coils and trans. FREE drawing. Post 1/9. (Ideal for stripping). Less valves.

TRANSMITTER No. 50, Ex-W.D., 6/9. V.H.F. contains coils, tuning cond.; fixed cond.; resist., etc. Less valves. FREE drawing. (Ideal for stripping). Carr. 1/9.

8in. P.M. SPEAKERS 8/9

IDEAL GIFT, if fitted in small cabinet. Treat the lady at home. Fit one in kitchen or cupboard door. Let her follow that TV or radio programme. At this price you can have one in every room. Post 1/9.

Send stamp for FREE catalogue.

REMEMBER
SATURDAY DUKE & CO.,
OPEN ALL DAY 621/3 ROMFORD RD., MANOR PARK,
LONDON, E.12. Tele: GRA 6677-8

SAMSON'S SURPLUS STORES

LONDON'S GREATEST DEALERS IN RADIO
AND ELECTRONIC EQUIPMENT

S.T.C. RECTIFIER SUPPLY UNIT No. 11 TYPE ZB 10235

Specification:—A.C. input 100-260 volts, 45-65 cycles. D.C. output 24 volts, 11 amps. and 130 volts 600 m.a. very conservatively rated. L.T. and H.T. completely smoothed. All-circuits fused. Mains on/off switch. Built in grey metal cabinet as illustrated. Height 5ft. 0in., width 1ft. 7½in., depth 1ft. 1½in. Weight 200 lbs.

These units were originally designed to supply L.T. and H.T. power in conjunction with Bay Power No. 3 to S.O.S./T. 3 channel telephone system, but are ideal heavy duty L.T. and H.T. supply units for the electronic industry, research laboratories, schools, etc., etc. Complete with Instruction Book and circuit. Supplied brand new at a fraction of the maker's price.

£17.10.0 ex-warehouse

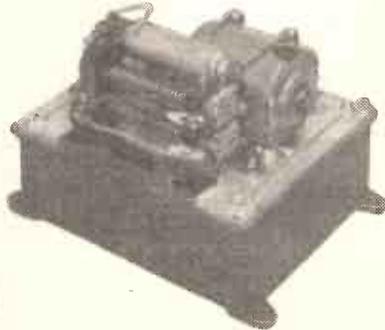
If further technical details are required, Instruction Book will be forwarded against a deposit of One Pound. Export enquiries are welcomed. We have a limited number of these units ready packed in original transit cases at a small extra charge.

LT SUPPLY UNIT. Type 115. A.C. input 200-250 v. Output 24 v. 26 amp. rating continuous ideal for charging 24 v. batteries at a high current. Approximate size 1ft. 6in. x 1ft. 6in. 1ft. 6in., **£17/10/-**, plus carriage. A.M. battery chargers designed to charge 12 2 volt cells at a maximum current of 10 amps., fine and coarse control, fitted fuses and 0-12 ammeter, **£15**, plus carriage.

HEAVY DUTY SLIDING RESISTORS. 398 ohm. 0.6 A. completely enclosed slider control. **45/-**. 293 ohm. 1.2 A. Completely enclosed slider control **65/-**. 300 ohm. 1 A. Geared drive with control handle **35/-**. 500 ohm. 2-0.36 A. Geared drive **27/6**. 1100 ohm. 0.4 A. Horizontal sweep. Control **17/6**. 100 ohm. 1.6 A. enclosed slider control, **25/-**. 2.6 ohm. 8.5 A. Geared drive with handle **25/-**. 5.3 ohm. 8 A geared drive **27/6**. 7.5 ohm. 4 A. slider control **17/6**. 0.4 ohm. 25 A. geared control **17/6**. 1 ohm. 12 A. slider control **12/6**. 50 ohm. 1 A. gear control **10/6**. 12in. field rheostats 38 ohm. 5.6 A. res. out. 2.1 A. res. on **45/-**. 95 ohm. 3.3 A. no control but fitted with adjustable tappings **22/6**. 850 ohm. 0.55 A. completed enclosed fixed res. **17/6**. P.P. on all resistors **2/6**, many other types available. Let us know your requirements.

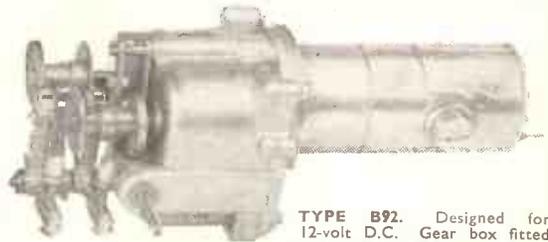
BATTERY TESTING VOLTMETERS. double reading 0-3 v. 0-30 v. centre zero **12/6**. P.P. 2/- A.M. telescopic microphone stands **25/-**. P.P. 3/- S.T.C. equipment wire 7/012 stranded copper plastic covered red green, brown, grey, white, brand new 200 yard drums, **12/6**, postage 2/- Heavy duty LT transformers PRI 230 v. see tapped 11 v., 11.5 v., 12 v., 12.6 70 amp. tropically rated **£6/10/-**, carr. 7/6. PRI 230 v. sec. tapped 4 v. 7 v. 11 v. 150 amps., **£7/10/-**, carriage 7/6. Pri. 230 v. sec. 17.5 v. 35 amps. tropically rated **£3/15/-**, carriage 7/6. Pri. 250 v. sec. 130 v. 18 amps., **£6/10/-**, carriage 7/6. Pri. 200/250 v. sec. 12 v. 45 amps., **£3/15/-**, carriage 5/- Pri. 200-250 v. sec. tapped 16 amps., **35/-**, carriage

5/- Pri. 230 v. sec. 50 v. 30 amps., **£6/10/-**, carriage 7/6. Pri. 230 v. sec. 50 v. 20 amps., **£5/5/-**, carriage 7/6. Variable voltage regulator transformers input 230 v. output 57.5 v. to 230 v. in 16 equal steps at 21amps., **£10/10/-**, carriage 10/- Occasionally we have limited supplies of constant voltage transformers and variacs; give us a ring we may be able to assist you with your requirements. Sterling Equipment wire PVC stranded copper 7/36, 500 yard drums assorted colours **32/6**, postage 2/6. Twin PVC Bell Wire 0.024 23 S.W.G., 220 yard coils, **25/-**, postage 2/- **HOOVER MINIATURE GEARED FLASHER MOTORS TYPE E.** 9 R.P.M. at 24 v. D.C. 4½ R.P.M. at 12 v. D.C.



Overall size of motor and gearbox 4½ x 2½ x 2in. Will operate on slightly higher voltage A.C. Mounted on metal box size 5½ x 4½ x 2½in. which

Special Offer of LOW VOLTAGE GEARED MOTORS MADE BY A LEADING AMERICAN MANUFACTURER



TYPE B92. Designed for 12-volt D.C. Gear box fitted with two ¼in. dia. drives, fitted with cams which operate a double-ended plunger spindle. This assembly can easily be removed if not required. No. 1 drive 20 r.p.m. at 12 v. D.C. 15 r.p.m. at 6 v. D.C. No. 2 drive 5 r.p.m. at 12 v. D.C. 3 r.p.m. at 6 v. D.C.

ALSO TYPE B91. Designed for 27½ v. D.C. Operation on 24 v. D.C. No. 1 drive 24 r.p.m. No. 2 drive 6 r.p.m. and on 12 v. D.C. No. 1 drive 16 r.p.m. No. 2 drive 4 r.p.m. Overall size of motor and gear box. 7½in. x 3½in. x 3in. Weight 1lb.14 oz. Supplied brand new at a fraction of the maker's price.

35/-

postage and packing 1/6

WHEN ORDERING PLEASE STATE WHICH TYPE REQUIRED

contains suppressor unit. **SUPPLIED BRAND NEW IN MAKER'S CARTONS.** 32/6, carr. 2/- **WESTINGHOUSE HEAVY DUTY CHARGERS.** A.C. input 200-250 v. D.C., output 144 v. 6 amps. Built in metal cabinets, size 2ft. x 1ft 10in. x 1ft. 8in. With ammeter. Fine and coarse switch. Variable control fuses and mains switch. **£17/10/-**, plus carr.

ALKALINE BATTERIES. Crates of five cells giving 6 v. at 53 A.H. Size of wood crate 15 x 5½in. x 11½in. **£5/19/6**, plus carr. 7/6. Single cells 2.4 v. 18/20 A.H. Size 4½ x 6 x 3½in., **15/-**, carr. 2/-

36FT. AERIAL MASTS. R.A.F. Type 50. Complete kit consists of a tubular steel section, length 4ft. Dia. 2in. Set of pickets. Top plate. Base plate. Guys and all fittings. Supplied new in canvas carrying bags. Ideal for T.V. aerial masts. **£7/10/-**, carr. 7/6. Extra sections 15/- each, carr. 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.

TELEPHONE CABLE TYPE D8 TWIN. 1 mile drums. **£7/10/-**, carr. 10/- Commando assault telephone cable. P.V.C. 1,000-yard drums. Ideal telephone cable and very useful for the home and garden. **10/6** per drum, P. and P. 3/-

ISENTHAL MERCURY CONTACTORS. A.C. 200-240 v. 2 pole 6 amps., contacts completely enclosed, fitted spirit level, overall size 7 x 4½ x 3½in. **35/-**, carr. 2/6.

HEAVY DUTY 40 AMP. CONTACTORS. A.C. 220-240 v. 2 pole. Supplied brand new in maker's cartons. **32/6**, carr. 3/-

169/171 EDGWARE ROAD, LONDON, W.2

TEL.: PAD 7851

AND

125 TOTTENHAM COURT ROAD, W.1.

TEL.: EUS 4982

PERSONAL SHOPPERS
WELCOME.

ORDERS ACCEPTED M/A
FROM COLLEGES, SCHOOLS,
LABORATORIES, ETC.

ALL MAIL ORDERS TO OUR
EDGWARE ROAD BRANCH
PLEASE. THIS IS OPEN ALL
DAY SATURDAY. HOURS
9-6. 9-1 THURSDAY.

SOLARTRON

TECHNICAL COMMERCIAL REPRESENTATIVES (OVERSEAS)

We are seeking men capable of selling a wide range of outstanding electronic test equipment in an international market.

The Solartron Group of Companies is expanding rapidly and offers unusual prospects to men who combine the ability to sell with sound technical experience in electronics especially the servo field.

Applicants must have language proficiency where necessary and after initial training and experience in the United Kingdom will be expected to undertake tours abroad of up to three months. Later, resident overseas appointments may occur. The relevant areas are North and South America Middle and Far East Western Europe Africa.

The Group operates a generous non-contributory Pension and Life Assurance Scheme.

Please submit applications in writing to the
**Group Personnel Officer,
The Solartron Electronic Group, Ltd.
Queens Road, Thames Ditton, Surrey.**

By John Cura and Leonard Stanley. Gives a clear and comprehensive explanation of the functions of the various controls on a television set with precise instructions on how to operate these controls to obtain the best results on the screen. Also covers interference and tells how it may be minimised or eliminated and the choice and installation of aerials and Band III converters.

Over 100 "tele-snaps" from screen photographs

5s. 0d. net.

BY POST 5s. 4d.

from all booksellers

Published by Iliffe & Sons Ltd.,
Dorset House, Stamford St., London, S.E.1

THE MULLARD RADIO VALVE CO. LTD., QUEENSWAY, WADDON (off Purley Way)

Transmitting and Microwave Division have vacancies for

TECHNICAL ASSISTANTS

Applicants should hold the General Certificate of Education at Advanced level in Science subjects or the O.N.C. or H.N.C. in Electrical Engineering.

There are facilities for further training for suitable applicants seeking higher qualifications. Ex-service personnel with experience in radar may be particularly interested in these posts. The salary is in accordance with age, qualifications, and experience. Selected applicants are offered permanent positions and there is a Pension Scheme.

Candidates are invited to apply to the
**Personnel Officer,
The Mullard Radio Valve Co. Ltd.,
Queensway, Waddon Factory Estate,
Croydon, Surrey.**

The Trade-Marks set out below were assigned on 1st October, 1956, by Pye Limited of Radio Works, St. Andrews Road, Cambridge, to Pye Telecommunications Limited of Ditton Works, Newmarket Road, Cambridge WITHOUT THE GOODWILL OF THE BUSINESS IN WHICH THEY WERE THEN IN USE.

No.	Mark.	Goods.
736930	REPORTER	Radio, television, telecommunication, telegraphic and telephonic apparatus.
746317	TRANSHALER	Megaphones, microphones, loudspeakers and electric amplifiers and parts thereof.

DYNATRON RADIO LTD. DEVELOPMENT DIVISION

The Chief Engineer requires the following additional staff in the design and development of high quality radio and electronic equipment in the Company's new development building.

SENIOR RADIO AM/FM Receiver Design Engineer.
AUDIO ENGINEER for the development and design of high fidelity L.F. amplifiers and speaker enclosures.
NUCLEONIC & ELECTRONIC DEVELOPMENT ENGINEER for Government and Industrial work. Similar previous experience essential.

Vacancies also occur for Junior Engineers for training in Radio & Electronic Engineering.
Excellent working conditions, attractive salaries and pension arrangements.

The work is very interesting and very wide in scope with the Company pursuing its long established policy (1927) of producing only outstanding radio, nucleonic and electronic equipment.

Write to Chief Engineer setting out full particulars of experience and career to

**DYNATRON RADIO LTD., DEVELOPMENT WORKS,
St. Peter's Road, Furze Platt, Maidenhead.**

APPOINTMENTS VACANT

“BELLING-LEE”

are looking for...

RESEARCH ENGINEERS (Technologists)

For development of (1) VHF and UHF receiving aerials. (2) Interference suppressors and screened compartments. (3) Circuit protection devices (fuses, cutouts, etc.). Minimum qualifications Grad. I.E.E., H.N.C. (advanced) or equivalent.

RESEARCH ASSISTANTS (Technicians)

To act as assistants to the above. Minimum qualifications O.N.C.

MATERIALS ENGINEER

To study and advise on suitability of existing or new materials for their products. Previous experience essential. Minimum qualifications: a degree in chemistry and proved knowledge of metallurgy.

... As part of the Company's plans for expansion the research department has recently been enlarged, and we have vacancies there for men and women of ability for whom there are excellent prospects of advancement. We are well established and have an excellent record of technical achievement and integrity in the radio and electronic field; we manufacture an extensive range which includes components, fuses, cutouts, aerials, interference suppressors, screened compartments and electrical car accessories. We think that this range of activities will appeal to those with a genuine interest in electronics, particularly as we do not "type" our research staff but en-

courage them to move from subject to subject according to their aptitude and ability.

The establishment is pleasantly situated on the outskirts of London at the edge of the Green Belt, and excellent facilities for further study exist at the Enfield Technical College; the appointments are permanent and include membership of a pension and life assurance scheme.

Applications (which will be treated as strictly confidential) to the Secretary, Great Cambridge Road, Enfield, Middlesex, should give all personal details, experience, qualifications and some indication of the salary expected.

BELLING & LEE LTD

GREAT CAMBRIDGE ROAD, ENFIELD, MIDDX., ENGLAND

The English Electric Valve Company, Chelmsford, have vacancies on their technical staff for engineers and physicists for research, development and production of the following devices:—

TRANSMITTING VALVES for communications, broadcasting and industrial purposes.

MAGNETRONS, KLYSTRONS and THYRATRONS for radar equipment.

TRAVELLING WAVE TUBES.

TELEVISION camera tubes.

TRANSISTORS and other semi-conductors.

MICROWAVE TEST equipment.

Interesting work. Attractive salaries. Non-contributory superannuation.

The Company will assist successful candidates to obtain accommodation. Please write to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. WW 1506E.

ELECTRONIC DEVELOPMENT ENGINEER

Applications are invited from young men interested in a post as Development Engineer to work on the development of transistor and printed circuit techniques with a view to their application principally to domestic radio and television receivers. Applicants should have a degree in Electrical Engineering or its equivalent and some experience of development work. Those interested should write, quoting (Reference TPC) and giving details of their qualifications and experience to the

**Personnel Manager,
The General Electric Co., Ltd.,
Radio and Television Works,
Spon Street, Coventry.**

TRANSFORMER DEVELOPMENT

A Junior Development Engineer is required to assist in the design and development of coils and small transformers for use on domestic radio and television receivers and other electronic equipment. A sound technical background is essential together with an interest in the economical aspects of design and development. Some experience is desirable but not essential. Applicants should write, quoting (Ref. TD) and giving details of experience and qualifications to the

**Personnel Manager,
The General Electric Co., Ltd.,
Radio and Television Works,
Spon Street, Coventry.**

THE MULLARD RADIO VALVE CO. LTD., WADDON, SURREY. (Near Croydon Airport)

An opportunity exists for a man of graduate standard to assist in the running of a department responsible for the quality of the output of factory producing transmitting and microwave valves. Some experience of transmitting or radar valves and their use, would be an advantage. The job will involve planning and supervising the work of a small group of technical staff.

The commencing salary will be according to age, qualifications and experience. There is a Pension Scheme and long service benefits.

Write giving full details to:—

**The Personnel Officer,
The Mullard Radio Valve
Co. Ltd.,
Queensway, Waddon, Surrey.**

A rare opportunity for SENIOR DEVELOPMENT ENGINEERS

with design and production liaison experience in radio, to join a company looking to the future.

These permanent positions offer ample scope for progress in an organization where Research and Development are given their true importance.

Generous starting salary.

Ideal working conditions.

There are a limited number of vacancies also for

JUNIOR ENGINEERS

particularly those with experience in the transistor field.

For either position apply to:
**Personnel Manager, Pye
Telecommunications Ltd.,
Ditton Works, Cambridge**

ELECTRONIC TEST ENGINEERS

1. **Test Engineers** of O.N.C. and H.N.C. standard are invited to apply for positions on the production testing of complex electronic equipments.

Consideration will also be given to engineers without the necessary academic qualifications, but who have sufficient practical experience.

2. An **Equipment Maintenance Engineer** is required for the maintenance and calibration of electronic test equipment used in production testing.

Experience in this field is essential.

Assistance with housing will be given. Reply in confidence to the—

**CHIEF INSPECTOR,
DENIS FERRANTI METERS
LIMITED,
BANGOR, NORTH WALES.**

RADIO TECHNICIANS IN CIVIL AVIATION

A number of appointments are available for interesting work providing and maintaining aeronautical telecommunications and electronic navigational aids at aerodromes and radio stations in various parts of the United Kingdom.

Applications are invited from men aged 19 or over who have a fundamental knowledge of radio or radar with some practical experience. Training courses are provided to give familiarity with the types of equipment used.

Salary £561 10s. at age 25 rising (subject to a practical test) to £671. The rates are somewhat lower in the Provinces and for those below age 25. Prospects for permanent pensionable posts for those who qualify.

Opportunities for promotion to Telecommunications Technical Officer are good for those who obtain the Ordinary National Certificate in Electrical Engineering or certain City and Guilds Certificates. The maximum salaries of Telecommunications Technical Officers are Grade III £790, Grade II £925, Grade I £1,160.

Apply to the Ministry of Transport and Civil Aviation (ESB1/RT), Berkeley Square House, London, W.1, or to any Employment Exchange (quoting Order No. Westminster 5788).

TESTERS REQUIRED for RADAR & ELECTRONIC WORK

Holding of Ordinary or Higher National Certificate an advantage, but men with suitable Service or Civilian experience will be considered. Opportunities for advancement available for progressive candidates.

Good rates of pay, conditions, canteen facilities, etc.

Apply in person or in writing to:—

**Employment Department,
Metropolitan-Vickers
Electrical Co., Ltd.,
Trafford Park, Manchester 17**

N.B.: For the convenience of applicants the Employment Department is open for interviews as follows:—

Monday and Friday 8.30 a.m. to 4 p.m. Tuesday, Wednesday and Thursday 8.30 a.m. to 6.30 p.m., and Saturday 8.30 a.m. to 11.30 a.m.



GUIDED WEAPONS

A. V. ROE & CO., LIMITED

offer posts in their

WEAPONS RESEARCH DIVISION

at

WOODFORD, CHESHIRE

for

DEVELOPMENT ENGINEERS

and

LABORATORY TECHNICIANS

to work in the following fields of engineering endeavour:—

- Servo-mechanisms
- Hydraulics
- Aircraft Turbines
- Analogue Computers
- Digital Computers
- Transistors
- Magnetic Amplifiers
- Gyroscopes
- Electrics & Electronics
- Environmental Test
- Instrument Test

Minimum qualifications desirable:

Development Engineers		B.Sc. or H.N.C. or equivalent and some years relevant experience.
Laboratory Technicians		O.N.C.
Instrument Test Engineers (Male or Female)		Inter B.Sc. or equivalent.

Apply, quoting Ref: WRD/GEN/R.156/W to:—

**Personnel Manager, A. V. Roe & Co., Limited,
Greengate, Middleton,
Manchester.**

SENIOR MECHANICAL DRAUGHTSMEN.

PHILIPS ELECTRICAL INDUSTRIES LIMITED

invite applications from Mechanical Draughtsmen for a number of vacancies in the Design Laboratories of their new Radio and Television Plant at Croydon, Surrey.

These posts are concerned with manufacturing development for mass production from designers' sketches or models of radio/electronic equipment, and applicants should have experience in light engineering. Production experience would be an advantage.

Starting salary up to £850 per annum according to experience and qualifications. In addition to a progressive salary policy, the Company operates a generous pension and life assurance scheme, together with extended sick-pay and holiday plans.

Applicants who are interested in these opportunities for interesting work in this extremely modern plant, are invited to write to:—

THE PERSONNEL OFFICER

Philips Electrical Industries Limited, Commerce Way, Purley Way, Croydon, Surrey.

Please quote reference No. D.D/R.

