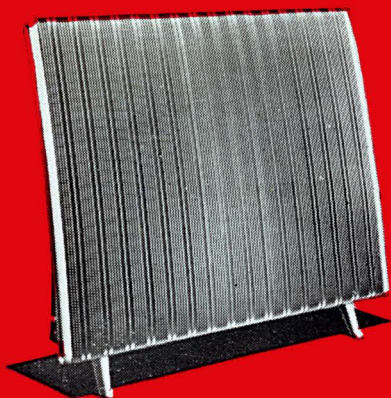
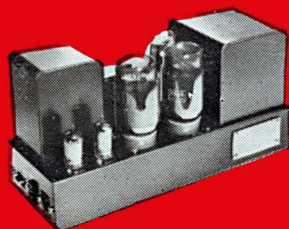


Hi Fi

1958

YEAR BOOK

STEREO EDITION



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Hi-Fi Year Book

— 1958 Edition —

Editor - - MILES HENSLOW



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FOREWORD

THIS third edition of Hi-Fi Year Book (1958) introduces Stereo for the first time as a separate subject. As the pages of the book are passed for Press, we await the first announcements of stereo discs for the Home Market. Before the next edition is prepared we confidently expect to see Stereo as an established form of home entertainment. The Directory sections of Hi-Fi Year Book have been considerably enlarged to cover the many new products that have become available during the past 12 months. Prices, as before, have been quoted with U.K. Purchase Tax as an extra. In each chapter the available equipment has been presented alphabetically, as nearly as possible, with full addresses, telephone numbers and cable addresses for overseas buyers. While every effort has been made to make this book as complete and as accurate as possible, no responsibility can be accepted for discrepancies.

MILES HENSLow

THE purpose of this Year Book is to provide as complete a survey as possible of all the best Hi-Fi equipment available on the British Market. To the best of our endeavours we have limited the editorial content to cover equipment of really good Hi-Fi standards, as they are understood and accepted in their true meaning by the Trade as a whole, by the acknowledged experts of the day, and by the editorial and publishing office of Hi-Fi Year Book.

It is, of course, important to add that no implication of unworthiness is intended towards any manufacturers whose products may have escaped mention, or whose advertisements do not appear in these pages. The above guarantee is a positive one—not a negative one.

SPECIAL NOTE

In view of the above, we draw the special attention of our readers to the enlarged section of Tape Recorders in this edition, in which we have included many instruments of good domestic quality, in response to numerous requests from all quarters. These recorders, unless specially noted as “professional” or “semi-professional,” are not necessarily claimed by their manufacturers to be Hi-Fi instruments, and their inclusion in this book does not contain any such implication.

INTRODUCTION

With the coming of Stereo, a new range of components will be added to the Hi-Fi Directory section. This year, as a prelude, "Hi-Fi Year Book" has been divided into two editorial sections. Next year, if circumstances dictate the need, separate directory sections may be included as well.

THIS year, 1958, marks the beginning of **The New Sound Age**, and brings stereo reproduction into our homes in a popular, practicable form through the medium of the disc. There have been several "landmark" years in the history of sound recording and reproduction. First was 1859, when Mr. Leon Scott demonstrated a device to the Royal Association, showing by means of hog's bristle and lamp black that the vibrations of sound could be recorded. There was certainly no commercial aim behind the experiments of Leon Scott; they are now of purely historical interest. Until the day when his "stylus" traced the first, lateral wavy line on to the rotating blackened cylinder, no sound had ever been registered in the form of a tangible record.

The First Reproduced Sound

Eighteen years later (1877) Thomas Edison coated a cylinder with tin foil, and caused sound vibrations to be indented in the foil in a vertical direction. Then, when the cylinder was turned again beneath a tracing stylus, the recorded sound was reproduced for the first time in history.

In 1888 Emile Berliner produced the first recorded discs. He used zinc smeared with tallow, and he dipped this in acid after his stylus had traced out the wavy lateral line. Where the stylus had cut away the wax, the zinc was exposed to the acid, and the lateral sound track was thus etched into the metal. This was his "master." He then coated it with graphite, electro-plated it, and produced copies from it. These were then played with steel needles.

By 1900 (circa) spring-driven "gramophones" were available to the public, with 5-inch discs pressed from a hard thermoplastic material of slate dust, carbon black and shellac.

By 1914 disc sizes had been standardised at 10 inches and 12 inches, with a U-shaped groove. The frequency response had risen from an indeterminate guess to about 2 octaves (500 to 2,000 c/s), and this was gradually extended to about 160 to 2,000 cycles during the next 10 years.

Electric Recording

1925 was the next big year, for it saw the introduction of electric recording. Until then, all recording was done acoustically, with the maximum possible amount of sound being conveyed towards diaphragm and cutting stylus by large horns. Electric recording was achieved by microphones and electronic amplifiers, driving electro-magnetic cutters. The result was an immediate widening of the recorded frequency range to nearly 6 octaves (about 80 to 5,000 c/s); and the advent of magnetic pickups for reproduction brought about a comparable increase of efficiency for music lovers—though then, as now, the disc makers were able to put on to the record far more than the average domestic reproducer could extract from it.

At about the same time as the "electric take-over" in the world of discs, electrically recorded sound tracks were added to the first cinematograph films, and domestic radio sets with superhet circuits and cone-type loudspeakers were becoming commonplace. For nearly 25 years the outward scene in Britain was one of development and improvement, with very little to show in the way of major events.

Stereo Experiments.

Behind the scenes, however, there was plenty of action during the years 1930 to 1940 and onwards. On the radio side Frequency Modulation was developed (USA) and at the EMI laboratories at Hayes (Britain) A. D. Blumlein worked out a system for the simultaneous recording of two separate sound tracks in a single

groove of a disc. This system was patented in 1931, and it produced very good stereo reproduction, judged by the standards of the day—but those standards included shellac discs, a speed of 78 rpm, and (so far as the public were favoured) steel needles. The Blumlein stereo system was a quarter of a century ahead of its time, and it had to be put on the shelf.

Stylus Improvements

During these years another major development was taking place. The screw-in steel needle—thick for loud, thin for soft, “use each point once only”—was on its way out. The “thorn” cult grew, and faded. Fine pointed, chrome-tipped miniature needles were introduced, and were sold for the new, “small sized” magnetic pickups. Then in 1949/50 the sapphire stylus reappeared on the scene (on the shelf since the days of Edison’s cylinder) together with the first microgroove long play discs.

The arena was being arranged for stereo. Blumlein’s patents were also taken out of their cubby hole and studied. They had expired by then, of course, so the field was relatively clear; but there was much in them to be worked upon. So here, with a quick reference to the important dates, we can study the stereo pattern in more detail.

1859—1877—1888—1925—1931—1958.

It is of more than unusual interest to note that a round century has passed, from the date of the first recorded sound trace to the realisation of full three-dimensional “stereo” sound from the complex twin-channel tracks on a long playing microgroove disc.

Stereo Methods

The story of stereo now passes from the experimental to the everyday. The introduction of stereo tapes by E.M.I., some two years ago, caused a ripple of interest on the surface of the Hi-Fi pond in the U.K., and the advent of stereo tapes in the U.S.A. caused a similar stir in that country—more over there than here, because the American public are more conditioned to tape than we are; nevertheless it was soon apparent that tape was not to be the medium for the introduction of stereo. Excellent as the results from tape proved to be, the introduction had to come via disc.

Three possible methods of producing stereo on and from disc were considered. The first (and probably the best) was ex-

ploited experimentally and dropped. It was known as the “Carrier” system, and it would have involved the user in too much expense with reproducing equipment. This left Hill-and-dale/lateral, and what is known as 45/45—which is, in effect, vertical lateral turned through 45 degrees, making a + into an x, so that the cutting stylus, and the reproducing stylus, follow a downward and outward movement against the left and right walls of the spiral groove.

During the latter months of 1957 and the Spring of 1958, the 45/45 ‘cut’ was internationally decided upon, and the recording characteristic was also agreed. This is a close approximation to the present British Specification number 1928 (American R.I.A.A.). In the meantime Decca, who had been working continuously with both vertical/lateral and 45/45 systems, and who were thus ready and waiting to go ahead with whichever was adopted, immediately went into production with experimental 45/45 pressings for the Hi-Fi industry.

Stereo Components

With discs to work with, pickup manufacturers were able to proceed with stereo pickups; and makers of amplifying equipment (already in possession of stereo tapes) likewise went ahead with provisional designs as soon as they saw the lights go green.

So far as the Hi-Fi enthusiast is concerned, the present problem is one of patience, until the components are ready; and the future problem will be that of choosing what is best from the large variety of components that will soon be available.

For the newcomer to Hi-Fi, with no changes to make, and with the future wide open, it would seem wise to select a stereo pre-amplifier at the outset—two channels, with an input on each for *tape*, *disc* and *radio*; and when making such a purchase it would also seem prudent to ensure that the gain is sufficient to accept a signal direct from the tape ahead.

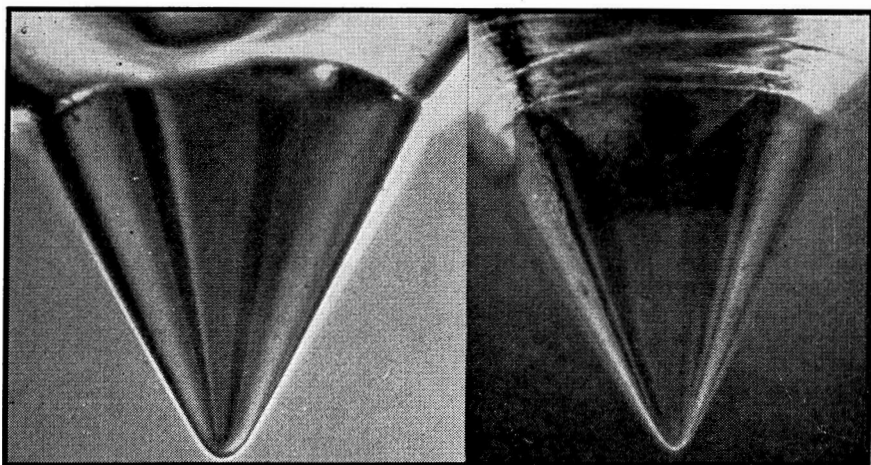
The choice of speakers is wide and varied, and the prime considerations will be those of room size and length of purse.

The choice of a pickup will need greatest care, and three factors seem to call for special attention—(1) Stylus pressure should not exceed 5 grammes, preferably 3 grammes; (2) Stylus tip radius should be .005 inch; and (3) The stylus should be a diamond.

THE ADVENT OF THE "HALF-THOU" POINT

By Cecil Watts

Just as the l.p. brought with it the "one-thou" stylus point, so has the stereo disc brought us the "half-thou" sapphire and diamond



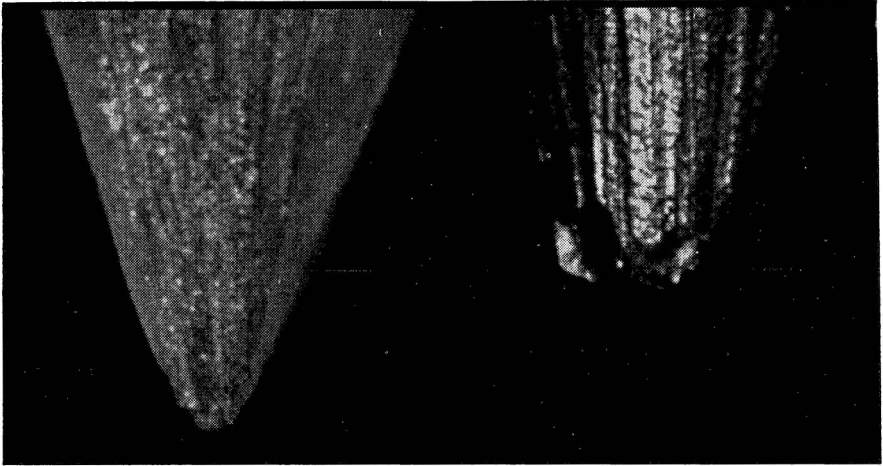
In the days of acoustic sound boxes, playing weights were measured in ounces (if measured!) and needle tip radii were of the order of $\frac{1}{16}$ inch. Over the past 20 years, and particularly during the past decade, great progress has been made in the production of styli, and playing weights have fallen steadily as pickups have been improved. On the left is a .001 point, the present standard for lp's, playing weight 10 grams or so. On the right is one of the new .0005 points for stereo, playing weight circa 3 grams. Both pictures are $\times 300$

RECORD manufacturers have been commendably modest with regard to the progress made during the past year in the improvement of recording techniques and the finished lp record. This modesty is understandable when it is realized that our appreciation of their improvements depends entirely on the efficiency of the equipment available for reproduction. I believe it true to say that, with certain types of musical sounds, even the finest pickups of today, fitted with the standard .001 in stylus, are now inadequate faithfully to trace many of the recently issued records. It would indeed be tantalizing to be told by the makers that improve-

ments were there if we had no means of appreciating them.

The general trend over the years in the evolution of the record groove and stylus has been to reduce both in like proportion (refer to **Hi-Fi Year Book**, 1956, pp 9-13), and during the last few years we have been accustomed to consider a stylus radius as fitting the groove approximately half-way between the top and the bottom.

For "stereo" or "two-channel" records, however, we are faced with the necessity for a stylus which can be controlled by a groove which varies in width and depth as it is modulated in two directions and which, on the crests of any up-



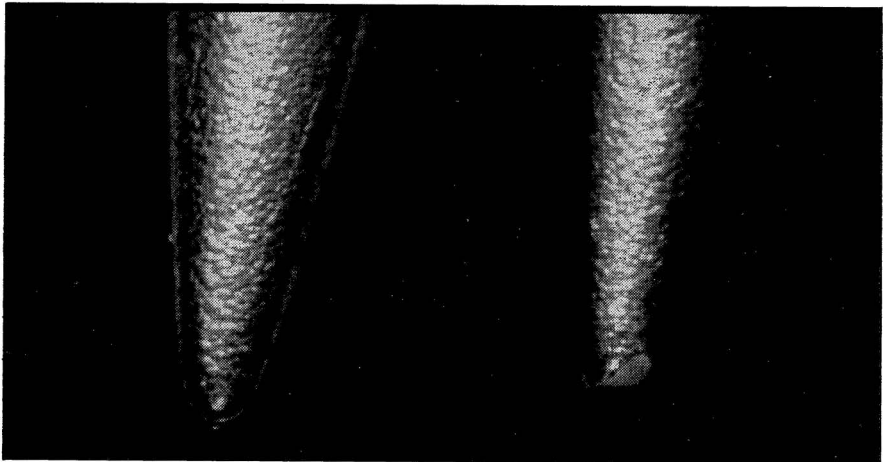
The fibre needle of the early 1920s had a long innings and preserved many valuable disc collections. Left, a freshly pointed fibre, and beside it the same point after one playing

ward excursion, may be reduced to as much as half the depth of the present lp groove. The greatest modulated depth of groove for the "stereo" record is likely to be approximately the same as that of present lp standards, but the radius of stylus tip must now be reduced to provide for the continuously varying depth.

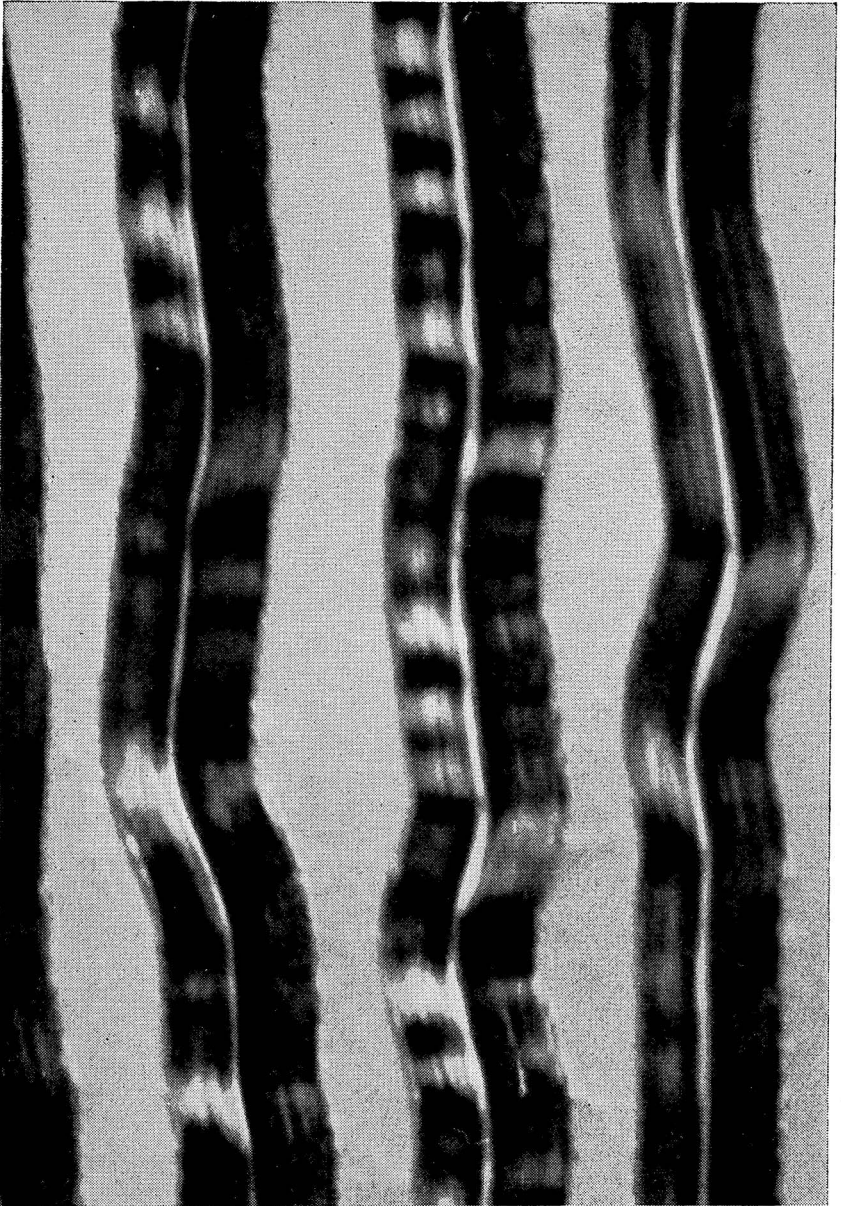
With the downward pressure of the stylus reduced to a practical minimum of 3 grammes, a sapphire point of say .0005 inch would have only a limited life, and the use of a diamond therefore becomes a necessity. Stylus manufacturers have already commenced to produce styli of

these dimensions, and the progress made in forming this hardest of all materials to an exact shape and polish is illustrated on page 7.

Now, with these preparations for the "stereo" record in mind, and remembering that a pickup designed for their reproduction will no doubt also be used for the reproduction of normal lp records, it is not inopportune for those of us requiring the highest definition to consider the immediate advantage of employing a .0005 inch radius stylus in our present pickups, so as to obtain more accurate tracing of the higher harmonics from recently issued



The chrome needle, introduced by EMI (about 1938), was the first miniature needle (shank about $\frac{1}{8}$ inch). Left, a new point ; right, after one playing—but the thin shank, as it wore away, left no damaging shoulders to chisel the record



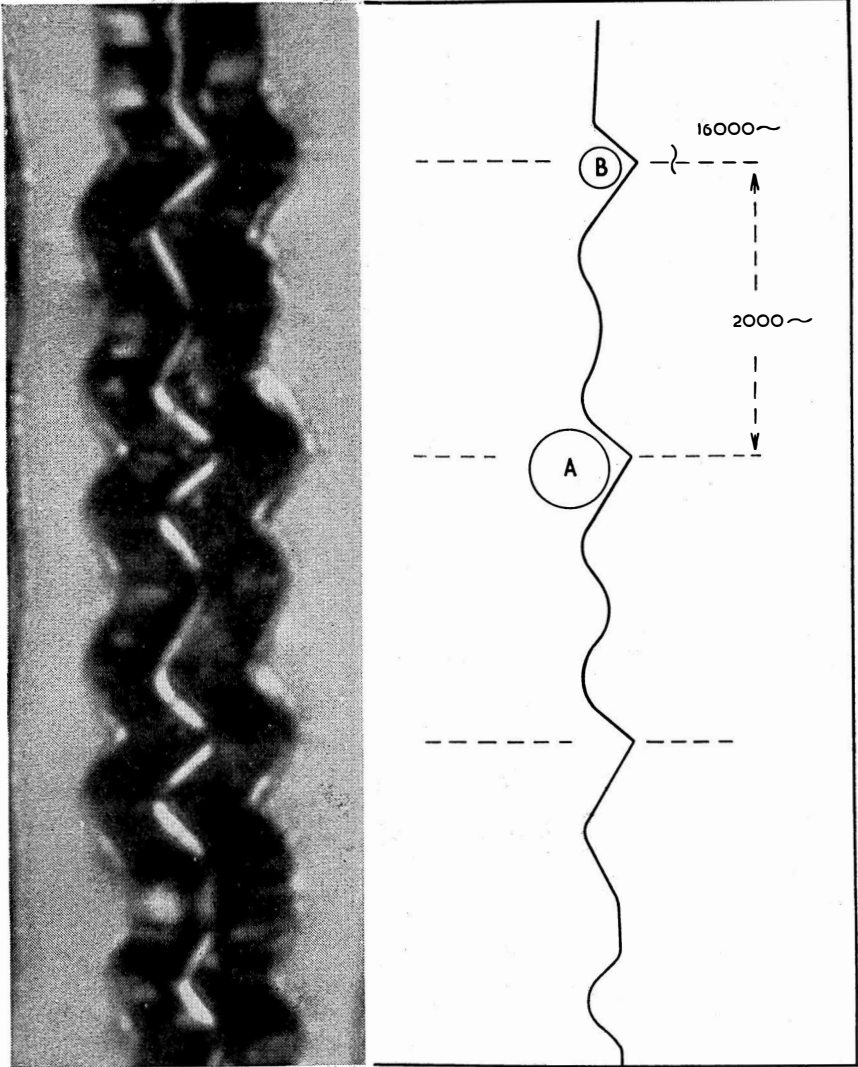
As playing weights grow less, and stylus tip radii are reduced, so will discs last longer and sound better. This photomicrograph of a recent lp shows traces of both "thou" and "half-thou" points which have played it

records. Any such use must obviously apply to records kept immaculately clean and previously played with a downward pressure not exceeding 3 or 4 grammes.

An indication of the general improvement in groove form is shown above.

This record has been played many times using both .001 inch and .0005 inch styli, with a downward pressure of 3 grammes.

A further illustration of the improvement in tracing obtainable from the .0005 inch stylus is shown on page 10. This wave



Here is another comparison of the virtues of "thou" and "half-thou" points. The diagram on the right will help the less experienced eye to follow the evidence provided by the photomicrograph on the left

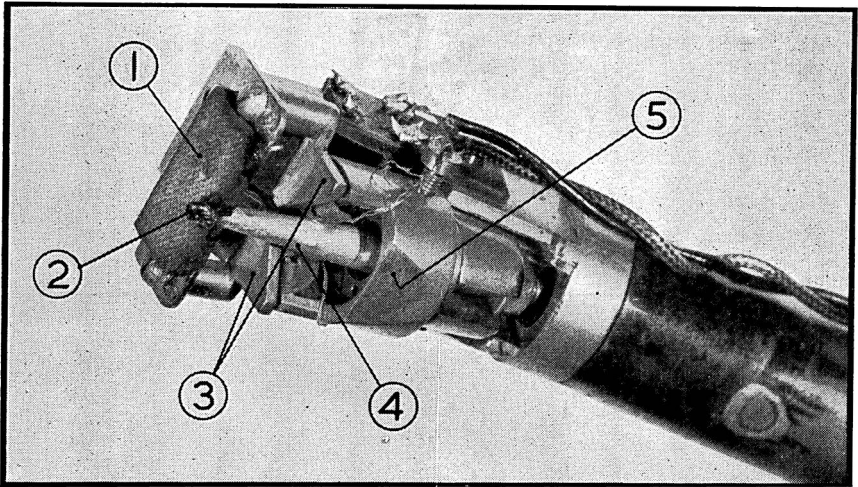
form is from Winifred Atwell's "**Other Piano**," and it clearly shows the inability of the .001 inch stylus accurately to trace the higher harmonics of this steep-fronted type of wave. The circumference of the .001 inch stylus is indicated by "A" in the diagram, while that of the .0005 inch stylus is marked "B."

In conclusion, do not despair! If your pickup is not quite such a lightweight as it

should be, or if it has slightly less compliance (vertical or lateral) than it should have, by no means will all be lost—even the high frequency traces of the new stereo disc. Because the 45/45 cut approaches the hill-and-dale (vertical), a slightly stiff pickup will do less damage to a stereo disc than a stiff pickup on a monaural disc. The cut is *downward*, and so the stylus will slide over, rather than chew away, the trace. Nevertheless, be careful!

PICKUPS FOR STEREO

By Stanley Kelly



This photo is of the historic Blumlein stereo pickup. The stylus armature (4) is pivoted at (5) in such a manner that the stylus point (2) can move in the vertical and horizontal directions. The inclined pole pieces are shown at (3)

THE idea of putting two channels into one groove is not new; the first serious attempt was made by Emerson in 1919, although the idea of applying the same signal simultaneously to both vertical and lateral modulations of the groove had been proposed as early as 1908. These were acoustic systems, of course, and the technical difficulties due to low available power, mechanical linkages and their attendant resonances, were enormous.

With the advent of electrical recording and replay equipment the vista increased considerably, and in 1929 Blumlein commenced his experiments which were the forerunner of the majority of present stereophony-on-disc systems.

The public have heard a lot about "two different systems," but basically they are one and the same, and either can be

recorded and replayed on identical equipment, always provided that the "phasing" of the two channels is correct in each case. By international agreement, what is known as the "45/45" system has been adopted as standard. In this system, the modulation of one channel is "carried" on one wall of the groove, and that of the other channel on the opposite wall. Because the stylus is spherical in shape, it is supported by both of the walls, and it would therefore appear that the statement above is a contradiction of terms. Let us examine the physical movement of the stylus:

Fig. 1 (a) shows the variation in groove profile over one cycle of modulation for channel "A," and Fig. 1 (b) for channel "B." These two cases assume no modulation in the other channel. It is thus seen that although the stylus is in fact

supported by both walls of the groove, the motion of the stylus point is at 45° to the normal plane of the record, and the apparent contradiction is explained!

Fig. 2 (a) shows the effect of putting the same signal (i.e., identical in amplitude and phase) to both channels. It will be seen that the lateral movements, being equal and opposite, cancel—and the stylus thus moves only in a vertical direction. If the phase of channel "B" is reversed (i.e., shifted by 180°) the movement in a vertical direction will now be zero for equal signals, whilst the lateral modulation will be maximum, see Fig. 2 (b).

A Warning!

This concept is most important, because the recording companies actually "phase" the two channels in this manner in order to obtain a "compatible" record, that is, one which can be played on a monaural system. And here, a word of warning: **DO NOT try to play a stereo disc with even the best currently available monaural pickups.** The disc will be ruined!

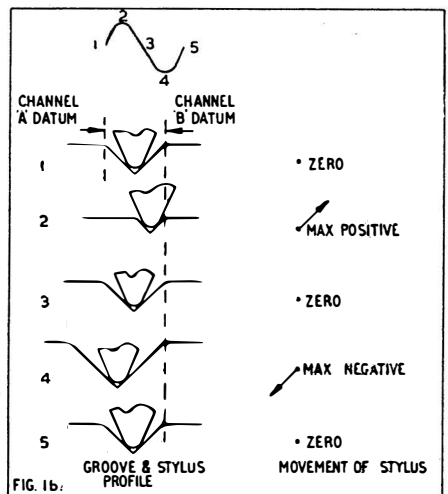
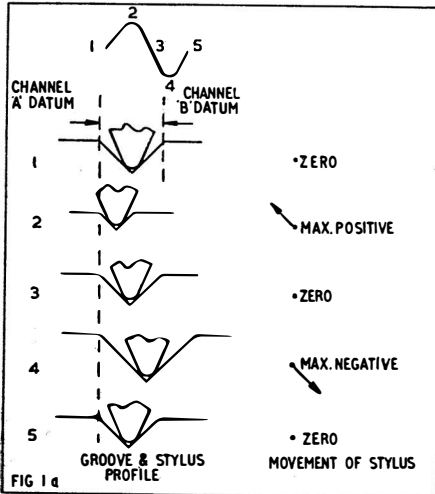
This 180° phasing brings another important advantage; the effects of tracing distortion can be reduced, and to this end the radius of the stylus is now 0.0005 inch (half thou). Additionally, this materially reduces the high frequency transfer loss, but because the record/stylus compliance is increased, the resonant frequency is reduced. To obtain the same upper frequency resonance as on normal lp discs, the effective stylus mass must be reduced by about 40 per cent.

From the foregoing it is apparent that the pickups must contain two sensing elements driven from one stylus: element (a) to respond to channel "A" modulation only, and element (b) to do likewise for channel "B." Any spurious response will show as "crosstalk," that is, channel "A" modulation appearing on element (b) output, and vice versa. The ideal is infinite rejection; but in practical records and pickups 40 dB (100:1) is aimed at, and a maximum of about 30 dB can be achieved in the middle frequencies, deteriorating to about 7 to 10 dB at the extreme ends of the frequency spectrum (40 cps and 12 Kc/s). If a resonance occurs anywhere in the recorded band the crosstalk can become very bad, and in some cases the output from the other channel could well be greater than the wanted one.

Two Main Systems

There are two major types of pickup systems: (a) output directly proportional to 45° modulation, and (b) output directly proportional to lateral and vertical modulation. (a) is self-explanatory, but (b), which is also named the "sum and difference" method, needs explaining.

Examination of Figs. 1 and 2 will show that, at varying levels and phase differences of the time channels, the instantaneous position of the stylus can be up or down and left or right of its "zero modulation" position. By judicious application of a little mathematics we can show that for Fig. 2 (b) (which is the practical case for commercial records) the lateral



These two diagrams show groove profile variations—1 cycle for each channel

displacement is equal to the sum of two 45° modulations, whilst the vertical displacement is the difference. The method of separating the two components at the pickup output will be dealt with later.

45° Pickups.

(a) **Magnetic.** Fig. 3 shows in schematic form a variable reluctance type of pickup. The pole pieces are chamfered to 45° and the armature is likewise contoured. Movement of the stylus in direction "A" will result in a varying separation between the armature and pole Y, thus altering the reluctance in the "A" magnetic circuit and inducing an EMF in coil "A." At the same time, the armature is moving parallel to the pole X, and the reluctance in "B" circuit will not change, thus no voltage will be generated in the coil "B." Exactly the same state of affairs in reverse will operate when the stylus moves in direction "B."

Precision Manufacture Essential

This is probably the simplest system which can be obtained. It needs precise control in manufacture to make sure that the faces of the armature and poles are exactly at right angles to each other, and that also the adjacent faces are parallel. When correctly constructed the results are extremely good.

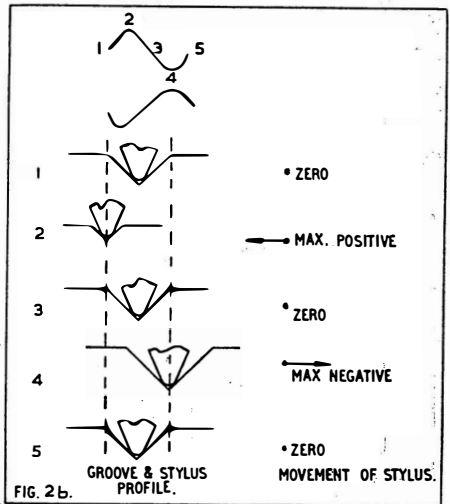
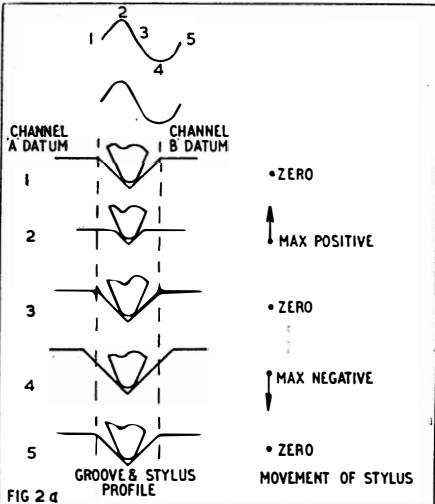
A variation of this is to make the system into a "Balanced Armature." This has the advantage of a completely closed magnetic circuit, but is a costly and difficult manufacturing proposition. Fig. 4 shows the general scheme; the polarising

magnet has been omitted for the sake of clarity, the coils are wound on opposite limbs, are connected in series, and form the two electrical circuits "A" and "B." Because the armature is of square section, whilst the reluctance is being varied in, say, circuit "A," the adjacent faces of circuit "B" will be moving in a parallel direction and their reluctance should not vary.

Balanced Armature System

The balanced armature system is considerably less sensitive to external variation (such as hum pickup, etc.) than the "open" magnetic circuit system, and its efficiency and harmonic distortion can theoretically be considerably improved. In practice however (especially because of the low magnetic efficiencies encountered in magnetic pickups) the harmonic distortion generated due to the flux varying in a non-linear manner is usually negligible with either type. The ultimate choice between the balanced armature and the variable reluctance pickup depends upon the hum field of the motor (and, if the power amplifier is mounted close to the motorboard, the external magnetic field of the power transformer). Usually, the balanced armature system is about 10 to 15 dB better as regards hum pickup than the variable reluctance.

(b) **Crystal.** The two classes cited above use a main moving element in which the "sensing" is generally in two electro-magnetic circuits. It is possible to apply the same philosophy to crystal car-



Channels can be phased to produce only vertical, or lateral, movements of stylus:

tridges. As is well known, if a correctly oriented slab of, say, Rochelle Salt, is cut from a crystal, application of a potential across the two faces will result in a stress being applied at 45° to the Y and Z axes, see Fig. 5 (a). Conversely, if a force is applied in the directions of the arrows (a) a charge will be developed across the two

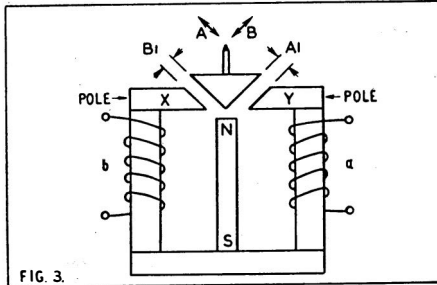


FIG. 3.

Schematic form of a variable reluctance stereo pickup

electrical faces, and this will show itself as a potential which will be directly proportional to the applied force.

If the two slabs of crystal material (one parallel to the Y and Z axes, and the other at 45° to those axes) are now cemented together, as shown in Fig. 5 (b), the upper slab will generate a potential when a vertical force is applied, whilst the lower slab will generate a potential on application of a torsional force. Thus, the assembly of 5 (c), in which the stylus is rigidly connected to one end of the bimorph whilst the other end is clamped, will enable the vertical and lateral modulations of the stereophonic groove to be transmitted to the two crystal elements; a voltage proportional to the vertical movement being obtained from the bender section, whilst the torsional section will effectively translate the lateral undulations of the groove.

In using this system, a method of obtaining sum and difference potentials must be used in order to retranslate the lateral and vertical motion of the stylus point into "45/45." It is possible to make the two sensing units completely separate, and to drive them via a bridge, as shown in Fig. 6, and one well-known crystal pickup manufacturer is producing a unit on these lines. The crystals are mounted at 45° to the normal, and movement of the stylus causes the appropriate crystal to flex. The yoke demands special consideration because it must be extremely rigid in the X direction to drive the crystal when the stylus motion is perpendicular to it, but at the same time it must be as flexible as possible in the Y direction when the stylus is moving at right angles to it. The degree in which these conditions are obtained will determine the freedom from cross-talk of the complete system. By a slight re-arrangement of the yoke it is possible to use torsional instead

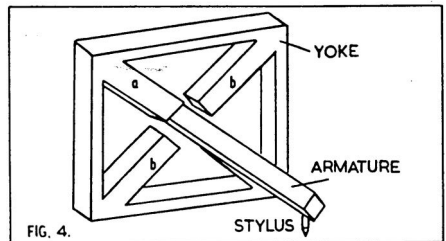


FIG. 4.

Basis of a balanced armature stereo system

of bender crystals, with a consequent increase in frequency response, due to the smaller reflected dynamic mass when the crystal is operated in a torsional manner, than when used as a bender.

The major advantages of the crystal unit are a high output voltage for a given playing weight, and simplicity and cheap-

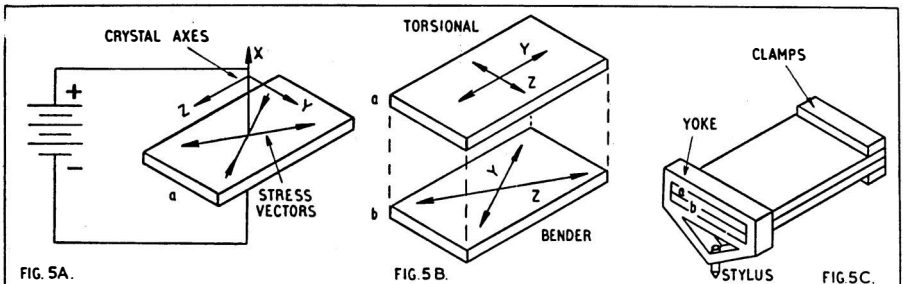


FIG. 5A.

FIG. 5B.

FIG. 5C.

These diagrams explain the basis upon which a crystal stereo pickup operates

ness of construction; but because of the higher effective dynamic mass the frequency response is somewhat restricted, compared with equivalent magnetic types. And when it is remembered that all these pickups will be played with a half-thou stylus, and probably with a maximum playing weight of 3 grammes, the maximum mechanical impedance which can be presented by the stylus to the record groove is seriously limited. Current experimental crystal cartridges show a fairly severe top cut above 8 or 9 Kc/s and the dynamic mass referred to the stylus tip is usually of the order of 12 to 15 milligrams compared with 0.5 to 2 milligrams on the best magnetic and dynamic units.

Weight and Wear go up together

It has been shown (*Hi-Fi News*, Dec., 1957 and March, 1958) that the stylus, and accordingly record wear, increase enormously with increased playing weight and reduced stylus diameter. For example, a half thou sapphire stylus has a "life" of about 4 to 5 hours at a playing weight of 7 grammes, but this increases to 70 hours at 3 grammes, and to 130 hours at 2 grammes. Using a diamond should increase the life of the stylus by about times 40; in point of fact, after a playing time of 2,400 hours at 2 grammes, the "flat" on a diamond point is still less than 4 microns.

In the moving coil system, two coils at 45°, as shown in **Fig. 7**, operated by small cantilevers, have been very successfully used as a recording head, but for use as a reproducer it suffers from the severe disadvantage that the dynamic mass is equal to the static mass of the coil, and it is extremely difficult to get the combined masses of the coils and assemblies below about 20 milligrams.

In the simple system, the major difficulty must always be in maintaining equal sensitive and low cross talk over the whole of the frequency range of both channels. This difficulty is considerably eased in

systems where sum and difference techniques apply. That is, where the two sensing elements respond to lateral and vertical motion only, and when the outputs are combined in such a manner as to separate the components 45/45.

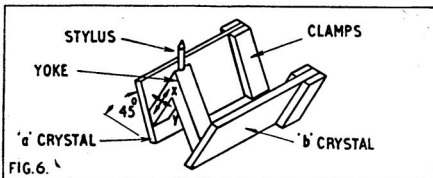
Fig. 8 shows the basic principle in schematic form. Coil A responds to vertical motion only, whilst coil B, which is centre tapped, responds to the lateral modulation only. Each half of coil B has the same number of turns as coil A. Moving the assembly in a vertical direction will result in a voltage developed in coil A only, whilst moving the coil in a lateral direction will result in an EMF being generated in coil B only.

If the assembly is now moved at +45° to the horizontal, a voltage will appear between the common terminal (E) and the two signal terminals (F and G), in which F will be the sum of the voltages in coil A and half of coil B, and G will be the difference.

If modulation is applied to one channel only, the voltages (v) in each half of coil B and the whole of coil A will be equal, therefore we shall obtain 2v from terminal F and zero from terminal G. Conversely, if the modulation is at -45° (i.e., the other channel only modulated) the conditions will be reversed and zero potential will be obtained from terminal F and full (2v) potential from terminal G.

Methods of Mixing

This mixing can be done either electronically by means of valves or transistors, or by using transformers, or by simply winding the appropriate number of turns on the pickup coils. In the case of a moving coil transducer, average values are 20 turns centre tapped for the lateral coil, and 10 turns for the vertical coil. The coupling transformers have an impedance ratio of about 25,000:1, whilst for magnetic units, about 5,000 turns would be used for the vertical coil, and 10,000 centre tapped for the lateral coil.



Method of driving "sensing" units by a bridge

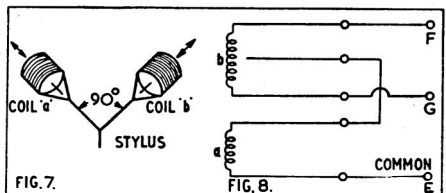


Fig. 7—Two cantilevers arranged for a cutter head

Fig. 8—The basic principle in schematic form

Fig. 9 shows a successful design of a magnetic pickup in which the cantilever is used as the vertical sensing element, whilst the "flapper" affixed to the bearing member of the cantilever is used for the horizontal transducer. This method has the advantage that, for lateral modulation which has the larger value, a push-pull closed circuit is used, whilst single-ended only is used for the vertical modulation.

Various moving coil systems have been postulated, but details of the units likely to make their appearance in the coming year have not yet been released.

The required mechanical constants for stereophony are that the vertical and lateral masses shall be equal. The compliance shall be of the order of 5×10^{-9} cm/dyne, whilst the dynamic mass should, of course, be an absolute minimum, and effective masses of the order of 2 to 3 milligrams should be considered as maximum design parameters. Because of the high compliance and small tip radius, a maximum playing weight of 3 grammes is mandatory, and because of the small playing weight particular attention must be paid to the design of the tone arm.

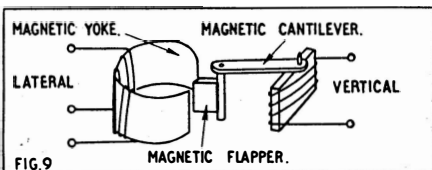
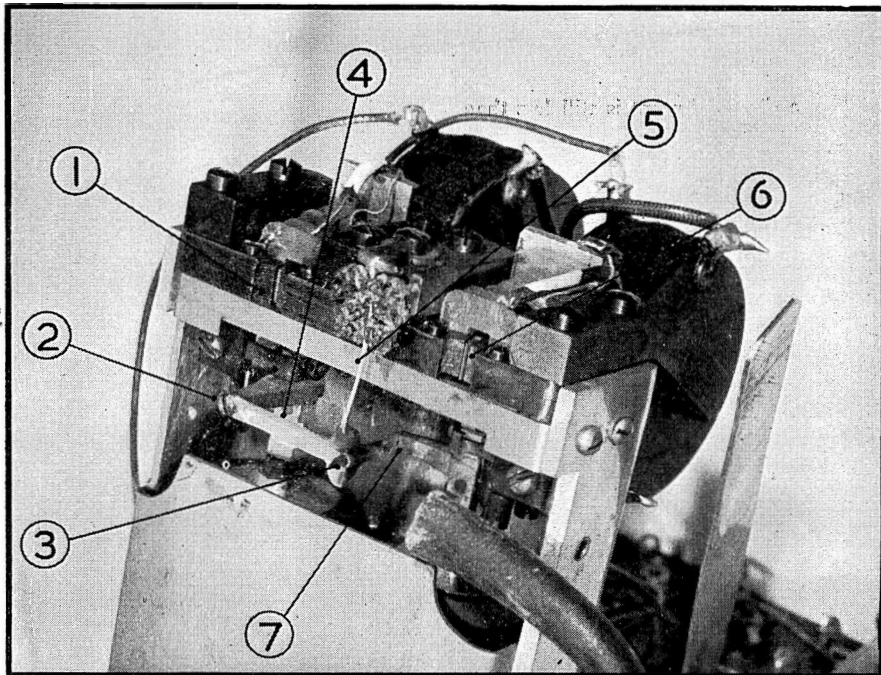


FIG. 9
A practical magnetic stereo pickup

Side thrust, due to offset angle and overhang, should be minimised as much as possible, and the friction of the back bearing should be less than 2,000 dyne cms. With two notable exceptions, no commercially available tone arms meet this stringent requirement for friction.

With monaural recordings, motor rumble is not excessive with high grade pickups in which their response in a vertical direction is very low, but with stereophonic recordings, where the pickup is virtually sensitive in all directions, the degree of unbalance (which is the prime cause of motor rumble) of the motor and turntable must be reduced considerably, and there will shortly be a call for "high quality" transcription turntables, with considerably reduced "rumble" compared to present-day turntables.



The experimental "moving iron" complex cutter head used by Blumlein in 1933 for making his stereo discs. The armatures of the two heads are shown in (1) lateral and (6) vertical. The stylus (3) is held by a tie wire (5) and is connected to the vertical armature by the link (7) and to the lateral armature by the links (4) and (2)

STEREO PRE-AMPLIFIERS

By H. Lewis York



The first stereo pre-amplifier to appear in the U.K. is illustrated above. Designed by the author for "Hi-Fi News", it is now available in Constructor's Kit form by Jason, and complete from Cape Electrophonics Ltd.

THE electronic link between a two-channel or stereo input signal and two loudspeakers is, basically, an identical pair of pre-amplifiers and amplifiers of the conventional type. For the highest possible quality of reproduction, each channel should be designed to be equal to the best available monaural pre-amplifier and amplifier, and all controls should be ganged so that adjustments to the volume level and the frequency characteristic are duplicated in each channel. Such equipment consists of a stereo pre-amplifier (such as that described in the March, 1958, issue of **Hi-Fi News**) with two similar main amplifiers of the best quality. The stereo pre-amplifier can be powered from one of the main amplifiers or from a separate power unit.

Two Smaller Amplifiers

As there are two sources of power in stereophonic reproduction, some reduction of power in the channels can be tolerated in practice, although it is theoretically possible that the signal might at times

consist of full power in one channel only. A good quality stereo system might therefore consist of the stereo pre-amplifier referred to above, with two small amplifiers, each capable of an undistorted output of some 5 watts.

A Fairly Wide Choice

In many cases the expense of a stereo system involving a new pre-amplifier will prove too expensive, and a less comprehensive arrangement will be adopted, using an existing pre-amplifier and main amplifier for one channel, and an inexpensive pre-amplifier and amplifier for the second channel. As this is most likely to be considered when stereo gramophone records are available, the equipment in the second channel need not be of the type which will operate from a tape head direct. Tape sub-amplifiers of the kind described in **Hi-Fi News** for July, 1957, can always be added when required. Many inexpensive pre-amplifiers and amplifiers are available, and reference should be made to the Directory section

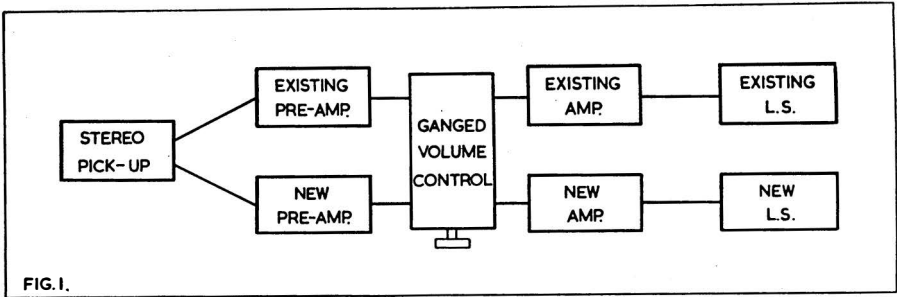


FIG. 1.

Fig. 1. A stereo set up using an existing pre-amplifier and amplifier. The ganged volume control, details of which

are given in **Fig. 2**, may conveniently be placed in the signal leads between the pre-amplifiers and amplifiers.

of the Year Book and to **Hi-Fi News** test reports. A power output of 5 watts will be adequate, except when the equipment is to be used in a large room; but it is necessary to ensure that there is sufficient gain to operate from the chosen stereo pickup.

The Importance of Balance

When separate pre-amplifiers are used, tone controls should initially be set to the level position, and then varied with care. The volume controls are adjusted for a suitable listening level and for stereo balance. In many cases—and in particular when the second channel is a pre-amplifier and amplifier of the same type as the first—the provision of a ganged switched volume control is well worth consideration. This can be connected in the signal leads between the pre-amplifiers and amplifiers, as indicated in **Fig. 1**. The switch can be a **Walters** type WS 2530,

mounted in a metal box approx 2½ in. x 2½ in. x 5½ in. deep. The resistors required and the connections to the switches is shown in **Fig 2**.

In use, the ganged control is set to maximum, and the individual volume controls are set to the highest volume level likely to be required and for stereo balance. The ganged control will then reduce the volume, in both channels equally, to that required.

For Home Construction

Since the above notes were written, **Hi-Fi News** has commissioned the author to design three alternative versions of a medium-powered amplifier for home constructors. These will work in conjunction with the twin-channel pre-amplifier already described. Constructional details appear in **Hi-Fi News**, from May, 1958, onwards, and will also be available in reprint form.—(Editor).

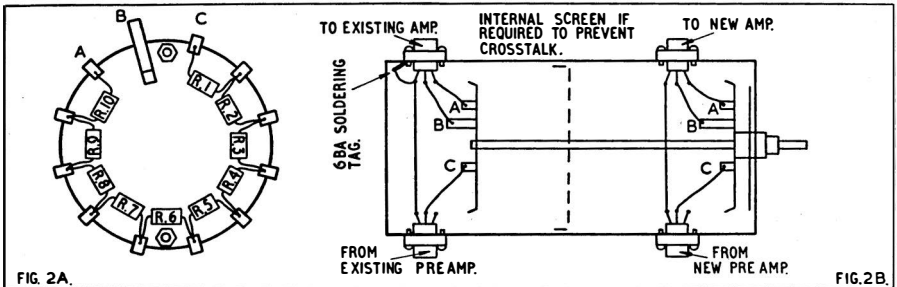


FIG. 2A.

FIG. 2B.

Fig. 2 (a) One wafer of the **Walters** WS2530 switch used in the **Hi Fi News Stereo Pre-amplifier**, viewed from the rear. The resistors are ¼ or ½ watt 5%, R1 47K, R2 22K, R3 15K, R4 10K, R5 4.7K, R6 2.2K, R7 1K, R8 470, R9 220, R10 100. **Fig. 2 (b)** Connections for a ganged volume control consisting of two similar

wafers carrying the resistors shown in (a). The metal box is a minimum size of 2½ ins. x 2½ ins. x 5½ ins. deep. The sockets are insulated coaxial **Belling & Lee** L603. The box is earthed by a connection to a soldering tag fitted to one of the bolts securing a coaxial socket.

STEREO VIA RADIO

By R. S. Roberts

STEREO promises to play a large part the field of high quality reception in the future. However good the quality of reproduction may be on a single channel system, it must obviously be more realistic if a second channel is added to provide a further "dimension."

Twin track tapes have been available for some time and stereo disc recordings will shortly become available, but very little progress has been made in the provision of stereo radio programmes.

No fundamental difficulty exists in the possibility of broadcasting such programmes. All that is necessary is that two signals are radiated, each being fed from its own microphone suitably disposed in the studio.

Despite the technical ease with which stereo can be broadcast, some understandable caution on the part of broadcasting authorities exists in the absence of agreed standards, a limited demand, and the economics involved in running two transmitters for the same programme. In addition, an overriding consideration is that such broadcasts must be compatible, i.e., **they must provide a normal programme signal when received on a normal receiver.**

UK and US experience

Some experiments have been made in this country, and a recent experimental transmission by the BBC aroused considerable interest. In this test two channels were used; these were the television sound (and the FM Third programme) for the left-hand channel, and the medium-wave Home Service (and the FM Home Service) for the right-hand channel. These alternatives made it possible for a variety of receiving equipment to be used.

In America, many experimental two-channel transmissions have been made

from time to time, some using an AM and an FM transmission.

These systems require a duplication of the rf tuning equipment, in addition to the usual duplication of af equipment, and in this respect the US system of "FM Multiplex" is more interesting. The Multiplex system requires one FM tuner and an adaptor for extracting the second channel.

FM Multiplex

One of the properties of FM is that, in the event that two signals find their way into the receiver, the stronger signal will be accepted and the weaker rejected. Armstrong (who can be said to have originated the modern FM system) showed as long ago as 1936 that the FM system is peculiarly suitable for the transmission and reception of more than one channel, and it is upon his work that modern "Multiplexing" has been developed.

The first public demonstration was in 1950, when the Multiplex Development Corp. showed that it was possible to transmit two independent music channels from a single FM transmitter. Subsequent development has resulted in a service where, on a subscriber basis, a choice of various programmes and programme combinations can be made. (It is even possible to have a programme of continuous music, free from advertising announcements!) In 1955 the FCC gave official blessing to FM Multiplex.

The principle involved is relatively simple. It is well known that, if an FM transmitter is fully modulated to produce a deviation of 75 Kc/s, the overall bandwidth necessary to transmit the signal without distortion is over 200 Kc/s, and a normal single-channel system is designed on this basis. Fig. 1 shows, in schematic form, the principle involved in transmit-

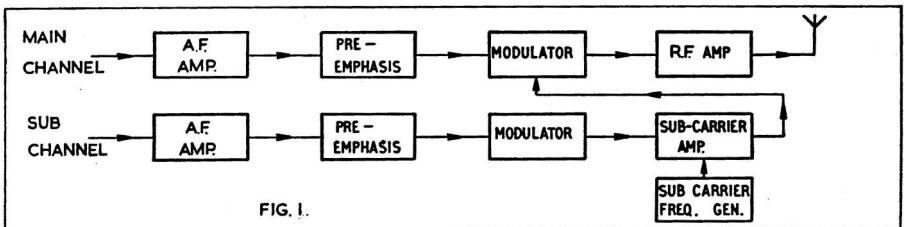


FIG. 1.

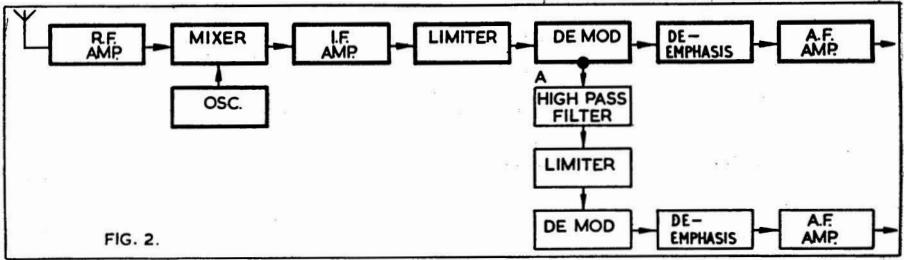


FIG. 2.

ting the usual "main" channel plus a "sub-channel." A sub-carrier frequency is chosen, and modulated by the second audio channel; it is then used to modulate the main transmitter amplifier, along with the modulation due to the main channel.

The sub-carrier frequency is high. It must be at least 20 Kc/s or so above the upper frequency limit of the main channel and, if this limit is assumed to be 15 Kc/s, the sub-carrier frequency has a minimum value of about 35 Kc/s. In the United States sub-carrier frequencies of 35, 41 and 67 Kc/s have been used.

Fig. 2 shows a normal FM receiver, outlined in heavy lines, for the main channel. From the point marked "A" is shown the method of extracting the "sub-channel." The output from the demodulator is passed through a high pass filter which stops the main channel frequencies, but which passes the sub-carrier with its modulation; the remainder of the sub-channel system follows normal FM receiver technique. (It should be noted that "Multiplex" in its US form is more complicated than shown in Fig. 2. Other sub-carriers are used, and control signals are transmitted to ensure that only authorised subscribers can receive the sub-carrier programmes. Most standard American FM receivers have an outlet corresponding to the point marked "A," and the sub-channels are extracted by an "adaptor" connected to this point.)

Multiplex requires wide-band i.f. and demodulator circuits in the main receiver, but is otherwise quite standard and compatible. It offers a relatively simple

method for obtaining the two channels necessary for stereo.

Other systems

The Multiplex system is particularly suited to FM conditions as they exist in the USA. One FM transmitter will be operating in any one area, unlike the FM system in this country where three programmes are radiated in any one area. It would seem, therefore, that a stereo system similar to that already tested by the BBC is most likely for conditions in this country. This would require two r.f. tuner channels, or some switching system.

If two of the FM transmitters were to be used for a stereo transmission, it would be possible to switch the oscillator frequency of an FM receiver at sub-sonic or super-sonic speeds by means of a suitable oscillator circuit. The audio output could be simultaneously switched to the audio channels.

A particularly attractive system would be possible if it were decided to use only the FM service for stereo. Over most of the country, the spacing between Home and Third, and Third and Light programmes is 2.2 Mc/s. By dividing off the i.f. output after the mixer into two i.f. channels, as shown in Fig. 3, it would be possible to provide the two channels with relative ease. Fig. 3 assumes a channel A on 90 Mc/s and a channel B on 92.2 Mc/s. The oscillator, set to a frequency of 100.7 Mc/s, would provide an i.f. of 10.7 Mc/s for the A channel, and 8.5 Mc/s for the B channel. The main attraction of this system is that the idea could be extended to utilise all three FM channels to provide a real "3 D" stereo system.

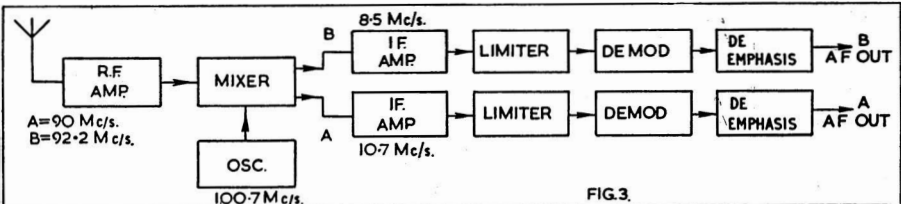


FIG. 3.

SPEAKERS FOR STEREO

By Ralph West

STEREO tapes have been with us for some time now, and an ever increasing number of people have thus been able to enjoy stereo in their homes. At the moment there is great excitement over the prospect of stereo discs becoming available within a short while, therefore many more people are naturally turning their thoughts stereowards and are wondering what to do about it. Let it be said at the outset that two channel stereo is not really stereo in the true sense of the word.

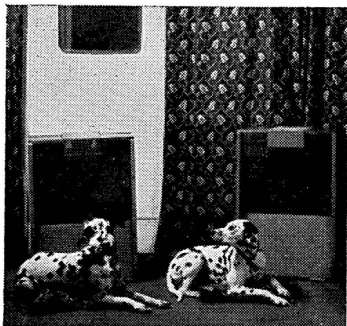
For that we need five or seven channels! Economic considerations, however, limit five- and seven-channel systems to the film industry at the moment—and probably for a long time to come!

The reasons are still unknown

In actual fact it is not yet fully understood how our senses decide on the direction of a source of sound. Some of the mechanism is known, but the knowledge does not give the straightforward help towards an understanding of how two-channel stereo works. In fact, from our present knowledge it would probably be easier to prove it couldn't work! Despite this, it does work, and well enough to be really worthwhile for domestic use!

All this is mentioned to help explain the various divergent views on the way to organise two-channel stereo, both at the microphone and the speaker ends of the chain.

At the microphone end, the two microphones are sometimes placed one on top of the other to get them as close together as is humanly possible; sometimes fairly close together with a screen or something in between; sometimes quite wide apart. At the receiving end there are likewise various fashions—directional speakers at different distances apart and pointing in various different directions, and omni-



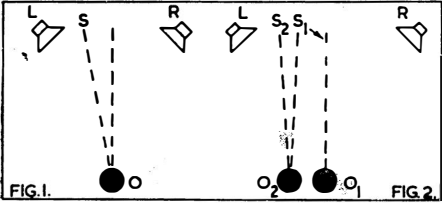
In this now familiar picture of the two Hi-Fi Dogs, two BK type LPR103s are illustrated.

directional speakers. Various authorities recommend quite different methods.

The sound image

Two channel stereo is possible because of the following phenomenon. If two loudspeakers L and R as in **Fig. 1** are fed with the same signal, and their relative signal inputs are varied, the apparent source of sound appears to move fairly smoothly across the space between them. It appears central when they receive the same signal, assuming them to be identical. Thus sound will appear to come from a position left of centre when the LH speaker is a little louder than the right. In this case the left ear will receive a little more sound than the right ear. The ear on the side nearest a sound source always hears a little more than the other ear, because of the shielding effect of the head. Turning the head slightly towards the left will balance up their two inputs, as the right ear will no longer be "so far round the corner" as far as the LH speaker is concerned. This is just what would happen if the source were really at S. So far, so good!

There are other things, however, that will also alter the apparent position of the source. If the sound reaches the left ear before the right ear, the source appears somewhere on the listener's left. This might occur in spaced-microphone type of recording, and the results would be quite



in order. Unfortunately it also occurs when the observer moves off the centre line as in Fig. 2. If the loud-speakers are operating at the same level and in phase, i.e., no time differences between them, then when on the centre line the sound will appear central; but when sitting left of this line the apparent source will tend to move an even greater distance left of centre, possibly right over to the LH speaker. A five-channel system (or better still, the seven-channel system) would not of course exhibit this defect. It can also be seen that such a system would be necessary to cover the whole width of a cinema audience. This phenomenon, wherein our sense recognises the direction of a noise as that direction from which the very first sound to reach the ear, is known as the Haas effect.

Directional speakers

F. H. Brittain demonstrated that the movement of the apparent position can be offset by cunning speaker arrangements. Directional speakers pointing so that their axes cross over in front of the proposed listening area are used (Fig. 3). When the observer moves from O₁ to O₂, though he is nearer to the LH speaker, the Haas effect is offset by having moved into a stronger part of the RH beam (and into a weaker part of the LH speaker beam). Experiments have been made, and they show how many dB extra from the RH speaker beam will offset so many milliseconds lead of the LH speaker's sound. The necessary speaker polar diagrams have been calculated and it is not impossible to design such speakers. It is, however, very difficult to get the same pattern of distribution at all frequencies. While this

spoils the scheme somewhat, it does not completely wreck it, since stereo effects depend rather more on the higher frequencies, where the desired polar distribution is most likely to be achieved.

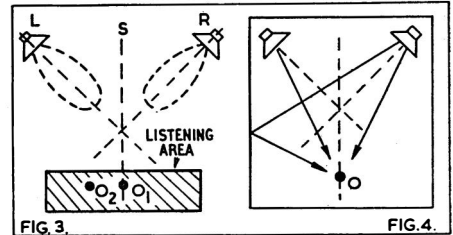
Reflections from walls

There is a far more serious factor to be considered—reflection from the walls of the room. Whilst this may not be serious for a large number of seats in a very large hall, it is a major item in our homes. (Fig. 4.)

Of all the (two channel) stereo the writer has experienced, the arrangements using omni-directional speakers have always been the more convincing. A series of experiments under domestic conditions are in progress and, while by no means complete, the results so far are overwhelmingly in favour of omni-directional speakers.

The HF content

This is all very disturbing in view of the previous reasoning, but an explanation has come to light, and has been checked on many occasions. When listening with directional speakers the HF



sound almost invariably comes from a relatively small area in space. This concentrated sound source stands out, as it were, when there is much energy at that end of the scale. This continually attracts the attention of the listener to one or other of the speakers. (Fig. 4.) Transient sounds of large amplitude like record surface noise and tape overload (too much top boost when recording, probably) are very noticeable and are still noticeable well off the axis of the speaker. Using omni-directional technique (Fig. 5) the effective sound source is generally much larger, due to the use of some reflecting device. It is still further increased in size by reflection from the adjacent walls or corner. The distracting effect of the concentrated source is thereby removed.

Striking confirmation of this effect was experienced at a stereo demonstration recently. Conventional forward-radiating loudspeakers were in use, and the stereo results were actually better on the whole when listened to through a forest of heads and shoulders! These effectively shielded the listener from the direct HF "splashes."

Identical pairs tested

Going back to the domestic experiments, tests were made to see whether the benefit lay rather with the make of speaker than with the omni-directional property. Several identical pairs of speakers were tried in all the 4 positions shown in Fig. 6, and a selection of tapes played ad nauseum! Positions 6a and 6b were on the whole the best, but 6c (favoured by some US authorities) and even 6d gave reasonable results. Then the speakers were laid on their backs, and 6in, wooden cones were placed over the speaker centres as shown in Fig. 7. (See also **Hi-Fi News** April, 1958—"HF Diffusers") The results were so strikingly improved that all the assembled group had no doubts as to which system was the best. Two of the pairs used were Lowther **Acousta Cabinets** with PM6 units, **CQ Seniors**. The reflecting cones were placed over the tweeter units in the CQ speakers.

"Effects" tapes

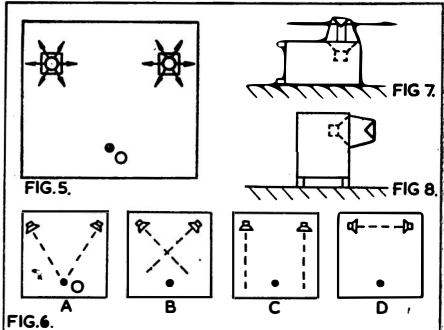
Two of the most interesting tests were two short items on one of the tapes—an aircraft flying over, and a wooden ball rolling along a skittle alley. Only with the omni-directional speakers was a smooth "transit," free from hops, etc., obtained. The ideal listening position was still, of course, on the centre line, but the degree of deterioration on moving to the side was definitely less than the best obtainable with the speakers used directionally.

The sound is spread

Even when well off the centre line the overall effect is much better than single channel with one speaker. The programme then sounds less as though it came out of a loudspeaker. The room, in fact, becomes an extension of the auditorium. Only the location of individual sounds becomes less precise. With the two speakers used directionally as in Fig. 6A, even putting the diffusing cone in front of the speaker as shown in Fig. 8, produced a marked improvement! All

wrong, but it added weight to our decision, and was quite acceptable to listen to incidentally!

Tests were also made with several combinations of different pairs of loudspeakers. Before using stereo, the pair were balanced up for sensitivity on a single input—full track tape was the handiest method available. Phasing was decided by ear on the basis of the sound appearing concentrated straight ahead. Out of phase usually produces 3 sources—ahead, and one at each speaker. Deep bass also suffers if the phasing is wrong.



As long as both speakers were omni-directional or approximately so, and had comparable HF responses (rather important) very satisfactory results were obtained. Some of the combinations rearranged the orchestra somewhat, but the main benefits of two channel stereo remained—"spaciousness" is the word often used. Two of the "odd" speakers used were the **Decca Corner Speaker** with PM6 unit and the **Wharfedale SFB/3**.

Identical speakers not essential

Well, there is much yet to find out, but it can confidently be said that with our present knowledge of two channel stereo and our existing loudspeakers, it is very well worthwhile. While two identical speakers are ideal they are not necessary. Omni-directional speakers appear to be superior—that is, omni-directional as far as high frequencies are concerned, and preferably omni-directional at mid frequencies, too. All cabinet speakers are omni-directional in the bass. Directional speakers can very simply be modified (see Fig. 8) to give workable results. Fig. 7 is much better if it can be done.

The reader is also referred to the article "Semi Stereo" in the February issue of **Hi-Fi News**.—R. L. W.

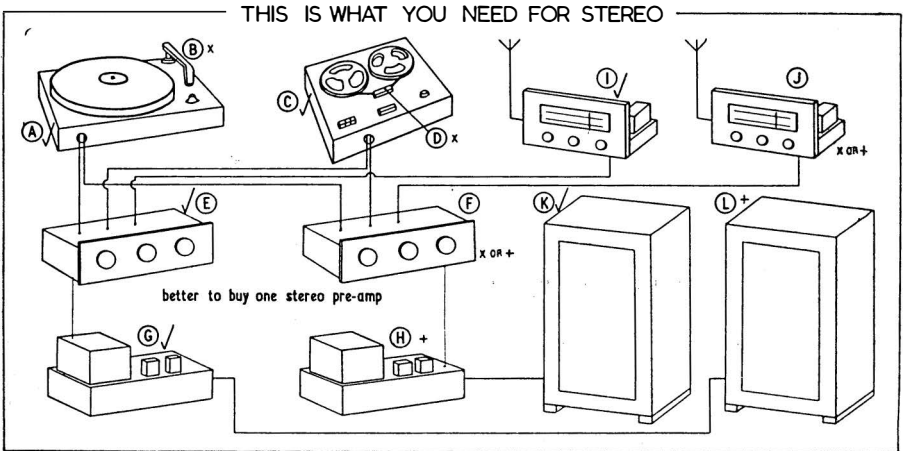
STEREO FROM TAPE

TO many it may seem strange that stereo from tape has not "caught on," in view of the fact that it has been available for more than two years, and that such enthusiasm is now being shown over stereo as a whole. The truth is, apparently, that tape is still ahead of its time for the average household ; and this is in no small measure on account of the comparatively high cost that is involved. Nevertheless, it would be very rash to assume that tape will now take a back seat, with the advent of stereo discs : on the contrary, there are several very good reasons for supposing that tape will gain favour as a result of stereo.

There are no reliable statistics for assessing the number of Hi-Fi enthusiasts whose equipment includes stereo, but they can certainly be counted in hundreds, and no more. On the other hand, there is already very reliable evidence that several hundreds more enthusiasts had, in the first three

months of 1958, either ordered or begun to build up stereo pre-amplifiers. This is only the initial wave of interest which followed the release of the news that stereo discs were coming. It is a wave which will be followed by others of increasing size. Then, when the necessary equipment has been installed for stereo disc replay, there will be very little extra expense involved in order to add the facility for stereo tape replay. For those with good tape decks it will probably amount to £10 or so for a stereo replay head. For others, a tape deck plus head for perhaps £30.

E.M.I. Ltd. have been steadily adding to their Columbia and H.M.V. tape catalogues over the past two years, and the April, 1958, release brought the totals of stereo tapes to 113. These include complete operas, symphonies, dance music and popular numbers. There is thus a really fine stock of material available for those who decide to include tape in their stereo plans.



For stereo from every possible source, disc, radio and tape, the Hi-Fi set-up would have to include all the above items. A "tick" indicates what is still useful for stereo, and an "X" shows what must be changed—for instance, B, the pickup ; D, the tape head ; and possibly E and F, the pre-amplifiers. A "+" shows the extras that must be added—tuner, amplifier and speaker

PICKUP PROGRESS

By Stanley Kelly

THE 1957 HI-FI YEAR BOOK produced a catch of four new crystal cartridges and five magnetic units. In the past year the fish have been extremely elusive, and instead of reporting new cartridges we must content ourselves with the review of development. The absence of new cartridges is probably due to the imminent release of stereophonic disc replay equipment. All manufacturers' energies have been bent in this direction. Solid progress has however been made towards the very material advantages of super light-weight pickups.

Lower and lower playing weights

During the past year various engineers have pointed out the immense advantages in record and stylus life by reducing the playing weight of the pickup to values below two grams. It has been shown that with playing weights in excess of about 2 grams the record is stressed beyond its elastic limit, so permanent deformation (and hence damage) to the grooves is occasioned on the first playing. In the transition stage between $\frac{3}{4}$ gram and 2 grams some plastic flow takes place, but the majority of the stresses

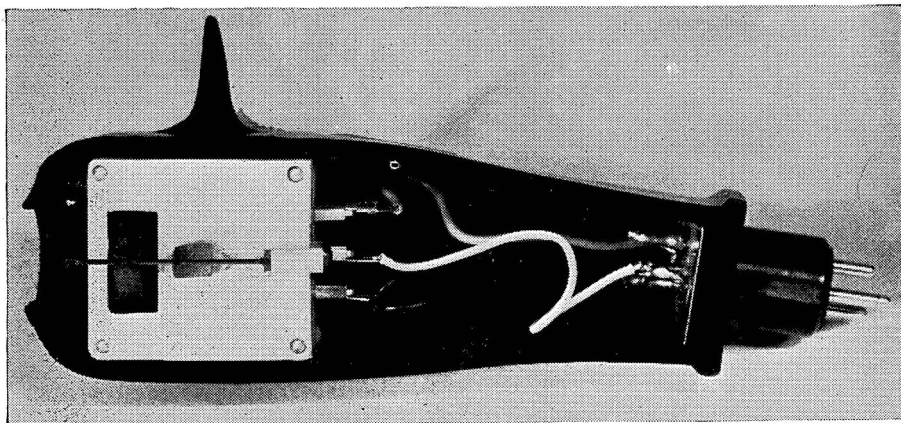
are purely elastic, whilst on playing weights of the order of $\frac{1}{2}$ gram only elastic deformation of the record takes place. Under these conditions the life of the record is increased phenomenally.

Life depends upon care, as ever

At a playing weight of 7 grams, with a well polished diamond, and using the Dust Bug for continuous record cleaning, record life of the order of 100 to 120 playings is obtained before the signal-to-noise ratio has decreased by 3 dB. Reducing the playing weight to $\frac{1}{2}$ gram increases the life to better than 1,500 playings.

The fly in the ointment is, of course, to obtain a pickup which will satisfactorily play a record at $\frac{1}{2}$ gram. Just reducing the playing weight of even the best available cartridges to $\frac{1}{2}$ gram will not do the trick ; all that will happen is that the stylus will jump out of the grooves on loud passages, and will probably ruin the record.

The art of pickup design and manufacture is rapidly approaching the proportions of watch-making, and whereas only three or four years ago one talked of super light-



The first of the new—an Acos stereo pickup which is now in production. Many others are on the way, and will doubtless be standard products in 1959.

weight pickups, in which the mass of moving parts was in the order of 10 milligrams, in modern designs it is between .3 and .5 milligrams at best. Concurrently, the compliance has to be increased almost tenfold over present-day pickups and is of the order of 20×10^{-6} cms/dyne. This extremely high compliance brings difficulties in the way of friction and stiction in the tone arm bearings, whilst the moment of inertia of the system has to be correspondingly reduced, otherwise the LF resonant frequency comes down to a cycle or two, and considerably accentuates "rumble."

Rumble Frequencies

The rumble frequencies are usually between 1 and 5 c/s and any resonance in these low frequencies will obviously amplify them. At the same time the problem of transmitted shocks to the motorboard (resulting in the pickup performing a grasshopper dance across the record, unless it is extremely well decoupled mechanically) is very serious.

The very positive advantages, entirely apart from long life of stylus and record, are an extremely wide frequency response, the upper resonant frequency will be of the order of 40 to 50 Kc/s and if the stylus radius is reduced to "half-thou," the high frequency transfer loss and tracing distortion are reduced considerably over conventional one-thou styli. Altogether this results in a much cleaner and sparkling performance of transients and the upper frequencies.

The Case for Variable Reluctance

It would appear that the only satisfactory mechanical solution for these very tiny masses is the variable reluctance type of cartridge, in which the stylus itself is the sum total of moving parts. A diamond stylus is mandatory, and will probably be a 10-thou square section, by 25 thou long, weighing just over one-tenth milligram. The armature itself, which is also the cantilever, will make up the rest of the system, and will weigh about 0.4 of a milligram.