ELECTRONIC ENGINEERS

Senior and junior Electronic Engineers are required for interesting and varied work in the Nelson Research Laboratories, English Electric Co. Ltd., Stafford. Applicants should have sound workshop experience and some knowledge of Drawing Office Procedure. Qualifications up to H.N.C. level are desirable.

Duties will involve responsibility for the Engineering Design and Development of prototype electronic equipment from the rough circuit stage to the issuing of manufacturing information to the Laboratories' Workshops and the posts offer ample scope for advancement to men with initiative and ability. Apply to Dept. G.P.S., 336/7 Strand, W.C.2., quoting Ref. WW 906A.

THE MULLARD RADIO VALVE CO., LTD.

require a TECHNICAL ASSISTANT for investigational work and technical/chemical control of a large Plating shop. The work is carried out in a modern laboratory in the outskirts of South London. Due to the nature of the work, applicants should possess either G.C.E., advanced level in Chemistry, Inter B.Sc., or Higher National Certificate. The commencing salary will be according to age, experience and qualifications and will not be less than £10/14/- at age 24.

Applications in writing should be addressed to the Personnel Officer, The Mullard Radio Valve Co., Ltd., New Road, Mitcham Junction, Surrey, quoting reference JFG/MR/L1.

The ROYAL NEW ZEALAND AIR FORCE

has vacancies for
BRITISH EX-SERVICEMEN
in the following trades:—
RADIO MECHANICS
RADAR MECHANICS

Commencing pay between £10.16.2 per week and £17.1.3 per week according to previous experience. Ages between 21 and 40, married or single.

This is an opportunity to start a new life in New Zealand with excellent conditions of service and free passage. Limited vacancies also exist in other trade groups. Write for full information to:—

The Royal New Zealand Air Force Headquarters (Dept. WW),

Adelphi Building,
John Adam Street,
London, W.C.2.

VACANCIES IN GOVERNMENT SERVICE

A number of vacancies, offering good career prospects, exist for:—

Radio Operators—Male

Cypher Operators—Male and Female

Apply, giving details of education, qualifications, and experience to:—

Personnel Officer,
G.C.H.Q. (FOREIGN OFFICE),
53 Clarence Street,
Cheltenham, Glos.

OPPORTUNITIES IN ELECTRONICS SENIOR ELECTRONIC ENGINEER ELECTRONIC DESIGN ENGINEERS

SPERRY GYROSCOPE COMPANY offers interesting and responsible posts connected with the detailed design and development of navigational and automatic control equipment for aircraft and guided missiles.

These posts will be located initially at Brentford and Feltham (Middx) and later at Bracknell (Berks), a New Town where housing will be available in approved cases. Other posts at Sunbury (Middx).

Enquiries, which will be treated in strict confidence, should be addressed in the first instance to

Mr. R. W. H. Lubbock,
Sperry Gyroscope Co., Ltd.,
Great West Road, Brentford, Middx.

BUSH RADIO LIMITED

Development Laboratories—KEW

Vacancies exist in all grades of work on colour television and associated test gear.

Write for application form to Personnel Dept. (Ref. CTV), Bush Radio Ltd., Power Road, Chiswick, W.4.

ELECTRONICS ENGINEERS

are invited to apply for work on specialised equipment for testing the guidance systems of

GUIDED WEAPONS.

Applicants will be called upon to carry out the design of units for this type of equipment; previous experience of similar work is thus desirable. Apply to the Personnel Manager (Ref. 87B)

DE HAVILLAND PROPELLERS LTD.,
Hatfield, Herts.

TEST ROOM PERSONNEL

required by a Company engaged in the manufacture of Microwave Instruments and Industrial Electronics Equipment.

The new modern factory is situated near London, and housing accommodation can be made available to successful applicants from the London area.

Apply Box No. 5589 c/o Wireless World.

TELECOMMUNICATION ENGINEERS

The Transmission Division, which designs and manufactures all types of Line Transmission Equipment, offers progressive careers to:—

ENGINEERING INSPECTORS, to inspect at all stages of manufacture and to ensure that the equipment, drawings and operating bulletins are in accordance with the requirements of the various contracts.

SYSTEM TESTERS. Experienced men for senior posts in the final functioning of complete systems.

TECHNICAL WRITERS for the preparation of operating bulletins and similar publications for field use by customers. The work will appeal to the man who wishes to work on his own initiative after a period of training.

The Company is located on Merseyside and the positions are on the permanent staff with generous Pension Fund (contributory) and full range of welfare activities including medical and dental facilities. Assistance will be given with housing and with removal expenses.

Please write to the Personnel Manager,

A. T. & E. CO. LTD.,

Strowger Works, Liverpool, 7

giving full details of age, experience, qualifications, etc.

MAGNETIC AMPLIFIERS SERVO MECHANISMS

Two vacancies exist in the Research Department of "SHORTS," for Development Engineers, one to work on Magnetic Amplifiers for automatic pilots and stabilisers; the other for work on electro-hydraulic servos for aircraft and missile control systems.

Applicants for either appointment should possess a degree, or equivalent, and have several years' experience in the relevant field of engineering development, and must be capable of accepting full responsibility for the design and construction of such components and equipment.

Housing assistance and generous removal allowance will be available from Great Britain for the successful married candidate.

Application with full personal data should be made to the:—

Staff Appointments Officer,

SHORT BROTHERS & HARLAND LIMITED,

P.O. Box 241, BELFAST.

Quoting S.A. 186.

FM/AM RADIOGRAM CHASSIS

£26 LISTS FREE.

**BEL, MARLBOROUGH YARD,
LONDON, ARCHWAY, N.19. ARCHway 5078**

Approx. 400 Transmitters, 1154, in Transit Cases, for Sale in Lots of not less than 50, at 12/6 each, collected at Blackpool. Also 1131 Transmitters with Valves, at £20 each collected at Blackpool.

**W. SMITH (METALS) LTD.
TALBOT ROAD, BLACKPOOL**

Phone: 23401/2

E.M.I. LTD.

DOMESTIC ELECTRONICS DIVISION REQUIRE

- (a) Mechanical Engineer-Draftsman to work on the design of magnetic recording equipment at their Greenford branch. Qualifications should include engineering apprenticeship or equivalent or several years experience in this field.
- (b) Mechanical Designers of magnetic recording equipment at their Hayes laboratories. A number of interesting projects are in hand, giving scope for inventive ability to applicants who have knowledge of electrical circuitry or interest in small mechanisms. Salaries will be commensurate with ability. Superannuation Scheme. Apply, giving full details to

Personnel Department (DED/11), E.M.I. Ltd., Hayes, Middx.

VACANCIES FOR SKILLED CRAFTSMEN IN GOVERNMENT SERVICE AT CHELTENHAM

Experienced in one or more of the following:—

1. Maintenance of radio communication receivers.
2. Sub-assembly lay-out, wiring and testing of radio type chassis.
3. Cabling, wiring and adjustment of telephone type equipment.
4. Fault finding in, and maintenance of, electronic apparatus.
5. Maintenance of Teleprinters or Cypher Machines and associated telegraph equipment.

BASIC PAY. £8/11/4 plus up to £2/10/- merit pay, assessed at interview and based on ability and experience.

Opportunities for permanent and pensionable posts
5-day week—good working conditions—single accommodation available

Apply to—Personnel Officer, G.C.H.Q. (FOREIGN OFFICE), 53 Clarence Street, Cheltenham

RESEARCH LABORATORY ASSOCIATED ELECTRICAL INDUSTRIES LIMITED

MICROWAVE RESEARCH. A Technical Assistant is required for fundamental research on new devices for microwave generation. Microwave, vacuum, or valve experience desirable, initiative and interest essential as the appointment offers opportunity for advancement.

Applicants must have satisfied National Service requirements. The Laboratory is in pleasant surroundings in the Berkshire countryside, with coach transport scheme from Reading and Newbury.

Apply giving experience and educational qualifications quoting reference No. EP/A/1 to the Personnel Officer,

Research Laboratory
ASSOCIATED ELECTRICAL INDUSTRIES LIMITED
Aldermaston Court, Aldermaston, Berkshire.

OPPORTUNITIES IN NEW ZEALAND

for Radio Mechanics and Technicians

Free Passages for fully qualified single men between 21 and 35 years for employment with the Post and Telegraph Department in New Zealand are available under the Immigration Scheme. For full information apply to:—Chief Migration Officer, New Zealand Migration Office, Adelphi Building, John Adam Street, LONDON, W.C.2.

There are also vacancies for linemen, telephone exchange mechanics (including trainees) and for postmen and postal assistants.



MORSE KEY

Bendix manufacture ... 7/- each

HIGH RESISTANCE HEADPHONES

2,000 ohms. Brand new, ex-W.D. boxed, type D.H.R. 15/- per pair, postage 1/-.

LOW RESISTANCE HEADPHONES

Brand new, ex-W.D. boxed, type C.L.R., 5/6 per pair, postage 1/-.

JOHNSON'S VARIABLE CONDENSERS

Single 500 pF 2,000 v. 9/- each.
Single 500 pF 3,000 v. 14/- each.
Single 1,008 pF 2,500 v. 16/- each.

SPARE PARTS FOR AR 88-D. & L.F.

	Each
Mains transformers	£4
Output transformers	30/-
Filter chokes	25/-
I.F. transformers	15/-
V.F.O. transformers	15/-
Main Variable Condenser (L.F. only)	35/-
Block condenser 3 x 4 μ F	25/6
Band switches	37/6
Antenna trimmers	3/6
Phasing trimmers	3/6

All the above spare parts are fully guaranteed to be in excellent working order.

FIELD TELEPHONE TYPE "F". In excellent working condition, £3/10/- each. Carriage 5/-.

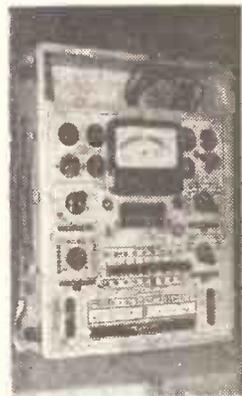
ROTARY CONVERTOR UNITS

Input 11.5-12.5 v. D.C. Output 300 v. 200 mAmps D.C. Price 30/-.

Packing and Carriage 5/-.

AMERICAN VALVE TESTER Model 314, individual leather switches for each tube element. Roll Chart for American type valves. 220/30 V. A.C. Brand new in nice wooden case with leather handles. Full instruction booklet.

£10. Carriage 10/-.



J. P. ELECTRIC

MAIL ORDER DEPT.

156 ST. JOHN'S HILL · LONDON · S.W.11

Z & I AERO SERVICES LTD.

Fully Serviced and Guaranteed Test Equipment

BONDING TESTERS, 5G/2126 (Record), complete with appr. 60ft. and 6ft. long matched leads with spikes, and shoulder carrying straps.

PRICE carriage paid £6 15 0
Alkaline Cells, extra £3 3 0

MARCONI TF-144G "STANDARD" SIGNAL GENERATOR, 85 kc/s to 25 Mc/s.

PRICE, fully overhauled and guaranteed, complete with Dummy Aerial and Mains Lead £85 0 0

MARCONI TF144F "STANDARD" SIGNAL GENERATOR, older version of the above.

PRICE £75 0 0
Packing and carriage £2 10 0

COSSOR TYPE 339 DOUBLE BEAM OSCILLOSCOPE, fully overhauled and guaranteed.

PRICE £30 0 0
Packing and carriage £1 0 0

TS-89/AP VOLTAGE DIVIDER, extending Voltage Range of an Oscilloscope up to 20 kV. Two ratios 100 to 1 and 10 to 1. Transmission flat from 159 c/s to 50 Mc/s.

PRICE, post free £5 0 0

Please write for illustrated details of the above and other Test Equipment, Communication Receivers, etc., indicating items of particular interest to you to:

Z & I AERO SERVICES LTD.

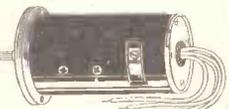
19, BUCKINGHAM STREET · LONDON, W.C.2
Telephone TRAFalgar 2371/2/3

We pay high prices for high-quality Electronic Test Equipment, American Communication Receivers, etc. We are particularly interested in Receivers type BC312, 342 and 348.

MIDLAND INSTRUMENT CO.

JOHN OSTER (U.S.A.) MOTORS, 12 v. 1.4-amp. D.C. shunt, speed 5,600 r.p.m., fitted enclosed reduction gearbox, with 2 outlet shafts in line with motor, 1/2 in. dia., 1 1/4 in. long, 1 1/2 in. between centres, providing very powerful drives of 8 and 24 r.p.m., also another shaft at right angles to motor which has a fine adjustment 1/2 in. linear reciprocating movement 24 times a minute, size overall 7 1/2 in. long, 3 1/2 in. wide, 3 1/2 in. high, easily the finest of ex Govt. motors, well worth £12, our price as brand new 30/-, post 1/6.

HUGHES 12-VOLT D.C. SHUNT MOTORS, taking 1.25 amps., up to 2-amps. on load, speed 5,600 r.p.m., external reversing terminations; size 3 1/2 in. long, 1 1/2 in. dia., 2 in. shaft, weight 20 oz., oil impregnated bearings, balanced armature, a very superior powerful motor, original cost over £7, our price new unused 10/-, post 1/3, 2 for 20/-, post paid. Ditto, fitted reduction gears, giving final drive of either 330 or 160 r.p.m. (state which required), 12/6, post 1/6, 2 for 25/-, post paid.



ACHROMATS by Ross or Taylor Hobson, new and perfect, 5 types all 40 mm. dia. f/1.7, f/2, f/2.3, f/2.7, f/3, focal lengths are approx. 2 1/2 in., 3 in., 3 1/2 in., 4 in. and 4 1/2 in. respectively, unmounted, 10/- each, post 6d., in brass mounts 12/6, post 1/-.

MAINS BLOWERS, 200/250 v. A.C./D.C., 1-amp., 5,000 r.p.m., consists of the motor with attached enclosed fan, end funnel intake 1 1/2 in. dia., side outlet lin. x 1/2 in., plinth base 5 in. x 4 1/2 in., finish black crackle and die cast aluminium, size overall 9 in. long, 4 1/2 in. wide, 5 in. high, weight 7 1/2 lb., a very superior blower, offered at a fraction of original cost, new unused, 25/-, post 3/-.

BATTERY CHARGER KITS. Consists of a G.E.C. full wave rectifier with associated Douglas 200/250 v. mains transformer, all brand-new components, to charge a 12-v. battery at 1-amp., 15/-, post 1/6, to charge a 12-v. battery at 1 1/2-amps., 25/-, post 2/-, to charge a 12-v. battery at 3 amps., 35/-, post 3/-.

CRYSTAL SET KITS. Consists of a Repanco low-loss M. & L.W. coil, with circuit, 3,000-m μ d. Wavemaster var. conds. with pointer knob, germanium crystal, w/o switch, 4 Clix plugs and sockets, all new components, 10/-, post 10d., Brown's headphones 120-ohms, fitted 6ft. leads, new boxed, 7/6, post 1/-.

MOTOR GENERATORS. Size 4 1/2 in. long, 3 1/2 in. dia., totally enclosed, black crackle finish, fit one to your car, with a 12-v. input, the output will operate your mains A.C./D.C. electric razor, ideal for caravanners, campers, tourists, etc., new unused, 12/6, post 1/9.

ILLUMINATED MAGNIFIERS, has low and high power lens system, special lamp giving light directly on the subject viewed, the holder takes a No. 8 battery, fitted switch and resistance dimmer, nickel plate and black crackle finish, complete with spare lamp in velvet lined instrument case, fraction of original cost, new unused, 12/6, post 1/6.

PROJECTION UNITS. Consists of the enclosed lamphouse, containing a 24-v. 12-watt lamp, polished reflector, in line with the optical mount, which contains a concave/convex curved glass forming a graticule, also a 40 mm. dia. f/2.2, 3 1/2 in. focal length achromat projection lens, in perfect condition, 12/6, post 1/6.

SLYDLOK FUSES, 250 v. 15 amp. type, end and back connection, new unused, fraction of original cost, 1/-, post 4d.; 10/- doz., post 1/9.

BURGESS MICRO SWITCHES, 2 types, red spot (normally closed), or green spot (normally open), new unused 1/6, post 4d.; 15/- doz., post 1/3.

Many other bargains; send stamped addressed envelope for lists.

MIDLAND INSTRUMENT CO., MOORPOOL CIRCLE, BIRMINGHAM, 17

Tel.: HAR 1308

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 Number: 2 words plus 1/-. (Address replies: Box 0000 c/o "Wireless World" Dorset House, Stamford St., London, S.E.1.) Trade discount details available on application. Press Day March 1957 issue. Thursday, January 31st. 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

EPIGRAM, model 5-3-3, transistor 5-speed portable record player; ask for details.
EPIGRAM portable sound reproducing equipment: Amplifiers with own built-in power supply.—For details and nearest dealer, write to W.W. Penco Products, Kings Langley, Herts, England. [6575]

SHERLEY LABORATORIES, Ltd., 3, Prospect Place, Worthing, Sussex. Tel. 30536
THE TWA/1515 stereonic tape recording and replay amplifier, separate meter monitoring on record and playback on both channels, 13watts O/P each channel, 96cms; TWA/15 tape recording and reproducing amplifier, 13watts O/P for Weatite and Collaro decks, 45cms; TW/PA recording and replay pre-amplifier, 30cms; both with valve voltmeter monitoring; type SB/1-15E high-fidelity amplifier, exceptionally wide tone-control system, 40mv sensitivity, 20cms; with two inputs and 3-position gram filter, 25cms; specialized amplifiers for the musical and scientific industries including the Mullard 20watt. [0095]

ARMSTRONG chassis, all models in stock.—157, Bromsgrove St., Birmingham. Mid. 1054. [6563]

SPENCER-WEST Distribution and Communal Reception Amplifiers cater for all requirements.—Full data and leaflets on request to Spencer-West, Ltd., Quay Works, Great Yarmouth, Norfolk. Tel. 4794. [0007]

RECEIVERS AND AMPLIFIERS—SURPLUS AND SECONDHAND

HRO Rx's and coils in stock, also AR83, BC348R, CR100, etc.—Requirements please to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Lev. 4986. [0053]

"**WIRELESS** World" 7-valve F.M. tuner, unused, with cathode follower, magic eye, and power supply for use on 200-250 volts A.C. fitted with latest type F.M. components of the highest grade including specified temperature compensating capacitors; price £14/15 including 7 valves; accurately aligned and tested ready for use; approx. half original price, exceptionally good reproduction, ideal for use with all high fidelity amplifiers and recorders; as above but including high-grade cabinet 14 1/4" x 9 3/4" x 9 1/2", £18/10, limited number; bargain; above are despatched by passenger train in boxes lined with foam rubber to ensure safety in transit.—Box 5084. [6534]

LOUDSPEAKERS—SURPLUS AND SECONDHAND

TANNOY 15in dual concentric speaker, 3 months old, absolutely perfect; £28/10 complete with crossover unit.—Box 5259. [6577]

TEST EQUIPMENT—SURPLUS AND SECONDHAND

ONE Marconi valve voltmeter, ex-Army, unused, in stout wooden packing case with high frequency attachment for 32.5—S. Gerrin, "Shaivah," Ty Gwyn Rd., Cardiff, Glam. [6584]

SIGNAL generator Homelab type 10, 100 kc/s, 100 mc/s, £6/10; Homelab TV pattern generator, type 4, £6; both as new.—Studley Electronics, 29, Studley Drive, Ilford, Essex. Lev. 6851. [6644]

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. Lev. 4986. [0056]

DYNAMOS, MOTORS, ETC.—SURPLUS AND SECONDHAND

BRIDGE connected rectifier units (large), 12 and 24V charging auto cut-outs, 300 amp starter relays, 12 and 24V working, heavy duty starter pushes; please see advert of October's "Wireless World," page 176.
T. W. PEARCE, 66, Great Percy St., W.C.1 [0012]

NEW COMPONENTS

CRYSTAL microphone inserts (Cosmocord MC/6/4), in steady demand by Hams and Sound Engineers; guaranteed newly made and boxed; 15/6 post free.—Radio-Aids, Ltd., 29, Market St., Watford. [0169]

PARTRIDGE TRANSFORMERS

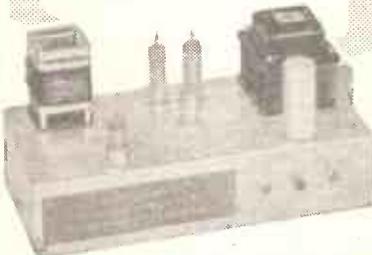
were employed by the

Mullard

Valve Measurement and Application Laboratories for the prototype of the

10 & 20 Watts

High Quality Amplifiers



Above is illustrated the Mullard 5-10 Amplifier, Distributed Load Version, fitted with a Partridge "C" core Output Transformer Type P4014 and Mains Transformer Type P4013. Price 98/6 and 86/6 respectively.



Potted mounted style available for any standard item.

Standard open style of mounting.

Standard hermetically sealed "C" core construction.

Standard open type "C" core construction.

Mains Transformer for Mullard 5-10 Amplifier, sub-chassis wiring.

Type P3667 Output Transformer for Mullard 5-10 Amplifier.

* and now a new component

High Fidelity Input Transformer Type MC/5, ratio 1:50, fully screened in mu-metal case. Price 38/6.