It is unfortunate that, as at present envisaged, moving coil pickups with their superior signal-to-noise ratio, especially as regards hum, have not yet been successfully constructed for these very small sizes, and despite the claims made for an American design, no crystal cartridge has been constructed approaching these requirements.

At the other end of the scale, the advent of transistorised portables has raised a very real demand for a high power output cartridge. High output cartridges are usually associated with crystal devices, which are capable of

giving working voltages as high as 10 volts peak from commercial discs. These high output cartridges of necessity have a somewhat limited frequency range, but they operate very satisfactorily at playing weights of 7 grams, and in view of the acoustic limitations of speakers and cabinets on portable equipment, the frequency response is more than adequate.

These high output voltages are developed from a very high source impedance and the load resistance must usually be in excess of $\frac{1}{2}$ megohm. With transistors the reverse is required. The average input impedance of transistor amplifiers is of the order of 1,000 ohms, and if a crystal cartridge is to be satisfactorily used, some impedance transforming device must be used.

Low Impedance Magnetic Limits

In the case of magnetic units they are naturally low impedance devices, and at least one manufacturer has a design on the stocks capable of giving approximately 100 microwatts from a normal lp record. This high output power results in the saving of at least one transistor over conventional designs. Again, the price is paid in restricted frequency range. We understand that the unit is sensibly flat to about 4 or 5 Kc/s and then "dies away" with alarming rapidity. Listening to the unit with a conventional 9 by 5 loudspeaker (which usually has a shrieking resonance at $3\frac{1}{2}$ Kc/s) does, however, give some semblance of top, and presumably is adequate to annoy one's neighbours on sunny afternoons on the beach.

The record companies are slowly but surely ceasing the manufacture of 78's and it is expected that the newcomer will buy only 45 and $33\frac{1}{2}$ records; the turnover cartridge, after a fruitful life of 10 years, will be expected to die with the 78 record. There is evidence that the "single-ended" cartridge will be prominent again later this year, but with a one-thou stylus of course—and thus the wheel turns.

Stereo/Monaural Pickups

Finally, there are the combined stereo/monaural pickups. Whilst it is theoretically possible to play monaural records with a stereo head, there are a number of cartridge designs coming off the drawing boards which combine stereo on one side and monaural on the other; these use a one-thou point for monaural and a half-thou for stereo.

These new cartridges are expected to make their appearance in 1958, and owners of "steam monaural systems" need not be over distressed at the advent of stereophony.

DIRECTORY OF PICKUPS AND ARMS

★ In the abridged specifications of this directory, the following abbreviations are used for economy of space : S.r.u.—Stylus can be replaced by user ; D.p.—Downward pressure of stylus ; Cms—centimetres per second. ■ Denotes Stereo Equipment

Burne-Jones & Company Ltd., 62 Sunningdale Road, Cheam, Surrey. Tel. : Fairlands 8866/7. Cables : Burjomag, Sutton.

B.J. C/12. Plug-in crystal head. Low mass cantilever stylus. S.r.u. Output voltages : l.p. $\frac{1}{2}$ v ; 78 1v. Range 20, 17,000 c.p.s. D.p. 4-8 grams. High impedance. Price £1 12s. 6d. (U.K. purchase tax 13s.). Diamonds available.

B.J. TAN/II arm. Designed to overcome "tracking error," this model incorporates "point contact" bearings and a height adjusting ring. Price £3 3s. (U.K. purchase tax £1 5s. 3d.).

B.J. Super 90 pickup arm. Two models. 12 in. and 16 in. Price (including two plug-in-shells to carry standard cartridges) super 90/12 in. £11 11s. (U.K. purchase tax £4 12s. 5d.); super 90/16 in. £12 5s. (U.K. purchase tax £4 18s.).

B.J. plug-in shell for holding cartridges. Price 17s. 3d. (U.K. purchase tax 6s. 11d.). ■ In preparation : a stereo pickup.

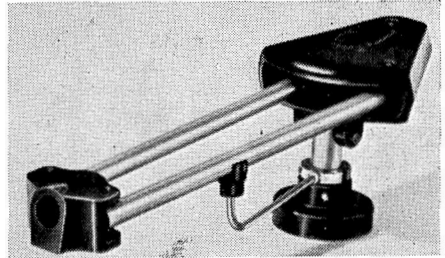
★

Collaro Ltd., Ripple Works, By-pass Road, Barking, Essex. Tel. : Rippleway 5533. Cables : Korllaro. Telex : Barking 28748.

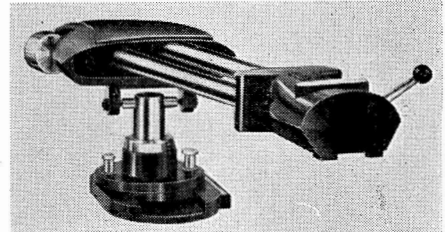
"**Studio P**" crystal turnover cartridge. Output voltage l.p. 50 mV. Range 50-12,000 c.p.s. D.p. 7.5 grams. Load impedance $\frac{1}{2}$ Megohm. Price, with 2 sapphire styli, £1 10s. (U.K. purchase tax 11s. 7d.).

"**Studio Transcription.**" Turnover crystal cartridge. Output voltage : l.p. 75 mV/cm/sec at 1 Kc/s. Range 50-15,000 c.p.s. Load impedance 1 Megohm. Price with 2 sapphire styli, £1 15s. (U.K. purchase tax 13s. 6d.).

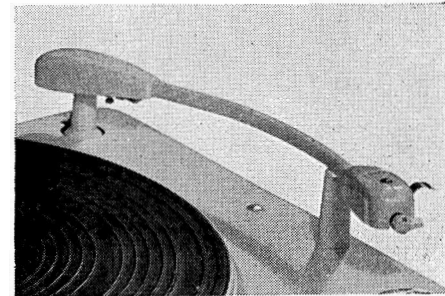
Studio transcription arm to play up to 16-in. records, suitable for turnover type cartridges. Price complete with "Transcription" cartridge £3 17s. 6d. (U.K. purchase tax £1 9s. 11d.).



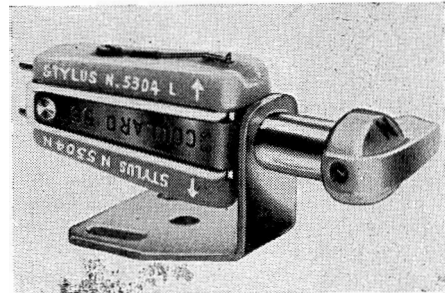
B.J. TAN/II arm



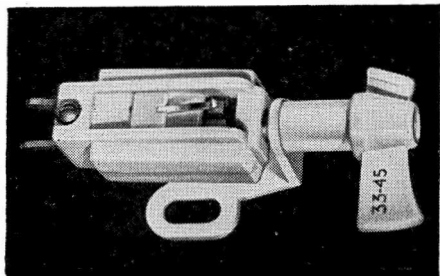
B.J. Super 90 arm



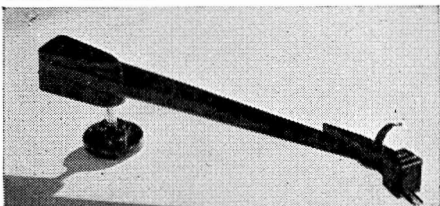
Collaro Transcription arm



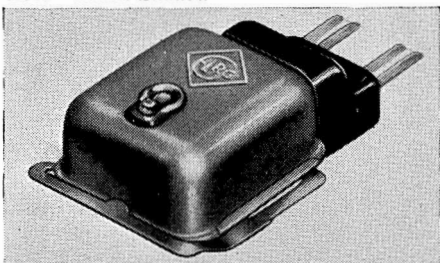
Collaro "Studio P" cartridge



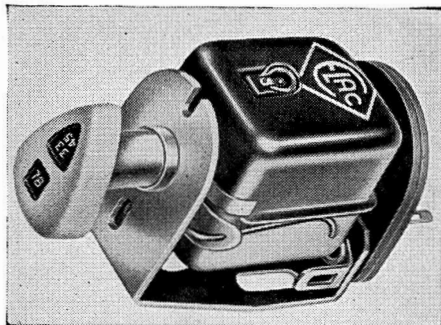
Acos "GP 65-1"



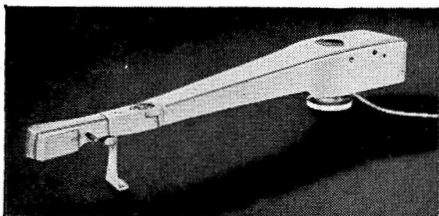
Acos "Black Shadow"



Elac Miratwin MST1



Elac Miratwin MST2



EMI Model 17 AE

Cosmocord Ltd., Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 5206. Cables: Cosmocord, Waltham Cross.

Acos GP65-1. Turnover crystal cartridge. Output voltage: 1.p. 160 mV/cm/sec. Range 40-12,000 c.p.s., substantially flat. D.p. 8-10 grams. Load impedance 2 Megohms. Price £1 10s. (U.K. purchase tax 11s. 7d.). Diamonds available.

Acos GP65-3. High output version.

Acos "The Black Shadow." Complete arm and slide-on 1.p. head. Output voltage: 1.p. 30 mV/cm/sec. Range 30-16,000 c.p.s. ± 3 dB. D.p. 4-6 grams. Load impedance 100K ohms or higher. Diamond stylus fitted. Price complete £6 (U.K. purchase tax £2 8s.). 78 heads available.

■ In preparation: a stereo pickup.

★

Decca Ltd., 1-3 Brixton Road, London, S.W.9.

Pickup arm type 13024, to take 3-pin plug-in heads. Price on application.

■ In preparation: a magnetic stereo pickup.

★

Elac. Electroacoustic GMBH, Kiel. Distributed in the U.K. by Thermionic Products, Ltd., Hythe, Southampton. Tel.: Hythe 3265/7. Cables: Technico.

Miratwin MST 2. Variable reluctance turnover cartridge. Output voltages at 10 cm/sec: 1.p. 55 mV; 78, 45 mV. Range 20-30,000 c.p.s. up to 19,000 c.p.s. ± 2 dB. D.p. 4-6 grams. Load impedance 68,000 ohms. Price, with 2 sapphires, £6 15s. (U.K. purchase tax £2 14s.). Diamonds available.

Miratwin MST1. Single version of MST2 for 1.p. only. Output voltage 55 mV at 10 cm/sec. Price with sapphire stylus £4 10s. (U.K. purchase tax £1 16s.). With diamond £7 13s. (U.K. Purchase Tax £3 1s. 3d.).

★

EMI Sales & Service Ltd., Hayes, Middx. Tel.: Southall 2468. Cables: Emiservice, London.

Model 17 AE. Transcription arm and pickup. Oil-damped unipivot arm, moving armature pickup. Separate plug-in heads.

Diamond l.p. stylus, sapphire 78 stylus, both mounted on cantilever assembly. Output voltage 50 mV (at transformer secondary). Range : l.p. 30-14,000 c.p.s. ; 78 30-16,000 c.p.s. D.p. 3-10 grams, adjustable. Load impedance 1 ohm (pickup only), matching transformer secondary impedance 15,000 ohms. Price on application.

★

Expert Gramophones Ltd., 39-41 New Oxford Street, London, W.C.1. Tel.: Covent Garden 2156.

Pickup and arm. Hard steel-pointed pivots for vertical and horizontal movements. Adjustments for tracking and stylus pressure. Moving coil pickup head. Also sold as separate plug-in head. Diamond styli for l.p. and 78, also thorn for 78. Output voltages : l.p. 60 mV ; 78, 80 mV (both at transformer secondary). Range 40-18,000 c.p.s. ± 1 dB (diamond stylus). D.p. adjustable down to 3 grams. Load impedance 10 ohms (pickup only), transformer secondary impedance 250,000 ohms. Price, complete with diamond, £11 5s. (U.K. purchase tax £4 14s. 6d.) ; plug-in head, diamond £9 (U.K. purchase tax £3 15s. 7d.) ; thorn £7 (U.K. purchase tax £2 18s. 10d.) ; transformer £2 15s.

★

The Garrard Engineering & Manufacturing Co. Ltd., Newcastle Street, Swindon, Wilts. Tel.: Swindon 5381. Cables : Garrard, Swindon.

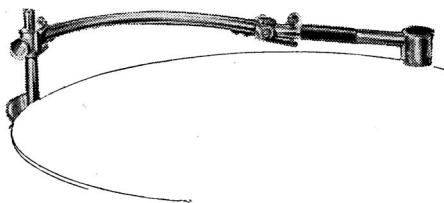
G.M.C.5 turnover moving coil cartridge
Separate coils attached to each stylus. Fitted with diamond l.p. and sapphire 78 styli. Output voltages with TP.1 transformer : l.p. 0.008v ; 78 0.03v. Range 20-16,000 c.p.s. D.p. 5 grams. Load impedance 0.5 Megohm min. across transformer. Price, including transformer, £7 7s. 6d. (U.K. purchase tax £2 17s. 7d.).

TPA 10 transcription pickup arm extendable from 7½ in. to 9½ in. Height of arm and angle of head adjustable. Price £4 4s. 6d. (U.K. purchase tax £1 13s.).

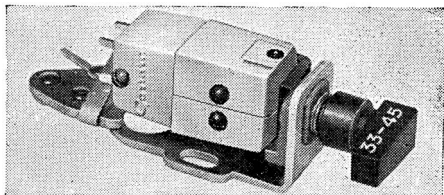
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Goldring Manufacturing Co. (Great Britain) Ltd., 486/488 High Road, Leytonstone, E.11. Tel.: Leytonstone 8343. Cables : Echovox, London.

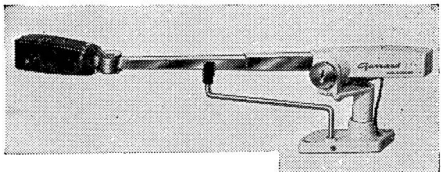
"600." Variable reluctance turnover cartridge ½ in. centre mounting holes s.r.u. Diamond stylus for l.p. sapphire for 78. Output voltage 3.2 mV/cm/sec. Range 20-21



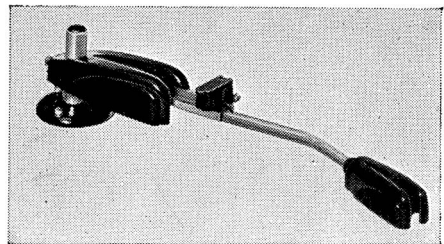
Expert arm and head



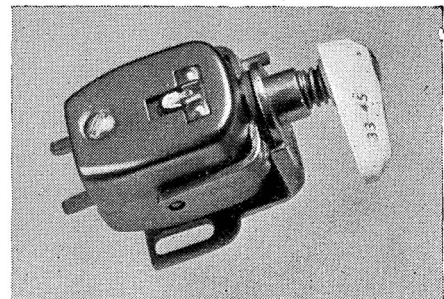
Garrard "G.M.C.5" cartridge



Garrard "TPA 10" pickup arm



Goldring TR.2 pickup arm



Goldring "600" cartridge

K/c.p.s. ± 2 dB. D.p. 7 grams. Load impedance 68,000 ohms. Price £8 8s. (U.K. purchase tax £3 5s. 6d.).

"633." Single-sided version of "600" cartridge for l.p.s. Diamond fitted. Price not yet announced.

■ In preparation : a stereo pickup.

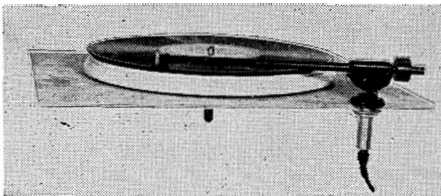
G.60. Transcription arm. Incorporates a new slide-in head that will accommodate most cartridges. Height adjustable. D.p. variable from 4 to 20 grams. Price not yet announced.

TR.1 and **TR.2** transcription pickup arms. TR.1 12 in., TR.2 16 in. Counter-balance weight adjustment from 2-12 grams. Adjustable height, ball races throughout. Price, TR.1, £8 8s. (U.K. purchase tax £3 5s. 6d.); TR.2, £9 9s. (U.K. purchase tax £3 13s. 9d.).

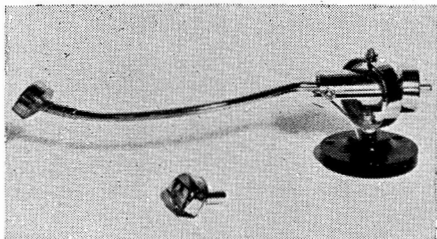
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H. J. Leak & Co. Ltd., 57/59 Brunel Road, East Acton, London, W.3. Tel. : Shepherds Bush 1173. Cables : Sinusoidal, Ealux, London.

Dynamic pickup Mk. II. Moving coil, interchangeable heads, both with diamond stylus. Output voltages : l.p. and 78 8 mV per cms (at transformer secondary). Range 40-20,000 c.p.s. ± 1 dB. D.p. l.p. 3 grams, 78 5 grams. Load impedance 50,000-100,000 ohms. Price, with 2 heads, £16. (U.K. purchase tax £5 19s. 9d.).



Leak Dynamic arm and head



M.S.S. "P.100" arm and head

The Lowther Manufacturing Co., Lowther House, St. Mark's Road, Bromley, Kent. Tel. : Ravensbourne 5225. Cables : Lowther, Bromley.

L.P. pickup. Moving coil fixed head. Output voltage 10 mV. Range 20-20,000 c.p.s. ± 2 dB. D.p. 4-6 grams. Impedance 25 ohms. Price with sapphire stylus £5 10s. (U.K. purchase tax £2 3s. 10d.); with diamond stylus £12 10s. (U.K. purchase tax £4 19s. 9d.).

78 pickup. Moving coil fixed head. Output voltage 18 mV. Range 20-20,000 c.p.s. ± 2 dB. D.p. 6 grams. Impedance 25 ohms. Price, same as for L.P.

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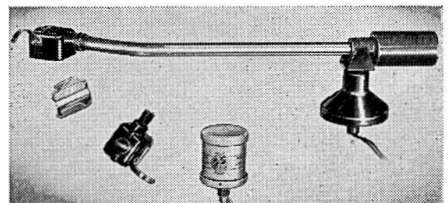
M.S.S. Recording Co. Ltd., Poyle Farm, Colnbrook, Bucks. Tel. : Colnbrook 2431. Cables : Emesco.

P.100 lightweight pickup. Gimble mounted arm, moving iron head. Output voltages l.p. and 78 1v. Range 50-10,000 c.p.s. (substantially flat). D.p. 5-10 grams. Load impedance, equalised 100,000 ohms. Price, with one head and sapphire stylus, £6 (U.K. purchase tax £2 14s.).

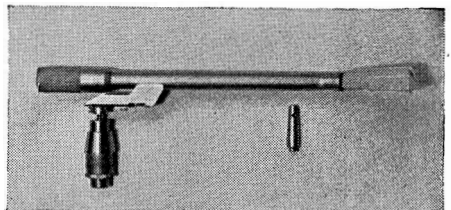
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Ortofon, Fonofilm Industri A/S. Copenhagen, Distributed in the U.K. by Goodsell Ltd., 40 Gardner Street, Brighton 1, Sussex, and Rimington Van Wyck Ltd., 42 Cranbourn Street, London, W.C.2.

Type A. Moving coil. Exchangeable heads with vertical coils. Diamond-tipped



Ortofon pickup head, arm and transformer



Philips "Magnetodynamic" arm and head

stylus. Output voltage : l.p. 0.5 mV/cm/sec. Range 20-20,000 c.p.s. \pm 2 dB. D.P. 5-6 grams. Load impedance 2 ohms (transformer required). Equivalent mass at stylus point 4 m.g. Directional force at stylus point 30 m.g. Price £7 15s. (U.K. purchase tax £3 5s. 1d.).

Type C. Moving coil as above. Diamond stylus. Output voltage l.p. 0.3 mV/cm/sec. Range linear 20-20,000 c.p.s. D.P. 305 grams. Load impedance 2 ohms (transformer required). Equivalent mass at stylus point 1.5 m.g. Directional force at stylus point 77 m.g. Price £14 (U.K. purchase tax £5 17s. 7d.).

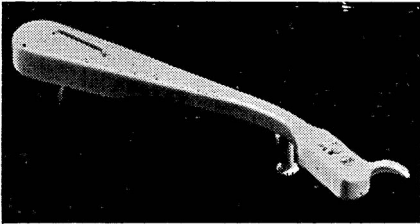
Transformer for use with above pickups. Price £2 10s. Ortofon pickup arm price £3 15s. (U.K. purchase tax £1 11s. 6d.).

★

Philips Electrical Limited., Century House, Shaftesbury Avenue, W.C.2. Tel : Gerrard 7777. Cables : Phillips.

AG.3025. Crystal head fitted with diamond stylus. Output voltage approx. 0.5v. Load impedance 500,000 ohms. Price £3 0s. 7d. (U.K. purchase tax £1 3s. 5d.).

NG.5400 Magnetodynamic. Arm and moving magnet l.p. head fitted with diamond stylus. Output voltage approx. 25 mV. Range substantially linear 20-20,000 c.p.s. D.p. 0-10 grams. Load impedance 68,000-100,000 ohms. Price complete £14 8s. (U.K. purchase tax £5 11s.). 78 head available.



RCA Orthophonic arm

RCA Great Britain Ltd., Lincoln Way, Sunbury-on-Thames, Middlesex. Tel : Sunbury-on-Thames 3101. Cables : Telex and Tex 28608.

Orthophonic 8-pole balanced variable reluctance pickup. Available in two arm lengths. Single or dual sapphire stylus, rocking cartridge. S.r.u. Output voltages : l.p. 100 mV ; 78 200 mV. Range, dual stylus, 20-16,000 c.p.s. \pm 20 dB ; single stylus rises to 20,000 c.p.s. D.p. : l.p. 5-7 grams ; 78 9-12 grams. Load impedance 10-100 K/ohms. Price, long arm and dual sapphire stylus, £10 7s. (U.K. purchase tax £4 1s. 5d.) ; short arm dual sapphire stylus £9 11s. 4d. (U.K. purchase tax £3 18s. 4d.) ; short arm single stylus £9 3s. 1d. (U.K. purchase tax £3 15s.). Diamonds available.

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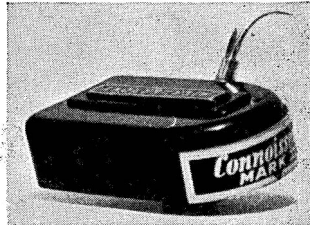
Ronette, Sole U.K. Importers : Trianon Electric Limited, 95 Cobbold Road, London, N.W.10. Tel : Willesden 2116 and 3696

Available mid-1958 : new range of crystal pickups. Also the "Biofluid" stereophonic cartridge. Write for further details.

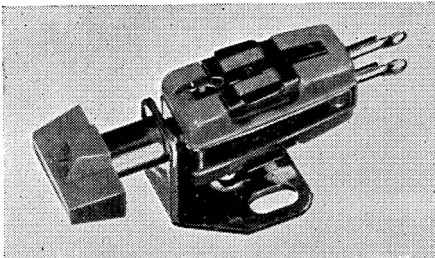
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A. R. Sugden & Co. (Engineering) Ltd., 36 Well Green Lane, Brighouse, Yorkshire. Tel : Brighouse 2397. Cables : Connoisseur, Brighouse.

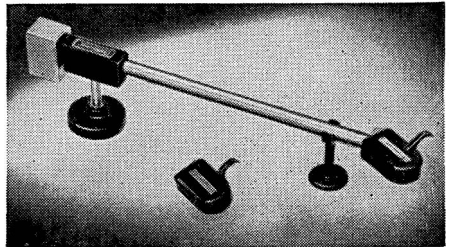
Connoisseur super lightweight Mk. II pickup. Interchangeable heads, moving iron. Output voltages : l.p. 15 mV ; 78 25 mV. Range 30-20,000 c.p.s. \pm 2 dB.



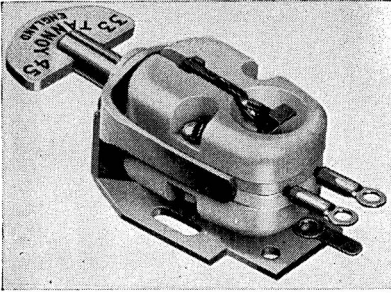
Connoisseur MK2 lightweight head



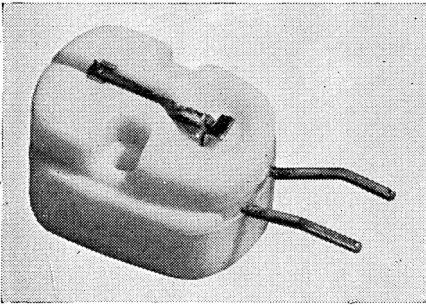
Ronette TX88 cartridge



Connoisseur pickup and arm



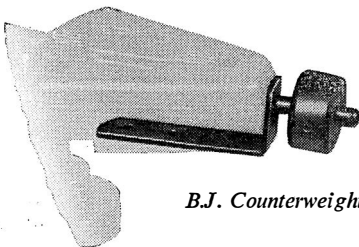
Tannoy "Variluctance" turnover cartridge



Tannoy single stylus "Variluctance" cartridge



Auriol pickup control



B.J. Counterweight

D.p. : 1.p. 4 grams ; 78 8 grams. Load impedance 10,000 ohms. Price, complete with one head and diamond stylus, £8 19s. (U.K. purchase tax £3 16s. 6d.) ; with sapphire stylus £5 17s. (U.K. purchase tax £2 10s.) ; head only with diamond stylus £6 12s. (U.K. purchase tax £2 16s. 5d.) ; with sapphire stylus £3 10s. (U.K. purchase tax £1 9s. 11d.).

★

Tannoy Products Ltd., West Norwood, London, S.E.27. Tel. : Gipsy Hill 1131. Cables : Tannoy, London.

Variluctance turnover cartridge. S.r.u. Output voltages : 1.p. 10-12 mV ; 78 18-20 mV. Range 20-16,000 c.p.s. \pm 2 dB. D.p. 5-6 grams. Load impedance 50,000 ohms. Price, with 2 diamonds, £12 (U.K. purchase tax £4 17s.) ; with 1 diamond and 1 sapphire £9 10s. (U.K. purchase tax £3 16s.) ; with 2 sapphires £7 (U.K. purchase tax £2 16s. 2d.).

Single stylus version of Variluctance for l.p.s also available. Price with diamond, £6 15s. (U.K. purchase tax £2 14s. 7d.).

★

Westrex Co. Ltd., Liberty House, Regent Street, London, W.1. Tel. : Regent 1001. Cables : Westelcal, Norphone, London.

■ **In preparation** : 10A Stereodisk pickup cartridge, twin moving coil, stereo or single track. Diamond stylus. D.P. 6 grammes.

★

Wollett Sound & Wireless Equipment, Wells Park Road, London, S.E.26. Tel. : Forest 2527.

In preparation : dynamic pickup arm with interchangeable moving coil heads. Diamond stylus. Write for details.

ACCESSORIES

Auriol (Guildford) Ltd., 63 Shepherds Lane, Guildford, Surrey.

Auriol Pickup Control. This unit eliminates accidental damage to the record by the stylus, the control provides air cushioned lowering and positive vertical lifting and lowering of the stylus. The supporting arm is serrated and calibrated for accurate positioning of the stylus at any pre-selected position within 1-2 microgrooves. Three cursors are provided to mark starting positions and an indexing clip is supplied to suit any specified pickup arm. Price £3 3s., inc. U.K. purchase tax. Export price £2 15s.

Available May/June, 1958. The Mk. II pickup control. This is similar to Mk. I but the arm can be moved clear of the turntable to allow for its use with auto-changer/manual-player units. Price approx. £2 15s. (U.K. purchase tax extra).



Burne-Jones & Co. Ltd., 62 Sunningdale Road, Cheam, Surrey. Tel.: Fairlands 8866/7. Cables: Burjomag, Sutton.

Counterweight Unit. The addition of this weight to a B.J. pickup arm permits speed and accuracy in weight compensation. The unit may be attached with or without standard weights supplied, and produces a total point pressure variation of approximately 4 grams. Price 12s. (U.K. purchase tax 4s. 10d.).

B.J./Acos Adaptor. This has been designed to accommodate Acos slide-on heads to the B.J. range of arms and those arms using standard 3-pin plug-in head fixing. Price 10s. (U.K. purchase tax 4s.).

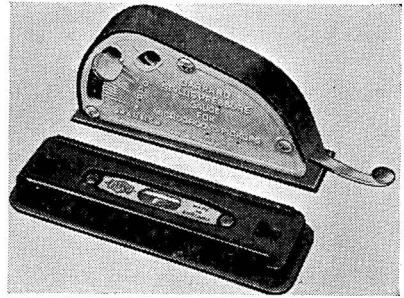
Alignment Protractor. For measuring the tracking accuracy of all pickup assemblies. Made in plastic ivoryne. Price 7s.



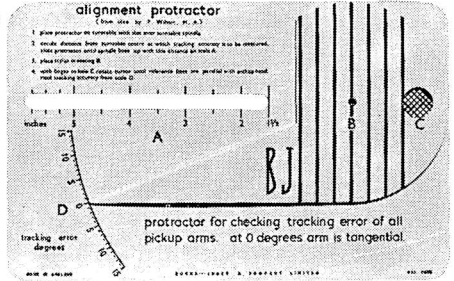
Goldring Manufacturing Co. (Great Britain) Ltd., 486/488 High Road, Leytonstone, E.11. Tel.: Leytonstone 8343. Cables: Echovox, London.

Anti-static Cleaning Pad. Removes dust from records and is fitted with a detachable brush for keeping stylus clean. Price 4s. 6d. (U.K. purchase tax 1s. 9d.).

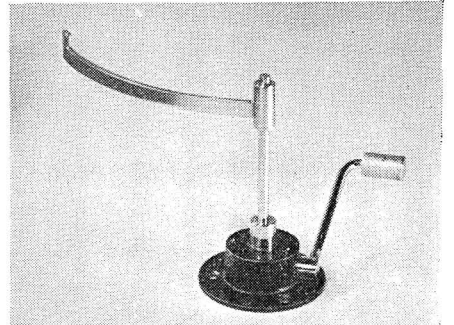
STB.1. Stylus balance, a simple yet accurate gauge which operates at record level. Stylus pressure is read directly in grams off the calibrated scale. Price 3s. 6d. (U.K. purchase tax 1s. 5d.).



Garrard S.P.G.2



B.J. alignment protractor



Thermionic "Microlift"

● This picture shows the Dust Bug in action. It also shows a most useful temporary mounting for turntable and pickup, using two wooden blocks.



The Garrard Engineering & Manfg. Co. Ltd., Newcastle Street, Swindon, Wilts. Tel. : Swindon 5381. Cables : Garrard, Swindon.

S.P.G.2. Stylus pressure gauge, also includes a spirit level for checking the level of the turntable. Price 18s. 9d. (U.K. purchase tax 7s. 4d.).

★

Rimington van Wyck Ltd., 42 Cranbourne Street, London, W.C.2. Tel.: Gerrard 1171.

Clendisc. An anti-static cleaner and preserver for all l.p. records, also suitable for 78s. Price 3s. 9d. and 6s.

Fredorec. A cleaning pad for removing dirt from all records. When used with Clendisc forms a perfect combination for record care. Price incl. purchase tax 3s. 2d.

★

Sound Sales Ltd., Works & Acoustic Laboratories, West Street, Farnham, Surrey, England. Tel. : Farnham 6461-2-3. Cables : Sounsense.

Pickup Matching Unit. Types A and C. A resistor/capitance network to facilitate suitable matching of crystal pickups. Available for Collaro and Acos range. Metal screened assembly provided with terminals for connection of pickup and screened lead for output. Size $1\frac{1}{4}$ in. cube. Price 10s. 6d.

★

Thermionic Products Ltd., Hythe, Southampton. Tel. : Hythe 3265/7. Cables : Technico.

Microlift. A device for raising and lowering a manual pickup arm at any point on the record for minimising risk of damage either to record or stylus through handshake. Easy to fit to any back-pivoted pickup. It does not hinder record handling by overlapping the turntable. Price 21s. (U.K. purchase tax 8s. 10d.).

★

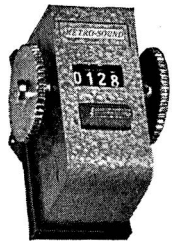
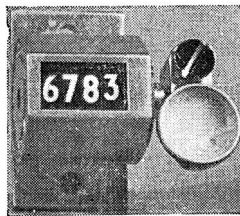
Cecil E. Watts, Darby House, Sunbury-on-Thames, Middx.

The "Dust Bug." Claimed to be the most efficient method of removing all static and dust from records as they are played. Instantly fitted, suitable for all types of records. Record quality is improved, surface noise and wear reduced. Price 17s. 6d. (U.K. purchase tax 7s.).

The "Parastat." For cleaning both sides of an lp disc simultaneously and making inert to all static charges. Principally for trade use. Price on application.



The "Clendisc" anti-static cleaner and "Fredorec" cleaning pad



Two useful counters to record the number of records played by a stylus are shown above. On the left is the **May Counter** which costs £1 1s. and is available from R. W. May, 2 Burnham Avenue, London, E.4.

The Metro-Sound "Stylometer," on the right, has provision for resetting to nought and costs £2 5s., from 19a Buckingham Road, London, W.1. Double versions of both counters are available.



Cecil Watts' "Parastat" shown in use

AMPLIFIERS AND PRE-AMPLIFIERS

By George Tillet

I SUPPOSE the most significant feature of amplifier design during the last year or so has been the emphasis on presentation and styling, which to my mind underlines the fact that High Fidelity has finally out-grown its brash experimental stage and is now accepted as a part of the domestic scene (or "Way of Life" as the Americans put it). Recently there has been a definite trend towards compact, self-contained units—that is, amplifier and control unit both housed in one cabinet. There are of course many advantages in having the main amplifier separate from the control unit, but it is a fact that with the increasing popularity of "G" plan and similar contemporary furnishing schemes, more and more people prefer an amplifier which will look equally at home on a bookshelf or room divider, as in a console cabinet.

The American-styled Pilot

One such amplifier is the American styled **Pilot HFA11** (reviewed in *Hi Fi News*, Feb., 1958) which is housed in a cabinet attractively finished in brushed brass, with specially moulded pointer knobs to match. These knobs, incidentally, are also functional in that there is no possibility of parallax error for which many quite expensive control units were criticised—and with justification, be it said—by the *Design* magazine. Other rather similar units are the **Jason J10**, housed in a matt black cabinet with copper trimmings, the **C.Q.10** with a diecast panel finished in florentine bronze, and the **Pye Mozart** in matt black with a copper panel.

Small versus Large

How does the performance of these and similar amplifiers compare with larger equipment? Some compromises are inevitable, of course, but due to the use of miniature

valves, and more particularly to transformers having grain oriented strip or "c" core, such compromises are remarkably small. For example, the output transformer used by the Pilot measures only 3 in. by 2½ in., with a stack of 1¼ in.; yet this Hinchley made component gives a very good account of itself, as can be seen by the power curve **Fig. 1**. The bass power response falls below about 45 c/s, but this is not too serious as long as high pass filters prevent (or rather attenuate) the lower frequencies before they reach the output stage, otherwise severe intermodulation distortion would occur.

Large Rooms and Multi-speakers

For a large room where, for instance, an elaborate multi-speaker system with a response extending down to the lower frequencies is used, it would, of course, be necessary to have a larger amplifier with an extended bass power response; but for most domestic applications amplifiers having the response of **Fig. 1** will be found perfectly adequate. An unusual feature of the Pilot is the provision of a D.C. heater supply for the first two stages to minimise the risk of hum.

The Small C.Q.

The C.Q. amplifier measures 11 in. by 4 in. by 8 in. and it is claimed to deliver full rated output of 10 watts down to below 30 cycles.

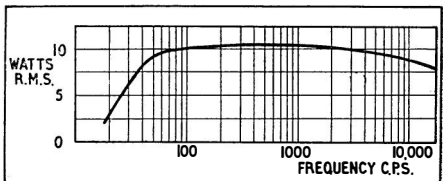


Fig. 1 shows the power curve of the Pilot HFA11

Two E.L.84s are used in the output stage which functions under "low loading" conditions similar to the *Altobass*. The output valves are considerably overbiased, and the normal anode load is reduced to about 6,000 ohms. Peak powers will then have the effect of driving the valves operating conditions back into a region of low distortion, the advantages being a low quiescent current with a smaller ripple on the H.T. line.

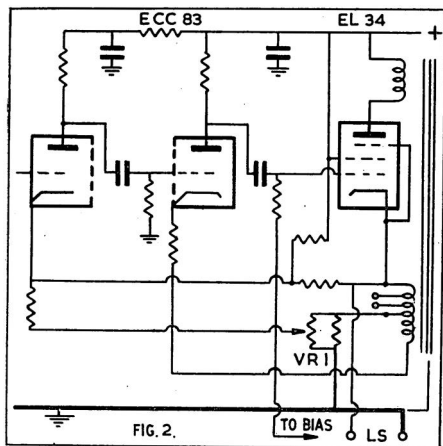


FIG. 2.
This circuit diagram of the Pye "Mozart" single-ended output stage shows negative feedback applied to the EL34 cathode

Standing dissipation is brought down from 22 watts to something like 15 watts. In an amplifier of this type, where size is most important, economies in the power supply are obviously very much worth while.

Separate Power Supplies

For the above reason the C.Q., in common with other similar amplifiers, does not provide an auxiliary power supply but advocate self-powered radio tuners. They are releasing a self-powered F.M. tuner in the near future, whilst Jason already have a number of self-powered F.M. or combined A.M./F.M. tuners available to match their J10 amplifier. This particular amplifier uses a rather novel circuit shown in Fig. 3. It will be seen that the cathode of the phase splitter V2 is returned to the cathode of the preceding valve, thus giving about 6 dB of positive feedback within the main feedback loop. Since the resistor R1 also carries the current of V2, it is reduced in value so as to give the correct cathode bias for V1. The small positive loop, whilst increasing the distortion, paradoxically enough enables the total amplifier distortion to be reduced. This

works out as follows: Let us assume the total amplifier distortion is 5%, and that the application of feedback loop of 20 dB reduces it by a like amount—20 dB, in other words a factor of 10, so making it 0.5%. Now supposing we connect an internal positive loop around the first two stages to increase the gain by 6 dB, and in the process we increase the distortion by 1% (it would not be as high as this in practice but let us stick to nice round numbers), we have a total distortion of 5% plus 1% = 6%. But the increase in loop gain has also increased, and the 20 dB feedback loop has also increased, and is now 26 dB, which has the effect of reducing the distortion by a factor of 20—i.e., in other words we now have 0.3%.

Positive Feedback Advantages

Alternatively, the feedback could have been altered to its previous value of 20 dB, and we could have had 6 dB extra gain, and the distortion would have remained at the original figure.* Another advantage of this form of positive feedback is that it has the effect of reducing the impedance at the anode, and increasing it at the cathode of the phase splitter, thus tending to equalise the dissimilar impedances characteristic of the "split load" type of phase inverter.

Incidentally the distortion of the *Jason* is claimed to be of the order of 0.05% at 10 watts.

Single-ended Mozart

It is almost taken for granted that an amplifier having a rated output of 8 to 10 watts will use two E.L.84s (or equivalents). A notable exception however is the *Pye Mozart* which does not even use a push-pull output stage, but a single valve—an EL34. But it is a single-ended stage with a difference—in fact a number of differences as can be seen in the diagram (Fig. 2). Negative feedback is applied to the cathode of the EL34, and both positive and negative feedback to the preceding stages. V.R.1 is a pre-set control which varies the proportions of feedback, thus changing the amplifier damping factor from positive to negative values. Many exaggerated claims are—or perhaps were—made for this feature, particularly in America.

Damping, and Small Speakers

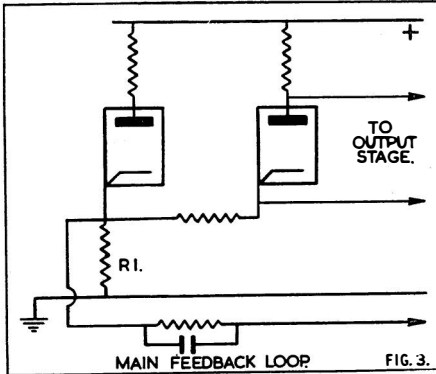
Whilst it is true to say that it is ineffectual when used with a really good speaker system, it can sometimes improve the results obtained with a cheap speaker. It is possible

* *Wireless World*, July, 1950 (Thomas Roddam), also *Wireless World*, March, 1950 (Griffiths).

that a small bookcase type of speaker might give more acceptable results with the application of a "critical" damping factor, thus the inclusion of this facility in a small amplifier such as this has a certain justification. The Mozart measures $3\frac{3}{8}$ in. by $5\frac{1}{8}$ in. by $10\frac{1}{2}$ in. and uses only 3 valves plus a metal rectifier—yet the sensitivity is 10 millivolts and the power output is claimed to be 9 watts for a distortion of 0.3%.

Push-pull Advantages

One of the lesser known advantages of a push-pull output stage is that the D.C. current flowing in the output transformer is virtually balanced out, thus the design of a small transformer having a polarising current of some 100 milliamps and giving a good power response must have been no easy task. Printed circuits and a special pickup compensator are other features of the Mozart. Known as the "Dialomatic," this compen-



The phase-splitter circuit of the Jason J10 amplifier is shown here, giving positive feedback within the main feedback loop

sator is very similar to that used by Decca described in the 1957 Year Book (page 21). Two calibrated input potentiometers are used, one being the load resistor and the other the attenuator; thus any pickup can be quickly and accurately matched. This means that if the owner decide; to invest in another pickup, all he has to do is to turn the two knobs on the back of the chassis to the appropriate settings—K6 for the Goldring, A2 for the Acos Hi-G, and so on. What could be simpler? No load resistor to change, no soldering, no necessity even to take the cover off the amplifier.

Printed Circuits

Apart from the *Altobass* version of the Mullard 510, no other printed circuit amplifiers have appeared on the scene,

although there are rumours of a kit set using printed circuits to be released soon. There is still a certain prejudice against printed circuits, despite their obvious advantages. This has been mainly due to the difficulty of replacing components. Certainly such criticisms do not apply to either the *Altobass* or the *Mozart*, which are so designed that all components are accessible and easily replaced should the necessity arise.

Transistors

Talking of printed circuits inevitably brings me to transistors (somehow I always associate these two items), the *Lowther-Murray* transistor pre-amplifiers have been available for some time and a remarkable good signal-to-noise ratio is claimed. As far as I know this is the only application of transistors in the high fidelity field although a number of firms have produced prototype amplifiers—and in one instance a complete tape recorder within the last few months. From America however comes news of a complete self-contained all-transistor amplifier with a rated output of 20 watts! Power is supplied by a mains transformer and metal rectifier and the maximum consumption is stated to be only 30 watts. The output stage is of course a Class "B" arrangement; even so, this does indicate a high order of efficiency. Apparently, although the hum level is quoted as being 100 dB below 2 watts, the noise is rather higher, and is piquantly described by a listener as "a quiet fried egg effect"!

Self-contained Amplifiers

Self-contained amplifiers have been very popular in America for a long time now, and today they probably account for over half the total sales over there, as I have mentioned before. They are not confined to the modest 8 to 10 watts or so, but boast of outputs of 25, 30 and even 70 watts! Even allowing for a possible difference in rating it still means that quite a lot of power has to be dissipated in the form of heat—hence the cabinets are little more than metal cages. It is also common practice to combine the amplifier with an A.M. and F.M. tuner—notable examples being the *Harmon-Kardon*, *Fisher* and *Sargent Raymond*. In this country, of course, the imposition of Purchase Tax effectively discourages this trend although *Chapman* have released a combined tuner and control unit which is sold separately from the main amplifier. The main amplifier itself is based on the Mullard 20 watt design and uses a special Partridge output transformer.

What of the next twelve months? Obviously the biggest impact on the Hi-Fi

world will be the introduction of stereosonic discs later this year. Most amplifier firms are now busily engaged designing twin-channel amplifiers, and conversion equipment for their monaural amplifiers sold during the past few years. Those owning 20 to 30 watt amplifiers will most likely find it convenient to duplicate them, but it is safe to say (for this country anyway) that stereosonic amplifiers giving a power output of 8 to 10 watts per channel will be the most popular. Many of these will be self-contained, and the new *Jason* is housed in a cabinet not much larger than the standard model.

Switched Controls

Many twin channel amplifiers will use switched type tone and volume controls, owing to the difficulties of matching ordinary ganged controls, but these difficulties are rapidly being overcome. One likely effect of stereosonic discs will be to stimulate interest in High-Fidelity on the continent. Many German firms, such as Telefunken, are already well ahead with this new development and the recent annual report of the German Philips Company had this to say: "We are confident that the trend in the Hi-Fi field will develop as favourably in Germany as it has done in the U.S. One important factor is the high technical standard in disc recording as well as in physical qualities of gramophone records." One might add that the German F.M. transmissions were also of a high standard, but although domestic radio is

extremely good there is no doubt that in the the Hi-Fi field they are far behind both this country and the U.S. Negative feedback is used to a more limited extent—one of the best amplifiers with a rated output in excess of 25 watts has a small feedback loop of only 6 dB, and the distortion is quoted at 3% for 20 watts. The output transformer used is a simple type and it was considered doubtful if the feedback could be increased to any great extent. Grain oriented strip and "C" core material seem to be very rarely used and it may be that this curious neglect of modern transformer technique is partly responsible for indifferent amplifier design in Germany.

Poor Presentation

Presentation on the Continent is also very poor—apart from Philips and one or two others—a surprising fact when one considers the superb styling of the numerous Continental tape recorders now being sold in this country. Nevertheless I am convinced that when German manufacturers seriously turn their attention to the Hi-Fidelity market many firms here will really have to sit up and take notice! Not that British designs are poor—on the contrary, we have seen some first-class designs during the last year or so, from R.C.A., Pamphonic, T.P. and Pilot, to name but a few; but there are still far too many firms who are quite content with the 5-knobs-on-a-stove-enamelled-panel type of presentation. It just isn't good enough any more.



Illustrated above is the new Tannoy "Hi-Gain 15" integrated unit in which pre-amplifier and main amplifier are combined. Provision is made for stereo by means of a ganged volume control, so that two of these units may be coupled together. Tape input (from tape head), Microphone, Radio, and disc (78 and l.p.) are the only input points—a welcome simplification. Claimed frequency response for 10 watts overall is 40 c/s to 15 Kc/s, and for 5 watts overall is 30 c/s to 20 Kc/s. The presentation is a good example of the new-style equipment which British manufacturers are now offering. This unit can be panel mounted or used to stand free. The prices are 38 and 40 guineas respectively

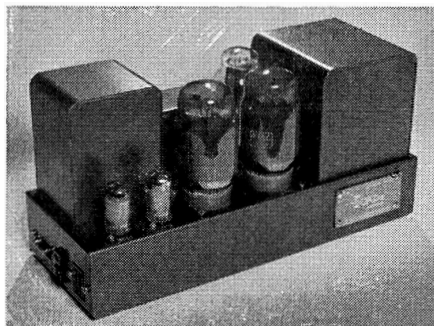
DIRECTORY OF AMPLIFIERS & CONTROL UNITS

★ The following abbreviations are used in this directory section : **HD**—Harmonic Distortion ; **<**—less than ; **H** and **N**—Hum and Noise ; **P.a.t.**—Power supplies available from tuner ; **RMS**—root mean square ; **N.L.**—Noise level ; **Sel.**—Selector switch ; **■**—Stereo equipment.

Acoustical Manufacturing Co. Ltd., St. Peter's Road, Huntingdon, Hunts. Tel. : H'don 361 and 574. Cables : Acoustical.

Quad II Q.C. II Control Unit. Inputs : radio/tape 100 mV ; mic. 1.5 mV ; gram. to suit pickup. Treble, bass, vol and on/off, filter slope. Switch filter 5, 7, 10 Kc/s and "out." Tape record socket, switched playback socket. H.D. <0.1%. H and N — 70 dB. P.a.t. determined by main amp. Size 10½ in. by 3½ in. by 6½ in. Weight 7 lb. To operate with Quad II power amp or similar. Price £19 10s.

Quad II Amplifier. 15 watts. Dist. total 3rd harmonic and higher. < 0.18% at 12 watts. Input for spec. output 1.4v. RMS for 15 watts. Response 20-20,000 c.p.s. ± 0.2 dB ; 10-50,000 ± 5 dB. Feedback incorporated in original ultra-linear arrangement. N.L. — 80 dB at 15 watts. Out. imp. 7 and 15 ohms. Output KT66's. Original combined anode/screen current circuit. Size 13 in. by 4¾ in. by 6½ in. Weight 18¼ lb. To operate with QCII control unit. Price £22 10s.



Quad II control unit and amplifier

★

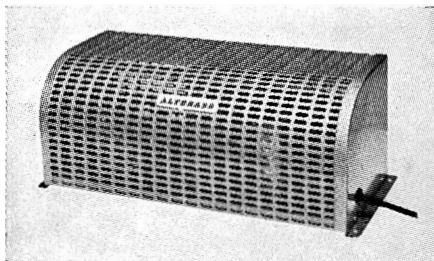
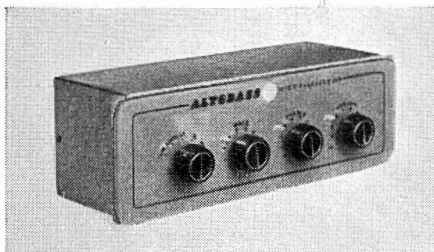
Altobass Ltd., Percy Road, Aylestone Park, Leicester. Tel. : Leicester 31616. Cables : Altobass, Leicester.

"High Fidelity 510" Control Unit. Inputs : tape 100 mV ; radio 100 mV ; P/U (l.p.) 50 mV ; P/U (78) 60 mV ; mic. 10 mV. 5 pos. sel., treble, bass, vol. and on/off. Tape replay socket. H.D. 0.15%. H and N — 64 dB mic. ; — 71 dB on other inputs. Size 10 in. by 3½ in. by 4¼ in. Sold only with 510 power amp.

"High Fidelity 510" Amplifier. 10 watts nom., 11 watts max. Dist. 0.1% (10 watts at 400 c.p.s.). Input for spec. output 40 mV. Response 15-20,000 c.p.s. ± 0.6 dB. Feedback — 20.5 dB. N.L. — 78 dB relative to 10 watts. Out imp. 3.75 or 15 ohms. Output EL84's. Ultra-linear. Size 13½ in. by 5½ in. by 5¾ in. Price complete with 510 control unit £24 3s.

In preparation

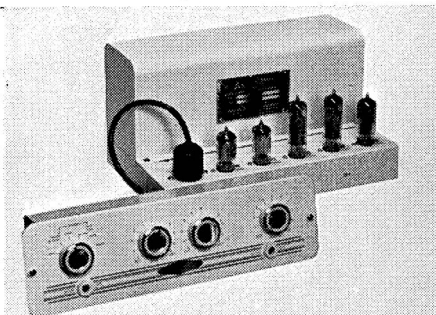
High Gain Control Unit, 3 and 50 mV sensitivity on P/U, also radio and two tape



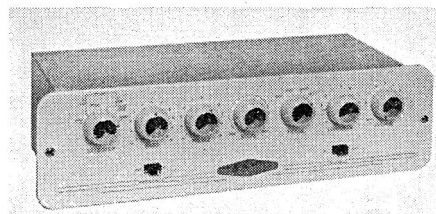
Altobass 5-10 control unit and amplifier



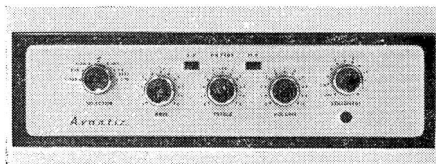
Armstrong A10 Mk II control unit and amplifier



Astronic A1332 control unit and A1333 amplifier



Astronic A1432 control unit



Avantic RL6-21 amplifier

inputs. 6 pos. sel. treble, bass, volume, on/off. Switched low pass filter, 5, 7 and 10 Kc.p.s. (24 dB/octave). Switched rumble filter. Tape record and replay sockets. Available July-August. Price not yet fixed.

★

Armstrong Wireless & Television Co., Warlters Road, Holloway, N.7. Tel. : North 3213/4.

Mk. II Control Unit. Inputs : radio 80 mV ; tape 80 mV ; mic. 4 mV ; gram. (4) 8-1200 mV. 4 pos. input switch ; 6 pos. equaliser ; treble, bass, vol. and on/off ; 6 pos. switched filter. Switched tape input. H.D. 0.05% at 1,000 c.p.s. at 180. mV. H and N better than - 60 dB. Rumble filter. P.a.t. 320v at 35 mA ; 6.3 at 2A. Size 5½ in. by 9¾ in. by 5¼ in. To operate with A10 Mk. II power amp. Price £10 10s.

A10 Mk. II. 10 watts rated, 20 watts max. Dist. 0.1%. Input for spec. output 400 mV for 10 watts. Response 15-30,000 c.p.s. ± 1 dB. Feedback 28 dB. N.L. better than - 80 dB. Out. imp. 1, 3, 7½ and 15 ohms. Output EL34's. Ultra-linear. Size 14 in. by 18½ in. by 6½ in. Weight 25 lb. To operate with Mk. II control unit. Price £21 10s.

★

Associated Electronic Engineers Ltd., 10 Dalton Gardens, Stanmore, Middx. Tel. : Wordsworth 4474/5/6. Cables : Astronic, Stanmore.

Astronic A1332 Control Unit. Inputs : mic. 20 mV ; gram. A.E.S., FFRR, NARTB 10-20 mV ; radio/tape 220 mV. 6 pos. sel., treble, bass, vol. and on/off, gram. input attenuator. Tape record and playback socket. H and N - 70 dB. P.a.t. (from main amp) 300v at 10 mA, 6.3v at 0.5 A. Size 12 in. by 3¾ in. by 1¾ in. Weight 3 lb. To operate with A1333 power amp. Price £9 10s. 6d.

Astronic A1432 Control Unit. Inputs : mic. 20 mV ; radio 120 mV ; P/U 4 mV or 20 mV ; tape (C.C.I.R.) 1-2 mV. 6 pos. sel. (3 record equal.) treble, bass, vol. on/off. Filter, 5, 7, 10 Kc.p.s. Slope 6-30 dB/octave. Loudness - 18 dB max. Presence + 6 dB, 2-3 Kc.p.s. Rumble filter. Variable P/U attenuator. Socket for direct replay from tape head. H.D. not measurable. H and N - 65 dB. Size 11½ in. by 3½ in. by 5½ in. Weight 3¾ lb. To operate with A1333 or A1440 amplifiers. Price £21 19s.

Astronic A1333 Amplifier. 10 watts nom., 13 watts max. Dist. 0.1% at 10 watts

Input for spec. output 0.33 RMS. Response 20-20,000 c.p.s. \pm 0.5 dB. Feedback 18 dB. N.L. - 72 dB. Out. imp. $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 ohms. Output N709's or EL84's. Ultra-linear. Size $11\frac{1}{2}$ in. by $6\frac{1}{4}$ in. by 6 in. Weight $16\frac{1}{2}$ lb. To operate with A1332 control unit. Price £18 19s. 6d.

■ **Astronic A1434 Stereo Control Unit.** Inputs, single channel : tape 1-2 mV ; l.p. (Int.) 4 mV ; radio 120 mV ; mic. 20 mV ; aux. 120 mV. Stereo inputs for tape, P/U and radio same sensitivities. 8 pos. sel. bass, treble, vol., on/off, rumble filter, presence switch, channel balance (pre-set). Dist. negligible. H and N - 65 dB. Size $11\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by 6 in. Weight 4 lb. To operate with amplifiers A1333 Mk. I and Mk. II or A1440.

In preparation

Astronic A1440 20-watt amplifier to work in conjunction with control units A1432, A1332 or stereo control unit A1434. Available July-September, 1958. Price approx. £40.

Astronic A1444 Combined Control Unit and Amplifier suitable for shelf mounting. 20 watts. Available June-August, 1958. Price not yet announced.

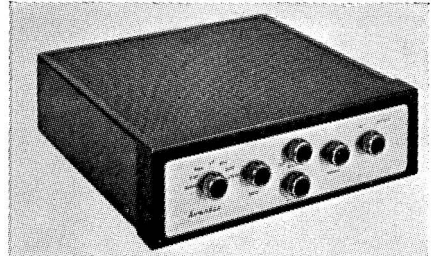


Beam-Echo Ltd., Witham, Essex. Tel. : Witham 3184. Cables : Beamic, Witham.

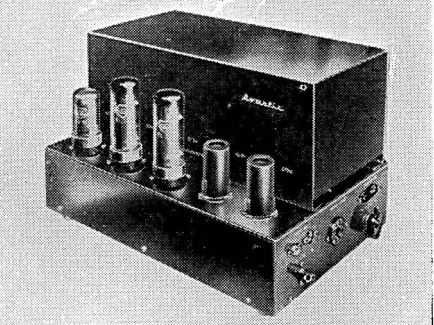
Avantic DL7-35 Control Unit. Inputs : P.U.1 4-6 mV ; P.U.2 40-60 mV ; P.U.3 500 mV ; tuner 1 100 mV ; tuner 2 500 mV ; aux. 1 2 mV ; aux. 2 20 mV ; tape 100 mV. 8 pos. sel. treble, bass, vol. and on/off, loudness. Switched filter 5, 10 and 20 Kc/s. 3-pos. monitor/record switch. Tape record and playback sockets. H.D. < 0.1% for 200 mV and < 0.2% for 2.0v. H and N, radio and tape - 64 dB ; pickup - 53 to - 56 dB ; aux. 1 - 45 dB. Roll-off freq. 40 c.p.s. Slope 12 dB/octave. P.a.t. 200v at 30 mA, 6.3v at 2.5 A. Size $11\frac{5}{8}$ in. by $4\frac{1}{8}$ in. by 7 in. Weight $6\frac{3}{4}$ lb.

Avantic DL7-35 Amplifier. 30 watts nom., 45/60 watts max. Dist. < 0.05% at 20 watts, < 0.1% at 27 watts. Input for spec. output 220 mV. Response 5-30,000 c.p.s. \pm 0 dB, 2-100,000 c.p.s. \pm 1 dB at 1,000 c.p.s. Feedback 30 dB. N.L. - 84 dB at 20 watts. Out. imp. 4, 8, and 16 ohms, switched. Output EL34's. Ultra-linear. Size $14\frac{1}{2}$ in. by 9 in. by $8\frac{1}{2}$ in. Weight $35\frac{3}{4}$ lb. Price complete with control unit £55.

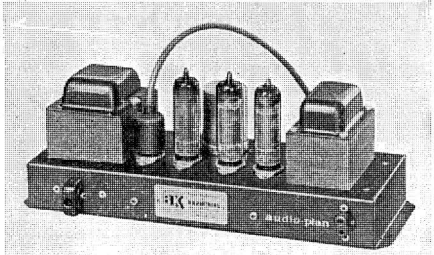
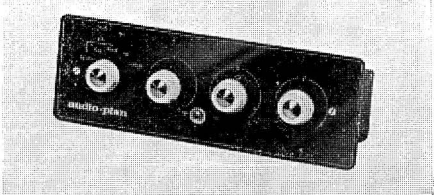
Avantic PL6-21 Self-contained Control Unit and Amplifier. Inputs : tuner 100 mV variable ; P/U 5 mV variable ; aux. 100 mV



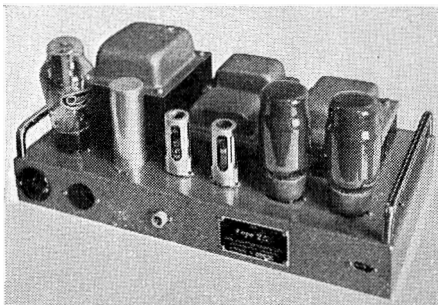
Avantic SPL12 Stereo control unit



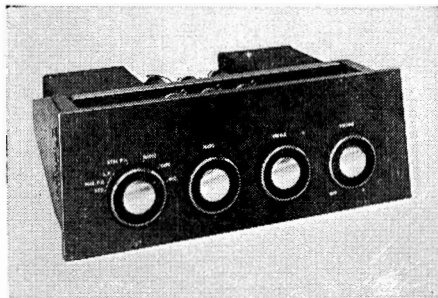
Avantic DL7-35 control unit and amplifier



B.K. Partners "Audio Plan" control unit and amplifier



Cape VLP Mk 2 control unit and VL1 amplifier



C.Q. Audio amplifier

variable ; tape 2-3 mV. 7 pos. sel. (3 record equal, 2 tape equal, $3\frac{3}{4}$ and $7\frac{1}{2}$ i.p.s.), treble, bass, switched high and low pass filters, loudness and on/off. Tape input and output sockets. p.a.t. 3 AC mains outputs. 20 watts peak output. H.D. 0.2% at 10 watts. 2% intermodulation distortion at 10 watts. Response 10-30,000 c.p.s. ± 1 dB. Feedback 26 dB at 1000 c.p.s. N.L. 70 dB below at full output. Out. imp. 4, 8, 16 ohms. Output EL84's. Type A 100-125v AC, type B 200-250v, type C 100-250v (slightly higher cost) at 40/60 c.p.s. Size 14 in. by $4\frac{7}{8}$ in. by $8\frac{1}{2}$ in. Weight 14 $\frac{3}{4}$ lb. Price £35.

■ **Avantic SPL12-D21 Combined Stereo Control Unit and Amplifier.** Inputs : 2 P/U 5 mV variable ; 2 tape 3 mV ; 2 tuner 100 mV variable. 5 pos. sel. (3 record equal), treble, bass, vol. loudness, stereo switch and balance control. Output 20 watts max. on

each channel. H.D. each channel 0.175% and 2% intermodulation dist. at 10 watts. Response 10-30,000 c.p.s. ± 1 dB. N.L. 70 dB at full output. Out. imp. 4, 8 and 16 ohms. Output EL84's on each channel. Size 15 in. by 14 in. by 4 in. Price to be announced.

■ **Avantic SPL12 Stereo Control Unit.** Inputs : 2 P/U 5 mV variable ; 2 tape 3 mV ; 2 tuner 100 mV variable. 5 pos. sel. (3 record equal), treble, bass, vol., loudness, stereo switch and balance control. Size 15 in. by 8 in. by 4 in. To operate with 2 DL7-35 amplifiers, one of these units will provide the required power supply. Price to be announced.

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B.K. Partners Ltd., 229 Regent Street, London, W.1. Tel.: Regent 7363.

Audio Plan Control Unit. Inputs for P/U and radio. 5 pos. sel. (4 record equal). H.D. 0.25%. H and N - 75 dB. Panel size $9\frac{1}{2}$ in. by $3\frac{1}{4}$ in. Weight 21 lb. To operate with Audio Plan power amp.

Audio Plan Amplifier Mk. I. 6 watts nom., 8.5 watts peak. Dist. 0.25%. Input for spec. output 40 mV. Response linear 30-100,000 c.p.s. at 3 watts. N.L. - 75 dB. Out. imp. 3 and 15 ohms. Output ECL82's. Size $11\frac{1}{2}$ in. by 4 in. by $4\frac{1}{2}$ in. Price with control unit £18.

Audio Plan Amplifier Mk. II. As Mk. I, but with aux. power for tuners, etc., H.T. at 30 mA and 6.3v at 2A L.T. Price with control unit £19 15s.

★

Cape Electrophonics Ltd., 43-45 Shirley High Street, Southampton. Tel. : Southampton 74251.

Cape Audio System. Three units, VL1 amplifier, VLP control unit and VLT tape unit. All self-powered with spare power for FM tuner 6.3v and 40 mA H.T. Inputs for radio, P/U, tape (direct head) and mic. (line transformer in VLP). Tape recording at $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 i.p.s. not affecting reproduction. Price £75. Also supplied with wired, matched and tested tape deck.

Cape VLP Mk. 2 Control Unit. Inputs : sel. pos. and sensitivity for 15 watts output from VL1 at 1,000 c.p.s. Radio 1 (100 mV) ; Radio 2 (50 mV). Pickup LP1 and LP2 (15 mV), 78A and 78B (18 mV). Mic. at transformer output (1.5 mV). Tape 15 i.p.s. (20 mV), $7\frac{1}{2}$ i.p.s. (30 mV). Mic. input socket 15, 30, 300 or 600 ohms match to balance line. Treble, bass, vol., low pass filter at 5 and

9 Kc/s. Fixed high pass filter at 30/40 c.p.s. Socket for recording output to VLT. Two supply sockets for 6.3v and 430v at 70 mA to VLT and FM tuner. Size 9 in. by 6 in. by 3 in. Weight 4 lb. To operate with VL1 power amp. Price £20.

Cape VL1 Mk. 2 Amplifier. 25 watts nom., approx. 40 watts max. Dist. at 1,000 c.p.s. 0.03% at 15 watts, 0.1% at 25 watts. Over range 50-10,000 c.p.s., 0.1% total at 15 watts. Input for 15 watts output, 0.8v R.M.S. Response 10-80,000 c.p.s. ± 0.5 dB. Feedback external loop 20 dB. N.L. - 85 dB at 25 watts. Out imp. 3.5, 7 and 15 ohms. Output KT66's. Ultra-linear. Choke regulated power supply. Output and driver stages balanced by direct coupled feedback. Size 15 $\frac{3}{4}$ in. by 8 $\frac{1}{2}$ in. by 7 in. Weight approx. 35 lb. Price £30.

Cape VLS Sub-amplifier. Max. gain $\times 100$. Gain and performance adjustable by feedback connection at internal tags. Can be supplied in various forms, e.g., as simple pre-amp with vol. control. Size 5 in. by 4 in. by 3 in. Price from £5.

Cape VLT Tape Unit (see tape amplifier directory).

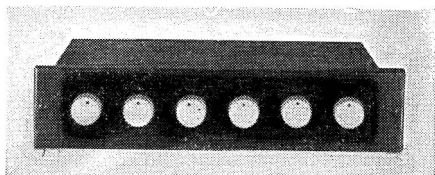
■ **Cape VLPS Stereo Control Unit.** Inputs : 2 radio (100 mV) ; 2 P/U (20 mV) ; 2 tape (0.5mV). 3 pos. sel., treble, bass, vol. (ganged switched controls). Channel selector A, B and stereo. Direct connection to tape replay head. H.D. 0.1% for 1.5v R.M.S. fixed high pass filter at 30/40 c.p.s. To operate with any power amplifiers. Power supply needed 6.3v at 1.6 A and 300/450v at 15 mA. The performance of this unit is similar to the VLP with tape head amplifier q.v. Price £25.

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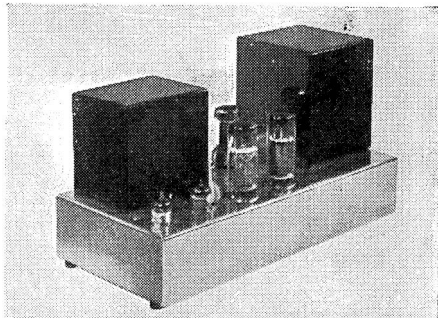
C. T. Chapman (Reproducers) Ltd., Sales Office : Riley Street, Chelsea, S.W.10. Tel. : Flaxman 4577/8.

Chapman 205CU Control Unit. 6 inputs from 1.5 mV-100 mV. 6 pos. sel., treble, bass, loudness. 3 pos. roll off, 5, 10 and 20 Kc/s. Tape record and playback jacks. H.D. < 0.1%. H and N radio - 64 dB, p/u - 54 dB. Rumble filter, better than 12 dB per octave below 35 c.p.s. Size 12 in. by 2 in. by 6 in. Weight 10 lb. To operate with power amp 205 or Williamson power amplifier. Price £18.

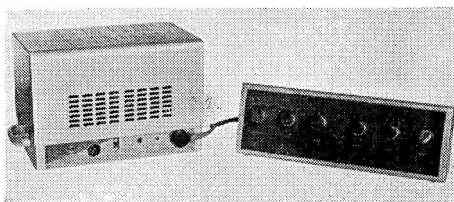
Chapman 205 Amplifier. 20 watts from 30-20,000 c.p.s. Dist. < 0.05% at 20 watts. Response 2-100,000 c.p.s. ± 1 dB. Feedback 30 dB. N.L. - 89 dB at 20 watts.



Chapman 205 control unit



Chapman 205 amplifier



E.M.I. control unit and amplifier

Out. imp. 15 ohms. Output EL34's. Ultra-linear. To operate with 205CU. Price £34.

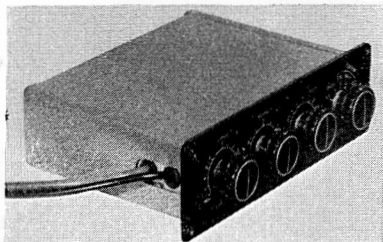
In preparation

Chapman "Tranquillo" 10-watt amplifier and control unit. Price approximately £30. Available June/July, 1958. Leaflets on request.

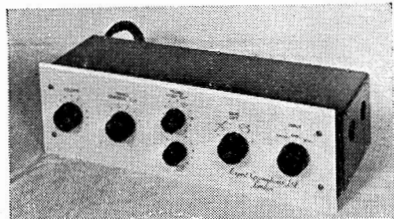
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C.Q. Audio Ltd., 2 Sarnesfield Road, Enfield, Middx. Tel.: Enfield 8262.

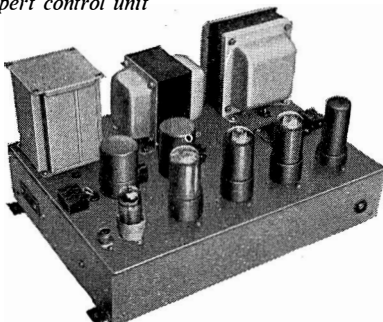
C.Q. 10-watt Combined Control Unit and Amplifier. Inputs : mag. P/U 10 mV ; crystal P/U 100 mV ; tape 300 mV ; radio 150 mV ; mic. 6 pos. sel., treble, bass, vol., tape outlet, 1 mW into 600 ohms. H.D. 0.1% at 10 watts. H and N - 80 dB below full output. P.a.t. 2 outlets of 200/240v AC one switched. Output 10 watts nom., 15 watts max. Response 20-25,000 c.p.s. ± 0.5 dB. Out. imp. 3.75, 8 and 15 ohms. Output EL84's. Ultra-linear. Power needed 100/120 or 200/240 AC. Size 11 in. by 4 in. by 8 in. Price £19 19s.



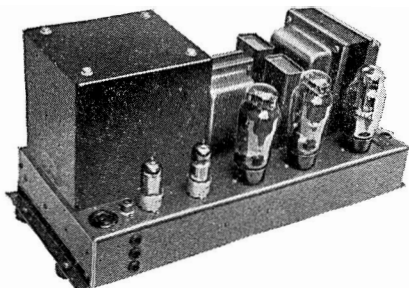
Dynatron TC10A control unit



Expert control unit



Expert "Standard" amplifier



Expert "Master" amplifier

Dynatron Radio Limited, Maidenhead, Berks.
Tel. : Maidenhead 2161/2/3.

Dynatron TC10A Tone Control Unit. Inputs : radio 0.15v ; A.F. 0.15v ; gram. 10 mV. 5 pos. sel. (3 gram.), treble, bass, vol. H.D. < 0.1%. H and N at least 74 dB below max. output. Size 3 in. by 9 in. by 6 in. Weight 3½ lb. To operate with L.F. 10A power amp. Price £12 12s. 6d.

Dynatron L.F. 10A Amplifier. 10 watts nom., 12 watts max. Dist. < 0.1%. Input for spec. output .75v. Response 30-30,000 c.p.s. ± 1 dB. Negative feedback. N.L. at least 76 dB below max. output. Out. imp. 3½, 7½ and 15 ohms. Output N209's. Ultra-linear. Size 8¾ in. by 7¾ in. by 13¾ in. Weight 14½ lb. To operate with TC10A control unit. Price £25.

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EMI Sales & Service Ltd., Blyth Road, Hayes, Middx. Tel. : Southall 2468. Cables : Emiservice, London. Telex : 2-2417.

H.M.V. 3050 Control Unit. Inputs : F.M., radio and tape, all 850 mV ; aux. 3 mV ; gram. 1.5 mV. 5 pos. sel., 5 pos. equalisation switch, treble, bass, switch filter at 5, 9, 13 and 20 Kc/s. Tape playback sockets. H.D. at 1,000 c.p.s. < 0.1% at 2v. H and N including 3051, level 50 dB below 10 watts. Bridged "T" bass cut filter. Size 18 in. by 6¾ in. by 3½ in. Weight 10 lb. To operate with 3051 power amp. or 3052 speaker comb.

H.M.V. 3051 Amplifier. (Also incorporated in 3052 speaker comb.). 10 watts nom., 18 watts max. Dist. < 0.1% at 10 watts. Input for spec. output 2.5v RMS. Response 20-20,000 c.p.s. ± 1 dB. N.L. < 75 dB below 10 watts output. Out. imp. 4, 8 or 16 ohms. Output KT66's. Ultra-linear. Size 14½ in. by 10 in. by 11 in. Weight 50 lb. To operate with 3050 control unit. Price on application.

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Expert Gramophones Ltd., 39-41 New Oxford Street, London, W.C.1. Tel. : Covent Garden 2156.

Expert Control Unit. Input P/U : tape, radio, all 20 mV. 3 pos. sel., vol., bass, treble filter-variable slope. Tape input socket. H.D. < 0.1%. H and N — 60 dB. Attenuation introduced below 20 c.p.s. P.a.t. from power amp. Size 12 in. by 3½ in. by 6 in. Weight 4 lb. To operate with Expert "Master" and "Standard" or any similar power amp. Price £18.

Expert "Standard" Amplifier. 12 watts nom., 14 watts max. Dist. 0.1%. Input for spec. output 200 mV. Response 20-25,000 c.p.s. ± 0.5 dB. Feedback 30 dB. N.L. — 80 dB at 8 watts. Out. imp. 15 ohms. Output EL84's. Ultra-linear. Size 12 in. by 9 in. by 6½ in. Weight 16 lb. To operate with Expert control unit or similar. Price £23.

Expert "Master" Amplifier. 20 watts nom., 26 watts max. Dist. 0.07%. Input for spec. output 200 mV. Response 20-30,000

c.p.s. \pm 0.5 dB. Feedback 30 dB. N.L. — 85 dB at 20 watts. Out. imp. 15 ohms. Output EL34's. Ultra-linear. Size 12 in. by 9 in. by 7½ in. Weight 24 lb. To operate with Expert control unit or any similar. Price £35.

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General Electric Co. Ltd., Magnet House, Kingsway, W.C.2. Tel. : Temple Bar 8000. Cables : Polyphase, London.

G.E.C. BCS2417A Control Unit. Inputs : p/U 15 mV ; radio 300 mV ; tape 7½ mV. 6 pos. sel. (4 gram.), treble, bass, presence, vol. Provision made for easy add. of tape pre-amp stage allowing direct connection to tape playback head. H and N approx. —66 dB at 12 watts. P.a.t. from BCS2418A power amp. To operate with BCS2418A power amp. and only sold in conjunction with it.

G.E.C. BCS2418A Amplifier. 12 watts nom. Dist. < 0.5% at 12 watts. Input for spec. output 120 mV. Response 15-20,000 c.p.s. \pm 1 dB. Feedback 15 dB overall. Out. imp. 15 ohms (or 1, 2 or 3 3-5 ohms speakers). Output N709's. Weight 7½ lb. Price, complete with BCS2417A control unit £40 19s.