Immediate delivery on all the above components

PARTRIDGE TRANSFORMERS LTD.
TOLWORTH SURREY
Phone: ELMbridge 6737/8

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, 25, 25v, 5/4x1 1/4, W/E, 1/3; 500, 12v, 3/4x3/4, W/E 2/1; 1,000+1,000, 6v, 1x3, clip, 3/3; 1,000, 6v, 1x2, clip, 2/3; 1,000+2,000 6v, 1x3, clip, 1/3; 100, 12v, 5/4x1 1/4, clip, 1/9; 2,000, 12v, 1 1/2x2, clip, 3/6; 50, 25v, 5/4x1 1/4, clip, 1/9; 100, 25v, 5/4x1 1/4, 2/-; 1,000, 25v, 1x3, clip, 4/-; 3,000, 25v, 1 1/2x4 1/2, 5/-; 5,000, 25v, 1 1/2x4 1/2, 6/6; 2,500, 50v, 1 1/2x4 1/2, 6/8; 5, 150v, 5/4x1 1/4, W/E, 1/3; 5, 150v, 5/4x1 1/4, clip, 1/3; 40+40, 150v, 1x2, clip, 2/8; 100, 275v, 1 1/2x3, clip, 3/-; 60+250, 275/350v, 1 1/2x4 1/2, clip, 6/-; 8, 450, 3/4x2, clip, 1/9; 16+24+8, 450/525v, 1 1/2x2, clip, 5/-; 20+10, 450v, 1x3, clip, 4/-; 8, 500v, 1 1/2x2 1/2, clip, 2/3; 32+32+8, 550/425v, 1 1/2x3, clip, 5/-; 32+32, 350/425v, 1 1/2x2, clip, 4/-; 100, 350/425v, 1 1/2x3, clip, 4/-; 2, 350v, 5/4x2, 1/3; 16+16, 350v, 1x2, clip, 3/6; 16+16, 275v, 1x2, clip, 3/-; 32+32+8, 275v, 1 1/2x2, clip, 4/3; 100+200, 350v, 1 1/2x4 1/2, clip, 7/-; 50+50, 350v, 1 1/2x3, lug, 4/6; 200, 250v, 1 1/2x3, clip, 3/6; 16+8+4, 275v, lug, 3/-; 200+250+250, 275v, 2x4 1/2, clip, 8/6; all ALI cans, some with sleeves, all voltages WKG, surge V where marked, all new stock guaranteed.

TELEVISION chassis, cadmium plated steel, size 14x13x24in, complete with 13 valve holders (9-B9A Pax, 1-B9A Cer, 2-B7G Cer, 1-Int. Oct. amp), 20 various tag strip cut away for metal rect., line trans., etc., 9/11 each, post paid.

FRONT and rear tube mounts to fit above chassis, 3/4 pair post paid.

P.M. focus rings wide angle, tetrode tube, fully adjustable, 9/11, post paid.

SCANNING coils, wide angle, with mounting lugs, 19/6, post paid.

T.V. metal rect. 250v 250ma, H.W. size 2 1/4 x 4in, 12/6, post paid.

C.T.V.I.P.'s 34MC/5, 2nd, 3rd, 4th, vision cans 13/16x13/16x2 1/2, slug tuned, set of three 5/6 post paid.

8mf. 600/750v, paper conds., 4in x 2in x 4/4in; 6/6.

1000 w/w pots, 3w, 1in spindle; 2/6.

RADIO CLEARANCE, LTD., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015]

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport St., London, W.C.2. See our displayed advertisement, page 169.

MAGSLIPS at low prices, fully guaranteed, No. 3 in Resolver No. 5 (AP 10861), 50v, 50c/s, unused, each in tin, 35/-, post 2/1; large stocks of these and other types.—F. B. Crawshaw, 94, Finsmore Way, Letchworth, Herts. Tel. 1851. [0087]

NEW GRAMOPHONE AND SOUND EQUIPMENT

3-SPEED portable transistor gram (operates on 4 1/2 volt battery); 21cms, 200mW transistor amplifier; 10cms. 4-WATTS H.F. model soon.

TRANSISTOR pre-amps; still £9/15.

COLLARO decks £20, amps 23cms and 25cms.

WEARITE, reflectograph decks, and amps available.

HEARDING ELECTRONICS, 120a, Mora Rd., Cricklewood, London, N.W.2. Gladstone 1770. [0032]

SPECIAL tape offer, few only left, prof. tape at 1,200ft., 22/6 (21/- each 6 and above); 1/6 P.P. plastic, not paper, guaranteed; satisfied users everywhere.

RECORDERS by Ferrograph. Levers-Rich and the new wonder recorder Brenell disc recorders, blank disks, microphones.

TAPE/DISK service, specialists in music recording and editing.

"**EROICA**" RECORDING STUDIOS (1949), Recorder House, Peel St., Eccles, M/c. Eccles 1624. Director Thurlow Smith, A.R.M.O.M. [0122]

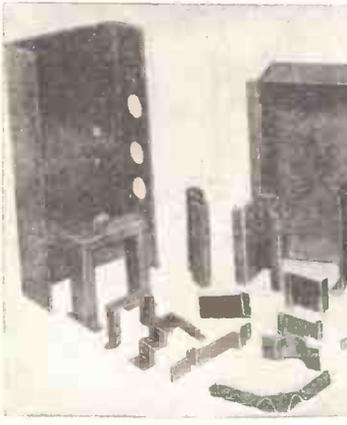
CONTINENTAL A/M-FM gram chassis complete with 3 speakers internal dipoles and magic eye escutcheon, 6 valves and rectifier, variable ferrite AE, brand new; £25 including tax.—M.C.V., Farrinndon Rd., E.C.1. [6496]

CINE-VOX disc recording equipments, type C7J, for high-quality recordings from existing microphone equipment; price from 28cms; also available as a complete channel inclusive of mic., amplifier and playback equipment, at 76ms; type C7 for highest quality professional requirements—recorder mechanism at 48cms, or complete channel at 110cms; demonstrations arranged in London.

PLEASE write for details to K.T.S., Ltd., "Coplow," Park Rd., Braunton, N. Devon. Tel. Braunton 224. Callers by appointment only. [0210]

ALL Hi-Fi enthusiasts please note!—We are supplying the Collaro tape transcriber complete with pre-amplifier and power pack ready to plug into any amplifier for only 58ms —making it one of the lowest priced quality tape recorders on the market; all other makes of recorders in stock; easy terms available.—Sound Tape Vision (Dept. W.W.), 71, Praed St., London, W.2. Pad. 2807. [0211]

The UNIQUE BENDER



YOU HAVE SEEN

from our successive advertisements what the UNIQUE BENDER looks like.

Now we show examples of a few of the many jobs it will handle. It also makes angles, channels, folded and beaded edges and special sections up to 39 in. long Quickly, Accurately, and with Professional Finish.

For 6 page Folder write to:-



A. A. TOOLS (W)

107a Whiteacre Rd., Ashton-u-Lyne

Every genuine A.A. tool bears this mark.

SURPLUS

TRANSMITTERS. Over 70 different types in stock, ranging from the BC611 American Handie Talkie to the Marconi SWB-8, 3,500 watts.

RECEIVERS. Nearly 100 types available from 15 kc. to 1,000 Mc/s., including portable and directional, the smallest hand held and the largest weighing 10 cwt. and using 85 valves.

TEST EQUIPMENT. American only. Over 100 different types of instruments in stock.

VALVES. American, over 200 types. British, over 150 types.

RECORDING GEAR by Dictaphone, Amertype, Soundscriber, Armour, R.C.A., Utah, Memovox, Edison, etc., for disc, wire, film and tape.

POWER SUPPLY. Dynamotors, Motor Generators, Rectifiers. Vibrators, Inverters, from 2 volts 100 amps. to 18,000 volts 1/2 amp.

AERIAL EQUIPMENT. Whips, 12in. to 15ft. Masts 20ft. to 80ft. Brackets, bases, wire guys, beams.

MISCELLANEOUS. Amplifiers, Cabinets Chests, Chokes, Controls, Cords, Crystals, Electric Accessories, Fuses, Hardware Insulators, Loudspeakers, Meters, Plugs, Relays, Switchgear, Transformers, etc.

Full lists available

Send your requirements. All packing and shipping facilities

P. HARRIS

ORGANFORD DORSET

Telephone: Lychett Minster 212

GRAMOPHONE AND SOUND EQUIPMENT—SURPLUS AND SECONDHAND

BURGOYNE tape deck in case, as new; £20 o.n.o.—Dobinson, 8, Kent Grove, Runcorn, Cheshire. Runcorn 3591. [6572]

COMPLETE B.S.R. disc recorder, good condition, must sell; offers, please.—70, Woodhouse Rd., Birmingham, 32. [6607]

WANTED, EXCHANGE, ETC.

WANTED, original case for BC 221, good price paid.—Box 5596. [6645]

WANTED, receivers A.P.R.4, also T.N.16, 17, 18, 19, etc., and any radio test gear.

LESLIE DIXON & Co., 214, Queenstown Rd., Battersea, S.W.8. Macaulay 2159. [0176]

4 Dynamotors, 12/24-volt D.C. 500/500 250 MA or near; price and details.—Radiovox, Ltd., Oxford Place, Leeds. [6619]

WANTED, valves, TV tubes, televisions, radios, radiograms, tape recorders.—Stan Willetts, 43, Spion Lane, West Bromwich, Staffs. Tel. 2392. [5847]

WANTED, HRO coils, Rx's, etc. A.P.88s, BS348s, S27s, etc.—Details to R.T. & I Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0163]

WANTED, B.C.610 Hallicrafters, E.T.4336 transmitters and spare parts for same; best prices.—P.C.A. Radio, Beaver Lane, Hammersmith, W.6. [0079]

UNISELECTOR switches, modern types 2 to 8 bank, any quantity; send sample with details of quantity and price.—Davis, Tudor Place, London, W.1. [6650]

WANTED, scrap, wire cable, transformers, N.F. metal components, top prices paid; please ring CUN. 3280 or write J. Feldman & Co., 31, Lord Hills Rd., London, W.2. [6459]

SPOT cash ready for purchase of surplus and bankrupt stocks of new valves and components; we sell plain valve cartons; list on request.—R. H. S., Ltd., 155, Swan Arcade, Bradford. [0190]

URGENTLY wanted, manuals or instruction books data etc., on American or British Army, Navy or Air Force radio and electrical equipment.—Harris, 93, Wardour St., W.1. Gerrard 2504. [6479]

WANTED, good quality communication RYS tape recorders, test equipment, domestic radios, record players, amplifiers, valves, components, etc., estb. 18 years.—Call, send or phone Ger. 4638 Miller's Radio, 38a, Newport Court, Leicester Sq., W.C.2. [6059]

WANTED, signal generators, types TFI44C, TF724, TF627, frequency meters, types BC221, TS174, TS175, also receivers types R1359 and R1294.—Send price and details to Hatfield Instruments, Ltd., Crawley Rd., Horsham, Sussex. Tel. Horsham 3232/3. [0037]

ALL U.S.A. V.H.F. test and communication equipment; TS174, TS175, TS47, B.C.221 freq. meters; receivers 1294, 1359; Hallicrafters S.27, S27CA, U.S.A., APRA and tuning units TN16, 17, 18 and 19, RCA AR88D, F.P. Hallicrafters SX28; valves 707A-707B, 2K28, 2K39, 2K33, 2K41; highest offers given by return.—Ger. 8410 and 4447.—Universal Electronics, 22, Lisie St., Leicester Sq., London, W.C.2. [0229]

VALVES WANTED

ALL types of valves British or American, transmitting and receiving; keenest cash prices paid. What have you to offer?—Write or call Lowe Bros., 9a, Diana Place, Epsom Rd., N.W.1. [4485]

CABINETS

LEWIS RADIO have the best selection and finest finish.—See page 162. [0224]

REPAIRS AND SERVICE

MAINS transformers rewound, new transformers to any specification. MOTOR rewinds and complete overhauls; first-class workmanship; fully guaranteed. F.M. ELECTRIC Co., The Pottery Bldgs., Warser Gate, Nottingham. Est. 1917. Tel. 47898. [0113]

USE Jefco coil winder, cheapest machine on the market.—Details, 170, London Rd., Southend-on-Sea. [6628]

MAINS transformers, E.H.T.s, chokes, field coils, etc., promptly and efficiently rewound or manufactured to any specification. LADBROKE REWIND SERVICE, Ltd., 820a, Harrow Rd., London, N.W.10. [0222]

VAC and drill armatures rewound, 17/6, fully guaranteed; reduced price for quantities.—K. Remington, 7, Teapot Lane, Maidstone. [6420]

TRANSFORMER rewind service mains, E.H.T. transformers and chokes, prompt delivery, range of replacement types ex-stock or manufactured to your specification. METROPOLITAN RADIO SERVICE Co., 75, Kilburn Lane, London, W.10. Ladbroke 2296.

D. C. 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.—134, Thornton Rd., Bradford, W.1. Tel. 22838. [0171]

WORK WANTED

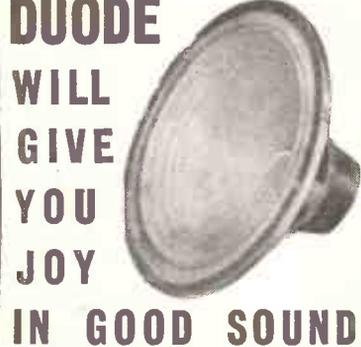
P.T.F.E. machining and moulding capacity available.—Bel, Marlborough Yard, London, N.19. Tel. Archway 5078. [0187]

COIL winding capacity available, also wave winding.—Enquiries to Electric Windings (London), Ltd., 245, Mile End Rd., London, E.1. Tel. Stepney Green 5524. [6630]

BENSON'S BETTER BARGAINS

CERAMICONS. N750 k., 2.2, 5.6, 6.8, 10, 12, 15, 27, 33, 39, 47, 68, 100 pfs., 6d. each. THROAT MIC'S., new, 2/6. MIC. TRANS., small, 3/- BOXES, with 16 toggle switches, 7/6. BATTERIES, new, 90, 45, 3, 1 1/2 volts, 6/-; 4 1/2 v. heavy duty, 2/6. ROD AERIALS, 9 pices, new 10/6. B7G PIN STRAIGHTENERS, 3/6. BC324A. (SCR5022) New condition, with 10 valves; 100/100 mc/s. Less xtls and relays, 45/- (incl 5/-). VALVES at 5/6; 6C4, 6AG5, 9001, 9002, 6SN7, 6AM6, EL91, VR99, VR109, 3A5, 12SK7M, 12A6, 807E, KT33C, 12SL7, EP54, 6AG7, TT11, BC52, 6K7GT, 8SH7M, 6A07, Pen46, at 4/-; EF60, RK34. KEYS, Morse, large, covered, 10/6; small 2/6. SWITCHES, Knife, large DPOO, 15/- COMMAND RX'S, 1.5-3 mc/s. Brand new, with valves, 55/-; BC454, 3-6 mc/s., 45/- (post 3/-). Condensers, var. spindled, ceramio, 15, 25 or 50 pfs., 1/3; 75 pfs., 1/6; butterfly 25 pfs., 1/6. SPEAKERS, new 8in., in round grey metal case, 27/6 (p.p. 3/-). RXS.112/114 (TE1987), with 3/HF91, 2/EL91, 6 gang tuner, new, 37/6, less valves, 7/6. (Circuit 11). MOTORS; SYNCH. 230 v. geared to 1 r.p.m. final, new, 22/6; Synch. 100 v. 3 000 r.p.m., 10WA, 10/- SUPPRESSORS, radio interference, ex-A.M., 5/6 (post 2/-). BRAND NEW R.F. 28, 27/6 (postage 2/6); RF24, RF25, 10/6. DYNAMOTORS (post 3/-). 12 v. to 250 v. 85 mA., and 6.3 v. 2.5 A., 10/6. BDDYSTONE, 12 v. to 100 v. 75 mA., cased, 15/-; 11 v. to 300 v. 200 mA., cased, 15/- (carr. 8/6). CLOCKWORK Contactors, 2 impulses per sec., 8/6. U.S.A. type, small, 9/6. R1392A, 100/100 Mc/s., 13 valves, used, good condition (damaged meters), 2A (carr. 10/-). METAL RECTIFIERS; 600 v. 30 mA., 6/-; 500 v. 500 mA., 10/6. 1,000 v. 30 mA., 7/6. WAFER SWITCHES, 1 pole 11 way 3 bank, 6 P 2 W 3 B, 3/6; 2 P 4 W 2 B ceramic, 4/6; 3 P 3 W 3 B, 4 P 3 W, 4 P 2 W, 1 P 6 W 5 B, 2/6. SPLITTERS, 15 a., G.E.C. D.P. switch, 4 fuses, new, 15/6. IF AMPLIFIER 178, 13.0 mc/s, with valves, 15/6 (postage 2/6) each. RELAYS, 6 v. 2 break, 1/6. L.F.T.S. 1913 mc/s., cased, new, 1/3. R1155 Coilpacks, new, 12/6. Used, 9/6. CHOKES, L.F. Ferranti, 10H, 120 mA., Screened, 7/6. 10H, 200 mA., 8/6; 5H, 200 mA., 5/6. HEADPHONE'S, L.R. super lightweight HS 30B, 17/6. VIBRAPAK'S, Mallory 12 v. to 250 v., 80 mA., synch. reversible 15/6; 12 v. to 150 v., 80 mA., smoothed, filtered, 15/6; 2 v. to 480 v. and 150 v. (dual-vibrator), smoothed, filtered, 30/- (post, each, 3/-). G.P.O. HAND GENERATORS, 5/6; underdone bells to match, 3/6; Handsets, 10/6. List and enquiries. S.A.E. please! Terms: C.W.O. Postage extra. Immediate despatch.

Callers and post: W. A. BENSON (WW), 136, Rathbone Road, Liverpool, 15. SEF 6853. Callers: SUPERADIO (W'chapel) LTD., 116, Whitechapel, Liverpool, 2. ROY 1130.



Personal taste is the final arbiter when choosing a sound reproducer and the choice is difficult when so many kinds and qualities of a high standard exist, as they do today. But a choice of DUODE NATURAL SOUND brings home a new level of enjoyment which increases as time goes on and an investment which lasts much longer than any similar.

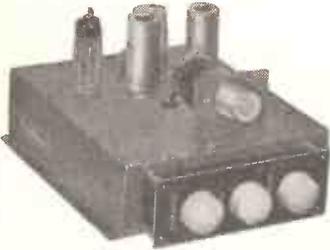
The new Duode 12B-C SOUND UNIT frequency range is over 20-16,000 cps, plus the unique built-in feedback giving crystal-clear transients, pin-point definition and positively no boom or whiskers. It can tell the truth—very softly or shake your room with organ thunder, but always giving you the supreme, lasting enjoyment of CLEARLY NATURAL SOUND

Whether you live in flatlet or mansion, the Duode 12B-C will increase pleasure for you in the coming months and for many years to come. Write now for details of special New Year plan.

DUODE LTD. 3, Newman Yard, London, W.1

Armstrong

The MISSING LINK—PABO-1
TAPE PRE-AMP AND ERASE UNIT
with built-in Recording Level Indicator and Monitoring facilities



PRICE £12 10 0

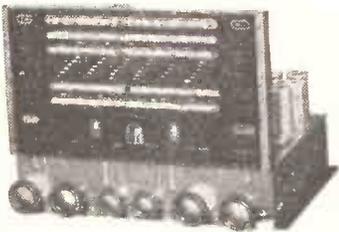
Dimensions: 9in. x 9in. x 4½in.

This compact unit provides the necessary link between the Tape Deck and Amplifier Control Unit in a high fidelity system. The circuit has been critically designed to preserve faithfully the quality of the signal fed to it and to pass it on without distortion or alteration except in so far as the built-in equalising circuits apply. These enable the standard tape recording curve to be applied in recording and the corresponding equalization on play back. PABO-1 can be used with almost all makes of High Fidelity Amplifier and Tape Deck.

MODEL AF-105

Three-in-one

AM/FM RADIOGRAM CHASSIS



PRICE £37

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

We shall be glad to give you a demonstration of these and other models in our range at our **Walters Road showrooms** (open 9-6 p.m. Weekdays and Saturday). If you are unable to visit us please write for descriptive literature mentioning **WIRELESS WORLD**.

HIRE PURCHASE facilities are available. **GUARANTEE:** All our models are sold under full and unconditional money back guarantee of satisfaction.

FREE TRIAL IN YOUR OWN HOME. Your money will be returned if for any reason you are not satisfied after 7 days' trial.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.
 Walters Road, London, N.7

Telephone: **NORth 3213**

PAINTS, CELLULOSE, ETC.
PANL, the air-drying black crackle paint; 3/6 per ¼th pint can.—G. A. Miller, 8, Kenton Park Cres., Kenton, Middx. [0250]

TENDERS
OFFERS invited for 4 G.E.C. F.M. mobile radio-telephone transmitter-receivers, 12v d.c., and one fixed station ditto, 200-250v a.c., 50 c.p.s. with omni-directional aerial and ancillary equipment; base transmitter frequency 85.375mc/s, mobile transmitter frequency 71.875mc/s; equipment recently working.—Details and form of tender from Chief Engineer, Middlesex County Main Drainage Department, P.O. Box No. 7, Isleworth, Middlesex. The Council does not bind itself to accept the lowest or any tender. [6599]

CAPACITY AVAILABLE
FACTORY Capacity available for the following categories:
 PLASTICS Injection Moulding (3 oz).
 ALUMINIUM Die-Casting.
 LIGHT Engineering.

ELECTRONIC & Electrical Assembly. Location Wiltshire.—Box 0077. [0114]

IMMEDIATE capacity light assembly, wiring, toolmaking, small injection moulding, quick delivery short or long runs.—Box 5110. [6541]

VACUUM Varnish Impregnation to RCS 214.H2, quick service; enquiries welcomed.—Anec, Ltd., Gosbrook Rd., Caversham, Reading. 71765. [6495]

MISCELLANEOUS
TAPE to disc; 12/6.—Mobile Recording Services, 5, New Brown St., Manchester. [6555]

INDUCTION motors, shaded pole, tapped 200/250 volts, 2,700 r.p.m., 3in-oz torque, as new; approx 475 to clear; £150 the lot.—Box 5052. [6530]

HAVE your tape recordings transferred to discs, 78s or L.P.s; high fidelity reproduction.—Write Parke, 18, Zulla Rd., Mapperley, Nottingham. [6636]

METALWORK, all types cabinets, chassis, racks, etc., to your own specification; capacity available for small milling and capstan work up to 1in bar.

PHILPOTTS METAL WORKS, Ltd. (G4B1)—Chepman St., Loughborough. [0208]

TAPE to disc recording, 45-hr. service; L.P. (30 min.) 22/-, 78s 11/-; s.a.e. leaflet.—Comprehensive Recording Service, A. D. Marsh, Little Place, Moss Delph Lane, Aughton, Ormskirk, Lancs. Aug. 3102. [6477]

DEVELOPMENT and small scale assembly; wide experience of Instrumentation, U.H.F. and Sub-Miniature techniques.—McCabe Electronic Equipment, Tel. 246580, 50a, Orlando Drive, Carlton, Nottingham. [6612]

YOUR own tape recording transferred to disc or L.P.s.—Write, call or phone Queensway Private Recording Studios, 123, Queensway, W.2. Tel. Bay. 4992. Studio recordings. [6543]

TAPE/DISC for connoisseurs, use Britain's oldest full-time transfer service; 30 min. 42/-; special prof. qual. tape, 25/- and 21/-.—Sound News Productions, 59, Bryanston St., W.1. Amb. 0091. [0192]

TRAIN at home for a better position or a new hobby.—We offer comprehensive modern home tuition courses covering over 100 careers and hobbies, practical equipment supplied with many courses. Write for free brochure, stating subject of interest, to: E.M.I. Institutes, Dept. WW39, London, W.4. (Associated with H.M.V.) [0180]

SWITCH Units, Type 270B. These beautiful electronic devices measure 14x7x6 approx. and contain a host of useful equipment, the main items being a precision double wound pot 4½in dia., 6 standard tropical pots, 4 Yaxley type switches, 3 P.O. lamp holders with bulbs, 2 toggle switches, 3 push switches, an assortment of knobs, multiway sockets, precision resistors, gear wheels, etc., etc. Have cost pounds to manufacture; our special price 7/6; rail charge and packing, 5/- England and Wales only. Wonderful value.
WALTON'S WIRELESS STORES, 48, Stafford St., Wolverhampton, Staffs. [0145]

NOTICES
BRITISH SOUND RECORDING ASSOCIATION. Details of membership, open to the professional sound recording engineer and all others interested in recording high quality production and other branches of audio engineering together with details of the London lecture programme and the Manchester, Portsmouth and Cardiff Centres, may be obtained from the Hon. Membership Secretary, H. J. Houlgate, A.M.I.E.E., 12, Strongbow Rd., Eitham, S.E.9. [0051]

AGENTS WANTED
PLASTIC moulding company, requires the services of free-lance agents, who have suitable connections with users of mouldings; exclusive territory granted.—Write Box 4636. [6462]

AGENTS required throughout the British Isles for the hand-in-hand range of top quality connoisseur standard microphones; performance immeasurably superior to other microphones; first-class men are invited to submit areas covered, types of buyers called upon, to—Box 5247. [6561]

ADVERTISERS, well known to radio amateurs and trade, and regular advertisers in "Wireless World," etc., for many years, desire exclusively to handle in Croydon area one or two lines (high quality radio components or complete units and assemblies) upon a buying or commission basis. Replies from interested manufacturers will be treated in strictest confidence.—Box 5515. [6587]

GILSON TRANSFORMERS

are popular with—

Lighting, High Voltage, Fatigue test, Radar, Nuclear, Sound equipment and other ENGINEERS and have been FOR MANY YEARS—

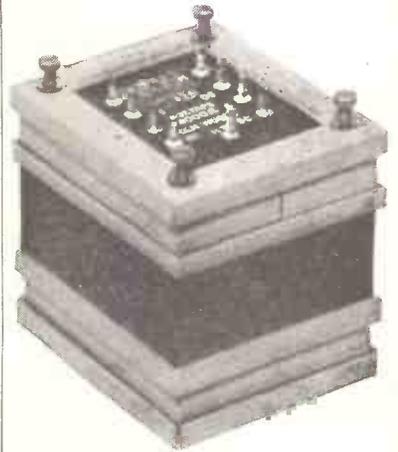
It is therefore not surprising, though very gratifying to us, that they have now proved equally popular with audio engineers and Amateur enthusiasts.

WE are now producing a range of Transistor audio transformers including those specified for the

MULLARD

200 milliwatt AMPLIFIER

TRANSFORMERS for U-L Amplifiers



15-WATT TYPE Ref. WO892

Please write for informative leaflets on the above.

R. F. GILSON LTD.

11a ST. GEORGE'S RD., WIMBLEDON, S.W.19

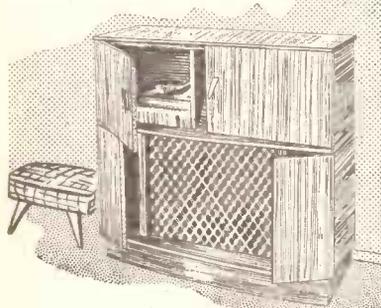
Phone: WIMbledon 5695

MAKERS OF NEON SIGN TRANSFORMERS Contractors to Admiralty, etc., A.I.D. Approved

Our stockists include: Berry's (Short Wave) Ltd., 25, High Holborn, London, W.C.1.; J. T. Filmer, Bexley; L. F. Hanney, Bath, etc.

CABINETS AND HI-FI EQUIPMENT

We can supply any Cabinet to your own specification



"The Continental"
£24-15-0

This elegant Cabinet is the latest in our range designed in the continental style. Solidly constructed and finished in selected mahogany veneers. Available dark, medium, light, high gloss or contemporary finish. Polished £29-15-0

We can also supply and fit this or any cabinet with the latest HI-FI amplifiers, tuners, transcription units, record changers, speakers, etc. Send for comprehensive illustrated catalogue of cabinets, chassis, autochangers, speakers, etc., all available on easy H.P. terms.

LEWIS RADIO COMPANY

120 (WW2) Green Lanes, Palmers Green, London, N.13. Telephone: BOWes Park 1155/6.



HIGH CLASS TAPE RECORDING EQUIPMENT
HEADS, DESKS, TAPE, ETC.

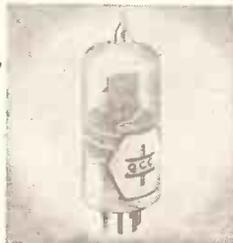
Send for lists

BRADOMATIC LTD.
STATION ROAD, ASTON, BIRMINGHAM 6
Telephone: East 2881-2

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 NEW MALDEN

SITUATIONS VACANT

TELEVISION and radio.

DEVELOPMENT engineers. ENGINEERS are required for senior and junior positions in the television and radio development departments of a well known manufacturer in the West London area. APPLICANTS for senior positions should have academic qualifications and several years' development experience. Junior engineers are required to have either academic qualifications or development experience.

ALL the posts are permanent and carry the benefit of the firm's pension scheme. Generous salaries will be paid to engineers showing initiative and responsibility. PLEASE write fully, in confidence, stating age, experience, etc., to Box 5117. [6548]

BROADCASTING engineers.

APPLICATIONS are invited from radio engineers for eventual appointment as broadcasting engineers in the Government broadcasting services of Colonial and Oversea Territories. APPLICANTS should be over the age of 23 and be Graduates of the Institution of Electrical Engineers or in possession of an Engineering Degree or Diploma recognised as granting exemption from the Institution's examination. Experience in the radio industry or in the radio branches of Her Majesty's Services for at least two years is necessary but applicants need not have experience directly related to broadcasting. SUCCESSFUL applicants will receive operational training in the B.B.C., and at any time within two years after initial engagement they will be required to take up contracts of appointment with a Colonial or Oversea Government in any part of the world as broadcasting engineers. Choice of territory will be given where possible, but it is not guaranteed.

TOTAL emoluments during training in the U.K. —£280 per annum. Salary on appointment to a Colonial territory will not be less than £1,000 per annum.

Apply Director of Recruitment, Colonial Office, London, S.W.1, giving age, qualifications and experience, quoting BOD 96/02. [6562]

UNIVERSITY OF DURHAM.

KING'S College, Newcastle upon Tyne.

APPLICATIONS are invited for the post of Senior Research Assistant in the Department of Physics. The successful applicant will help in the design and supervision of the electronic controls of a high precision mass spectrometer now being built. Preference will be given to a graduate in electrical engineering.

COMMENCING salary will be at an appropriate point within the range £600-£700 per annum plus P.S.U. contributions and the appointment will be for a period of three years in the first instance.

FURTHER particulars may be obtained from the undersigned to whom applications should be addressed as soon as possible after the publication of this announcement.

G. R. HANSON
REGISTRAR of King's College. [6640]

GOLD COAST Local Civil Service.

POSTS and Telecommunications Department. VACANCIES for Engineers (BCD 108/15/03), Wireless Engineers (BCD 108/15/04), and Master Telecommunications Engineering School (BCD 108/15/07)

APPOINTMENTS, either pensionable in salary range £225-£1,630 p.a. or contract in salary range £1,130-£2,020, plus temporary addition of £29/15 p.a. Gratuity £12/10 for each month of satisfactory service in contract appointments. Free passages for officer, wife and 3 children under 13 years. Quarters, if available, at reasonable rentals. Generous leave. CANDIDATES should have passed or be exempt from the examinations of the Institution of Electrical Engineers and have had two years' practical experience in the Engineering Department of the British Post Office or with a large telecommunications equipment manufacturer.

1. ENGINEERS. Candidates should preferably possess more than the minimum qualifications above and have wide knowledge and experience of telecommunications practice and administration. Experience of power generation and distribution an advantage. To take charge of a telecommunications engineering district involving responsibility for installation and maintenance of overhead and underground telegraph apparatus.

2. WIRELESS Engineers. Candidates should also have had considerable experience with H.F. and V.H.F. fixed and mobile equipment, and air and sea navigational aids. Experience of telecommunications practice and administration. To take charge of Wireless Engineering Division or be assistant to engineer in charge involving installation and maintenance of medium H.F. and V.H.F., W/T and R/T stations operated by posts and telecommunications, police, and civil aviation departments.

3. MASTER. Telecommunications Engineering School. Candidates should also have had five additional years experience in telecommunications engineering, and some experience of teaching. To be responsible for training of junior technical staff in telecommunications subjects, and to assist Principal of the school in administration and discipline.

WRITE Director of Recruitment, Colonial Office, London, S.W.1, giving age, qualifications and experience, and quoting appropriate reference number. [6574]

Excellence in design..

Specialists in Sub-miniature Telecommunication Components



Actual Size (Approx.)



TEMPATRIMMER

Normal capacity 6.5pF—Temperature Coefficient continuously adjustable from +2000 to -2000 parts per million per degree Centigrade. Length 1.31" Width .670" Height .5"

Details from—

OXLEY

DEVELOPMENTS CO. LTD.
ULVERSTON, NORTH LANCs

Tel: ULVERSTON 3306

NEW CABLE CHEAPER IN SMALL COILS

All coils 20-49 yds. in length, unless requested shorter. All prices per 100 yd. lot, less supplied add 5%. Full 100 yd. coils are available add 5% to any price.

TWIN FLAT	1/044	3/029	3/029WE	3/038WE	7/029WE
Plastic	47/	63/6	80/	107/	137/
Rubber	48/8	62/8	75/8	97/8	120/8

FLUORESCENTS Comp. with choke and starter less tube.

Battens 4ft. square shape, 37/6. Hexagon, 39/6.

6ft. square shape, 47/6. Hexagon, 49/6.

Condensers extra. 4ft. 6/6; 6ft. 9/6.

Send for full fluorescent and control gears also cable, accessories and radio lists. Add part carriage on small orders please

BRDISCO (W.), 561 GREEN LANES, LONDON, N.8.

SPECIAL OFFER G.E.C., B.T.H. WESTINGHOUSE GERMANIUM CRYSTAL DIODES

1/- each. Postage 2½d

Diagrams and three Crystal Set Circuits Free with each diode.

A large purchase of these fully GUARANTEED diodes from the manufacturers enables us to make this attractive offer.

COPPER INSTRUMENT WIRE ENAMELLED, 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

**INFORMATION THEORY
AND ITS ENGINEERING
APPLICATIONS**

By D. A. Bell, Ph.D., M.I.E.E.
2nd Edition. Information theory is the science underlying all exchange of information, and is of special importance in the development of telecommunications and automatic control systems. A new and completely revised edition. 25/- net.

MARINE RADAR

By D. G. Lang. From now on the service engineer should find no difficulty in tracing and clearing faults in radar equipment. With this book he will be able to understand how every part of marine radar equipment works. Simplified diagrams of all circuits normally met with in commercial radar are given. 30/- net.

PITMAN

Parker St., Kingsway, London, W.C.2.

SITUATIONS VACANT

SAUNDERS-ROE, Ltd., require:—

SIX technicians interested in aircraft and missile stability and control to join an ANALOGUE Computer Team. APPLICANTS should have experience in one of the following:

- Aerodynamic stability,
- Servo-mechanisms,
- Flutter or electronics.

THEY must possess an engineering degree or H.N.C., as theoretical evaluation and test work is involved.

ASSISTANCE with accommodation is available, conditions are good and salaries will be commensurate with ability.

THOSE interested should apply, quoting age, experience, qualifications and ref. WW26, to the Personnel Officer, Saunders-Roe, Ltd., East Cowes, Isle of Wight. [6647

CITY OF LIVERPOOL Education Committee.

RIVERSDALE TECHNICAL COLLEGE.

PRINCIPAL: A. E. Kinsman, B.Sc. (Eng.), A.M.I.E.E., A.M.I.Mech.E.

APPLICATIONS are invited for the appt. of Assistant, Grade A, in radio and television servicing.

SALARY: £475×£25 to £900 per annum (plus addition for graduation and training; increments up to a maximum of twelve may be allowed for industrial or war service. Ability to assist in full-time marine radio courses would be an advantage, but is not essential.

Further particulars and application forms (returnable as soon as possible) may be obtained from H. S. Magnay, M.A., Director of Education, 14, Sir Thomas St., Liverpool, 1.

THOMAS ALKER, Town Clerk and Clerk to the Local Education Authority (J.4591). [6592

G. & E. BRADLEY, Ltd., have the following vacancies for Electronic Engineers.

2 ENGINEERS with considerable circuit design experience; salary range £700-£1,000 p.a. dependent upon experience and qualifications; Knowledge of microwave techniques an advantage for one post.

2 JUNIOR Engineers for development work on electronic equipment; salary range £500-£700 p.a.

2 JUNIOR Engineers for technical investigation of British and American equipment, including the most recent designs of radar, navigation and test equipment; previous experience of this type of work is desirable; salary range £500-£700 p.a.

APPLICATION forms from Mr. D. P. Thurnell, Assistant Chief Engineer, G. & E. Bradley, Ltd., Mount Pleasant, Alperton, Wembley, Middlesex. [6564

MUIRHEAD & Co., Ltd., Beckenham, Kent, require:—

DEVELOPMENT Engineer for interesting work on development of synchros and servo motors; the qualifications for this position are a Degree in Physics or Electrical Engineering or H.N.C. with endorsements exempting from Graduate I.E.E.

TECHNICAL Assistant for development of test equipment for synchros and magstrips; applicants should have a Degree in Engineering or Physics or H.N.C.; some experience advantageous but qualified engineers who have recently completed National Service should apply.

TEST Engineer for testing and calibrating electrical and electronic instruments, preferably with H.N.C. in Telecommunications.

SERVICE Engineer with H.N.C. or equivalent qualifications, to deal with faults and repair of electronic test apparatus, mainly in a frequency range up to 200 kc/s.

SALARIES commensurate with qualifications and experience; a pension scheme is in operation and the company has its own sports ground; excellent recreational, social and canteen facilities are available.—Please write giving full details to the Personnel Manager. [6565

TECHNICAL Publications.—E. K. Cole, Ltd., Southend-on-Sea, require:—

(a) WRITERS, fully experienced in preparing manuals for radio/electronic equipment.

(b) EXPERIENCED illustrators for diagrams and technical drawings.

(c) JUNIOR writers and illustrators. WRITE to Personnel Manager, giving full details of experience, age, and salary required. [6617

SKILLED technicians for building of prototype and special equipment, able to work without supervision to high standards.

ELCONTROL, Ltd. (Industrial Electronics), Hitchin, Herts. Tel. 2411 (or 4539 after 7 p.m.). [6621

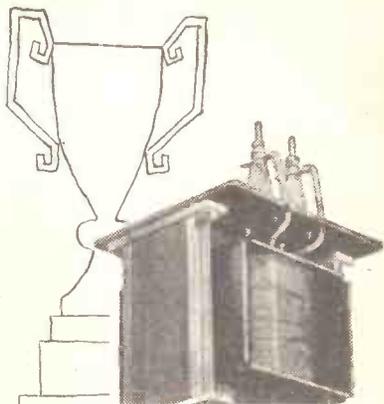
SENIOR mechanical designers are required by Pye Limited of Cambridge for work on television receivers.

APPLICATIONS from specialists in this field will be very favourably considered for positions of responsibility.—Please write, with brief details of qualification and experience, to Chief Engineer, quoting "S.M.D." [6560

TECHNICAL Writer for preparation of operating manuals, testing procedures, technical bulletins and press releases.

APPLICANTS should have an aptitude for this specialised form of writing together with knowledge of electronics to H.N.C. standard or equivalent.

SALARY commensurate with qualifications and experience; excellent working conditions; pension scheme; social and sports facilities; modern canteen. Please write, giving full details, to:—MUIRHEAD & Co., Ltd., Precision Electrical Instrument Makers, Beckenham, Kent. [6570



**out
of
the
top
drawer**

One of our many contented customers described our service as "the kind you dream about but seldom get." This is also the kind of service that he will enjoy from the special transformer we designed and made for him. As with all our instruments, it received meticulous, painstaking attention during every stage of its manufacture resulting in a unit of the finest possible performance and reliability. Right out of the top drawer, in fact.



SAVAGE TRANSFORMERS LTD.

NURSTED ROAD, DEVIZES, WILTS. Tel: Devizes 932

NEW S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS. Largest L.T. range in Great Britain. Latest Current Products. NOT Surplus.

CURRENT PRICES (1st Nov.)

S.T. & C. E.H.T. K3/15, 4/9; K3/45, 8/10; K3/50, 9/4; K3/100, 15/10; all post 4d. extra. **BRIDGE CONNECTED FULL WAVE.** 17v. 1a., 18/6; 1.5a., 32/6; 2.5a., 39/-; 3a., 37/6; 4a., 45/6; 5a., 48/6; all post free. 33v. 0.6a., 29/-; 1a., 31/6; 1.5a., 57/-; 2a., 65/-; 3a., 66/-; 4a., 78/-; 5a., 88/-; all post 1/6. 54v. 1a., 42/6; 1.5a., 78/-; 2a., 91/-; 3a., 92/-; 5a., 126/-; 72v. 1a., 55/-; 1.5a., 97/-; 2a., 118/-; 3a., 118/-; 5a., 164/-; 100 v., 1a., 80/-; 1.5a., 140/-; 2a., 166/-; 3a., 170/-; 5a., 237/6; all post 1/10.

BRIDGE CONNECTED WITH 7/8in. SQUARE COOLING FINS. 17v. 6a., 64/-; 10a., 74/-, post 2/3.

BRIDGE CONNECTED HEAVY DUTY FUNNEL COOLED OR 7/8in. SQUARE COOLING FINS. Both types, same price. 17v. 12a., 124/-; 20a., 144/-; 30a., 210/-; 50a., 340/-; 33v. 6a., 106/-; 10a., 128/-; 12a., 210/-; 20a., 250/-; 54v. 6a., 148/-; 10a., 180/-; 72v. 6a., 190/-; 10a., 232/6; 100v. 6a., 275/-; 10a., 335/-, all post 3/-.

LATEST PRICE LIST

"WESTALITE" (BRIDGE), 12-15v. D.C. 1.2a., 18/8; 2a., 25/-; 2.5a., 32/10; 5a., 37/4; 10a., 64/6; 20a., 117/8; 30a., 171/2; 50a., 278/-; 24v. 1.2a., 18/8; 2.5a., 32/10; 5a., 60/4; 10a., 109/8; 20a., 208/4; 36v., 1.2a., 32/10; 2.5a., 60/4; 5a., 82/8; 10a., 154/6; 100v. 1.2a., 60/4; 2.5a., 115/4; 5a., 195/10; 10a., 391/8. All post extra from 1/6-3/-. E.H.T. Rects., 14D134, 24/10; 36EHT60, 35/10; post 4d. 1 m.a. A.C./D.C. meter-rects.

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

COMMUNICATIONS EQUIPMENT

WIRELESS SET 10 MK. III. Frequency 3-8 Mc/s., and 25 Mc/s. Antenna output 8 watts. Systems A.1, A.2, A.3. Power source 15 v. battery with operating equipment for mobile or ground use.

AMPLIFIER R.F. NO. 2. For use with Wireless Set No. 10 MK. III. Boosts antenna output to 40 watts. Wireless Set X32D. Frequency 3-8 Mc/s. in two switched bands. C.W. and frequency modulated and amplitude modulated R.T. Remote control facilities. Mobile or fixed station use. Power source 12 v. D.C.

WIRELESS SET 62 MK. II. Frequency range 1.6-10 Mc/s. in two switched bands. Crystal controlled. For mobile use. Systems A.1, A.2, A.3—with operating equipment. Power source 12 v. D.C.