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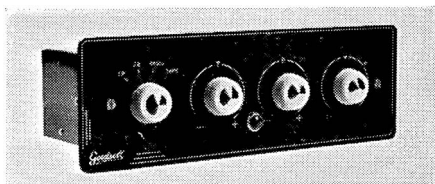
Goodsell Ltd., 40 Gardner Street, Brighton. Tel. : Brighton 26735.

Golden UL/TC Control Unit. Inputs : gram. 15 mV ; mic. 5 mV ; radio 60 mV. 6 pos. sel. (4 gram.), treble, bass, vol., tape/radio socket. Spec. dependent on amp used. Size 7 in. by 8 in. by 2 in. For use with MA5 or MA5 De Luxe power amp. Price £8 8s.

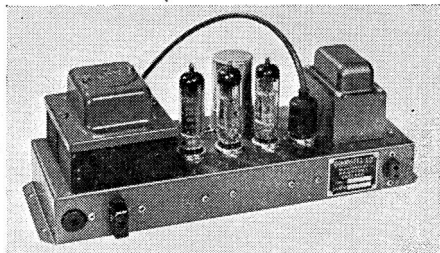
Also available UL/FTC, this is a high gain version of the UL/TC. P/U input variable between 5 and 150 mV. It also has a low pass filter giving steep cuts at 5, 7, 10 and 13 Kc/s.

Golden PFA Control Unit. Inputs : gram. 5-7 mV ; mic. 5 mV ; radio 80 mV. 4 pos. sel., treble, bass, vol. Separate "roll-off" and "turnover" facilities covering all known equalising characteristics. Switched filter 5, 7, 9, 13 Kc/s and "out." Spec. dependent on amp used. Size 11 in. by 9 in. by 3½ in. Weight 4 lb. To operate with MA5 and G.W. 18 power amp. Price £20.

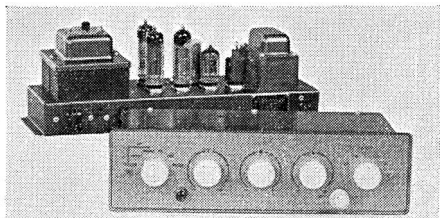
PA8 Control Unit. Inputs : radio 150 mV ; tape P/U 40 mV. 4 pos. sel., treble, bass, vol., tape input socket. P.a.t. (from main amp.) 250v at 35 mA, 6.3v at 2.5 A. H and N better than 70 dB at 6 watts. Size 8½ in. by



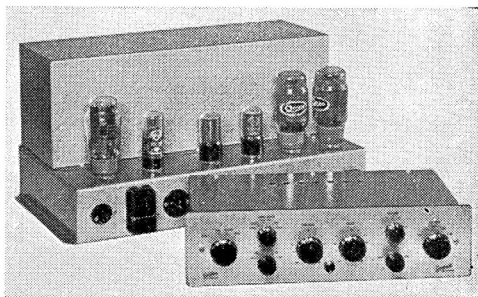
Goodsell PA8 control unit



Goodsell MA2 amplifier



Goodsell UL/FTC control unit and MA5 Mk. II amplifier

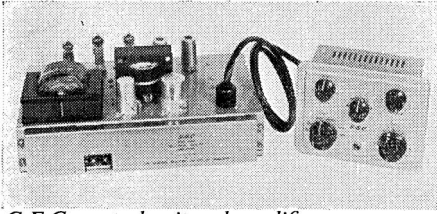


Goodsell PFA control unit and GW18 amplifier

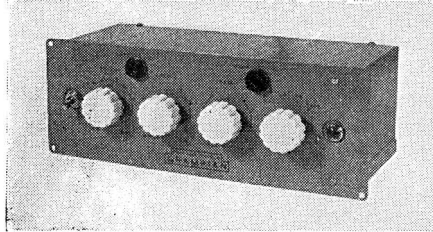
2½ in. by 2¼ in. To operate with MA2 power amp.

MA2 Amplifier. 6 watts nom., 8 watts max. Dist. 0.2% at 6 watts. Input for spec. output, 1.5v R.M.S. Response 25-50,000 c.p.s. Feedback 18 dB. N.L. — 70 dB. Out. imp. 3 or 15 ohms. Output ECL82's. Size 12¾ in. by 4½ in. by 5 in. Weight 9 lb. Price complete with PA8 control unit £9 15s.

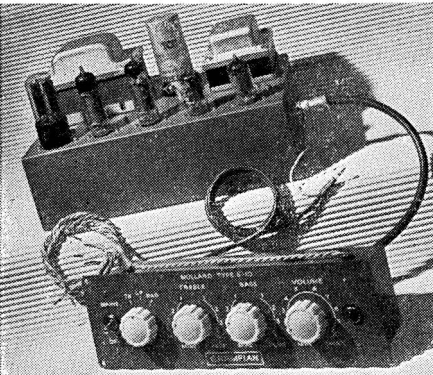
MA5 Mk. II Amplifier. 15 watts. Dist. < 0.2% at 12 watts. Input for spec. output



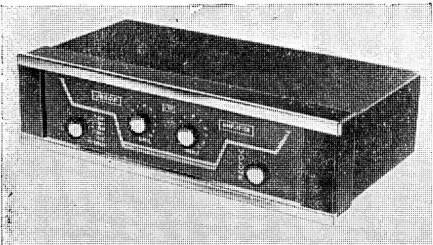
G.E.C. control unit and amplifier



Gramplan 56 control unit



Gramplan 54 control unit and 5-10 amplifier



Jason J10 amplifier

1.5v. Response 30-25,000 c.p.s. ± 2 dB. Feedback 20 dB. N.L. - 70 dB. Out. imp. 4, 8, 15 ohms. Output EL84's. Ultra-linear. Size $8\frac{1}{2}$ in. by 7 in. by $6\frac{1}{2}$ in. Weight 16 lb. To operate with UL/TC or PFA control units. Price £15.

MA25 Amplifier. 20 watts. Dist. 0.2%. Input for spec. output 1.5v. Response

20-100,000 c.p.s. Feedback 20 dB. N.L. - 80 dB. Out. imp. 3, 8, 15 ohms. Output EL34's. Ultra-linear, special output transformer. Size 16 in. by 7 in. by 6 in. To operate with UL/TC, UL/FTC or PFA control units. Price from £21.

GW12 Mk. II Amplifier. 20 watts. Dist. 0.1% input for spec. output 1.5v. Response 20-100,000 c.p.s. Feedback 20 dB. N.L. better than - 75 dB. Out. imp. 3, 8 and 15 ohms. Output KT66's. Ultra-linear. Size 14 in. by 10 in. by 7 in. Weight 35 lb. To operate with PFA or UL/TC control units. Price £27 10s.

Golden GW18 "Williamson" Amplifier Mk. II. 30 watts. Dist. <0.1%. Input for spec. output 1.5v. Response 20-100,000 c.p.s. ± 2 dB. Feedback 20 dB. N.L. - 75 dB. Out. imp. 3 or 8 or 15 ohms. Output KT88's. Size 17 in. by $11\frac{1}{2}$ in. by $8\frac{3}{4}$ in. Weight 54 lb. To operate with PFA control unit. Price from £40 10s.

In preparation

■ **Twin Channel Control Units and Amplifiers** from 16-90 watts. Prices from £42. Available on request.

■ **Stereo Replay, Tape Record and Replay Unit.** Prices from £21. Available on request.

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Gramplan Reproducers Ltd., Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657/8/9. Cables: Reamp, Feltham.

Gramplan 56 Control Unit. Inputs : P/U 10 mV ; radio 100 mV ; tape 50 mV. 4 pos. sel., treble, bass, vol. Tape input socket. P.a.t. from power amp. Size $10\frac{1}{2}$ in. by $3\frac{3}{4}$ in. by $5\frac{3}{4}$ in. Price £11 2s. 6d.

Gramplan 5-10 Amplifier. 10 watts nom., 11 watts max. Dist. <0.4% at 40 c.p.s. ; <0.2% at 400 c.p.s. ; <0.3% at 2,000 c.p.s. Input for spec. output 40 mV. Response 10-20,000 c.p.s. ± 0.5 dB. Feedback 20 dB. N.L. - 73 dB. Out. imp. 4, $7\frac{1}{2}$ and 15 ohms. Output EL84's. Ultra-linear. Size $10\frac{1}{2}$ in. by $7\frac{1}{4}$ in. by 6 in. Weight 13 lb. To operate with 54 or 56 control unit. Price £15 17s. 6d.

In preparation

Gramplan 580 Control Unit. Inputs : radio, tape, P/U, 50 mV approx. 6 pos. sel., treble, bass, vol. Tape replay socket. Switched equalisation for P/Us. Size $10\frac{1}{2}$ in. by 4 in. by $4\frac{1}{2}$ in. To operate with 10-15 amplifier. Price not yet announced.

Gramplan 10-15 Amplifier. 10 watts nom., 15 watts peak. Dist. 0.1% at 10 watts. Input for spec. output 300 mV. Response

30-20,000 c.p.s. ± 1 dB. Feedback 20 dB N.L. — 65 dB below full output. Out. imp. 4, 8, 15 ohms. Output EL84's. Ultra-linear. Size 11 in. by 7½ in. by 6½ in. Weight 15 lb. To operate with "580" control unit. Price not yet announced.

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Jason Motor & Electronic Co., 3/4 Gt.Chapel Street, London, W.1. Tel.: Gerrard 0273/4.

J10 Combined Control Unit and Power Amplifier. Inputs : mic. 1 mV ; tape 0.5 mV ; radio 0.5 mV ; P/U 10v. and crystal P/U. 6 pos. sel., treble, bass, vol. P.a.t. 270v at 10 mA, 6.3v at .3A. Output 10 watts nom., 15 watts max. Dist. 0.1%. Response 30-30,000 c.p.s. ± 2 dB. N.L. better than 55 dB (mic. input). Out imp. 15 ohms (other imp. to order). Output EL84's. Ultra-linear. Size 15 in. by 8½ in. by 4¾ in. Price £22 10s.

In preparation

■**J20 Stereo Twin Channel Amplifier.** Specification as J10 but consisting of 2 separate amplifiers. Price approx. £38.

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H. J. Leak & Co. Ltd., 57/59 Brunel Road, East Acton, London, W.3. Tel.: Shepherds Bush 1173. Cables : Sinusoidal, Ealux, London.

Point One Plus Control Unit. Inputs : tape 50 mV or mic. 4 mV, tuner 50 mV, P/U 9.5 mV. 6 pos. sel., 4 record equal, treble, bass, vol., mains on/off. Switch filter 4, 6 and 9 Kc/s. Input level control for P/U, tuner. Tape record and replay sockets on front and rear. H.D. <0.01%. H and N — 66 dB. Size 11½ in. by 4¾ in. by 5 in. Weight 4¾ lb. To operate with TL/12 plus, TL/25 plus or TL/50 plus amplifier. Price £12 12s.

Vari-slope III Control Unit. Inputs : tape or mic. 5 mV ; tuner 45 mV ; pickup I 9 mV ; pickup II 9 mV. 6 pos. sel. and change-over switch for pickup I/pickup II. Treble, bass, vol., mains on/off. Switched, low pass filter 5, 7, and 9 Kc/s plus Vari-slope controls. Rumble filter, cut-in. Input level controls for tuner, pickup I, pickup II. Tape input sockets on front and back panels. H.D. <0.01%. H and N — 66 dB. P.a.t. on TL/12 plus power amp. Size 11½ in. by 4¾ in. by 4 in. Weight 4½ lb. To operate with TL/12 plus TL/25 plus and TL/50 power amp. Price £15 15s.

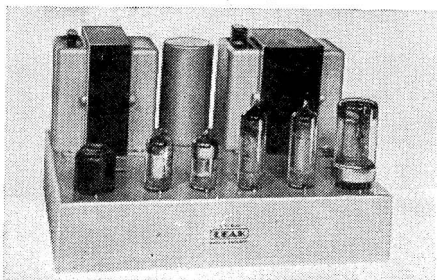
"Point One" TL/12 Plus Amplifier. 12 watts. Dist. 0.1%. Input for spec. output 125 mV. Response 20-20,000 c.p.s. ± 0.25 dB. Feedback 26 dB. N.L. — 84 dB.



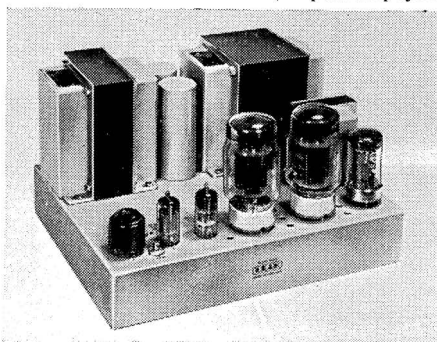
Leak point one plus control unit



Leak Vari-slope III control unit



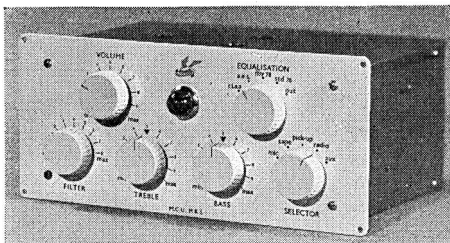
Leak TL/12 plus amplifier



Leak TL/50 plus amplifier

Out. imp. 4, 8 and 16 ohms. Output EL84's. Ultra-linear. Size 10 in. by 8 in. by 6 in. Weight 16 lb. To operate with Vari-slope III or Point One Plus control units. Price £18 18s.

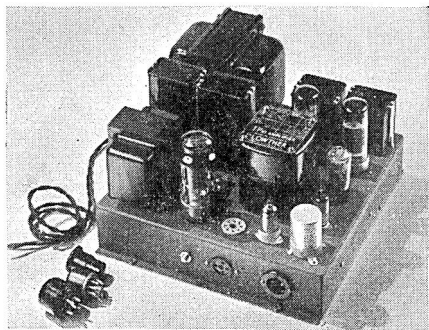
"Point One" TL/25 Plus Amplifier. 25 watts. Dist. 0.1%. Input for spec.



Lowther Master control unit Mk II



Lowther LL10 amplifier



Lowther LL16 amplifier

output 125 mV. Response 20-20,000 c.p.s. ± 0.25 dB. Feedback 26 dB. N.L. - 83 dB. Out. imp. 4, 8 and 16 ohms (other imps. to order). Output EL34's. Ultra-linear. Size 10 in. by 8 in. by $6\frac{3}{8}$ in. Weight 22 lb. To operate with Vari-slope III or Point One Plus control units. Price £25 4s.

"Point One" TL/50 Plus Amplifier. 50 watts. Dist. 0.1%. Input for spec. output 125 mV. Response 20-20,000 c.p.s. ± 0.25 dB. Feedback 26 dB. N.L. - 84 dB. Out. imp. 4, 8 and 16 ohms (other imps. to order). Output KT88's. Ultra-linear. Size $11\frac{1}{2}$ in. by 9 in. by $6\frac{3}{8}$ in. Weight 26 lb. To operate with Vari-slope III or Point One Plus control units. Price £33 12s.

In preparation

■ Stereomaster Control Unit. Twin channel inputs for P/U, 5 mV; tuner 50 mV; tape recorder 50 mV; tape head 4 mV; mic. 3.5 mV; Stereo/monaural and rumble switches, balance, treble, bass, vol., mains on/off. Input level controls. Tape sockets for recording. H.D. 0.01% on each channel. H. and N. - 66 dB. To operate with "Point One" stereo 20 amplifier. Available Autumn 1958. Price £21.

■ "Point One" Stereo 20 Amplifier. 10 watts each channel. Dist. 0.1% on each channel. Input for spec. output 125 mV. Response 20-20,000 c.p.s. Feedback 24 dB. N.L. - 80 dB. Out imp. 4, 8 and 16 ohms. Output EL84's. Ultra-linear. To operate with "Point One Stereo" control unit. Available Autumn, 1958. Price approx. £30 9s.



Lowther Manufacturing Co., Lowther House, St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

Lowther No. 2 Control Unit. Inputs: mic. 45 mV; P/U 45 mV; radio 100 mV. 4 pos. sel., treble, bass, vol., on/off. Mic./tape input socket. H.D. 0.1% on 1v RMS. H and N - 60 dB. Size $10\frac{1}{2}$ in. by 3 in. by $3\frac{1}{2}$ in. Weight 2 lb. To operate with LL10, LL16 and similar power amp. Price £10 10s.

Masier Control Unit Mk. I. Inputs: mic., P/U 3 mV; tape, radio 100 mV. 5 pos. sel. 5 pos. rec. equal, treble, bass, vol., on/off, low pass filter, 18 dB per octave, 35 down to 4 Kc/s. Tape input sockets. H.D. < 0.1%. H and N - 90 dB. Size $10\frac{1}{2}$ in. by $5\frac{1}{2}$ in. by $7\frac{1}{2}$ in. Weight 6 lb. To operate with LL10, LL16 and similar power amp. Price £20.

Master Control Unit Mk. II. Inputs: mic., P/U and tape head 3 mV; radio, aux. 100 mV. 6 pos. sel. 5 pos. record equal, treble, bass, vol., on/off. Low pass filter. 18 dB per octave. 35 down to 4 Kc/s. Socket for direct connection to tape playback head. H.D. < 0.1%. H and N - 80 dB. Size $10\frac{1}{2}$ in. by $5\frac{1}{2}$ in. by $7\frac{1}{2}$ in. Weight 6 lb. To operate with LL10, LL16 and similar power amp.

Lowther LL10 Amplifier. 10 watts. Dist. < 0.1%. Input for spec. output .75v. Response 30-30,000 c.p.s. ± 1 dB. Feedback 22 dB. N.L. - 80 dB. Out. imp. 16 ohms with adjustment. Output EL34's. "Lowther Linear" (screen and anode feedback). P.a.t. Size 12 in. by 9 in. by $6\frac{1}{2}$ in. Weight

18½ lb. To operate with MCUI, MCUII or control unit No. 2. Price £25.

Lowther LL16 Amplifier. 16 watts. Dist. < 0.1%. Input for spec. output 0.75v. Response 20-60,000 c.p.s. ± 1 dB. Feedback 22 dB. N.L. - 90 dB. Out. imp. 16 ohms with adjustment. Output EL34's. "Lowther Linear." P.a.t. Size 12 in. by 12 in. by 8½ in. Weight 30 lb. To operate with MCUI, MCUII or control unit No. 2. Price £40.

Lowther-Murray Transistor Control Unit No. 1. Inputs : 5 mV. 5-50 ohms. On/off battery switch only. Imp. matching transistor pre-amp forward gain 100-1. Dist. not measurable at normal output. No hum/noise. Size approx. 3½ in. by 3½ in. by 6 in. Weight 1 lb. To operate with any power amp. Price £9 9s.

Lowther-Murray Transistor Control Unit No. 2. Spec. as for No. 1 but gain 45-1. Size 3½ in. by 3½ in. by 3½ in. Weight 8 oz. To operate with any power amp. Price £6 6s.

Lowther-Murray Transistor Control Unit No. 3. Inputs 5 mV, low imp. 5-50 ohms. Imp. matching transistor control unit with corrections for connection to normal "Radio" position. 4 pos. sel. off, R.I.A.A., ffr 78, mic. H.D. nil. H and N no hum, less noise than record or radio background. Size approx. 3½ in. by 3½ in. by 6 in. Weight 2 lb. To operate with any power amp. Price £12 12s.

In preparation

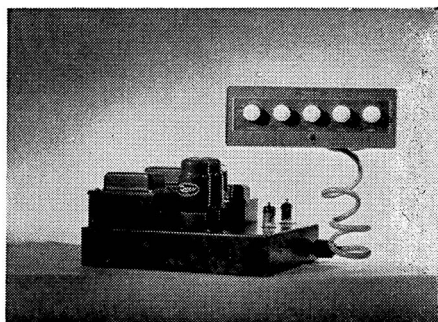
■ **Lowther S.C.U. Stereo Control Unit.** Input as for Master Control Unit Mk. I Tape input sockets. H.D. 0.1%. Dual low pass filters. Dual output balanced and balance controls between channels. Size and weight as M.C.U. Mk. I. To operate with LL10S power amp. Price (tentatively) £40.

■ **Lowther LL10S Stereo Amplifier.** 10 watts output on each channel. Dist. 1%. Input for spec. output 0.75v. Response 20-40,000 c.p.s. ± 1 dB. N.L. 80 dB. Out. imp. 7.5 or 15 ohms. Output EL34. "Lowther Linear." Size 11 in. by 10 in. by 8 in. To operate with SCU control unit. Price (tentatively) £40.

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Pamphonic Reproducers Ltd., 17 Stratton Street, W.1. Tel.: Grosvenor 1926.

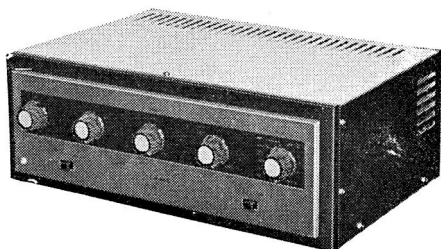
1004 Self-contained Control Unit and Power Amp. Separate controls for bass, treble, volume and loudness (contour), and



Pamphonic 2001 control unit and amplifier



Pamphonic 1004 amplifier

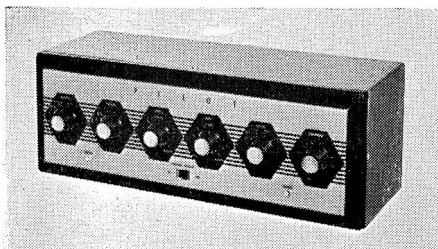


Pilot HFA II amplifier

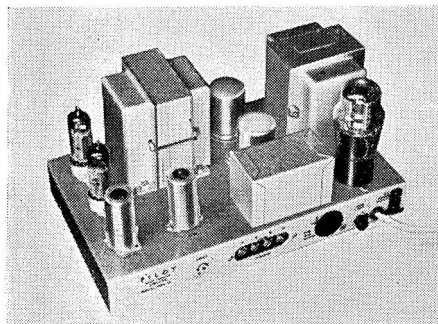
input selection. Plug-in gram. attenuation. 10 watts. Dist. at 1,000 c.p.s., 0.5% at 10 watts. Input voltage for spec. output mic. 2.5 mV ; tape/radio 100 mV ; P/U 12-15 mV. Response substantially flat 50-50,000 c.p.s. Feedback 20 dB. N.L. mic. - 53 dB, P/U - 54 dB. Out. imp. 3.5 and 15 ohms. Output 6 BW6's. Ultra-linear. Price £26 5s.

1002B Control Unit. Inputs : mic. 2-3 mV, radio/tape 60 mV ; P/U 6-8 mV. Push-button sel. 9 pos. (6 gram.). Cut-off filter 4, 7, 12 Kc/s and "out." Terminals for tape input. H and N 60 dB below 0.5v. P.a.t. Size 10½ in. by 4½ in. by 7½ in. To operate with 2001 power amp. Price £25 4s.

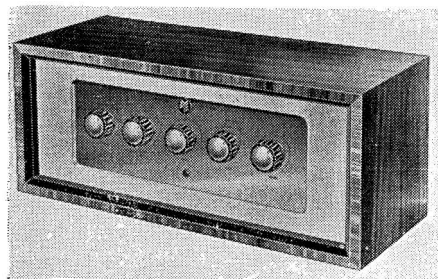
2001A Control Unit. Inputs : 3-120 mV depending on input. 6 pos. sel. Pre-set



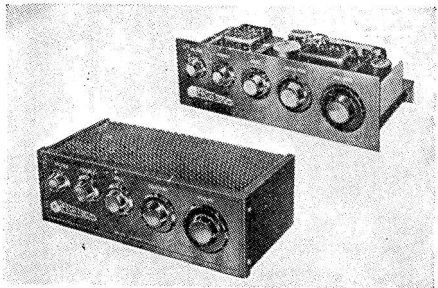
Pilot HFC12 control unit



Pilot HFA12 amplifier



Pye "Proctor" control unit



Pye Mozart HF10 and HF10M

level control for tape/radio. Cut-off filter at 4, 7, 12 Kc/s and "out." Loudness control. Tape input sockets. H and N 60 dB below full output. P.a.t. To operate with 2001 power amp. Price £12 12s.

2001 Amplifier. 25 watts. Dist. at 1,000 c.p.s., 0.05% at 15 watts. Input for spec. output 0.5v. Response substantially flat 2-100,000 c.p.s. Feedback 28 dB. N.L. 90 dB below full output. Out. imp. 3.75, 6.6, 10 and 15 ohms. Output KT66's. Ultra-linear. To operate with 2001A or 1002B control units. Price £29 8s.

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Period High Fidelity, see "Saville"

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Pilot Radio Limited, High Fidelity Division, Park Royal Road, London, N.W.10. Tel.: Elgar 7353. Cables: Piloset, London.

HFA11 Self-contained Control Unit and Power Amplifier. 5 inputs—magnetic P/U 3/5 mV; crystal P/U 160 mV; radio, aux., tape, 120 mV. 7 pos. sel. (4 record equal.). Switched scratch and rumble filters. Variable treble, bass, loudness and vol. Tape input and output sockets. 10 watts output. Dist. $\pm 0.1\%$ for 8 watts at 1 Kc. Response 20-20,000 c.p.s. ± 1 dB. Neg. feedback 21 dB. N.L. 80 dB below full output. Out. imp. 3.8 and 15 ohms. Output EL84's. Ultra-linear. Size $13\frac{3}{8}$ in. by $8\frac{5}{8}$ in. by 5 in. Weight 11 lb. Price £31 10s.

HFC12 Control Unit. Inputs: P/U magnetic 3/5 mV and 20 mV; crystal 50 mV; radio 150 mV; tape 150 mV; aux. 3/5 mV. 7 pos. sel. (4 record equal.) treble, bass, vol. Filter 5, 7, 10 Kc/s. and flat, loudness with on/off, muting switch. Tape input and output sockets. Built-in high pass filter. H.D. (with main amp.) 0.1% for 8 watts at 1,000 c.p.s. H and N 80 dB below full output. P.a.t. AC outlet only. Size $13\frac{3}{8}$ in. by 5 in. by $5\frac{1}{8}$ in. Weight 4 lb. Price £16 16s.

HFA12 Amplifier. 12 watts nom. Dist. 0.1% for 8 watts at 1 Kc. Input for spec. output 200 mV. Response 15-50,000 c.p.s. ± 1 dB. Feedback 22 dB. N.L. 80 dB below full output. Out. imp. 3, 8 and 15 ohms. Output EL84's. Ultra-linear. Size $11\frac{1}{2}$ in. by $6\frac{1}{4}$ in. by $6\frac{3}{4}$ in. Weight 15 lb. To operate with HFC12 control unit. Price £21.

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Pye Limited, Radio Works, Cambridge. Tel.: Cambridge 85985. Cables: Pyrad, Cambridge.

HF10 Mozart Self-contained Control Unit and Power Amplifier. Inputs: tape 100 mV; radio 100 mV; P/U 15, 10 and 10 mV on each of the 3 curves at 1,000 c.p.s. special compensation for all makes of P/Us. 5 pos. sel., treble, bass, vol., mains on/off, filter at 4, 7, 12 Kc/s. and out. Tape replay socket.

H.D. 0.3% at 1,000 c.p.s. and 9 watts. H and N main amp. — 70 dB ; tape, radio — 60 dB ; P/U — 55 dB. Output 10 watts nom. Response 3-70,000 c.p.s. \pm 3 dB. Feedback 3 main loops over output stage — 5, 8 and 14 dB. Out. imp. 4, 8 and 15 ohms. Output 1 EL34. Integrated single ended ultra-linear. Size 10½ in. by 3½ in. by 5½ in. Weight 10¾ lb. Price £23 2s. Also available in metal case for shelf mounting, HF10M £24 13s. 6d. and mounted in cabinet with provision for motor HFP1 £33 12s.

Proctor HF25A Control Unit. HF25AW in cabinet. Inputs : tape 120 mV ; radio 120 mV ; mic. 3 mV ; P/U max. sens. 8 mV dependent on P/U compensator used. 7 pos. sel. (4 gram.), treble, bass, vol. and on/off. Switched filter 4, 7 and 12 Kc/s and "out." Tape input socket. H and N — 60 dB on 0.5v. Size 10½ in. by 4 in. by 4 in. Weight 2 lb. To operate with HF25 power amp. Price HF25A £12 12s. ; HF25AW £17 6s. 6d.

Provost HF25 Amplifier. 25 watts nom., 30 watts max. Dist. 0.3% at 25 watts, 3.0% at 30 watts. Input for spec. output 0.5v. Response 2-160 Kc/s \pm 3 dB. Feedback 26 dB. Variable poss. feedback by means of manual control. N.L. — 90 dB at 25 watts. Out. imp. 3.75, 6.6, 15 and 60 ohms. Output KT66's. Ultra-linear. Size 13½ in. by 10 in. by 7 in. Weight 27 lb. To operate with HF25A control unit. Price £29 8s.

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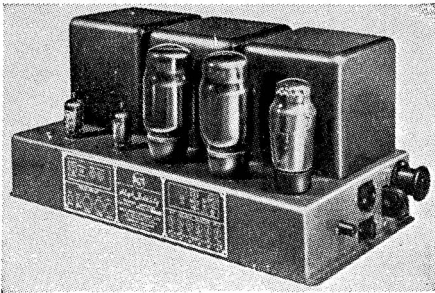
RCA Great Britain Ltd., Lincoln Way, Sunbury-on-Thames, Middx. Tel.: Sunbury-on-Thames 3101. Cables : Telex and Tex 28608.

RCA New Orthophonic Control Unit LMI.32215A. Inputs : mic. 6.5 mV ; radio/tape 200 mV ; radio/tape 50 mV ; P/U (crystal) 300 mV ; P/U (magnetic) 11.5-16 mV. 6 pos. sel. (4 gram.), treble, bass, vol. Switched filter 5, 7 and 10 Kc/s. Variable slope control inc. on/off switch, variable to 35 dB per octave. Tape playback. H.D. < 0.1% at 700 c.p.s. at 10 watts. H and N 85 dB below rated output. Rumble filter built in on power amp. LMI.32216. P.a.t. 395v at 45 mA, 6.3v at 2.5 A. Size 12½ in. by 6½ in. by 3½ in. Weight 7 lb. To operate with RCA power amp LMI.32216A. Price £16 10s.

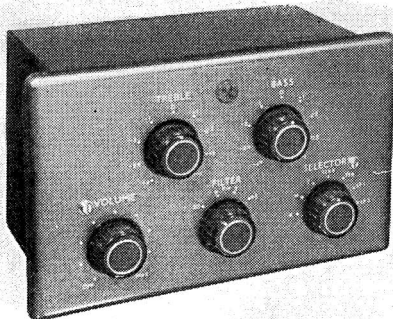
RCA New Orthophonic Amplifier LMI.32216A. 20 watts nom., 40 watts max. Dist. at 700 c.p.s. < 0.1% at 10 watts. Input for spec. output 1.2v. Response



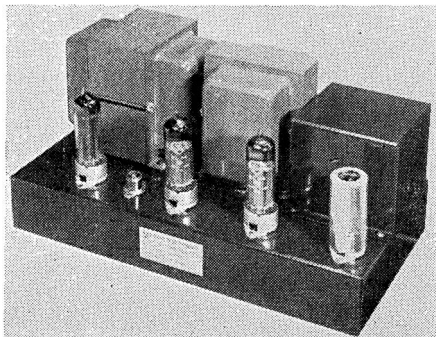
RCA control unit



RCA amplifier

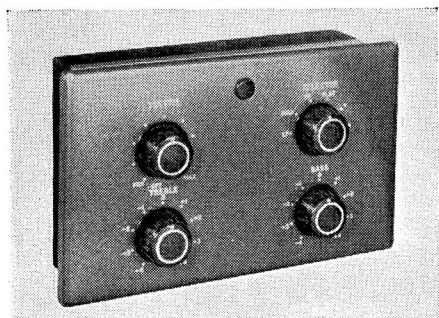


Rogers R.D. Junior control unit

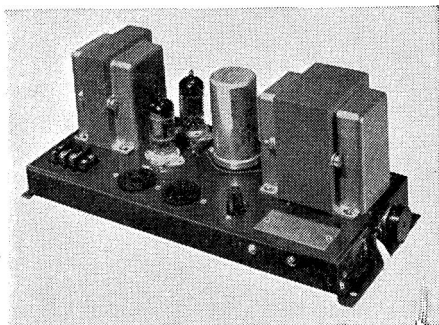


Rogers RD Junior amplifier

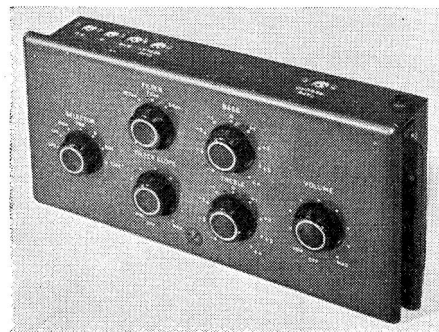
20-20,000 c.p.s. \pm 0.2 dB. Feedback — 40 dB total. N.L. 85 dB below rated output. Out. imp. 4, 7 and 15 ohms. Output KT66's. Improved ultra-linear. Size 16½ in. by 8 in. by 7½ in. Weight 32 lb. To operate with LMI.32215 control unit. Price £24 10s.



Rogers R.D. Minor control unit



Rogers R.D. Minor amplifier



Rogers K.D. Senior control unit

Rogers Developments (Electronics) Ltd.,
4-14 Barmeston Road, Catford, S.E.6.
Tel.: Hither Green 7424. Cables :
Rodevco, London, S.E.6.

RD Cadet Control Unit. Prov. spec. inputs : tape 100 mV ; radio 100 mV ; P/U1 comp. 60 mV ; P/U1 flat 15 mV ; P/U2 comp. 300 mV ; P/U2 flat 75 mV. 6 pos. sel., treble, bass, vol. on/off. Tape record and replay sockets. Size 8½ in. by 5½ in. by 2½ in. Weight 3 lb. To operate with RD Cadet amplifier. Price £7.

RD Junior Mk. II Control Unit. Inputs : tape 20 mV ; radio 50 mV ; mic. 2 mV ; P/U1 5-6 mV ; P/U2 25-30 mV. 7 pos. sel., (4 record equal.), treble, bass, vol. on/off. Switched filter 4, 5, 7, 9 and 20 Kc/s. Tape record and replay sockets. Size 8½ in. by 5½ in. by 4¾ in. Weight 5 lb. To operate with RD Junior amplifier. Price £11.

RD Cadet Amplifier. Prov. spec. 5 watts nom., 6 watts max. Dist. 3.5% at 4 watts (100 c.p.s. and 6,000 c.p.s. mixed 4 to 1). Input voltage for spec. output 600 mV. Response 30-20,000 c.p.s. ± 0.25 dB. Feedback 14 dB ± 1 dB, 30-20,000 c.p.s. N.L. - 72 dB below 5 watts. P.a.t. 230v at 35 mA, 6.3v at 2 A. Out. imp. 15 or 3.78 ohms. Output ECL83's. Ultra-linear. Size 11 in. by 4½ in. by 4½ in. Weight 6½ lb. To operate with RD Cadet control unit. Price £10 10s.

RD Senior Mk. II Amplifier. 20 watts nom., 36 watts peak. Dist. 0.1% at 15 watts. Input for spec. output 1.4v for 20 watts. Response 25-20,000 c.p.s. ± 0.25 dB. Feedback 25 dB (2 loop). N.L. - 95 dB below 20 watts. Out. imp. 3.75, 7.5 and 15 ohms. P.a.t. 425v at 40 mA, 6.3v at 2 A. Output EL34's. Ultra-linear. Size 13 in. by 8 in. by 8 in. Weight 28 lb. To operate with RD Senior Mk. II control unit. Price £28.

RD Senior Control Unit Mk. IV. Inputs : radio/mic. 2 mV ; radio 100 mV ; tape 50 mV ; P/U 8-10 mV. 7 pos. sel. (4 record equal.), treble, bass vol. and on/off. Switched filter 5, 7 and 9 Kc/s. Filter slope control 5-30 dB per octave. Tape record 1.5v and replay socket (flat or C.C.I.R. at 7½ i.p.s.). Rumble filter fixed 12-15 dB fall off below 25 c.p.s. Size 10½ in. by 5 in. by 2½ in. Weight 5 lb. To operate with RD Senior Mk. II power amp. Price £13 10s.

RD Junior Amplifier. 9-11 watts nom., 13 watts max. Dist. at 1,000 c.p.s. 0.12% at 9 watts, 0.2% at 11 watts, 0.5% at 13 watts. Input for spec. output 600 mV RMS for 9 watts. Response 20-30,000 c.p.s. ± 0.25 dB. Feedback 20 dB. N.L. - 85 dB below 9 watts. P.a.t. 285v at 40 mA, 6.3v at 2.5 A. Out. imp. 2-3, 6-8, 12-16 ohms. Output EL84's. Ultra-linear. Size 11 in. by 6 in. by 5½ in. Weight 15 lb. For Junior II control unit. Price £17.

■ In preparation : a stereo control unit.

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Period High Fidelity Ltd., 28 South Street, London, W.1. Tel. : Grosvenor 4686.

■ **Saville Stereo control unit.** Inputs for P/U 78 and P/U 1.p. stereo tapes and stereo disk. 10 mV sensitivity. 6 pos. sel. Ganged

treble, bass and vol. Direct replay from tape head. H.D. 0.1% at 1,000 c.p.s. and 20 watts H. and N. 85 dB down at rated output. Size 11 in. by 5½ in. by 6¼ in. To operate with Saville main amplifier. Price £15.

Saville Amplifier. 20 watts. nom. 30 watts peak. Dist. 0.1% at 1,000 c.p.s. and 20 watts. Input for spec. output, 1v. Response 32-30,000 c.p.s. ± 1 dB. N.L. 85 dB down at rated output. Out. Imp. 7 and 15 ohms. Output EL34's. Ultra Linear. Size 11¼ in. by 7½ in. by 8 in. For use with Saville Stereo control unit. 2 amps are necessary for stereo. Price £27.

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Shirley Laboratories Ltd., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

Jupiter 3B/1-15E Self-contained Control Unit and Power Amplifier. Inputs: radio, tape, P/U 78 and L.P. Output 15 watts nom., 25 watts max. Input for spec. output approx. 50 mV for 15 watts. Treble, bass, vol. Response 45-35,000 c.p.s. ± 1½ dB. N.L. - 80 dB. Dist. 0.2% at 10 watts and 1,000 c.p.s. Out imp. 15 ohms or as requested. Output EL84. P.a.t. 250v at 35 mA, 6.3v at 2 A. Size 10 in. by 7 in. by 6½ in. Weight 14 lb. Price £23 2s.

Jupiter 3B/1-30E Self-contained Control Unit and Power Amplifier. Spec. as for 3B/1-15E except output 30 watts nom., 45 watts max. Response 28-35,000 c.p.s. ± 1½ dB. Output EL34's. Price £33 12s.

Mullard 20-watt Control Unit. Inputs: radio/tape 100 mV; l.p. 4 mV/50 mV; 78 5 mV/60 mV; mic. 1.5 mV. 4 pos. sel., treble, bass, vol., low-pass filter at 5, 10 and 20 Kc/s. High-pass filter at 35 c.p.s. Sold only with Mullard 20-watt power amp.

Mullard 20-watt Amplifier. 20 watts nom., 35 watts max. Dist. 0.05% at 20 watts. Input for spec. output 220 mV. Response 30-20,000 c.p.s. ± 0.5 dB. N.L. - 89 dB. Out. imp. as required. Output EL34's. Ultra-linear. Price complete with control unit £54 12s.

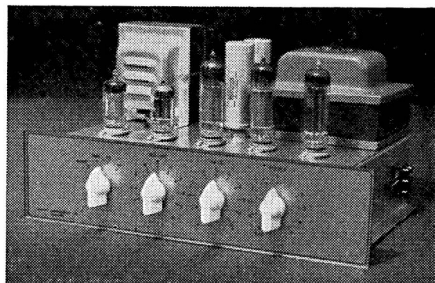
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H. L. Smith & Co. Ltd., 287/289 Edgware Road, London, W.2. Tel.: Paddington 5891/7595.

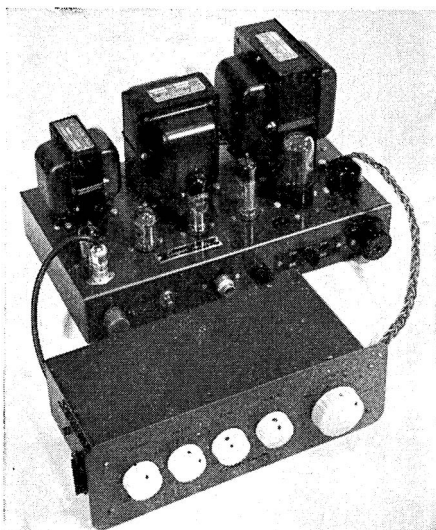
Cooper-Smith Mk. II Control Unit. Inputs: radio 100 mV; P/U 3 mV; mic. 1.5 mV; tape 100 mV. 6 pos. sel. (3 record equal.), treble, bass, vol. on/off. Switch filter 6, 8 and 10 Kc/s. Co-axial tape replay switch. H.D. 0.1% or less at 1,000 c.p.s. H and N - 80 dB. Rumble filter 12 dB cut at 30 c.p.s. Size 10 in. by 3½ in. by 6½ in. Weight 2¾ lb. To operate with B.P.1 power amp.



Saville stereo control unit



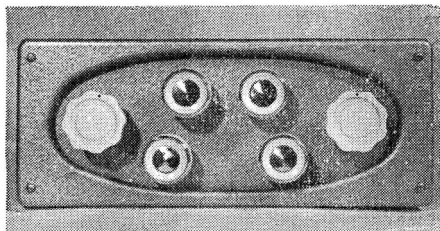
Shirley Jupiter amplifier



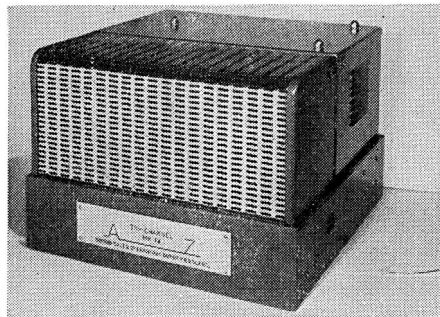
Cooper-Smith control unit and amplifier

Price in kit form £8 3s. Assembled and tested £11 3s.

Cooper-Smith B.P.1. 10 watts nom., 12 watts max. Dist. 0.15% or better at 10 watts. Input for spec. output approx. 1.9 V. Response 20-30,000 c.p.s. ± 1dB. Feedback 18 dB. N.L. 90 dB below max. output. Out. imp. 3.75 and 15 ohms. Output 6BQ5's or EL84's. Ultra-linear. Size 12 in. by 7 in.



Sound Sales Tri-Channel control unit



Sound Sales Tri-Channel amplifier

by $7\frac{1}{2}$ in. Weight $16\frac{1}{2}$ lb. To operate with Cooper-Smith Mk. II control unit. Price in kit form £12 12s. Assembled and tested £14 17s.

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Sound Sales Ltd., Works and Acoustic Laboratories, West Street, Farnham, Surrey. Tel.: Farnham 6461-2-3.. Cables: Sounsense.

A-Z Wide Range Tone Control Unit Mk. III. Inputs: radio 150 mV; P/U 10 or 25 mV. 5 pos. sel., treble, bass, vol. Switched filter 4, 7 Kc/s and "out." Tape input, special connection. H.D. 0.06% inc. power amp. H and N better than -80 dB inc. power amp. P.a.t. from power amp. Size $11\frac{1}{2}$ in. by $4\frac{1}{4}$ in. by $4\frac{3}{4}$ in. Weight $4\frac{1}{2}$ lb. Sold only with A-Z Mk. III power amp.

A-Z Mk. III Amplifier. 10 watts nom. 13.5 watts max. Dist. 0.06% at 8 watts. Input for spec. output, 18 dB below 1v for 10 watts. Response flat 12-17,000 c.p.s. ± 1 dB up to 27,000 c.p.s. Feedback -22 dB. N.L. better than -80 dB at 10 watts. Out. imp. 3, 6, 15 or 30 ohms. Output EL84's. Ultra-linear. Size $10\frac{3}{4}$ in. by $7\frac{1}{8}$ in. by 6 in. Weight $13\frac{1}{2}$ lb. Supplied only with A-Z wide range tone control unit. Price £25.

A-Z Senior Control Unit with transistor input. Inputs: mic. 1 mV; radio 100 mV; tape 250 mV; tape 1 mV (from head)

C.C.I.R. and N.A.R.T.B.; P/U variable 1-100 mV. 11 pos. sel. (5 record equal.), treble, bass, vol., presence control, switched filter, 2 pos. and out combined with variable slope. Tape recording in all positions, also jacks for portable recorders. Specially designed for use with M.C. pickups or tape-head without necessity of left transformers. Size 11 in. by $4\frac{1}{2}$ in. by 6 in. Weight 7 lb. Sold only with A-Z Senior power amp.

Tri-Channel Control Unit with transistor input. Inputs: mic. 1 mV; radio 100 mV; tape (from recorder) 250 mV; tape (from head, C.C.I.R. and N.A.R.T.B.) 1 mV; P/U variable 1-100 mV. 11 pos. sel. (5 record equal.). Presence, middle channel response; treble, top channel response; bass, bass channel response. Infinitely variable electronic crossover system, controlling 3 separate amplifying channels to appropriate speakers via master vol. control. Switched filter. Tape recording in all positions also jacks for portable recorders. H and N better than -80 dB. Dist. not measurable at normal output. Size $11\frac{1}{4}$ in. by $4\frac{3}{8}$ in. by 6 in. Weight 7 lb. Sold only with Tri-channel amp. and speaker enclosure.

Tri-Channel Amplifier Mk. IV. Bass 20-30 watts, mid-channel 8-12 watts, treble channel 4 watts. Total undistorted output approx. 45 watts. Dist. 0.05%. Response infinitely variable on 3 channels. N.L. better than -80 dB. Output EL84's, EL34's and LN309. Ultra-linear. Size 18 in. by 10 in. by $8\frac{3}{4}$ in. Weight 58 lb. Price complete with control unit and tri-channel speaker enclosure £125.

■ **A-Z Stereo/Monaural Control Unit** with transistor input. Provision for direct replay from low gain P/U or tape head, external jacks with parallel connections at rear. Inputs for mic., radio, tape and P/U. 11 pos. sel. (5 record equal.). Balancing control for stereo. Presence, bass, treble, master vol. all on monaural or stereo. For use with two A-Z Mk. III or A-Z Senior Mk. II power amps. Size $11\frac{1}{4}$ in. by $9\frac{1}{2}$ in. by $4\frac{3}{8}$ in. Weight 14 lb. Price with 2 matched A-Z Mk. III amplifiers £65; with 2 matched A-Z Senior amplifiers £84.

■ **Tri-channel Stereo Control Unit and Tri-channel Stereo Amplifier.** Designed for stereophonic or monaural reproduction using 2 Tri-channel main amps. and 2 labyrinth speakers. Stereo to monaural changeover switch, giving parallel or stereo connection. Price complete with control unit, 2 amps and 2 speaker systems £300.

A-Z Senior Mk. II Amplifier. 20 watts nom. 30 watts max. Dist. 0.05% at 20 watts. Response flat 10-30,000 c.p.s.

Feedback 25 dB. N.L. — 80 dB at 20 watts. Out. imp. 3, 6, 15 or 30 ohms. Output EL34's. Ultra-linear. Size 14½ in. by 8½ in. by 8½ in. Weight 42 lb. Price complete with A-Z Senior control unit £42.

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Specto Ltd., Vale Road, Windsor, Berks. Tel.: Windsor 1241/2. Cables: Specto, Windsor.

Spectone 5-15 "Eton" Combined Control Unit and Amplifier. 3 pos. sel. Plug-in equalisers for crystal P/U's. 10 watts nom. 15 watts max. Dist. better than 0.3% at 10 watts. Input for spec. output 500 mV. Response 20-20,000 c.p.s. ± 0.5 dB. Feedback — 26 dB. N.L. — 73 dB on 10 watts. Out. imp. 15 ohms. Output EL84's. Size 14 in. by 7 in. by 8¾ in. Weight 14¾ lb. Price £18 18s.

Eton Pre-amp. Available for low output P/U's, etc. Input 40 mV for 500 mV output. H.D. better than 0.1%. H and N — 73 dB. Size 6½ in. by 3½ in. by 1⅞ in. Weight 17 oz. Price £4 4s.

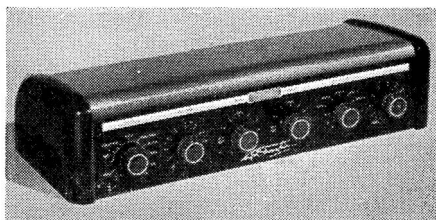
Spectone 5-15 "Windsor" Control Unit. Inputs: radio 100 mV; P/U 50 mV; aux. 10 mV. 4 pos. sel., treble, bass, vol. and on/off. H.D. better than 0.15% on all inputs for 40 mV output. H and N — 54 dB on mic., — 73 dB others. Size 10 in. by 5 in. by 3 in. Weight 3¼ lb. Sold only with the Windsor power amp.

Spectone 5-15 "Windsor" Amplifier. 10 watts nom., 15 watts max. Dist. better than 0.3% at 10 watts. Input for spec. output 40 mV. Response 20-20,000 c.p.s. ± 0.5 dB. Feedback — 26 dB. N.L. — 73 dB on 10 watts. Out. imp. 15 ohms. Output EL84's. Size 14 in. by 7 in. by 8¾ in. Weight 14¾ lb. Price with control unit £24 17s. 6d.

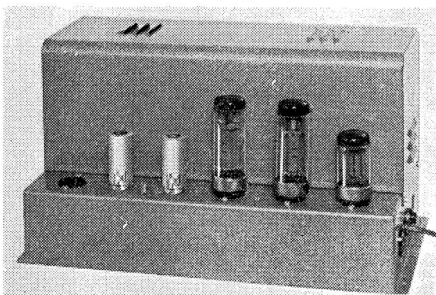
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A. R. Sugden & Co. (Engineers) Ltd., Well Green Lane, Brighouse, Yorks. Tel.: Brighouse 2397. Cables: Connoisseur, Brighouse.

Connoisseur HQ20 Control Unit. Inputs: radio, tape and P/U 10 mV. 5 pos. record char. switch, treble, bass, vol. Steep slope filter, 5, 7 and 9 Kc/s. Tape input sockets. H.D. at 1,000 c.p.s. better than 0.1% at 20 watts. H and N with amp 75 dB down on 20 watts. 30 c.p.s. rumble filter. Size 11½ in. by 4 in. by 4¾ in. To operate with HQ20 power amp. Price £16.



Tannoy Autograph "F" control unit



Tannoy amplifier

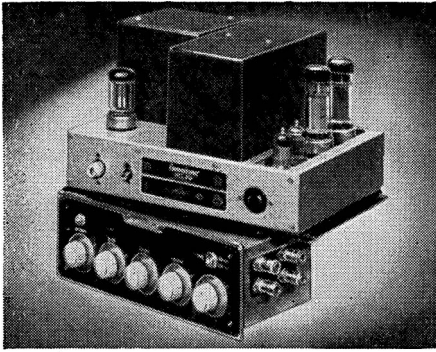
Connoisseur HQ20 Amplifier. 20 watts nom., 30 watts max. Dist. better than 0.1% at 20 watts. Input for spec. output 300 mV. Response 20-50,000 c.p.s. ± 0.5 dB. N.L. 85 dB at 20 watts. Out. imp. 15 ohms. Output EL34's. Ultra-linear. Size 12 in. by 8¼ in. by 7½ in. Sold only with control unit. Price £31 10s.

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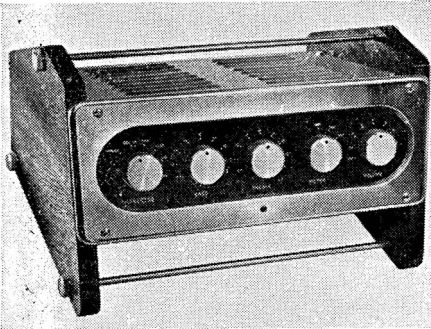
Tannoy Products Ltd., West Norwood, London, S.E.27. Tel.: Gipsy Hill 1131. Cables: Tannoy, London.

Autograph Type F Control Unit. Inputs: mic. 5 mV; radio 100 mV; tape 100 mV; P/U 5 mV at 1 Kc. 11 pos. sel. (9 record equal.), treble, bass, vol., filter at 4, 5, 7 and 9 U c/s; slope 6-40 dB per octave. Tape record and replay. H.D. < 0.07%. H and N better than — 70 dB. Rumble filter fixed at 30 dB per octave below 20 c.p.s. Size 16 in. by 7½ in. by 4 in. To operate with Tannoy 20-watt power amp. Available for free standing. Price £37 10s. or panel mounting £31.

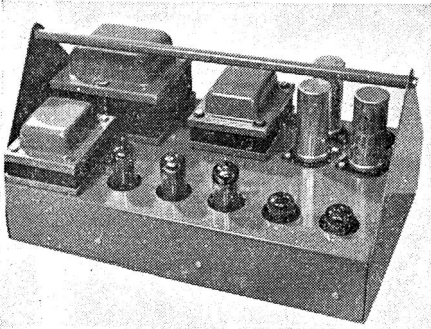
Tannoy 20-watt Amplifier. 20 watt nom. Dist. 0.07% at 1,000 c.p.s., 0.1% at 20-20,000 c.p.s. Input for spec. output 0.4v. Response 20-70,000 c.p.s. ± 0.1 dB. Feedback damping factor 40. N.L. (unweighted) 90 dB below max. output. Out. imp. 4, 8 or 16 ohms. Output EL39's or KT66, or 6L6G's or 5881's. Ultra-linear. P.a.t. 450v at 50 mA, 6.3v at 1.5 A. Size 15 in. by 8½ in. by 8½ in. To operate with Autograph type F control unit. Price £33 10s.



Connoisseur HQ20 control unit and amplifier



Thermionic TP100CU control unit



Thermionic TP100 amplifier

Thermionic Products Ltd., Hythe, Southampton. Tel. : Hythe 3265/7. Cables : Technico.

TP100CU Control Unit. Inputs : mic. 50 mV ; radio 50 mV ; P/U (crystal) 100 mV ; P/U (magnetic) average 20 mV. 8 pos. sel. (4 gram.), treble, bass, vol. and optional on/off. Switched filter, 5, 7 Kc/s and "out." H.D. < 0.1 %. H and N - 60 dB for 0.5 output. Rumble filter. P.a.t. 300v at 50 mA ; 6.3v at 2.5 A. Size 10 $\frac{3}{8}$ in. by 7 $\frac{1}{4}$ in. by 5 $\frac{1}{8}$ in. Weight 5 lb. 14 oz. To operate

with TP100 power amp. Price £17 14s. (£1 15s. extra for special wooden "Book-End" stand.)

TP100 Amplifier. 10 watts. Dist. at 1,000 c.p.s., < 0.1% at 10 watts. Input for spec. output 0.5v. Response 25-30,000 c.p.s. \pm 0.25 dB. Feedback - 20 dB. N.L. - 95 dB at 10 watts. Out. imp. 3.75 and 15 ohms. Output N709's. Size 11 in. by 7 in. by 5 $\frac{1}{4}$ in. Weight 14 lb. To operate with TP100CU control unit. Price £19 16s. (£1 extra for special carrying tray.)

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Trix Electrical Company Limited, 1-5 Maple Place, London, W.1. Tel. : Museum 5817. Cables : Trixadio, Wesdo, London.

Trixonix T800 Combined Control Unit and Power Amp. Inputs : LP 4 mV ; 78 12 mV ; radio/tape 100 mV. 3 pos. sel., treble, bass, loudness control (additional bass and treble boost given at low vol. levels). 4 pos. pickup equalisation plug fitted. Tape input socket. H.D. at 1,000 c.p.s. < 0.5 % at 6 watts. H and N better than - 60 dB. Rumble filter 18 dB octave below 30 c.p.s. P.a.t. 270v at 20 mA, 6.3v at 1 A. 8 watts nom., 12 watts max. Response 30-15,000 c.p.s. \pm 1.5 dB at 6 watts. Triple-loop feedback. Out. imp. 3, 8 and 15 ohms. Output EL84's. Size 12 $\frac{1}{4}$ in. by 9 $\frac{1}{2}$ in. by 5 in. Weight 16 $\frac{1}{2}$ lb. Price £33 12s.

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Verdik Sales Ltd., 139/143 Sydenham Road, Sydenham, London, S.E.26. Tel. : Sydenham 3118/9.

Verdik Standard Control Unit. Inputs : radio 100 mV ; tape 100 mV ; mic. 10 mV ; P/U 78 60 mV ; P/U L.P. 50 mV. 5 pos. sel., treble, bass, vol., on/off, tape replay sockets. H.D. mic. 0.15% approx., other inputs better than 0.1%. H and N. Mic. - 60 dB, other inputs - 75 dB at 10 watts. Size 10 $\frac{1}{4}$ in. by 23 $\frac{1}{2}$ in. by 4 $\frac{1}{2}$ in. To operate with Verdik Quality Ten power amp. Price £6 6s.

Verdik High Gain Control Unit. Inputs : radio 50 mV ; tape 1 mV at 1,000 c.p.s. ; P/U 2.5 mV at 1,000 c.p.s. ; mic. 5 mV. 8 pos. sel. (5 records equal.), treble, bass, vol. on/off. Tape replay sockets. H.D. better than 0.1%. H and N. Mic. - 60 dB, other inputs - 20 dB at 10 watts. Rumble filter. Size 10 $\frac{1}{4}$ in. by 2 $\frac{3}{4}$ in. by 4 $\frac{1}{2}$ in. To operate

with Verdik Quality Ten power amp. Price £9 9s.

Verdik Quality Ten Amplifier. 10 watts nom., 12 watts max. Dist. 0.1%. Input for spec. output 50 mV. Response 20-15,000 c.p.s. ± 1 dB. Feedback 20 dB. N.L. - 75 dB referred to 10 watts. Out. imp. 4, 8 and 16 ohms. Output EL84's. Ultra-linear. P.a.t. 250v at 35 mA, 6.3v at 2 A. Size 10 in. by 5 $\frac{1}{8}$ in. by 5 $\frac{3}{8}$ in. To operate with Verdik Standard or High Gain control units. Price £14 14s.

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Vortexion Ltd., 257/263 The Broadway, Wimbledon, London, S.W.19. Tel.: Liberty 6242/3. Cables: Vortex, Wimbledon, London.

TRG10/A Control Unit. 4 input from 1 mV to 3v for direct replay from any make of tape recorder with equalisation for different tape speeds. 10 pos. sel. (5 P/U, 3 tape, radio and mic.). H.D. < 0.1%. H.D. within 6 dB theoretical minimum according to gain. Rumble filter. Size 5 in. by 4 $\frac{3}{8}$ in. by 2 in. To operate with TRG10 power amp. Price £14.

TRG10 Amplifier. 10 watts nom., 15 watts max. Dist. 0.1%. Input for spec. output 0.5 or 3v. Response 20-50,000 c.p.s. ± 2 dB, - Feedback 26 dB. N.L. - 80 dB. Out. imp. 4-16 ohms. Output EL84's. Ultra-linear. Size 8 $\frac{3}{8}$ in. by 4 $\frac{1}{8}$ in. by 5 in. Weight 12 lb. To operate with TRG10/A control unit. Price £21.

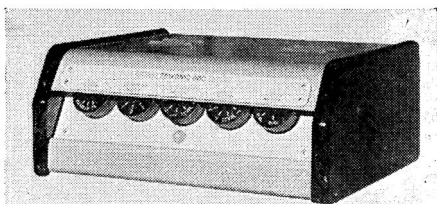
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Wellington Acoustic Laboratories Ltd., Allways, Kings Lane, Wrecclesham, Farnham, Surrey. Tel.: Farnham 6461/4961.

■ **WAL Stereo/Monaural Control Unit.** Transistor input direct connection to tape head or low output P/U. 11 pos. sel. (5 record equal., 2 tape C.C.I.R. and N.A.R.T.B.), treble, bass, vol., presence and stereo balance. Switch giving parallel or stereo. Size 11 $\frac{1}{4}$ in. by 9 $\frac{1}{2}$ in. by 4 $\frac{3}{8}$ in. Weight 14 lb. Supplied only with WAL Stereo/Ten twin arm.

■ **WAL Stereo/Ten Twin Amplifier.** 5 watts per channel. Out. imp. 3 or 15 ohms. Output LN309's. Ultra-linear. Size 10 $\frac{3}{8}$ in. by 7 $\frac{1}{8}$ in. by 6 in. Weight 16 lb. Price complete with control unit £60.

WAL Gain. Impedance matching transistor pre-amp, battery operated (3,000-hour life). Noise and distortion too low to measure, gain better than 100. Suitable for use with low output P/U or for direct connection to tape head. For use with any amplifier. Size 3 $\frac{5}{8}$ in. by 2 $\frac{1}{2}$ in. by 2 $\frac{1}{8}$ in. Price £5.



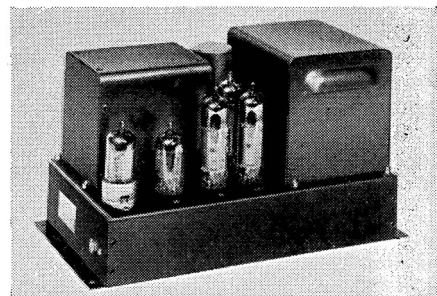
Trixonix combined control unit and amplifier



Verdik Standard control unit



Verdik High Gain control unit



Verdik Quality Ten amplifier

Westrex Company Ltd., Liberty House, Regent Street, London, W.1. Tel.: Regent 1001. Cables: Westelcol, Norphone, London.

In preparation

■ **Stereo Control Unit.** Inputs: disk, tape, radio, controls treble, presence, bass, vol., balance.

■ **Stereo Transistor Control Unit.** Inputs: disk, tape, radio, controls, treble, bass, vol., balance.

■ **Stereo Amplifier.** Output 10 watts per channel, common power supply. Dist. 0.1%. Input 0.05v. N.L. - 75 dB.

Whiteley Electrical Radio Co. Ltd., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762/3/4/5. Cables: Whitebon, Mansfield.

Stentorian WB12 Standard Control Unit. Inputs 50 mV. 6 pos. sel. (3 gram.), treble, bass, vol. Tape/Radio input socket. H and N - 72 dB at 10 watts. P.a.t. 300v at 50 mA, 6.3v at 1.5 A. Size 9 in. by 3½ in. by 3¼ in. Weight 2½ lb. To operate with WB12 power amp. Price £9.

Stentorian WB12 Major Control Unit. Inputs: mic. 2.5 mV; P/U 10 mV; radio 100 mV; tape 100 mV; aux. 50 mV. 9 pos. sel. (4 record equal.), treble, bass, vol on/off, switched filter at 5.7 and 11 Kc/s.; filter slope. Tape input socket. H.D. <0.1%. H and N - 66 dB. Size 11¾ in. by 4½ in. by 4 in. Weight 5½ lb. To operate with WB12 power amp. Price £19 10s.

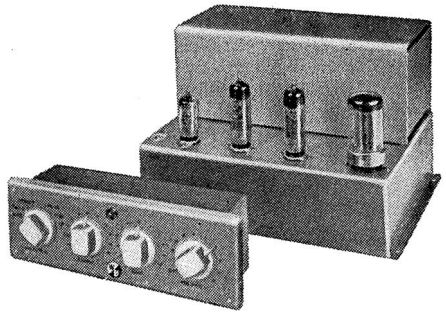
WB12 Amplifier. 12 watts nom., 15 watts max. Dist. at 400 c.p.s. 0.2%, at 1,000 c.p.s. 0.12%. Response 20-20,000 c.p.s. ± 0.15 dB. Feedback 25 dB. N.L. - 80 dB at 10 watts. Out. imp. 3-4 and 15 ohms. Output EL84's. Ultra-linear. Size 10¾ in. by 8 in. by 7 in. Weight 13 lb. To operate with WB Major or Standard control units. Price £18 10s.

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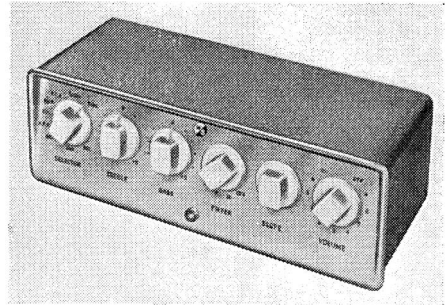
W & N Electronics Ltd., 80/82 Uxbridge Road, London, W.13. Tel.: Ealing 4774.

Audiomaster Mk. II and Mk. III Control Units. Inputs: tape, 1.8 mV; P/U 8 mV; mic. 1 mV; tuner 50-200 mV; aux. from 2 mV (flat). 10 pos. sel. (4 record equal.), 3 pos. mic. sel., treble, bass, vol. on/off, loudness, switched filter at 5; 7, 9, 12 Kc/s., filter slope, amp/record/monitor switch. Direct replay from tape head, C.C.I.R. or N.A.R.T.B. H.D. better than 0.1% for 200 mV out. H and N 250 mV out, tape and mic. - 45 dB, P/U and aux. - 56 dB, tuner - 65 dB. Roll off frequency comm. 50 c.p.s. Size 13¾ in. by 5¾ in. by 8 in. Weight 11½ lb. To operate with W & N/520 power amp. Price £28 15s.

W & N/520 Amplifier. 20-25 watts nom. 60 watts inst. peak. Dist. 0.05% at 20 watts. Input for spec. output, 220 mV. Response 15-30,000 c.p.s. ± 0.5 dB. Feedback 20-26 dB. N.L. better than 85 dB. Out. imp. 4, 8 or 16 ohms. Output EL84. Ultra-linear (43% of winding). Size 12 in. by 6¾ in. by



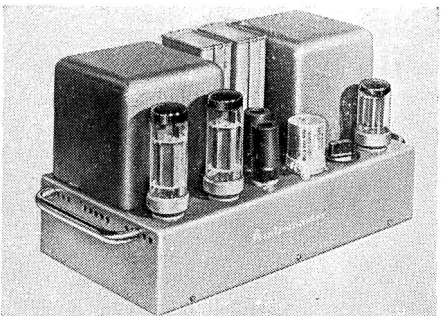
Whiteley Stentorian WB12 control unit and amplifier



Stentorian WB12 Major control unit



W & N Audiomaster control unit



W & N Audiomaster amplifier

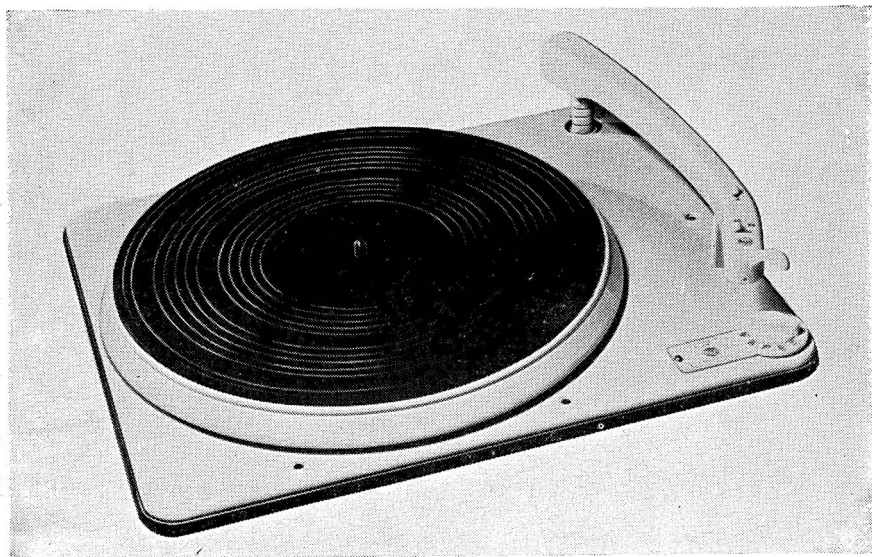
8½ in. Weight 28½ lb. To operate with Audiomaster Control Units Mk. I, II or III. Price £30 15s.

Philips Electrical Limited, Century House,
Shaftesbury Avenue, W.C.2. Tel. : Gerrard
7777. Cables : Phillamps.

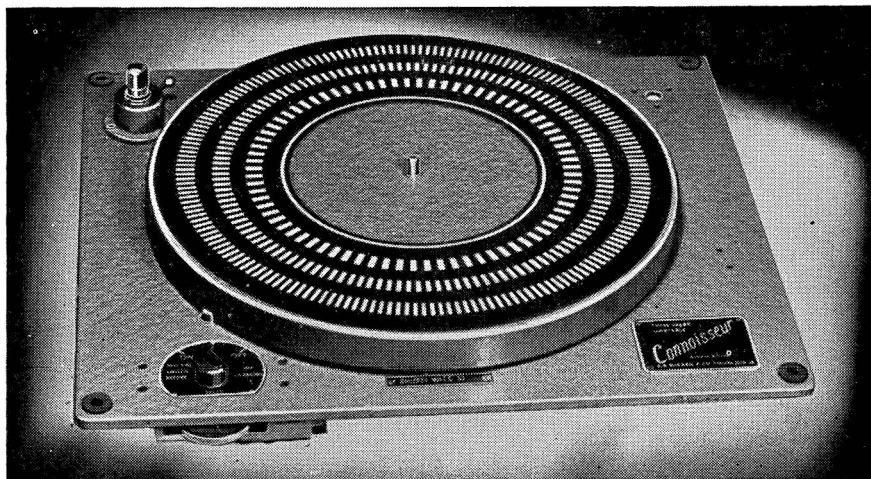
AG2005 High Fidelity Record Player.
Three speeds, 33 $\frac{1}{3}$, 45 and 78 r.p.m. Built-in
stroboscopic indicator and speed control.
Price £18 3s. 10d. (U.K. purchase tax
£7 0s. 2d.).

RCA Great Britain Ltd., Lincoln Way,
Windmill Road, Sunbury-on-Thames, Middx.
Tel. : Sunbury 3101. Cables : Telex and
Tex 8608.

LMI-32241A4 Transcription Turntable Unit
complete with RCA 8-pole variable reluctance
pickup. Price £22 6s. (U.K. purchase tax
£8 14s.).



RCA LMI 4-speed transcription unit



Connoisseur transcription motor

A. R. Sugden & Co. (Engineers) Ltd., Well Green Lane, Brighouse, Yorkshire. Tel. : Brighouse 2397. Cables : Connoisseur, Brighouse.

Connoisseur Transcription Motor. Three speeds. With variable speed adjustment. Price £20 (U.K. purchase tax £8 11s.).

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Woollett Sound and Wireless Equipment, Wells Park Road, London, S.E.26. Tel. : Forest Hill 2527.

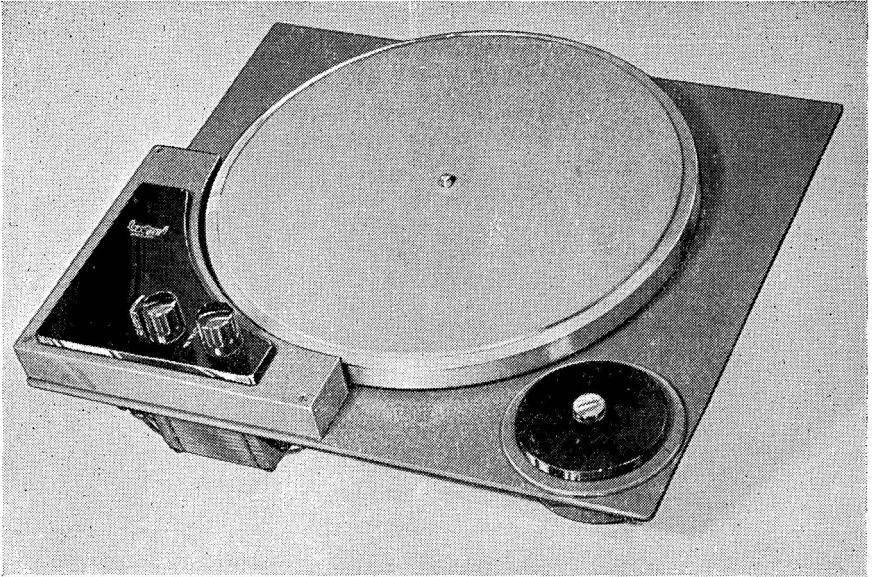
3-speed Transcription Motor Unit, fitted with accessory container. Price £17 17s. (U.K. purchase tax £7 2s. 5d.).

4-speed Transcription Motor Unit, with variable speed adjustment providing 8% variations on 78 and 3% on $16\frac{2}{3}$, $33\frac{1}{3}$ and 45 r.p.m. Will accommodate any pickup on baseplate. Price as 3-speed model.

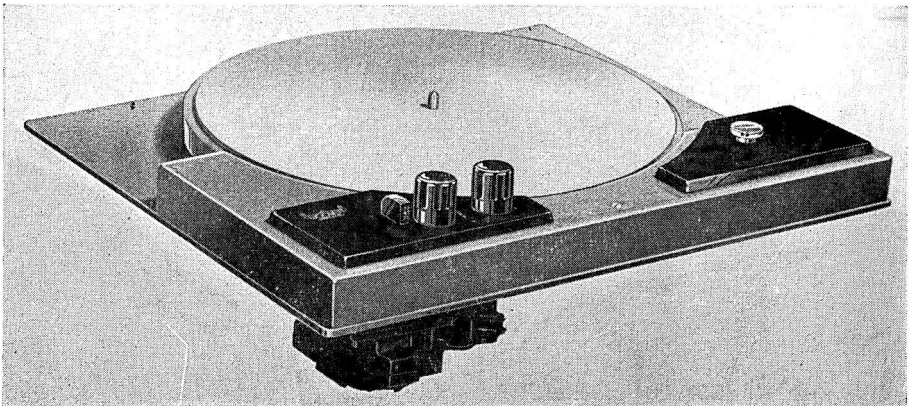
Optional extra : matching accessory container with lid, £1 7s. (U.K. purchase tax 10s. 10d.) either fixed to baseplate or separate.

In preparation

Stroboscopic discs, one for 60 c.p.s. and one for 50 c.p.s.; each giving $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 75, 77, 78, 79 and 81 r.p.m.



Woollett 4-speed transcription motor



Woollett 3-speed transcription motor

DIRECTORY OF MOTOR UNITS

★ **Important Note**—No mention is made of record-changers in the following directory. The list is confined to motor units of transcription quality only. The products listed below can be recommended, and conform to the requirements necessary for high-quality sound reproduction.

Collaro Limited, Ripple Works, By-Pass Road, Barking, Essex. Tel. : Rippleway 5533. Cables : Korllaro Telex, Barking.

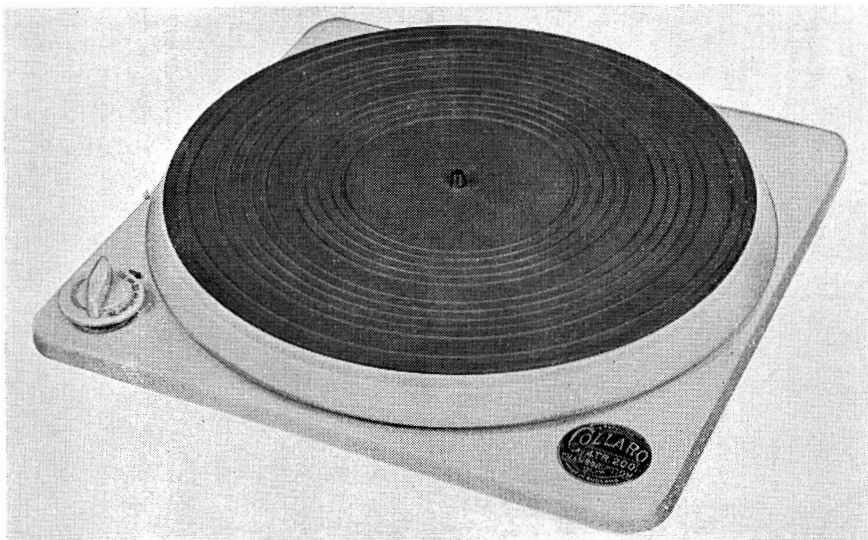
Transcription Unit, Model 4T200. Four speeds. Complete with pickup arm and "Studio P" head with turnover cartridge.

Plays discs up to 16-in. diameter. Price £13 16s. 6d. (U.K. purchase tax £5 6s. 6d.).

Transcription Unit Model 4TR200, specification as for 4T200 but without the arm and pickup. Price £10 15s. (U.K. purchase tax £4 3s.).



Collaro 4T200 transcription motor



Collaro 4TR200 transcription motor

Garrard Engineering & Manufacturing Co. Ltd., Swindon, Wiltshire, England. Tel. : Swindon 5381. Cables : Garrard, Swindon.

Model 301 Transcription Motor. Three speeds. Variable speed adjustment. Price £19 (U.K. purchase tax £7 8s. 3d.).

Stroboscopic Turntable, extra cost, £1 3s. 6d. (U.K. purchase tax 9s. 2d.).

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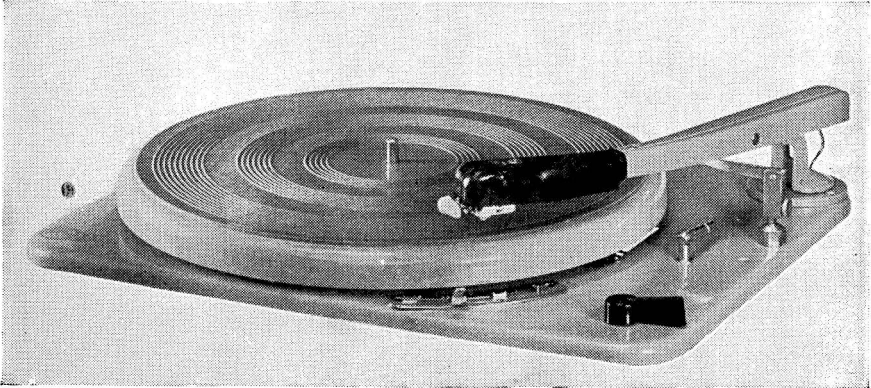
Goldring Manufacturing Co. (Great Britain) Ltd., 486/488 High Road, Leytonstone, London, E.11. Tel. : Leytonstone 8343.

Lenco Transcription Unit Type GL50/4. Four speeds at pre-selected points for 78,

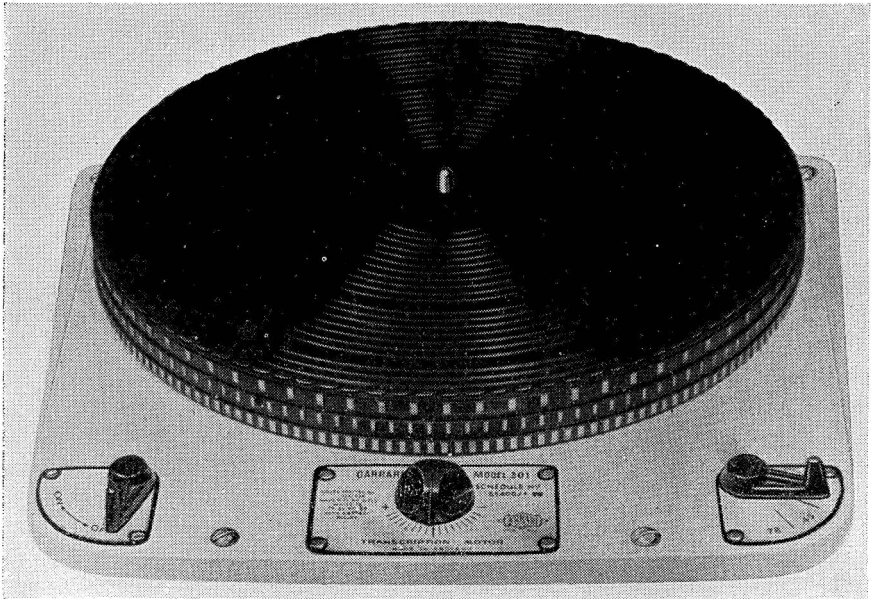
45, 33½ and 16½ r.p.m. positions. Speed continuously variable from 29 to 86 r.p.m. Complete with pickup and Goldring "500" cartridge. Price £15 15s. (U.K. purchase tax £6 2s. 10d.).

Lenco Transcription Unit Type GL56. As above, but with mechanical lift and lower device. Price £16 16s. (U.K. tax £6 11s.).

Lenco Transcription Motor Type GL55. As type GL56, but without pickup arm and head. Price £12 12s. (U.K. purchase tax £4 18s. 4d.).



Lenco transcription unit. 4-speed and variable with pickup lift device



Garrard Model 301 with stroboscopic turntable

DIRECTORY OF RADIO TUNERS

★ In the abridged specifications of these directory entries the following abbreviations have been used : P.s.n.—Power supply needed ; A.F.C.—Automatic frequency control.

Acoustical Manufacturing Co. Ltd., St. Peter's Road, Huntingdon, Hunts. Tel : Huntingdon 361 and 574. Cables : Acoustical.

F.M. Tuner. Variable tuning. Range 87.5-108 Mc/s. Special double neon display ind. P.s.n. 330v at 27 mA ; 6.3v at 1.85 amps. Size 10½ in. by 3½ in. by 6 in. Weight 6 lb. Price £21 (U.K. purchase tax £9 9s.).

A.M. Tuner. Variable tuning, DM 70 ind. P.s.n. 330v at 20 mA ; 6.3v at 1.2 amps. Size 10½ in. by 3½ in. by 6 in. Weight 6 lb. Price £21 (U.K. purchase tax £9 9s.).

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Armstrong Wireless & Television Co., Warlters Road, Holloway, London, N.7. Tel. : North 3213/4.

F.M. Tuner FM 61. Dial/permeability tuning. Range 88-108 Mc/s. A.F.C. Ratio disc. Magic eye ind. P.s.n. 220-410v at 35 mA ; 6.3v at 2 amps. Size 9¾ in. by 5¼ in. by 7 in. Weight 4½ lb. Price £15 15s. (U.K. purchase tax £6 6s.).

A.M. Tuner type AM44. Range 19-50 ; 51-150 ; 176-525 ; 850-2,000 metres. P.s.n. 250/320v at 20 mA ; 6.3v at 1.4 amps. Price £14 3s. 6d. (U.K. purchase tax £5 13s. 6d.).

In preparation

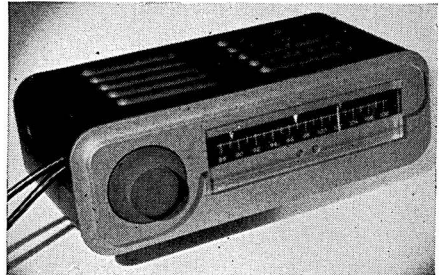
AM/FM Tuner. 6 wavebands. RF stage, FM, medium, long and 3 short wave. Available June, 1958.

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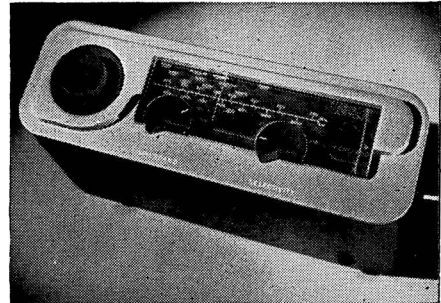
Beam-Echo Ltd., Witham, Essex. Tel. : Witham 3184. Cables : Beamec, Witham.

Avantic A.M./F.M. Tuner. Continuous tuning. Range (F.M.) 88-100 Mc/s ; (A.M.) 195-565 metres. A.F.C. Foster-Seeley disc. Magic eye ind. P.s.n. 200v at 40 mA ; 6.3v at 2.5 amps. Size 12½ in. by 7 in. by 5 in. Weight 6½ lb. Price £27 10s. (U.K. purchase tax £10 14s. 3d.).

Avantic VHF-FM/AM-MW Tuner. Type 612. Free tuned, Range (F.M.), 88-108 Mc/s ; (A.M.) 180-565 continuously variable



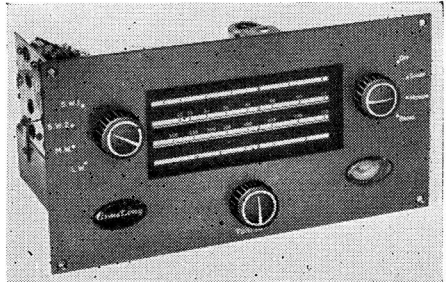
Quad F.M. tuner



Quad A.M. tuner



Armstrong FM61



Armstrong AM44

A.F.C. Foster-Seeley disc. Magic eye and neon ind. Self powered. Multiplex output available for binaural or stereo reception. Sensitivity F.M., 2 μ V. for 20 dB quieting. Size 14 in. by 4 $\frac{7}{8}$ in. by 8 $\frac{1}{2}$ in. Type A 100-125v AC; Type B 200-250v AC; Type C at slightly higher cost 100-250v AC. All 40-60 c.p.s. Price £35 (U.K. purchase tax £13 13s.)

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C.T. Chapman (Reproducers) Ltd., Chapel Lane, High Wycombe, Bucks. Tel.: High Wycombe 2474.

F.M. Tuner FM80. Switched. Range 8.75-100 Mc/s A.F.C. Wide band ratio det. P.s.n. 250v at 40mA; 6.3v at 2A. Size 9 in. by 4 $\frac{1}{4}$ in. by 5 $\frac{5}{8}$ in. Weight 8 $\frac{1}{2}$ lb. Price £15 15s. (U.K. purchase tax £6 6s.)

F.M. Tuner FM91. Free tuned. Range 87.5-100 Mc/s or 88-108 Mc/s A.F.C. Wide band ratio det. Bright Line tuning ind. P.s.n. 250v at 40mA; 6.3v at 2A or self-powered. Price and size to be announced.

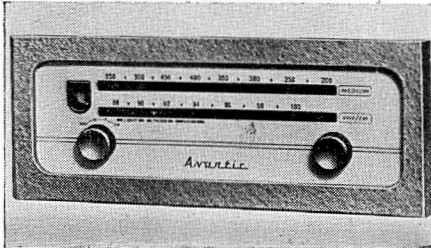
A.M./F.M. Tuner. F.M.85. Free tuned. Range (F.M.) 87.5-100 Mc/s; (A.M.) 190-550, 800-2,000 metres. Ratio det. plus

limiter. Magic eye ind. P.s.n. 250v at 40 mA or self-powered. Size 10 $\frac{3}{16}$ in. by 6 $\frac{1}{8}$ in. by 7 in. Weight 7 lb. or 10 lb. Price £18 or £21 self-powered (U.K. Purchase Tax £7 4s. or £8 8s. self-powered).

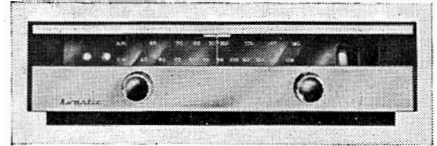
A.M./F.M. Tuner S5E/FM. Free tuned. Range (F.M.) 87.5-100 Mc/s or 88-108 Mc/s; (A.M.) 12.5-37, 35-100, 90-250, 190-550 metres. Ratio det. plus limiter. Magic eye tuning ind. P.s.n. 200/250v at 40/50 mA or self-powered. 13 $\frac{1}{2}$ in. by 6 $\frac{1}{2}$ in. by 9 in. Weight 10 $\frac{1}{2}$ lb. or 13 $\frac{1}{2}$ lb. powered. Price £24 7s. 6d. (U.K. purchase tax £9 15s.) or £27 7s. 6d. (U.K. purchase tax £10 19s.)

A.M./F.M. Tuner S5/FM. Free tuned. Range (F.M.) 87.5-100 Mc/s or 88-108 Mc/s; (A.M.) 16-50, 195-550, 800-2,000 metres. Ratio det. plus limiter. Magic eye tuning ind. P.s.n. 200/250v at 40/50 mA or self-powered. 13 $\frac{1}{2}$ in. by 6 $\frac{1}{2}$ in. by 9 in. Weight 10 $\frac{1}{2}$ lb. or 13 $\frac{1}{2}$ lb. powered. Price £24 7s. 6d. (U.K. purchase tax £9 15s.) or £27 7s. 6d. (U.K. purchase tax £10 19s.)

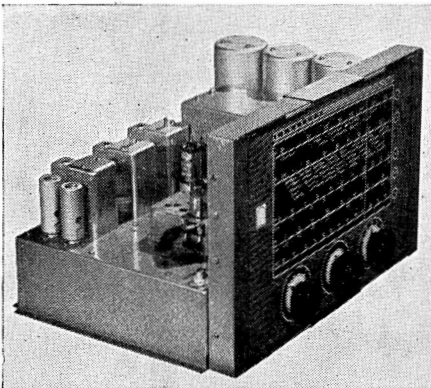
A.M./F.M. S6BS/F.M. Free tuned. Range (F.M.) 87.7-108 Mc/s; (A.M.)



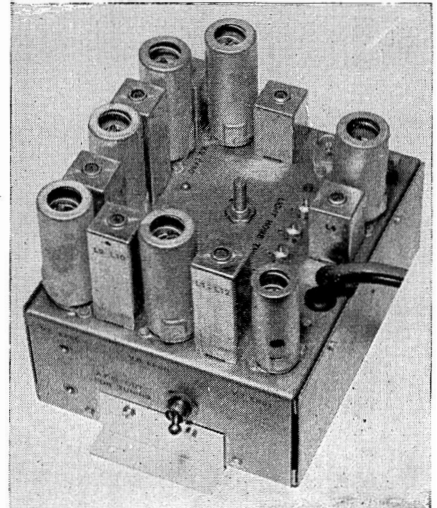
Avantic AM/FM



Avantic VHF-FM/AM-MW



Dynatron T.10 F.M./A.M. tuner



Dynatron switched tuner

RADIO TUNERS

By R. S. Roberts

THE tuner necessary to provide a broadcast programme to feed into a high quality amplifier will give either (a) a choice of a large number of stations, as is the case with a normal domestic receiver, or (b) a choice of three programmes (Home, Third and Light) only from the new VHF stations of the BBC. The former will not provide quality up to the standard associated with modern high quality equipment, but the limited programme choice provided by the latter is capable of a very high standard of quality. The difference between the two standards of quality is concerned with two types of transmission, amplitude modulation (AM) as used by all the older broadcast stations, and frequency modulation (FM) as used by the recently introduced VHF service.

The quality standards required of a radio signal are the same as for records or tape; a wide band of frequency response, and a low noise level. The band-width requirement is mainly concerned with maintenance of adequate h.f. response in the audio frequency band; noise level is a relative term concerned with reception of interfering signals along with the programme, and generation of noise by other than radio signals.

Amplitude Modulation

AM is a form of modulation that is as old as the valve itself. It is a relatively simple system in which the amplitude of the radiated signal is varied in accordance with the loudness of the modulating signal, and this variation occurs at the frequency of the modulation. Since the inception of broadcasting, around 1920, it has, of course, received considerable development, and has resulted in a practically "standard" system for the transmission of speech and music for entertainment purposes.

With the growth of broadcasting during the years, many thousands of entertainment programmes are radiated all over the world on a wide range of frequencies. This results in a wide choice of programmes for the owner of an AM re-

ceiver. His "domestic" programmes are available on the medium and long wave bands, and the short wave ranges enable him to roam over the world and select programmes from almost any country at will. Circuit techniques used in the receiver are such that the AM tuner is easy to use, and a tuner intended for local stations' use can be quite simple. The disadvantages of AM are many, but the two most important, from the quality point of view, concern band-width and signal-to-noise ratio.

Band-width

The band-width of an AM transmission is twice the modulating frequency. If the highest modulating frequency is, say, 15 Kc/s, the overall band-width of the transmitted signal is 30 Kc/s. To take full advantage of this transmission, and to ensure that the highest modulating frequencies are fed to the a.f. amplifier, all the r.f. circuits (and if a super-het is used) must be wide enough to ensure no attenuation over the 30 Kc/s band. As a theoretical principle this is quite sound, and it can be achieved in practice, but in existing conditions on the broadcast frequency bands it is not possible. The medium wave band, for example, is hopelessly congested with hundreds of stations broadcasting in a relatively restricted frequency range. In order to obtain some order out of what would otherwise be chaos, international agreement has spaced adjacent stations 9 Kc/s apart; **this means that the overall band-width of a station cannot be more than 9 Kc/s, and the highest modulating frequency 4.5 Kc/s.**

Unfortunately the situation is worse than it would appear because, despite internationally agreed frequencies, some stations "wander" from their allotted channel and approach closer to an adjacent frequency. This results in two types of interference: the side bands (produced as a result of modulation) of the two stations can overlap, producing a distinctive form of interference called "monkey chatter," and the two carrier frequencies

can beat together to produce a heterodyne whistle having a frequency equal to the difference between the two carrier frequencies. The AM system is particularly susceptible to noise of the heterodyne type, and this becomes more disturbing as the two carrier frequencies approach closer together.

Another form of noise which is particularly disturbing in an AM receiver is that due to electrical effects, such as are produced by switch contacts, motor commutators and car ignition systems. All of these produce signals which are mainly AM in character and, if passed into an AM receiver, will give rise to a noise output from the reproducing system.

Frequency Modulation

In this system, the amplitude of the radiated signal is held constant but the frequency is varied by the modulation. The frequency swings about the mean value at a rate determined by the modulating frequency, and to an extent determined by the intensity of the modulating signal.

The FM system is not new and, many years ago, it was shown to have possibilities for high quality, noise-free reception. It has its disadvantages; it requires a much wider band-width than AM and is essentially local, the effective range of an FM transmitter of this type being relatively short. The British FM system uses the band 88—100 Mc/s where the wider band-widths can be accommodated with ease.

The problem of possible congestion by a large number of stations is solved in two ways. Transmitter ranges are short so that, by geographical spacing, the same frequencies can be used for many transmitters; in the event of two signals being received on the same frequency, it is a property of the system that the weaker signal will be rejected in favour of the stronger.

The receiver includes an amplitude limiter, and this gives FM a tremendous advantage over AM where noise is concerned. Noise voltages, being largely AM in character, are suppressed by the limiting action, resulting in a good signal-to-noise ratio.

Tuners

In order to feed a high-quality amplifier with a radio signal it is essential that an FM tuner be used, if quality is the main consideration. The BBC provides a choice of Light, Home and Third pro-

grammes in any one area, and these are the only programme stations that will be available. If long-range listening is essential, an AM tuner unit must be used, with all its shortcomings of noise and lack of high frequencies.

A wide range of tuners is now available. Most manufacturers of amplifiers make tuners designed basically for their own equipment, but usable with other makes. Some tuners are self-powered (requiring an a.c. mains power connection), but others are designed to pick up their power from a suitable socket in the amplifier. Tuners available are, mostly, for FM only, but several are available for FM and AM.

Accurate Tuning

It is essential that an FM signal is tuned accurately and that it stays in tune, otherwise a distorted signal will result. This requirement tends to dictate the price of a tuner to some degree. Provided that the design and manufacture of the tuner is sound, an ordinary tuning scale, used with some form of tuning indicator, can be quite satisfactory if care is used in the tuning process. Tuning may be made easier by incorporating some form of automatic frequency control (AFC) in the design; this permits some degree of carelessness in tuning whilst ensuring that the signal stays in tune. A much more logical system of tuning uses a three-position selector, whereby the user can select any one of the only three programmes available to him. Such systems usually employ some form of AFC, so that a tuning problem does not exist for the user.

Sensitivity

Sensitivity is another factor to be taken into account when considering the use of a tuner. Anyone living well within the FM service area can obtain excellent results with relatively simple (and cheap) tuners, but a listener who lives in an area of weak field strength will require a more sensitive tuner that uses more valves—and costs more money.

Finally—about aerials. The FM tuner achieves its low noise level to a degree depending on the strength of the signal delivered to it. This means that, in an area of high field strength, one may use any old piece of wire as an aerial and obtain quite good results, but the performance will be that much better when a properly designed aerial system is used.

6 bandspreads : 13, 16, 19, 25, 31 and 41 metres ; also 15-43, 43-140, 175-570 metres wide band ratio det. Magic eye ind. Self-powered. Size $13\frac{3}{4}$ by $12\frac{1}{4}$ in. by 11 in. Weight 14 lb. Price to be announced.

A.M. Tuner S5E. Free tuned. Range 12.5-37, 35-100, 90-250 metres. Magic eye ind. fitted as extra. P.s.n. 200/250v at 20 MA ; 6.3v at 1.5 amps. Size 9 in. by 7 in. by $6\frac{1}{2}$ in. Weight 6 lb. Price £16 (U.K. purchase tax £6 8s.).

A.M. Tuner S6E. Free tuned. Range 12.5-37, 35-100, 90-250, 190-550 metres. Otherwise similar to the S6BS. Size 13 in. by $8\frac{1}{4}$ in. by $9\frac{3}{4}$ in. Weight 12 lb. or $15\frac{1}{2}$ lb. powered. Price £22 10s. (U.K. purchase tax £9) or £27 powered (U.K. purchase tax £10 18s.).

A.M. Tuner S6BS. Free tuned. Range 6 bandspread ranges : 13, 16, 19, 25, 31 and 41 metres. Magic eye ind. P.s.n. 250v at 30/40 mA ; 6.3v at $1\frac{1}{2}$ amps, or self-powered. Size $13\frac{3}{4}$ in. by $12\frac{1}{4}$ in. by 11 in. Weight 14 lb. Price £33 (U.K. purchase tax £13 4s.) or £37 10s. powered (U.K. purchase tax £15).

C.Q. Audio Ltd., 2 Sarnesfield Road, Enfield, Middx. Tel.: Enfield 8262.

In preparation

F.M. Tuner. Free tuned. Range 88-108 Mc/s. A.F.C. Foster-Seeley disc. Self-powered. Price to be announced.

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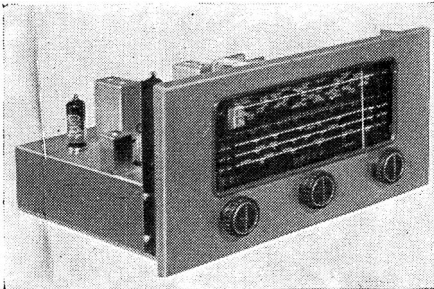
Dulci Co. Ltd., 97/99 Villiers Road, London, N.W.2. Tel. : Willesden 6678/9.

F.M./V.H.F. Tuner. Permeability tuning. Range 87-100 Mc/s. Ratio det. Magic eye ind. Self-powered. Size, front panel $10\frac{1}{2}$ in. by $5\frac{7}{8}$ in., depth including knobs $7\frac{1}{2}$ in. Weight $5\frac{3}{4}$ lb. Price £17 10s. 3d.

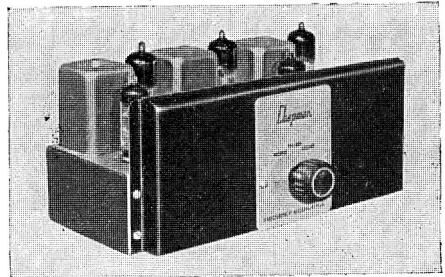
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Dynatron Radio Ltd., Maidenhead, Berks. Tel. : Maidenhead 3811/2/3.

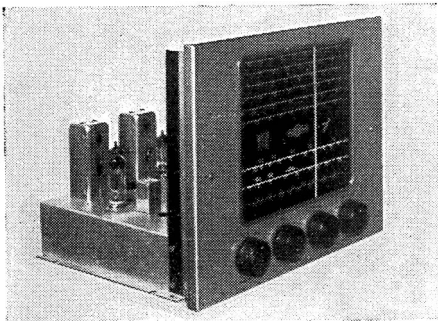
F.M. Tuner. F.M.2 LV and F.M.2 HV. Switched tuning. Range 88-100 Mc/s. A.F.C. control approx. ± 300 Kc/s. Foster-Seeley disc. P.s.n. 250v at 45 mA ; 6.3v



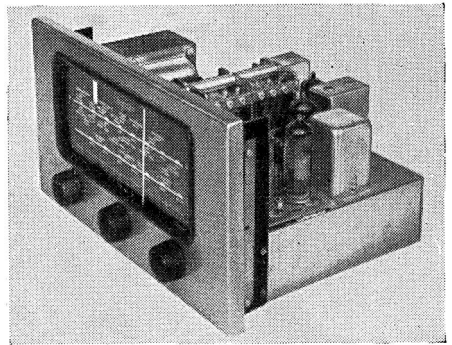
Chapman S5E/FM



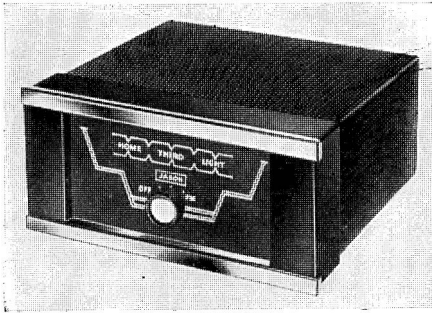
Chapman switched FM80



Chapman S6BS



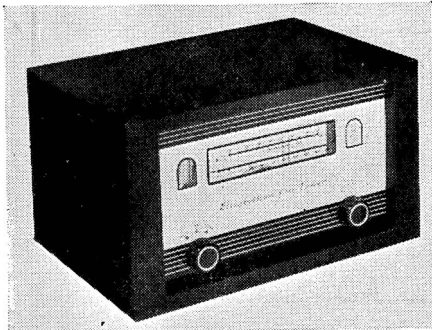
Chapman FM85



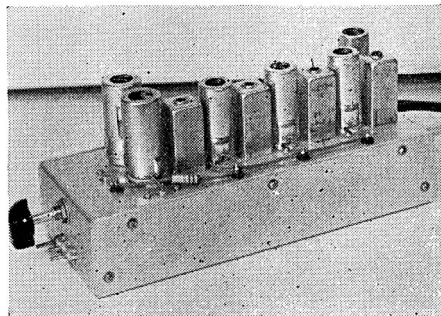
Jason FMS2



Jason AM/FMS2



Elizabethan F.M. tuner



G.E.C. switched tuner

at 2.5 amps. Size $5\frac{1}{2}$ in. by $6\frac{1}{2}$ in. by $5\frac{1}{2}$ in. Weight $2\frac{1}{4}$ lb. Price—F.M.2 LV £18 ; F.M.2 HV £21 (U.K. purchase tax—F.M.2 LV £7 0s. 6d. ; F.M.2 HV £8 3s. 9d.).

Ether Pathfinder A.M./F.M. Tuner T10A. Tuning, variable condenser (A.M.). Permeability (F.M.). Range (F.M.) 88-108 Mc/s, (A.M.) LW 800-2,000 metres, M.W. 190-550 metres, SW1 13-48 Mc/s, SW2 48-160 Mc/s. Ratio det. Magic eye ind. P.s.n. 250v at 60 mA, 6.3v at 3 amps. Size $8\frac{3}{4}$ in. by 14 in. by $10\frac{5}{8}$ in. Weight $14\frac{1}{2}$ lb. Price £47 9s. 9d. (U.K. purchase tax £18 10s. 3d.).

Ether Marshal A.M. Tuner T139. 5 wavebands, 10-30, 28-80, 80-200, 200-580, 800-2,200. Ratio det. Magic eye ind. Own separate amplifier. Size $8\frac{1}{2}$ in. by 14 in. by $10\frac{5}{8}$ in. Weight 25 lb. Price complete with amplifier £131 6s. 5d. (U.K. purchase tax £51 4s. 3d.).

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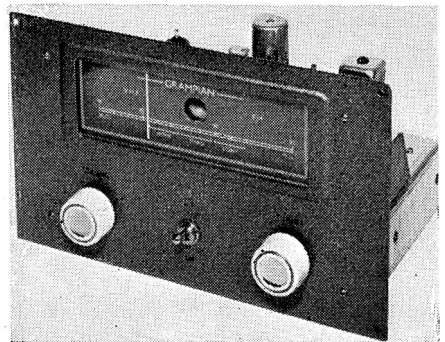
EAP (Tape Recorders) Ltd., Bridge Close, Oldchurch Road, Romford, Essex. Tel.: Romford 62366-7.

Elizabethan F.M. Tuner. Manual tuning. Range 81-105 Mc/s. Ratio det. Magic eye ind. Self-powered. Price £18 3s. 9d. (U.K. purchase tax £7 0s. 3d.).

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General Electric Co. Ltd., Magnet House, Kingsway, W.C.2. Tel. : Temple Bar 8000. Cables : Polyphase, London.

VHF/F.M. Tuner. BCS 1352 Switched tuning. Range 88-98 Mc/s. A.F.C. Foster-Seeley disc. P.s.n. 150v at 20 mA ; 6.3v at 1.8 amps. Power pack available (Cat. No. BCS 1351). Price Tuner only £19 5s. 8d. ; power unit £6 5s. (U.K. purchase tax tuner only £8 11s. 4d.).



Grampian FM 571

Goodsell Ltd., Gardner Street, Brighton, Sussex. Tel. : Brighton 26735.

F.M. Tuner. FMT 501. Perm. tuning. Range 88-100 Mc/s. Ratio det. Magic eye ind. P.s.n. 300v at 28 mA. Size 11 in. by 8 in. by 8 in. Weight 3 lb. Price £13 17s. 6d. (U.K. purchase tax £5 16s. 6d.).

V.H.F./F.M. Tuner. Switched. Range 85-108 Mc/s A.F.C. Ratio det. with limiter. P.s.n. 175-300v at 25 mA, 6.3v at 1.7 amps. Size 6 in. by 5 in. by 6 in. Weight 1½ lb. Price £11 15s. (U.K. purchase tax £4 14s.).

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Grampian Reproducers Ltd., 19 Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657. Cables : Reamp, Feltham.

F.M. Tuner 571. Free tuned. Range 85-90 Mc/s. Ratio det. Magic eye ind. P.s.n. 300v at 35/40 mA, 6.3v at 2.5 amps. Size 10½ in. by 5½ in. by 6½ in. Weight 3¼ lb. Price £17 10s. (U.K. purchase tax £7 1s. 6d.).

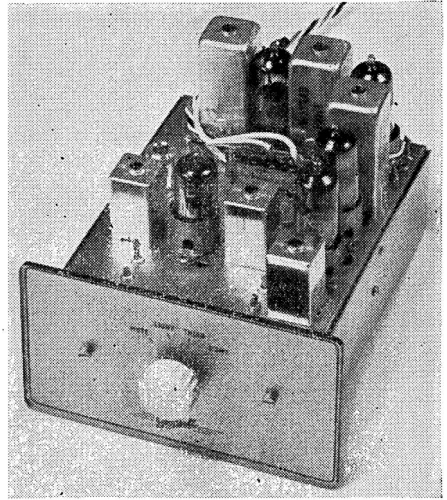
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Jason Motor & Electronic Co., 3/4 Gt. Chapel Street, London, W.1. Tel.: Gerrard 0273/4.

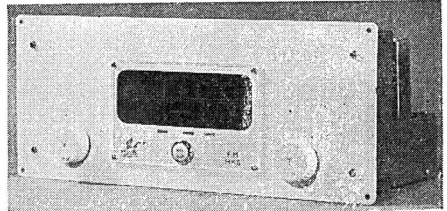
Prefect F.M. Tuner. Switched incremental inductance tuning. Range 88-95 Mc/s. A.F.C. Foster-Seeley disc. Sensitivity 60µv for 40 dB quieting. P.s.n. 220-270v at 30-40 mA, 6.3v at 2 mA. Size 4½ in. by 4¾ in. by 6 in. Price £11 6s. (U.K. purchase tax £4 7s. 9d.).

F.M. Tuner FMS2. Switched incremental inductance tuning. Range 88-95 Mc/s. A.F.C. Foster-Seeley disc. Sensitivity 15µv for 40 dB quieting. Self-powered. Size 8½ in. by 8¼ in. by 4¾ in. Price £17 5s. (U.K. purchase tax £6 14s. 6d.).

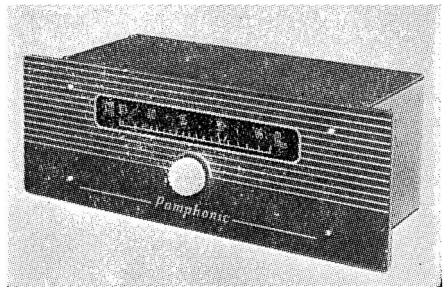
A.M./F.M. Tuner AM/FMS2. 3 gang condenser (M.W.). Switched incremental inductance (F.M.). Range (F.M.) 88-95



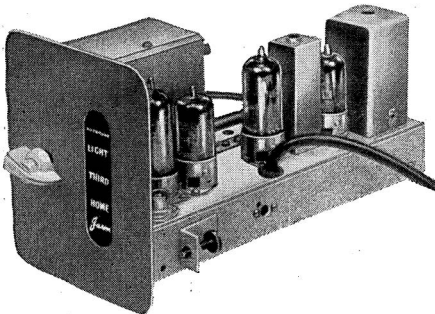
Goodsell switched FM tuner



Lowther Mk. II F.M. tuner



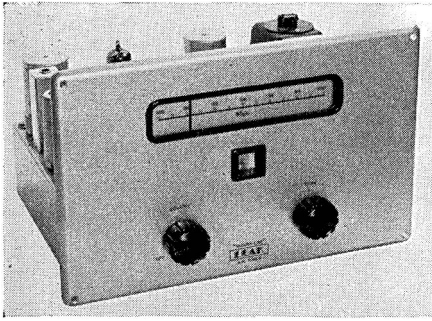
Pamphonic 640 FM tuner



Jason switched F.M. tuner



Pamphonic 645 FM/AM tuner



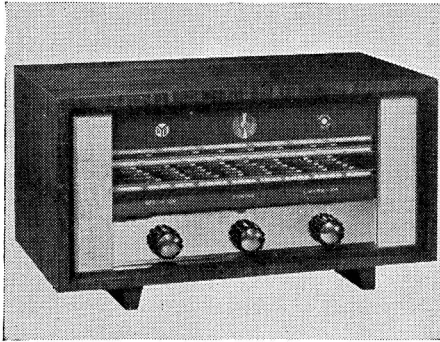
Leak F.M. "Through-line" tuner

Mc/s. (A.M.) 186-565 metres. A.F.C. Foster-Seeley disc. Magic eye ind. (A.M.). Sensitivity for 40 dB quieting F.M., 15 μ v, A.M. 10 μ v. Self-powered. Size 15 in. by 8 $\frac{1}{4}$ in. by 4 $\frac{3}{8}$ in. Price £22 16s. (U.K. purchase tax £8 15s. 8d.).

A.M./F.M. Tuner AM/FM2. Variable capacitor 3 gang tuning, A.M. and F.M. Range (F.M.) 88-108 Mc/s. (A.M.) 180-565 metres with variable selectivity. A.F.C. Foster-Seeley disc. Magic eye ind. Sensitivity for 20 dB quieting, F.M. 2 μ v, A.M. 10 μ v. Self-powered. Size 15 in. by 8 $\frac{1}{4}$ in. by 4 $\frac{3}{8}$ in. Price £33 (U.K. purchase tax £12 17s. 5d.).

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H. J. Leak & Co. Ltd., 57/59 Brunel Road, East Acton, London, W.3. Tel. : Shepherds Bush 1173. Cables : Sinusoidal, Ealux, London.

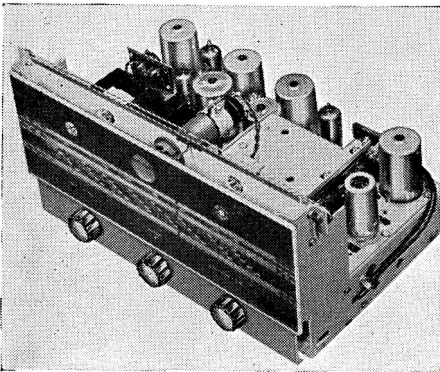


Pye F.M./A.M. tuner

F.M. Tuner, Through-Line. Variable tuning. Range 88-100 Mc/s. A.F.C. Foster-Seeley disc. Original magic eye ind., circuit accurate to 2 Kc/s. Self-powered. Size 10 $\frac{3}{8}$ in. by 7 in. by 7 in. Weight 10 lb. Price £25 (U.K. purchase tax £10 10s.).

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The Lowther Manufacturing Co., Lowther House, St. Mark's Road, Bromley, Kent. Tel. : Ravensbourne 5225. Cables : Lowther, Bromley.



Pye F.M./A.M. tuner chassis

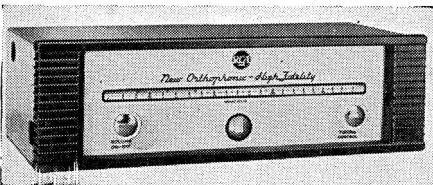
F.M. Tuner Mk. II. Twin gang tuning, horizontal scale. Range 87.5-100 Mc/s. A.F.C. Foster-Seeley disc. Press button ind. 50 c.p.s. injection. P.s.n. 250v at 35 mA ; 6.3v at 2 amps. Size 13 $\frac{1}{4}$ in. by 5 $\frac{1}{2}$ in. by 5 in. Weight 5 $\frac{1}{4}$ lb. Price £22 (U.K. purchase tax £8 15s. 7d.).

F.M. Tuner Mk. III. Twin gang tuning, horizontal scale. Range 87.5-100 Mc/s. A.F.C. Foster-Seeley disc. Press button ind. 50 c.p.s. injection. Self-powered. Size 13 $\frac{1}{4}$ in. by 5 $\frac{1}{2}$ in. by 5 in. Weight 5 $\frac{1}{4}$ lb. Price £24 10s. (U.K. purchase tax £9 15s. 6d.).

A.M. Tuner DT/5. Ganged condenser, band spread tuning. Range 12-30, 30-90, 90-200, 195-550 metres. "S" meter ind. P.s.n. 250v at 30 mA ; 6.3v at 2.75 amps. Size 12 in. by 10 $\frac{1}{2}$ in. by 12 in. Weight 10 lb. Price £33 (U.K. purchase tax £13 3s. 4d.).

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S. E. Opperman Ltd., Stirling Corner, Boreham Wood, Herts. Tel.: Elstree 2021.



RCA F.M. tuner

Sterling F.M. Tuner. Variable permeability tuning. Range 86-100 Mc/s. Ratio

det. Self-powered. Size $7\frac{1}{2}$ in. by $7\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Weight 4 lb. Price including purchase tax in U.K. £13 13s.

★

Pamphonic Reproducers Ltd., 17 Stratton Street, London, W.1. Tel. : Grosvenor 1926.

640 F.M. Tuner. Variable tuning. Range 86-103 Mc/s. Ratio sel. Magic eye ind. P.s.n. 200v at 30 mA, 6.3v at 2 amps. Size (panel) $9\frac{3}{16}$ in. by $3\frac{3}{4}$ in. Price £15 (U.K. purchase tax £5 15s. 6d.).

645 F.M./A.M. Tuner. Switched F.M., variable A.M. Range (F.M.) 86-103 Mc/s. (A.M.) 185-565 metres. A.F.C. Foster-Seeley disc. Magic eye ind. Sensitivity F.M., $15\mu\text{v}$ for 40 dB quieting. Self-powered. Size 13 in. by $10\frac{1}{2}$ in. by $4\frac{1}{2}$ in. Price £21 13s. 2d. (U.K. purchase tax £8 6s. 10d.).

★

Pye Ltd., Radio Works, Cambridge, England. Tel. : Cambridge 58985. Cables : Pyrad, Cambridge.

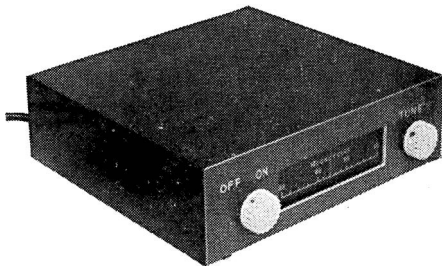
A.M./F.M. Tuner, HFT. 111 W. 2 chassis forms. Horizontal and vertical scale. Permeability tuning. Range (F.M.) 87.1 100 Mc/s. (A.M.) 183-564 ; 956-1,910 metres. Foster-Seeley disc. Magic eye ind. Self-powered. Size 15 in. by $8\frac{3}{4}$ in. by 9 in. Price £26 10s. 8d., chassis form £21 19s. 8d. (U.K. purchase tax £10 4s. 4d., chassis, £8 9s. 4d.).

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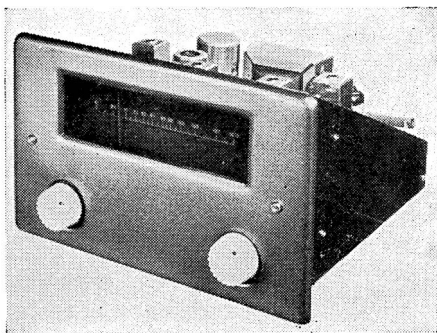
RCA Great Britain Ltd., Lincoln Way Windmill Road, Sunbury-on-Thames, Middlesex. Tel. : Sunbury 3101. Cables : Telex and Tex 8608.

F.M. Tuner LMI 32230B. Continuously variable tuning. Range 87.5-108 Mc/s (full international F.M. broadcast band). A.F.C. Ratio det. 6AL7 electron ray tuning ind. P.s.n. 230-390v at 40 mA (adjustable tapings); 6.3v at 2.25 amps. Size $12\frac{7}{8}$ in. by $6\frac{1}{2}$ in. by $3\frac{7}{8}$ in. Weight 7 lb. Price £24 3s. (U.K. purchase tax £9 8s. 4d.).

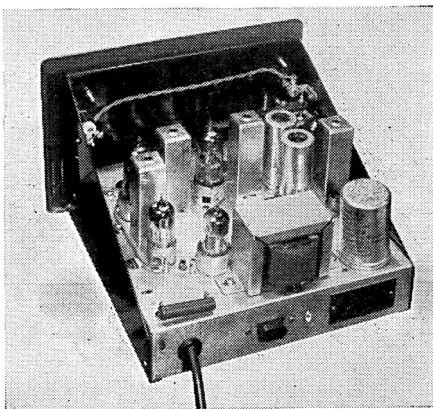
Power Unit LMI 32283. For supplying power for radio-tuners or tape units. Power available 290 or 230 volts at 45 mA D.C. and 6.4 volts at 2.25 amps A.C. To run from 110/120, 150, 200/255 volts, 50 or 60 c.p.s. Intended for use with R.C.A. Supersensitive Tuner LMI 32230B. Price £3 10s.



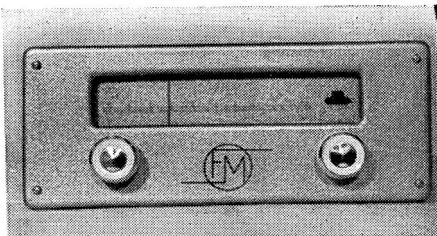
"Sterling" F.M. tuner



Rogers R.D. Junior F.M. tuner



Rogers R.D. Junior F.M. tuner (rear view)



A-Z F.M. Syncrolock Mk IV

Rogers Developments (Electronics) Ltd., "Rodevco Works," 4-14 Barmeston Road, Catford, S.E.6. Tel. : Hither Green 7424. Cables : Rodevco, London.

R.D. Junior FM Tuner. Variable inductance tuning. Range 87-107.5 Mc/s. A.F.C. Foster-Seeley disc. Tuning ind. centre-zero meter (optional extra). Sensitivity for full limiting, 10 μ v. P.s.n. 270v at 38 mA, 6.3v at 2.3 A or self-powered. Size 9 in. by 5 $\frac{3}{8}$ in. by 8 $\frac{5}{8}$ in. Price £16 11s. (U.K. tax £6 1s. 9d.) or £18 5s. 6d. powered (U.K. purchase tax £7 13s. 6d.).

★

Shirley Laboratories Ltd., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

In preparation

B/F.M. F.M. Tuner. Continuously variable tuning. De-luxe model. Available April-May, 1958.

★

Sound Sales Ltd., Works and Acoustic Laboratories, West Street, Farnham, Surrey. Tel.: Farnham 6461/2/3. Cables : Sounsense, Farnham.

A-Z F.M. Syncrolock Unit Mk. IV. Variable twin gang tuning. Range 87.5-108 Mc/s. Foster-Seeley disc. Magic eye ind. Self-powered. Size 11 $\frac{1}{8}$ in. by 4 $\frac{3}{8}$ in. by 7 $\frac{1}{4}$ in. Weight 9 lb. Price £22 (U.K. purchase tax £8 9s. 5d.).

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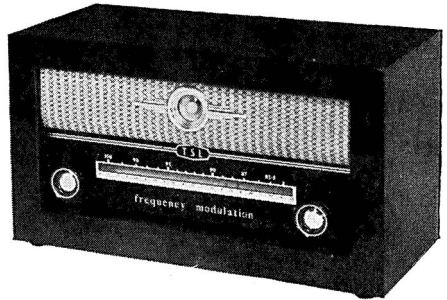
Stratton & Co. Ltd., Eddystone Works, Alvechurch Road, West Heath, Birmingham 31. Tel. : Priory 2231. Cables : Stratnoid, Birmingham.

Eddystone 820 A.M./F.M. Tuner. Continuous F.M., switched A.M. tuning. Range (F.M.) 87.5-100 Mc/s, (A.M.) medium and long wave. Foster-Seeley disc. Magic eye ind. Self-powered. Size 6 $\frac{1}{2}$ in. by 11 in. by 10 in. Weight 11 $\frac{1}{2}$ lb. Price £22 (U.K. purchase tax £9 18s.).

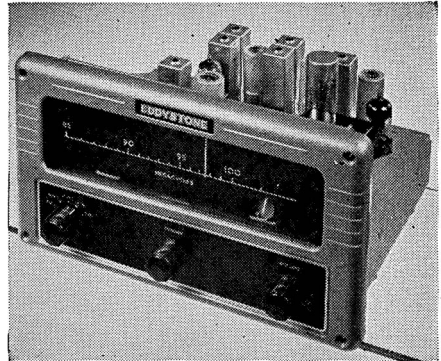
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Technical Suppliers Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel. : Shepherds Bush 2581/4794.

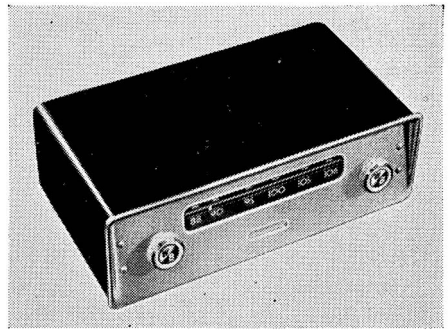
F.M. Tuner Mk. III International Model. Variable permeability tuning. Range 88-108 Mc/s. Ratio det. Magic eye ind. Self-powered. Size 10 $\frac{5}{8}$ in. by 7 in. by 5 $\frac{5}{8}$ in. Weight 6 lb. Price £13 13s. (U.K. purchase tax £5 5s.).



T.S.L. Mk. III International F.M. tuner



Eddystone 820 A.M./F.M. tuner



W/B Stentorian F.M. tuner

Whiteley Electrical Radio Co. Ltd., Victoria Street, Mansfield, Nottinghamshire. Tel. : Mansfield 1762-5. Cables : Whitebon, Mansfield.

In preparation

W/B Stentorian F.M. Tuner. Variable permeability tuning. Range 88-108 Mc/s. Foster-Seeley disc. P.s.n. 200-240v at 40-50 mA, 6.3v at 2 amps. This unit will use a printed circuit. Price approx. £25 including purchase tax in the U.K.

HI-FI FURNITURE

MOST people who have been experimenting with Hi-Fi for a number of years will have memories of at least one untidy corner—if not a permanently untidy room—with wires running this way and that, with turntable units propped up in their cartons, and with dust settling over all—in a word Hi-frustration. When the Hi-Fi bug bit its first enthusiast there were no cabinets, except converted ones ; and for nearly eight years, apart from a few general purpose boxes on legs, there was no serious attempt made to cater for this new and rapidly growing hobby. And then, quite suddenly, as though everyone awoke to the need simultaneously Hi-Fi cabinetwork began to appear from all quarters ; and today, as typified by the following pages of examples, there is already a fairly wide choice of Hi-Fi housing on the market ; and there is as much again on the way.

“ Stumbling Blocks ”

One of the main reasons for the long absence of this most necessary side of the Hi-Fi catalogue was that no one really knew what was wanted. The cabinet maker certainly did not, because he had no knowledge of Hi-Fi, and he had to rely upon his customers to tell him their requirements. And the Hi-Fi customers were singularly unhelpful, for few of them really knew what they wanted themselves, and certainly no two of them shared the same ideas.

There were other stumbling blocks in the way, too. Few amplifiers of different makes were within inches of the same size ; no two motor units were of the same depth, width, or overall weight ; no two pickups demanded the same amount of room, either in weight or distance behind the pivot ; and no two components of different category (e.g., tuners and pre-amplifiers) matched up—with one or two notable exceptions, led by Quad. The result of all this was that no one really knew his own mind, and as it was by no means certain that one could even get hold of the unit of one's choice, the fateful step of “ ordering a cabinet ” was delayed for weeks and months.

“ Sorry Tale ”

Just by way of completing this sorry tale—which many “ old hands ” will recall only too vividly—tape decks suddenly appeared on the scene in profusion, and with an exasperating variation of dimensions, and so upset even those plans which had matured over the

months—and everything had to begin all over again.

The Hi-Fi enthusiast of 1958 does not realise how lucky his wife is ! With the variety of planned Hi-Fi furniture that is now available ; there is no reason at all why even the most humble embryo collection of equipment should not be decently housed, *ab initio* ; and if the same amount of thought is given to the housing as to the essential components, there is still less reason why the same cabinetwork cannot eventually accommodate the most ambitious set-up that may evolve from those small beginnings. One good reason for this is, of course, that much of the cabinetwork currently available has been built around Hi-Fi equipment by people who know what they are about.

Heal and Co.

Heal and Co. were probably the first to pay serious attention to the subject, and they built the “ Chairsides ” unit for a Quad amplifier and tuner, plus a Garrard 301 transcription unit. They later brought out other models to house other equipment, tape decks included.

At the other end of the scale *Whiteley Electrical* realised the difficulty of the enthusiast in search of a good speaker enclosure at a moderate price—and also took a realistic view of the bulk and the fragile nature of a “ hollow box ” in the hands of modern public transport ; so they planned a number of “ ready-to-assemble ” units. These were an immediate success, and the range has now been extended to include all manner of Hi-Fi set-ups.

The “ Plans ”

Then came the “ Plans ”—tailored Hi-Fi furniture in unit form, offering a really wide selection of alternatives. *Record Housing*, who first concentrated upon an “ expanding ” record storage system, turned their attention to this scheme. *Imhof's*, working upon the same theme, developed the “ Imflex ” system. *B.K. Partners* designed the “ B.K. Plan.” *Gnome* thought out and brought out the “ G-Plan.” *Largs* likewise evolved a planned system. And all the while, of course, simplified cabinetwork which could be adapted to take different combinations of equipment was being developed by such well-known names as *Stamford*, *Maggie* and *Davies*.

The most awkward unit to be catered for is the transcription turntable ; and this de-

mands two essentials—first, adequate depth (front to back) to accommodate itself and its attendant pickup ; second, a rock-steady support. In view of this, many enthusiasts prefer to house the unit separately, and to place the “ box ” (which can be very attractive in teak, mahogany or painted wood) on its own firm table, thus reducing the overall depth of the cabinetwork, required by the rest of the equipment, to a mere 9 or 12 in.

Tape Decks

Tape decks, also of unfortunately large dimensions (back to front) have the advantage of not having to be mounted dead level, nor do they mind being on less firm legs. Some people like to house these two units in one piece of furniture—either in “ pull-out ” drawers, one above the other, or with an up-and-down lid for the turntable, and a drawer beneath it for the deck. Still others like the idea of the whole shooting party under one roof. And for such people the various “ plans ” are full of opportunities.

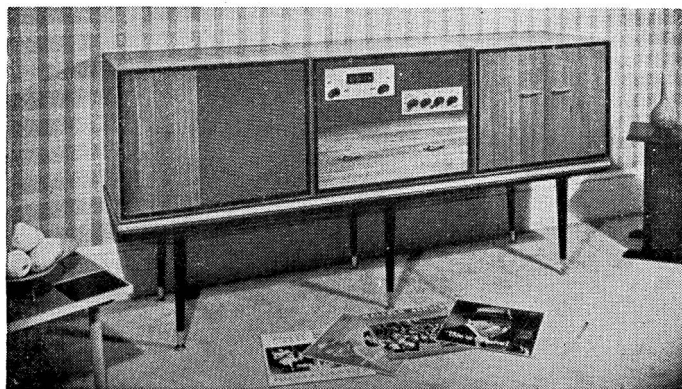
Stereo brings new problems with it, so far as extra space is called for by a second amplifier, but here again an expanding

“ plan ” will usually take care of such things.

And, as a final note to introduce a few examples of the latest Hi-Fi Furniture, what is the most complicated set of Hi-Fi equipment that the most extravagantly minded enthusiast is likely to put together in the foreseeable future ? The answer to that one, in logical numerical sequence is (1) Transcription turntable with ample room around the motor board for two pickups—one for standard lps and one for stereo, (2) Twin-channel pre-amplifier to handle disc, tape and radio. (3) Two approximately matched amplifiers, one for each channel. (4) Tape deck feeding the pre-amplifier with stereo output. (5) Two FM tuners, against the days when the B.B.C. may broadcast experimental stereo programmes. (6) Stereo “ Record ” amplifier and oscillator unit for putting on tape anything—stereo or single channel—that is being listened to, from radio, disc or mike.

All that sounds like a lot of space, but there are several makers of Hi-Fi furniture whose products will handle it with ease—still leaving plenty of room for record storage and the occasional bottle of sherry !

EXAMPLES OF HI-FI FURNITURE



*B.K. Partners
Audio-Plan*

B.K. Partners Audio-Plan comprises three units, the loudspeaker enclosure, the equipment cabinet, and a record storage cabinet. All units measure 24 in. by 18 in. by 18½ in., and can be mounted on individual legs or on tables taking two or three units. Legs cost 19s. 6d. or £2 2s. a set, and the tables £7 7s. and £13 13s. The units are finished in teak and sapele mahogany veneer.

The speaker enclosure is basically a reflex

enclosure and is designed to take a 12-in. drive unit, but can be adapted to take other sizes. Price £16 19s. 6d. The equipment cabinet has space for most amplifiers, control units and tuners in the top half, while the bottom drawer will take a transcription motor or tape deck. Price £17 19s. 6d. The storage cabinet will take 12-in. records with a shelf for tapes, etc. Price £16 16s. Manufactured by B.K. Partners Ltd., 229 Regent Street, London, W.1.

*Brearcliffe
consoles*

There are two Brearcliffe consoles, the double and the single. The double will take any make of motor unit and pickup or tape deck plus any amplifier, control unit and tuner, with storage space for records and tapes. It measures 39 in. by 32 in. (including 6-in. legs) by 20 in. The price is £30 9s. The single unit will house a transcription motor, amplifier and control unit, also with storage space. Dimensions are the same as above, except that it is 19 in. wide. The price is £22 1s.

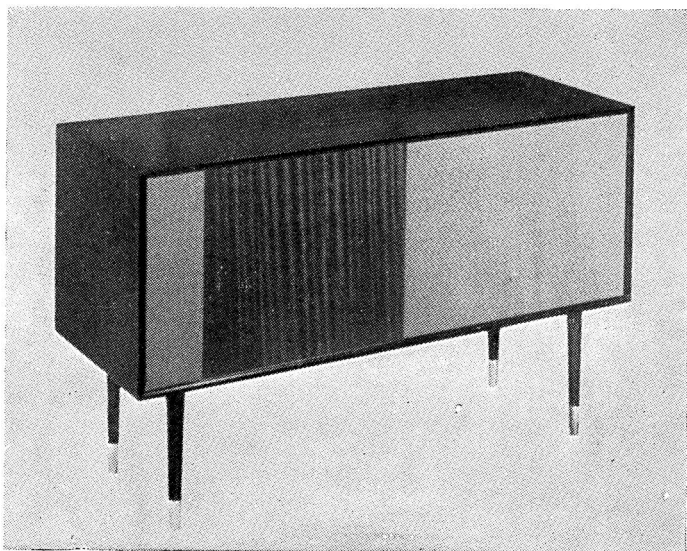


Both units are constructed of heavy veneered plywood with satin lacquered finish. There is a choice of sapele mahogany, walnut or light oak veneers. Manufactured by James Turner, Little Barn, Arford, Headley, Hampshire.

*Imhof's
"Inflex"
system*

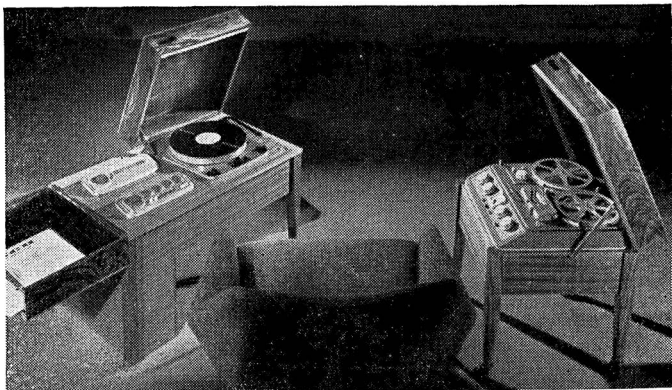
Imhof's were one of the first firms to produce specialised Hi-Fi furniture. The present range, known as the Inflex system, is based on three units 22 in. by 17 in. by 16½ in., three variations are available, a loudspeaker, control cabinet and record storage cabinet. There are also double units 44 in. wide.

The loudspeaker enclosure is designed to take a 12-in. drive unit and costs £30 9s. when supplied with the Tannoy D.R. or £16 10s. without a speaker. The double unit (shown above) costs £21 19s. The control



cabinet costs £15 15s. and the single storage cabinet £11 11s., and a double one, £19 19s. They can be mounted on wooden legs (£1 1s. extra) or metal ones (£2 2s. extra). Double or treble wooden leg bases are available at £6 16s. 6d. Manufactured by Alfred Imhof Ltd., 112/116 New Oxford Street, London, W.C.1.

*Heal's Quad
chairside
control cabinet
and
tape deck
cabinet*



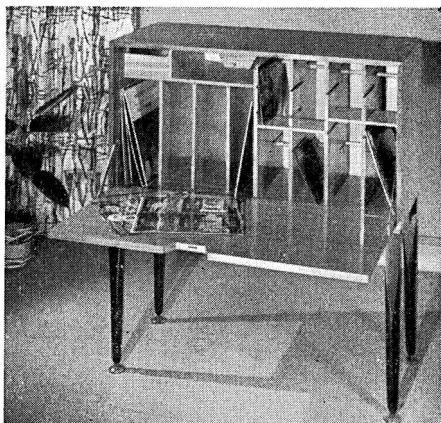
The Heal's Quad chairside control cabinet is designed to take the Quad amplifier, control unit, radio tuner, and a transcription motor and pickup, or can be adapted for tape deck. Provision can also be made for a second tuner at an extra cost of £1 10s. When closed the measurements are 32½ in. by 23 in. by 19 in. It is veneered in mahogany and rosewood and fitted

with easy-running castor. Price £30.

The tape deck cabinet is similar in design and finish to the Quad cabinet. It can be supplied ready to accommodate a "Ferrograph 66," or, at the same price, £19, with an uncut top panel for fitting other types of equipment. The measurements are 18 in. by 23 in. by 19 in.



The Heal Standard chairside cabinet (above left), accommodates most makes of high fidelity equipment, amplifiers, control units, tuners, and transcription motors or tape decks. Good ventilation for the equipment is provided by large grilles front and back ensuring that overheating will not occur. It is veneered in teak with ebonised lid and legs. The overall dimensions of the cabinet are 35½ in. by 24 in. by 23 in. The front instrument panel and the back panel are removable for the easy installation of equipment. The price is £37 10s.



records on the left-hand side, with a shelf above for record reviews or magazines, and on the right the shelves are adjustable so that a number of alternative shelving variations are available to provide space for 12, 10 and 7-in. records, also boxes of tape. There are adjustable backstops, so that the smaller records are kept to the front of the cabinet. A small drawer is provided for keeping a card index of record titles. The cabinet is veneered in mahogany and rosewood, or in teak with ebonised base. It measures 36 in. by 15 in. by 20 in. Price with fall flap or sliding doors £25, on plinth £26, on legs (22 in. high) £30. Manufactured by Heal and Son Ltd., 196 Tottenham Court Road, London, W.1.

The Heal record storage cabinet (above right) has been planned to house 12-in.

MICROPHONES

By John Borwick

THERE comes a time in the life of every tape recorder owner when he is no longer content to record only from broadcasts and gramophone records. But when he looks round for a suitable microphone he may be understandably bewildered by the plethora of types available. This article is intended to help in this difficult choice by briefly explaining some of the terminology.

All microphones have this much in common: (a) they include some component—diaphragm, ribbon, or what have you—which is light and easily set into sympathetic

vibration, the enclosed air being at normal atmospheric pressure, so that the alternating rise and fall in outside pressure due to sound waves will cause the diaphragm to be deflected inwards and outwards. Such a microphone is “blind” to the direction from which the sounds are arriving—that is, it is omni-directional except at higher frequencies, when it tends to become uni-directional owing to the obstacle effect of the case (see Fig. 2a). This variation in frequency response with direction may sometimes cause trouble indoors, where reflected sounds arrive from all angles, but is unimportant for open-air recordings, on-the-spot interviews, etc. Many modern types are physically small, and the omni characteristics are extended to quite high frequencies.

Pressure Gradient Microphones

The Pressure Gradient microphone (Fig. 1b) is open to the air on both sides. It therefore samples the instantaneous pressure at two points in space, and responds to their difference. The term “gradient” need not cause any confusion, if one considers its application to motoring, where the gradient of a section of roadway is established by subtracting the heights above sea-level of two points a fixed distance apart. The pressure difference, and therefore the output of a P.G. microphone, will be a maximum when the two points are in line with the direction of propagation of the sound wave, and will fall to zero when they are at right angles to it. The directivity pattern which results from this is a figure-of-eight, the live angles at front and back being nominally 100° (see Fig. 2b). This type of microphone is thus “dead” to sounds arriving at the side, and particularly suitable for use in over-reverberant surroundings and in multi-

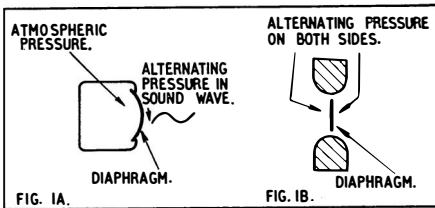


Fig. 1—(a) Pressure-operated microphone; (b) Pressure gradient microphone

vibration by the air movements in sound waves, i.e., they translate sound energy into mechanical vibration; (b) they utilise these vibrations to generate an alternating e.m.f., i.e., they translate the mechanical vibration into an alternating voltage. In the ideal microphone these transformations produce an electrical output whose waveform is a “carbon copy” of that of the original sounds.

(a) Driving the Diaphragm

There are two basic ways in which energy may be “extracted” from the passing sound wave. These are termed Pressure and Pressure Gradient operation.

The pressure-operated microphone (Fig. 1a)

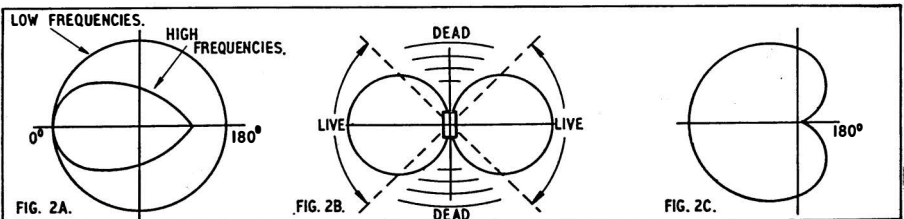


Fig. 2—Field response of microphones: (a) Pressure; (b) Pressure gradient and (c) Cardioid

microphone layouts. Low frequencies are emphasised, however, at working distances of two feet or less, and bass cut will have to be resorted to for close speaking or singing.

It is possible, though beset with difficulties, to design a microphone which combines the characteristics of the Pressure and P.G. principles, to give wide-angle response at the front, and zero back response. The directivity response in this case is heart-shaped, i.e., "Cardioid." Cardioid microphones are not cheap, and may not tempt the domestic enthusiast, but their advantage to commercial users for Public Address and multi-microphone set-ups will be obvious (see Fig. 2c).

(b) Generating the Voltage

Some four methods are commonly employed to derive a voltage from the oscillations of microphone diaphragms.

Moving coil and ribbon microphones depend on electro-magnetism—the well-known principle that movement of a conductor in a magnetic field sets up an e.m.f. Fig. 3a illustrates the *moving-coil* type. A specially-shaped permanent magnet main-

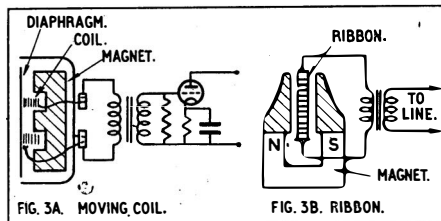


Fig. 3—*Moving-coil and ribbon microphones*

tains a strong annular field. The coil is attached to the back of the diaphragm, and will vibrate in the magnetic field so as to produce an alternating voltage across the output terminals. It will be seen that a moving-coil microphone is constructed something like a small loudspeaker, and indeed the two functions are combined in a single unit in some two-way intercommunication installations. Moving-coils have an output impedance of some 15 to 50 ohms and may be connected by reasonably long cables to a step-up transformer on the amplifier. They are robust, and make good hand microphones, wind-shields being available for some types.

The *ribbon microphone* (Fig. 3b) comprises a thin strip of aluminium or other foil, suspended between pole-pieces designed to concentrate the magnetic field along its length. Most ribbon microphones work on the P.G. principle and are therefore bi-directional. They generally incorporate a built-in trans-

former to step up the low internal impedance (a fraction of an ohm) to a few hundred ohms for connection to line, or some other impedance as required. They are very susceptible to wind pressure, and cannot usually be employed outdoors.

Crystal microphones utilise the piezoelectric properties of Rochelle salt. A sandwich formed by cementing together two

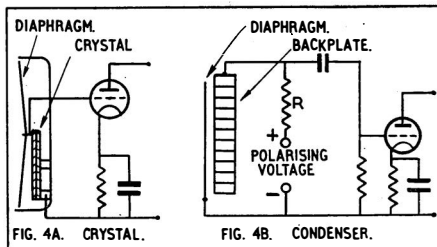


Fig. 4—*Crystal and condenser microphones*

thin slices of the crystal exhibits opposite electrical charges on the two faces when subjected to a bending force. Fig. 4a shows one form of the crystal microphone, in which a diaphragm bears on one corner of the "bimorph." In a less sensitive form, direct pressure operation of the crystal is used. The internal impedance corresponds to a capacitance of roughly 2,000 p.f., calling for a load resistance of several megohms, and the use of only a short run of low-capacity cable. Some crystal microphones are so small and light as to be easily worn on the clothing. They are usually pressure-operated.

Condenser microphones (otherwise known as electro-static microphones) take the form of a capacitor in which the back plate is fixed, and the other a flexible diaphragm. Vibrations of the latter cause fluctuations in the capacitance of the microphone, and, since

charge
voltage = —————, this will produce an
capacitance

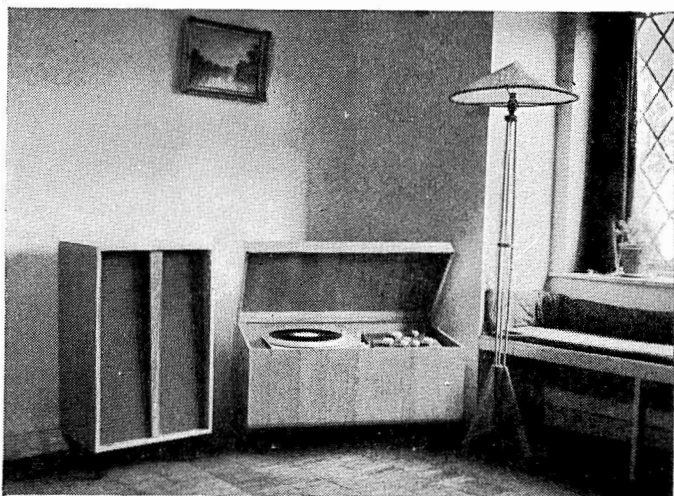
alternating voltage provided the charge is maintained constant. This is the function of the resistance R in series with the polarising supply (see Fig. 4b).

Carbon microphones rely on the fluctuations in resistance of a "button" of carbon granules against which the diaphragm presses, and which is energised by a battery. The high level of background noise has caused this type of microphone to be used less and less for high fidelity work.

Sensitivity

So far we have been taken up with the fidelity of the microphone's conversion of sound into electricity, but what about its efficiency? It is clearly desirable to obtain

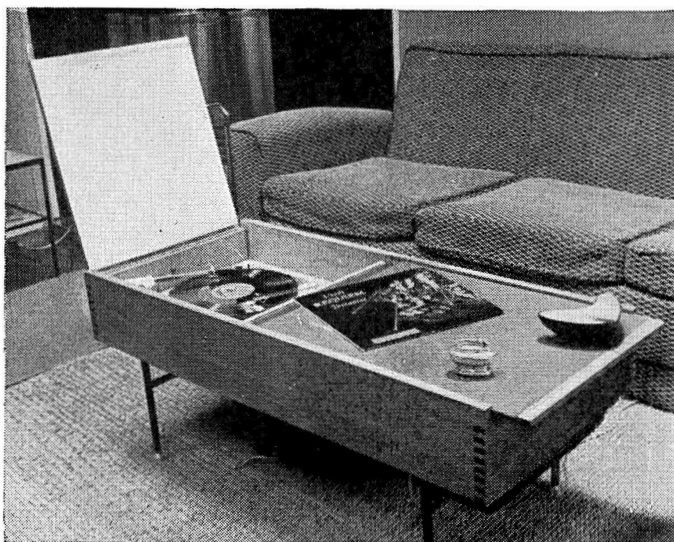
*Wellington
Acoustic
Laboratories
"Lowboy Mk. I"*



Wellington Acoustic Laboratories Ltd., Always, Kings Lane, Wrecclesham, Farnham, Surrey, produce two lowboy cabinets primarily intended to house Sound Sales tape equipment; the Mk. I, price £19 10s., and the Mk. II, price £27. The Mk. I, shown here, has space for amplifier and control unit, tuner, tape deck or transcription motor. The Mk. II will take amplifier and control unit, recording pre-amplifier, tuner, tape deck and

transcription motor. There is sufficient space to take the Sound Sales Tri-Channel system. The finish is natural oak or walnut. Dimensions for the Mk. I are 34 in. by 23 in. (including legs) by 16 $\frac{3}{4}$ in. Mk. II, 35 $\frac{1}{2}$ in. by 23 $\frac{1}{4}$ in. (including legs) by 19 $\frac{1}{2}$ in. Also shown in the illustration is the W.A.L. Duo-Reflex speaker, price £27 with drive unit.

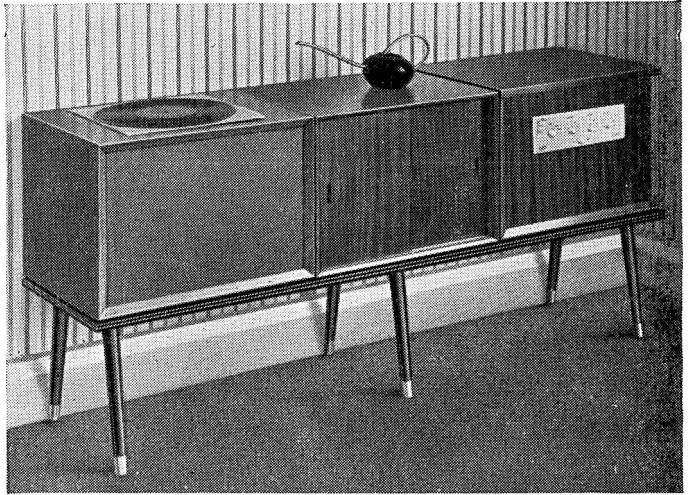
*Magpie
player
table*



The Magpie player table incorporates a novel feature in that it can be used as a coffee table, or other small low table in the home. Basically, the Magpie player consists of a long, low, rectangular cabinet (44 in. by 20 in.) on metal legs (11 in., total height 18 in.). It will house a transcription motor, amplifier and control unit and tuner. The table-top surface of the cabinet comprises a lift-up lid

of 11-ply, $\frac{5}{8}$ in. birch over the turntable section and a sliding formica top over the second half. The amplifier is housed in a basket arrangement of wire mesh for cooling purposes. The price is £23 2s. Manufactured by Magpie Furniture Ltd., Station Approach, Mortlake, London, S.W.14.

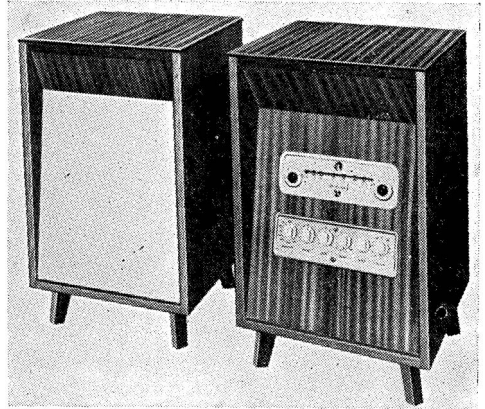
*The
Record Housing
Nordyk
range*



Recording Housing produce a wide range of cabinets for record storage, equipment housing and as speaker enclosures. In the illustration three of the "Nordyk" range are mounted on a "Continental Bench." All units are 20 in. by 14 in. by 14 in. and are finished in striped walnut, natural oak or medium mahogany. The speaker enclosure is a simplified horn and will take 8 or 10-in. units, it costs £5 17s. 6d. The record storage cabinet will

hold 150 records, the price is £4 17s. 6d. The equipment cabinet will hold a motor unit, amplifier and control unit, a tuner could be mounted on the side, this costs £5 19s. 6d. The bench costs £4 17s. 6d., the units can also be mounted on various types of individual legs. Manufactured by Record Housing, Brook Road, London, N.22.