CRYSTAL CALIBRATOR NO. 10. For use with Set 62.

MOBILE RADIO TELEPHONE. 70-90 Mc/s., complete with loudspeaker, hand microphone, etc.

HANDY TALKIE SCR-536. Frequency range 3.5-6 Mc/s. Complete with spare coils, etc.

TCS TRANSMITTER/RECEIVER STATIONS. complete. Frequency range 1,500 kc/s-12,000 kc/s. Output 10 watts phone, 25 watts C.W. All operating equipment including Remote Control with loudspeaker and choice of Dynamotor Supply (12 v., 24 v., or 115 v.)

AIRCRAFT RADIO COMPASS. Installation Type SCR289G. Frequency coverage 200 kc/s-1750 kc/s in three switched bands. Superhet communications receiver with compass circuit element. Remote Control facilities and motor driven aerial loop complete with all operating accessories.

AIRBORNE VHF EQUIPMENT. ARC-1 multi-channel transmitter/receiver, complete. 100-156 Mc/s. ARC-3 10-channel transmitter/receiver complete. 100-156 Mc/s.

MICROPHONE INSERT. G.F.O. Carbon. 2/6 each.

TELEGRAPH AND TELEPHONE EQUIPMENT Filter, line and directional.

High Speed Morse Telegraph Transmitters.

Telegraph Type Printers.

Terminal Units Apparatus VF Speech + Duplex.

Apparatus VF Speech + Simplex.

Apparatus two-tone Telegraph.

Carrier Terminals 1 + 1.

Carrier Terminals 1 + 4.

Apparatus VF 8-channel Duplex.

Field Telephone Sets types D.F.H. and L.

Switchboards, universal coil, 6-line and 10-line.

Prices and further details on request.

Transmitting valves, types 803, 805, 832.

Magnifying Hunter 3in. used, at 6/6 each.

Morse Keys, totally enclosed, A.M. type, at 1/6 each.

Aerial winches, Air Ministry type 5, at 2/6 each.

Flexible Drives, 7ft. 6in. long.

ATTENUATOR ASSEMBLIES for "T" networks 21 steps vitreous wire wound Resistors.

R. GILFILLAN & CO. LTD.
 7, HIGH ST., WORTHING, SUSSEX
 Tel. Worthing 8719 and 30181.
 Cables 'GIL WORTHING.' Codes BENTLEY'S 2nd

SITUATIONS VACANT

T.V. Engineer required; pleasant seaside town.—Clark Bros., Euston Rd., Morecambe. [6573]

WANTED, experienced T.V. engineer, able to drive—permanency to right man.—Garlicks, Northallerton, Yks. [6604]

ENGINEER, conversant with assembly of Selenium converters, full or part-time; Central London area.—Write Box 5377. [6600]

COST clerk required for senior position with radio company (non-domestic); sound radio background and costing experience essential. PERMANENT and progressive appointment for applicant able to work on own initiative.

SITUATION ten miles out of London; non-contributory pension scheme; five-day week; age limit 40.

SALARY, subject to annual review, will be commensurate with experience and ability.

REPLIES to Box 5285. [6580]

FREE lance transformer designer required for new company; please forward details of experience and fees required.—Box 5558. [6531]

TELEVISION, radio testers and fault finders required, excellent training and every opportunity available for advancement, good conditions and pay.

APPLY Personnel Manager, Dynatron Radio, Ltd., Ray Lea Rd., Maldenhead. [6642]

ENGINEER required for development work on Polystyrene capacitors, specialised experience essential; own staff advised; London area.—Write Box 5365. [6593]

RADIO/Television.—Service engineer, capable man required, ability to drive an advantage: good wage; half-day Saturday.—Apply Staff Manager, Gamages of Holborn. [6616]

ELECTRONIC Engineer to work on the design and development of electronic and transistor amplifier for use in servo-mechanisms and computing circuits.

APPLICANTS should have had at least three years' experience of laboratory work on electronic circuits, and preferably those familiar with transistor techniques, but the company are prepared to train suitable applicants in this field, providing they have attained H.N.C. in Electronic Engineering.

ADVANCED rates of pay for competent men; canteen and medical services and sports and social facilities are available together with Service holiday and payment during illness arrangements also pension provisions.

APPLICANTS can be considered for the tenancy of houses on the company's attractive estate. APPLICATIONS should be made in writing to the Personnel Manager, Kelvin and Hughes, Ltd., Winchester Rd., Basingstoke, Hants. [6566]

SENIOR Development Engineer required for work on audio transistor equipment; previous experience essential; South-east London area; please write, giving full details.—Box 5400. [6603]

CHIEF Inspector required by small electrical/electronic manufacturers for test laboratory; must have sound background electrical testing and preferably some AID/ARB experience; London area.—Write Box 5477. [6614]

DRAUGHTSMEN required for light engineering concern in Boreham Wood area; salary £780 to £925; five-day week, four weeks' holiday, generous sick leave, good canteen.—Box 5451. [6618]

TELEVISION Engineers, able to drive, required by leading Murphy dealers; permanency, first-class salary and conditions.—Singer's, 211 Kilburn High Rd., N.W.6. Mai. 6408. [6222]

ELECTRONIC service.—Intelligent young man required for interesting work on servicing and development of industrial electronic apparatus; basic theoretical knowledge essential, mid-Herts.—Box 5602. [6641]

EXPERIENCED TV/radio engineer required, high standard of technical ability essential; salary up to £1,000 paid according to qualifications.—Full particulars and qualifications to W. T. Baker, 74, Nolton St., Bridgend. [6586]

EXPANDING company of electronic engineers require a senior buyer to control department, current experience in the industry essential; housing available for suitable applicants; state present salary and salary required.—Box 5595. [6643]

INSTRUMENT-MAKING Electrical Test Room Assistants required with experience of good quality resistance or capacitance work; senior and junior; also Instrument Makers.—Write or call H. W. Sullivan, Ltd., Leo St., Peckham, S.E.15. [6598]

E. K. COLE, Ltd., Malmesbury, Wilts, require two Grade I Testers with experience in communications or radar equipment. Transport from outlying areas. Full canteen and welfare facilities.—Applications should be made to the Personnel Manager. [6611]

TELEVISION Development Engineer (senior) with administrative experience required; capable of carrying out development projects with minimum supervision up to production stage; Kingston area.—Write, giving full personal details, Chief Engineer, Box 5567. [6638]

PROJECT Engineer to control and co-ordinate electronic and mechanical projects; experience of estimating, planning, time and motion study desirable; a progressive position in an expanding firm; high salaries; superannuation scheme.—Box 5478. [6615]



GRAM MOTORS AUTOCHANGERS CABINETS

Garrard RC 110 3-speed Autochangers. GC2 crystal heads, twin sapphire styl. Maker's cartons. A.C. mains 200/250 volts. £7/19/6, plus 5/6 cart.

Garrard RC 120 3-speed Autochangers with additional facility of manual control to play single records. GC2 crystal heads. A.C. mains 200/250 volts, £9/19/6, plus 5/6 cart.

Gollars BC54 3-speed Mixer Autochangers, with O or T heads. A.C. mains 200/250 volts, £8/19/6, plus 5/6 cart.

Garrard RC 80 3-speed Autochangers. GC2 crystal heads with twin sapphire styl. Maker's cartons. A.C. mains 200/250 volts. £9/19/6 plus 5/6 cart.

Thorens Swiss made single speed autochangers (78 r.p.m.). Cream finish. A beautiful precision job. A.C. mains 200/250 volts. £4/19/6 plus 5/6 cart. Rexine covered cabinets adaptable for the above units, 45/-, plus 5/6 cart.

Record players fitted Garrard 78 r.p.m. A.C. 6a. motors. Governor controlled variable speed. Standard magnetic pick-up, 12in. turntable. Volume control and jack plug. 100/150, 200/250 volts, A.C. 60/60 cycles. Black crackle finish case with 2 locks, keys, and carrying handle. £4/19/6 plus 5/6 cart.

Rexine Covered Portable Record Player Cabinets cut for B.S.R. Regent HF100 units, with space for amplifier. Ex well known manufacturer. Our price £2/19/6. Larger size cut for Monarch changer, £3/5/-, plus 5/6 cart.

3-Speed Record Players, fitted with Acos turnover HG759 pick ups with twin sapphire styl, rexine case with lid, fitted clasps and handle. Worth 10 gns. Our price £7/15/6, plus 5/6 cart.

3-Speed Gram Motors, by well-known maker. Our price 59/6, plus 5/6 cart.

Send stamp for complete bargain lists.

RONALD WILSON & CO.
 (DEPT. W.W.), 12 BRIDGE STREET, WORCESTER.

WHY WASTE TIME

Give that set its best chance
FIT QUALITY COMPONENTS
 Catalogue 1/-
ALL POPULAR CIRCUITS
COVENTRY RADIO
 Est. 1925
189, DUNSTABLE ROAD, LUTON, BEDS.
 Phone: Luton 2677

Morse Code operating as a PROFESSION

The essential qualification of a Radio Officer at sea, in the air or ashore is **EXPERT MORSE OPERATING.** The Candler method of teaching Code is known the world over.

45 years of teaching Morse Code is proof of the efficiency of the Candler system.

Send 21d. stamp for Payment Plans and full details of all Courses.

THE CANDLER SYSTEM CO.
 (55W) 52b ABINGDON ROAD, LONDON, W.8
 Candler System Co., Denver, Colorado, U.S.A.

METERS

All types
 Any make

Single and Multi-range repaired and recalibrated

We can convert or supply meters to your requirements.

PROMPT DELIVERY

E.I.R. INSTRUMENTS LTD.
 329 Kilburn Lane, London, W.9
 Tel.: LADbroke 4168

PROVED The finest method for cleaning records
 Already over 20,000 enthusiastic users

THE "Dust Bug"
AUTOMATIC GRAMPHONE RECORD CLEANER
 PATENT APPLIED FOR

Price reduced to 17/6 (plus 7/- purchase tax) from your local dealer or

Cecil E. Watts
 Consultant and Engineer (Sound Recording and Reproduction)
 Darby House, SUNBURY-on-THAMES, MIDD.

THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKISTS
OF BRITISH AND AMERICAN
TECHNICAL BOOKS

- Transistor Circuit Handbook, by L. E. Garner, Jr. 40/-. Postage 1/-.
- Radio and Television Engineers' Reference Book, by E. Molloy. 70/-. Postage 1/6.
- Frequency-Modulated Radio, by K. R. Sturley. 15/-. Postage 6d.
- T.V. Fault Finding Data Publication No. 5. 5/-. Postage 4d.
- Fixed Capacitors, by G. W. A. Dummer. 45/-. Postage 1/-.
- Television Receiver Servicing, Vol. 1, by E. A. W. Spreadbury. 21/-. Postage 1/-.
- Television Receiver Servicing, Vol. 2, by E. A. W. Spreadbury. 21/-. Postage 1/-.
- Electronic and Radio Engineering, by F. E. Terman. 71/6. Postage 1/6.
- Maintaining Hi-Fi Equipment, by J. Marshall. 23/-. Postage 1/-.
- Suppressing Radio and Television Interference, by B. L. Morley. 5/-. Postage 4d.
- Radio Designers' Handbook, by F. Langford-Smith. 42/-. Postage 1/3.
- Radio Valve Data, by "Wireless World." 4/6. Postage 6d.

Write or call for your new 1956 catalogue

**19-23 PRAED STREET
LONDON, W.2**

PADddington 4185 Open 6 days 9-6 p.m.

WANTED

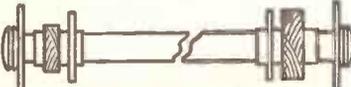
**B. C. 312 | B. C. 610E
UNMODIFIED | TRANSMITTERS
RECEIVERS**

FREQUENCY METERS 221

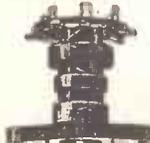
**We will pay Top Cash Prices
for sets in good condition.**

**P.C.A. Radio,
Beavor Lane, Hammersmith, W.6
RIVerside 8006**

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, MW 3/-. LW 3/6. Dual wave TRF Coils, matched pairs (as illustrated) 7/- pair. Type S.S.O. Supersonic Type Osc. coil, provides 6.3 v. 3 a. RF for pre-amp heater. Eliminates induced 50 c/s hum, 40/100 kc, 15/- ea. Transistor coils, etc. Available from leading stockists. Stamp for complete data and circuits.

**THE TELETRON CO. LTD.,
266, Nightingale Rd., London, N.9. How. 2527**

SITUATIONS VACANT

MCMICHAEL 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]

TELEVISION engineers required by leading Murphy dealers, first class opportunity and wages for suitable men; bonus and pension schemes.—Apply for appointment, Ewell Court Electrical, Ltd., 197, Kingston Rd., Ewell, Surrey. Tel. Ewell 1475. [6585]

TECHNICAL assistant, age 20 to 30, required for high voltage, high current impulse laboratory, progressive position, experience in electronic or dielectric work be advantageous.—Apply EMP Electric, Ltd., Garman Rd., Tottenham, N.17. [6588]

ELECTRONIC Development Engineer required, degree standard, conversant with Ministry and A.I.D. requirements; must be versatile and have ability to organize; excellent prospects in small company central south coast location; write in first instance to—Box 4260. [0173]

ADDISON ELECTRIC Co., Ltd., have a vacancy in their West London laboratory for an electronic engineer to carry out experimental development of new measuring and control techniques; small staff, good opportunities and scope for initiative. APPLICATIONS stating age, experience and starting salary required, should be sent to the Managing Director, 10-12, Bosworth Rd., London, W.10. [6595]

TECHNICAL sales representatives required in several areas to carry additional lines by leading soldering iron manufacturer, good connections with quantity users essential, existing accounts and enquiries handed over.—State territory covered and terms of business to Box 4747. [6489]

ASSISTANT required by London Chartered Patent Agents with view to training for qualifying as a Patent Agent; knowledge of electrical or mechanical engineering; good opening for right type.—Write giving details of age, experience, etc., to Box No. D2948 c/o White's, Ltd., 72, Fleet St. E.C.4. [6508]

INSTALLATION and service engineer required with sound knowledge of mobile and fixed v.h.f. communications equipment.—Apply with details of experience and salary required, to Personnel Officer, British Communications Corporation, Ltd., Second Way, Exhibition Grounds, Wembley. [6596]

TELEVISION/RADAR service engineer desirous of a change to a different field in precision Electro-Medical equipment; a training period on the equipment will be arranged. This is a new product in a well established company in the Crawley area and offers exceptional opportunities to a suitable applicant.—Box 5316. [6589]

TECHNICAL sales representative required by leading manufacturer of electronic components; applicants must have thorough knowledge of modern circuitry, and own a reasonably modern car; remuneration by straight salary, plus expenses; pension scheme.—Write full details and salary required, Box 5228. [6581]

ELECTRONICS technician, to construct complex equipment from theoretical circuit diagrams, interesting and congenial employment with good prospects.—Applicants should write giving fullest details of career to Professor Ubbelohde, Department of Chemical Technology, Imperial College, London, S.W.7. [6623]

ELECTRONIC Technician required to maintain electronic control equipment and also assist in development of new industrial control systems; applicants should have minimum O.N.C.; excellent salary dependent upon age, qualifications and experience.—Apply Grundy (Teddington), Ltd., Somerset Works, Elmtree Rd., Teddington, Middlesex. [6602]

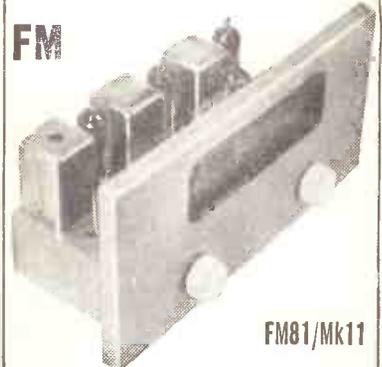
TRANSFORMER Design Engineer required by small but progressive N.W. London radio component concern; applicant should have knowledge of transistor circuitry and be familiar with modern methods of manufacturing small A.F. and mains transformers; the situation offers considerable prospects to right man.—Box 4870. [6507]

ELECTRONIC Engineers.—Two vacancies exist for engineers to take charge of projects overseas, candidates should have H.N.C. or equivalent and have had some experience in industrial electronics, must be single, prepared to work abroad and should be in the age group 26-32.—Write Box 5W.993, c/o 191, Gresham House, E.C.2. [6578]

UNIVERSITY of Southampton, Technical Department.—Applications are invited from radio officers with sea-going experience, and who hold the P.M.G.I. and M.O.T. Radar Maintenance Certificates, for a post as assistant teacher Grade A in the radio school. Application forms and further details may be obtained from the Secretary and Registrar. [6605]

MURPHY RADIO, Ltd., have vacancies in the radio and television laboratories for senior and junior engineers; these posts offer excellent prospects of advancement.—Applications, giving full details of experience and qualifications, should be addressed initially to Personnel Department (R6), Murphy Radio, Ltd., Welwyn Garden City, Herts. [6568]

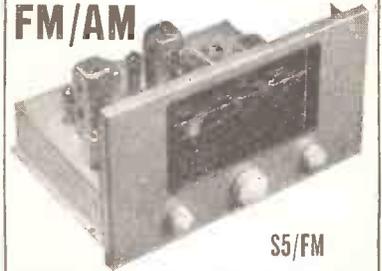
—TUNERS—



F.M. V.H.F. TUNER completely stable drift free tuning. Volume control. Tuning indicator, A.V.C. Sensitivity better than 4 μV for 20 db quieting. 21 gns. Tax paid.



A.M. 9-band all-wave tuner. 13 m.-570 m. Band spread, variable selectivity. Tuning indicator. Logging scale, delayed amplified A.V.C. Tropicalised. Sensitivity better than 2 μV for 250 m/v output. £46/4/-tax paid.



FM/AM: World Wide A.M. in 2 ranges. S5E/FM 12.5 m-37 m.; 35 m.-100 m.; 90 m.-250 m.; 190 m.-250. S5/FM: 16 m.-50 m.; 195 m.-550 m.; 880-2,000 m. Sensitivity better than 10 μV on all ranges. PLUS completely stable drift free VHF-FM. Sensitivity better than 8 μV for 20 db quieting. Tuning indicator on all bands AM and FM. £34/2/6 tax paid.

All tuners suitable for modern high quality amplifiers. Most tuners available with Escutcheons in Gold, Silver or Bronze.

**C. T. CHAPMAN
(Reproducers) LTD**

**RILEY WORKS, RILEY STREET,
CHELSEA, S.W.10**

FLAxman 4577/3
Export Enquiries Invited

OPPORTUNITIES IN RADIO

Get this FREE Book!

'ENGINEERING OPPORTUNITIES' reveals how you can become technically qualified at home for a highly paid key-appointment in the vast Radio and Television Industry. In 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
388b COLLEGE HOUSE,
29-31, WRIGHT'S LANE,
LONDON, W.8.



SITUATIONS VACANT

THE M.S.S. RECORDING Co., Ltd., requires an assistant electronic and electrical design engineer, with experience of audio frequency design and measurement techniques and some knowledge of small electro-mechanical devices; O.N.C. essential, H.N.C. an advantage.—Please reply to Poyle Farm, Poyle Rd., Colnbrook, Bucks, as soon as possible. [6649]

RADAR and radio experienced men with Higher National or C. & G. Certificates in electrical engineering and telecommunications wanted by a firm of consulting geophysicists; initial salary £660; permanent career offered to those of initiative prepared to accept responsibility and work in camp conditions in all parts of the world; liberal home leave and allowances.—Apply Box 4849. [0188]

TEST Foreman required by a division of a large engineering company situated in the eastern suburbs of London; applicants should have had previous experience on the test and inspection of electronic and television components and up-to-date knowledge of modern techniques desirable; a good salary and company superannuation scheme available.—Please reply, giving full details, to Box 5217. [6569]

WANTED for newly formed company (nr. Crawley, Sussex) a Chief Engineer to control production of electrical connectors and wiring looms. Applicants should have experience of A.I.D. procedures and must be capable of interpreting designers' requirements.—Apply in the first instance, giving details of experience, qualifications and salary required, to Box 5003. [6523]

RADIO AND ALLIED INDUSTRIES, Ltd., require Senior and Junior Development Engineers for responsible and interesting work in their Radio and Television Laboratories at McMichael Works, Slough. Excellent conditions and opportunities for advancement. Pension Scheme.—Apply in writing, to Personnel Officer, Dept. R.D. McMichael Works, Wexham Rd., Slough, Bucks. [6610]

ELECTRONICS engineers.—Large organization has a few vacancies for electronic engineers to train as project leaders, taking charge of all aspects of contracts abroad, qualifications H.N.C. or equivalent, age group 26-32, must be single and willing to work anywhere abroad for periods up to two years; excellent salary.—Write Box WD.996, c/o 191, Gresham House, E.C.2. [6624]

ELECTRONIC engineers or physicists required for rapidly expanding research department; experience of pulse techniques or ultrasonics desirable but not essential; the work is varied and interesting and offers scope and opportunities for people with initiative; B.Sc. or H.N.C. standard.—Write, giving details of age, experience, salary required, etc., to Ultrasonoscope Co. (London), Ltd., Sudbourne Rd., London, S.W.2. [6624]

ELECTRONIC Engineers required for interesting new design work on equipment for automatic control, and programming of vibration test specifications. Applicants must have first-class electronic experience; knowledge of vibration testing procedures would be an advantage; excellent prospects.—Write full details qualifications and experience, Secretary, Goodmans Industries, Limited, Axiom Works, Wembley, Middlesex. [6609]

RADIO technicians required by International Aeradio, Ltd., for overseas service; permanent and pensionable positions; inclusive salary from £894 per annum to £1,378 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.1. [0262]

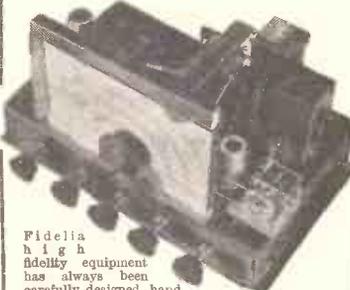
SUNVIC CONTROLS, Ltd., require an electronic test engineer for interesting work on nucleonic equipment; qualifications: H.N.C. or equivalent; preference will be given to applicants with experience in pulse techniques; housing available if required.—Write giving full details of experience, salary required, etc., to Mr. C. E. Davis, Works Superintendent, Sunvic Controls, Ltd., No. 1 Factory, Temple Fields, Harlow, Essex. [6591]

DRAUGHTSMEN.—Attractive opportunities are available for suitable men in connection with work on electronic equipment; previous practical experience and National Certificate desirable. Prospects of engineering appointments for those achieving Higher National; good salaries, five-day week, pension scheme, staff canteen, modern welfare amenities.—Apply Personnel Superintendent, The Edison Swan Electric Co., Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. [6583]

HILGER & WATTS have a vacancy on their staff for a man capable of adjusting and testing magnetic instruments, after training; the work requires a basic understanding of magnetism and simple electrical circuits to O.N.C. standard, experience in the use of slide rules and log tables and a conscientious approach to work; ownership of a car is essential as the work is carried out near Dorking; the post carries a good salary, a car allowance and is pensionable.