*The Whiteley Electrical range
of ready-to-assemble cabinets*



There are five different equipment cabinets in the range, in traditional and contemporary styles. Prices range from £5 10s. to £16 16s. Shown here are the "Prelude" cabinets, above are the bass reflex and Hi-Fi console, these measure 19 in. by 33 in. by 19½ in. and cost £13 13s. On the left is the table model, which costs £9 19s. 6d. and measures 19½ in. by 17½ in. by 18½ in. All are finished in sapele mahogany veneer. Manufactured by Whiteley Electrical Radio Co. Ltd., Mansfield, Notts.

as high an output voltage as possible for a given value of sound pressure, in the interests of a good ratio between the signal and the noise generated in the microphone itself and the first stage of amplification. In the specifications of microphones it is common practice to take the standard sound pressure as 1 dyne/cm², and to quote the open circuit output voltage in dB relative to 1 volt—thus an output of 1 millivolt corresponds to -60 dB. However, quoting the voltage

gives only a rough idea of the relative sensitivities of different types because of the very different output impedances which exist.

Choosing a microphone is as important as selecting any other component in a Hi-Fi rig, and a glance at the price range—20-odd shillings to almost as many pounds—will confirm the need for careful selection. A trial recording should be carried out, if possible, comparing the performance of two or three types.

DIRECTORY OF MICROPHONES

★ In these abridged specifications, the following abbreviations are used: O.c.s.—open circuit sensitivity. Source imp.—microphone source impedance. Rec. load imp.—recommended load impedance.

Atlec-Lancing Corp. Sole U.K. Distributors, Soundrite Ltd., 83 New Bond Street, London, W.1. Tel.: Legation 3618.

A range of professional microphones. Details on request.

★

Collaro Ltd., Ripple Works, By-Pass Road, Barking, Essex. Tel.: Rippleway 5533. Cables: Korllaro-Telex-Barking 28748.

Studio Crystal. Response 50-10,000 c.p.s. O.c.s. at 1,000 c.p.s., 1.8 mV/U.B. Source imp. 1,500 P.F. Rec. load imp. 5 megohm. 6-ft. cable. Tel. jack plug. Price £2 5s.

★

Cosmocord Limited, Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 5206. Cables: Cosmocord, Waltham Cross.

Acos Mic. 33-1 or Mic. 33-2 with Switch. Crystal. Response 30-7,000 c.p.s. O.c.s. -55 dB, ref. 1v/dyne/cm². Source imp. cap. equiv. to 0.002 mfd. Rec. load imp. not less than 4.7 megohm. 8-ft. cable. Price £2 10s. or £2 15s. with switch.

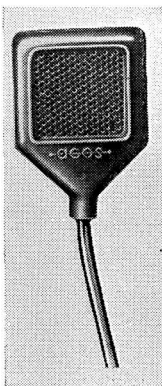
Acos Mic. 36 Crystal. Response 70-5,000 c.p.s. O.c.s. -55 dB ref. 1v/dyne/cm². Source imp. cap. equiv. to 0.002 mfd. Rec. load imp. not less than 4.7 megohm. 8-ft. cable. Table stand or adaptor for floor stand. Price £3 3s. or £3 8s. with switch.

Acos Mic. 22-1, Mic. 22-2. Crystal. Response 40-6,000 c.p.s. O.c.s. -50 dB ref. 1v/dyne/cm². Source imp. cap. equiv. to 0.002 mfd. Rec. load imp. not less than 4.7 megohm. 8-in. table stand or floor stand adaptor. Price £4 4s.

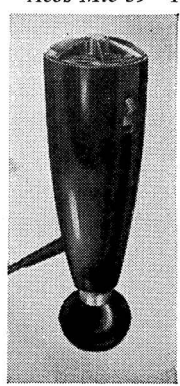
Acos Mic. 16-1 or Mic. 16-2. Crystal. Response 30-10,000 c.p.s. O.c.s. -65 dB



Acos Mic 39—1



Acos Mic 28—2



Acos Mic 36

ref. 1v/dyne/cm². Source imp. cap. equiv. 0.0015 mfd. Rec. load imp. not less than 4.7 megohm. 8-in. table stand or floor stand adaptor. Price £12 12s.

Acos Mic. 39-1. Crystal. Response 40-15,000 c.p.s. ± 6dB. O.c.s. — 60 dB, ref. 1v/dyme/cm². Source imp. equals capacity of 800 p.F. Rec. load imp. not less than 4.7 megohm. 8-ft. cable. Desk or floor stand, adaptor available. Price £5 5s.

Acos Mic. 40. Crystal. Response 40-6,000 c.p.s. O.c.s. — 50 dB, ref. 1v/dyme/cm². Source imp. equals capacity of 2,000 p.F. Rec. load imp. not less than 4.7 megohm. 8-ft. cable. Foldaway desk stand. Price £1 15s.

★

Film Industries Ltd., 90 Belsize Lane, N.W.3. Tel. : Hampstead 9632/3. Cables : Troosound, Haver.

M.7. Moving coil. Response 80-9,000 c.p.s. Source imp. 30 ohms. 6-ft. twin screened cable standard, other lengths if required. Table, desk and floor stands available. Price £6 5s.

M.8. Ribbon Response 40-14,000 c.p.s. Standard source imp. 30 ohms with inbuilt transformer. Other impedances up to 170 K/ohms available. 12-ft. twin screened cable standard, other lengths if required. Table, desk and floor stands available. Price £8 15s.

★

General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2. Tel. : Temple Bar 8000. Cables : Polyphase, London.

G.E.C. Studio Ribbon Microphone BCS2372S. Response 50-14,000 c.p.s. ± 1 dB. O.c.s. — 79 dB, 250 ohms ref.

1v/dyne/cm². Built-in trans. "captive head" terminals at rear. Price £19 19s.

BCS2249A. Floor stand suitable for above mics. **BCS2246A** table stand. **BCS2255** "Boom" studio stand.

★

Lustraphone Ltd., St. Georges Works, Regents Park Road, N.W.1. Tel. : Primrose 8844. Cables : Lustraphon, London.

LX55 Crystal. Response 30-8,000 c.p.s. High source imp. 9-ft. cable. Price £2 10s.

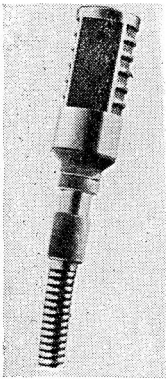
Lustrette LD/61 Series. Moving coil. Response 70-12,000 c.p.s. Source imp. low, line and high. Built-in trans. when required. 9-ft. cable. Price £3 7s. 6d.

Master C51. Moving coil. Response 50-8,000 c.p.s. Source imp. low, line and high. Built-in trans. for line and high. 3-pin moulded mic. plug. Stand as required. Price low £5 5s. ; line and high £5 15s. 6d.

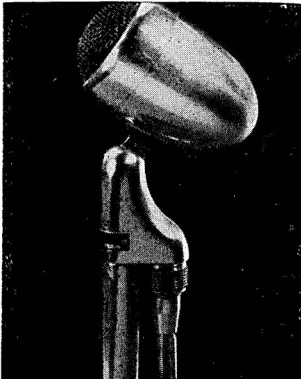
Master C48 and C48/S with Switch. Moving coil. Response 50-8,000 c.p.s. Source imp. 20 ohms. 3-pin moulded mic. plug. 6-ft. cable. Price C48 £6 6s. ; C48/S £7 7s.

Hand Pencil LFV/H59. Moving coil. Response 150-14,000 c.p.s. Source imp. low, line and high. Built-in trans. for line and high. 20-ft. cable for low and line. 9-ft. for high. Price £8 8s.

Full-Vision LFV/59. Moving coil. Response 150-14,000 c.p.s. Source imp. low, line and high. Built-in trans. for line and high. 20-ft. cable with low and line. 9-ft. with high. Stand as required. Price £8 18s. 6d.



Film Industries M8



Ronette G210



Trux G7822



RCALMI 6203C

Master VR53. Ribbon velocity. Response substantially flat to 14,000 c.p.s. Source imp. low, line and high. Built-in trans. 3-pin moulded mic. plug. 6-ft. cable. Stand as required. Price £9 19s. 6d.

Ribbonette VR/64. Ribbon. Response, substantially maintained up to 13,000 c.p.s. Source imp. low, line and high. Built-in transformer. 20-ft. cable for low and line. 9-ft. for high. Table base. Price £7 17s. 6d.

Lapel Mic. LP/62. Electro-Magnetic. Response, substantially maintained up to 6,000 c.p.s. Source imp. 30 and 1,000 ohms. 6-ft. cable. Price £3 7s. 6d.

DI 59/B.S. Moving coil. Response, substantially flat from 150-14,000 c.p.s. Source imp., low. 6-ft. cable. Price £11 11s.

★

RCA Great Britain Limited, Lincoln Way, Windmill Road, Sunbury-on-Thames, Middx. Tel. : Sunbury-on-Thames 3101. Cables : RCA, London. Telex : 28608.

Varacoustic LMI. 6203C. Ribbon. Response 60-10,000 c.p.s. Source imp. 50, 250 and 600 ohms. 30-ft., 2-conductor shielded cable. Stand as required. Price £22 10s.

LMI 6204C. Ribbon. Response 60-10,000 c.p.s. Source imp. 40,000 ohms. 30-ft., 1-conductor shielded cable. Stand as required. Price £22 10s.

Ronette, Sole U.K. Importers : Trianon-Electric Limited, 95 Cobbold Road, London, N.W.10. Tel. : Willesden 2116 and 3696.

Ronette. 19 different crystal microphones. Response according to type from 50-10,000 c.p.s. and 20-16,000 c.p.s. Source imp. 200 ohms. Rec. load imp. 5 megohms. Supplied with or without transformers. 9-ft. cable. Price range from £2 10s. to £17 2s. Desk stand DS5 £1 7s. 6d.

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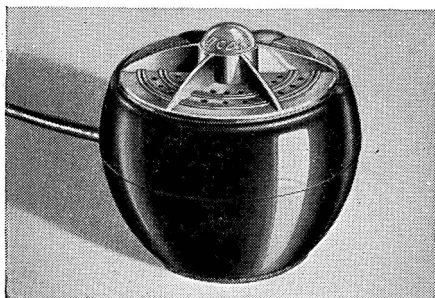
Distributed by Simon Sound Service Ltd., 48 George Street, Portman Square, W.1. Tel. : Welbeck 2371. Cables : Simsale, London.

Cadenza Ribbon. Response 50-12,000 c.p.s. O.c.s. high impedance—58 dB, low impedance—93 dB, ref. 1v/dyne/cm² or with suitable line transformer—58 dB, ref. 1v/dyne/cm². Source imp. 30 ohms and 80 K/ohms. Price £8 18s. 6d. ; with tripod desk stand and 11-ft. cable £10 10s.

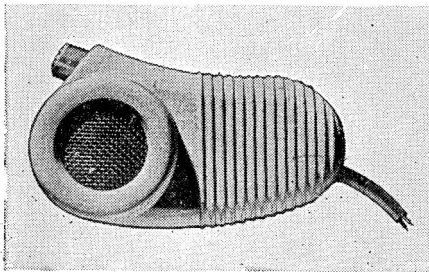
★

Tape Recorders (Electronics) Ltd., 784-8 High Road, Tottenham, London. N.7. Tel. : Tottenham 0811. Cables : Taperec, London.

Sound M1. Piezo-electric hand mic. Rec. load imp. 1-5 megohm. 8-ft. screened cable and standard jack plug. Price £2 15s.



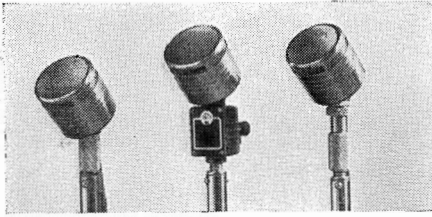
Acos Mic 33—1



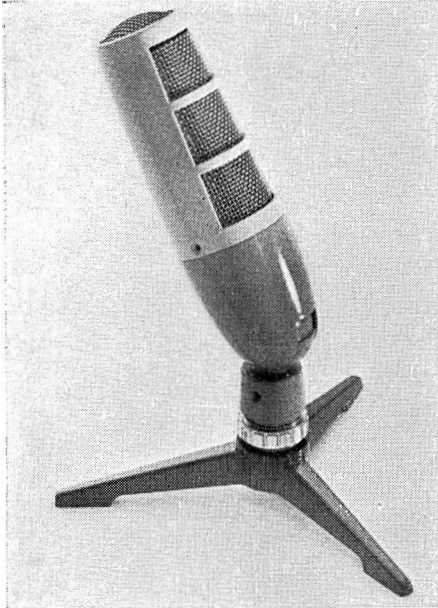
Vitavox B50



Lustraphone Ribbonette VR/64



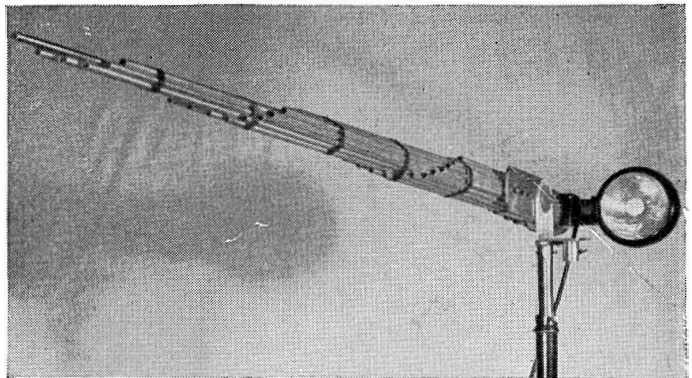
Trix G7871 Models A, B and C



The Cadenza

**S. T. & C.
"Machine-Gun"
Microphone**

This microphone was built in about 1939 and used in trials by the B.B.C. for picking up sound from distant sources out of doors. After the war, trials were continued and since then it has been used for research in architectural acoustics, particularly for locating the sources of echoes. To help in this the spotlight was mounted pointing in the direc-



Trix Electrical Company Limited, 1-5 Maple Place, London, W.1. Tel. : Museum 5817. Cables : Trixadio, Wesdo, London.

G7871. 3 models A, B, C. Moving coil. Response 50-8,000 c.p.s. Source imp. 30 ohms. G7871/A 18-ft. cable. G7871/B no cable. 2-pin plug. G7871/C 18-ft. cable. 3-pin locking type plug. Stand as required. Price A £7 10s. ; B £8 8s. ; C £9 9s.

G7822. 2 models B, C. Ribbon. Response 50-10,000 c.p.s. Source imp. 30 ohms. G7822/B 2-pin plug, no cable. G7822/C 18-ft. cable, 3-pin locking type plug. Stand as required. Price B £12 10s. ; C £11.

Various types of floor and desk stands available, also flexible stems and hand grips.

★

Vitavox Limited, Westmoreland Road, London, N.W.9. Tel. : Colindale 8671. Cables: Vitavox, Hyde, London.

B50. Moving coil. Response 60-8,000 c.p.s. O.c.s. — 85 dB ref. 1v/dyne/cm². Source imp. 25 ohms. 6-ft. cable. Price £6 10s.

B51. Crystal. Response 60-8,000 c.p.s. O.c.s. 50 dB. Source imp. 1 megohm. 6-ft. cable. Price £5 10s.

B52. Moving coil. Response 60-8,000 c.p.s. O.c.s. 85 dB ref. 1v/dyne/cm². source imp. 600/100,000 ohms. Built-in transformer. 6-ft. cable. Price £7 10s.

Type A. Moving coil. Response 60-8,000 c.p.s. O.c.s. — 82 dB ref. 1v/dyne/cm². Source imp. 25 ohms. Rec. load imp. 25 ohms. Desk, table or pedestal stands available. Price £9 9s.

tion of maximum pick-up. The direction of maximum echo amplitude was then found by trial and the spotlight illuminated the surface from which the echo was being reflected.

TAPE RECORDERS

By J. C. Latham

THE following Tape Recorder Directory has been divided into two sections. First, professional and semi-professional machines and then tape recorders intended for general domestic use. The distinction is mainly a question of quality although some professional recorders may be somewhat restricted in quality because they are designed to be portable.

Space is Important

There are several very good reasons why a portable tape recorder should give worse results than a more generously sized equipment. It is obviously impossible to obtain the best sound quality from a small loudspeaker, particularly when this loudspeaker is mounted in a box which is already packed full. It is equally unreasonable to expect a large and heavy output stage to be provided. Every domestic recorder should, however, be provided with a socket from which a signal can be obtained to feed external equipment capable of giving really high quality. The remaining limitation on the quality to be obtained from portable recorders is probably the difficulty of obtaining really low background hum, because the pre-amplifier is bound to be mounted rather close to the motors. Such tape recorders may also have inferior mechanical drive for the tape since it is inconvenient to have a very free mounting when the apparatus is liable to be carried on its side and suffer considerable bumping about.

Portability Brings Limitations

For these reasons professional equipment is designed to be portable only when absolutely necessary, whereas domestic tape recorders are nearly always portable. Within these limitations the buyer of the domestic tape recorder will be able to enjoy about as much quality as he cares to pay for. One of the main directions in which economy is likely to be noticeable will be in the quality of the tape drive mechanism. The falling

off in performance often noticed at lower tape speeds is far more often caused by flutter than by any restriction on the frequency response. Many radio sets sound quite acceptable without the band-width exceeding 5 K/cs.

Improvements in Tape Heads

Domestic equipment must obviously be manufactured to sell at an attractive price and even where the remedy for defects is well known it may be necessary to wait for new manufacturing techniques before improvements can be made. More satisfactory playback heads are now becoming available which are making it possible to obtain a wide frequency response at lower tape speeds. The resulting economy of tape is of great value to the domestic user, and even the master tapes for discs are now made at 15 in. a second instead of 30 in. There seems little justification for using a tape speed higher than $7\frac{1}{2}$ in. a second for home use, and modern designs of tape deck are unlikely to provide it. In this connection continental manufacturers are leading the way in designing for lower speeds. The use of thinner tape is also a valuable way of increasing the playing time and it will probably not be long before "double play" tape is more generally available. 2,400 ft. of this can be wound on the standard 7-in. reel. Improvements are also being made in the surface finish of the heads, and in the methods of keeping the tape in contact with them. Bad contact between the tape and the head can cause considerable low frequency noise.

Mechanical Requirements

Apart from any electrical considerations, the ease with which the mechanical handling of the tape can be carried out is of the greatest importance. Many excellent decks are marred by inefficient brakes or lethargic re-winding. Some decks also emit unreasonable noises when operating the controls, which are apt to disturb the performers

when making a recording. The use of counters on many new tape recorders has gone a long way towards meeting the difficulty of finding one's place on a reel of tape. Push buttons are also becoming deservedly popular as a means of making the operating easier.

Stereo and Tape

The mounting enthusiasm for Stereo reproduction is likely to increase the interest in tape recorders. It is only with some difficulty that the quality obtainable from modern lp discs can be reached by the average tape recorder; whereas equipment necessary for playing the forthcoming stereo discs is going to be at least as expensive and complicated as that necessary for playing stereo tapes. In addition, tape stereo is likely to show a big advantage over discs, since the tape is not going to wear out at anything like the same rate. Stacked heads, which are now almost universally employed in preference to staggered heads, can usually be fitted to existing tape recorders in place of the present head. Those intending to experiment with stereo recording will also have to provide a full track erase head or make use of a bulk eraser.

Specifications

A quick examination of the specifications to be found in this Directory is likely to show that better performance is often claimed for domestic equipment than for professional equipment costing many times the price. Professional manufacturers are likely to be conservative with their figures, since for one thing their sales do not rely so much upon advertising, and, for another, optimistic figures would very soon be found out. Lack of complete information can also give a misleading impression. The figures for frequency response, for example, need to be qualified by information on how many dBs variation are tolerated.

Frequency Response

There are many technical reasons why it is difficult to obtain a really flat high frequency response from a tape recorder. Variations can be expected as a result of using different varieties of tape, of changes in mains voltage and of wear on the heads. It is also important that the azimuth alignment of the heads is correct since although errors will not matter when playing back one's own recordings, they will cause considerable losses in other people's recordings or when playing pre-recorded tapes. The easiest way of checking this point is to make use of the test

tapes which are provided by both "Scotch Boy" and E.M.I.

It is unfortunately far more difficult to make accurate measurements of flutter than it is to hear it on a recording. Figures quoted should always be treated with reserve until an opportunity occurs to listen to results. The best material for this test is probably piano music; it is almost impossible to judge on speech.

Professional Essentials

The specifications for professional equipment usually reveal slightly different facilities, considerably more use being made, for example, of 600 ohm low impedance lines. Reference levels are often quoted in dBm which are dB relative to a milliwatt. This is about 0.7 volts in 600 ohms. Rigid specifications govern the rise time and over-shoot of meters which are often provided as a level indicator. They may be described as a VU (volume unit) meter or as a PPM (peak programme meter). Low impedance lines are also used with microphones since they enable much longer lengths of cable to be used without high frequency losses. As a further aid to reducing pick-up these are usually centre-tapped. The basic impedance of most high quality microphones is only a few ohms, which is increased by a suitable built-in transformer. Further transformers are used in the tape deck to match the line into the first grid.

Precision-made Reels

Professionals also use larger reels for the tape, which are accurately machined to avoid the wobble common when using plastic reels, and which are open on one side. Such reels require fairly tight rewinding of the tape. In order to improve the signal-to-noise ratio, full track heads are normally used, since twice as much output can be obtained without a corresponding increase in background level. It may be worth noting that many professional decks can be mounted vertically which is not so often the case for those used in domestic apparatus.

Recorders for Disc Cutting

Highly specialised machines which include provision for variable groove spacing are used to play back the master tapes when cutting discs. An additional playback head is provided, some 3 ft. along the tape in front of the normal head. This distance corresponds to about one revolution of a long playing record. The average signal level from this first head is used to determine in advance what the groove spacing will be.

Choosing a Domestic Tape Recorder

For the benefit of those who are choosing a tape recorder, some advice may be helpful on sorting out the bewildering variety of claims made by the manufacturers, and some guidance valuable on what other features to look for.

The object of the tape deck itself is to move the tape at an even speed past the heads. It is unwound from one reel and wound up on the other. It is usual on half track machines to turn the reels over at the end in order to play the tape back the other way. Some machines, however, merely reverse the direction of the tape, another pair of heads being brought into play. Specifications can include figures for flutter as a percentage of the variation in the speed of the tape past the heads. Although details are rarely quoted, attention should be paid to the rate of fast winding, and to the efficiency of the brakes. Are the reels suitably held, for instance, so that the tape will not spill when carrying the recorder? The standard tape reel is 7 in. in diameter and holds 1,200 ft. of normal thickness tape which will play for half an hour a side at $7\frac{1}{2}$ in. a second. Extra playing time can be obtained by using thinner tape or lower tape speeds.

Important Features

Manufacturers will usually quote figures for background level, this will be mainly hum, which results from the considerable bass boost required on playback. The design of the tape deck itself usually sets the limit since the hum is picked up in the playback head from motors and mains transformers. A satisfactory deck should have well screened heads having substantial *mu*metal cans, and be provided with motors which do not have large external fields. The hum from mains transformers is particularly objectionable since it consists of harmonics which are much more easily reproduced in a loudspeaker than the fundamental 50 c/s. Since pre-recorded tapes are made at $7\frac{1}{2}$ in. a second it is convenient for this speed to be available on the deck chosen.

Frequency Response

Continuing now with the electrical side, the most important figures are the frequency response obtainable at any particular tape speed, and the amount of variation at the limits. The upper frequency limit will bear a direct relationship to the speed of the tape, halving the speed will halve the response. A figure of 3 dB down at 12 Kc/s with a tape speed of $7\frac{1}{2}$ in. a second can be considered reasonably good. A low frequency limit of

about 40 c/s is usual at any tape speed. It is wise to find out what variety of tape is recommended, and to keep to it, since the difference in quality between the various brands is small provided they are used with amplifiers which have been designed for them. Reasonable quality will only be obtained when AC biasing and erasing are used. This will normally be the case except on some miniature battery recorders. The bias frequencies will probably be quoted, and can be between 40 and 100 Kc/s.

Separate Heads are Best

It is helpful if separate heads are provided for record and playback, since it is better to be able to monitor the recording by playback from the tape itself rather than by listening to the incoming signal. There is little to choose between a good tuning eye and the simple meter circuits offered. Both methods will give satisfactory results provided it is realised that the transient response is poor, and that allowance must be made for different types of programme material. Piano music, for example, should be recorded at a modest level since it contains considerable peaks.

Looking After the Machine

Tape recorders will repay a little care and attention. The moving parts, particularly those associated with the drive mechanism, should be oiled sparingly. Where rubber idler wheels form part of the design, these should be examined carefully for irregularities on the edges. Most tape recorder designs ensure that these idler wheels do not remain in contact when the deck has been switched off. It is possible for them to do so however, if the mains are disconnected while the controls are still set in the operating position. Damaged idler wheels can usually be replaced without undue expense. Some means of adjustment is often provided for the mechanical brakes and these should be attended to. It is worth while taking special care to obtain even braking on both reels when thinner tapes are going to be used. All screws should be checked for tightness because repeated stopping and starting or much transporting of the deck can often shake them loose.

The main deterioration can be expected as a result of wear on the heads. Some makes of tape are noticeably smoother on the coated side, while others are reputed to contain a certain amount of lubricant. Use of such tapes will help to reduce wear. The pressure pads should be checked also to make sure that they are not causing unnecessary wear by pressing too strongly on the back of the tape.

Tape-Tape Head Contact

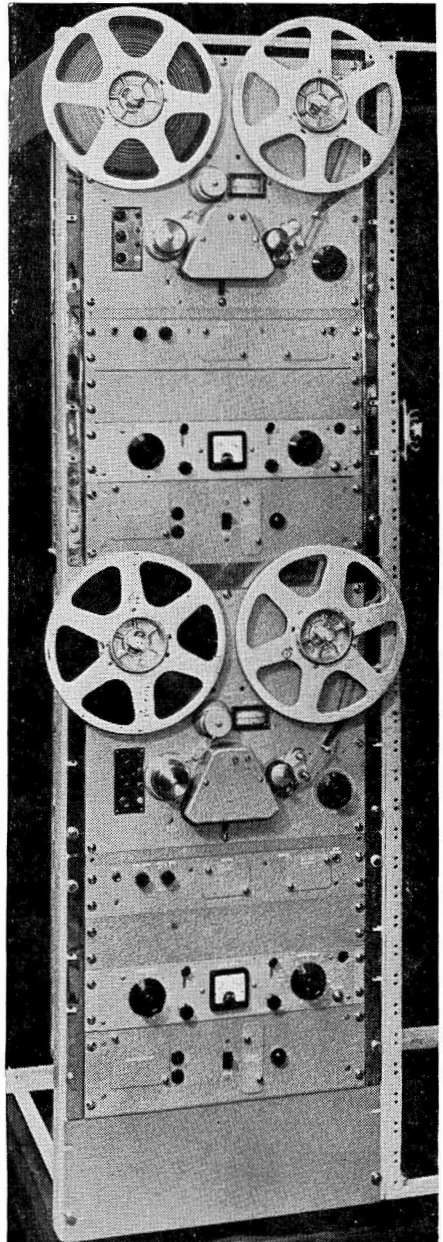
The initial polishing of the head face will result in rather better contact between the surfaces, which will improve the high frequency response. Performance will deteriorate, however, if the pole pieces are worn unduly thin, or if ridges are worn in the head face because of misalignment between the head and the tape. Examination of the head after the first few weeks of use will easily show whether the tape is making satisfactory contact. The polished surface should be symmetrical about the gap without showing more wear at the top or the bottom. Slight rotation of the heads or adjustment of the pressure pads or tape guides will improve matters before damage caused by misalignment has gone too far. It is helpful, when checking vertical alignment, to scrape the coating from a portion in the middle of a reasonable length of tape, so that a check can be made on both erase and record playback heads on half track machines by looking through the tape when it is threaded up in its normal position. A slightly thicker stack of laminations will be provided on the erase head so that it can erase a full half of the tape width.

Playback Heads

The record playback head should cover a narrower strip, which neither reaches the very edge of the tape nor the centre line. Attention to the heads should include alignment for azimuth, which is done by adjusting for maximum high frequency output on a test tape followed finally by a careful cleaning of the surface with methylated spirits. Other solvents should be used with caution since they may dissolve the plastic moulding on top of the deck.

Professional Gear for the Home

From all the above it will be clear that a very wide gap exists between the small portable tape recorder and the big studio model. However, it should not be thought, from this apparent hurdle, that the really top grade recorder is beyond the reach of the home user, for it is not. In the following Directory sections there are professional quality tape decks which can be purchased by the serious experimenter; and there is nothing to stop such an enthusiast from adding his own electronic system, and this can be produced, with care, to rival the best that has ever been made.



Above, is an example of a rack-mounted recorder for professional use. The two "deck units" are EMI TR90s. Above and below them are amplifier, power, meter and monitor units. The TR90 is now in production for twin-channel work. It is available in console form, or in portable units, or rack mounted, as in the illustration

DIRECTORY OF TAPE RECORDERS

★ The decks and recorders illustrated are a representative selection of those available for professional, semi-professional, and domestic use. The abbreviations used for the specifications in this directory are as follows: Fr—frequency response; i.p.s.—inches per second; P.s.n.—Power supply needed. ■ — Stereo equipment

PART I — PROFESSIONAL

Bradmatic Ltd., Station Road, Aston, Birmingham 6. Tel.: East 2881-2. Cables: Bradmatic, Birmingham.

Bradmaster. Models 5B, 5CS, 5CD, 5D Semi-prof. tape deck. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. 3 motors. Model 5B 7-in. spools; 5CS and 5CL $9\frac{3}{8}$ -in. spools; 5D $10\frac{1}{2}$ -in. N.A.B. spools. Fr.: $7\frac{1}{2}$ i.p.s., 40-15,000 c.p.s.; $3\frac{3}{4}$ i.p.s.; 40-7,500 c.p.s., both ± 4 dB (dependent on amp. used). Size and weight dependent on model. Price 5B £42; 5CS £45 10s.; 5CL £47 10s.; 5D £50.

Bradmatic Console. Models 25, 35, 45. Semi-prof. recorders less output stage. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. 3 motors. $10\frac{1}{2}$ -in. N.A.B. spools. Fr.: $7\frac{1}{2}$ i.p.s., 40-15,000 c.p.s.; $3\frac{3}{4}$ i.p.s., 40-7,500 c.p.s., both ± 4 dB. V.U. level meter. Size, 35 in. by 27 in. by 25 in. P.s.n. 230v 50 c.p.s. or 110v 60 c.p.s. Price Model 25 (fitted with type 10/7A amp) £173; Model 35 (fitted with type 10/7AM amp) £175; Model 45 (fitted with type W/7 AS amp) £190.

■ **Bradmatic Console Model 45.** Deck and pre-amp. Model 5D tape deck. 3 motors. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. $10\frac{1}{2}$ -in. spools. Response 40-15,000 c.p.s. ± 4 dB. Size 35 in. by 27 in. by 25 in. P.s.n. 110v, 60 c.p.s. or 230v, 50 c.p.s. Price £190.

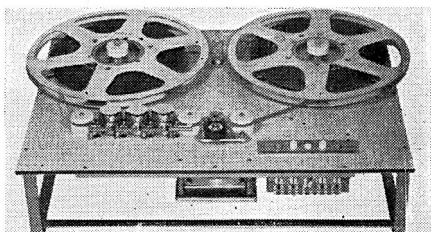
All the above models are available with full track or stereophonic heads to special order. Prices on application.

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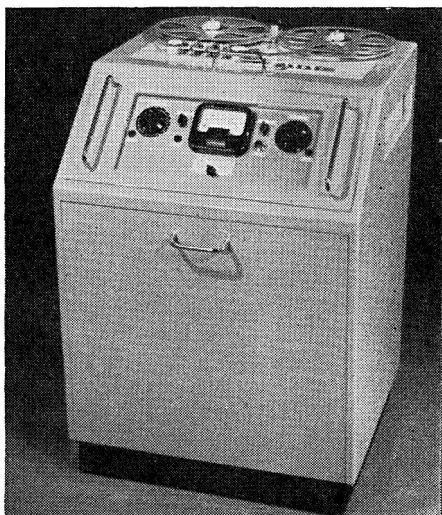
EMI Sales & Service Ltd., Blyth Road, Hayes, Middx. Tel.: Southall 2468. Cables: Emiservice, London. Telex, Emiglobe 2-2417.

H.M.V. Model 3031. G.P. tape playing deck with 2-stage pre-amp and equaliser. $7\frac{1}{2}$ i.p.s. 1 motor. 7-in. spool. Fr.: to C.C.I.R. spec., 40-10,000 c.p.s. ± 3 dB. Size $12\frac{1}{2}$ in. by $17\frac{1}{2}$ in. by $14\frac{1}{2}$ in. Weight 37 lb. P.s.n. 195-255v 50 c.p.s.

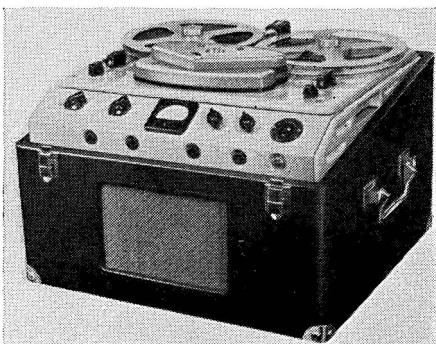
Model 3032. Similar to 3031 but mounted in a console cabinet. Size 35 in. by $20\frac{1}{2}$ in. by 16 in. Weight 60 lb. (approx.).



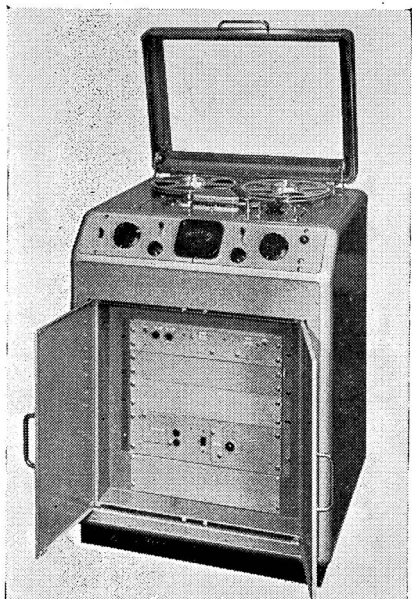
Bradmatic Model 5D deck



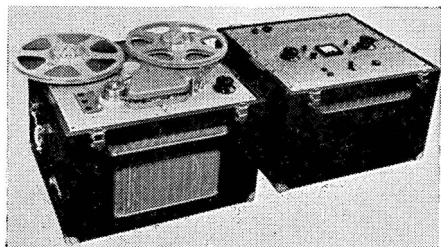
Bradmatic Console



EMI TR51 recorder



EMI TR90 In console form (above)
 Transportable (below)



EMI L/2 battery driven portable

Model 3033. Complete G.P. tape reproducer, including amp. and loudspeaker system, using 3031 deck. Size 35 in. by 28 in. by 16½ in. Weight 135 lb. (approx.).

E.M.I. Model L/2. Prof. battery operated portable magnetic recorder. 2 types: L/2A 3¾ i.p.s.; L/2B 7½ i.p.s. 1 motor. 5-in. spools. F.r.: 7½ i.p.s., 50-7,000 c.p.s.; 3¾ i.p.s., 50-3,000 c.p.s. Level meter. Size 14 in. by 8 in. by 7 in. Weight with batteries 14½ lb. P.s.n. 10 U2 or 2LP type 1.5v cells, and two B101 type 67.5v H.T. batteries. Price £102 18s.

E.M.I. Model TR51. Prof. transportable recorder. Four types: A, 15 and 7½ i.p.s. full track; C, 15 and 7½ i.p.s. half track; B, 7½ and 3¾ i.p.s. full track; D, 7½ and 3¾ i.p.s. half track. 1 motor 8¼-in. or 7-in. spools. F.r.: 15 i.p.s., 50-15,000 c.p.s.; 7½ i.p.s., 50-10,000 c.p.s.; 3¾ i.p.s., 50-6,000 c.p.s. V.U. level meter. Size 13½ in. by 18 in. by 17 in. Weight 59 lb. Price £175.

TR90. Prof. recorder for rack mounting or as a console or transportable. 30 and 15 i.p.s. or 15 and 7½ or 7½ and 3¾ i.p.s. 4 motors. 10½-in. spools. F.r.: 15 i.p.s., 50-15,000 c.p.s.; 7½ i.p.s., 50-10,000 c.p.s.; 3¾ i.p.s. 50-6,000 c.p.s. all ± 2 dB. V.U. meter level ind. or peak programme meter. Size (transportable version) 2 cases 14½ in. by 20 in. by 16½ in. Weight 80 and 58 lb.

■ **H.M.V. "Stereosonic" Tape Deck.** Pre-amp. and control unit. Model 3035. 1 motor. 7½ i.p.s. Input for single channel tape records, discs, and 2 aux. inputs. 7-in. spools. C.C.I.R. spec. Response 40-10,000 c.p.s. ± 3 dB. Deck size 17 in. by 11½ in. by 13½ in. Control unit 16 in. by 4 in. by 4 in. Bass, treble and vol. controls give combined control on both amp circuits. P.s.n. 195-255v, 50 c.p.s.

■ **H.M.V. "Stereosonic" Reproducer.** Model 3034. Complete reproducer in 2 cabinets, including 2 amps and loudspeaker system using 3035 deck. Size 35½ in. by 27½ in. by 19½ in. Weight: first cabinet with tape deck 140 lb.; second 120 lb.

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Leavers-Rich Equipment Ltd., 78b Hampstead Road, London, N.W.1. Tel.: Euston 1481. Cables: Leemag, London.

Model E. No. ER141K. Prof. reproducer console. 15 and 7½ i.p.s. 3 motors. 11½-in. spools. F.r.: 15 i.p.s., 50-15,000 c.p.s.; 7½ i.p.s., 50-10,000 c.p.s., both ± 2 dB on

C.C.I.R. test tape. Size 30 in. by 22 in. by 36½ in. Weight 162 lb. Price £450.

Model E. No. E141R. Complete rack mounting prof. recorder. 15 and 7½ i.p.s. 3 motors. 11½-in. spools. F.r. : 15 i.p.s., 50-15,000 c.p.s. ; 7½ i.p.s., 50-10,000 c.p.s., both ± 2 dB. V.U. level meter. Size 19 in. by 17½ in. by 9 in. Weight 50 lb. Price £375.

Model E. No. E121P. Prof. portable recorder. Spec. as for E141R. In two cases, 20 in. by 17 in. by 11½ in. and 15 in. by 18 in. by 10 in. Weight 79 lb. Price £510.

Model E. No. E141K. Prof. network recorder console. Spec. as for E141R. Size 30 in. by 22 in. by 36½ in. Weight 185 lb. (approx.). Price £450.

Model C. No. C621P. Prof. portable recorder. 15 i.p.s. 3 motors. 9½-in. spools. F.r. : 50-15,000 c.p.s. ± 2 dB. V.U. level meter. Size 13 in. by 18 in. by 10 in. Weight 73 lb. P.s.n. 12v battery or auxiliary mains unit. Price £425.

Model DB. No. DB221P. Prof. portable recorder. Spec. as for C621P but in two cases 13 in. by 18 in. by 10 in. and 16 in. by 20 in. by 11½ in. Total weight 74 lb. P.s.n. as C621P. Price £480.

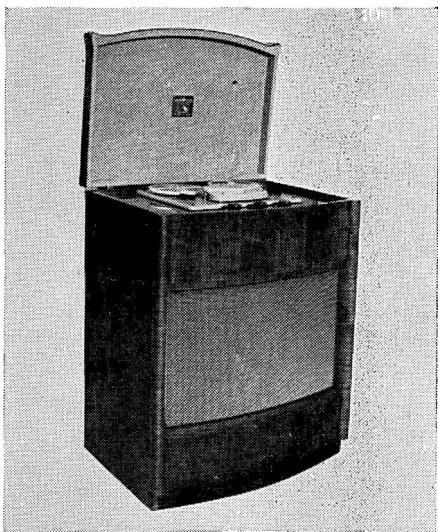
Model CS. No. CS621P. Syncropulse recorder, for magnetic recording in sync. with cameras, etc. Spec. as for C621P. In two cases both 13 in. by 18 in. by 10 in. Total weight 73 lb. P.s.n. as C621P. Price £525.

■ **Model E. No. ED 142P.** Complete portable dual channel recorder. 3 motors. 15 and 7½ i.p.s. Monitoring off tape, separate V.U. meter, unit amp. L.R. and H.R. mic. or line inputs. 11½-in. spools. Response at 15 i.p.s., 50-15,000 c.p.s. ± 2 dB. Size 2 cases 16 in. by 20 in. by 11 in. Total weight 80 lb. Price £575.

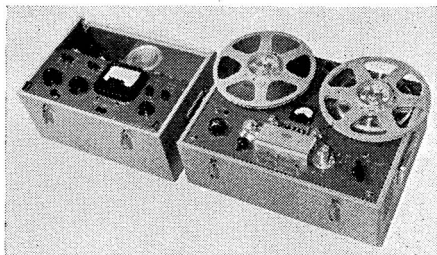
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Multimusic Ltd., Reflectograph Division, Maylands Avenue, Hemel Hempstead, Herts. Tel.: Boxmoor 3636. Cables : Multimusic, Hemel Hempstead.

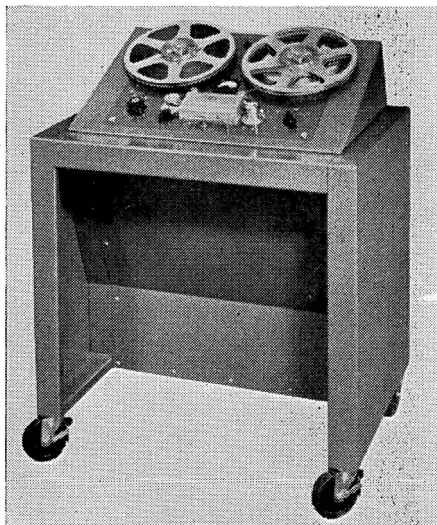
“400.” Prof. tape deck, record amp. and pre-amp. (3 units) continuously variable speeds from 3½ to 8 i.p.s. 3 motors. 8¼-in. spools. F.r. : 7½ i.p.s., 50-10,000 c.p.s. ± 2 dB ; 45-12,000 c.p.s. ± 3 dB. Meter level ind. Neon lit. stroboscope. Separate record and replay amps. Size : deck, 17¼ in. by 13¾ in. by 7½ in. ; amps., 13¼ in. by 6½ in.



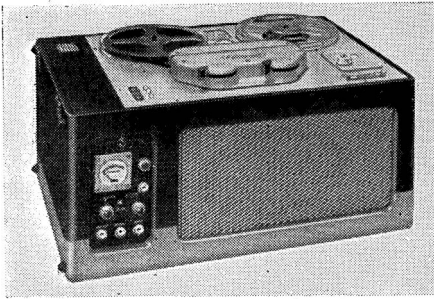
EMI Model 3033 console player



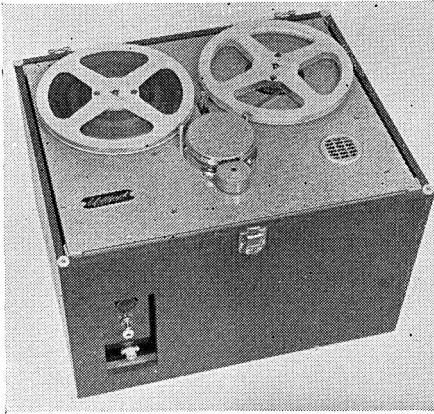
Leavers-Rich Series E No. E121P



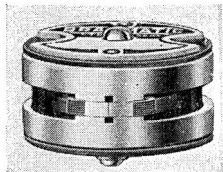
Leavers-Rich Series E No. E141K



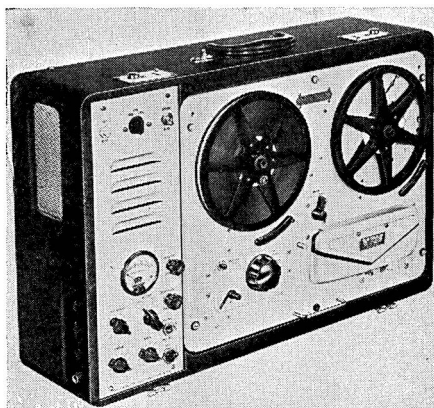
Reflectograph 500



Reflectograph continuous player 81/70/75



Bradmatic sound head without fixing stem



Vortexion W.V.A. semi-professional portable

by $3\frac{1}{2}$ in. ; power pack, 11 in. by 5 in. by 5 in. Price £88 4s.

“500.” Complete prof. recorder. Spec. as for model 400, but incorporating output stage and loudspeaker in portable case 21 in. by $14\frac{1}{2}$ in. by $10\frac{1}{4}$ in. Weight 50 lb. Price £98 14s.

81/10/25. Complete recorder and continuous player. $3\frac{3}{4}$ i.p.s. 3 motors. $8\frac{1}{4}$ -in. spools. F.r. : 40-7,000 c.p.s. ± 2 dB. Meter level ind. Size $18\frac{1}{2}$ in. by 16 in. by $11\frac{3}{4}$ in. Weight 54 lb. Price on application.

81/70/75. Continuous player, spec. as for 81/20/25. Price on application.

“90.” Continuous player for rack mounting. $3\frac{3}{4}$ or $7\frac{1}{2}$ i.p.s. One motor. 14-in. spools. F.r. : $3\frac{3}{4}$ i.p.s., 40-7,500 c.p.s. ± 2 dB ; $7\frac{1}{2}$ i.p.s., 50-10,000 c.p.s. ± 2 dB. Price on application.

■“550.” Complete reproducer. 3 motors. $3\frac{1}{2}$ to 8 i.p.s. continuously variable. Facilities, record monaural $\frac{1}{2}$ track, replay monaural or stereo tape, input sockets for replay of monaural or stereo discs, and monaural or stereo radio. Output socket for monaural or stereo amps. $8\frac{1}{4}$ -in. spools. F.r. : 50-10,000 c.p.s. ± 2 dB ; 45-12,000 c.p.s. ± 3 dB. Price on application.

■“440.” Conversion unit, comprises stereo head, playback pre-amp and power pack to convert model 400 for stereo reproduction of tape & discs. Price on application.

■“540.” Conversion unit comprises stereo head, playback amplifier and power pack to convert model 500 for stereo reproduction of tape and discs. Price on application.

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Stancil-Hoffman Corp. Sole U.K. Distributors, **Soundrite Ltd.**, 83 New Bond Street, London, W.1. Tel. : Legion 3618.

A range of multiple channel communication recorders. Details on request.

★

Vortexion Limited, 257/263 The Broadway, Wimbledon, London, S.W.19. Tel. : Liberty 6242. Cables : Vortexion, Wemble, London.

Model W.V.A. Semi-pro. complete recorder. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. or 15 and $7\frac{1}{2}$ i.p.s. 3 motors. $8\frac{1}{4}$ -in. spools. F.r. : $7\frac{1}{2}$ i.p.s., 40-12,000 c.p.s. ± 3 dB. Level meter. Weight 48 lb. (approx.). Price £93 13s. (£5 extra for 15 i.p.s.).

Model WVB. Prof. recorder, extra monitor head amp. Spec. as for model WVA. Price £110 3s. (£5 extra for 15 i.p.s.).

PART 2

GENERAL PURPOSE AND DOMESTIC RECORDERS

Beam-Echo Ltd., Witham, Essex. Tel. :
Witham 3184. Cables : Beamec, Witham.

Avantic Mk. III Player. G.P. $7\frac{1}{2}$ i.p.s. One motor. 7-in. spools. Fully compensated to C.C.I.R. standards by means of built-in pre-amp. Output (variable) 500 mV max. F.r. : 30-12,500 c.p.s. ± 3 dB. P.s.n., motor 115 or 230v A.C. ; pre-amp 300v at 5 mA, 6.3v at 0.4 amps. Price £40.

■ **Avantic Mk. III.** Deck and preamps. 1 motor. $7\frac{1}{2}$ i.p.s. Inputs for stereophonic and $\frac{1}{2}$ track recordings. 7-in. spools. Built-in preamp fully compensated to C.C.I.R. spec. Output (variable) 500 mV max. Response 30-12,500 c.p.s. ± 3 dB. Panel size 16 in. by $10\frac{1}{8}$ in. Total depth $3\frac{3}{4}$ in. Weight $12\frac{1}{4}$ lb. P.s.n. motor 115 or 230v A.C. Preamp 300v at 10 mA, 6.3v at 0.8 amp. Price to be announced.

★

Brenell Engineering Co. Ltd., 1a Doughty Street, London, W.C.1. Tel. : Holborn 7358/Chancery 5809.

In preparation

Brenell MK V. G.P. tape deck. 15, $7\frac{1}{2}$, $3\frac{1}{2}$ and $1\frac{7}{8}$ i.p.s. 3 motors, $8\frac{1}{4}$ -in. spools. Size 15 in. by $11\frac{1}{2}$ in. Weight approx. 16 lb. Price not yet fixed.

Brenell "3 Star." G.P. recorder. $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i.p.s. One motor. 7-in. spools. Magic eye level ind. Price and size not yet fixed.

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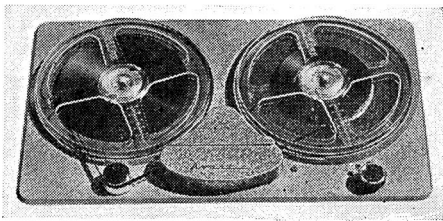
Collaro Ltd., Ripple Works, By-Pass Road, Barking, Essex. Tel. : Rippleway 5533. Cables : Korlarro-Telex-Barking.

Collaro Mk. IV. Prof. and G.P. tape deck. 15, $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. 2 motors. 7-in. spools. F.r. : up to 12,000 c.p.s. at $7\frac{1}{2}$ i.p.s. ± 3 dB with record/playback equalisation. Size 13 in. by $11\frac{3}{8}$ in. by $5\frac{9}{16}$ in. Weight $16\frac{1}{2}$ lb. P.s.n. all main voltages supplied. Price £25.

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Dulci Co. Ltd., 97/99 Villiers Road, London, N.W.2. Tel. : Willesden 6678/9.

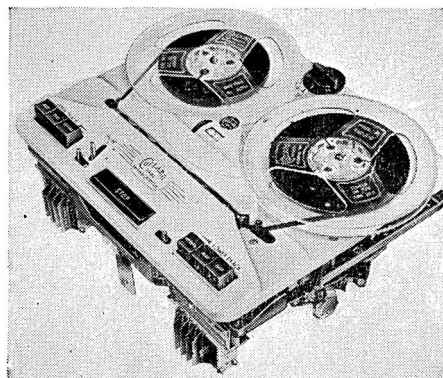
Dulci-Harting. G.P. tape deck and pre-amp. Harting deck. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. motor. 7-in. spools. F.r. : $7\frac{1}{2}$ i.p.s., 30-15,000 c.p.s. ± 2 dB ; $3\frac{3}{4}$ i.p.s., 30-10,000 c.p.s. ± 3 dB. Size 16 in. by 13 in. Price £57 15s.



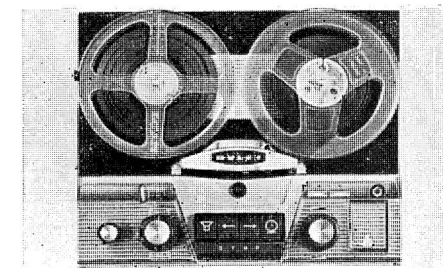
Beam-Echo "Avantic" Mk.3 deck



Brenell "3 Star"



Collaro Mk. IV tape deck



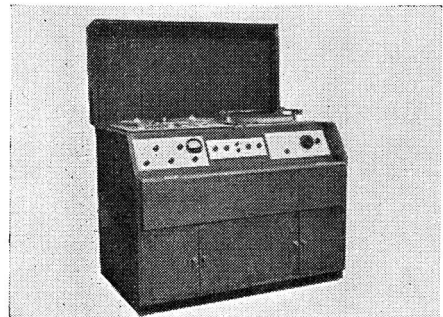
Dulci-Harting deck and pre-amp.



Elizabethan Essex



Elon J.C. 20



Expert Everest

E.A.P. (Tape Recorders) Ltd., Bridge Close, Old Church Road, Romford, Essex. Tel.: Romford 62366-7.

Elizabethan Essex. G.P. portable recorder. Collaro tape deck. Fr.: 15 i.p.s., 50-16,000 c.p.s.; 7½ i.p.s., 50-12,000 c.p.s.; 3¾ i.p.s., 50-7,000 c.p.s. Magic eye level ind. Size 19½ in. by 15 in. by 10 in. Weight 45 lb. Price, with Cadenza ribbon mic. and 1,800 ft. of tape, £78 15s.

In preparation

Elizabethan Consolette. Spec. as for the Essex but fitted in a veneered cabinet with

12-in. detachable legs. Storage space for microphone, tapes or F.M. tuner. Size 21 in. by 15½ in. by 10½ in. Weight 50 lb. Price, with Cadenza ribbon mic. and 1,800 ft. of tape, approx. £83.

Elizabethan Altone. G.P. recorder. 3 speeds. 3 motors. 7-in. spools. Fr.: 7½ i.p.s., 50-10,000 c.p.s.; 3¾ i.p.s., 50-7,000 c.p.s.; 1¾ i.p.s., 50-4,000 c.p.s. Magic eye level ind. Size approx. 15½ in. by 13½ in. by 6 in. Weight 35 lb. Price approx. £62.



Elon Tape Development Co. Ltd., 377 Milkwood Road, Herne Hill, London, S.E.24. Tel.: Brixton 3417.

Elon J.C. 20. G.P. recorder. Collaro tape deck. Fr.: 15 i.p.s., 40-16,000 c.p.s.; 7½ i.p.s., 50-10,000 c.p.s.; 3¾ i.p.s., 50-7,000 c.p.s.; all ± 3 dB. Magic eye level ind. Size 16½ in. by 16 in. by 9¾ in. Weight 43 lb. Price £65 2s.



Expert Gramophones Ltd., 39-41 New Oxford Street, London, W.C.1 Tel.: Covent Garden 2156.

Everest. Complete semi-pro. recorder. 7½ and 3¾ i.p.s. 3 motors, 1 fan. 10½-in. spool. Fr.: 7½ i.p.s., 30-16,000 c.p.s.; 3¾ i.p.s., 30-9,000 c.p.s., both ± 2 dB. Meter level ind. Price £329 16s. 6d.



British Ferrograph Recorder Co. Ltd., 131 Sloane Street, S.W.1. Tel.: Sloane 1510. Cables: Britferro, Knights.

Ferrograph 3 A/N and 3 A/H. Complete semi-pro. recorders. Any two adjacent speeds from 1¾ to 15 i.p.s. 3 motors. 8¼-in. spools. Fr.: 15 i.p.s., 40-15,000 c.p.s. ± 2 dB; 7½ i.p.s., 40-12,000 c.p.s. ± 3 dB, 50-10,000 c.p.s. ± 2 dB; 3¾ i.p.s., 50-6,000 c.p.s. ± 3 dB. Sustained peak-signal level meter. Size 18½ in. by 17½ in. by 9¾ in. Weight 49¾ lb. P.s.n. 100/130v or 200/250v A.C. Price 3 A/N (7½ and 3¾ i.p.s.) £82 19s.; 3 A/NH (15 and 7½ i.p.s.) £90 6s.

Models 66N and 66H. Complete semi-pro recorders for console mounting. Spec. as for 2 A/N and 2 A/H. Size 17½ in. by 17½ in. by 9 in. Weight 45 lb. Price 66N (7½ and 3¾ i.p.s.) £88 4s.; 66H (15 and 7½ i.p.s.) £92 8s.

■ **Ferrograph, Stereo "77."** Complete reproducer. 3 motors. 7½ and 3¾ i.p.s. Facilities: ½-track monaural record and monitoring, playback and stereo playback, all usual inputs. 8¼-in. spools. Response at

7½ i.p.s. 50-10,000 c.p.s. ± 2 dB ; ± 3 dB at 12,000 c.p.s. Size 18½ in. by 17½ in. by 9¾ in. Weight 50 lb. (approx.). P.s.n. 100/130v or 200/250v A.C. Price £102 18s.

Ferrograph Stereo "88." A complete 2-channel recorder/reproducer. Portable. For tape speeds of 7½ and 15 i.p.s. Switched input meter enables levels of both channels to be balanced. Output of each channel on playback approx. 2 millivolts across 600 ohms. Can also be used for monaural record/replay. Price £110 5s.

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The General Electric Co. Ltd., Magnet House Kingsway, London, W.C.2. Tel. : Temple Bar 8000. Cables : Polyphase, London.

Stereophonic Equipment. A complete stereophonic set-up incorporating two G.E.C. octagonal loaded-port speaker cabinets each containing a G.E.C. metal-cone drive unit and presence unit. In a separate console, two G.E.C. BCS2417/2418 amplifiers and control units and a Truvox TR2113 tape deck. Inputs for tuner and pickup. Price BCS1415 stereophonic amplifier console £163 15s. ; BCS1866 stereophonic speaker assy. complete £27 5s. 10d. (U.K. purchase tax £10 10s. 2d.).

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Grundig (Gt. Britain) Ltd., 6 Government Buildings, Kidbrooke Park Road, London, S.E.3. Tel. : Lee Green 8541. Showroom : 39-41 New Oxford Street, W.C.1. Cables : Grundig, London. Telex : 22054.

Reporter TK5. G.P. portable recorder. 3¾ i.p.s. 1 motor. 5½-in. spools. F.r. : 50-9,000 c.p.s. ± 3 dB. Magic eye level ind. Size 12½ in. by 14¾ in. by 8 in. Weight 23½ lb. Price £55 13s. (inc. mic.).

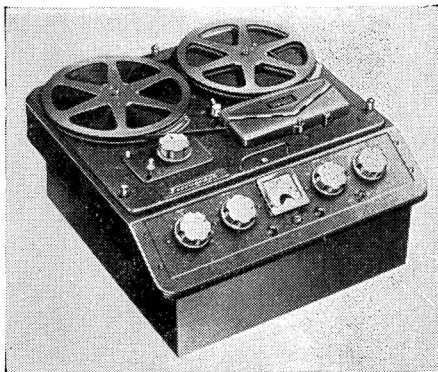
Reporter TK8. G.P. portable recorder. 7½ and 3¾ i.p.s. 1 motor. 7-in. spools. F.r. : 7½ i.p.s., 50-13,000 c.p.s. ; 3¾ i.p.s. 50-9,000 c.p.s., both ± 3 dB. Magic eye level ind. Size 14½ in. by 14½ in. by 8 in. Weight 32 lb. Price £75 12s.

TK830/3D. G.P. portable recorder. 7½ and 3¾ i.p.s. 1 motor. 7-in. spools. F.r. : 7½ i.p.s., 40-15,000 c.p.s. ; 3¾ i.p.s., 50-10,000 c.p.s., both ± 3 dB. Magic eye level ind. Size 19¼ in. by 8 in. by 10½ in. Weight 46 lb. Price £105.

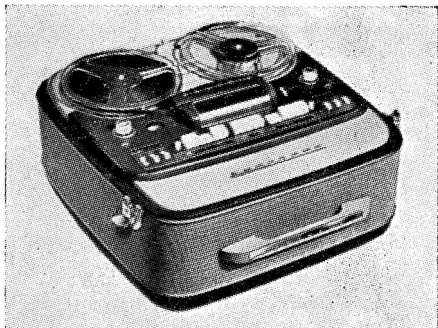
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Magnafon Ltd., 3 Baggally Street, London, E.3. Tel. : Advance 3112.

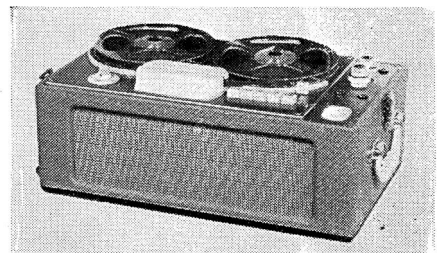
M.1. G.P. portable recorder. Motek tape deck. F.r. : 7½ i.p.s., 50-10,000 c.p.s. ;



Ferrograph Model 66 for console



Grundig TK830/3D



Magnafon M1

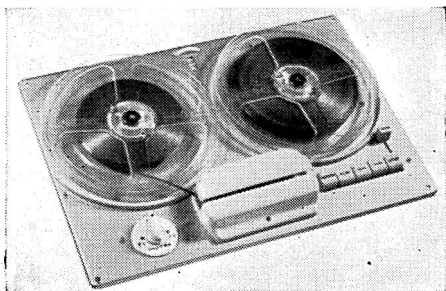
3¾ i.p.s., 50-7,000 c.p.s. ; 17/8 i.p.s., 50-3,500 c.p.s., all ± 3 dB. Magic eye level ind. Size 18½ in. by 11½ in. by 8 in. Weight 26 lb. Price £50 8s.

"58". G.P. portable recorder, Collaro tape deck. F.r. : 15 i.p.s., 40-16,000 c.p.s. ; 7½ i.p.s., 40-11,000 c.p.s. ; 3¾ i.p.s., 40-7,000 c.p.s., all ± 3 dB. Magic eye level ind. Size 18 in. by 15 in. by 7¼ in. Weight 40 lb. Price £65 2s.

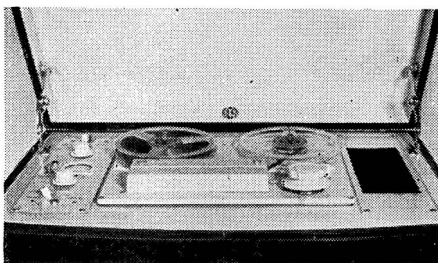
"P". G.P. tape deck and pre-amp. Collaro tape deck. F.r. : as for model "58." Magic eye or meter level ind. self-powered. Size 14½ in. by 12 in., 6 in. below



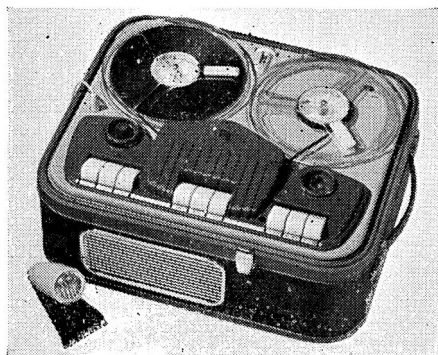
Magnafon "58"



Motek K9 tape deck



M.S.S. CMR/DE



Philips AG8108

base board, 1½ in. above. Weight 20 lb. Price, with magic eye, £42; with meter £52 10s.

★

The Magnetic Recording Co., 2 Bellevue Road, Friern Barnet, London, N.11. Tel.: Enterprise 2226.

Wyndsoor Dauphin. G.P. console recorder. Harting tape deck with extra monitor head fitted. F.r.: 7½ i.p.s., 50-15,000 c.p.s.; 3¾ i.p.s., 50-8,000 c.p.s., both ± 3 dB. Magic eye level ind. Size 21 in. by 16½ in. by 16½ in. When on legs supplied, 30 in high. Price £93 9s.

★

Modern Techniques, Wedmore Street, London, N.19. Tel.: Archway 3114.

Motek K9. G.P. tape deck. 7½, 3¾ and 1⅞ i.p.s. 3 motors. 7-in. spools. F.r.: approx. 50-10,000 c.p.s. at 7½ depending on amplifier used. Size 15 in. by 11 in. Price £22 1s.

★

M.S.S. Recording Co. Ltd., Colnbrook, Bucks. Tel.: Colnbrook 2431. Cables: Emesco.

Model CMR/DE. G.P. recorder. 7½ and 3¾ i.p.s. 3 motors. 8¼-in. spools. F.r.: 3¾ i.p.s., 100-7,500 c.p.s. ± 3 dB; 7½ i.p.s., 60-10,000 c.p.s. ± 5 dB; flat 100-7,000 c.p.s. Level meter. Size 36 in. by 28 in. by 18 in. Weight 110 lb. Price £140; F.M. tuner available at an extra £25.

★

Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

A.G. 8108. Complete G.P. portable recorder. 7½, 3¾ and 1⅞ i.p.s. One motor. 7-in. spools. F.r.: 7½ i.p.s., 50-15,000 c.p.s.; 3¾ i.p.s., 50-8,000 c.p.s.; 1⅞ i.p.s., 50-3,500 c.p.s., all ± 2 dB. Magic eye level ind. Size 15¾ in. by 13 in. by 8 in. Weight 30 lb. Price complete with mic. £65 2s.

★

Reps. (Tape Recorders) Ltd., 118 Park Road North, South Acton, W.3. Tel.: Acorn 4141.

J.C. 20. G.P. portable recorder. Collaro tape deck. F.r.: 15 i.p.s., 40-17,000 c.p.s.; 7½ i.p.s., 50-10,000 c.p.s.; 3¾ i.p.s., 60-6,000 c.p.s., all ± 3 dB. Magic eye level ind. Size 16½ in. by 16 in. by 9¾ in. Weight 44 lb. Price with crystal microphone and spool of tape £65 2s.

In preparation

Model with 2-in. meter level ind. Price approx. £68 5s.

Henri Selmer & Co. Ltd., 114 Charing Cross Road, London, W.C.2. Tel.: Temple Bar 0444. Cables : Selmatone, West. Cent.

Truvoice. Complete G.P. portable recorder. Collaro tape deck. Magic eye level ind. Size 15 in. by 18 in. by 7½ in. Price complete £67 4s.

★

Simon Equipment Ltd., Recorder House, 46-50 George Street, London, W.1. Tel.: Welbeck 2371. Cables : Simsale, London.

Simon SP/4. Complete semi-prof. portable recorder 7½ and 3¾ i.p.s. 1 synchronous motor. Automatic tape reversal at end of track. 7-in. spools. F.r. : 7½ i.p.s., 30-12,000 c.p.s. ± 3 dB ; 30-15,000 c.p.s. ± 5 dB ; 3¾ i.p.s., 30-7,000 c.p.s. ± 3 dB. Magic eye level ind. Size 16½ in. by 14¾ in. by 10½ in. Weight approx. 40 lb. Price £99 15s.

★

Sonomag Ltd., 2 St. Michael's Road, London, S.W.9. Tel. : Brixton 5441.

Sonomag Adaptatape Mk.III. G.P. tape deck and pre-amp. Collaro tape deck. F.r. 15 i.p.s. 50-15,000 c.p.s.; 7½ i.p.s. 50-12,000 c.p.s.; 3¾ i.p.s. 50-8,000 c.p.s., all ± 3 dB. Magic eye level ind. Meter extra. Size 14 in. by 14 in. by 6 in. Weight 30 lb. Price complete with power supply £39 18s.

Sonomag Mk.III. Complete G.P. portable recorder using Collaro tape deck. Spec. as for Adaptatape. Magic eye level ind. Size 16½ in. by 14 in. by 7 in. Weight 34½ lb. Price £54 12s. incl. a mike and reel of tape.

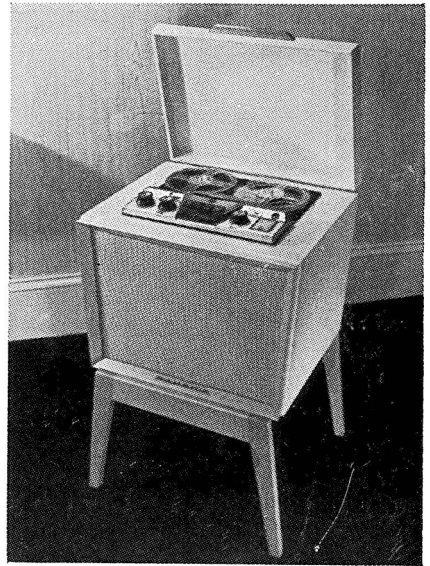
★

Specto Ltd., Vale Road, Windsor, Berks. Tel. : Windsor 1241/2. Cables : Specto, Windsor.

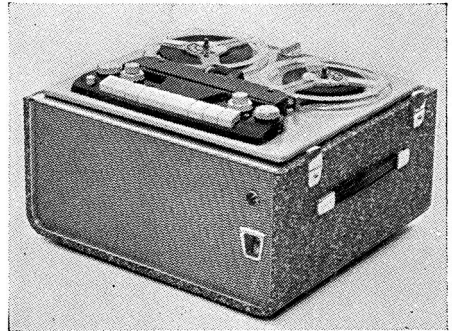
Spectone 151. G.P. portable recorder. Collaro deck. F.r. : 15 i.p.s., 30-16,000 c.p.s. (to C.C.I.R. spec.); 7½ i.p.s., 30-12,000 c.p.s. (to C.C.I.R. spec.); 3¾ i.p.s., 40-6,000 c.p.s., all ± 3 dB. Level meter. Size 18½ in. by 16 in. by 11¾ in. Weight 50 lb. Price £79 16s. (inc. crystal mic.).

■ **Spectone 126.** Complete stereophonic reproducer. 3 motors. 7½ i.p.s. Provision is made for feeding an external crystal pickup or radio tuner unit into one or both amps. 7-in. spools. Response C.C.I.R. spec. 50-12,000 c.p.s. ± 1.5 dB. Size 32½ in. by 23½ in. by 22½ in. Price £165.

■ **Spectone 123.** Complete stereophonic reproducer. Spec. as for 126, plus provision for transcription motor, F.M. tuner, single



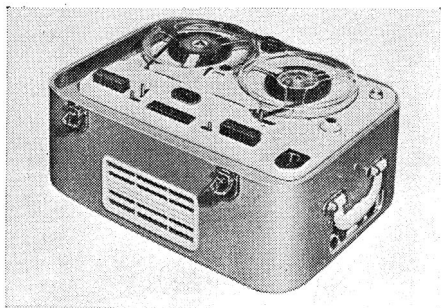
Windsor Dauphin



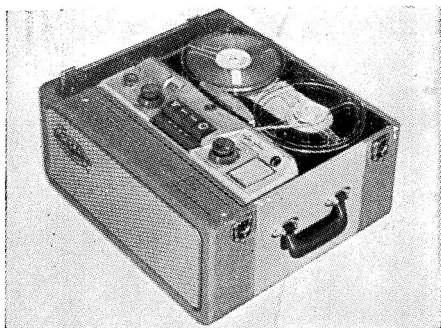
Simon SP/4



Sonomag Mk. III portable recorder



Sound 777



Harting HM5



Tandberg "3 Stereo"



Truvox R2

track and stereo reproduction. Size 44 in. by 25 in. by 34½ in. Price £210.

■ **Spectone 129.** Complete reproducer, 3 motors. 7½ i.p.s. 7-in. spools. Facilities: ½ track record and replay plus twin track replay for stereo. Complete mixing on 3 input channels. Size 32½ in. by 22¾ in. by 22½ in. Price £183 15s.

★

Tape Recorders (Electronics) Ltd., 784-788 High Road, Tottenham, London, N.17. Tel. : Tottenham 0811-3. Cables : Taperec, London.

Sound 777. A.19. Complete G.P. portable recorder. Collaro tape deck. F.r. : 15 i.p.s., 90-14,000 c.p.s. ± 3 dB ; 7½ i.p.s., 90-11,000 c.p.s. ± 3 dB ; 3¾ i.p.s., 90-7,000 c.p.s. ± 3dB. Magic eye level ind. Size 16 in. by 15½ in. by 8 in. Weight 30 lb. Price £46 4s. (microphone extra).

Sound A.20. Complete G.P. portable recorder. Collaro tape deck. F.r. as for model A.19. Magic eye level ind. Size 18 in. by 12¾ in. by 8¼ in. Price complete with microphone and spool of tape £57 15s.

In preparation

Sound 333. A.21. Complete portable recorder. One motor. 4-in. spools. Magic eye level ind. Size approx. 10 in. by 7 in. by 4½ in. Weight approx. 10 lb. Price to be announced. Available mid-1958.

★

Technical Suppliers Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel. : Shepherds Bush 2581. Cables : Teknika, London.

Harting HM5. Semi-prof. portable recorder. 7½ and 3¾ i.p.s. 1 motor. 7-in. spools. F.r. : 7½ i.p.s., 30-16,000 c.p.s. ± 1½ dB ; 3¾ i.p.s., 30-10,000 c.p.s. ± 1½ dB. Magic eye level in. Size 15½ in. by 17½ in. by 10½ in. Weight 37½ lb. Price £86 2s.

■ **Tandberg "3 stereo."** Semi-prof. and G.P. portable recorder with stereo replay. Twin amplifier channels inbuilt. 7½, 3¾ and 1¾ i.p.s. 1 motor. 7-in. spools. F.r. : 7½ i.p.s., 30-16,000 c.p.s. ; 3¾ i.p.s., 30-10,000 c.p.s., 1¾ i.p.s., 30-4,000 c.p.s. All ± 2dB. Magic eye level ind. Size 15 in. by 11½ in. by 6½ in. Weight 27 lb. Price £104 9s. 6d.

★

Telefunken. Distributed in the U.K. by **Welmec Corporation Ltd.,** 147 Strand, London, W.C.2. Tel. : Temple Bar 3357. Cables : Welmcocor, London.

KL65/TS. Tape deck and pre-amp. 3¾ and 1¾ i.p.s. One motor. 5-in. spools.

F.r. : $3\frac{3}{4}$ i.p.s., 60-11,000 c.p.s. ; $1\frac{7}{8}$.p.s., 60-6,000 c.p.s. both ± 3 dB. Magic eye level ind. Size 12 in. by $9\frac{1}{4}$ in. by $5\frac{1}{4}$ in. Weight 14 lb. Price £47 5s.

KL65/KS. Complete G.P. portable recorder. Spec. as for KL65/TS, but incorporating loudspeaker and output stage. Size 15 in. by $13\frac{1}{4}$ in. by $6\frac{1}{4}$ in. Weight 20 lb. Price £59 17s.

KL35. Semi-prof. portable recorder. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. One motor. 7-in. spools. F.r. : $7\frac{1}{2}$ i.p.s., 40-16,000 c.p.s. ; $3\frac{3}{4}$ i.p.s., 60-11,000 c.p.s. both ± 3 dB. Magic eye level ind. Size 20 in. by $15\frac{1}{2}$ in. by 8 in. Weight 41 lb. Price £105.

★

Truvox Ltd., 15 Lyon Road, Harrow, Middx. Tel. : Harrow 9282. Cables: Truvoxeng, London.

Mk. III/U. G.P. tape deck. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. 3 motors. 7-in. spools. F.r. : $7\frac{1}{2}$ i.p.s., 50-12,000 c.p.s. ; $3\frac{3}{4}$ i.p.s., 100-7,000 c.p.s., both ± 3 dB. Panel size $14\frac{1}{4}$ in. by $12\frac{11}{16}$ in. by $7\frac{1}{2}$ in. Weight $14\frac{1}{2}$ lb. Price £24 3s.

Mk. IV. G.P. tape deck. Spec. as for Mk. III/U. Weight $15\frac{1}{2}$ lb. Price £27 6s. (with timing scale) ; £30 9s. (with counter).

R.2. G.P. tape recorder. Spec. as for Mk. III/U. Magic eye level ind. Size 15 in. by 14 in. by $8\frac{1}{2}$ in. Weight 37 lb. Price £69 6s. (with timing scale) ; £72 9s. (with counter). Both include crystal mic. and 1,200 ft. of tape.

■ **Truvox TR2049 Stereophonic Head.** Stacked heads with safety gap for $\frac{1}{4}$ -in. tape. Azimuth adjustment incorporated — will directly replace Truvox $\frac{1}{2}$ -track heads. Response 50-15,000 c.p.s. ± 3 dB with suitable amp. Impedance 50,000 ohms at 10 Kc/s. Cross talk better than 45 dB. Price £14 10s.

★

Verdik Sales Ltd., 139/143 Sydenham Road, Sydenham, London, S.E.26. Tel. : Sydenham 3118/6

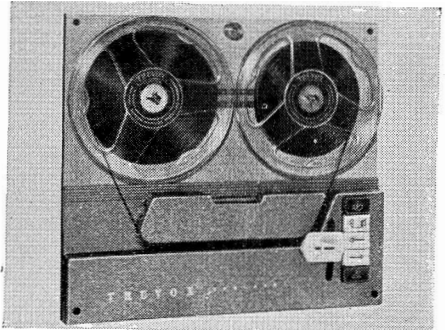
In preparation

G.P. Portable Recorder. Separate recording and replay amplifiers. 3 heads. 3 motors. $3\frac{3}{4}$ and $7\frac{1}{2}$ i.p.s. F.r. : 40-12,000 c.p.s. Magic eye level ind. Price £44 2s.

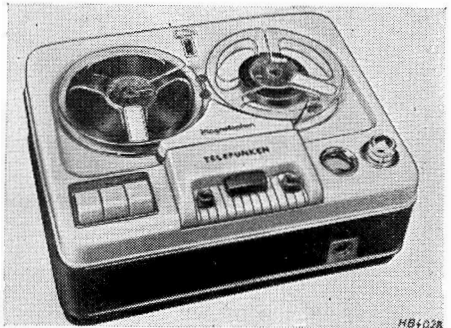
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Veritone Ltd., 5 Avenue Parade, Ridge Avenue, N.21. Tel. : Laburnum 6642.

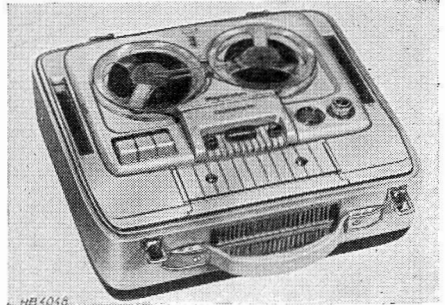
D.S.2. G.P. portable recorder. $3\frac{3}{4}$ and $7\frac{1}{2}$ i.p.s. 3 motors. 7-in. spools. Magic eye level ind. Size $19\frac{3}{4}$ in. by $12\frac{1}{2}$ in. by 8 in. Weight 34 lb. Price £57 15s.



Truvox Mk. IV deck



Telefunken KL65/TS



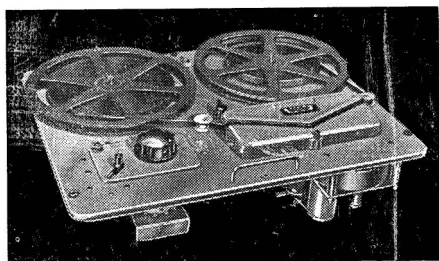
Telefunken KL65/KS



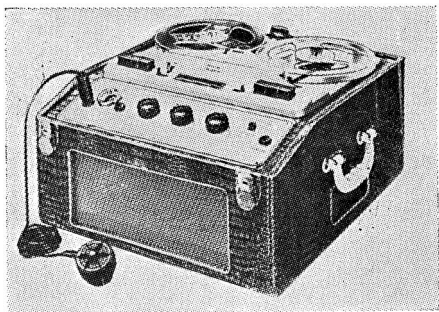
Veritone D.S.2



Walter 505



Wearite Series 3 deck



Winstone "Thoroughbred"

Walter Instruments Ltd., Morden, Surrey.
Tel. : Derwent 4421/5.

Walter 505. G.P. portable recorder. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. One motor. 7-in. spools. Magic eye level ind. F.r. : level at $7\frac{1}{2}$ i.p.s., 40-14,000 c.p.s. Size 16 in. by $12\frac{1}{2}$ in. by $7\frac{1}{2}$ in. Weight 23 lb. Price £59 17s. with Acos Mic. and spool of tape.

★

Wright & Weaire Ltd., 131 Sloane Street, S.W.1. Tel. : Sloane 2214. Cables : Writewea Knights.

Wearite Tape Deck. Models 3A, 3B, 3C. Semi-pro. $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. 15 or $1\frac{1}{2}$ i.p.s. to order. 3 motors. $8\frac{1}{4}$ -in. spools. Panel size $16\frac{1}{2}$ in. by 13 in. by 7 in. Weight 18 lb. 3A standard monaural record/replay. Price £35. 3B monaural record/replay plus monitor, £40. 3C industrial dual track recorder £45.

■ **Models C77, C88.** Spec. as for Model 3, but with stereo head fitted. C.77 monaural record/replay, stereo replay. Price £47 10s. C88. stereo record/replay. Price £50. Limited supplies.

★

Winstone Electronics Ltd., Govett Avenue Shepperton, Middlesex. Tel. : Walton-on-Thames 6321. Cables : Winstone, Shepperton.

Winstone "Thoroughbred." G.P. portable recorder. Collaro tape deck. F.r. : 15 i.p.s., 50-16,000 c.p.s. ; $7\frac{1}{2}$ i.p.s., 50-12,000 c.p.s. ; $3\frac{3}{4}$ i.p.s., 50-7,000 c.p.s. Magic eye level ind. Size $17\frac{1}{8}$ in. by $15\frac{3}{8}$ in. by $9\frac{3}{8}$ in. Weight 48 lb. Price £68 5s.

TAPE AMPLIFIERS AND MIXER UNITS

Associated Electronic Engineers Ltd., 10 Dalston Gardens, Stanmore, Middx. Tel. : Wordsworth 4474/5/6. Cables : Astronic, Stanmore.

In preparation

Model A.1441. 4 channel transistorised mixer unit. Available September-October, 1958.

★

Brenell Engineering Co. Ltd., 1A Doughty Street, London, W.C.1. Tel. : Chancery 5809/Holborn 7358.

T.P.2. Tape pre-amp. Inputs : Mic. 2.5mV, radio/P.U. 250 mV. Frequency correction for 15, $7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s. F.r. : 15 i.p.s., 50-14,000 c.p.s. ; $7\frac{1}{2}$ i.p.s., 60-10,000 c.p.s. ; $3\frac{3}{4}$ i.p.s., 60-5,000 c.p.s., all ± 3 dB. Facilities include head demagnetising, monitoring, auxiliary power switch. Output approx. 1v at source, input of 50,000 ohms. P.s.m. 300v at 40mA, 6.3v at 1.5 amps. Size panel 15 in. by $4\frac{1}{2}$ in. 5 in. deep. Price £17 17s.

P.V.2. Power unit for use with T.P.2 when main equipment extra power supply is inadequate. Price £4 18s.

Cape Electrophonics Ltd., 43-45 Shirley High Street, Southampton. Tel. : Southampton 74251.

Cape VLT. Tape Unit. Replay amplifier. Gain approx. $\times 30$ giving overall sensitivity with VLP of 0.6 mV at 15 i.p.s. and 1mV at 7½ i.p.s. Recording amp. 18 dB feedback. Parallel T network in feedback loop adjustable for 3 tape speeds. Peak signal level meter. Oscillator low distortion circuit, p.s.n. 430v and 6.3v. Size 9 in. by 6 in. by 3 in. Weight 3¼ lb. Price £25 (see amplifier directory).

★

Grundig (Gt. Britain) Ltd., 6 Government Buildings, Kidbrooke Park Road, London, S.E.3. Tel. : Lee Green 8541. Showroom : 39-41 New Oxford Street, London, W.C.1. Tel. : Covent Garden 2995. Cables : Grundig, London. Telex 22054.

G.M.U.3. Four channel mixer and pre-amp. Inputs : Mic. 1, 1.2 mV, 100 K/ohms ; Mic. 2, 2.4mV, 100 K/ohms. Polarised 100v D.C. Mic 3 as Mic. 2. Channel (radio/P.U.). 300mV, 500 K/ohms. Out. imp. approx. 1,000 ohms. Magic eye level ind. Output level 65mV. Self-powered. Price £16 16s.

★

Kenton Laboratories Ltd., 4 Tottenham Mews, London, W.1. Tel. : Museum 8105.

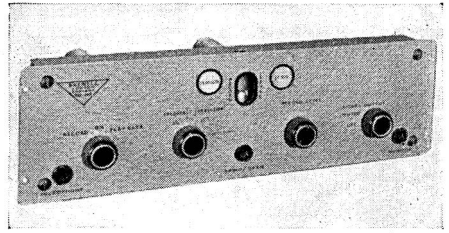
Kenton Mixer Unit Mk. I. 4 inputs. Channels 3 and 4 are of low sensitivity for high output tuner or pre-amp, 50,000 ohms. 1 and 2 are of high sensitivity for low output mic. or pickup 100,000 ohms. These channels are amplified + 20 dB to match output from channels 3 and 4. Output impedance 50,000 ohms. Pilot light. Self-powered. Size 8 in. by 3¼ in. by 5 in. Price £10 15s.

★

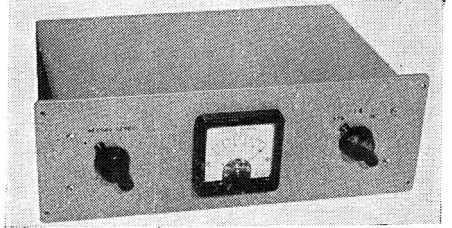
The Lowther Manufacturing Co., St. Mark's Road, Bromley, Kent. Tel. : Ravensbourne 5225. Cables : Lowther, Bromley.

Tape B and E Unit, No. 1. Tape Record unit for bias voltage and record level metered control with playback pre-amp. or direct head connection. Switch to allow meter setting of bias voltage to suit head or tape. P.s.n. 250v at 30mA ; 6.3v at 3 amps. Price £25.

Companion Supply Unit No. 2. H.T. and L.T. power supply suitable to power radio tuners. Preamp and tape bias amplifier. Output 250v at 40 mA, 6.3v at 3 A. Price £5 10s.



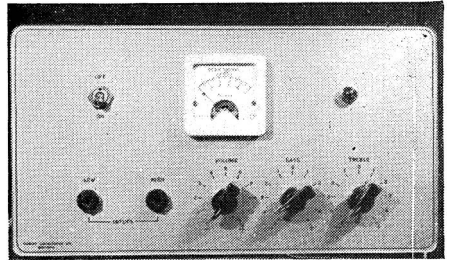
Brenell TP2



Cape VLT



Grundig G.M.U.3



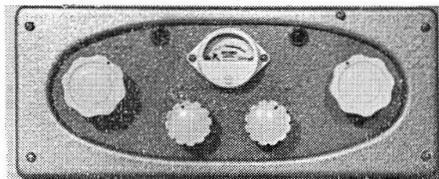
Shirley TWA/15

Lustraphone Ltd., St. George's Works, Regents Park Road, London, N.W.1. Tel. : Primrose 8844. Cables : Lustraphone, London.

M.U.577. Transistor mixer unit. Inputs : 1 and 2 are unbalanced and are suitable for high imp. mics. (low or line imps. to order). 2 and 3 are high imp. and suitable for radio or P/U. Output is balanced to match that from 1 and 2. F.r. substantially flat 50-14,000 c.p.s. Power by mercury cell with 1,000 hours life. Price, standard model, £22.



Masterlink M2A



Sound Sales A-Z Precord

M.S.S. Recording Co., Ltd., Colnbrook, Bucks. Tel. : Colnbrook 2431. Cables : Emesco.

4 M 2 or 2 ML. Microphone mixing and control unit. Up to 4 mics. or line, P/U and 2 mics. Microphone switching and level control. Output sockets for 600 ohm line and headphone monitor. 4 input sockets. H.D. at 1 mW 1,000 c.p.s. tone, is 0.25%. H and N at normal output level on 1mW signal to noise ratio 60dB. Size 14½ in. by 12 in. by 7 in. Price £50.

★

RA/50. Amplifier for recording and playback. 50 watts. Dist. 2.5% at 50 watts. Input for spec. output 1v. Response 30-15,000 c.p.s. ± 2 dB. Feedback 12 dB. N.L. - 80 dB at full output. Out. imp. RA50/1 1,800 ohms ; RA50/2 200 ohms ; RA50/3 15 ohms. Output EL37's. Size 19 in. by 14 in. by 8 in. Weight 96 lb. Power available for pre-amp. Price £70.

★

Rogers Developments (Electronics) Ltd., "Rodevco Works," 4-14 Barmeston Road, Calford, S.E.6. Tel. : Hither Green 7424. Cables : Rodevco, London.

General Purpose Power Pack. Suitable for tape units and radio tuners. Output 250v at 45 mA, 6.3v at 2.5A. Size 7½ in. by 3 in. by 5 in. Price £4 5s.

R.D. Booster Unit. For use with Rogers control units or similar, this enables direct connection to tape head ; may also be used

with low output pickups. Gain × 20. Maximum usable sensitivity 2mV. Max. input imp. 100,000 ohms. Size 6½ in. by 3½ in. by 1½ in. Price £3.

★

Shirley Laboratories Ltd., 3 Prospect Place, Worthing, Sussex. Tel. : Worthing 30536.

TW/PA2. Recording amplifier for use with high quality power amplifier. Inputs : 1.5mV and 60mV. bias and base oscillator. Full corrections. Valve voltmeter modulation level ind. For use with Wearite tape deck, can be supplied to order for any deck. Size 10 in. by 5½ in. by 5¼ in. Weight 3½ lb. P.s.n. from main amp. or power pack can be supplied at £6 16s. 6d. Price £31 10s.

TW/CT. Tape amplifier for use with Collaro tape deck. F.r. : as recorder, 50-12,000 c.p.s. ; as amplifier 50-16,000 c.p.s. Bass and treble boost and cut. Magic eye level ind. Output 3½ watts. Inputs 1.5 mV and 40 mV. Price on application.

TWA/15. Tape amplifier for use with most tape decks, also for use with pickup or radio. Inputs : 1-1.5 mV and 40 mV. Output : 15 watts, 20 watts peak. F.r. : as recorder 50-12,000 c.p.s. as reproducing and gram amp. 20-40,000 c.p.s. Bass and treble boost and cut. H. & N. 85 dB down. Valve-Voltmeter level ind. power supply on separate chassis. Price £47 5s.

■ **TWA/1515.** Complete stereo record and replay amplifier. Output 15 watts continuous, 25 watts peak on each channel. Inputs : 1.5 mV and 50 mV. Bass and treble boost and cut. Level indicated by separate sustained peak-reading valve voltmeters. Power supply and oscillator on separate chassis. F.r. : 40-30,000 as ordinary amp. ; 40-15,000 as recording amp. Size : control unit 23 in. by 7½ in. by 7 in. Weight 19 lb. Power unit 10 in. by 8 in. by 7½ in. Weight 22 lb. Price £100 16s.

■ **TW/PA22.** A two-channel version of the TW/PA2. Price on application.

★

Sound Sales Ltd., Works and Acoustic Laboratories, West Street, Farnham, Surrey. Tel. : Farnham 6461-2-3. Cables : Sounsense.

A-Z General Purpose Power Pack for supplying additional units beyond the scope of the main amplifier. Output 250v at 35 mA, 6.3v at 2 A. Size 11¼ in. by 4½ in. by 4½ in. Weight approx. 6 lb. Price £5 10s.

A-Z Precord Unit. Designed for use with Wearite, Truvox or Collaro tape deck. Self-

powered inputs : mic. or radio/pickup. Sel. switch for record and replay. Green and red ind. lights give add. visual check. Calibrated recording live indicator. Equalisation for $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 i.p.s. C.C.I.R. and Ampex characteristics. Variable bias control. Record level gain control. Size $11\frac{1}{4}$ in. by $9\frac{1}{2}$ in. by $4\frac{3}{4}$ in. Weight 12 lb. Price £30.

★

Specto Ltd., Vale Road, Windsor, Berks. Tel.: Windsor 1241. Cables : Specto Windsor.

Spectone Electronic Mixer. 142 and 142A. Inputs : radio 100 mV ; mic. 1.5 mV ; P.U.1 6 mV ; P.U.2 50 mV. Output 0.5v. P.U.1 can be used as second mic. input. F.r. : radio 20-20,000 c.p.s. - 0.5 dB ; mic. 25-20,000 c.p.s. - 0.5 dB. H and N P/U - 53 dB. P.s.n. model 142, 200-300v at 5 mA ; 6.3v at 1.2 amps. Model 142A, self-powered. Size panel $12\frac{1}{4}$ in. by $5\frac{1}{4}$ in. Casing $11\frac{1}{4}$ in. by $4\frac{1}{4}$ in. by $4\frac{1}{4}$ in. Weight : 142 2.5 lb. ; 142A 5 lb. Price : 142, £17 17s. ; 142A, £22 1s.

★

Tele-Radio (1943) Ltd., 189 Edgware Road, London, W.2. Tel. : Paddington 4455.

Masterlink M2A. Tape pre-amp originally for Wearite series of deck, suitable for Reflectograph, Collaro and Brenell decks. 2 units, pre-amp and oscillator and separate power supply. Switched inputs for mic., 1.2 mV and radio/P.U., 100 mV. Meter indicates bias, rec. signal, P/B signal. F.r. : 30-20,000 c.p.s. - 1 dB. Oscillator cut-out facility for deck connection. Switched equalisation for 3, $7\frac{1}{2}$ and 15 i.p.s. Low imp. output approx. 200 mV. C.C.I.R. adjustment pre-set. Size 12 in. by 6 in. by 8 in. Price £28 7s.

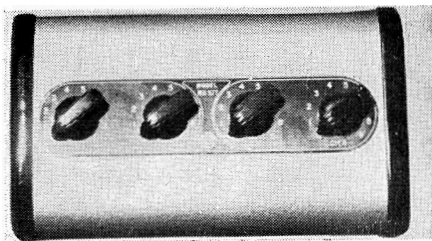
In preparation

■ **Stereolink.** Pre-amplifier for the replay of stereo tapes to C.C.I.R. spec. Controls : vol, balance, treble, bass and system, i.e., right, left, common and stereo. Output approx. 100-200 mV. Size 12 in. by 6 in. by 8 in. P.s.n. approx. 250v at 20 mA. To operate with two matched power amps. Price approx. £20-£25.

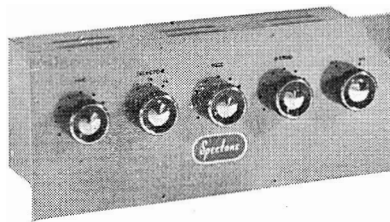
★

Truvox Limited, 15 Lyon Road, Harrow, Middx. Tel. : Harrow 9282. Cables : Truvoxeng, London.

Type "K" Recording Amp. Inputs : 1 megohm at 1-2 mV ; $\frac{1}{2}$ megohm at 0.5v. Vol. and on/off. Record/replay switch. Tone control. High imp. output. H and N



Lustraphone MU57



Spectone Electronic Mixer

- 45 dB. Output 4 watts. Primarily for Truvox tape deck. Price £19 19s.

★

Vortexion Ltd., 257/263 The Broadway, Wimbledon. Tel. : Liberty 6242/3. Cables ; Vortexion, Wimble, London.

3-channel Prof. Mixer. Built-in mu-metal shielded input transformer, hermetically sealed controls, screened mains transformer. Output 1m watt, 600 ohm balanced or unbalanced. Peak programme meter calibrated zero level + 12 to ± 20 dB. Size $18\frac{1}{2}$ in. by $10\frac{1}{2}$ in. by 6 in. Weight approx. 23 lb. Price on request.

4-channel Prof. Mixer. For 30-50 ohm mic. balanced line or other imps. to order, heavy mu-metal shielded transformers, hermetically sealed controls. Outputs $\frac{1}{2}$ v on more than 20,000 ohms or 600 ohm, 1 mV. Has own screened power pack for AC mains. Similar 12 way is also available. Size $18\frac{1}{2}$ in. by $10\frac{1}{2}$ in. by 6 in. Weight approx. 23 lb. Price £40 8s. 6d. 600 ohm output extra.

★

W & N Electronics Ltd., 80/82 Uxbridge Road, London, W.13. Tel.: Ealing 4774.

In preparation

Audiomaster Mk. 1-3. Semi-professional recording amp supplying constant current for direct supply to tape head and erase and bias supply. For use with any high grade tape deck. Correction at $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 i.p.s.

30 i.p.s. can be supplied to order. F.r. : 15 i.p.s. 50-1,400 c.p.s. ; $7\frac{1}{2}$ i.p.s. 50-10,000 c.p.s. ; $3\frac{3}{4}$ i.p.s. 50-5,000 c.p.s. All ± 2 dB. Oscillograph cathode ray tube or meter level ind. Size 8 in. by $5\frac{5}{16}$ in. by 8 in. Price not yet available.

TAPE ACCESSORIES DIRECTORY

EAP (Tape Recorders) Ltd., Bridge Close, Oldchurch Road, Romford, Essex. Tel.: Romford 62366/7.

Elizabethan Stethoset Headphones. Lightweight, high impedance. Price £3 13s. 6d.

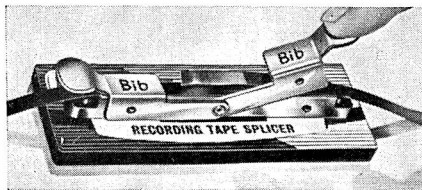
Elizabethan Radio/P.U. Connecting Lead. 3 yards of low loss screened cable fitted with British Standard jack plug and coaxial plug. Price 15s.

★

EMI Sales & Service Ltd., Blyth Road, Hayes, Middx. Tel.: Southall 2468. Cables : Emiservice, London. Telex : 2-2417.

Emitape Jointing Compound. AP35 for C.A. base tape. AP77 for P.V.C. base tape. A jointing fluid for making permanent welded joints in magnetic tape. Price 7s. 6d. per bottle.

Emitape Jointing Tape. AP103. Adhesive jointing tape for simple and quick splicing and editing of magnetic tape. Price 7s. 6d. per reel.



Multicore "Bib" tape splicer

Emitape P.V.C. Editing and Marker Tapes. A range of six coloured tapes to enable colour code reference to be inserted in a reel of recorded tape for quick editing and indexing purposes. AP38/1 white ; AP38/2 red ; AP38/3 yellow ; AP38/4 blue ; AP38/5 orange ; AP38/6 green. Price 4s. 6d. per reel.

Emitape Plastic Tape Spools in cartons, all standard sizes available. Price : 3 in. and $3\frac{1}{4}$ in. 3s. ; 5 in. and $5\frac{3}{4}$ in. 4s. 6d. ; 7 in. 5s.

Emitape Jointing Block and Cutter. Type AP46. For splicing and editing tape. The tape location channel gives perfect alignment to the tape and the cutter is of non-magnetic material. Price 17s. 6d.

Emitape Non-magnetic Scissors. Type AP39. Made of non-ferrous metal, the scissors may be used for splicing magnetic tape without risk of magnetising, so ensuring a completely noiseless join. Price 16s.

★

Leavers-Rich Equipment Ltd., 78b Hampstead Road, London, N.W.1. Tel. : Euston 1481. Cables : Leemag, London.

Lee Raser. Junior ER30A ; Standard ER31B ; Senior ER32B. Ultra rapid demagnetisers for spools of tape and accessories. Price £6 5s. ; £9 10s. ; £15.

★

Multicore Solders Ltd., Multicore Works, Hemel Hempstead, Herts. Tel. : Boxmoor 3636.

The "Bib" Tape Splicer. This splicer enables the tape to be jointed easily and to be edited to the accuracy of a syllable. Supplied complete with razor cutter and mounted on flock-covered panel. Price 18s. 6d.

★

Truvox Ltd., 15 Lyon Road, Harrow, Middx. Tel. : Harrow 9282. Cables : Truvoxeng, London.

Dictating Attachment. TA1. Price £4 4s. Telephone attachment, for recording 2-way telephone conversations. Price £2 2s. **Headphones**, for use with any recorder with low impedance output socket. Price £3 3s. **A.M. Radio Jacks.** Price Standard (M.W. only) £2 10s. (U.K. purchase tax £1 2s.) ; Senior (M.W. and L.W.) £3 9s. 6d. (U.K. purchase tax £1 10s. 6d.).

★

Wellington Acoustic Laboratories Ltd., Allways, Kings Lane, Wrecclesham, Farnham, Surrey. Tel.: Farnham 6461/4961.

WAL Tape Eraser. A mains operated tape demagnetiser, accommodates from 5 to 10 in. reels, push button operated. Erases both tracks in a few seconds. Available for 200-250v 50 c.p.s. or 110-125v, 60 c.p.s. Price £7 18s. 6d.

★

Wright & Weaire Ltd., 131 Sloane Street, London, S.W.1. Tel. : Sloane 2214. Cables : Writwea, Knights.

Wearite Defluxer. For depolarising heads of tape recorders and players. It ensures maximum signal/noise ratio from any tape recorder and protects recorded tapes from cumulative background noise and the gradual attenuation of the higher frequencies. Price £2 10s.

LOUDSPEAKERS

HOW TO CHOOSE ONE

By Ralph West

THE newcomer to the field of high fidelity reproduction of sound is faced with an embarrassing choice of component parts from which to build up a complete system. The loudspeaker is one of the more difficult components to choose, and while the ultimate advice is to buy the most expensive speaker you can afford, it is not a thing to be rushed.

In his lecture in the Northern Polytechnic series on high fidelity reproduction last year, Percy Wilson advocated initial economy on the choice of loudspeaker, pointing out that when a better one is purchased later on, the first can be used as an extension in another room. We could now add, if its HF response is adequate, it could become one of the stereo pair in due course. Undue economy is not advised, since the results cannot of course be better than the speaker. There are good speakers available, or constructable, for about £20. An 8-inch or similar unit, in a well designed cabinet, can produce all the bass anyone needs, and it will probably have a better top response than a larger unit.

Experience is Important

Probably the biggest factor in choosing a speaker is the need for experience. A few lucky people, probably with a long experience with live music, can tell straight away whether the loudspeaker they are listening to gives anything like the real thing, and whether they will be happy living with it. To most of us, listening—**real** listening, is a faculty we acquire gradually. At first we are usually thrilled with the excessively sparkling top, the floor-shaking bass of the larger-than-life type of reproduction, all too common, alas, also at our exhibitions. It is a phase many of us go through—and we enjoy it too! Unfortunately some grow out of it too slowly—to the annoyance of others in our crowded civilisation.

In the course of time we become dissatisfied with raucous sounds and enjoy more subtle sounds—just as our palate matures and savoury tastes replace sweetness.

There are other aspects of experience to be considered. It is highly desirable to hear many loudspeakers before a decision is made. Not all on the same afternoon—and not once each, either!

A good start could be made at one of the specialist shops that have facilities for the rapid comparison of loudspeakers. Don't hear those far beyond your price range: it only confuses the issue. Your wife or girl friend will be a very valuable assistant in this matter, though she will also be influenced by the looks—and quite rightly so! Her judgment of quality is uncanny, and very quick too; probably because, unlike us, she is not blinded by the technical merits of the "Super-Boosted Howler" or whatever it boasts, and is able to listen dispassionately. My lady is also very sensitive to excessive high note output, especially that due to speaker resonances and distortion.

Don't play it too loudly!

The loudspeaker should **not** be heard at too high a level. Almost any speaker is impressive under those conditions as long as it doesn't rattle. A lack of top, or of bass, or indeed any shortcoming at any point in the range does not show up when played at a very high level. When at a level not likely to wake sleeping children in the room above, it should still sound very pleasant—and will probably be nearer the right level anyway. Extreme top and some of the weight of the base will have gone, but 100 feet away from an orchestra in a large hall this would be the case anyway.

It might be a good idea to take two or three selected records with you, and hear them on the various speakers. One record would not be enough, as any one particular recording may have some deficiency which a particular speaker may remedy. Three suitable types of record would be as follows:—(a) **full orchestra**—but make sure it is "clean", otherwise the good speaker may show up the distortion whereas a cheaper one may so blur the top that it passes muster. (b) **a vocal record**, or better, a male

speaking voice via the BBC FM service. (c) **some modern popular record**, featuring the close-up technique of a small group. Played at the right level, this item could sound as if it were being performed in the room.

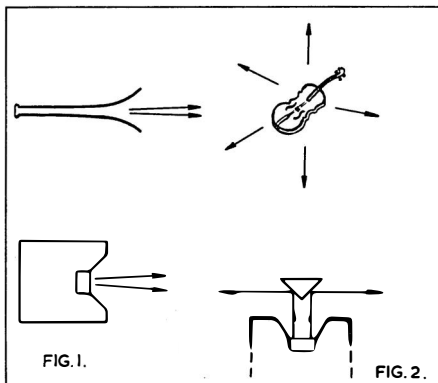
When listening it is wise to be properly relaxed in a comfortable chair, and with no other distracting sounds or movements taking place. When listening to the orchestral record, with eyes closed, try and imagine it is the real thing. If the view doesn't feel clear—**note the word "feel"**—either the record or the speaker is not so good. This is an excellent test for smoothness of response in the middle frequency range—about 100 c/s to 1,000 c/s, and is probably the most important feature, though not so immediately obvious as trouble at the extremes of the frequency spectrum.

Check for HF Distribution

Wide distribution at high frequencies is very desirable, and it can be checked by using the popular record and by moving around in front of the speaker—over an area likely to apply in your home surroundings. Considerable changes in quality (the high frequency content) shows poor distribution. An even better test is to detune an FM receiver so that it emits a loud hissing sound. This is not "white noise" but it will do nicely. Poor HF distribution will now show up as changes in loudness and apparent pitch of this sound when moving around as before, preferably keeping the head at about the same height as when seated! Many speakers in use and on sale at present would show up badly with this test! Many people appear to be insensitive to such details, but would they ever consider it worthwhile sitting in front of one or two circular holes, varying between 2 inches and 12 inches in diameter, in a partition separating them from the entertainment they had just paid for?

Too long have we listened to sound coming out of a circular hole in the vertical face of a box or something. Only things like trumpets do that in real life (Fig. 1). The human voice is somewhat similar. All other musical instruments radiate sound in practically all directions (Fig. 2). If we are hoping to get anywhere near the real thing in our own home, we will need something that radiates all frequencies in all directions. All cabinet speakers radiate bass notes in all

directions; it is the higher frequencies that normally issue from the cone in a beam that gets narrower as the frequency gets higher. It is this high frequency energy that needs spreading out. With an omni-directional speaker, not too close to the walls and corner, the "close-up" record, played at the correct level, should sound something like the real thing, in the room.



In the case of an orchestra, we would not expect to get that into our own rooms. We would, however, expect the sound to reach our ears from several directions. An orchestra is a wide source of sound most of the time, and some sound may be reflected from walls, etc. To reproduce this effect really well in our homes we would need stereo equipment; but if the single speaker can be made to behave as a wider source than its 8 inch opening, then an orchestra will sound much more like the real thing. It will seem to be spread out beyond the speaker and boundaries of the room. If the omni-directional speaker of Fig. 3 is moved nearer to the corner, reflection from the walls will effectively widen the source of sound. Contrast that with Fig. 6!

It is also possible to feed the signal into two loud-speakers, so enhancing the effect still further. This was discussed more fully in "Semi Stereo" in the February 1958 issue of "Hi-Fi News." Further information on HF distribution appears in the April 1958 issue of the same magazine.

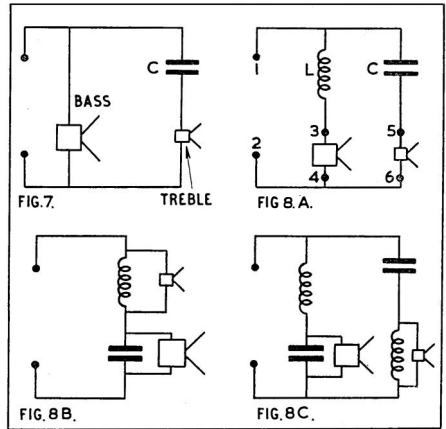
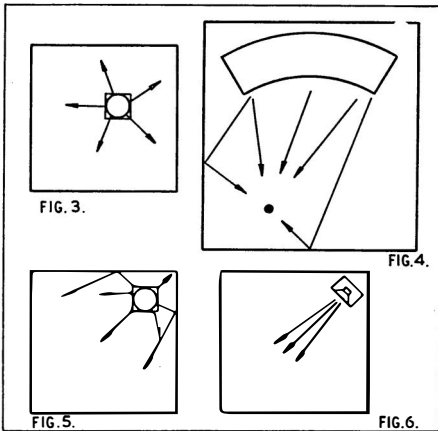
It used to be considered necessary to stiffen up the cabinet walls as much as possible, so that the minimum amount of

movement took place. It has recently been demonstrated that this is not necessarily so (see February 1958 *Hi-Fi News* again). A. R. Neve (CQ) has demonstrated that it is possible, by careful design, actually to make use of wall flexing in order to widen and smooth the response! One of the many requirements is that each panel resonates at a different frequency from the others. When tapped with the knuckle no two panels should sound alike. Indeed that is sound advice in any case, and for practically all cabinets in use at present. Unless actually made of thick concrete or brick they **must** vibrate quite a bit, and so add their quota of sound that may, or may not, help.

A word about driving units for those who fancy building their own loudspeaker systems. As ever, cost usually determines the goodness of most aspects of its performance, but the cabinet design has a very large influence in the bass. As said much earlier on, an 8 inch unit in a well designed cabinet can actually have a better bass response than a 12 inch unit in a poor cabinet. In this country

be able to recommend a suitable condenser value.

If the larger speaker has plenty of high frequency output—a harder, thinner cone—it may be necessary to reduce its HF output, especially if there are any pronounced resonances in the upper register. If it is at all harsh, it will be necessary to use a crossover. **Figs. 8A** and **8B** show



simple quarter-section and series types, while **8C** shows a slightly more elaborate circuit, a half-section type.

The action of circuit **8A** can be described simply as follows:—The bass speaker receives its power via a choke or coil *L*. The fundamental property of any coil is to oppose alteration of the current flowing through it. The opposition becomes greater, the faster the current changes. It thus has a smoothing action and cuts down the rapid variations, i.e. the high notes, without affecting the bass. The condenser *C* has almost the opposite effect. No current actually flows through it—only into it and out of it.

at present the 12 inch unit might be cheaper, for it does not incur purchase tax, but its HF response is generally not so good in range, or in smoothness, as that of an equally good 8 inch unit, and a tweeter may be needed. If the larger speaker has a cone designed for the lower frequencies only—probably thick and soft, so as to absorb high frequency energy—a simple circuit like **Fig. 7** will suffice. The maker of the tweeter will

If a large number of electrons are pushed into one terminal, they spread out over the length of foil attached to it, and repel an equal number off the other foil, and out of the other terminal. The more times per second this is done, the more electrons flow through the tweeter per second, and the more noise it makes; i.e. it receives very much more energy at the high frequencies than at low frequencies.

As a manufactured article it will have six terminals suitably named, 1 and 2 — “input”; 3 and 4 — “bass”; 5 and 6 — “treble”, in all probability. A lower-priced model might only have four terminals.

Circuit **8B** achieves the same result through by-passing the unwanted signals to the other unit. **Fig. 8C** is in effect a combination of **8A** and **8B**. **Fig. 8D** shows how the signal is shared between the two speakers. The frequency at which the two speakers receive half the power each is known as the crossover frequency. The more elaborate crossover circuits effect a more rapid change-over. This may be necessary if, say, the bass speaker has a noticeable cone resonance at a frequency not far above crossover, or if the tweeter response falls off rapidly below the chosen crossover frequency.

Various speaker manufacturers issue quite a large amount of information for home constructors, and several of them also make crossover units. Anyway, they will be able to advise on suitable crossover frequencies and types of crossover circuit to use.

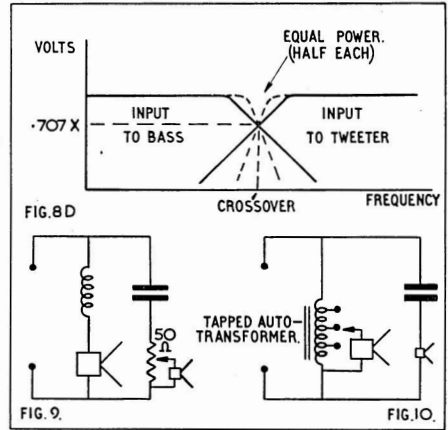
It is advisable to make sure that the tweeter is as sensitive as, or more sensitive than the bass speaker. It is quite in order to cut down the output of the tweeter by a simple resistance or potentiometer as in **Fig. 9**, but it is not wise to do this to the bass speaker as the damping is much reduced and various bass resonances may give trouble.

If the available units, or desired units, have sensitivities the wrong way round; i.e. more sensitive bass unit, then attenuation of the bass unit should be done with a suitable auto-transformer (**Fig. 10**). Messrs. GEC make a suitable transformer with lots of tapings (for their metal cone speaker), and several other speaker manufacturers are able to supply suitable transformers.

Going back to speaker unit prices, one of the most expensive items is the permanent magnet. This is a pity, since a strong magnetic field is very desirable. It can improve the results in four ways. First, the efficiency is raised, so that a given electrical input produces more sound. On its own, this is not very important, because domestic amplifiers have quite a margin of spare power. Secondly, the high flux increases the electromag-

netic damping that the amplifier can put on the speaker. All modern amplifiers have enough negative feedback to reduce their output impedance (on 15 Ω output) to something under 1 Ω .

This, in series with the 10 Ω to 14 Ω of typical speech coils is the effective damping load. Any abrupt cessation of signal may leave the cone moving, and therefore still producing sound. Its speech coil, moving in the powerful magnetic field, generates electricity which flows in this load. This helps to brake it to a standstill. The stronger the field, the more quickly will it stop. This produces cleaner bass, less hangover and



blurring of the sound, and less cabinet resonance too.

Thirdly, it increases the high note response. The speech coil unfortunately acts like the choke in **Fig 8A**, reducing the high note output. The “smoothing” action is all the greater, because of the close proximity of the iron pole-pieces. The powerful field saturates the pole-tips and reduces their effect on the coil, so that it allows more current to flow at very high frequencies. Fourthly, it does smooth the top response slightly. Well, all good things cost a lot!

This is by no means a complete treatise on how to choose a loudspeaker, but it may help the newcomer to appreciate some of the factors involved. After all this, only the would-be purchaser (and his wife!) can make the choice. Shall we say, in spite of all this, if it sounds right it **is right**, but it doesn't really matter as long as you like it and **keep on liking it!**

SPEAKERS & ENCLOSURES — Directory

● This directory is divided into two parts. **Part 1** deals with the range of drive units which, by makers' specifications, are within the Hi-Fi classification. **Part 2** deals with complete enclosures. These, as a general rule, embody the drive units of Part 1. For economy of space the following abbreviations are used: v.c.i.—voice coil impedance; r.c.f.—recommended crossover frequency (and in Part 2) Rec.—recommended units; Height by Width by Depth are the order of printed dimensions.

PART I—DRIVE UNITS

Altobass Ltd., Percy Road, Aylestone Park, Leicester. Tel.: Leicester 31616. Cables: Altobass, Leicester.

2000. Dual Concentric. 12 in. Moulded paper cone, corrugated surround (L.F.). Bakelised fabric pressure tweeter. Voice coil $1\frac{1}{2}$ in. (L.F.), 1 in. (H.F.). Gap flux (L.F.) 8,000 gauss, (H.F.) 1,300 gauss. Total flux (L.F.) 90,000 maxwells, (H.F.) 50,000 maxwells. Handling capacity 10 watts. v.c.i. 10 ohms. Frequency range 30-20,000 c.p.s. Built-in crossover at 2,000 c.p.s. Price £17 17s.

★

Bakers "Selhurst" Radio, 24 Dingwall Road, Croydon, Surrey. Tel.: Croydon 2271/2.

Junior de-luxe 8-in. fibre cone, bakelised apex. Foam surround. Voice coil 1 in. Gap flux 18,000 gauss. Handling capacity 8 watts. v.c.i. 15 ohms. Frequency range 35-20,000 c.p.s. Price £8 4s. 3d. (U.K. purchase tax £3 3s. 3d.).

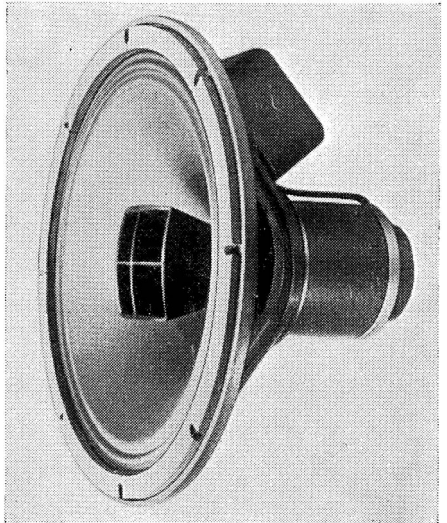
Junior Special. Spec. as for Junior de-luxe, but with aluminium voice coil and drive giving increased response and peak handling capacity. Price £9 (U.K. purchase tax £3 15s.).

12-in. de-luxe fibre curvilinear cone, bakelised apex. Foam surround. Voice coil $1\frac{1}{2}$ in. Gap flux 15,000 gauss. Handling capacity 15 watts. v.c.i. 3 or 15 ohms. Frequency range 20-17,000 c.p.s. Price £9 15s.

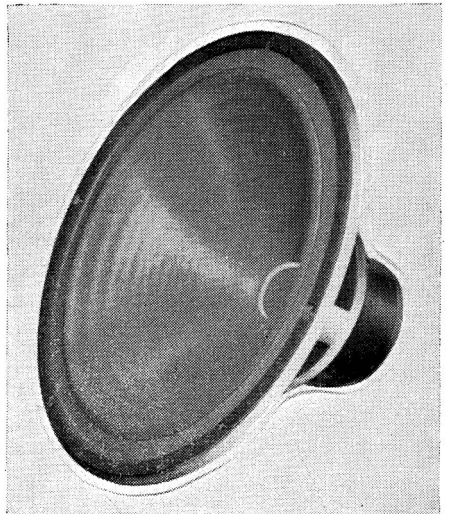
12-in. Ultra de-luxe fibre curvilinear cone, bakelised apex. Foam surround. Voice coil $1\frac{1}{2}$ in. Gap flux 17,000 gauss. Peak handling capacity 20 watts. v.c.i. 15 ohms. Frequency range 18-20,000 c.p.s. Price £11 7s. 6d.

Ultra Twelve 12-in. fibre curvilinear cone, bakelised apex. Foam surround. Voice coil $1\frac{1}{2}$ in. Gap flux 17,000 gauss. Aluminium voice coil and drive. Handling capacity 20 watts. v.c.i. 15 ohms. Frequency range 20-25,000 c.p.s. Price £17 10s.

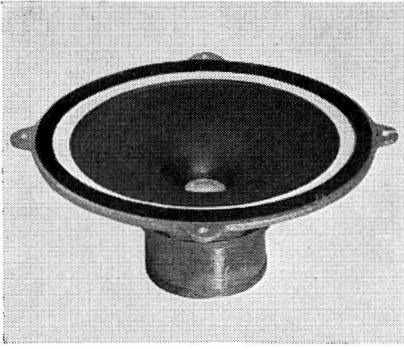
15-in./CS Auditorium. Fibre cone, bakelised apex. Foam surround. Voice coil 2 in. Gap flux 17,000 gauss. Handling



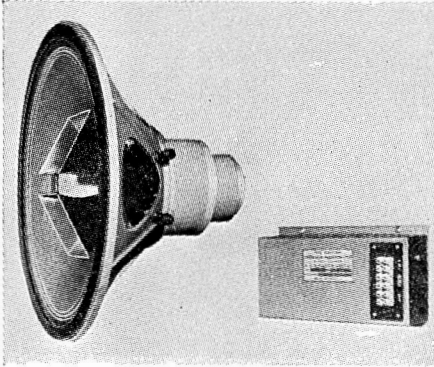
Altobass 2000



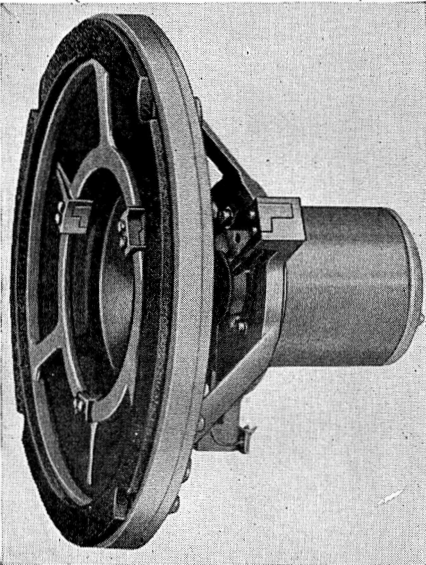
Bakers' Duode 12C



Bakers Selhurst Ultra Twelve



B.T.H. K10A and crossover



Goodmans Axiom 80

capacity 15 watts. v.c.i. 8 or 15 ohms. Frequency range 20-13,000 c.p.s. r.c.f. 5,000 c.p.s. Price £18.

Ultrasonic 3½-in. bakelised cone. Foam surround. Voice coil 1 in. (aluminium). Gap flux 18,000 gauss. Handling capacity 12 watts above 1,000 c.p.s. v.c.i. 15 ohms. Frequency range 1,000-25,000 c.p.s. r.c.f. 1,600 or 3,000 c.p.s. or by 3µF condenser. Price £8 4s. 3d. (U.K. purchase tax £3 3s. 3d.).

★

Beam-Echo Ltd., Witham, Essex. Tel.: Witham 3184. Cables : Beamec, Witham.

Avantic PXD. 33. 15 in. Paper cone, foam suspension. Voice coil 3 in. Gap flux 15,000 gauss. Total flux 180,000 maxwells. Handling capacity 20 watts. v.c.i. 12-15 ohms. Frequency range 20-5,000 c/s. r.c.f. 400 c.p.s. Price to be announced.

★

B.T.H. Sound Equipment Ltd., Reynolds House, 5 Great Newport Street, London, W.C.2. Tel.: TEMple Bar 0016.

K10A. 18 in. Coaxial. (L.F.) paper cone felt surround, (H.F.) hemispherical aluminium diaphragm, horn loaded. Voice coil (L.F.) 2½ in., (H.F.) 1½ in. Gap flux (L.F.) 14,300 gauss, (H.F.) 13,000 gauss. Total flux (L.F.) 285,000 maxwells, (H.F.) 48,000 maxwells. Handling capacity 20 watts. v.c.i. 10 ohms. Frequency range, minimum of 50-15,000 c.p.s. depending on cabinet. Supplied only with own crossover unit operating at 1,700 c.p.s. with 15 ohms input. Price complete £45.

★

C.Q. Audio Ltd., 2 Sarnesfield Road, Enfield, Middx. Tel.: Enfield 8262.

LS.95. 9 × 5 in. elliptical, paper cone, corrugated surround. Voice coil ¾ in. Total flux 11,000 maxwells. Handling capacity 6 watts v.c.i. 15 ohms. Frequency range 40-9,000 c.p.s. r.c.f. 4,000 c.p.s. Price £3 10s. (U.K. purchase tax £1 7s. 6d.).

LS. 4/H.F. Unit. 4 in. paper cone, corrugated surround. Handling capacity 6 watts. v.c.i. 15 ohms. Frequency range 3,000-20,000 c.p.s. r.c.f. approx. 4,000 c.p.s.; 6µF condenser recommended when used with LS.95.

★

Duode Ltd., BCM/Duode, London, W.C.1.

Duode 12C. 12-in. Linen moulded cone. Foamed plastic surround. Voice coil 1.5 in. Gap flux 17,000 gauss. Total flux 190,000 lines. Handling capacity 15 watts. v.c.i. 15-8-5 ohms. Frequency range 20-16,000 c.p.s. Price £20.

Duode 12 B-C. 12-in. Linen moulded cone. Foamed plastic surround. Voice coil 1.5 in. Gap flux 14,500 gauss. Total flux 130,000 lines. Handling capacity 15 watts. v.c.i. 15-8-5 ohms. Frequency range 20-16,000 c.p.s. Price £15.

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Goodmans Industries Ltd., Axiom Works, Wembley, Middx. Tel.: Wembley 1200, Cables: Goodaxiom, Wembley.

Axiette. 8-in. Paper cone. Plastic treated surround. Voice coil 1 in. (2.5 cms). Gap flux 15,000 gauss. Handling capacity 6 watts. v.c.i. 3 ohms or 15 ohms. Frequency range 40-15,000 c.p.s. Price £5 (U.K. purchase tax £1 18s. 6d.).

Axiom 80. 9½ in. Paper cone, free edge surround. Voice coil 1 in. (2.5 cms). Gap flux 17,000 gauss. Total flux 62,600 maxwells. Handling capacity 6 watts. v.c.i. 15 ohms. Frequency range 20-20,000 c.p.s. Price £17 10s. (U.K. purchase tax £6 14s. 9d.)

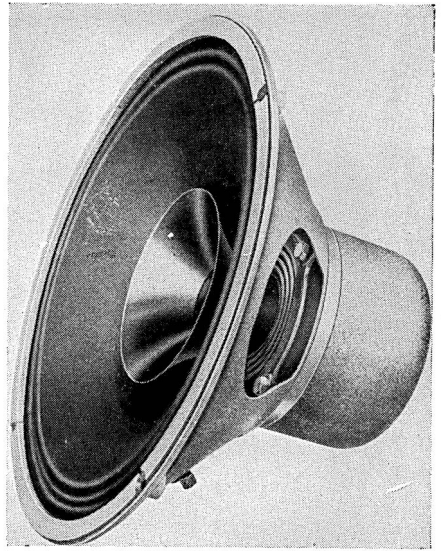
Audiom 60. 12-in. Paper cone. Paper surround. Voice coil 1½ in. (4.4 cms). Gap flux 14,000 gauss. Total flux 158,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range up to 7,000 c.p.s. r.c.f. 750 c.p.s. when used as bass speaker in multi-speaker systems. Price £9 2s. 9d.

Audiom 70. 12-in. Paper cone. Paper surround. Voice coil 1½ in. (4.4 cms). Gap flux 17,500 gauss. Total flux 195,000 maxwells. Handling capacity 20 watts. v.c.i. 15 ohms. Frequency range up to 7,000 c.p.s. r.c.f. 750 c.p.s. when used as bass speaker in multi-speaker systems. Price £14 10s.

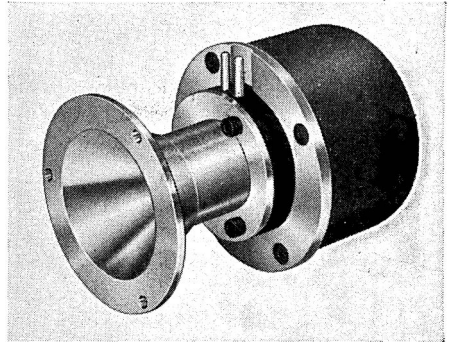
Axiom 300. 12 in. Twin diaphragm, paper cone. Plastic treated surround. Voice coil 1½ in. Gap flux 14,000 gauss. Total flux 158,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range 30-16,000 c.p.s. Built-in mechanical cross-over network at 5,000 c.p.s. Price £11 5s. 9d.

Axiom 400. 12 in. Twin diaphragm, paper cone. Plastic treated surround. Voice coil 1½ in. Gap flux 17,500 gauss. Total flux 195,000 maxwells. Handling capacity 20 watts. v.c.i. 15 ohms. Frequency range 30-16,000 c.p.s. Built-in mechanical cross-over network at 5,000 c.p.s. Price £16 1s.

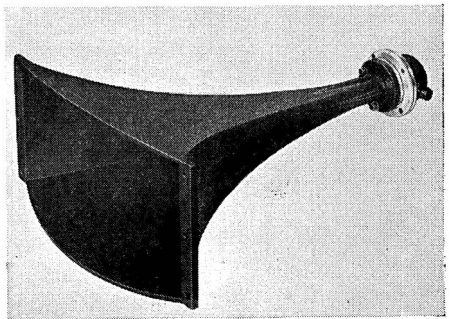
Audiom 80. 15-in. Paper cone. Paper surround. Voice coil 2 in. (5 cms). Gap flux 14,500 gauss. Total flux 215,000 maxwells. Handling capacity 25 watts.



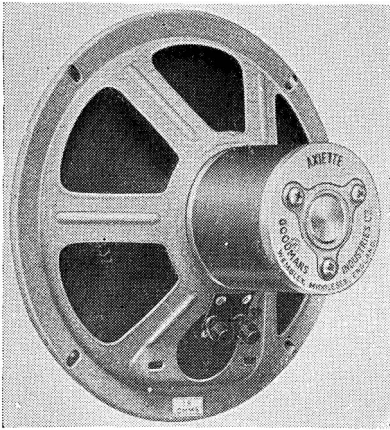
Goodmans Axiom 150 Mk. 2



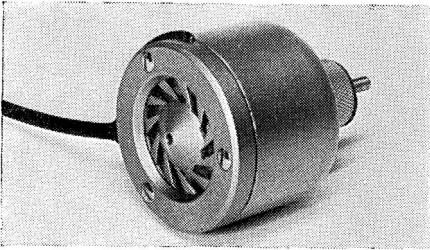
Goodmans Trebax



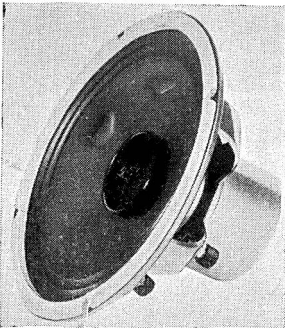
Goodmans Midax



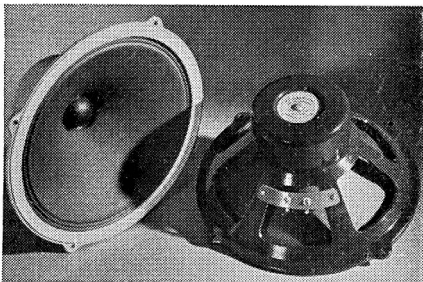
Goodmans Axiette



G.E.C. HF presence unit



G.E.C. metal cone unit



Grampian 1255/15

v.c.i. 15 ohms. Frequency range up to 7,000 c.p.s. r.c.f. 750 c.p.s. when used as bass speaker in multi-speaker systems. Price £22 10s.

Midax. Horn-loaded pressure mid-range unit. Resin impregnated linen diaphragm. Voice coil $1\frac{1}{2}$ in. Suitable for inclusion in systems of up to 25 watts. v.c.i. 15 ohms at 400 c.p.s. Frequency range 400-8,000 c.p.s. r.c.f. 750 c.p.s. and 5 Kc/s. Price £11 16s.

Trebax. Horn-loaded pressure Tweeter. Aluminium diaphragm. Voice coil 1 in. Handling capacity suitable for inclusion in systems of up to 25 watts. v.c.i. 15 ohms at 10 kc/s. Frequency range 2,500-16,000 c.p.s. r.c.f. 5 Kc/s. Price £6 4s.

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General Electric Co. Ltd., Magnet House, Kingsway, W.C.2. Tel. : Temple Bar 8000. Cables : Polyphase, London.

Metal Cone Speaker. BCS1851. 8-in. Duralumin cone. P.V.C. surround. Voice coil 1 in. Gap flux 13,500 gauss. Total flux 53,400 maxwells. Handling capacity 6 watts continuous, 12 watts peak. v.c.i. 4.1 ohms at 400 c.p.s. Frequency range 30-20,000 c.p.s. Price £6 13s. 7d. (U.K. purchase tax £2 11s. 5d.)

Presence Unit BCS1852. Miniature metallised pressure diaphragm. Surround integral with diaphragm. Overall dia. $1\frac{1}{8}$ in. Voice coil $\frac{3}{4}$ in. Gap flux 10,500 gauss. Total flux 26,000 maxwells. Handling capacity 3 watts max. continuous at 5 Kc/s. v.c.i. 15 ohms. Frequency range 1,000-15,000 c.p.s. Price £3 19s. 6d. including condenser and mounting components.

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Grampian Reproducers Ltd., Hanworth Trading Estate, Middx. Tel. : Feltham 2657/8/9. Cables : Reamp, Feltham.

Grampian 1255/15. 12-in. Paper impregnated cone and surround. Voice coil $1\frac{1}{2}$ in. Gap flux 14,500 gauss. Total flux 130,500 maxwells. Handling capacity 10 watts. v.c.i. 15 ohms. Frequency range 20-15,000 c.p.s. Price : £9.

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The Lowther Manufacturing Co., Lowther House, St. Mark's Road, Bromley, Kent. Tel. : Ravensbourne 5225. Cables : Lowther, Bromley.

P.M.6. 6-in. Selected paper cone. Plastic surround. Voice coil 39 mm. Gap

flux 17,500 gauss. Total flux 196,000 maxwells. Handling capacity 6 watts. v.c.i. 15 ohms. Frequency range 10-18,000 c.p.s. Price £18 18s.

P.M.2. Mk.I. 6-in. Selected paper cone. Plastic surround. Voice coil 39 mm. Gap flux 21,000 lines per sq. cm. Total flux 281,000 maxwells. Handling capacity 6 watts. v.c.i. 15 ohms. Frequency range 10-20,000 c.p.s. Price £30.

PM 2 Mk. II. 6 in. Selected paper cone. Plastic foam surround. Voice coil 39 mm. Gap flux 23,000 gauss. Total flux 350,000 maxwells. Handling capacity 6 watts. v.c.i. 15 ohms. Frequency range 10-22,000 c.p.s. Price £40.

P.M.3. 6-in. selected paper cone. Plastic surround. Voice coil 39 mm. Gap flux 22,000 gauss. Total flux 307,750 maxwells. Handling capacity 6 watts. v.c.i. 15 ohms. Frequency range 10-20,000 c.p.s. Not sold separately from enclosure type T.P.1.

P.M.4. 6-in. Selected paper cone. Plastic surround. Voice coil 39 mm. Gap flux 24,500 gauss. Total flux 385,000 maxwells. Handling capacity 6 watts. v.c.i. 15 ohms. Frequency range 10-20,000 c.p.s. Price £48.

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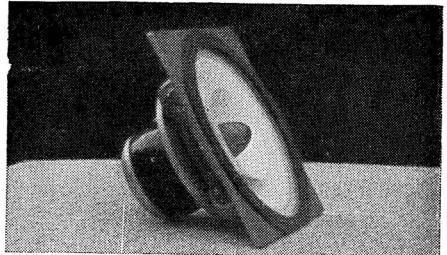
Philips Electrical Ltd., Century House, Shaftesbury Avenue, W.C.2. Tel.: Gerrard 7777. Cables : Phillamps, London.

9710. 8 in. Paper cone corrugated surrounds. Voice coil 1 in. Gap flux 8,000 gauss. Total flux 97,000 maxwells. Handling capacity 10 watts. v.c.i. 7 ohms. Frequency range 40-10,000 c.p.s. r.c.f. 500-1,000 c.p.s. Price £4 8s. 5d. (U.K. purchase tax £1 14s. 1d.)

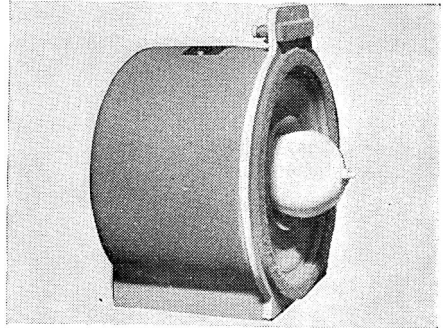
9710 M. 8-in. Dual cone. Paper corrugated surround. Voice coil 1 in. Gap flux 8,000 gauss. Total flux 97,000 maxwells. Handling capacity 10 watts. v.c.i. 7 ohms. Frequency range 40-18,000 c.p.s. r.c.f. 500-1,000 c.p.s. Price £4 18s. 7d. (U.K. purchase tax £1 17s. 11d.)

9762. 12-in. Paper cone. Corrugated surround. Voice coil 1½ in. Gap flux 11,000 gauss. Total flux 134,000 maxwells. Handling capacity 20 watts. v.c.i. 7 ohms. Frequency range 40-10,000 c.p.s. r.f.c. 500-1,000 c.p.s. Price £10.

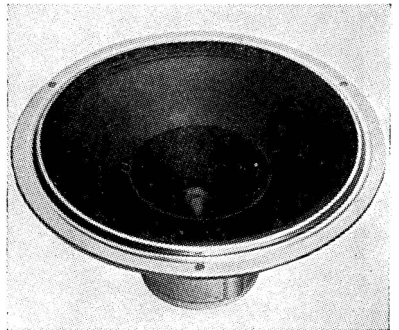
9762M. 12-in. Dual cone. Paper. Corrugated surround. Voice coil 1½ in. Gap flux 11,000 gauss. Total flux 134,000 maxwells. Handling capacity 20 watts. v.c.i. 7 ohms. Frequency range 40-18,000 c.p.s. Price £10 10s.



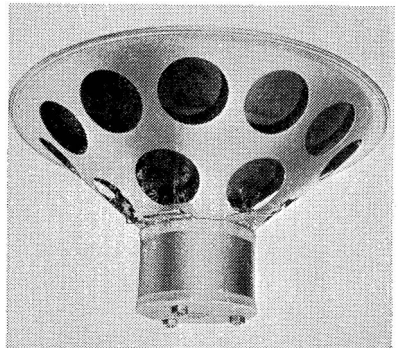
Lowther P.M.6



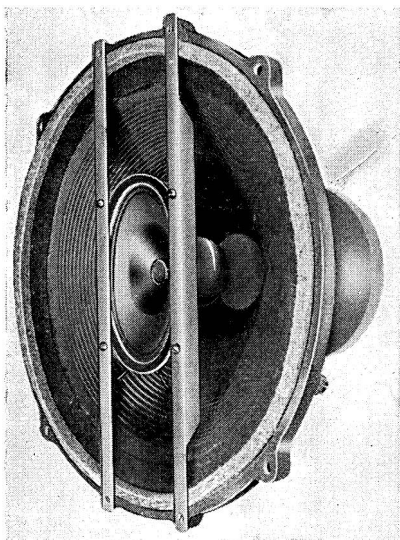
Lowther P.M.3



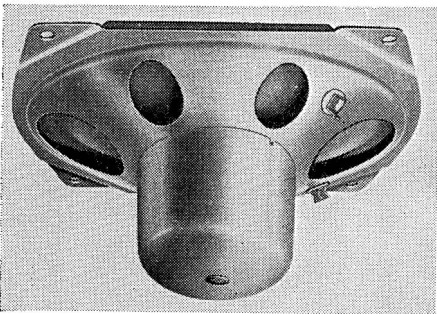
Philips 9710M



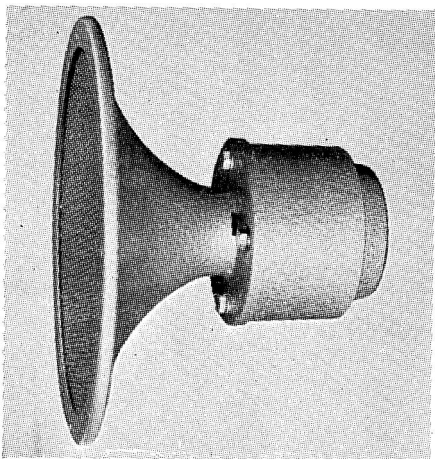
Philips 9762M



Plessey 15-in. Dual Concentric



Plessey Six-Four tweeter



Tannoy H.F. unit

Plessey Co. Ltd., Vicarage Lane, Ilford, Essex. Tel. : Ilford 3040. Cables: Plessey,

Single-twelve. CP73012/10. 12-in. Moulded fibre cone. Surround corrugations integral with cone. Voice coil 1 in. Gap flux, 10,000 gauss. Total flux 33,000 maxwells. Handling capacity 10 watts. v.c.i. 15 ohms. Frequency range 40-7,000 c.p.s. r.c.f. 2,000 c.p.s. Price £4 14s. 3d.

Dual-twelve. CP73020/12/1. 12-in. bass unit, 6 in. by 4 in. treble unit. Moulded fibre cones. Surround corrugations integral with cone. Voice coil (L.F.) 1 in. (H.F.) $\frac{3}{4}$ in. Gap flux, L.F. 12,000 and H.F. 8,500 gauss. Total flux (L.F.) 40,000 (H.F.) 17,000 maxwells. Handling capacity 10 watts. v.c.i. 15 ohms. Frequency range 40-17,000 c.p.s. Built-in crossover at 2,000 c.p.s. Price £7 2s. 6d.

Single-fifteen/12. CP73025/12/7. 15-in. Moulded fibre cone with concentric corrugations. Velour surround. Voice coil 2 in. Gap flux 12,000 gauss. Total flux 152,500 maxwells. Handling capacity 20 watts. v.c.i. 15 ohms. Frequency range 25-3,000 c.p.s. Price £15 10s.

Single-fifteen/15. CP73025/15/1. 15 in. Moulded fibre cone with concentric corrugations. Velour surround. Voice coil 2 in. Gap flux 15,000 gauss. Total flux 230,000 maxwells. Handling capacity 25 watts. v.c.i. 15 ohms. Frequency range 25-3,000 c.p.s. r.c.f. 2,000 c.p.s. Price £22 10s.

Dual-fifteen. CP73021/2. 15-in. bass unit, 6 in. by 4 in. treble unit. Moulded fibre cone with concentric corrugations. Velour surround. Voice coil 2 in. Gap flux 15,000 gauss. Total flux 230,000 maxwells. Handling capacity 25 watts. v.c.i. 15 ohms. Frequency range 25-17,000 c.p.s. Built-in crossover at 2,000 c.p.s. Price £24 7s. 6d.

Six Four/H.F. Unit. CP73001/12/20. 6 in. by 4 in. elliptical curvilinear moulded fibre cone. Surround corrugations integral with cone. Voice coil $\frac{3}{4}$ in. Gap flux 12,000 gauss. Total flux 24,000 maxwells. Handling capacity 5 watts. v.c.i. 5 ohms. Frequency range 1,000-17,000 c.p.s. r.c.f. 2,000 c.p.s. Price including U.K. purchase tax £1 18s. 8d.

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Romagna Reproducers Ltd., 2 Sarnesfield Road, Enfield, Middx. Tel.: Enfield 8262.

Kelly Ribbon H.F. Speaker Mk. II.

Junior. Catenodal horn, mouth 8 in. by 4 in. Aluminium foil ribbon. Gap flux

10,000 gauss. Handling capacity 10 watts. v.c.i. via built-in transformer, 15 ohms. Frequency range 2,500-25,000 c.p.s. r.c.f. 3,000 c.p.s. Price £10 10s.

In Preparation

Senior as the Junior, but with larger magnet increasing the response up to 30,000 c.p.s. and handling capacity to 15 watts. Price £15 15s.

★

Sound Sales Ltd., Works and Acoustic Laboratories, West Street, Farnham, Surrey, England. Tel. : Farnham 6461/2/3. Cables: Sounsense.

Dual Suspension Auditorium. Models A and B. 12-in. paper cone. Very flexible velvet surround plus dual suspension spider. Voice coil working in 0.06 in. by $\frac{1}{4}$ in. deep gap, maximum effective travel $\frac{3}{8}$ in. Gap flux 10,600 gauss. Total flux 95,000 maxwells. Handling capacity 12 watts in suitable enclosure. v.c.i. model A 15 ohms ; model B 3 ohms. Frequency range 30-13,500 c.p.s. with suitable mounting. r.c.f. about 3,000 c.p.s. Price £9 13s. 4d.

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Tannoy Products Ltd., West Norwood, London, S.E.27. Tel. : Gipsy Hill 1131. Cables : Tannoy, London.

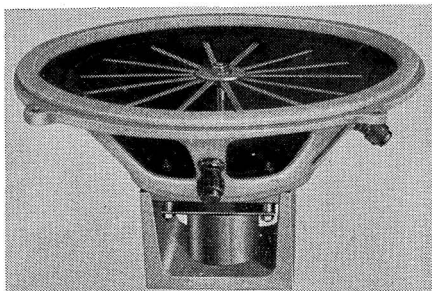
12-in. Low Frequency Unit. Moulded fibre cone. Plastic treated surround. Voice coil 2 in. Gap flux 10,000 gauss. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range 35-4,000 c.p.s. r.c.f. 1,700 c.p.s. Price £14 14s.

15-in. Low Frequency Unit. Moulded fibre cone. Plastic treated surround. Voice coil 2 in. Gap flux 12,000 gauss. Handling capacity 25 watts. v.c.i. 15 ohms. Frequency range 30-3,000 c.p.s. r.c.f. 1,000 c.p.s. Price £21 10s.

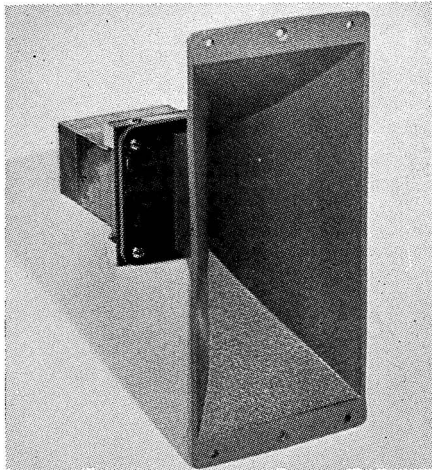
Direct Radiator. 12-in. moulded fibre cone. Plastic treated surround. Voice coil 2 in. Gap flux 14,000 gauss. Handling capacity 15 watts. v.c.i. 20 ohms. Frequency range 40-16,000 c.p.s. Price £14 14s.

Dual Concentric. 12 in. cone. Moulded fibre with plastic treated surround (L.F.). Light alloy plastic coated diaphragm horn loaded (H.F.). Voice coil both 2 in. Gap flux (L.F.) 10,000 gauss (H.F.) 15,000 gauss. Handling capacity 15 watts. v.c.i. via cross-over 18 ohms. Frequency range 30-20,000 c.p.s. r.c.f. 1,700 c.p.s. Price £39 15s.

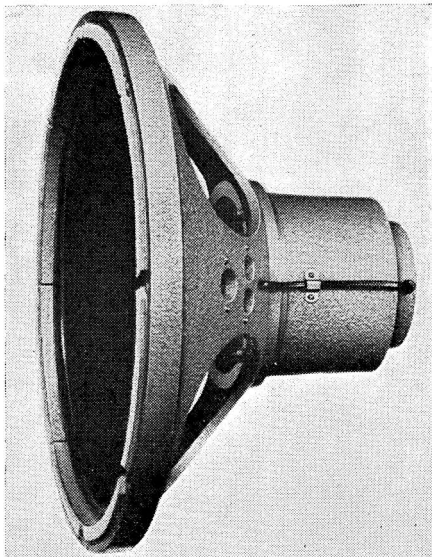
Dual Concentric. 15 in. cone. Moulded fibre with plastic treated surround (L.F.).



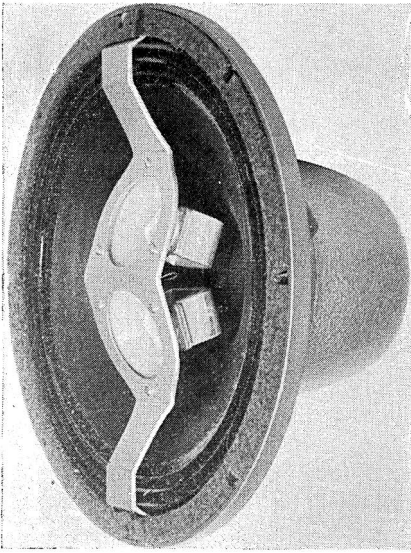
Sound Sales Dual Suspension Auditorium



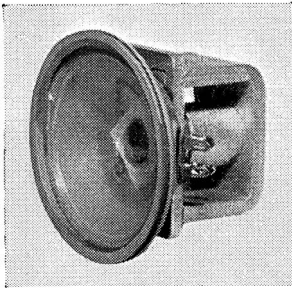
Kelly Ribbon Mk. II



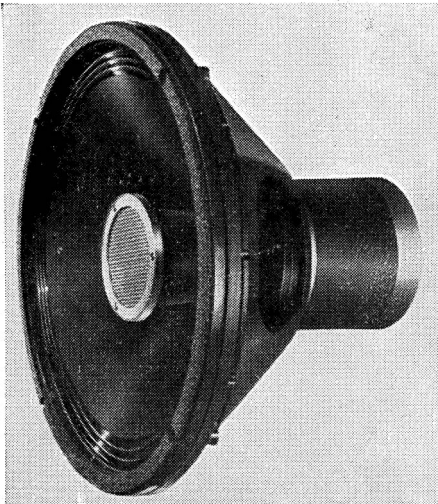
Tannoy 15-in. Dual Concentric



TSL-Lorenz LP312-2



*TSL-Lorenz
LPH65
Tweeter*



Vitavox DU120 Duplex

Light alloy plastic coated diaphragm horn loaded (H.F.). Voice coil both 2 in. Gap flux (L.F.) 12,000 gauss (H.F.) 18,000 gauss. Handling capacity 25 watts. v.c.i. via crossover 15 ohms. Frequency range 25-20,000 c.p.s. r.c.f. 1,000 c.p.s. Price £37 10s.

High Frequency Speaker Unit. Horn loaded plastic coated light alloy diaphragm. Voice coil 2 in. Gap flux 15,000 gauss. Handling capacity 20 watts above 1,000 c.p.s. v.c.i. 15 ohms. Frequency range 25-20,000 c.p.s. r.c.f. 1,000 c.p.s. Price £18.

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Technical Suppliers Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel.: Shepherds Bush 2581/4794.

TSL-Lorenz. LP. 215. 8-in. Reinforced paper cone. Permafex surround. Voice coil 1 in. Handling capacity 8 watts, peak load 12 watts. v.c.i. 4.5 ohms. Frequency range 35-12,000 c.p.s. Price £4 19s. 6d. (U.K. purchase tax £1 18s. 4d.)

LP. 312-2. 12-in. Reinforced ribbed paper cone. Permafex surround. Voice coil 1½ in. Handling capacity 25 watts. (Peak rating in suitable enclosure 40 watts.) c.c.i. 15 ohms. Frequency range 20 to above 17,000 with 2 type LPH 65 treble speakers in a fitted bridge assembly. r.c.f. 3,000-5,000 v.p.s. Price £14 19s. 6d.

TSL-Lorenz Tweeter LPH 65. 2¾ in. Special plastic cone. Plastic surround. Voice coil ½ in. Handling capacity 2 watts (H.F. only). v.c.i. 5.5 ohms. Frequency range 2,000 to above 17,000 c.p.s. r.c.f. 3,000-5,000 c.p.s. Price £1 8s. 6d. (U.K., purchase tax 11s.)

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Vitavox Ltd., Westmoreland Road, London, N.W.9. Tel.: Colindale 8671. Cables: Vitavox, Hyde, London.

Duplex Coaxial DU 120. 12-in. and 3-in. Paper and polyester film cones and surround. Voice coil (L.F.) 1.75 in., (H.F.) 0.650 in. Gap flux (L.F.) 14,000, (H.F.) 12,000 gauss. Total flux (L.F.) 160,000, (H.F.) 15,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range 40-15,000 c.p.s. nominal. Price £19 10s.

AK.120. 12 in. Paper cone. Paper surround. Voice coil 1.78 in. Gap flux 14,000 gauss. Total flux 160,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range 40-12,000 c.p.s. r.c.f. 1,000 c.p.s. Price £14.

K15/40. 15 in. Paper cone. Paper surround. Voice coil 2.25 in. Gap flux 14,000 gauss. Total flux 260,000 maxwells. Handling capacity 40 watts. v.c.i. 15 ohms. Frequency range 40-10,000 c.p.s. r.c.f. 500 c.p.s. Price £25.