THOSE interested are invited to write, stating their age and salary required and giving details of their education, qualifications and experience to The Personnel Officer, Hilger & Watts, Ltd., 125, Camberwell Rd., London, S.E.5. [6590]

Fidelia HAND BUILT



Fidelia high fidelity equipment has always been carefully designed, hand built and sold entirely by ourselves. This concentration of effort enables us to offer outstanding performance and a high level of engineering excellence at modest prices. Our range includes:

Fidelia Imperial. This model incorporates a VHF/FM radio unit, gramophone pre-amplifier and tone control with an input circuit suitable for almost any pick-up, and is available with alternative power amplifier units. Prices £32/10 and £37/10.

Fidelia Major AM/FM 12 valves. Separate power amplifier with 9-watt triode push-pull output. Normal wavebands plus VHF and gram. Independent bass and treble controls, etc., £44.

Fidelia de Luxe AM/FM 11 valves, 7-watt triode push-pull output, C/R tuning indicator, etc., £33/12.



Full details of these and our other models willingly on request.

2 AMHURST ROAD, TELESOMBE, CLIFFS, Nr. BRIGHTON, SUSSEX.

Tel.: Peacehaven 3156

PRECISION SHEET METALWORK

We specialise in manufacturing of Chassis in all metals, large or small quantities to your own specifications

V. W. BEAMISH

Shardeoes Garage, Shardeoes Rd., New Cross, London, S.E.14.

Telephone: TIDeway 4795



Ask for Leaflet Ref. 2356 which gives full technical details of this wonderful new unit.

SPENCER - WEST TYPE 50 BAND III CONVERTOR

Perfect results with any receiver. From your dealer or on 7 days' approval from:

SPENCER - WEST LTD.,
Quay Works, Great Yarmouth

Phones: 4794 & 3609

FM and HI-FI COMPONENTS

in stock for the

WIRELESS WORLD FM TUNER UNIT	circuits 1s. 6d.
DENCO FM TUNER	" 2s. 0d.
RADIO CONSTRUCTOR FM	" 3s. 6d.
MULLARD AMPLIFIERS	" 4s. 0d.
G.E.C. 912 PLUS AMPLIFIER	" 2s. 6d.
G.E.C. FM PLUS TUNER	" 2s. 6d.

Separate price lists on request to
J. T. FILMER THE WATFORD ESTATE, BEKLEY, GLOS.
Tel.: Beazleyheath 7287



The LESDIX CRYSTAL SET

In neat black Bakelite case 4in. x 3in. x 2in., fitted solid dielectric variable tuning condenser, tapped aerial coil, germanium diode detector, plugs and sockets for aerial, earth and headphones. Complete with double headphones and transformer, 30/-, post 2/-.

I.F. STRIPS. 7 valve 10 mc/s., 8/- each, post free. The foundation for home made television sets.

400 CYCLE INVERTERS. Double output, 115 volts 750 watts, 3-phase and 250 VA. 24/26 volts single phase from 24 volts D.C. input. Write for special leaflet.

ELECTRICITY FROM THE WIND. 60 watt geared generator, shunt wound, totally enclosed, 12 volts 5 amps. output, with control box connected and fitted cut-out and smoothing unit; speed 60 r.p.m. for full output. Ideal for use as WIND CHARGER if suitable prop. is used.

METERS. D.C. Moving Coil. 5 mA. 2in. sq. flush 10/6, 100 mA. R/flush, 12/6, 200 mA. 2 1/2in. R/flush 12/6, 500 mA. R/flush 12/6, 20 amps. 2in. R/flush 10/-, 40 volts sq. flush 10/-, 3,500 volts 3 1/2in. proj. panel 35/-.

Leslie Dixon & Co.

Dept. A., 214 Queenstown Road, London, S.W.8

Telephone: MACaulay 2159

SOLDERING ?

**HENLEY
SOLON**
ELECTRIC
SOLDERING IRONS



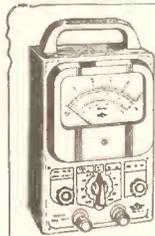
for 25 years
the best

25 watt Instrument Model

A model for
every purpose

Leaflets on request from :

**W. T. HENLEY'S TELEGRAPH
WORKS CO. LTD.**
51-53 Hatton Garden,
London, E.C.1
Tel: CHAncery 6822



PULLIN
SERIES 100
TEST METER
AC/DC 10,000 V/V
21 RANGES
100µA to 1000 V
COMPLETE IN DIE-CAST
CASE WITH TEST LEADS
CLIPS AND PRODS
FULLY GUARANTEED

Sent post free for £2.10.0 and nine further
monthly payments of £1.4.6.
Cash price £12.7.6

FRITH RADIOCRAFT LTD
69-71 CHURCH GATE LEICESTER
& 28 HIGH ST NEWPORT PAGNELL Bucks

FOR
**TELEVISION
LENSES**

CONTACT THE
MAKERS

J. H. DALLMEYER
Optical & Scientific LTD
Instrument Mfrs.
Church End Works, Willesden
Phone: Willesden 6521-3. N.W.10

SITUATIONS VACANT

ELECTRONIC Engineers (two) required, age 23-30, exempt or completed National Service, for maintenance and technical control of digital computer. Qualifications: Science degree or equivalent, with experience impulse technique. Specialised training would be arranged for successful candidates. Salary in accordance with qualifications and experience. APPLY General Manager, Department of Research and Technical Development, Messrs. Stewarts & Lloyds, Ltd., Corby, Northants. [6648]

ENGINEERS or Physicists reqd. for interesting work on special radio valves including microwave valves. Min. qualifications B.Sc. or H.N.C. Experience desirable but not essential as specialised training will be given to successful candidates who have not previously worked in this field. Attractive opportunities for advancement in this branch of electronics.—Quote TEC/11, Personnel Dept., M.O. Valve Co., Ltd., Brook Green, Hammersmith, W.6. [6627]

IMMEDIATE vacancy for a technical assistant (electronics) to help in Cambridge University research on physical and chemical properties of surfaces; applicants should be (a) experienced in the design, construction and maintenance of electronic equipment; (b) competent in the use of hand tools, and (c) capable of supervising a junior assistant; salary £500 to £650.—Applications stating age, qualifications and experience to Box 525. [6579]

ELECTRONIC engineer required for small research department of geophysical consulting concern; work of varied and interesting nature, includes low-frequency amplifier design, magnetic recording, vibration detection and display, and servo devices; complete familiarity with two or more of these subjects is a better recommendation than paper qualifications though H.N.C. or better in electronics, with a background of physics, would be an advantage.—Apply Box 522. [6575]

DRAUGHTSMEN, Senior, Intermediate and Junior, required by Bush Radio, Ltd., at their Chiswick and Kew Drawing Offices for work in connection with the design and development of commercial radio and television receivers.—Apply for interview, which may be arranged for Saturday mornings, giving full particulars of age, previous experience and salary required to the Personnel Department, Ref. DO.1, Bush Radio, Ltd., Power Rd. W.4 or Telephone Chiswick 6491. [6576]

ELECTRONICS.—Graduate required in Shepherd's Bush laboratories of B.I.C.C. for the development and design and construction of a wide range of electronic instruments, to be used in the research laboratories and for automatic control projects; previous experience in this field is essential; pension fund; 5-day week.—Applications, giving details of age, qualifications and experience, to Staff Officer, British Insulated Callender's Cables, Ltd., 21 Bloomsbury St., London, W.C.1, reference L/68/56. [6552]

RECORDING and cutting engineer: a recording and cutting engineer capable of working without supervision is required by a major recording company; duties will involve complete responsibility for the maintenance of all equipment both on the company's premises and on location and design work where the appropriate research departments.—Applications should be made in the candidate's handwriting, giving details of qualifications, past experience, and salaries earned and required, to Box 5386. [6594]

SKILLED radio mechanics and servicemen.—A large organisation has vacancies for men who are prepared to travel and work anywhere in the world, periods abroad 6 to 24 months; salary £75 per month plus all found; vacancies must be single, medically fit and have a good knowledge of radio theory and practice; initial engagements one to three years with excellent opportunities for men with ability and right temperament to obtain permanencies.—Write Box WW.998, c/o 191, Gresham House, E.C.2. [6625]

SELENIUM Rectifiers.—Senior Executive required by expanding company in North Midlands area to direct research and production of selenium Rectifiers; a knowledge of Germanium and Silicon Rectification would be useful; this is an important appointment with a progressive organisation and offers exceptional opportunities to the successful applicant with suitable experience, initiative and energy. Applications marked "Personal" to Managing Director, Box 5146, quoting details of education and training, qualifications, career, age and salary required. All applications will be treated in strictest confidence. [6559]

PHYSICISTS required at Ministry of Supply Experimental Establishment in Carmarthen-shire for development of optical and electronic instruments required in investigation of models under high speed tests. Qualifications: H.S.C. (Science) or equivalent, but degree or H.N.C. in Physics or Electrical Engineering may be an advantage. Houses will be made available for married successful candidates within reasonable time. Salary within range: Experimental Officer (minimum age 26) £875—£1,075.—Forms from M.L.N.S., Technical and Scientific Register (E), 28 King Street, London S.W.1, quoting A413/6A. Closing date 11th February, 1957. [6651]

**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

EX-GOVT. ROTARY CONVERTORS. 24 volts D.C. Input 50 volts 50 cycles, 1 phase at 450 watts. OUTPUT (complete with Step Up Transformer) from 50 volts to 230 volts, £13/10/- each or CONVERTOR only £9/10/- each.

EX-NAVAL ROTARY CONVERTORS 110 volts D.C. Input. Output 230 volts 50 cycles 1 phase 250 watts capable of 50 per cent. overload, in good condition, guaranteed weight approx. 110 lb., £13/10/- each.

P.M. EXTENSION SPEAKERS. 8in. dia. 3 ohm. coll. In good condition, 10/- each, post 1/6.

TOTE SWITCHES with operating gear, large 25/-, small 15/- each.

1 H.P. D.C. MOTORS, 110 volts, 3,000 r.p.m., new 35/-; starters to suit N.V.R. 25/-.

MAGSLIP MOTORS, 50 volts, A.C., large size, as new, 8/6, p/p. 1/6 each. Trans Type 15/-, p/p. 1/6.

IRON CLAD Safety Switches, 2 pole, D.P., D.T., 250 volts 60 amps, new, 18/6, p/p. 1/6 each.

D.C. MOTORS. 24 volts, large size, 8/6, p/p. 1/- each.

ROTARY CONVERTORS, new, with all smoothing and control, input 28 volts D.C. Output 300 volts, 260 M/amps, 150 volts, 10 M/amps, and 14.5 volts, 5 amps. All outputs are D.C. 45/-, p/p. 2/6 each.

LARGE METER Movements, fairly low F.S.D., average 6 inch deflection, very high quality, 7/6, p/p. 1/6 each.

MOVING COIL Meters, all 2 to 3 inches dia., damaged cases or glasses, 3 for 10/-, guaranteed one sound meter; 6 for 18/-, two sound meters, no junk all are or suitable for M/amp. meters.

THREE PHASE TRANSFORMER, 2,000 watts, wound for 110 v.-200 v. and 400 v. Not auto, new, £25, carr. paid.

MAINS TRANSFORMERS, all 200/250 volts primaries (new) Heavy duty Output combination of 0/6/12/18/24/30/36 volts 4/5 amps, 33/6 each. Ditto 6/8 amps, 51/6 each. Ditto 15 amps, Output 75/- each. Another combination of 0/6/12/18/24 volts 6/8 amps, 51/6 each. Ditto 10/12 amps, 58/6 each. Ditto 25/30 amps. Output 85/- each.

MEDIUM SPOT WELDER TRANSFORMERS. Input 200/220 volts. OUTPUT combination of 0/2/4/8/8/10/12 volts at 50/70 amps, 25/7/6 each. Ditto 120/150 amps. Output £8/10/- each.

ELECTRIC LIGHT OR POWER CREDIT METERS, 10 amp. load 25/-; 20 amp. load, 47/6; 30 amp. load, 57/6. Fully guaranteed, carriage paid.

PREPAYMENT METERS. 1/- slot, set at 2d. per unit, 10 amp. load, 24/2/6; 20 amp. load, 25/2/6. Carriage paid, fully guaranteed.

6d. SLOT ONLY PREPAYMENT METERS, 5 amp. load only, set at 4d. per unit, 52/6 each. Carriage paid, fully guaranteed.

LARGE RANGE OF VOLT, AMP. AND MILLIAMM. METERS, from 7/6 each to 50/- each, sizes from 2in. dia. up to 7in. dia. Please state requirements for price.

10 WATT P.M. SPEAKERS in all case with tapped transformer, ex-naval. As new, 30/-, post 8/-.

BREAST MICROPHONES, with mouthpiece, 6/-, P/P

AUTO WOUND Voltage changer TRANSFORMERS. Tapped 0/110/200/230/250 volts 200 watts, 48/6 each; 350 watts, 57/8 each; 600 watts, 76/8 each; 1,000 watts, 28/5/- each; 2,000 watts, 211 each; 3,000 watts, 217/10/- each.

FILM PROJECTORS, 35 mm., silent and sound, with lens £35; without lens £30. Buyer collects, other gear. Please call. Good film for cutting, size 3 1/2in. x 2 1/2in. 7/6; 5 1/2in. x 4 1/2in., 12/6. Both post free.

EX-B.A.F. MORSE TAPPING KEYS 5/- each.

Any TRANSFORMERS made to order within 7 days from date of order. Please ask for quote. Numerous other items in stock.

MAINS TRANSFORMERS. 110/250 volt Input 300/0/300 volt 70/80 M/amps, 12 volt 1A, 4 volt 2A. Useful for Wireless, Model Trains, Chargers etc., or as an 80-watt Auto Transformer 110/250 volts, 10/9 each. Guaranteed.

MORSE TAPE Recorders with motor or clockwork drive (NOT radio tape decks), D.C. motors only, £5 each, carr. 7/6.

MEGGAHS, large size, slight adjustment needed, 500 v., £3/10/-, carriage 10/-.

Clients in Eire and Northern Ireland, please ask for quotation as to carriage charges. The above charges only apply to England.

SPLENDID ODD BARGAINS FOR VISITORS.

OPEN ALL DAY SATURDAY

PLEASE PRINT YOUR NAME AND ADDRESS.

Solder with

LITE SOLDER
 REGD TRADE MARK
"PERMATIP"
 AND
"PERMABIT"
INSTRUMENTS
 FOR
GREATER
SOLDERING
EFFICIENCY

The soldering bit which maintains its face indefinitely without attention. 25 models available for mains or low voltage supply. Bit sizes 3, 32 to 3/8 inch. Full details in booklet S.P.5 from sole manufacturers:—

LIGHT SOLDERING DEVELOPMENTS LTD.
 106, GEORGE ST., CROYDON, SURREY
 Tel. CROydon 8589

SITUATIONS VACANT

STANDARD TELEPHONES & CABLES, Ltd., require in their Newport laboratory, an engineer for the design of filters, equalisers and other networks; previous experience is desirable but not essential; salary will be dependent upon qualifications and experience. The successful applicant will participate in a non-contributory pension scheme, sickness and accident scheme, special insurance facilities and other generous welfare arrangements.—Apply, giving full details of age, experience and training, to Personnel Manager, Standard Telephones & Cables, Corporation Rd., Newport, Mon. [6637]

AIR MINISTRY requires electrical engineers at R.A.F. Radio Standards Centre, Henlow, Beds, for development of techniques for calibration of high grade radio test equipment. Qualifications: Higher School Certificate (Science) or Final City & Guilds Certificate (Telecommunications) or equivalent, but H.N.C. or pass degree may be an advantage. Appointments according to age, experience, etc., as Experimental Officer (min. age 26) or Assistant Experimental Officer. Salary within range, E.C. 2375-£1,075, A.E.O. £350 (age 18) 2755.—Forms from M.L.N.S., Technical and Scientific Register (K), 26, King St., London, S.W.1. quoting D 492/6A. Closing date 8 February, 1957. [6659]

CENTRAL ELECTRICITY AUTHORITY, Research Laboratories, Leatherhead, Surrey, require Engineers in the electronics and Instruments section to assist in experimental and development work in the laboratory and in the field; candidates should have a degree or equivalent qualifications, experience in one of the following an advantage: (a) noise, vibration and harmonic measurement; (b) field strength and voltage measurement at radio frequencies; ability to calibrate equipment and analyse experimental data is also desirable; salaries £735-2910 p.a. according to ability.—Applications to D. Morat, Director of Establishments, Winsley Street, London, W.1, as soon as possible. Quote ref. WW/915. [6567]

UNIVERSITY OF SOUTHAMPTON—Instrument mechanic or toolmaker, preferably under 30, required for the mechanical workshop of the electronics department; applicants should be able to do their own milling and turning and be capable of producing mechanical apparatus on a "one-off" basis. Experience of precision work is desirable but no experience of electronic techniques is required; excellent working conditions, hours and holidays; staff superannuation scheme.—Applications in writing, giving full details of experience and qualifications, together with the names of two persons to whom reference may be made, should be sent to the Secretary and Registrar as soon as possible. [6582]

PRACTICAL Electronic Engineers required for the maintenance of production test equipment used in the manufacture of radio components and various electrical products. A certain amount of design and construction is entailed, together with the carrying out of routine electrical investigations and production trouble-shooting. Applicants should have a sound basic knowledge of electronic principles and the ability to work from circuit diagrams with the minimum of supervision or working knowledge of radio and television an advantage. Practical experience of this type of work will be rated as highly as academic qualifications. Good salaries will be paid and a Pension Scheme is in operation.—Please reply, in confidence, to Box 4641, quoting T.P.3. [6469]

APPLICATIONS are invited for the appointment of demonstrator in the Department of Aircraft Electrical Engineering to assist in the supervision and checking of students' laboratory work; salary dependent on qualifications and experience within a range rising to £1,050 per annum with family allowance; a university degree or equivalent in engineering or physics is desirable but not essential; candidates should have a good general experience in electrical machinery and be able to carry out tests on motors, generators and power equipment; successful candidate would be considered for promotion to a lectureship appointment at a later date.—Applications (quoting reference EP/D) giving full particulars and the names of three referees should be forwarded to the Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks, from whom further particulars may be obtained. [6634]

CHIEF technician required by Posts and Telegraphs Department, Nigeria Federal Government for one tour of 12 to 24 months in first instance either (a) with prospect of permanent salary (including family allowance addition) £1,014 rising to £1,284 a year, or (b) on temporary terms, salary scale (including inducement addition), £1,170, rising to £1,438 a year with gratuity at rate of £150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards children's passages and grant up to £150 annually towards maintenance in U.K. Liberal leave on full salary. Candidates must have had wide practical experience of modern radio technique and equipment, in particular V.H.F. equipment, and preferably also V.H.F. multi-channel equipment. Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/41905/WF. [6620]

LYONS RADIO LTD.

MICROPHONE/HEADPHONE SETS. Made by T.M.C. Type AP12500, microphone hangs on chest but is suitably based for bench or wall mounting. Double headphones are rubber cushioned, with head-band. On/off switch to mike. Very strongly made and fitted with long connecting cord. Ideal for two-way communication, just link-up with flex as required. Sound powered, batteries not required. PRICE per Set, 19/6, post 1/9 or per pair, 37/6, post 2/6.

MICROPHONE FLOOR STANDS. Strongly made ex-A.M., sectional, extend to nearly 6ft. and can be "closed down to approx 21in. Plain finish. PRICE ONLY 19/6, post 2/6.

TWIN P.A. SPEAKERS. Bakelite horns mounted back to back on metal mounting plate with line transformer, voice coil 15 ohms. Overall size 16in. long x 11in. wide x 9in. high. Horn dia. 8in. In condition as new and unused. Made by Parmeko for the Admiralty. PRICE 47/6, carriage 5/-.

INDICATOR UNITS TYPE 96. Contain cathode ray tube type VCR97, 6—VR65's, 3—VR54's, over a dozen pots, and dozens of resistors and condensers, flexible couplers and a wealth of useful gear. Size approx. 18 x 8 x 8in. In used but good condition. PRICE ONLY 35/6, carriage 6/-.

THROAT MIKES. American made, carbon type with neck band, as new in maker's cartons. PRICE 2/9, post 6d.