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Wharfedale Wireless Works Ltd., Idle, Bradford. Tel. : Idle 1235-6. Cables : Wharfedel, Idle, Bradford.

8-in. Bronze/FS/AL. Paper cone. Foam plastic surround. Voice coil 1 in. (aluminium). Gap flux 10,000 gauss. Total flux 39,500 maxwells. Handling capacity 4 watts. v.c.i. 2-3 ohms or 8-10 ohms. Frequency range 40-10,000 c.p.s. Price £3 5s. (U.K. purchase tax £1 6s.)

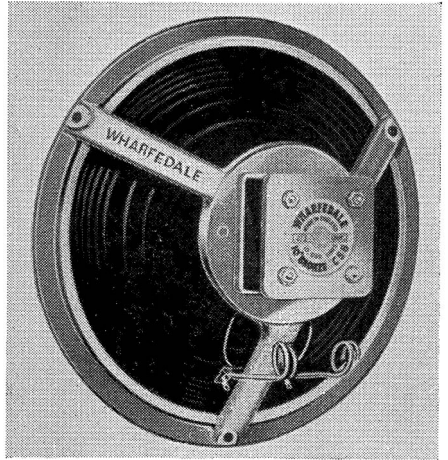
Super 8. 8-in. Paper cone. Surround, paper corrugations. Voice coil 1 in. Gap flux 13,000 gauss. Total flux 54,000 maxwells. Handling capacity 6 watts. v.c.i. 2-3 or 12-15 ohms. Frequency range 40-12,000 c.p.s. r.c.f. 10,000 c.p.s. Price £4 10s. (U.K. purchase tax £1 15s. 11d.)

Super 8/FS. 8-in. Paper cone. Foam plastic surround. Voice coil 1 in. Gap flux 13,000 gauss. Total flux 54,000 maxwells. Handling capacity 5 watts. v.c.i. 2-3 or 12-15 ohms. Frequency range 40-12,000 c.p.s. Price £5. (U.K. purchase tax £1 19s. 11d.)

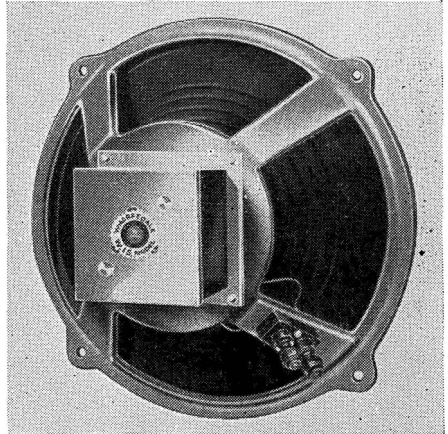
Super 8/FS/AL. 8 in. Paper cone. Foam plastic surround. Aluminium voice coil, 1 in. Gap flux 13,000 gauss. Total flux 54,000 maxwells. Handling capacity 4 watts. v.c.i. 2-3 or 8-10 ohms. Frequency range 40-14,000 c.p.s. Price £5 5s. (U.K. purchase tax £2 1s. 11d.)

10-in. Bronze/FSB. Paper cone with bakelised apex. Foam plastic surround. Voice coil 1 in. Gap flux 10,000 gauss. Total flux 39,500 maxwells. Handling capacity 6 watts. v.c.i. 2-3 or 12-15 ohms. Frequency range 30-10,000 c.p.s. Price £3 19s. 6d. (U.K. purchase tax £1 11s. 9d.)

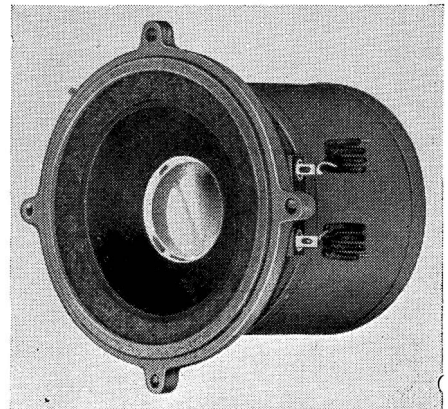
Golden/FSB. 10-in. Paper cone with bakelised apex. Foam plastic surround. Voice coil 1 in. Gap flux 13,000 gauss. Total flux 54,000 maxwells. Handling capacity 8 watts. v.c.i. 2-3 or 12-15 ohms. Frequency range 30-12,000 c.p.s. Price £6 5s. (U.K. purchase tax £2 9s. 11d.)



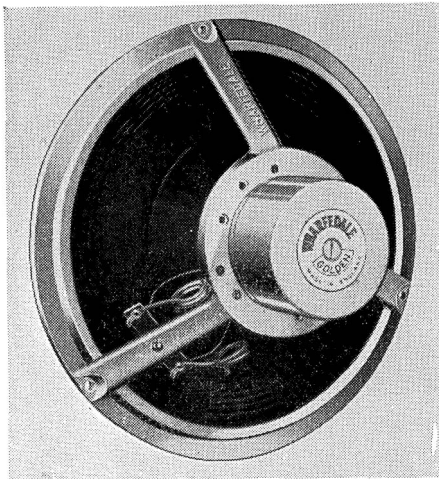
Wharfedale Bronze/FSB



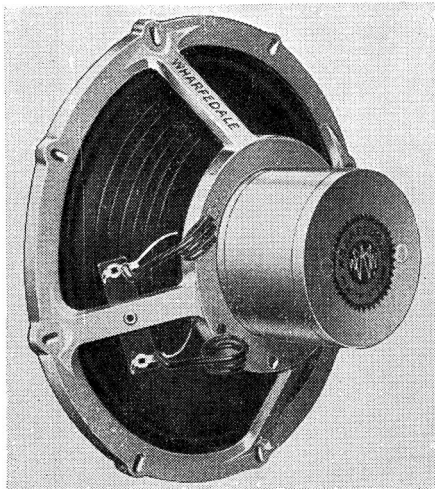
Wharfedale W15/FS



Wharfedale Super 3



Wharfedale Golden|FSB



Wharfedale Super 8

W10/FSB. 10-in. Paper cone with bakelised apex. Foam plastic surround. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 74,000 maxwells. Handling capacity 10 watts. v.c.i. 2-3 or 12-15 ohms. Frequency range 30-14,000 c.p.s. Price £9 7s. 6d. (U.K. purchase tax £3 14s. 10d.)

W12/FS. 12-in. Paper cone with bakelised apex and aluminium dome. Foam plastic surround. Voice coil 1½ in. Gap flux 13,000 gauss. Total flux 145,000 maxwells. Handling capacity 12 watts. v.c.i. 12-15 ohms. Frequency range 30-10,000 c.p.s. Price £10 5s.

Super 12/FS/AL. 12-in. Paper cone with bakelised apex. Foam plastic surround. Voice coil 1½ in. (aluminium). Gap flux 17,000 gauss. Total flux 190,000 maxwells. Handling capacity 12 watts. v.c.i. 12-15 ohms. Frequency range 30-14,000 c.p.s. Price £17 10s.

W 15/FS. 15-in. Paper cone. Foam plastic surround. Voice coil 2 in. Gap flux 13,500 gauss. Total flux 180,000 maxwells. Handling capacity 15 watts. v.c.i. 12-15 ohms. Frequency range 20-2,000 c.p.s. r.c.f. 800 c.p.s. Price £17 10s.

Super 3. 3-in. Bakelised paper cone with aluminium dome. Foam plastic surround. Voice coil 1 in. (aluminium). Gap flux 13,000 gauss. Total flux 54,000 maxwells. Handling capacity 6 watts above 1,000 c.p.s. v.c.i. 2-3 or 8-15 ohms. Frequency range 3,000-20,000 c.p.s. r.c.f. 4,000 c.p.s. Price £5. (U.K. purchase tax £1 19s. 11d.)

★

Messrs. Whiteley Electrical Radio Co. Ltd., Victoria Street, Mansfield, Notts. Tel. : Mansfield 1762-5. Cables : Whitebon, Mansfield.

Stentorian HF.812. 8-in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12000, gauss. Total flux 47,000 maxwells. Handling capacity 5 watts. v.c.i. universal (3, 7.5 and 15 ohms). Frequency range, 50-12,000 c.p.s. Price £2 19s. 6d. (U.K. purchase tax £1 4s.)

H.F.816. 8-in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. Handling capacity 6 watts. v.c.i. universal 3 ohms, 7.5 ohms and 15 ohms. Frequency range 50-14,000 c.p.s. Price £4 17s. 7d. (U.K. purchase tax £1 19s. 5d.)

T.816. 8-in. Paper cone and surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range up to 17,000 c.p.s. r.c.f. 1,500 c.p.s. Price £4 12s. 7d. (U.K. purchase tax £1 17s. 5d.)

HF.912. 9-in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. Handling capacity 7 watts. v.c.i. universal (3, 7.5 and 15 ohms). Fre-

quency range 40-13,000 c.p.s. Price £3 3s. (U.K. purchase tax £1 5s. 6d.)

HF. 1012. 10-in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. Handling capacity 10 watts. v.c.i. universal 3 ohms, 7.5 ohms and 15 ohms. Frequency range 30-14,000 c.p.s. r.c.f. 3,000 c.p.s. Price £3 11s. (U.K. purchase tax £1 8s. 9d.)

HF. 1016. 10 in. Composite paper and cambric cone. Cambric surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. Handling capacity 10 watts. v.c.i. 3, 7.5 and 15 ohms. Frequency range 30-15,000 c.p.s. Price £5 13s. 11d. (U.K. purchase tax £2 6s. 1d.).

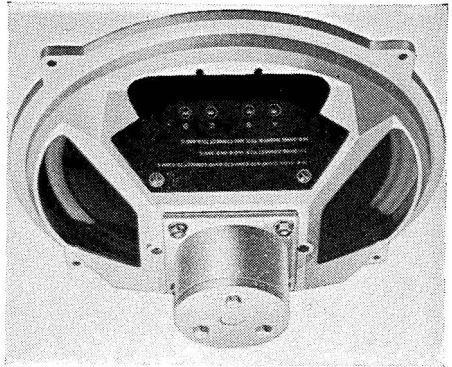
10-in. Concentric Duplex. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux (L.F.) 12,000 gauss, (H.F.) 13,000 gauss. Total flux 95,000 maxwells. Handling capacity 7 watts. v.c.i. 15 ohms. Frequency range 30-14,000 c.p.s. r.c.f. 3,000 c.p.s. Price £7 16s. 4d. (U.K. purchase tax £3 3s. 2d.)

HF.1214. 12-in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1.5 in. Gap flux 14,000 gauss. Total flux 106,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range 25-14,000 c.p.s. r.c.f. 3,000 c.p.s. Price £9 15s. 6d.

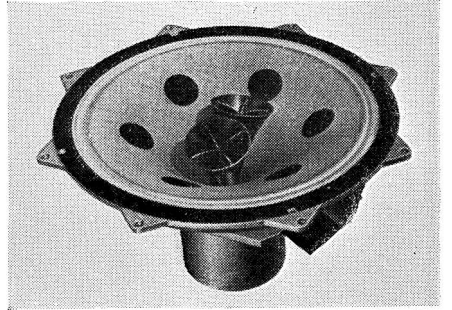
12-in. Concentric Duplex. Composite (paper and cambric) cone. Cambric surround. Voice coil 1½ in. Gap flux (L.F.) 14,000 gauss, (H.F.) 17,000 gauss. Total flux 220,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range 25-17,000 c.p.s. r.c.f. 3,000 c.p.s. Price £25.

15-in. Concentric Duplex. Composite paper and cambric cone. Cambric surround. Voice coil 2 in. Gap flux (L.F.) 14,000 gauss (H.F.) 17,000 gauss. Total flux 350,000 maxwells. Handling capacity 25 watts. v.c.i. 15 ohms. Frequency range 20-18,000 c.p.s. r.c.f. 3,000 c.p.s. Price £40 3s.

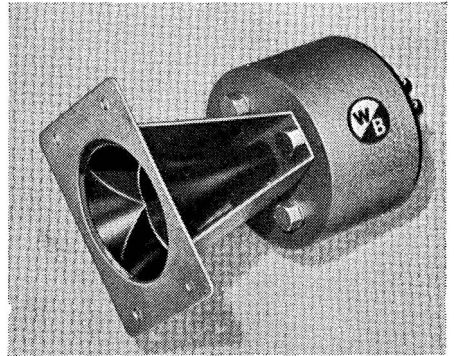
HF.1514. 15-in. Composite (paper and cambric) cone. Cambric surround. Voice coil 2 in. Gap flux 14,000 gauss. Total flux 178,000 maxwells. Handling capacity 25 watts. v.c.i. 15 ohms. Frequency range 25-4,000 c.p.s. r.c.f. 1,500-3,000 c.p.s. Price £24 10s.



Whiteley HF 1012



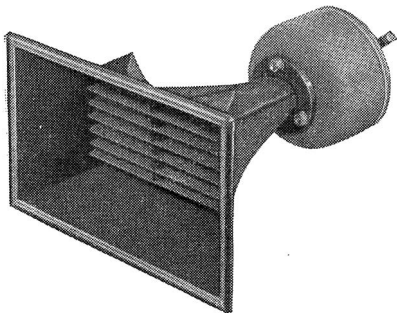
Whiteley 15-in. Concentric Duplex



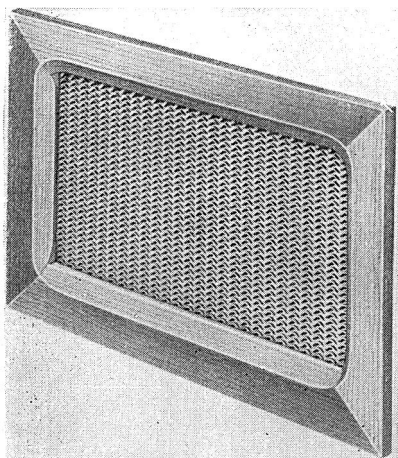
Whiteley T12 tweeter

T.10 Tweeter. Alloy cone and surround. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 44,600 maxwells. Handling capacity 5 watts. v.c.i. 15 ohms. Frequency range 2,000-14,000 c.p.s. r.c.f. 3,000 c.p.s. Price £4 4s.

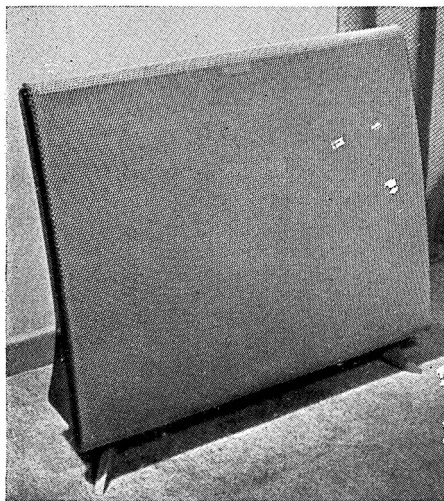
T.12 Tweeter. Alloy cone and surround. Voice coil 1.5 in. Gap flux 16,000 gauss. Total flux 110,000 maxwells. Handling capacity 15 watts. v.c.i. 15 ohms. Frequency range 3,000-17,000 c.p.s. r.c.f. 3,000 c.p.s. Price £12 12s.



Westrex H.F. unit



Goodmans acoustical resistance unit



Quad electrostatic loudspeaker

Westrex Co. Ltd., Liberty House, Regent Street, London, W.1. Tel. : Regent 1001. Cables : Westelcol, Norphone, London.

20/80 Low Frequency Unit. 15-in paper cone with damped surround and spider. Voice coil 3 in. of edgewound copper ribbon. Gap flux 13,200 gauss. v.c.i. 16 ohms. Handling capacity 30 watts. Frequency range up to 800 c.p.s. r.c.f. 675 c.p.s. Price £33 15s.

High Frequency Unit, with acoustilens coupling unit. Horn loaded. Alloy dome on 3-in. voice coil of edgewound aluminium ribbon. Gap flux 17,500 gauss. Handling capacity above 500 c.p.s. up to 30 watts. Frequency range 500 c.p.s. to over 15,000 c.p.s. R.c.f. 675 c.p.s. Speaker includes horn and acoustic lens giving necessary dispersion. Price complete with horn and lens £69 17s.

★

Acoustic Resistance Units

Goodmans Industries Ltd., Axiom Works, Wembley, Middx. Tel. : Wembley 1200. Cables : Goodaxiom. Wembley.

172 ARU Unit. This unit combines both reflex port and acoustic resistance in one complete unit. The port area and resistance are calculated to suit a particular cabinet volume and speaker cone resonance, thus being usable with a variety of cabinet designs and driving units. Price £2 15s. 3d. to £3 16s. 6d.

★

Electrostatic Speakers

Acoustical Manufacturing Co. Ltd., St. Peter's Road, Huntingdon, Hunts. Tel.: Huntingdon 361 and 574. Cables : Acoustical.

Quad Electrostatic Loudspeaker. Full range doublet covering 45 c/s to 18 Kc/s. Attenuation outside band asymptotic to 18 dB/8ve. Total integrated radiation at max. output equivalent to 95 phons in rooms of up to 5,000 cu. ft. with average reverberation. Dispersion approx. 70 deg. horizontal ; 15 deg. vertical. Impedance 30-15 ohms, 40 c/s to 8 Kc/s falling above 8 Kc/s. Designed for use with standard Quad II Amplifier or equivalent. Suitable for AC supplies 100-120 or 200-250v. 50-60 c/s. Free standing unit requires no enclosure or cabinet. Weight 35 lb. Price £52 complete.

SPEAKERS, PART 2—ENCLOSURES

Altobass Ltd., Percy Road, Aylestone Park, Leicester. Tel. : Leicester 31616. Cables : Altobass, Leicester.

In preparation

Corner Folded Horn, forward facing 12-in. and 10-in. units, upward facing 1-in. tweeter with diffuser. Available July-August. Price not yet fixed.

Bass Reflex Cabinets for Altobass 200. Dual concentric units. Two types for corner position or free standing. Available June-July. Price not yet fixed.

★

Armstrong Wireless & Television Co., Warters Road, Holloway, London, N.7. Tel. : North 3213.

Armstrong Labyrinth. Folded exponential horn, back loading. Free standing, forward facing. Two drive units. 12-in. bass ; 6-in. treble. Rec. Goodmans Audiom 60 and Plessey tweeter. Crossover 2,200 c/s. Response 20-16,000 c/s. Size 33 in. by 18 in. by 18 in. Weight 92 lb. Price (complete) £30, (without units) £21.

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Bakers "Selhurst" Radio, 24 Dingwall Road, Croydon, Surrey. Tel. : Croydon 2271/2.

A range of phase-inverter enclosures for single and multi-speaker systems. Prices on application.

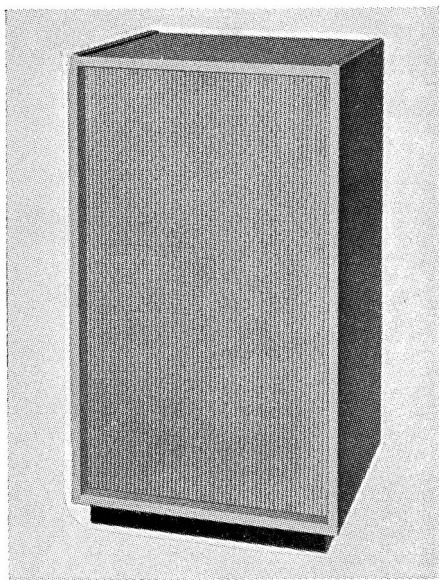
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Beam-Echo Ltd., Witham, Essex. Tel.: Witham 3184. Cables : Beamec, Witham.

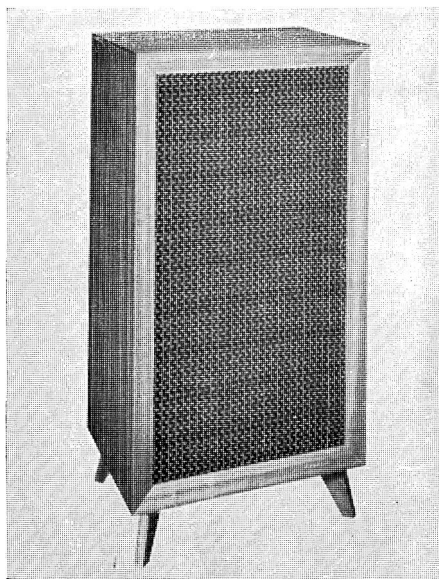
Avantic Mk. 2. Friction loaded vent type. Two drive units. 12-in. dual cone and horn-loaded pressure unit. Crossover 5,000 c/s. Response 35-15 000 c/s. Size 40½ in. by 20½ in. by 14½ in. Weight 82 lb. Price £47 5s.

Avantic Mk. 4. Forward facing reflex enclosure, dual throated ports for corner placing. Three drive units, 12 in. bass, mid-range unit and pressure H.F. unit. Crossover at 400 and 4,000 c.p.s. Response 20-20,000 c.p.s. Size 36 in. by 25 in. by 18 in. Price (complete) £47 5s.

Avantic Mk. 6. Forward facing reflex enclosure, dual throated ports for corner placing. Three drive units, Beam-Echo PXD.33 15 in. bass unit, separate middle and

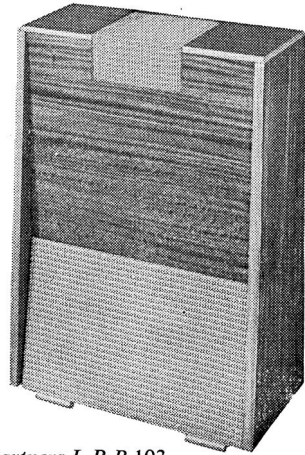


Armstrong Labyrinth

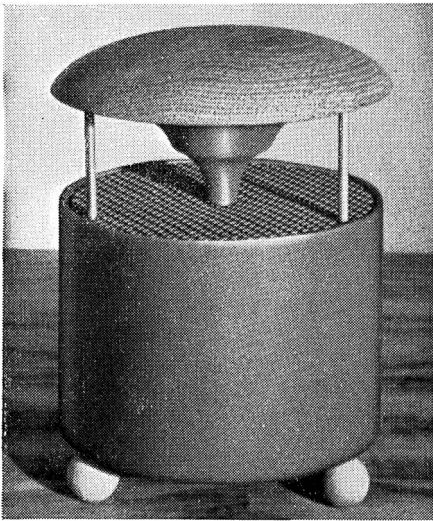


Beam-Echo Avantic Mk. 2

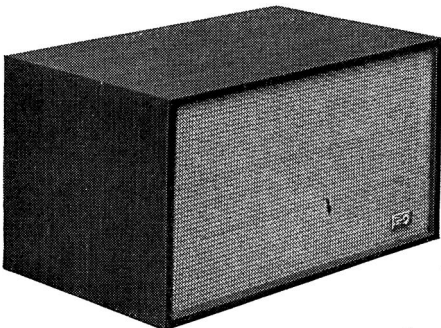
H.F. units. Crossover at 400 and 4,000 c.p.s. Response 20-20,000 c.p.s. Size 45 in. by 33 in. by 22 in. Price (complete) £78 15s.



B.K. Partners L.P.R.103



B.J. "Top C"



CQ enclosure

B.K. Partners Ltd., 229 Regent Street, London, W.1. Tel. : Regent 7363.

L.P.R. 103. Reflex with acoustic filter. Two drive units, with h.f. upward and l.f. direct radiation. Rec. Wharfedale Bronze 10/FSB and Wharfedale Super 3 tweeter. Crossover through 2 mfd filter condenser and level control. Response 35-18,000 c/s. Size 29½ in. by 20 in. by 11 in. (at base). Price (with rec. units) £24 19s. 8d. (U.K. purchase tax £3 11s. 8d.); without units, £12 8s. 6d.

AP.10 and AP.12. Audio Plan speaker unit. Forward facing reflex, designed to accept 12 or 10 in. units with resonance below 40 c.p.s., also some H.F. units. Rec. Tannoy 12 in. dual concentric Vitavox DU.120 ; Wharfedale W.12/FS, Super 12, Bronze 10, etc. Size 24 in. by 18 in. by 18½ in. Weight 42 lb. Price of cabinet only £16 19s. 6d.

★

Burne-Jones & Co. Ltd., 62 Sunningdale Road, Cheam, Surrey. Tel. : Fairlands 8866

B.J. Reproducer Cabinet. Corner horn including reflex loading: a two- or three-speaker system, radiating forwards, also backwards into the corner. Rec. units, Bass units, 10-in. and 8-in. from the Wharfedale and Stentorian ranges, and tweeter if required in space provided. Response, with selected units, 30-20,000 c/s. Size 41½ in. by 35 in. by 18½ in. Price of cabinet £26 16s. 6d. including side panels.

B.J. Reproducer Cabinet R-2. A new horn loaded and reflex reproducer complete with 12-in. drive unit. Response 25-9,000 c.p.s. Price under £30.

B.J. Top "C" Tweeter. Horn loaded omni-directional. To stand on top of any reproducer. Response 2,000-20,000 rec. for use with B.J. R-2 enclosure. Complete with built-in crossover and balance control. Price approx. £5.

★

C.Q. Audio Ltd., 2 Sarnesfield Road, Enfield, Middx. Tel.: Enfield 8262.

"CQ" Enclosure. Controlled "Q" reflex. Forward facing table model with optional screw-in legs. One unit. Wide range 9 in. by 5 in. elliptical. Response 35-10,000 c/s. Size 22 in. by 12 in. by 13 in. Weight 22 lb. Price £9 (U.K. purchase tax £3 12s.).

Senior "CQ." Controlled "Q" reflex. Forward facing table model, with optional

screw-in legs. Wide range 9-in. by 5-in. elliptical, and 4-in. extended range tweeter. Crossover at 7,000 c/s. Response 35-17,000 c/s. Size 22 in. by 12 in. by 13 in. Weight 23 lb. Price £12 (U.K. purchase tax £4 16s.).

“**Tetraq**” treble unit. Two 4 in. tweeters housed in a box with four triangular sides. Range 4,000-20,000 c.p.s., crossover built in. Size 17 in. by 13 in. by 20 in. on 5-in. legs. Price (complete) £4 16s. 6d. (U.K. purchase tax £1 18s. 6d.).

In kit form a speaker system using the flexing walls system. Handling capacity 10 watts. Bass and 2 treble drive units. Size 17 in. by 13 in. by 20 in. on 5-in. legs. Price complete, including U.K. purchase tax £14 14s.

★

Dynatron Radio Ltd., St. Peter's Road, Furze Platt, Maidenhead, Berks. Tel.: Maidenhead 2161 and 5151.

CLS.10. Vented port type. Designed to function as a bass reflex chamber by means of an acoustic filter connected in the base of unit. 12 in. bass and two 5 in. treble units fitted. Range 30-15,000 c.p.s. Size 34 in. by 27½ in. by 13½ in.

★

E.M.I. Sales & Service Ltd., Blyth Road, Hayes, Middlesex. Tel.: Southall 2468. Cables : Emiservice, London. Telex : 2-2417.

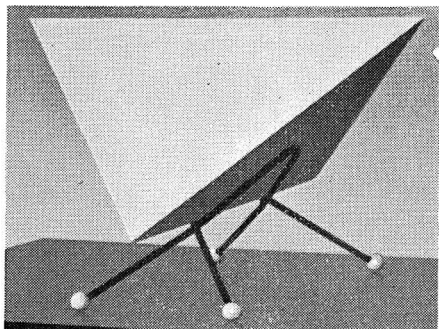
“**His Master's Voice**” Loudspeaker Combination. Model 3052 (incorporating Model 3051 power amplifier). Forward facing enclosure with non-directional H.F. dispersion, incorporating six drive units : three 12-in. m. coil (bass), two 6-in. m. coil (middle reg.), one narrow ribbon electrostatic (tweeter). Crossovers. Response 20-20,000 c/s. Size 36 in. by 48 in. by 19 in. Weight, app. 170 lb. Price on application.

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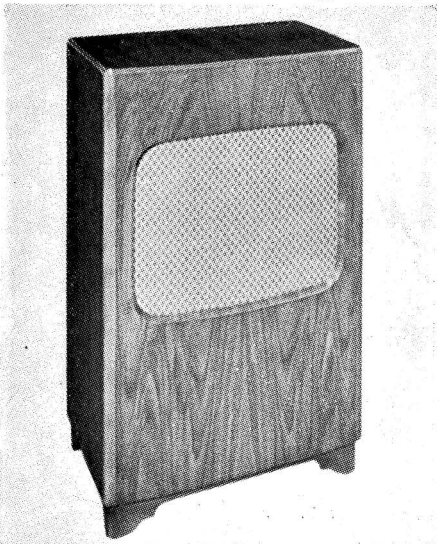
Expert Gramophones Ltd., “Ingerthorpe,” Great North Road, London, N.2. Tel. : Mountview 6875.

“**Acoustic Column.**” Elongated reflex. Vertically mounted 12 in. bass unit and 2½ in. tweeter. Rec. Baker 12 in. and Lorenz tweeter. Size 44 in. by 14 in. by 14 in. Price (complete) £33.

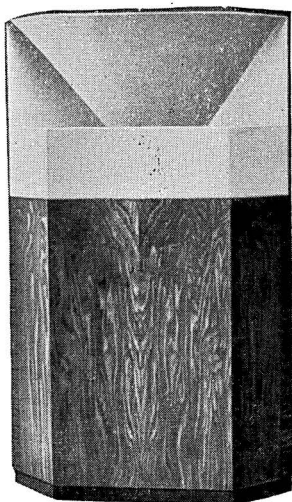
“**All Range.**” Corner reflex. Vertically mounted 12 in. unit : horizontally mounted 8 in. unit. Rec. Baker 12 in. and Philips 9710 M. Size 42 in. by 30 in. by 23 in. Price (complete) £65.



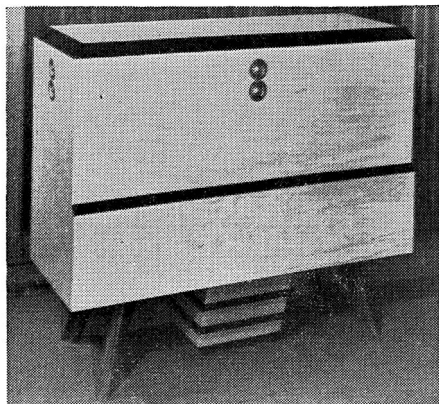
CQ “Tetraq”



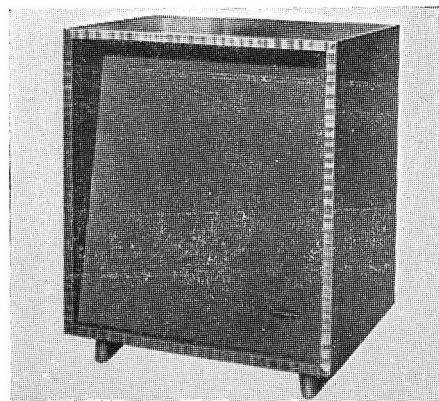
*Dynatron
CLS10*



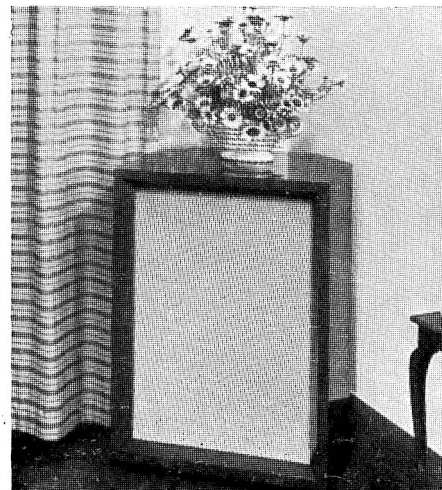
*Expert
“Master
Speaker”*



G.E.C. Periphonic enclosure



Goodmans "Sherwood" range



Grampian RB12

Master Speaker. Corner reflex. 15-in. concentric unit, vertically mounted with reflector. 90° distribution. Rec. unit 15-in. Tannoy dual concentric. Crossover 1,000 c/s. Size 60 in. by 34 in. by 24 in. Price (complete) £110 ; without unit £70.

★

General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2. Tel. : Temple Bar 8000. Cables : Polyphase, London.

Octagonal Cabinet. Model BCS1862. Loaded port type. Forward facing small enclosure. One or two metal cone-type units, 8-in. nominal, with presence unit if required. Response 30-20,000 c/s. Size 30 in. by 20 in. by 14½ in. Weight app. 30 lb. with 1 unit. Price without units £17 10s.

Periphonic Cabinet. Model BCS1 867. Double-pipe loaded with periphonic L.S. coupling unit. Forward facing large enclosure. Two metal-cone type units 8-in. nominal, with 4 presence units, 2 front and one each side. Special crossover network and auto-transformers for 15 ohms input. Response 30-15,000 c.p.s. Size 42 in. by 15 in. by 36 in. enclosure. Height 35½ in. overall. Price, cabinet only, £63.

★

Goodmans Industries Ltd., Axiom Works, Wembley, Middlesex, England. Tel. : Wembley 1200. Cables : Goodaxiom, Wembley.

A range of loudspeaker systems is produced complete in enclosures ; fitted with one, two, three or four drive units. These enclosures employ friction loading using acoustical resistance units and are normally supplied complete. Write for a copy " High Fidelity Loudspeaker Manual " which gives latest details and prices of the range.

★

Grampian Reproducers Ltd., Hanworth Trading Estate, Feltham, Middlesex, England. Tel. : Feltham 2657. Cables : Reamp Feltham.

Grampian RB12. Forward facing reflex, shaped for corner or wall position. One 12-in. unit. Grampian unit recommended 1255/15. Size 31 in. by 22 in. by 16 in. Weight 60 lb. Price (complete) £25 ; without unit £16 10s.

The above cabinet also available in kit form, for user assembly. All woodwork fully machined and drilled ; ready to assemble stain and polish. Complete with mesh material, screws, glue, etc., £11.

Lockwood & Co. (Woodworkers) Ltd.,
67 Lowlands Road, Harrow, Middlesex,
England. Tel. : Byron 3704.

Lockwood Standard speaker cabinets,
"Major" and "Minor." Free standing
reflex types. Accommodating up to three
units, 15-in., 8-in., 5-in. (or 15-in. with pres-
sure units) rec. units, Wharfedale, Tannoy or
Vitavox weights, 112 lb. and 78 lb. Prices
without units £35 and £25.

★

Lowther Manufacturing Co., Lowther House,
St. Mark's Road, Bromley, Kent, England.
Tel. : Ravensbourne 5225. Cables : Low-
ther, Bromley.

Corner Reproducer TP1. Folded bass horn/
direct h.f. horn type. One specially designed
6-in. pressure unit, PM3. Acoustical cross-
over. Response 40-20,000 c/s. Size, 47 in.
by 32 in. by 21 in. from corner. Weight 70 lb.
Price of standard Model A £96.

Corner Horn Model PW2. Horn and bass
chamber type, with front of diaphragm horn
loaded down to 250 c/s, rear bass chamber
down to 40 c/s. One 6-in. or 8-in. unit.
Rec. Lowther PM6 or PM2 Mk. 1. Response
40-18,000 c/s. Size 60 in. by 15 in., corner to
front face. Weight 60 lb. Price £34 10s.

Acousta Cabinet. Models FH/V, FH/H.
Folded horn type, forward facing, with rear
folded horn. Vertical on plinth, or hori-
zontal on 12-in. legs. One unit, 6-in. or
8-in. Rec. Lowther PM6. Response
60-17,000 c/s. Size 30 in. by 18 in. by 15 in.
Weight 45 lb. Price without unit £18 18s.,
walnut, oak, mahogany.

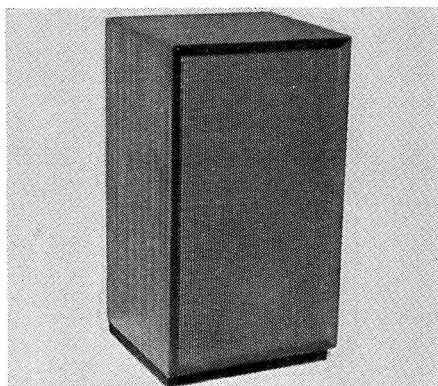
This enclosure is also available in a
"Do-it-yourself" kit form. Price £14 14s.
ex works.

Audiovector. Compound horn. 180 deg.
compound upward facing mid- and high-
frequency horn with rear folded horn. One
8 in. unit. Rec. Range 30-20,000 c.p.s. Size
approx. 40 in. by 30 in. by 18 in. Price
approx. £50.

★

M.S.S. Recording Co. Ltd., Colnbrook, Bucks,
England. Tel.: Colnbrook 2431. Cables :
Emessco.

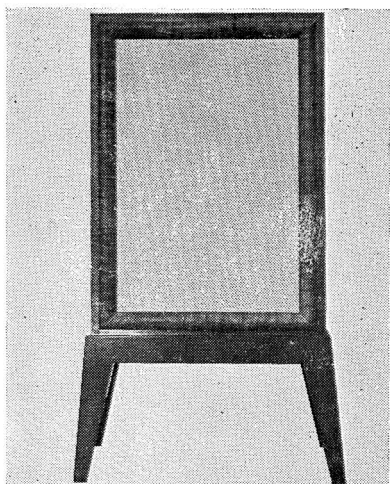
Model LSX/1. Reflex forward facing.
Cabinet on walnut pedestal. One 8-in. unit.
Response 40-15,000 c/s. Size 34 in. by 17 in.
by 10½ in. Price £25.



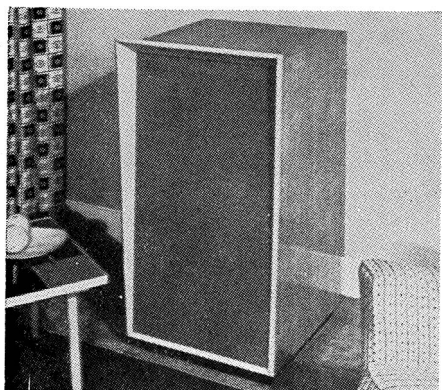
Lowther Acousta cabinet



Lowther TP1



M.S.S. LSX/1



Musicraft F.E.H.

Musicraft, 20/22 High Street, Southall, Middx., England. (Branches at 13 King Street, Richmond, Surrey and 80/82 Uxbridge Road, Ealing, London, W.13). Tel.: Southall 3828.

F.E.H. Enclosure. Folded exponential horn type, forward facing. Two units, 8-in. and 3-in. Rec. Goodmans "Axiette" and Wharfedale Super 3. Crossover 4/5,000 c/s. Response 30-17,000 c/s. Size 36 in. by 20 in. by 20 in. Price (complete) £51 1s. 7d. (U.K. purchase tax £3 18s. 5d.); without units £40 10s.

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Pamphonic Reproducers Ltd., 17 Stratton Street, London, W.1. Tel.: Grosvenor 1926.

Victor Senior. Two units. Bass, 15-in. treble 6-in. elliptical. Response 30-15,000 c/s. Crossover 1,000 c/s. Price £57 15s.

Victor Junior. Two units. Bass 12-in., treble 6-in. elliptical. Response 35-12,000 c/s. Price £36 15s.

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Pilot Radio Ltd., High Fidelity Div., Park Royal Road, London, N.W.10. Tel.: Elgar 7353. Cables: Piloset, Harles, London.

HFS 14. Corner reflex. Forward facing with bass and treble diffusion ports. One 12 in. unit with foam surround fitted. Range 30-16,000 c.p.s. Size 36 in. by 21 in. by 14 in. Weight 31 lb. Price £29 8s.

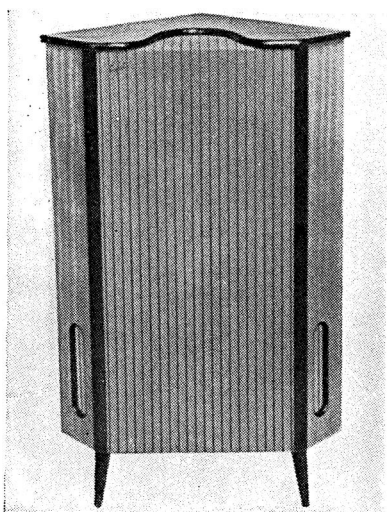
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Pye Limited, Radio Works, Cambridge. England. Tel.: Cambridge 58985. Cables. Pyrad, Cambridge.

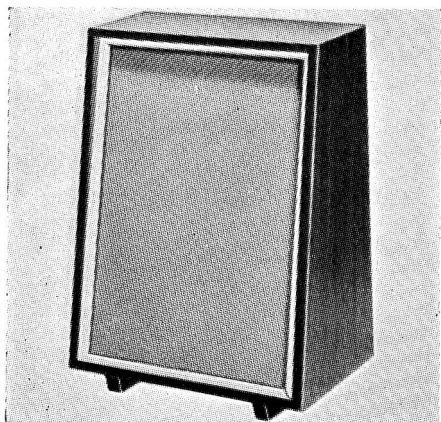
Enclosure HF12BS. Reflex type, with two forward facing speakers, designed for bookshelf. 8-in. units. Response 40-13,000 c/s. Size 11 $\frac{3}{4}$ in. by 23 $\frac{1}{2}$ in. by 11 $\frac{1}{2}$ in. Weight 27 $\frac{1}{2}$ lb. Price £14 8s. 1d. (U.K. purchase tax £5 10s. 11d.)

Enclosure HF12SMT. Reflex type, with forward facing unit. 12-in. unit and 4-in. tweeter, co-axially mounted. Response 30-15,000 c/s. Size 31 in. by 20 $\frac{1}{2}$ in. by 14 $\frac{1}{2}$ in. Weight 79 $\frac{1}{4}$ lb. Price £33 12s.

Enclosure HF25SC. Corner reflex. 15-in. dual concentric unit and pressure type treble unit. Response 30-20,000 c/s. Size 37 in. by (across front) 26 in. by 17 in. Weight 88 lb. Price £71 8s.



Pilot HFS14



Pye HF12SMT

RCA Great Britain Ltd., Lincoln Way, Sunbury-on-Thames, Middlesex, England. Tel. : Sunbury 3101. Cables, telex and tex : 28608.

Panoramic Multiple Speaker System. Models LM1 32245D (Walnut) and LM1 32245C (Light oak). Ported bass reflex. Forward facing, screw-in legs. Three m. coil units. 15-in. with cloth surround, and two 2½-in. Crossover operates at 2,000 c/s. Response 29-20,000 c/s. Price £53 18s. 6d., plus plinth £2 12s. 6d. Size 32 in. by 25 in. by 16 in. Weight 136 lb.

★

Rogers Developments (Electronics) Ltd., 4-14 Barmeston Road, Catford, London, S.E.6. Tel. : Hither Green 7424. Cables : Rodevco, London, S.E.6.

RD Junior Corner Horn. Folded exponential horn, designed to use room's corner walls as part of horn. Diffused treble. One 8-in. unit. Rec. Goodmans "Axiette," Wharfedale Super 8 FS/AL, or Lowther PM6. Response 35-16,000/20,000 c/s (top limit dependent upon unit fitted). Size 36 in. by 32 in. by 25 in. Price without unit £18 17s. 6d., plus optional pair of side panels £3 10s. Price with PM6 unit less panels £37 15s. 6d.

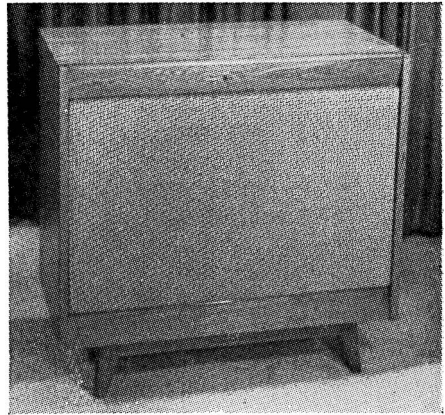
RD Senior Reproducer. ARU enclosure, forward facing. Three drive units : two 8-in., one ribbon tweeter. Rec. two Goodman Axiom 80 and Kelly ribbon. Crossover 3,000 c/s. Response 20-30,000 c/s. Size 36 in. by 27 in. by 15 in. Price, units as specified £82 17s. (U.K. purchase tax £13 19s. 6d.) ; without units, £47 17s.

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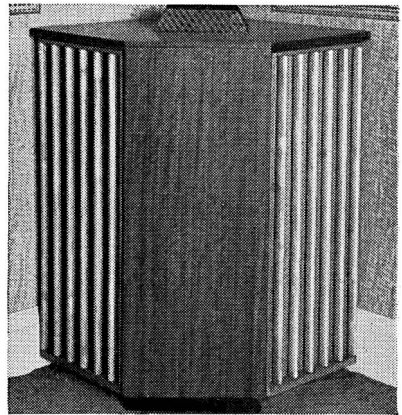
Sound Sales Ltd., Works and Acoustic Laboratories, West Street, Farnham, Surrey, England. Tel. : Farnham 6461. Cables : Sounsense.

Phase Inverter Speaker. Model A, 15 ohms. Model B, 3 ohms. Reflex type. Ported cabinet for forward facing, inc. treble diffuser. 12 watt handling. 12-in. Sound Sales dual suspension auditorium unit. Response 30-13,500 c/s. Size 29 in. by 14 in. by 18½ in. Weight 44 lb. Price £18 10s.

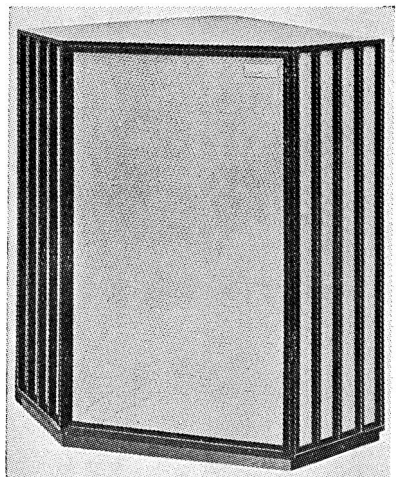
Tri-Channel Mk.4. Special labyrinth construction, reflex. Distribution over 90° arc. Three 12-in. Sound Sales Auditorium units, and one electrostatic tweeter. Response 25-27,000 c/s when used with associated amplifiers. (This equipment is sold com-



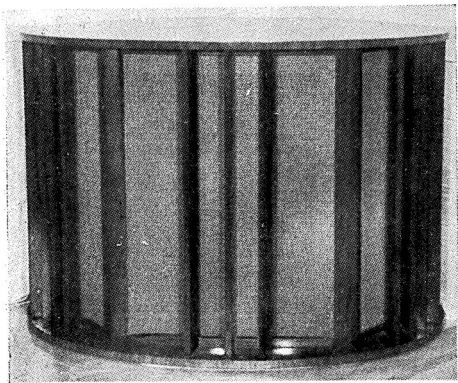
RCA "Panoramic"



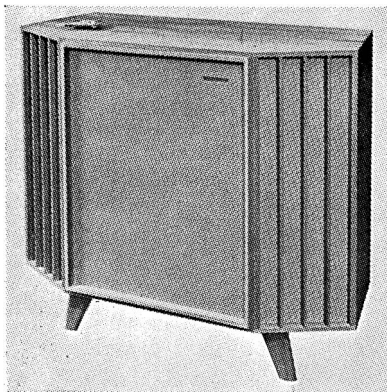
Rogers Junior corner horn



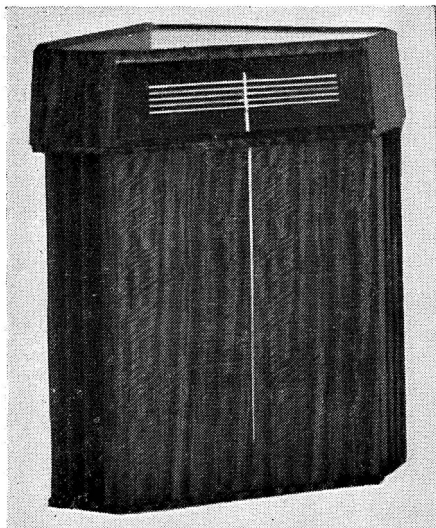
Tannoy "G.R.F."



Sound Sales Tri-Chamel



Tannoy "Landsdown"



Vitavox "Klipschorn"

plete. Refer to amplifier section). Size 43 in. by 31 in. by 25 in. Weight 202 lb. Price including amplifiers, complete, £125.

★

Tannoy Products Ltd., West Norwood, London, S.E.27. Tel.: Gipsy Hill 1131. Cables: Tannoy, London.

Canterbury. Reflex, with forward facing unit, dual throated ports, for corner placing. One 12-in. dual concentric unit, or direct radiator. Size 37 in. by 25 in. by 17 in. Price with dual concentric £57 15s.; with direct radiator £43 15s.

Landsdown. Reflex. Forward facing unit, dual throated ports. For side wall placing. One 12-in. dual concentric unit. Response 30-20,000 c/s. Size 32 in. by 36 in. by 17 in. Price £68 5s.

York. Reflex. Forward facing unit, dual throated ports, for corner placing. 12-in. or 15-in. dual concentric unit. Response 35-20,000 c/s. Size 45½ in. by 32 in. by 22½ in. Price, with 12-in. unit, £66; with 15-in. unit £75.

G.R.F. Folded horn. Rear horn loaded, forward facing unit, for corner. One 15-in. dual concentric unit. Response 20-20,000 c/s. Size 48 in. by 38 in. by 29 in. Price £122.

Guy R. Fountain Autograph. Folded horn. Front and rear horn-loaded unit, forward facing for corner placing. 15-in. dual concentric unit. Response 20-20,000 c/s. Size 58½ in. by 43 in. by 26½ in. Price £165.

★

Tele-clinic (Sales & Service) Ltd., Warrington. Sole distribution, **Western Sound Recorders Ltd.**, 11 Wilson Patten Street, Warrington, Lancs. Tel.: Warrington 35534.

"Normanda." Free standing reflex type with folded horn midrange unit. Three speakers, 12 in. bass, midrange pressure unit and 2½ in. tweeter. Crossover 1,000 c.p.s. Size 33 in. by 26 in. by 18 in. 3 in. pedestal. Weight 110 lb. Price £63.

★

Trix Electrical Co. Ltd., 1-5 Maple Place, London, W.1. Tel.: Museum 5817. Cables: Trixradio, Wesdo, London.

Triple Unit Assembly, comprises 12-in. bass reproducer, 6 in. by 4 in. elliptical and 4-in. tweeter mounted in corner console cabinet.

Response 40-12,000 c.p.s. Size 22 in. by 16 in. by 32 in. high. Price complete £28 7s.

★

James Turner, Little Barn, Arford, Headley, Hampshire. Tel.: Headley Down 2335.

“Brearcliffe 12.” Corner reflex. Designed to accommodate most drive units up to 12 in. Provision for tweeter. Size 36 in. by 21 in. by 13½ in. Price of cabinet £18 18s.

“Brearcliffe 15.” Similar to above, but designed for two units up to 15 in. Size 39 in. by 27 in. by 17 in. Price £24 3s.

★

Vitavox Ltd., Westmoreland Road, London, N.W.9. Tel.: Colindale 8671. Cables: Vitavox, Hyde, London.

Klipschorn. Double channel horn. Folded L.F. horn, forward facing H.F. horn. 2 drive units: 15-in. L.F., pressure type H.F. Crossover at 500 c/s. Response 30-15,000 c/s. Size 50 in. by 30 in. by 27 in. Weight 210 lb. Price with specified units £165.

★

Wellington Acoustic Laboratories Ltd., Allways, Kings Lane, Wrecclesham, Farnham, Surrey. Tel.: Farnham 6461/4961.

WAL Duo-Reflex Speaker. Forward facing reflex enclosure. Incorporating 12-in. bass unit with foam surround and H.F. pressure tweeter. Built-in crossover unit. Size 33 in. by 18 in. by 14 in. Weight 55 lb. Price £27. Available as a matched pair for stereo £52.

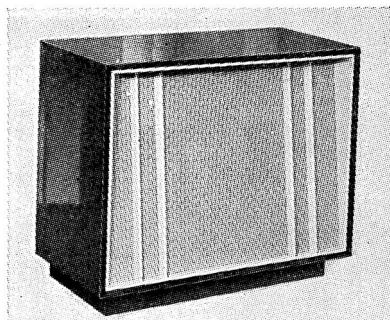
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Wharfedale Wireless Works Ltd., Idle, Bradford. Tel.: Idle 1235-6. Cables: Wharfedale, Idle, Bradford.

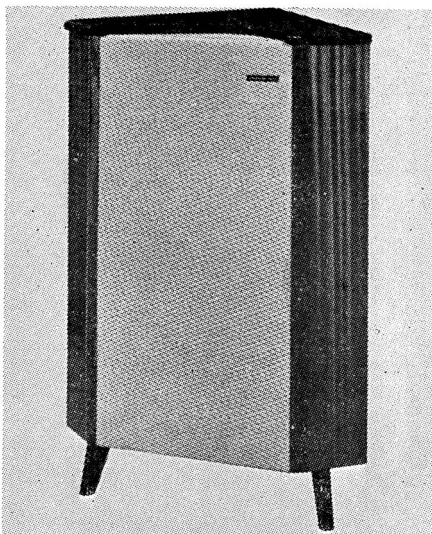
RJ-8. Damped reflex. Forward facing. One 8 in. drive unit. Rec. Super 8/FS/AL; 8 in. Bronze FS/AL. Response 60-14,000 c.p.s. Size 24½ in. by 11 in. by 10½ in. Weight 16½ lb. Price without unit £11 10s.

AF/10. Forward facing reflex with acoustic filter. 1 10-in. unit. Rec. 10-in. Bronze/FSB, Golden/FSB, W10/FSB. Response 40-10,000 or 14,000 c/s depending on unit fitted. Size 30 in. by 17 in. by 10½ in. Weight 35 lb. Price without units £15 15s.

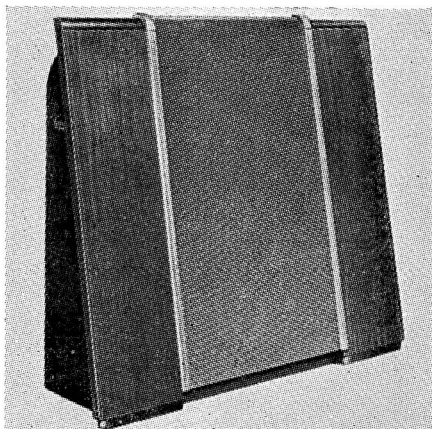
SFB/3. Sandfilled baffle. 3 drive units. 12 and 10-in. units facing forwards. 3-in. H.F. unit facing upwards for omni-directional treble distribution. Response 30-20,000 c/s.



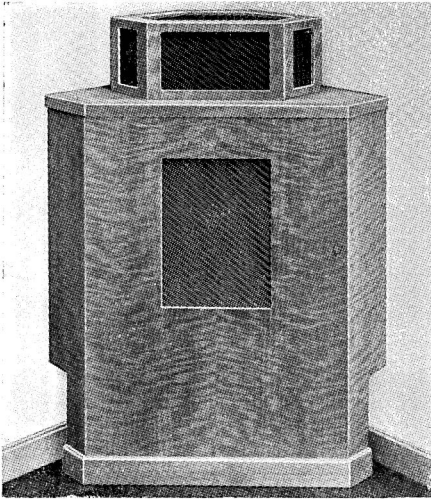
“Normanda”



“Brearcliffe” Enclosure



Wharfedale SFB/3



Wharfedale "Omni-directional"

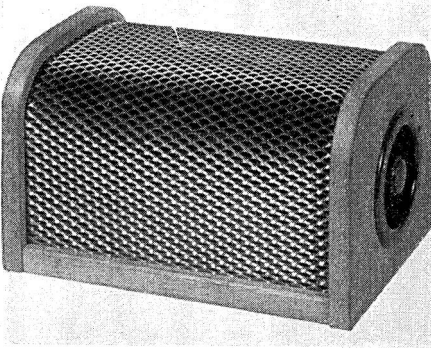
Size 34 in. by 31 in. by 12 in. Weight 64 lb. Price with units £39 10s. (not sold separately).

"Omni-directional" 3-speaker corner system. Sand-filled reflex enclosure, bass unit facing forward, separate mid range and treble units facing upward. 15-in. 8-in., and 3-in. units. Rec. W15/FS, Super 8/FS, Super 3. Response 20-20,000 c/s. Size 48 in. by 34 in. Weight 160 lb. Price with specified units £73 10s.; sandfilled panel only £31; twin treble cabinet £8 15s.

Super 3 Cabinet. Open baffle, facing upward to house 1 Super 3. Crossover 5,000 c/s. Response 5,000-20,000 c/s. Size 8 in. by 6 in. by 5 in. Weight 1½ lb. less unit. Price £4 10s. (for 8/15 ohm speakers); £5 (for 2/3 ohm speakers).

★

Westrex Company Ltd., Liberty House, Regent Street, London, W.1. Tel.: Regent 1001. Cables: Westelcol, Norphone, London.



Wharfedale Super 3 cabinet

Acoustilens 20/80 High Fidelity System. Large reinforced 1-in. ply reflex housing own (15 in.) 20/80 low frequency unit and horn loaded high frequency unit with acoustic lens. Crossover 675 c.p.s. Response below 30 c.p.s.—above 15,000 c.p.s. Size 44 in. by 33 in. by 19½ in. Weight approx. 160 lb. Price complete with units and crossover £169.

★

Whiteley Electrical Radio Co., Ltd., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762/3/4/5. Cables: Whitebon, Mansfield.



Stentorian "Prelude"

Stentorian Corner Console. Infinite baffle. 1 8-in. unit. Rec. HF812. Response 50-12,000 c/s. Size 26 in. by 17 in. by 7½ in. Price with specified unit £8 9s. 6d. (U.K. purchase tax £1 4s.); without unit £5 10s.

Stentorian Junior Console. Bass reflex for corner position. 1 or 2 drive units. Rec. HF816 or HF1012 with T10 tweeter, if required. Crossover 3,000 c.p.s. Response HF816, 50-14,000 c/s; HF1012 & T10 30-14,000 c/s. Size 33 in. by 22½ in. by 18½ in. Price with HF816 £14 6s. 7d. (U.K. purchase tax £1 19s. 5d.); with HF1012 and T10 £18 14s. (U.K. purchase tax £1 8s. 9d.); without units £9 9s.

Stentorian Standard Console. Forward facing bass reflex. 1 or 2 drive units. Rec. HF1012 or HF1214 with T10 or T12, if

required. Crossover 3,000 c/s. Response with HF1012 and T10 30-14,000 c/s ; with HF1214 and T12 25-17,000 c/s. Size 32 in. by 22 in. by 16 in. Price with HF1012 and T10 £19 15s. (U.K. purchase tax £1 8s. 9d.) ; with HF 1214 and T12 £34 7s. 6d. ; without units £10 10s.

Stentorian Senior Corner Console. Bass reflex for corner position. 10-in. or 12-in. drive unit with tweeter, if required. Crossover 3,000 c/s. Response with HF1012 and T10 30-14,000 c/s ; with HF1214 and T12 25-17,000 c/s. Size 35 in. by 30 in. by 19 in. Price with HF1012 and T10 £20 16s. (U.K. purchase tax £1 8s. 9d.) ; with HF1214 and T12 £35 8s. 6d. ; without units £11 11s.

Stentorian "Prelude." Bass reflex for corner position. One 8 in. or 10 in. unit with provision for tweeter. Rec. HF812, HF816, or HF1012 and T10. Crossover at 3,000 c.p.s. Response depending on unit used. Size 33 in. by 21 in. by 17 in. Weight 23½ lb. Price without units £10 10s. Model also available for free standing, otherwise as above. Size 33 in. by 19 in. by 19½ in. Weight 27½ lb. Price £11 11s.

Stentorian Sloping Dual Front. Tweeter housing, reversible, either forward or rear facing. 1 8-in. unit. Rec. T816. Response 1,000-17,000 c/s. Size 13 in. by 10½ in. by 7½ in. Price with unit £8 10s. 1d. (U.K. purchase tax £1 17s. 5d.) ; without unit £3 17s. 6d.

CROSSOVERS, ETC.

Beam-Echo Ltd., Witham, Essex. Tel.: Witham 3184. Cables : Beamec, Witham.

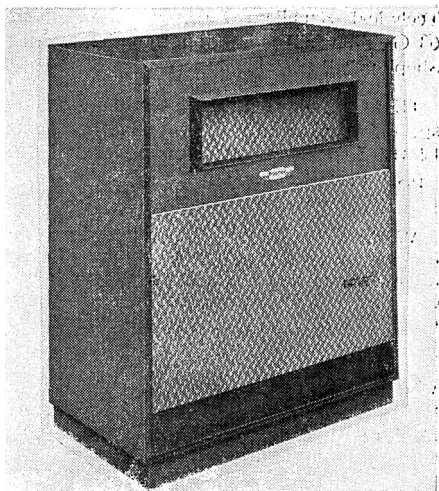
BEA 4400. Three-way, half section crossover network of patented design. Operating at 400 and 4,000 c/s. All terminations 15 ohms. Price to be announced.

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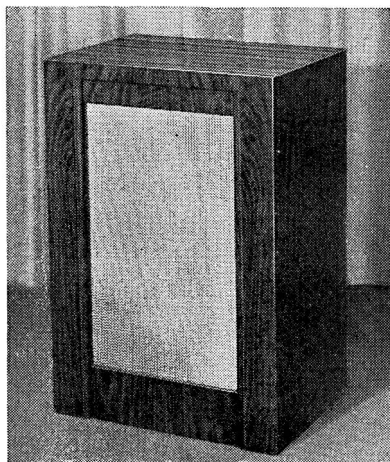
Goodmans Industries Ltd., Axiom Works, Wembley, Middx. Tel. : Wembley 1200. Cables : Goodaxiom, Wembley.

X0/5000-Crossover Unit. A 2-way half-section crossover network, operating at 5,000 c.p.s. All terminations 15 ohms. Price £1 19s.

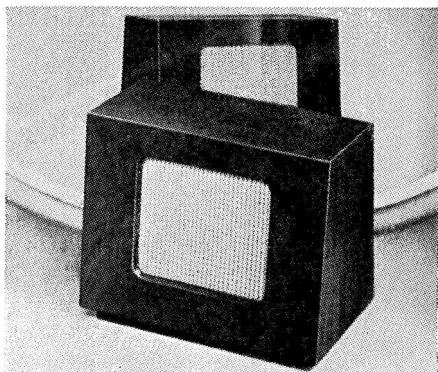
X0/750-Crossover Unit. A 2-way, half-section, crossover network, operating at 750 c.p.s. All terminations 15 ohms. Price £5 10s. 9d.



Westrex Acoustilens 20/80



Stentorian Senior Console



Stentorian Sloping Dual Front

Technical Suppliers Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel. : Shepherds Bush 2581/4794.

HP1 Crossover Unit. A $\frac{3}{4}$ -section crossover specially designed for use with T.S.L. Lorenz LP312-2 speaker system, crossover at 5,000 c.p.s. Price £2 2s.

★

Westrex : Dividing Network. Constant impedance parallel network, using two L-type filter sections, low and high pass, crossover at 675 c.p.s. For any impedance 16-24 ohms. Price £13 10s. 6d.

★

Wharfedale Wireless Works Ltd., Idle, Bradford, Yorks. Tel. : Idle 1235-6. Cables : Wharfedale, Idle, Bradford.

Loudspeaker Separators. $\frac{1}{4}$ -section type. Operating at 1,000 or 3,000 c.p.s. 8 units available to cover from 2-16 ohms impedance. Slope 6 dB/octave. Size 7 in. by 4 in. by 3 $\frac{3}{8}$ in. Weight 2-2 $\frac{1}{2}$ lb. Max input 30 watts. Price from £2 11s. to £4 17s. 6d. depending on type.

HS/CR3/2. $\frac{1}{2}$ -section 3-way separator unit with crossover at 800 and 5,000 c.p.s. Max input 30 watts. Slope 12 dB/octave. Size 9 in. by 6 in. by 5 in. Weight 6 $\frac{1}{2}$ lb. 2 models. 2-6 ohms, Price £11 ; 7-16 ohms, Price £8 10s. Also available with crossover at 400 and 5,000 c.p.s. 7-16 ohms only, Price £12 10s.

WMT1 Matching Transformer. Auto transformer for matching 10-16 ohms or 7-9 ohms speakers to sets with 2-5 ohms output or vice versa. Response 20-15,000 c.p.s. ± 1 dB. Handling capacity 15 watts. Can also match speakers of different imps. to crossover unit in 2 or 3 speaker systems. Size 2 $\frac{3}{8}$ in. by 2 $\frac{3}{8}$ in. by 2 $\frac{3}{8}$ in. Weight 12 $\frac{1}{2}$ oz. Price 13s. 6d.

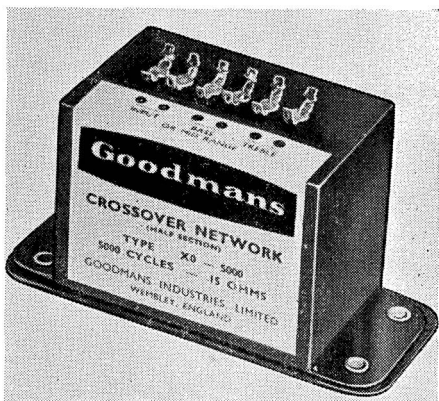
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Whiteley Electrical Radio Co. Ltd., Victoria Street, Mansfield, Notts. Tel. : Mansfield 1762-5. Cables : Whitelton, Mansfield.

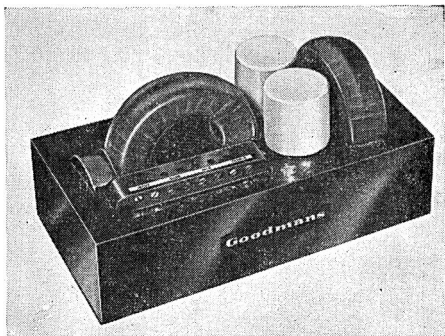
CX 500 Crossover Unit. A 2-way half-section crossover network operating at 500 c.p.s. All terminations 15 ohms. Price £1 6s.

CX 1500 Crossover Unit. As CX 500, but operating at 1,500 c.p.s. Price £1 18s. 3d.

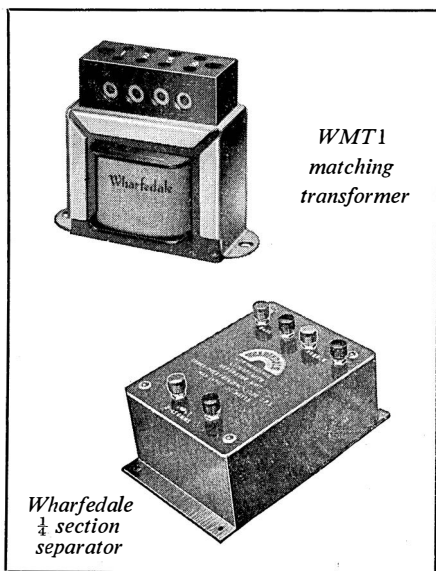
CX 3000 Crossover Unit. As CX 1,500, but operating at 3,000 c.p.s. Price £1 10s.



Goodmans XO-5000 crossover



Goodmans XO750/5000 crossover



*WMT1
matching
transformer*

*Wharfedale
 $\frac{1}{4}$ section
separator*

PRINTED ELECTRONIC CIRCUITS

By S. G. Button

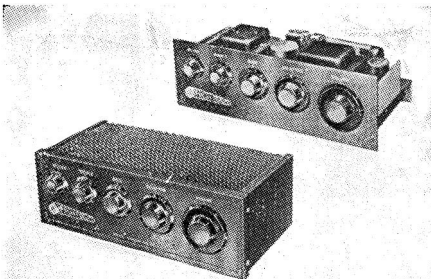
EARLY in 1945, a form of Printed Circuit was used in a proximity fuse in mortar shells, developed by the National Bureau of Standards. This appears to be the first occasion that such a technique was employed, but the actual birth of Printed Circuits is rather obscure.

What are Printed Circuits?

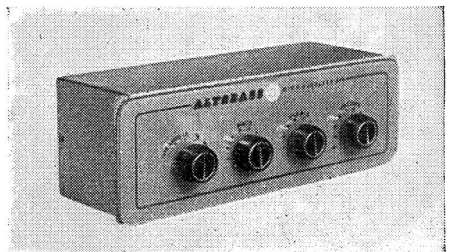
It is sometimes said that everything new should be treated with suspicion, and this has, to a great extent, been the case with Printed Circuits. Just because our equipment, for as long as we can remember, has been built up on a steel chassis, with cable forms carefully arranged to look both neat and attractive (and be functionally efficient) does not mean that this is the ideal method, and nothing else will be as satisfactory. It is not suggested that Printed Circuits will completely oust conventional construction any more than Transistors will supersede Valves. Both have their place and will continue to fulfil their particular functions, and it is up to the users to have a clear understanding of their advantages and disadvantages, and therefore

be able to utilise their properties to the best advantage.

Actually, the name is very ambiguous, as circuits are not printed in the accepted sense of the word. There are six main classifications of Printed Circuits (a) painting with conductive paint with a brush or stencil, (b) spraying with molten metal or paint, (c) chemical deposition, (d) vacuum processes, (e) die-stamping, and (f) dusting. One of these methods was used to a greater or lesser extent until about 1949, when the bonding of copper foil on to a bakelite base material was perfected, and this material was employed as the basis of Printed Circuits, and is today used almost exclusively. Practically all Printed Circuits produced in this country and elsewhere are manufactured from a board consisting of a 1/16 inch or 1/8 inch thick bakelite panel, to one or both faces of which is laminated a copper foil of 0.0015 inch or 0.003 inch thick. The required circuit is then printed on to the copper face, with an acid resisting ink, and the board placed in an acid bath which removes all surplus copper. The ink is



The Pye Mozart amplifier is one of the latest audio components to use printed circuitry, with a considerable saving in space. The layout is very neat



The Altobass is another high fidelity amplifier which makes use of the latest type of printed circuits.

Both amplifiers illustrated here are widely distributed and may be examined at Hi-Fi dealers' showrooms.

then removed, leaving the copper "circuit" printed on the base material.

How they are made

There are, of course, a number of ways of producing Printed Circuits. The copper can be treated with a light sensitive solution, which is then exposed from a photographic negative of the required circuit. The board is then coated with a chemical resist. After exposure, the image is developed which removes the chemical resist from those parts of the copper which have not been exposed. The board is then immersed in an acid bath, which etches away the surplus copper. The circuit can be printed on the copper by using a Silk Screen method, using an acid resisting ink. The above, or variations of them, are the most commonly used to-day, and are capable of producing excellent work of good definition. For example, it is possible to produce a conductor 0.002 inch thick with a space of 0.002 inch and hold this over a 6 inch length, which indicates that the line definition is of a very high order.

The general appearance of Printed Circuits will be seen from Fig. 1 where (a) is a television time base, (b) an aerial cross-over network, and (c) a transistor amplifier.

Advantages and Disadvantages

In what way are Printed Circuits superior to conventional wiring, and in fact are they? This is a question to which

there is no simple answer. Firstly, the three main advantages enjoyed by this technique are wiring uniformity, compactness and cheapness, although the latter will be qualified later. Let us consider these points in somewhat greater detail. Obviously, the layout of the wiring must in all cases be identical, and consequently, provided that sufficiently close tolerance components are used, it should be possible to lay down a specification for equipment, and hold that specification to much closer limits than is the case with conventional wiring.

Stray Capacitances

Look at a chassis built amplifier, for example. It is nothing unusual to find a cable form, possibly containing twenty or thirty leads, all neatly laced together and running halfway round the chassis. Now just consider the stray capacitances both between leads, and from the leads to chassis. A typical example of a simple resistance coupled amplifier stage is given in Fig. 2 with the stray capacitances shown dotted. Such strays can amount to 50 pF or more, and can have a marked effect on performance. Now with printed wiring, adjacent conductors can be very close, but being of strip formation, the capacitance between them is remarkably small. With a spacing of $\frac{1}{8}$ inch and conductors 12 inch long the capacitance only amounts to 4.8 pF. Consequently, such strays can be ignored and circuit

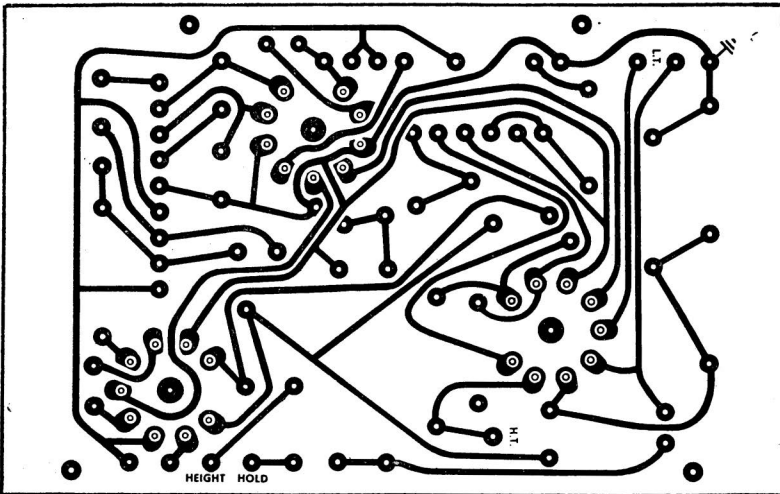


Fig. 1a is an example of a printed circuit designed for the time base of a television receiver. This shows the close and carefully planned spacing of conductors and the points which will be drilled to take components

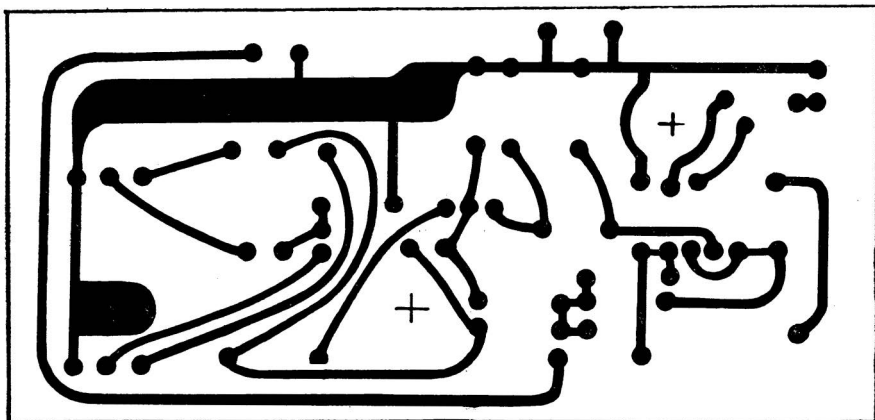


Fig. 1b is another example of printed circuit design—this time for a transistor amplifier

parameters can be lumped where they are required—and the designer's theoretical ideas can be more faithfully reproduced in practice. Also, stray capacitances will be identical in the 1st, 200th and 10,000th model. Naturally, the same argument applies equally well to mutual inductance effects.

Space Saving

With a Printed Circuit assembly, all components are mounted on one side of the board, and all the wiring is on the opposite face. The result is that, **firstly**, components can be mounted closer together, as there is no wiring to worry about on the component side of the board; **secondly**, the overall depth is reduced to the height of the largest component. Generally speaking, from 20% to 50% saving in space can be achieved. This applies particularly to computers and similar equipment where a number of identical units are required. These can be mounted on separate boards, and the boards then stacked closely together to give a very compact assembly.