ELECTROMAGNETIC FREQUENCY MODULATOR. For the "Simple Wobbulator" as described in "W.W." page 252, June issue. PRICE 7/6.

3 GOLDHAWK ROAD, (Dept. M.W.) SHEPHERD'S BUSH, LONDON, W.12
 Telephone: Shepherd's Bush 1729

YOUR METER DAMAGED?

don't scrap it—

LET GLASER REPAIR IT

Leading Electrical Instrument 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
 97-100 ALDERSGATE STREET, E.C.1
 (Tel.: MONarch 6822)

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

Tape Recorders ONLY

We specialise solely in Tape recorders, stocking every good make—Grundig—Simon—M.S.S.—Ferrograph—Wyndson—Elizabethan—Philips—Editor Sound—etc., etc.

Call and hear them all in comfort, or write

Dixon's Electronics
 227 OXFORD ROAD,
MANCHESTER
 Telephone Ardwick 4269

Official Grundig repair agents. Parts for most machines in stock. H.P. and credit terms.

Smith's
 of
EDGWARE ROAD

for Close Tolerance Wax-protected Silver Mica CAPACITORS

Values stocked (pF):	130	230	390	603	1500
5	22	65	135	245	400
6	27	68	140	250	410
8.2	28	70	145	270	450
10	30	75	150	280	470
11	33	80	160	300	500
12	35	82	175	315	530
13	40	100	180	330	530
15	47	110	200	340	540
18	50	120	220	355	550
20	56	125	235	360	600
Tot.: up to 33pF		1pF	Over 33pF	1%	

PRICES

5-300pF	9d.	316-820pF	10d.
1000-2500pF	1/3	3000-5000pF	1/6
Special (limited number only) 0.1 mfd 1%		1/3	

H. L. SMITH & CO. LTD
 287/289 EDGWARE ROAD LONDON W2
 Telephone Paddington 5891

SOUTHERN RADIO'S WIRELESS BARGAINS

TRANSCEIVERS. Type "38" (Walkie-Talkie). Complete with 5 valves. In metal carrying case. Ready for use. Less external attachments, 30/- per set. **ATTACHMENTS** for use with "38" **TRANSCEIVER HEADPHONES, 15/6; THROAT MICROPHONE** with Lead and Plug, 4/6; **JUNCTION BOX, 2/6; AERIAL, 2/6.**

TRANSCEIVERS. Type "18" Mark III. **TWO UNITS** (Receiver and Sender) contained in Metal Case. Complete with Six Valves, Microammeter, etc. **LESS EXTERNAL ATTACHMENTS, 44/10/-.**

TRANSMITTERS. T1154. Complete all valves, etc., etc. Perfect order. 3 frequencies. £2/7/6, in transit case. Delivered U.K.

BOMBSIGHT COMPUTERS. Ex-R.A.F. BRAND NEW. A wealth of Components. **GYRO MOTORS, REV. COUNTERS, GEAR WHEELS, etc.,** etc. Ideal for Model Makers, Experimenters, etc., £3.

LUBRA HOLE CUTTERS. Adjustable 3in. to 3 1/2in. For Metal, Wood, Plastic, etc., 7/-.

RESISTANCES. 100 ASSORTED USEFUL VALUES. Wire Ended, 12/6 per 100.

CONDENSERS. 100 ASSORTED. Mica, Metal Tubular, etc., 15/- per 100.

PLASTIC CASES. 14in. x 10 1/2in. Transparent. Ideal for Maps, Display, etc., 5/6.

STAR IDENTIFIERS. Type 1 A-N. Covers both Hemispheres. In case, 5/6.

CONTACTOR TIME SWITCHES. In sound-proof case. Clockwork movement. 2 impulses per sec. Thermostatic Control, 11/6.

REMOTE CONTACTORS, use with above, 7/6.

MORSE PRACTICE SET with Buzzer on Base, 6/9. Complete with Battery, 9/6.

MORSE TAPPERS. Std., 3/6; Midget, 2/9.

CRYSTAL MONITORS. Type 2. New in Transit Case. Less Valves, 8/-.

METERS AND AIRCRAFT INSTRUMENTS. Only need Adjustment or with broken Glass. **TWELVE INSTRUMENTS,** including 3 brand new Aircraft Instruments, 35/- for 12. Postage or carr. extra. Full list of Radio Books, 2 1/2d.

SOUTHERN RADIO SUPPLY LTD.
11 LITTLE NEWPORT STREET
LONDON, W.C.2. Gerrard 6653

CONDENSERS

We have a very comprehensive stock to offer manufacturers & servicemen
Large Quantities Available

BLOCK PAPER TYPES
0.25 mfd. 2kv. wkg., size 2 1/2 x 2 x 1 1/2in. 0.5 mfd. 2 kv. wkg., size 4 1/2 x 2 x 1 1/2in. 1 mfd. 2 kv. wkg., size 4 1/2 x 2 1/2 x 1 1/2in. 1 mfd. 350 volts, size 2 1/2 x 1 1/2 x 1 1/2in. doz. 15/-
2 mfd. 250 and 400 volts wkg., size 2 1/2 x 2 x 1 1/2in. 8 mfd. 400 volts A.C. wkg., size 5 x 3 1/2in. doz. 18/-
4 mfd. 400 and 700 volts wkg., size 2 1/2 x 2 x 2in. and 4 1/2 x 2 1/2in. doz. 30/-
6 mfd. 500 volts wkg., size 4 1/2 x 3 x 3in. 8 mfd. 400 volts wkg., size 4 1/2 x 3 x 1 1/2in. doz. 36/-

MANY OTHER TYPES IN STOCK INCLUDING SOME G.P.O. TYPES
TRIMMERS AIR SPACED (VARIABLE). 5, 25, 50 pf. with 1in. spindle. doz. 15/-
SPECIAL CONDENSERS, metal cased, 1 mica condenser, 1,200 volts wkg., these are mica stacked foil sealed in bitumen, size 2 1/2 x 2 1/2in. doz. 18/-
Neutralizing condensers, 450 pf. ± 1%. This is all high voltage air spaced condenser, screened in a metal can, size 3 1/2 x 3 1/2 x 1 1/2in. each 5/-
Ceramic high voltage condensers, 50 pf., 100 pf., 110 pf., 1,000 pf., 10 kv. wkg. doz. 30/-
MOULDED MICAS. .01, .001, .002, .003, .005, etc. per 100 22/6
SILVER MICAS. 27, 60, 70, 75, 100, 120, 200, 500, 1,000, 2,200, 3,300, 4,700, 5,000 and 10,000 pf. (Tol. from 2%, 5%, 10%, 20%) per 100 22/6
Try our mixed box of condensers. . . . per 100 20/-
PABNECO REFRANT SPEAKERS with 10 ohms pressure unit. Rating 15 watts. These are mounted in an all steel frame and can easily be erected. . . . each 110/-
MAGSLIPS. 2in. types, A.P. 6550 and A.P. 6549, 2in. type A.P. 10747. . . . each 22/6
RADIAL STUD SELECTOR SWITCHES. Mounted on an insulated panel 5 x 5in. and have a laminated brush with make before break, 20 stud tap. . . . each 5/-
All goods offered for sale are ex-W.D.

Please include postage on all orders under £1.
TERMS C.V.O. WRITE OR CALL
W. MILLS,
3B TRULOCK RD., TOTTENHAM, N.17.
Phone: Tottenham 9213 & 9330.

SITUATIONS VACANT

CENTRAL ELECTRICITY AUTHORITY, Research Laboratories, Leatherhead, Surrey, require an **Instrument Engineer** in the electronics and instruments section; duties include the maintenance, calibration and repair of a wide variety of physical, chemical and electrical instruments; experience in electronics or nuclear equipment an advantage. candidates should have H.N.C. or equivalent qualification; salary £520-£695 p.a.—Applications to D. Moffat, Director of Establishments, Wimsley St., London, W.1, as soon as possible. Quote ref. AE.919. [6571]

CENTRAL ELECTRICITY AUTHORITY, Research Laboratories, Leatherhead, Surrey, require a **Telecommunications Engineer** in the electronics and instruments section, to be responsible for experimental and development work in connection with the application of telecommunication techniques in the electricity supply industry. A good knowledge of communication theory and electronic techniques as applied to line signalling and telegraphy is essential. Experience in radio communication equipment or microwave apparatus development an advantage. Candidates should have an honours degree with previous research experience. Salary £995-£1,345 p.a.—Applications to D. Moffat, Director of Establishments, Wimsley Street, London, W.1. Quote Ref. WW928. [6601]

APPLICATIONS are invited for the appointment of Senior Lecturer in the Department of Aircraft Electrical Engineering. Candidates should possess a university degree or equivalent in engineering and should have considerable experience of one of the following: (a) electrical machine design (b) aircraft electrical systems, or (c) electrical power systems. Salary dependent on qualifications and experience within a range rising to £1,600 per annum with F.S.S.U. and family allowance. Successful candidate will be required to lecture at a post-graduate level on aircraft and G.W. power systems and to equip and supervise laboratories and other installations. Opportunities exist for private research work. Applications (quoting reference EP/SL) giving full particulars and the names of three referees, should be forwarded to the Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks, from whom further particulars may be obtained. [6608]

APPLICATIONS are invited for the appointment of lecturer in the Department of Aircraft Electrical Engineering; salary dependent on qualifications and experience within a range rising to £1,200 per annum with F.S.S.U. and family allowance; a university degree or equivalent in engineering or physics is desirable and candidates should preferably (though not essentially) have experience of one of the following: (a) electrical machine design (b) aircraft electrical installations, or (c) electrical power systems; successful candidate will be required to lecture at post-graduate level on aircraft and G.W. power systems and to assist in the equipping and supervision of laboratories; opportunities exist for private research work.—Applications (quoting reference EP/L) giving full particulars and the names of three referees should be forwarded to the Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks, from whom further particulars may be obtained. [6635]

APPLICATIONS are invited for the appointment of lecturer in the Department of Aircraft Electrical Engineering; a university degree in physics or electrical engineering is desirable together with experience in telecommunications, radar, microwave techniques or allied subjects. A knowledge of aeronautical applications would be an added qualification but is not essential; salary dependent on qualifications and experience within a range rising to £1,200 per annum with F.S.S.U. and family allowance. Successful candidate will be required to lecture at a post-graduate level on aircraft and G.W. guidance systems and to assist in the equipping and supervision of laboratories; opportunities exist for private research work.—Applications (quoting reference ER/L) giving full particulars and the names of three referees should be forwarded to the Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks, from whom further particulars may be obtained. [6632]

APPLICATIONS are invited for the appointment of demonstrator in the Department of Aircraft Electrical Engineering to take charge of the everyday running and maintenance of a teaching and research laboratory devoted to work in the telecommunications, radio navigational, radar and microwave fields; preference will be given to candidates holding a university degree or professional qualification; experience in aeronautical applications of any of the above fields is an added qualification but candidates without such experience will be considered; salary dependent on qualifications and experience within a range rising to £1,050 per annum with family allowance; successful candidate would be considered for promotion to a lectureship appointment at a later date.—Applications (quoting reference ER/D) giving full particulars and the names of three referees should be forwarded to the Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks, from whom further particulars may be obtained. [6633]

BAKERS 'selhurst' RADIO

Demonstrating!
The full range "ULTRA



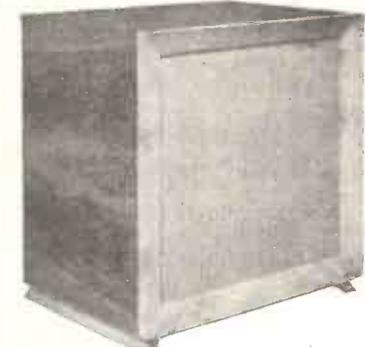
20-25,000 c/s

Cone Resonance 20 c/s

£17 . 10 . 0

Demonstrating!

The **BRADFORD PERFECT BAFFLE**
(Patent Pending)



A radically new idea in speaker enclosures. All the BASS. No boom, resonances or distortion. **COMPACT.**

17" x 17" x 13 1/2" : £16 . 10 . 0
24" x 17" x 13 1/2" : £20 . 10 . 0

Demonstrating!

The-GOODSELL "Golden Range" with the ORTOFON Pick-Up, and the new WOOLLET 4-speed Transcription Turntable.

Daily : 10 a.m.—5 p.m.
Saturdays : 10 a.m.—noon



LIMITED

17, Charing Cross Rd. London, W.C.2.

Tel.: TRAlgar 5575 (opp. Garrick Theatre)

Trade & Export enquiries to:—

JOHN LIONNET & COMPANY
(at above address)

SPECIALIST SWITCHES
specified for the
MULLARD
TAPE AMPLIFIER CIRCUITS

Amplifier Type 'A'

SS/567/A } the set ... 32/6
SS/567/B }
SS/567/C }

Amplifier Type 'B'

SS/567/A 16/6

SPECIALIST SWITCHES

23 RADNOR MEWS · LONDON W.2

AMBassador 2308

Enquiries by post or phone only

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

Come to **WEBB'S** for the
SPECIAL PURPOSE
EDDYSTONE "888" RECEIVER

Tunes only six Amateur bands with full 12-in. bandspread. The answer to Amateur Band reception problems. Descriptive brochure post free on request.

Price **£110**

(Available on easy terms, please enquire)

WEBB'S RADIO

14 SOHO STREET, LONDON, W.1

Sales Dept. — 'Phone GERard 2089

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., C. & 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.



SITUATIONS WANTED

BUSINESS partnership reqd. by expd. qualified electro-mechanical/electronic engineer, 15 yrs. varied exp. including TV, radio, radar, Govt. contracts, printed ccts., transistors, instrumentation and economic production methods, shorthand-typist wife part-time; small capital available; Surrey area.—Box 5502. [6626]

EXECUTIVE engineer in top level management post seeks change to similar position with company of repute in the electronic or closely allied industry; experienced in industrial applications, development, sales, works methods, M.O.S. contract procedure and complete management; enquiries please from directors and top-level management.—Box 5597. [6646]

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. WW47, London, W.4. [0006]

CITY and Guilds (Electrical, etc.) on "No Pass—No Fee" terms, over 95% successes.—For full details in modern production in all branches of Electrical Technology send for our 144-page handbook, free and post free, B.I.E.T. (Dept. 338A), 29, Wright's Lane, London, W.8. [0117]

SERVICES WANTED

WIRELESS Telegraphy and Telephony, P.M.G. Certificate; leading Correspondence School seeks the assistance of a suitably qualified author to prepare a course of study on this subject.—Write, giving details of experience and qualifications, to Box 5375. [6597]

PERSONAL

WANTED.—Pen friends from all parts of U.K., those taking Brit. I.R.E. or C. & G. exams in telecommunications and/or employed in this field kindly write to B. K. Sood, F-4, Jangpura, New Delhi, India. [6622]

TWO technical authors with 20 years' experience in the electronic, electro-mechanical and light mechanical engineering field, would welcome suggestions and offers of the remunerative employment of spare time.—Tel. Bexleyheath 8104. [6613]

TUITION

NOTHING succeeds like success! What we have done a thousand times we can do again for you—see the B.N.R.S. advt. page 84 [0172]

WIRELESS operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7 [0104]

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]

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, 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]

TV & Radio—A.M.Brit.I.R.E., City & 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. 397A), 29, Wright's Lane, London, W.8. [0116]

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 organization; moderate fees.—Write to E.M.I. Institutes, Dept. WW28, London, W.4. [0179]

WIRELESS telegraphy—Merchant Navy offers 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 Transmitting Licence. [0124]

COURSES in Electronics, covering practical and theoretical aspects, basic principles, industrial applications, electronic apparatus, etc. Also courses in Radio and TV Engineering and Frequency Modulation. Guaranteed coaching for Brit.I.R.E., City & Guilds, etc. Study at home under highly qualified tutors. Write for free book: International Correspondence Schools, Ltd., Dept. CL.42, Kingsway, London, W.C.2. [0033]

INCORPORATED Practical Radio Engineers' home study courses of radio and TV engineering are recognized by the trade as outstanding and authoritative. Moderate fees to a limited number of students only. Syllabus of Instructional Text is free. "The Practical Radio Engineer" journal, sample copy, 2/-, 6,000 Alignment Peaks for Superhets 5/9.—Membership and entry conditions booklet, 1/-, all post free from the Secretary, I.P.R.E., 20, Fairfield Rd., London, N.8. [0098]

NEW BOOKS
ON RADIO & TELEVISION

Electronics in Industry, by G. M. Chute. Postage 1/6	56/6
Electronic Computers and Management Control, by Kosmetsky and Kircher. Postage 1/6	37/6
Electronic Devices, by Albert. Postage 1/6	44/-
Colour T.V. Receiver Practices, by C.E. Dean. Postage 1/-	36/-
Frequency Modulated Radio, by Sturley. Postage 8d.	15/-
Frequency Modulated Receivers, by J. D. Jones. Postage 9d.	17/6
Sound Reproduction, by Briggs. Postage 1/-	17/6
Suppressing Radio and T.V. Interference, by Morley. Postage 4d.	5/-
The A.R.R.L. Handbook 1956. Postage 1/6	30/-
Radio Valve Guide Book No. 3, by Babani. Postage 4d.	5/-

UNIVERSAL BOOK CO.

12 LITTLE NEWPORT STREET,
LONDON, W.C.2 (adjoining Lisle Street).

JAMES H. MARTIN & CO.

COLLARO Tape Transcriber, 3 speed, £20. MONARCH U48 Gram-autochange unit, 4 speed with crystal turn-over heads, £39/15/-. FM/VEF Tuner chassis, ready wired with 6 valves, inc. tuning indicator, 16 circuits built-in Power Supply. £17/10/- SOUND Tape Recorder complete with mike and tape. £57/15/-. Soldering Irons, instrument type with neon lamp in handle, 230/250 v. 22/6, postage extra.

Easy Terms available. Stamp (only) for List.
JAMES H. MARTIN & CO., FINSTHWAITE, NEWBY BRIDGE, ULVERSTON, LANCs.

ARIEL SOUND LTD.

- ★ Industrial Electronic Equipment
- ★ Prototype Design & Development
- ★ Electronic Assembly Sub-contracting

57, Lancaster Mews,
London, W.2.
Tel. PADdington 5092

SPECIAL OFFER—NOT EX W.D.

NEW E.D.C. 1/2 h.p. Motors, 1425 r.p.m., 230/1/50 self starting, B/B, foot mounted. **£3.19s.6d.** plus 7/6 carriage. Money refunded if not satisfied.

MATHEW BROS., 87, Beddington Lane, CROYDON. Thornton Heath 3402/3.

LOUDSPEAKER CABINETS

For
GOODMANS W.B. G.E.C.
KELLY and JENSEN
STANDARD BASS REFLEX CABINETS
Demonstrations without Appointment

You can see your cabinet being made in our cabinet-making workshop

Cabinets made to order.
ARMSTRONG CHASSIS AND AMPLIFIERS
LOUDSPEAKERS

Open till 5.30 Saturdays.

A. DAVIES & CO. (Cabinet Makers)
3 Parkhill Place, off Parkhill Road, London, N.W.3. GULLIVER 5775.

Build your own Tape Recorder with the

'ASPEN' TAPE DECK KITS

Compact model
7½in. x 11in., 5in. reels.....kit **£7 10 0**
Standard model
10½in. x 15in., 7in. reels...kit **£8 10 0**
Easy to assemble, with full working drawings and instructions. First class motor, latest design High-Fidelity heads and the recorder

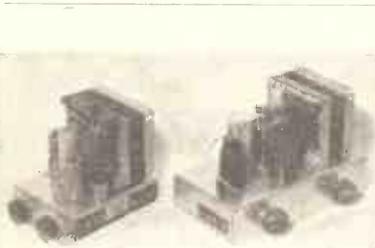
AMPLIFIER.....kit **£5 18 0**
Power pack.....kit **£2 18 6**
(without valves)
Carr. extra

"... I should like to place on record my appreciation of the standard of your kits, both of the deck and amplifier, both of which work very satisfactorily."

J. S. B., Wolverhampton

Send stamp for full particulars to:-

W. S. ASPDEN,
10, MARKET STREET, WESHAM,
KIRKHAM, LANCs.



3-VALVE QUALITY AMPLIFIERS
Suit modern crystal P.U.s; for 200-250 v. A.C.; neg. feedback, volume and tone controls; new Components and PLAYING TESTED.

B7g £4/7/6, INT. OCTAL £4/2/6, B9A £4/12/6. Carr. 3/6 all types.

E.K.E. 47, Arksey Lane, Bentley, Doncaster.

TUITION

WIRELESS.—See the world as a radio officer in the Merchant Navy; short training period; low fees, scholarships, etc., available; boarding and day students; stamp for prospectus.—Wireless College, Colwyn Bay. [0018]

BOOKS, INSTRUCTIONS, ETC.

TELECOMMUNICATIONS Principles 1 and 2 in m.k.s. units, equivalent to two complete correspondence courses for these C and G exams. 100 worked, 100 unworked examples, price 10/6; also "Radio Reference" covers basic D.C. and A.C. theory, valves, transistors, oscillators, R.F., A.F. and power amplifiers, detectors, receivers, transmitters, F.M., V.H.F., aerial arrays, sound, test equipment, constructional techniques. 120,000 words, 588 figs., price 25/- W. Clarke Riddford, 384, The-hurst Rd., Reading. [6325]

BOOKS WANTED

WANTED complete vols. Newnes Radio & Television Servicing.—Box 5546. [6629]

WANTED—"Wireless World," January, February, March, 1950, and September, October, November, 1951.—Box 4746. [6487]

GUIDED WEAPON TRIALS

Trials Engineers and Assistants are required for Flight Trials of Guided Weapons, including preparation of equipment for firing and reporting on defects. These posts, based at Feltham, Coventry and Aberporth (Wales), entail some travelling in the United Kingdom and "away-from-base" expenses are re-imbursed. Excellent salaries and pension scheme. The work is practical, but an understanding of theoretical factors involved is vital. Engineers should be professionally qualified with a knowledge of Electronics, and Assistants are preferred with National Certificates and practical experience of an electro-mechanical or electronic kind.

Enquiries invited by the Personnel Manager, (Ref. W.W.11.) Sperry Gyroscope Company Limited, Great West Road, Brentford, Middlesex.

LONDON CENTRAL RADIO STORES

8in. P.M. SPEAKERS. 3 ohm. In good working order. 11/6.

B18 VERTICAL LIQUID COMPASS. Panel mounting with rim lighting. Does not need to be gimbaled and has built-in correctors. As new, 45/-.

SIMPSON OHMMETER. Moving coil. Two range 0-2,000 ohms, 0-20,000 ohms, size 3 x 6 x 2½in. New and boxed. £11/5/-.

A.C./D.C. VOLTMETER. 0-150, 0-300 moving iron. 6in. scale. In case, with carrying handle. Size 7½ x 7½ x 4in. £11/5/-.

AVO VOLTAGE TESTER. Roller panel type in wooden carrying case. Perfect order. £9/10/-.

UNISELECTOR SWITCHES. Have many applications including automatic tuning, circuit selection, etc. Operates on 25-50 v. Full wipe 4-bank, double coils. 45/- Half wipe 6-bank. 12/6.

2 AND 3-CORE CABLE. Heavy duty P.V.C. Suitable for lighting, outdoor use, etc. 9/6 per dozen yards.

4 AND 6-CORE FLEXIBLE CABLE. P.V.C. covered for general wiring, etc., 8/8 per dozen yards.

MIRROE GALVO'S. Instrument resistance, 190 ohm. External resistance 1,400 ohm. Sensitivity 2,200 M.M.S. In wooden transit box. Size 13 x 6 x 6. £3/10/-.

CARBON HAND MIKE. Type No. 4. 8/6.

MOVING COIL HAND MIKE. Type No. 7. 8/6.

SINGLE FLARE RE-ENTRANT SPEAKERS. Bakelite 15 ohm impedance. Suitable for P.A. work and all outdoor functions. Size 18 x 18 x 12½in. 30/-.

TWIN FLARE SPEAKERS similar to above. Size 24 x 18 x 12½in. 50/-.

HIGH-SPEED ELECTRO-MAGNETIC COUNTERS. 25-50 v. D.C. working 500 ohm coil. 0-9,999. 18/6.

SOUND POWERED BREAST MIKE and HEADSET. No batteries needed. Brand new and boxed. 12/6.

HAND MARCHING COMPASSES. Magnetic type. Bakelite with luminous dial and reflector. Course setting ring. New and boxed. Size 3 x 2 x ½in. 15/-.

All prices include carriage.

23 LISLE ST. (GER. 2969) LONDON, W.C.2

Closed Thursday 1 p.m. Open all day Saturday

SERVICE FOR THE SERIOUS CONSTRUCTOR

From our very large stocks of components & equipment we offer for prompt delivery

STEEL METER CASES WITH ALUMINIUM PANEL, SLOPING FRONT	
4in. x 4in. x 4in.	8/6
5in. x 5in. x 5in.	13/6
6in. x 6in. x 12in.	22/6
SMALL STEEL TEST METER CASES WITH ALUMINIUM PANEL	
4in. x 4in. x 2½in.	6/-
6in. x 4in. x 3in.	8/-
8in. x 6in. x 3in.	10/-
10in. x 6in. x 2½in.	12/-
STANDARD STEEL CASES WITH ALUMINIUM PANEL	
10in. x 7in. x 7in.	22/6
12in. x 7in. x 7in.	28/6
14in. x 7in. x 7in.	32/6
14in. x 9in. x 8in.	41/6
16in. x 9in. x 8in.	45/-
18in. x 11in. x 8in.	51/6
16in. x 11in. x 10in.	58/6
18 S.W.G. ALUMINIUM CHASSIS	
6in. x 3in. x 2in.	5/9
8in. x 4in. x 2in.	6/3
8in. x 6in. x 2½in.	7/6
10in. x 6in. x 2½in.	8/3
12in. x 6in. x 2½in.	8/6
12in. x 8in. x 2½in.	9/8
14in. x 10in. x 2in.	10/3
17in. x 10in. x 3in.	12/6
18 S.W.G. STEEL CHASSIS	
14in. x 8in. x 2½in.	9/8
14in. x 10in. x 2½in.	10/3
17in. x 10in. x 3in.	12/6
FULLY DRILLED CHASSIS FOR WILLIAMSON AMPLIFIER. Finished Old Gold.	
G.E.C. OSRAM 912 AMPLIFIER DRILLED CHASSIS. Aluminium	21/-
G.E.C. OSRAM 912 FRONT PANEL	14/6
"PANEL" CRACKLE PAINT, BLACK, per tin	3/-

T.R. MASTERLINK

A quality Tape Pre-amplifier Unit for use between standard tape decks and the best audio-amplifier. With 3-speed play-back equalisation, erase- and adjustable bias, metering of signal and bias voltage, oscillator cut-out, D.C. solenoid supply, etc. Also included—input matching, separate power supply unit; frequency response ± 1 db from 30 to 20,000 c/s plus 6 db pre-emphasis at 5 kc/s. Fully detailed leaflet on request. TRADE ENQUIRIES INVITED. **27 Gns.**

UNIVERSAL AVOMINOR with 22 ranges	£10 10 0
ADVANCE E2 SIGNAL GENERATOR, 100 kc/s to 100 mc/s in 6 ranges.	£32 10 0
TSL TWEETER LPH.65	£1 19 6
O-30 M/A METER	7 6
COLVERN 2K 15 WATT PRECISION POTS	8 6
PEN40 VALVE, new, boxed	8 6
T.R. WILLIAMSON KIT to spec.	£25 0 0
CROSS-OVER INDUCTANCES, 4 mH. pot core, Litz wound, per pair	15 0
WEARFEDALE SF83 SPEAKER	£37 10 0
WEARFEDALE TAPE-DECK 2A	£35 0 0
COLLABO TAPE DECK	£20 0 0
E.M.L. TAPE, 1,800ft.	£2 10 0
SCOTCH BOY TAPE, extra play, 1,800ft.	£2 14 0
BELLING & LEE PLUGS AND SOCKETS, T.C.O. CONDENSERS, RESISTORS BY LEADING MAKERS, TEST EQUIPMENT, HI-FI EQUIPMENT.	

(Postage and Package extra.)

THE T.R. CATALOGUE

56 pages of components, amplifiers, tube equipment, F.M. Tuners, motors, pick-ups, loud-speakers, etc. Illustrated.

1/3 Post Paid

- Shop Hours—9 a.m. to 6 p.m. (1 p.m. Thursdays)
- Few minutes from Marble Arch.
- H.P. Facilities.

TELE-RADIO (1943) LTD.,

189, EDGWARE RD. W.2
(Our only Address)

Phone: PADDINGTON 4455-6

"DIPLOMA" HEADPHONES



Lightweight High Resistance (4,000 ohms). Complete with cord.

17/6

Ideal for CRYSTAL SETS
The 'TYANA' Standard Soldering Iron



- Adjustable Bit.
- Weight approx. 4 oz.
- Heating time 3 min.
- 40 Watt economy Consumption.
- Standard Voltage Ranges.

16/9

Replacement Elements and Bits always available

KENROY LIMITED
152/297 UPPER ST., ISLINGTON,
LONDON, N.1

Telephone: CANonbury 4905-4663

COLOUR TELEVISION

The Sylvania Thorn Colour Television Laboratories Ltd.

is now able to offer appointments of unusual interest. The new Laboratories, which are situated at Enfield, Middlesex, are fully equipped to carry out Research Development in all aspects of Colour Television.

* Applications are invited for the following vacancies.

1. TECHNICAL ASSISTANT

(male or female) of H.N.C. or equivalent standard, to assemble electron-optical structures, work a demountable vacuum system and assist generally in electron-optical studies for colour tubes.

2. TECHNICAL ASSISTANT

to work on the problem of preparation of colour tube phosphor screens. The work necessitates a knowledge of Physics and Chemistry and requires initiative and inventive ability. A University Degree and some experience in the vacuum tube field would be preferred.

3. TECHNICIAN for the maintenance and calibration of Instruments and Test Gear. Applicants must have had considerable experience in this field.

4. TECHNICIAN with machine and bench glass working experience is required for bulb fabrication, sealing-in and pumping of experimental colour tubes. Experience with cathode ray tubes or similar products is essential. Versatility is a necessity.

Positions offer good and progressive salaries according to achievement, and eligibility to Contributory Pension and Life Assurance Fund.

Apply direct to:

Mr. B. C. Flemming-Williams,
GENERAL MANAGER,

Sylvania Thorn Colour Television
Laboratories Ltd.

Great Cambridge Road, ENFIELD, Middlesex.

APPLIED ELECTRONICS LABORATORIES, THE GENERAL ELECTRIC CO. LTD.

The services of experienced electronics engineers are required for advanced engineering development work on guided weapons.

Senior positions are vacant in the following fields.

1. GENERAL PULSE CIRCUITRY with application to sub-miniature techniques and the design and development of units by statistical method. Experience of semi-conductor work desirable for one position.
2. ELECTRONIC AND INSTRUMENT SERVOS involving design and development of servos with special relationship to overall system considerations.
3. MAGNETIC AMPLIFIERS. Design and development of magnetic amplifier stabilisers and drive stages for small electric motors.
4. INSTALLATION. Design of layouts for simplicity of inter connection in subminiature work. Wide electronic experience is essential.

Engineers of graduate standard with suitable experience are needed. A number of vacancies exist for engineers wishing to gain valuable experience in these and other fields. Good opportunities exist for advancement.

Reply stating age, qualifications and experience to

Personnel Manager (Ref. R.G.)
Applied Electronics Laboratories,
Brown's Lane, Allesley,
Coventry.

MURPHY RADIO LTD. ELECTRONICS DIVISION

VACANCIES exist in an expanding laboratory for Senior and Junior Engineers and for Draughtsmen in the following fields:—

TRANSISTOR circuit design and engineering applications to communication and pulse systems.

V.H.F. and U.H.F. transmitters and receivers for use in NAVIGATIONAL AIDS, MOBILE COMMUNICATION SYSTEMS and RADIO TELEPHONE LINKS.

AERIAL DEVELOPMENT in connection with the above.

TELEMETRY EQUIPMENT design in collaboration with the Ministry of Supply.

Posts are pensionable, Sports Club and other recreational facilities are available.

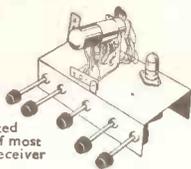
Applications should be addressed to:—

Personnel Department (E.14), Murphy
Radio Limited, Welwyn Garden City.

OSCILLOSCOPE

(MINIATURE TYPE)

Supplied in kit form for workshop or experimental use. Complete with full instructional notes giving details of applications to radio work. Can be operated from power supply of most AC domestic radio receiver equipment.



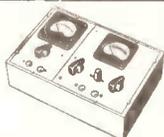
Price £10 (inc. post/pkg.)
(Power unit, if required, £3 extra)

Order now or send stamp for further details to:—
E.M.I. INSTITUTES, Dept. 0127, LONDON, W.4
(Associated with "His Master's Voice", etc.)

1C82

PORTABLE TEST PANEL

for workshop or laboratory use



Two separate moving coil meters, one for voltage and the other for current measurement. Supplied in wooden case with metal front and with test prods.

Ranges (AC & DC)
0-30 mA
0-10v, 0-25v,
0-500v
0-10,000 ohms
Size 8½" x 5½" x 2½"
light weight.

Price £6.10.0 (incl. post/pkg.)
Order now (immediate delivery) from:
E M I. Institutes, Dept. 127, London, W.4

CATALOGUE

L/P

& HANDBOOK

FOR 1956

— 1957

R
E
C
O
R
D
L
I
B
R
A
R
Y

- The only comprehensive selective catalogue of Classical L/P Records—listing only recordings recommended by the Critics.

- Nearly 3000 discs listed (as already available to Library members).

Also selections on :-

- The care of Long Playing Records.
- The Reproduction of Long Playing Records.
- A Basis for a Record Collection (100 Recommended L/Ps)
- FULL DETAILS OF LIBRARY MEMBERSHIP

POST 3/- FREE FROM

THE LP RECORD LIBRARY
SQUIRES GATE STATION APPROACH, BLACKPOOL, LANCs.

LOCKWOOD

makers of
Fine Cabinets

and woodwork of every description for the Radio and allied trades

LOCKWOOD & COMPANY (WOODWORKERS) LTD.

Lowlands Rd., Harrow, Middlesex. Byron 3704

The Research & Development Organisation of

AERONAUTICAL & GENERAL INSTRUMENTS LTD.

have the following vacancies:—

SENIOR STAFF

SENIOR DESIGN DRAUGHTSMAN, H.N.C. or equivalent, experienced in the design of small electro-mechanical devices.

SENIOR ELECTRONICS ENGINEERS of high technical ability.

Apply: **I.S.I. Ltd., 105, Lansdowne Road, East Croydon. (CRO 8282)**



SIFAM ELECTRICAL INSTRUMENT CO. LTD.
LEIGH COURT - TORQUAY - Telephone 4547/8

For Prompt Delivery

WAFER SWITCH ASSEMBLIES, CUSTOM BUILT

Banks	PAXOLIN		CERAMIC	
	s.	d.	s.	d.
1	7	0	11	3
2	10	3	22	7
3	13	6	33	4
4	16	2	45	2
5	18	10	56	2
6	21	6	67	8
7	23	8	—	—
8	26	11	—	—

When A.B. 11 and 12 way Wafers are required, please add 1/- per bank to above prices. SPECIALS AT TIME & MATERIAL PLUS 50%.

● N.S.F. TYPE "G" SWITCHES.

1 Bank	£1 4 0	Control Plate etc., each
2 Banks	£1 13 0	
3 Banks	£2 2 0	15/-
4 Banks	£2 11 0	
5 Banks	£3 0 0	Wafers, each
6 Banks	£3 9 0	
		9/-

Quotations gladly given for small as well as large quantities, also for special assemblies.

TELE-RADIO (1943) LTD.
189, EDGWARE ROAD, LONDON, W.2.
Paddington 4455/6.

RADIO ENGINEERS AND AMATEURS

Send 6d. for our latest list. We are stockists of the new Collaro Tape Deck and 4-speed Monarch Changer, the Whiteley Electrical W.B.21 Amplifier, W.B. Speakers & Cabinets. Price and Bernard's Books. We also supply valves, condensers, resistors and a wide range of components at keen prices.

From the Mail Order Specialists:
RADIO HAM SHACK LTD.,
155, Swan Parade, Bradford, 1, Yorks.

'neo'-MAINTEST
100/700V AC/DC 17/6
SEARCH LEAD TEST PROD 7/6
THE PERFECT FAULT FINDER
NEO ELECTRICAL INDUSTRIES LTD
MANCHESTER 4

BELCLERE TRANSFORMERS

offer—

- ★ High Quality Driver and Output transformers for use with Transistor Amplifiers.
- ★ Output transformers for F.M. receivers—types suitable for Push-pull or single-ended output stages.
- ★ Transformers to customer's own specification.

Illustrated leaflet and fullest details upon request. Excellent Delivery—Competitive prices.

BELCLERE TRANSFORMERS

P.O. Box No. 22
117 High Street, Oxford
Tel. 48362. Cables: Belclere, Oxford.



MINIATURE & SUB-MINIATURE ELECTROLYTICS



These ranges will appeal particularly to all concerned with the design and servicing of small-scale equipment incorporating transistors or printed circuits.

The usual T.C.C. high standard of construction has been maintained throughout. The elements are hermetically sealed in aluminium tubes with rubber bungs (T.C.C. Patents Nos. 578487, 587072 and 587509), with wire terminations $1\frac{1}{2}$ " long. Polarity is plainly indicated by the red and black bungs.

In the CE59 range, maximum working temperature is 70°C. These condensers can be supplied with transparent insulating sleeves at slight extra cost.

The range of Sub-Miniature Electrolytics comprises some of the smallest of this type yet available. These diminutive condensers are suitable for use in miniature walkie-talkie equipment, hearing aids and similar assemblies where every component is scaled down to the absolute minimum physical size. Temperature range is minus 30°C. to plus 60°C.

CE59 RANGE

Capacity in µF.	Peak Wkg. Volts D.C.	T.C.C. Type No.
100	6	CE59AE
50	12	CE59BE
25	25	CE59CE
12	25	CE59C
5	50	CE59D
12	50	CE59DE
6	100	CE59EE
4	150	CE59FE
2	200	CE59GE

Size throughout range $1\frac{1}{16}$ " long x $\frac{3}{8}$ " diameter

SUB-MINIATURES

Capacity in µF.	Peak Wkg. Volts D.C.	Dimensions in inches		T.C.C. Type No.
		Length	Diameter	
6	1.5	$\frac{5}{8}$ "	$\frac{1}{8}$ "	CE58
4	4	$\frac{5}{8}$ "	$\frac{1}{8}$ "	CE58AA
2	8	$\frac{5}{8}$ "	$\frac{1}{8}$ "	CE58A
1	12	$\frac{5}{8}$ "	$\frac{1}{8}$ "	CE58B
0.25	25	$\frac{5}{8}$ "	$\frac{1}{8}$ "	CE58C
6	3	$\frac{9}{16}$ "	.18	CE68AA
10	3	$\frac{9}{16}$ "	.18	CE68AA
1	25	$\frac{9}{16}$ "	.18	CE68C
8	6	$\frac{11}{16}$ "	.2	CE69A
4	12	$\frac{11}{16}$ "	.2	CE69B
32	1.5	$\frac{11}{16}$ "	$\frac{1}{4}$ "	CE67
8	15	$\frac{11}{16}$ "	$\frac{1}{4}$ "	CE67B



THE TELEGRAPH CONDENSER CO. LTD

RADIO DIVISION · NORTH ACTON · LONDON · W.3 · Tel: ACO rn 0061

Ersin Multicore

SAVBIT

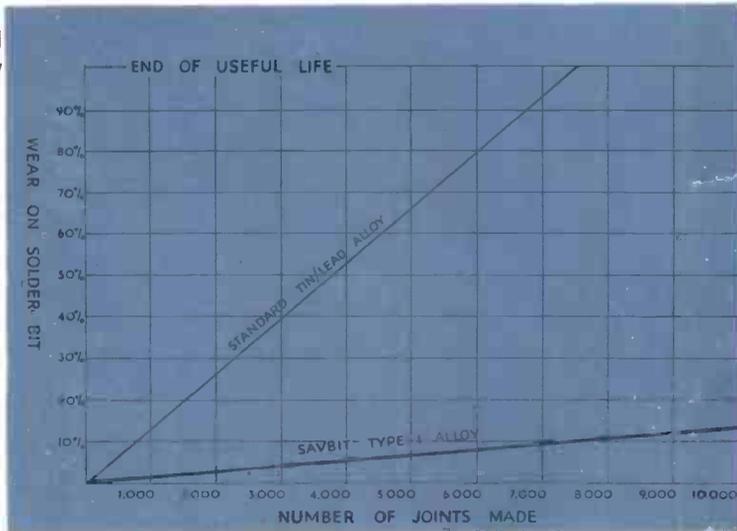
TYPE 1 ALLOY

saves up to **90%**

of your soldering iron replacement costs

COMPARISON OF BIT WEAR BETWEEN STANDARD TIN/LEAD ALLOY AND SAVBIT TYPE 1 ALLOY

You can see from the graph just how much you can save on soldering iron replacement costs. The wear on soldering iron bits, when SAVBIT Type 1 Alloy is used, is one tenth of that when a standard tin/lead alloy is used. This is because SAVBIT Type 1 Alloy reduces the absorption of copper from the bit into the alloy, extending the life of the bit by up to 10 times.



7 LB. REEL

Savbit Type 1 Alloy which contains 5 cores of non-corrosive Ersin Flux is supplied in 3 gauges on 7 lb. reels for factory use. Ersin Multicore 5-core Solder is also available on 7 lb. reels, in 6 standard tin/lead alloys and 9 gauges. Prices on application.



1 LB. REEL

Approximately 170 ft. of 18 s.w.g. Ersin Multicore Savbit Type 1 Alloy is wound on the 1 lb. reel. This is a convenient quantity for factories where each operative uses a comparatively small quantity of solder at a time. 15/- each (subject).



SIZE 1 CARTON

5/- each (subject)
Savbit Type 1 Alloy is also available in cartons containing 53' of 18 s.w.g. Ersin Multicore Solder is also available in 4 other specifications

Catalogue Ref. No.	Alloy Tin Lead	S.W.G.	App. l'gth per carton
C 16014	60/40	14	19 feet
C 16018	60/40	18	51 feet
C 14013	40/60	13	17 feet
C 14016	40/60	16	36 feet

HOME CONSTRUCTOR'S 2/6 PACK

Contains 19 ft. of 18 s.w.g. 60/40 alloy wound on a reel or, for soldering printed circuits, 40 ft. of 22 s.w.g. 60/40 alloy also wound on a reel. 2/6 each (subject).



Bib WIRE STRIPPER & CUTTER

This 3 in 1 tool strips insulation, cuts wires and splits plastic extruded twin flex. It is adjustable to most wire thicknesses. 3/6 each (subject).



Bib RECORDING TAPE SPLICER

By providing considerable economies in tape, this splicer soon pays for itself. It makes the accurate jointing of recording tape simple and quick. 18/6 each (subject).