Saving in Cost

Dealing very briefly with the question of cost, on large quantity mass production, the saving is appreciable, but it is not everything which warrants a minimum of 50,000 production. However, although the saving in actual £ s. d. may be practically nil, the added reliability, freedom from the human element in assembly, and uniformity of results may well outweigh any monetary saving, and may even make Printed Circuits worth while if the material costs are higher. More semi-skilled

labour can usually be employed, and less supervision is necessary. Particularly on small assemblies, it is not easy to fit components in the wrong place, there just are not any holes for the leads—and it only requires a cursory glance to see if a component has been left out. A further saving is on test. At least it is known that there are no wiring mistakes.

Home Construction

Brief mention must be made here of the advantages of Printed Circuits to the home constructor. Quite obviously, it is possible to supply a complete amplifier in kit form, using a Printed Circuit, and be quite confident that, provided the correct components are mounted in their correct places, the performance will be up to a specified minimum standard. This makes possible the supply of kits of far more advanced design than has been possible in the past, where considerable variations in layout

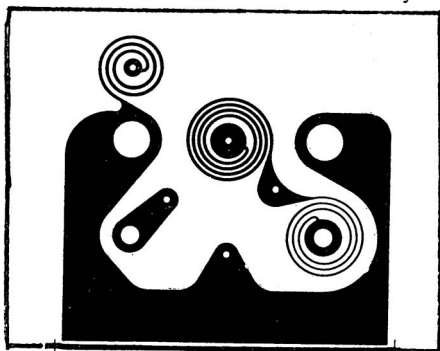


Fig. 1c is a printed circuit designed for an aerial cross-over network. The spirals are inductances

and wiring had to be taken into consideration.

It has been suggested in some quarters that this takes all the fun out of home construction; but this appears to be a view held only by a small minority, for whom conventional kits will no doubt be available for some considerable time.

The average constructor is only too glad to be able to build his own equipment, and be confident that the results will be in every way equal to similar equipment assembled by the manufacturer.

Future Prospects

At the present time only a comparatively small number of manufacturers are utilising this technique to the full, although their use is increasing rapidly, if not for complete assemblies, at least for sub-assemblies, and this trend will certainly continue. The technique of Printed Circuits is being utilised for very many applications, not directly connected with circuitry. Examples of components now being produced by this method are Slip Rings, Commutators, Stud Switches, Switch Back Plates, Fuses, Strain Gauges

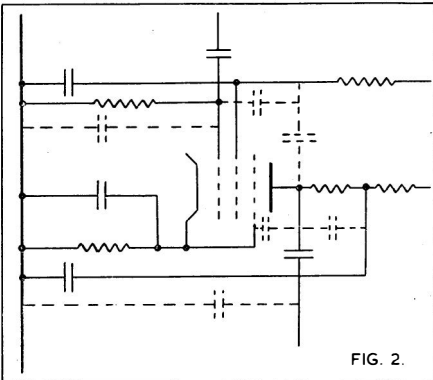


FIG. 2.

This diagram shows (by dotted lines) how stray capacitances exist in a conventionally wired amplifier

and Cable Forms to mention just a few.

At one time the only base material available was laminated bakelite, but now we have PVC, Fibreglass, Epoxy Resin, and in fact an ever-increasing number of base materials being used, which is continually increasing the scope of this technique.

Aluminium Cores

A new material which is now beginning to come on to the market consists of an aluminium core, on one face of which is laminated a coloured PVC. On the re-

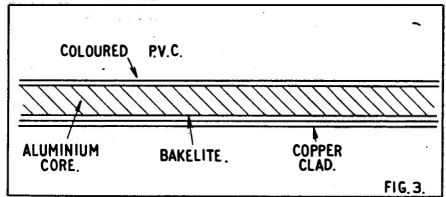


FIG. 3.

A sectional diagram shows how various materials are laminated together for printed circuit manufacture

verse face a thin sheet of bakelite is laminated to the aluminium, and the bakelite is in turn copper clad. This is illustrated in Fig. 3. The aluminium can be up to $\frac{1}{4}$ inch thick. One purpose for which this material is being used is car dashboards. All the instruments are mounted on the front face, and the wiring printed on the back. This material would appear to have many future uses, particularly as instrument panels.

"Potted Circuits"

Printed Circuits are now finding a use in potted circuits, where a small assembly is, when completed, potted in a suitable resin. This system would appear to lend itself admirably to impedance matching networks for high fidelity amplifiers. By this method, an otherwise standard unit can be modified by various plug-in units.

Sub-Assemblies

Whatever the future may hold, it is anticipated that manufacturers will be more inclined to use Printed Circuits for sub-assemblies rather than as complete units. By adopting the sub-assembly principle a faulty section can easily be replaced, and the faulty unit repaired at a later date. It must be realised that replacing a component on a Printed Circuit is more difficult than with conventional construction, and any "ham-handed" operator can easily ruin a complete circuit board by careless handling.

Experiments

It is fairly certain that Printed Circuits, as we know them to-day, will be with us for some time to come; but at the same time they are not considered ideal. Work is progressing to find some method of bonding the circuit into the base material, to give additional protection to the circuit, while methods of really printing the circuit are actively being sought.

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summarises the annual Hi-Fi position.
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HI-FI NEWS

LOOKING AHEAD

A GREAT deal of importance has occurred in the Hi-Fi world during the past twelve months, but remarkably little has appeared on the surface, where the changes have all been the result of good solid progress—chiefly in design, presentation and finish. The year has been most noteworthy for this. Hi-Fi equipment has gradually changed, in outward appearance, from boxes with primitive knobs and terminals (the “amateur’s joy”) towards sleek panels and trim lines which have begun to be well and truly “houseworthy.” In short, Hi-Fi has left the corner table, taking its maze of untidy wires with it, and has graced the bookshelf. It has also found a place, often in good and attractive cabinetwork, with the rest of the household furniture.

Behind the scenes, however, really terrific work and planning have been going on—particularly during the past few months (January to April, 1958)—and it is the results of this work which we should see during the year ahead. The theme is, of course, Stereo.

As these words are written, in the spring of 1958, there are still quite a number of manufacturers who have yet to make up their minds about stereo; and that is the best proof of the suddenness of the impact of this latest and greatest Hi-Fi development. A year ago, apart from the twin-channel tapes and equipment pioneered in Britain by E.M.I. Ltd., there was little or no stereo, and certainly no one regarded it as a serious item on the agenda. The record manufacturing companies had been considering it very seriously, of course, but very little was said about it—and nothing publicly.

Then, suddenly, in the closing months of 1957, stereo “blew up.” We learned of stereo discs that had been made and demonstrated in America, and of British made stereo discs that had been taken to America and demonstrated almost simultaneously to a selected audience of interested people in the manufacturing world.

In England, “Hi-Fi News” and “Record News,” two of the leading publications in this field, published the full story of these spectacular developments—and stereo was announced as “something just around the corner.” Within a matter of only a few weeks, several manufacturers of pickups and amplifiers were at work “on the drawing board,” planning for the new equipment that

they realised would be needed to meet the stereo disc when it arrived; and the major disc manufacturing companies said, in effect, “We are ready for stereo, and will have discs for sale when there is equipment for playing them.”

The B.B.C., which had also been making behind-the-scenes tests with stereo over closed circuits, sprang a lively surprise on the listening public with stereo broadcasts that could be received on everyday sets. More of these tests are forecast, and will doubtless have taken their place in the story of stereo before the next edition of **Hi-Fi Year Book** is compiled.

Stereo, as a subject, is discussed in a series of short chapters in the first section of this **Year Book**. As we close for press the whole situation is so fluid, so active, and so interwoven with closely guarded secrets, that there is all too little to be said about it.

But within a few months—by the autumn of the year—it is certain that at least a dozen manufacturers will have added stereo components to their lists.

Those who wish to keep abreast with these exciting developments are advised to study the regular monthly news and reports in “**Record News and Stereo Disc**,” and in “**Hi-Fi News**.” The former magazine deals particularly with the actual records, and the latter watches the subject from the technical and semi-technical point of view, with emphasis upon equipment. In combination, these two journals cover the complete subject from all angles. The publishers of these leading monthly journals will gladly send specimen copies to readers who write for them (mentioning **Hi-Fi Year Book**) to 99 Mortimer Street, London, W.1.

The year ahead will undoubtedly be one of the most fascinating of all for those who are interested in the hobby of high fidelity, sound reproduction. Stereo represents the *New Age of Sound* that is about to find its place in the homes of the millions. All the progress that has been made during the past eighty years—since the day of the cylinder and sapphire of Edison—is about to be duplicated and presented as one great culmination of widespread endeavour. “Stereo” is the word for the future, make no mistake about that!

Many of those who still doubt the importance of stereo are quoting the history of

stereo tapes, and asking (themselves and others) "if stereo is so big, why have so few people taken advantage of it?" The answer to that is, of course, that only one person in ten thousand has so far become interested in tape, let alone stereo tapes. On the other hand, there is only one home in ten thousand that does not boast a record player of sorts. When lp discs were announced, over ten years ago, many people said that there was no future for them!

The record turntable is a homely thing, and the disc is something that everybody uses. In other words, the disc is the natural medium for the introduction of stereo. Gradually, as more and more people sample the stereo disc, this new form of reproduced sound, with its far greater realism, will find its inevitable place in the order of progress. Gradually, too, as reproducing equipment is brought up to date, modified and replaced by twin-channel reproducers, more and more people will look again at tape—but that is perhaps a jump or two ahead, as is the thought of all-stereo sound in cinemas, and regular stereo broadcasts. These things will come, of course, but they will take time.

At first it will be the army of Hi-Fi enthusiasts who will give the greatest support to stereo—and who will, therefore, be the first to enjoy its full benefits. Only a few years ago these enthusiasts could be numbered in their thousands; today they are an important majority in their hundreds of thousands, appreciative of real quality, and becoming increasingly critical as their experience grows. For these people the modern disc holds a wealth of enjoyment that others have yet to discover; for them the stereo disc will immediately open up a new world of fascinating musical entertainment.

Within the three or four months that have elapsed since the news of the stereo disc was announced, at least four British pickup manufacturers have produced prototypes, several of which will have been demonstrated at the 1958 London Audio Fair. Pickups by Decca, Cosmocord, Ronette, Goldring, Burne-Jones, Ortofon and others, are on the way. Within the same space of time, stereo pre-amplifiers have been produced by Cape Electroponics, Jason (both of these to the *Hi-Fi News* design), Rogers and Astronic; and, again, many others are on the way. Stereo discs have been pressed and demonstrated by Decca, E.M.I., Pye, and Connoisseur; and stereo recordings have been made, for future disc releases, by several other companies.

The Hi-Fi enthusiast has already two-thirds of the necessary stereo playing equipment in his possession; a stereo pickup, an extra amplifying channel and a second speaker are all that he requires to complete his chain. The enthusiast who also possesses a good quality tape deck can then expand his Hi-Fi set-up still further, to take in stereo tape, by the addition of a (stacked) stereo head. Home recordings of stereo sound are a stage further ahead, but well within the reach of the more advanced enthusiast.

From home stereo recording, to the home recording of television pictures on tape is a big step; nevertheless it is a problem which is already exercising the minds of far-sighted designers. It was two years ago that we forecast this development as inevitable for the broadcasting companies. Already, as is well known, the American Ampex Corporation have supplied the leading U.S.A. broadcasting organisations with many standard production models of their "Videotape" instruments, which are in daily use. Now they have added the facility of colour, and it has thus become practicable to record a complete television programme of over 1 hour duration—sound, and pictures in full colour—on a 12½-in. reel of tape. The electronics involved are naturally complex, and take up far too much space for the home enthusiast at this stage of development—even if he could afford the many hundreds of pounds that the equipment costs! Nevertheless, the electronic writing is definitely on the wall. It is of interest to note, in passing, that Ampex guarantee a frequency response from 15 Kc/s to 2½ Mc/s within 3 dB.

While on the subject of television, too, we venture to forecast that it will not be very long before really high fidelity TV receivers are planned. The public are rapidly becoming very conscious of quality, and whereas it was once commonplace to hear TV sound being praised in comparison with sound radio, with the advent of F.M. broadcasts, and the spread of Hi-Fi equipment into the homes of the multitudes, it is now TV sound which is being criticised—and rightly so.

After 12 post-war years of television, there are still no receivers on general sale which do full justice to the really high quality sound that has been radiated by the B.B.C. for that same long period. The same applies to the vision signals, too, but with no standards for comparison there will be no complaints!

The B.B.C. were wise in their original decision to adopt the 405-line television

system. Much has been written (and far more has been said) about the advantages of the Continental and American systems which use more lines per inch ; but the fact is that our own system, *if properly and fully exploited*, can give us far better pictures than any American viewer is at present watching. We repeat, *if properly exploited*. And if these paragraphs on vision seem to be out of place in this edition of a book which deals with sound, we plead the excuse that we are "looking ahead." Sound from a TV receiver is (or should be) as important to the listener as sound from his Hi-Fi speaker. We look forward to the day when there will be no difference—to the day when the drive for quality will be the prime inspiration in all things. We look forward to colour pictures on television screens. Those which we have seen this year (in Britain) were really beautiful—so far ahead, in detail and in delicacy of tone, from those we saw a bare five years ago—that we could scarcely credit the improvement. But before such things can reach the public there is a vast amount of work to be done.

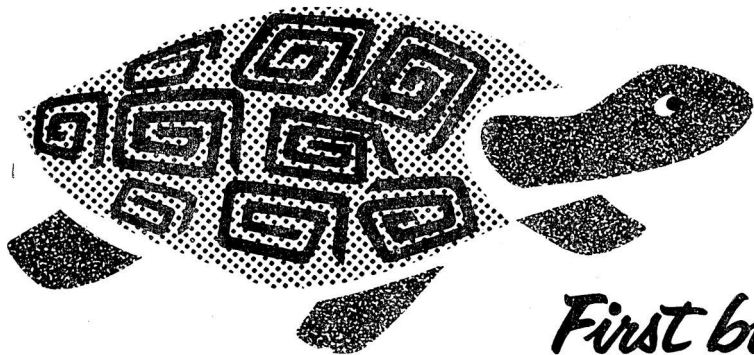
The drive must be for quality, all along the line ; then such things will become reality ; and before we can expect quality we must all learn to appreciate it—to deliver it in everything we do—and to be more and more critical of everything that does not measure up to the best.

High fidelity reproduction does not, after all, stop at "sound." It must surely apply to all that is connected with sound, via electronics, in the complete pattern of our domestic enjoyment. In the future—the distant future—when we are recording and reproducing stereo colour pictures and sound of the highest quality, by our own firesides, these present-day "incidentals" will all be as dry as dust—of no more interest than the museum exhibits of sledgehammer pickups and hill-and-dale cylinders. But today they are of the utmost importance.

The purveyors of our home entertainment via electronics—the broadcasters and the disc makers—are constantly offering us far better quality than even the best of our equipment can handle. Our task, in the immediate future, is to tackle this leeway.

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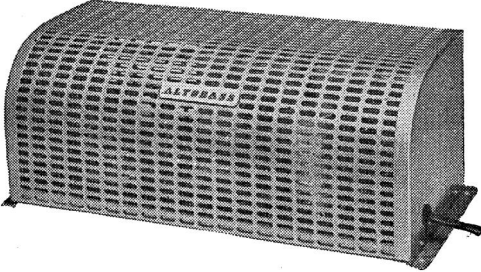
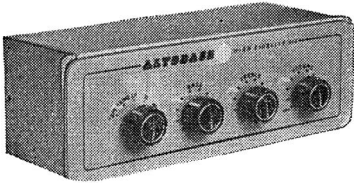


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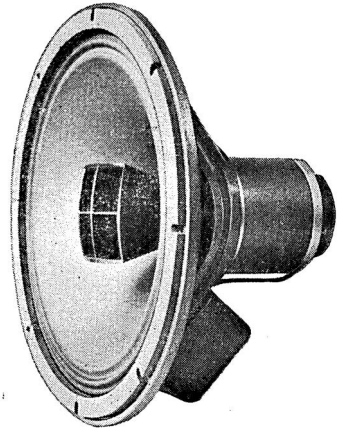
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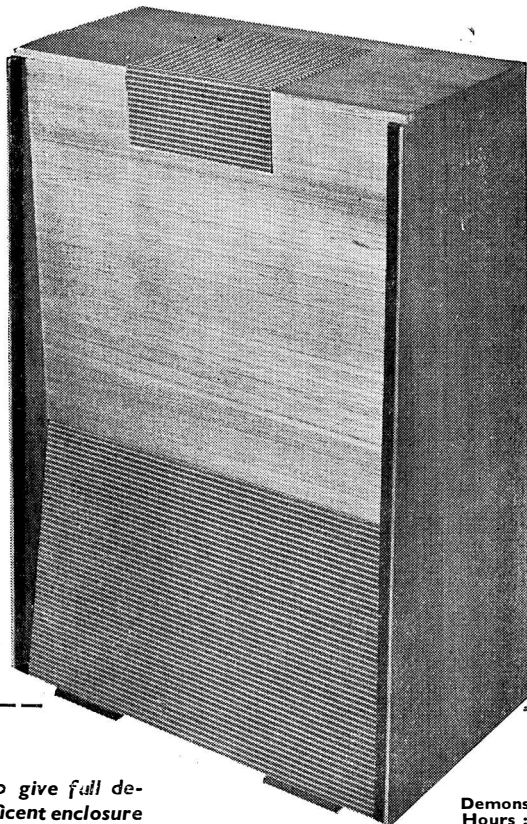
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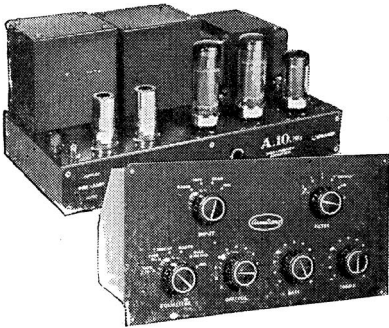


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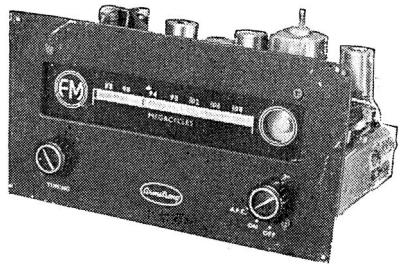
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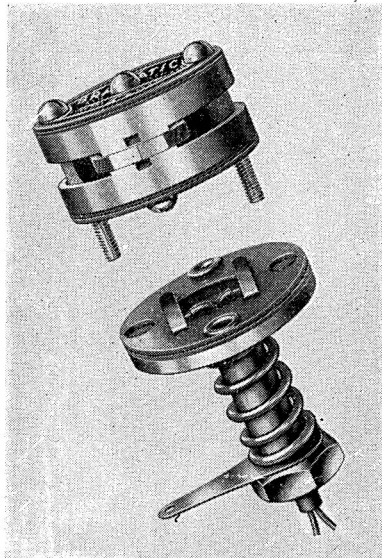
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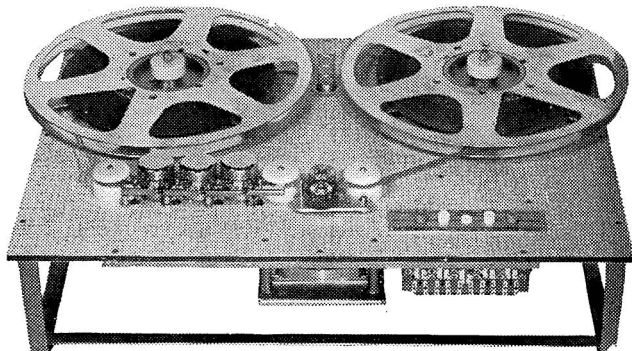
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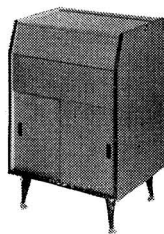
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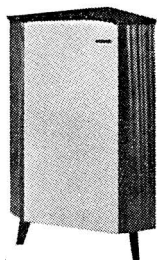
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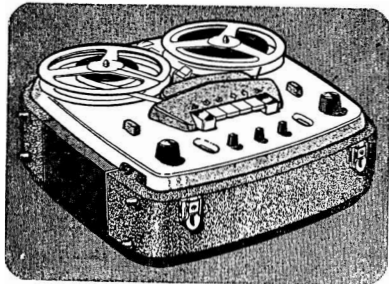
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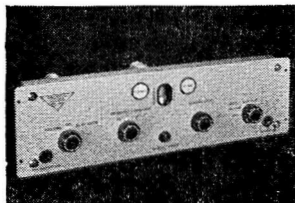
BRENNELL MARK 5 TAPE DECK

- 4 speeds $1\frac{7}{8}$, $3\frac{3}{8}$, $7\frac{1}{2}$, 15 i.p.s.
- 3 Motors
- Up to $8\frac{1}{2}$ in. dia. spools
- Provision for Extra Heads (up to 4 in all)
- Safety Switch to Prevent Accidental Erasure

- Pause Control
- Interlocked Switching
- Fast Wind and Rewind
- Digital Revolution Counter

TAPE PRE-AMPLIFIER T.P.2

Designed to suit any Brenell Deck, incorporates all the best features of the modern tape pre-amplifier,



- Frequency correction for $3\frac{3}{8}$, $7\frac{1}{2}$ and 15 i.p.s.
- Monitoring facilities via headphones.
- Monitoring facilities via main amplifier equipment.
- Head DE-MAGNETISING facilities.
- Frequency response :
 - $3\frac{3}{8}$ i.p.s. 60 c/s — 6,000 \pm 3 dB
 - $7\frac{1}{2}$ i.p.s. 60 c/s — 10,000 \pm 3 dB
 - 15 i.p.s. 50 c/s — 14,000 \pm 3 dB
- Output to main equipment approximately 1v at 50,000 ohms.
- Valves : EF86, ECC83, EL84, EM81.
- Power requirements : 300v at 40 milliamps. H.T. Supply. 6.3v at 1.5 amps. Heater.

Sole Manufacturers:-

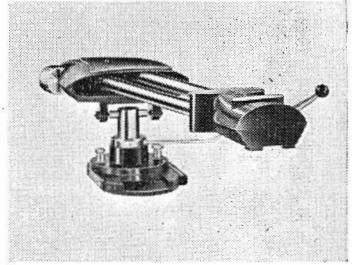
BRENNELL ENGINEERING CO. LTD.

1a DOUGHTY STREET, LONDON, W.C.1

Tel. : HOL 7358 and CHA 5809

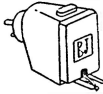
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BJ C12 HEAD combines high sensitivity with low mass



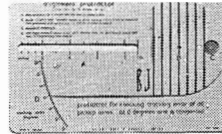
BJ PLUG-IN SHELL is the cartridge carrier with attractive lines and finger-lift control



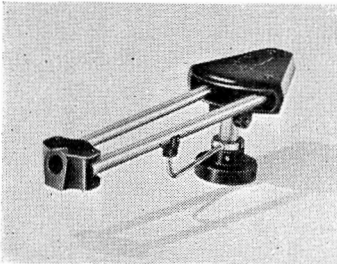
BJ ADAPTOR couples all ACOS heads to the BJ ARM



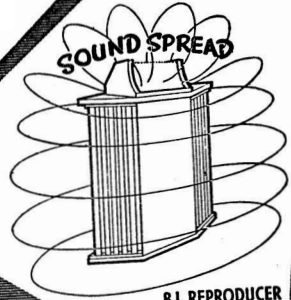
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For specifications see Amplifier Directory Section.

Complete with wired and matched Brenell
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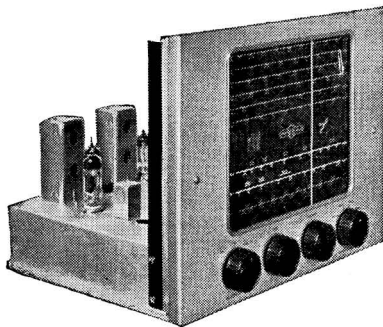
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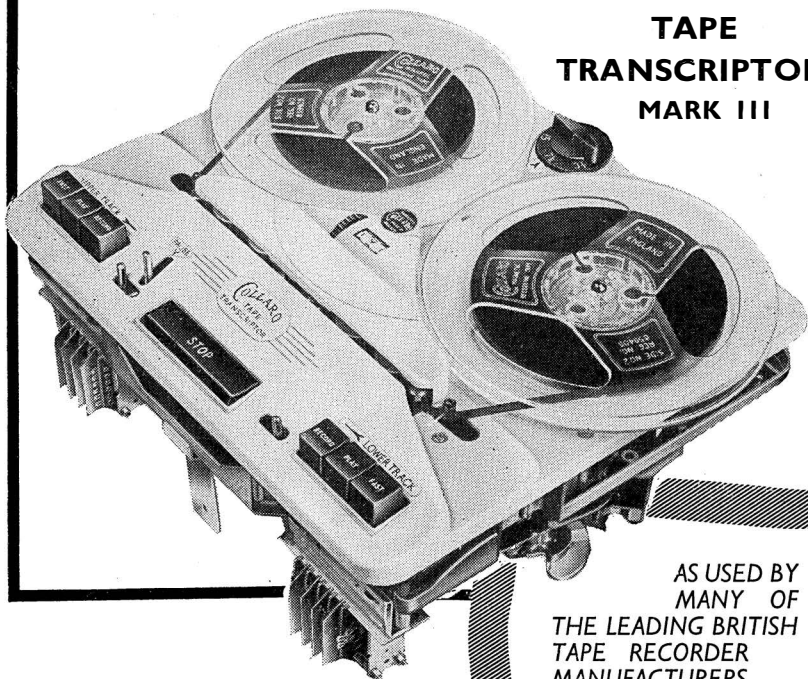
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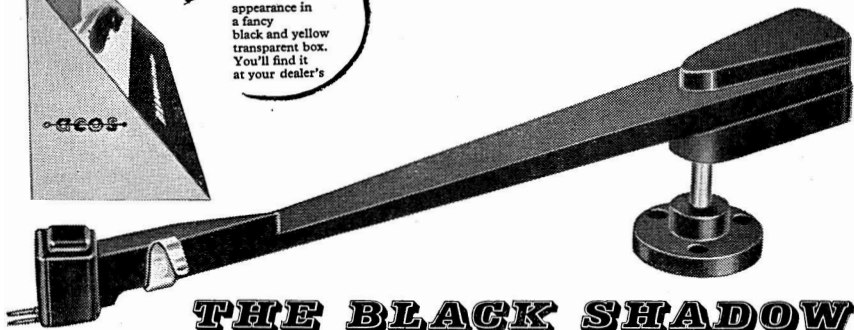
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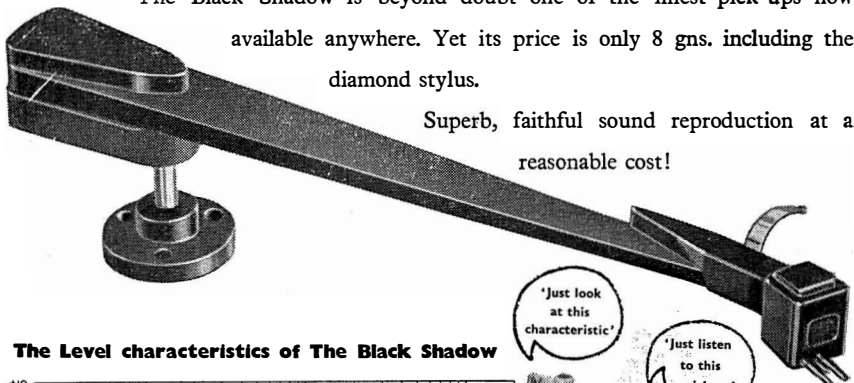
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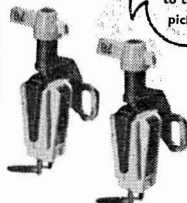
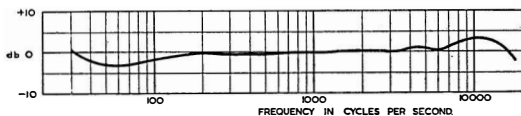
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'Just listen to this pick-up'

The Level characteristics of The Black Shadow

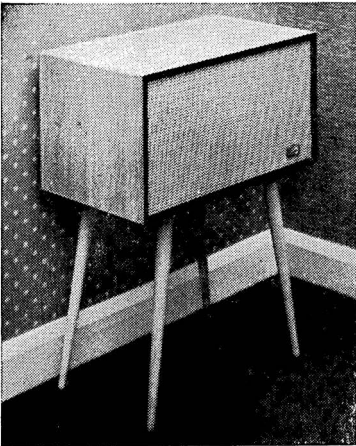


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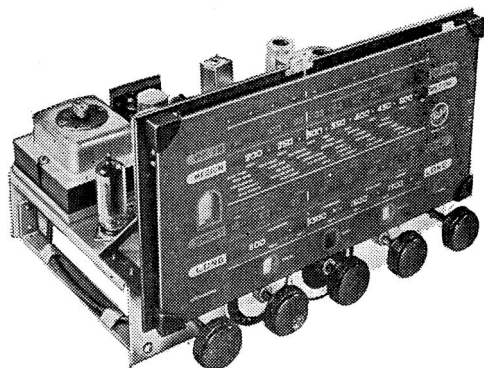
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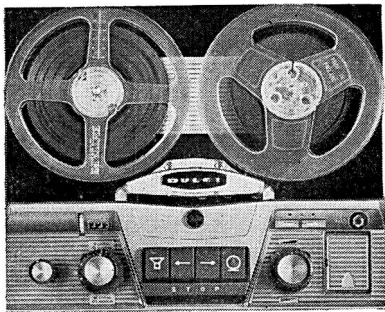


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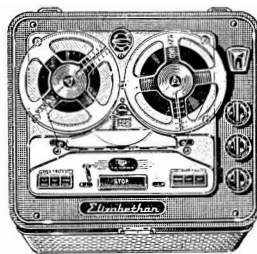
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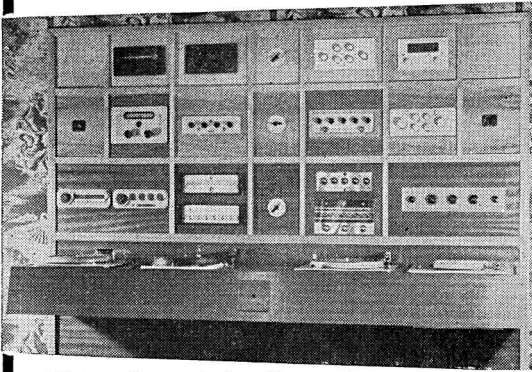


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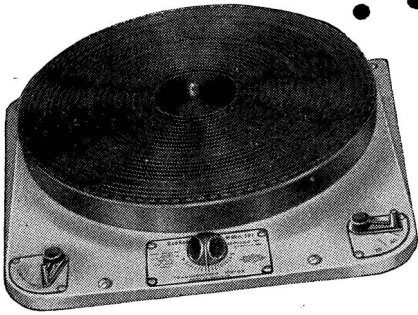
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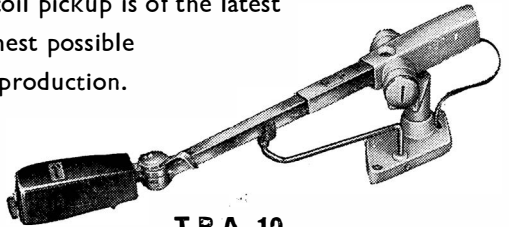


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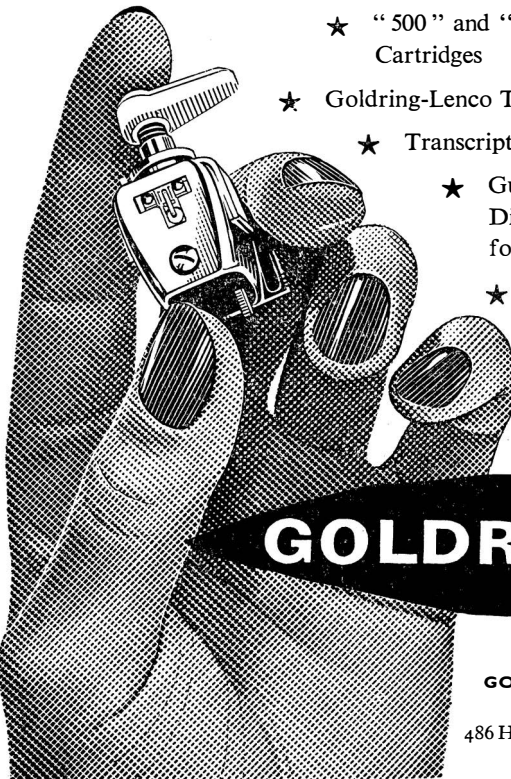


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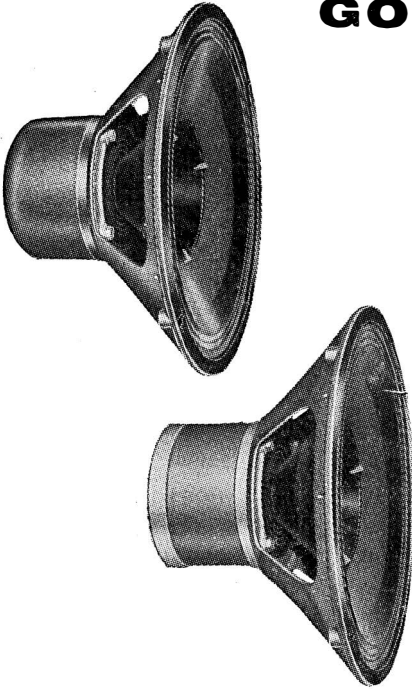
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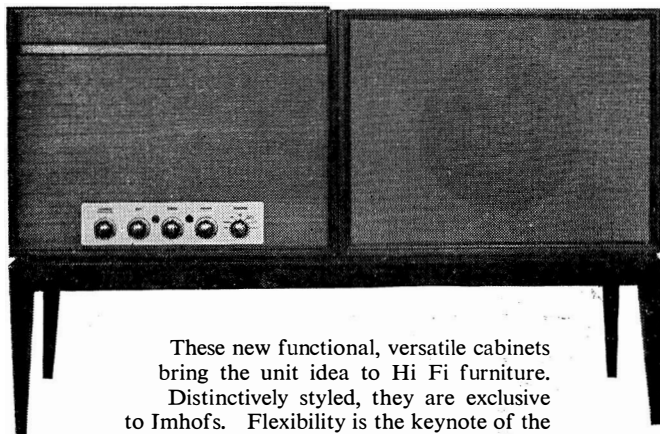
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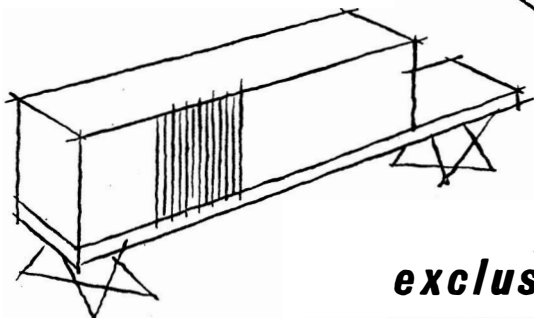
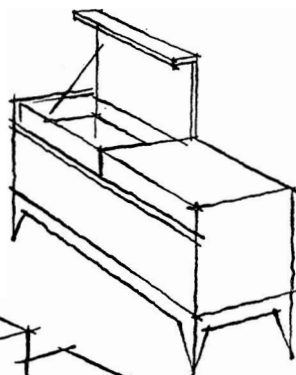
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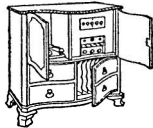
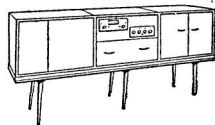
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Perhaps you are thinking of choosing ready-made cabinets? We stock all leading makes, traditional and contemporary. Or, if you like, we will make your cabinets to measure, it will cost very little more.

By using the Tailargram Service you will ensure perfect music from furniture that really fits *your* home.



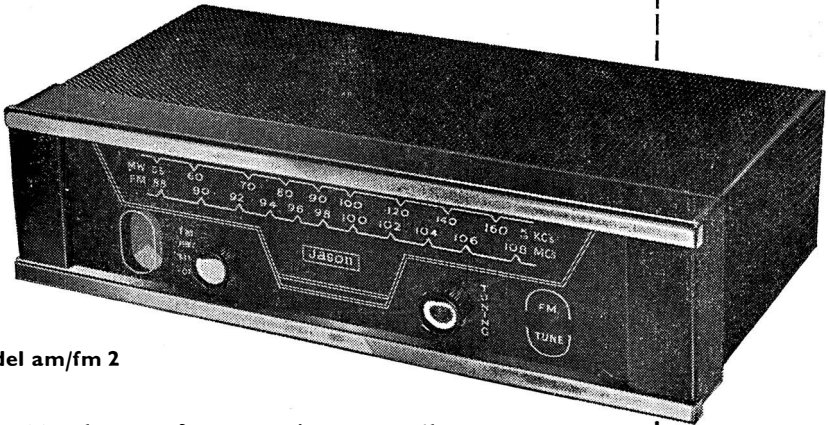
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Jason

design and build outstandingly good equipment



model am/fm 2

This 11-valve am-fm tuner is an excellent example of Jason design and quality. It is one of a series of four similarly styled units which includes the J10 amplifier and two other types of tuners. They are intended for shelf mounting. Jason also make stereophonic equipment and have a series of very popular designs to enable the home constructor to build his own fm and am-fm tuners. A stereophonic pre-amp design is also to be made available. You are invited to apply for leaflets for whatever part of the Jason programme interests you.

★ FROM LEADING STOCKISTS EVERYWHERE

★ LEAFLETS AND NAME AND ADDRESS OF YOUR NEAREST JASON STOCKIST GLADLY SENT ON REQUEST

● *Trade Enquiries invited*

amplifiers and
matching tuners for
shelf-mounting



kit designs for
home-constructors



stereophonic
pre-amp kits



stereophonic
amplifier



switched f.m. tuners

THE JASON MOTOR AND ELECTRONIC CO.

3-4 GREAT CHAPEL STREET, OXFORD STREET, LONDON, W.1

Telephone
GERard 0273-4

Where and What Shall I Buy?

That is the question you may possibly be asking yourself—perhaps we can help you. Many people visiting us for the first time have expressed surprise at the very large selection of High Fidelity Equipment and Tape Recorders that we can offer, and we are told that we are quite the most interesting and helpful Hi-Fi shop in Surrey and Hampshire.

We feel in all modesty that they have some justification for this because :

We do stock most of the good High Fidelity Equipment and Tape Recorders listed in this Hi-Fi Year Book, together with a large range of Cabinets. We also design and make cabinets to customers' requirements.

We have a cheerful, helpful staff to advise you with your purchases and problems. You can compare the merits of any combination of Amplifier, Speaker, Pickup, and V.H.F. Tuner in our demonstration room.

We are not a large organisation, but we want to please you, the customer, and we offer a personal service backed by sound advice, and a reputation for scrupulously fair dealing. We do not only want to sell you the equipment—we want to give you service and to help you to get the best out of it.

If you are interested in High Fidelity Equipment it will pay you to visit our showrooms in Farnham. If you are unable to do this, our representative will be pleased to call at your home to discuss the installation of any sound equipment.

Lloyd & Keyworth Ltd.

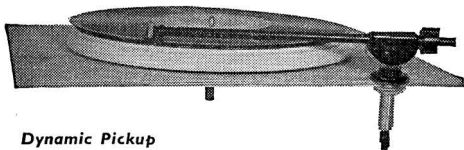
The Record Shop

26/27 Downing Street, Farnham, Surrey

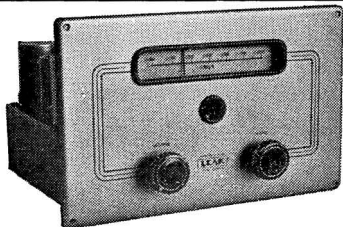
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Dynamic Pickup



Trough-line F.M. Tuner



"Point-One" Plus Pre-amplifier

We have devoted over 23 years entirely to the design and manufacture of audio equipment and we are proud of our position as leaders in this field. We were the first firm in the world to design and market Amplifiers having a total distortion content as low as 0.1% ; a claim which was received with incredulity in 1945, but which was subsequently confirmed by the National Physical Laboratory and has become an accepted world-wide standard.

High engineering ideals have guided our efforts, and Leak Amplifiers have been the choice of the B.B.C., Commonwealth and foreign Broadcasting authorities and Recording Studios. This acceptance by professional audio engineers has led to a demand for Leak equipment from music lovers throughout the world.

On the important question of prices it is appropriate to mention one of the basic principles of Leak design. From long experience and by extreme attention to design details during development work on the pre-production models, we enable our craftsmen to achieve a high output per man-hour. The labour costs thus saved offset the increased cost incurred for high grade materials, components and finishes, and this together with quantity production (made possible only by a world-wide market), explains how quality products may be sold at reasonable prices.

Write for details of the full range of new Leak High Fidelity Equipment.



... the first name in High Fidelity

H. J. LEAK & CO. LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, LONDON, W.3., ENGLAND.

Cables : Sinusoidal, London.

Britain's best Hi-Fi equipment . . .

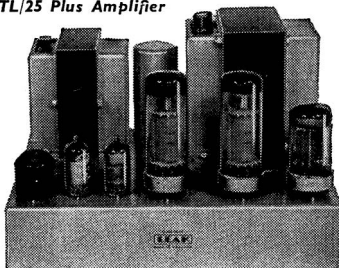


"Varislope III" Pre-amplifier



TL/12 Plus Amplifier

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50

various types of
**PICK-UPS
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various types of
RUN-IN TAPES
(coloured)

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various types of
**RECORDING
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(L.P. and Standard)

SPLICERS • **JOINTING-COMPOUNDS**

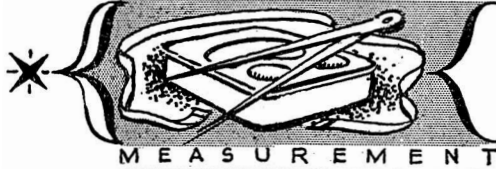
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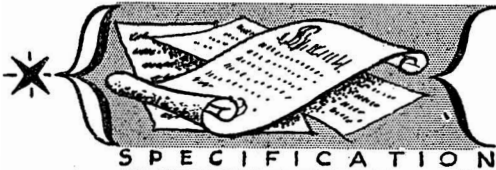


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tuner units
a.m. — f.m.



transistor
pre-amplifiers



pick-ups

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control units



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— *from every point of view*

the greatest range of instruments on offer
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The Lowther Corner Reproducer type T.P.I. is the most outstanding electro-dynamic acoustic development of our time.

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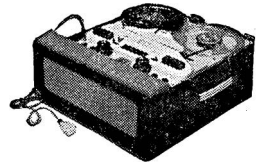
RICHMOND: 13 King Street, Richmond, Surrey

Tel.: RIC 6798

SOUTHALL: 20 - 22 High Street, Southall, Middx.

Tel.: SOU 3828

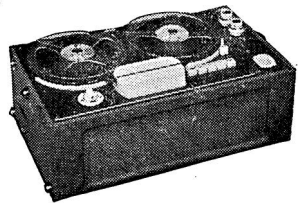
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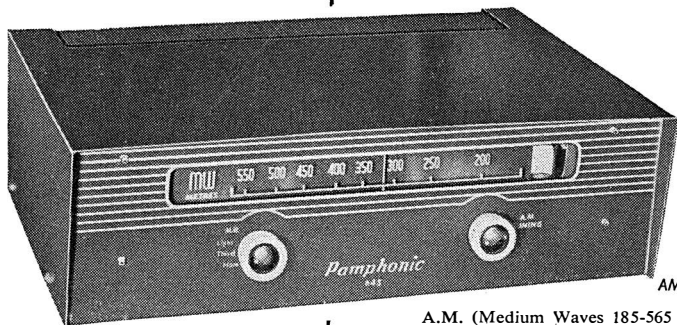
207 EDGWARE ROAD, LONDON, W.2

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another success

OUR LATEST AM/FM TUNER

This latest addition to our range, designed to provide high quality reception from the BBC VHF transmitters and from stations in the Medium Wave Band (185-565 metres). Features: automatic frequency control; Foster-Seeley discriminator; designed for $\frac{1}{2}$ megohm output load; visual tuning indicator; switched spot tuning on VHF.



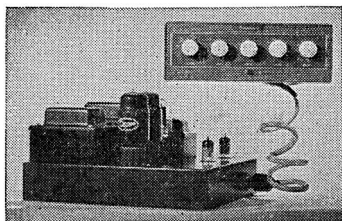
Overall Dimensions.
13" wide x 4" high x
9" deep.
Weight.
9 lbs. approx.

AM/FM TUNER model 645

Price
£30 inc. P.T.

A.M. (Medium Waves 185-565 metres) 10 micro-volts for 1.0 volt output. F.M. (3 switched stations) 15 micro-volts for 40 db quieting, 1.0 volt output. Using an outdoor di-pole aerial this sensitivity could give first class reception up to 80 miles on VHF, and with an indoor aerial 30-35 miles. The di-pole aerial used for F.M. also provides the necessary pick-up for A.M. reception.

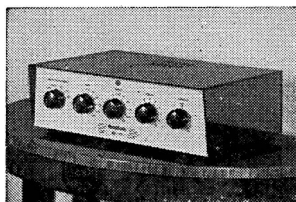
HERE ARE TWO MODELS THAT ARE STILL BEING PRAISED



AMPLIFIER model 2001 and PRE-AMPLIFIER model 2001A

25 watts continuous output, total distortion only .05%. Pre-Amplifier has inputs for Tape, Gram., Mic. and AM/FM tuner. Compensator for record characteristics and continuous adjustable bass and treble controls. Automatic attenuation control for various cartridge characteristics.

Price
complete
40 gns.



Price
25 gns.

INTEGRATED AUDIO AMPLIFIER model 1004

Selector switch covers the majority of recording characteristics. Separate bass and treble controls. Supplies for Radio and Gram. motor provided.

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Pamphonic

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***Living
sound
captured
for ever . . .***

Knowing that for recording quality it is without equal, more and more experts and connoisseurs of hi-fi recording are choosing Mastertape. Now manufactured with a new improved lacquer it is anti-static and free from curl yet costs no more than many inferior makes.



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MSS RECORDING CO. LTD., Colnbrook, Bucks.

Telephone: COLNBROOK 2431

Unique and progressive— High Fidelity equipment by **PILOT**

HFA 11 10-watt combined amplifier/control unit

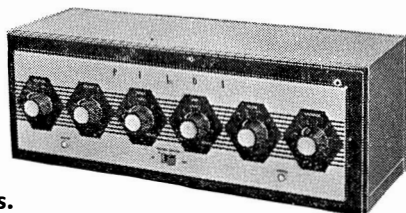
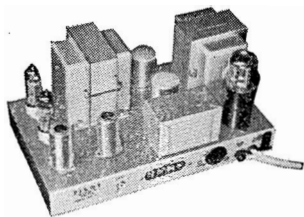
The HFA 11 embodies a power amplifier, pre-amplifier and control unit on one chassis providing wide flexibility of control and full provision for use of ancillary equipment.

The amplifier with its attractive brushed brass finish can be simply placed on a shelf or table, or it can be panel mounted.



30 gns.

HFC 12 control unit/pre-amplifier HFA 12 12-watt power amplifier



36 gns.

The '12' system is composed of two separate units, enabling them to be used in a variety of installation combinations. The HFC 12 possesses a unique feature in the muting switch which desensitises the amplifier when records or input sources are being changed without the necessity to alter the main controls. A loudness control gives bass and treble compensation at low listening levels.

HFS 14 Corner speaker enclosure

This enclosure is admirably suited to fulfil the exacting requirements of High Fidelity reproduction in the average room of the modern home. The 12-inch speaker unit combined with the acoustically correct enclosure ensures a realistic and intimate reproduction. The cabinet is hand-finished in polished Sapele Mahogany with a striped Tygan front. **28 gns.**

With more and more people fast awakening to the thrill of High Fidelity reproduction of voice and music, there is an ever increasing demand for Pilot High Fidelity. And here is equipment you will be proud to handle. Clean, contemporary design, convenient and complete control, and the highest standards of precision engineering are combined in every Pilot instrument.

The High Fidelity Division of Pilot Radio is always at your service—ready to advise you on all aspects of sales and installation.

PILOT

HIGH FIDELITY DIVISION

PILOT RADIO LTD · PARK ROYAL ROAD · LONDON · N.W.10 · ELGAR 7353

The new Pye Mozart Lowboy has been specially designed to keep perfect company with the highly successful Pye 12 watt Contemporary Speaker System.

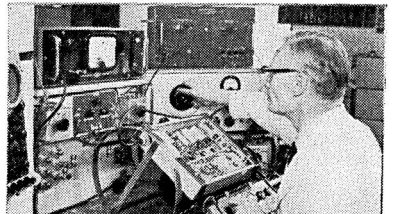
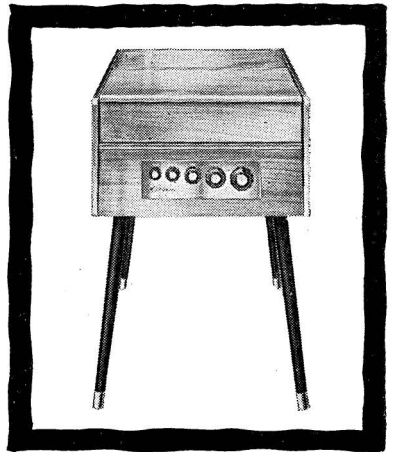


The Lowboy incorporates the Mozart 10 watt amplifier — one of the smallest and most efficient units ever devised for the home use — leaving ample room for the fitting of a record player of your choice. Used together these Pye units offer the enthusiast the basis of a craftsman-built high fidelity system at very reasonable cost, and completely contained in two matching cabinets. See Pye 2-Unit High Fidelity at your nearest Pye Dealers.

Mozart

Ingenious design and printed circuitry in the Mozart amplifier have made possible an undistorted output of 10 watts from a chassis which measures only 10½" x 3⅜" x 5".

It features simple controls and facilities for high fidelity reproduction from records, tape and radio. The new 'Dialomatic' compensation unit gives instant matching for any type of pick-up.

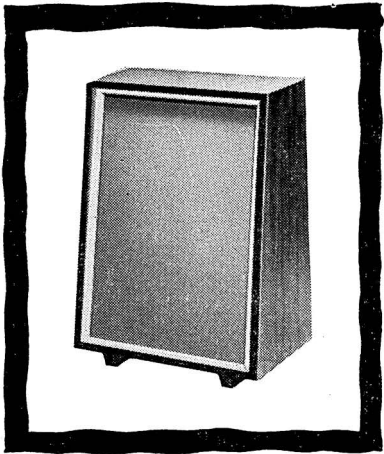


The creative mind of the scientist . . . in the hands of the craftsman

PYE 2-UNIT HIGH FIDELITY SYSTEMS

Contemporary Speaker

*Features 12" speaker and special
4" treble unit acoustically
mounted in a walnut-veneered
Contemporary-style cabinet.
Frequency range:
30-15,000 c.p.s. Power
handling capacity: 12 watts.*



PYE LIMITED OF CAMBRIDGE



...looking for the perfect system ?

There is of course a different answer for everyone—the main thing is that *your* high fidelity system should suit your ear, your home and your pocket at one fell swoop !

A word of warning, however—it is only too easy to spend a lot of money on hi-fi equipment. Only the expert knowledge you get at Q.M. can help you to choose items that combine to good effect. A letter or, better still, a visit to Q.M. can give you the kind of advice that makes *sound* sense about any of the equipment shown in Hi-Fi Year Book.

Incidentally, we are adept at answering difficult export problems.

Heard about the Q.M. Record Service ? You simply order your record and it is promptly delivered in *factory-fresh condition*. Each record is unplayed but carefully inspected by us, PARASTAT TREATED, and packed in a polythene bag. L.P.s and 45s — post free (except single 45s). Overseas costs only 4/5ths of home prices.

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Our showroom is open for demonstrations daily 9.30-6. Friday 1.30-9. Closed Monday.

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PHILIPS

NG5400



The precision-engineered arm is equipped with a micrometer adjustment of playing weight over a range of 0-10 gms. Both arm and rest are adjustable in height.

Magnetodynamic ...and magnificent

SPECIFICATION

Sensitivity: 4mV. for each cm./sec. velocity.

Effective armature mass: 3mg.

Lateral compliance: At least 5×10^{-6} cm./dyne.

H.F. resonance: 25,000 c/s.

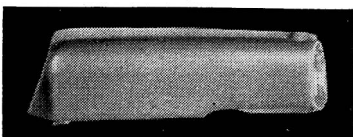
Frequency response: Substantially linear
20-20,000 c/s.

Stylus: Diamond for microgroove records.

Playing weight: Adjustable
0-10 gms.

Take a look at the Philips Magnetodynamic Pick-up and Arm. If you want to improve your sound equipment, or if you're starting afresh, take a *good* look. For this superlative performer is the first *moving magnet* pick-up. A diametrically magnetised Ferroxidure rod of low mass and inertia is the only moving part, and the carefully designed cantilever type stylus ensures good vertical compliance and low mechanical noise. The output is in the region of 25 mV., and no input transformer is needed. This, in fact, is almost certainly the finest pick-up on the market.

PRICE with microgroove diamond: **19 gns** (tax paid)



Pick-up head made in Holland

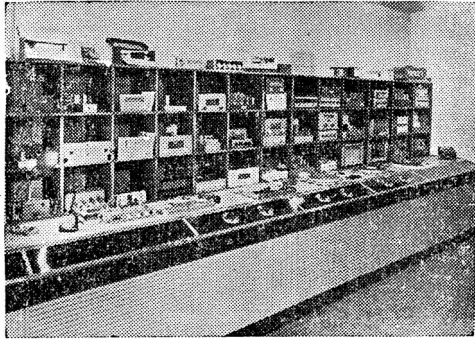


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Beam-Echo	Goodmans	Pilot	T.S.L.
Champion	Goodsell	Pye	Westrex
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Rare Records Ltd

5-7 BARTON SQ., ST. ANN'S SQ., MANCHESTER, 2.



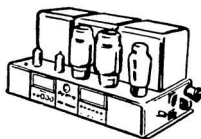
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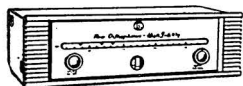


Plug in and play with

RCA



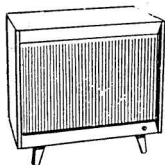
MAIN AMPLIFIER



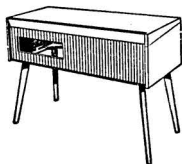
F/M TUNER



TRANSCRIPTION DECK



LOUDSPEAKER SYSTEM



LOWBOY CABINET

When you buy RCA you can be sitting enjoying true High Fidelity listening within minutes of getting it home. RCA Engineers have done all the wiring and looked after the matching of every single component so that all you need to do is "plug-in-and-play".

RCA is neat and compact, too, for the amplifier, tuner, transcription deck and speaker are all accommodated in two beautifully styled furniture units—a separate panoramic speaker system and a bespoke chairside lowboy cabinet.

The RCA New Orthophonic equipment is unique in being a *complete* system of *matched* units designed together by the world's leading sound engineers for perfect reproduction.

Illustrated leaflets giving full details of *New Orthophonic* equipment and other self-contained plug-in-and-play *High Fidelity* instruments sent on request.



New Orthophonic
High Fidelity

RCA GREAT BRITAIN LTD.

(An associate company of Radio Corporation of America)

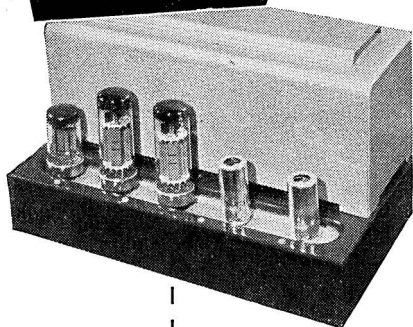
Lincoln Way, Windmill Road, Sunbury-on-Thames, Middx.

The **RD**

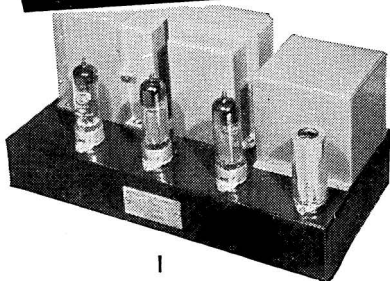
1958 RANGE of

SOUND EQUIPMENT

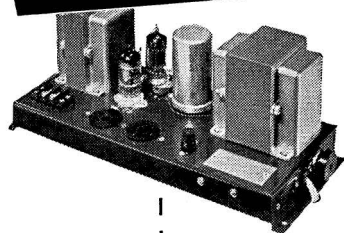
RD SENIOR



RD JUNIOR



RD CADET



THE three amplifiers illustrated, together with their matching control units, form the basis of a comprehensive range of equipment, designed for Home High Fidelity Systems, including FM receivers, tape equipment, loudspeaker enclosures and equipment cabinets.

The unusually high standard of workmanship and materials, allied to moderate price, have gained for "RD" equipment an enviable world-wide reputation, each unit maintaining leadership in its own particular price class.

Available from leading high fidelity dealers throughout the country

A complete set of *Illustrated Literature*, covering the current range of units may be had free and post free on request.

★ **RELIABILITY** backed by a **TWO YEAR GUARANTEE**

Designed for Home High Fidelity Systems

Trade and Export inquiries invited:

ROGERS DEVELOPMENTS (ELECTRONICS) LTD.,

"RODEVCO WORKS" - 4-14, BARMESTON ROAD - CATFORD - LONDON, S.E.6 - HITher Green 7424

Reflectograph



PROFESSIONAL RECORDERS FOR THE HOME

The Reflectograph tape recorder and reproducer has previously been supplied in limited quantities to Broadcasting Authorities, Recording Studios and Laboratories. It has now been attractively re-styled and is available in two models.

THE REFLECTOGRAPH IS THE ONLY RECORDER IN THE WORLD POSSESSING ALL THESE FEATURES:—

Tape deck finished in "hammered gold" and cream. Fitted with 3 heads, separate record and replay amplifiers, enabling instant comparison to be made between signal recorded on tape and the input. Variable speed between 8 and $3\frac{1}{2}$ I.P.S.

Stroboscope, lit by neon lamp, shows precise speeds of $7\frac{1}{2}$ and $3\frac{3}{4}$ I.P.S.

Easy tape threading into a straight slot.

Provision for conversion to stereo.

Lever deck controls, providing variable speed wind forward and back from extra fast to inching for editing; sound available for editing if required; instant stop and start.

Peak level recording meter; push-button record-playback controls with record safety latch; clock-type tape position indicator; 3 Garrard motors; 2 matched loudspeakers; accommodates up to $8\frac{1}{2}$ " reels.

3 watts undistorted output; 2 input and 2 output sockets; plays total of 2 hours 8 minutes on two tracks at $7\frac{1}{2}$ i.p.s. or 4 hours 16 minutes at $3\frac{3}{4}$ i.p.s.

Fitted with Bib tape splicer on deck, complete with reel of tape, spare reel, 2 screened jack plugs.

Model 400 specification is similar to above, excluding 3 watts output, 2 loudspeakers and 1 output socket.

Additional facilities include sockets on chassis for radio and pick-up; socket for microphone on instrument panel, where an additional switch provides instant selection of microphone, radio or pick-up. The combined record and playback amplifier may be mounted vertically or horizontally.

DIMENSIONS :

Model 500 — 21" long x $14\frac{1}{2}$ " wide x $10\frac{1}{2}$ " high; Weight 50 lbs.

Model 400 — Deck on stand: $17\frac{1}{4}$ " long, $13\frac{3}{8}$ " wide; height above deck $1\frac{3}{8}$ "; height below deck $7\frac{1}{2}$ ". Instrument panel $4\frac{3}{8}$ " wide, 7" high. Aperture for chassis $3\frac{3}{4}$ " wide, 6 $\frac{1}{2}$ " high. Depth of chassis $13\frac{1}{4}$ ".

Reflectograph 500 is self-contained. The portable duo-tone case is finished in luxan hide and pigskin colours and is complete with an output amplifier and two matched loudspeakers.

Reflectograph 400 is supplied in three units for incorporation in furniture: it comprises the Reflectograph deck mounted on a stand, combined record amplifier and playback pre-amplifier and the power pack. The units, complete with inter-connecting leads, have been designed for operation in conjunction with the leading makes of high fidelity amplifiers.

MODEL 500 — 94 GUINEAS
MODEL 400 — 84 GUINEAS

Prices apply only in the U.K. and are subject to change without notice. Reflectograph models 400 and 500 are available from leading high fidelity and audio retailers. In case of difficulty please write to:

**REFLECTOGRAPH DIVISION, MULTIMUSIC LTD.,
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Rx
 To half-a-pint of water add one teaspoonful of CLENDISC. Immerse the FREDOREC pad. Squeeze out well to expel all surplus liquid, thus leaving the pad just damp, but not wet.

CLENDISC – Anti-Static
 Cleaner and Preserver
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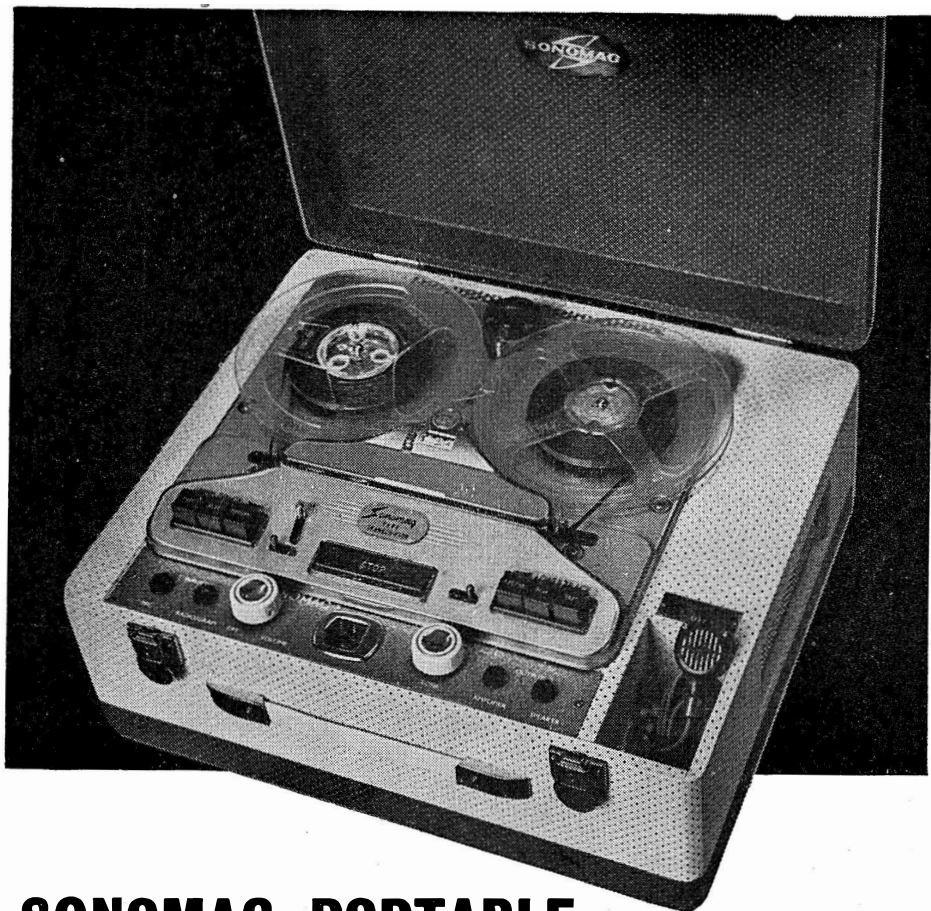
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 3/2 (inc. tax)
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AVAILABLE FROM ALL GOOD
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1950 was a great year for the Gramophone. It saw the birth in this country of L.P. Records and the introduction of CLENDISC—still the finest formula for keeping them clean. After all these years, CLENDISC is the most effective and safest medium for keeping your records in pristine condition. It has powerful anti-static properties and used in conjunction with the now-familiar FREDOREC PAD in accordance with the "prescription" above, it will keep your records in mint condition, improve reproduction and reduce surface noise. CLENDISC is also a wonderful tonic for your 78 Records. Time has proved that CLENDISC and the FREDOREC PAD are indispensable accessories to every discerning record-lover. Use your FREDOREC PAD every time you play a Record!

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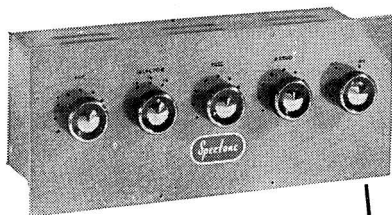
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SPEAKER SOCKET SEPARATE MICROPHONE AND RADIO SOCKETS FOR MIXING.
HI FI JACK NEW MOVING COIL MICROPHONE 1,200 ft. TAPE

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SONOMAG  **2 ST. MICHAEL'S RD., STOCKWELL, S.W.9**
Telephone : BR1xton 5441 (3 lines)

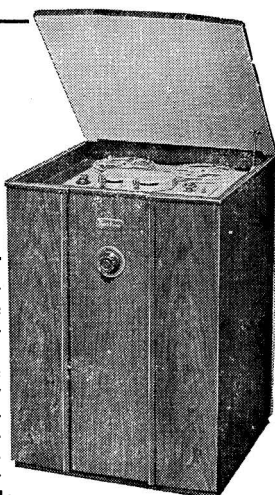


**Spectone
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The Spectone Electronic Mixer provides full mixing facilities from three sources of sound. Three separate gain controls entirely independent of each other enable any input signal to be regulated without affecting the other signals. Two models available:
Model 142 (unpowered version) Price £17-17-0
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**Spectone
RECORDER**

**AND STEREO-
PHONIC TAPE
REPRO-
DUCER**

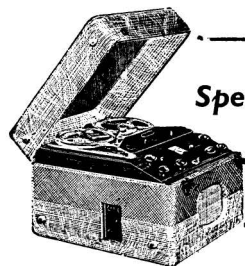


This unit combines single channel recording and full three source mixing facility with twin channel stereo-
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channel reproduction on one or two speakers. Here is "high fidelity" of a quality hitherto unattainable.
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Equipment
for quality
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Specifications include two direction recording and replay; three speeds; an accurate digit tape counter, and an easy to read recording level meter. The machine is built and rigorously tested to C.C.I.R. specification, and is backed by the unequalled Specto after-sales service. With microphone, 76 gns.



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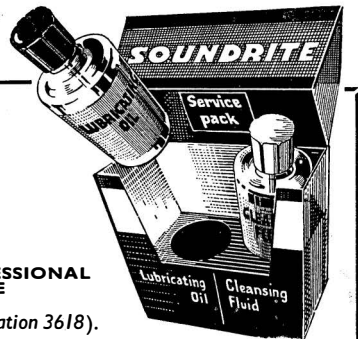
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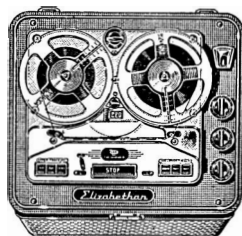
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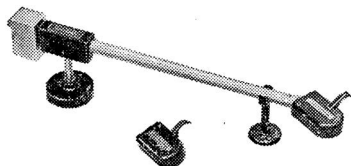
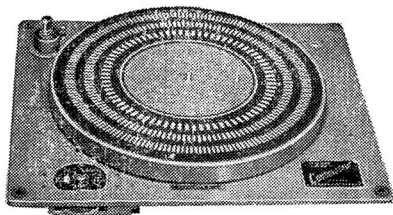
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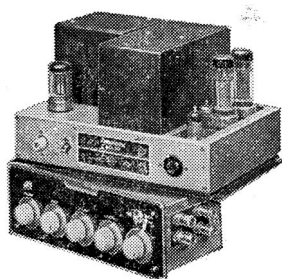


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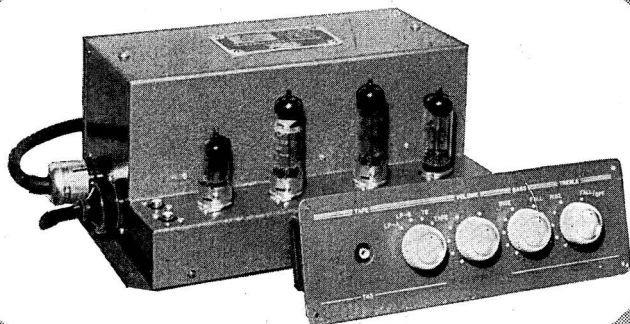
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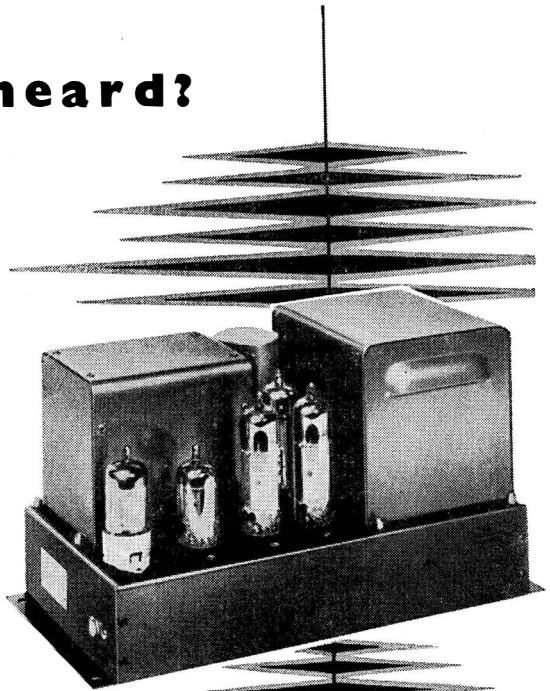
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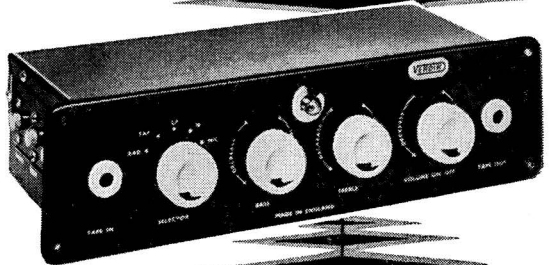
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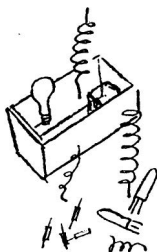
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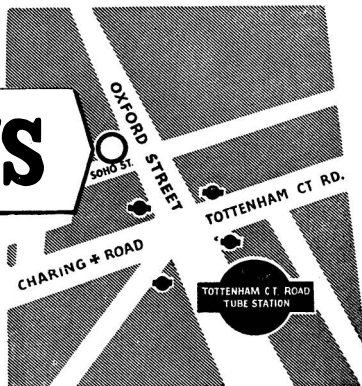
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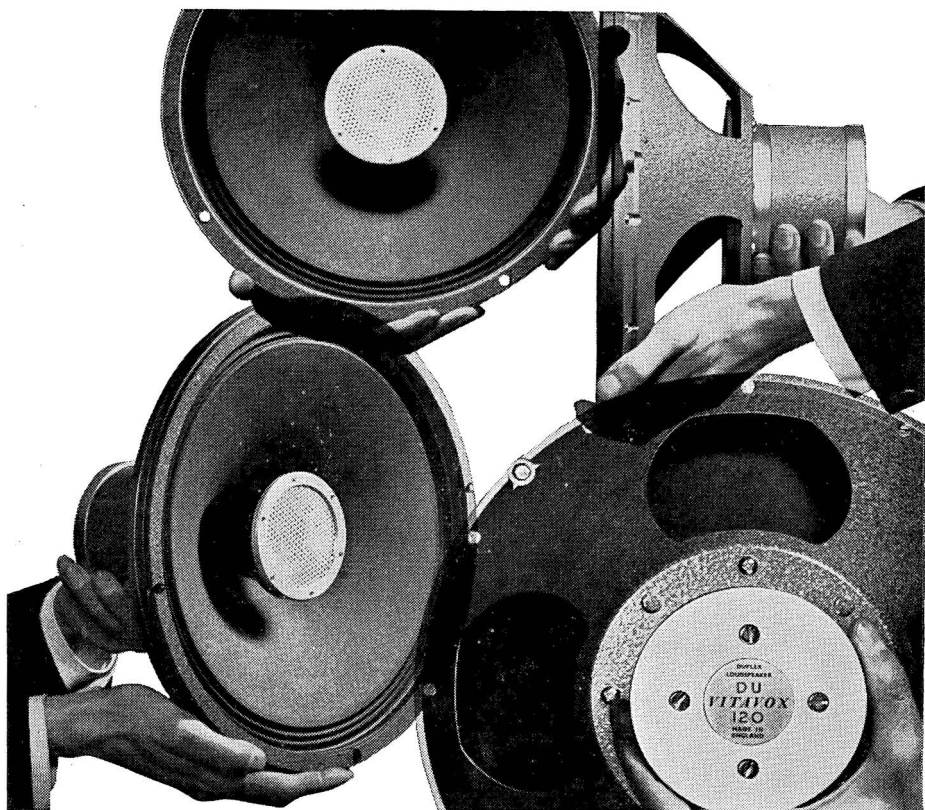
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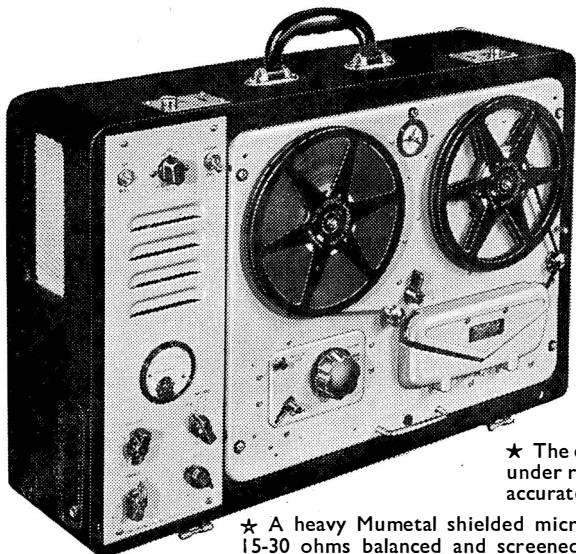
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★ The total hum and noise at $7\frac{1}{2}$ inches per second 50-12,000 c.p.s. unweighted is better than 50 dbs.

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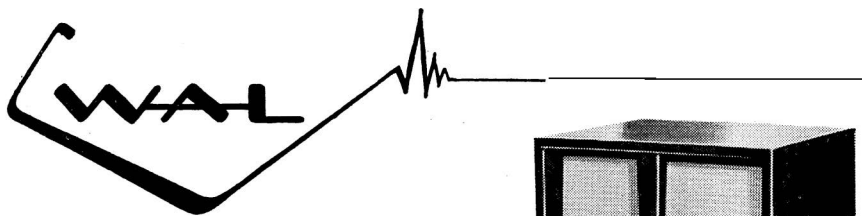
★ The distortion of the recording amplifier under recording conditions is too low to be accurately measured and is negligible.

★ A heavy Mumetal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 microvolts approximately to fully load. This is equivalent to 20ft from a ribbon microphone and the cable may be extended 440yd without appreciable loss.

- ★ The 0.5 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 4 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.
- ★ 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.
- ★ Our special MONITOR HEAD MODEL WVB has an additional head and amplifier which enables this recorder to perform a number of useful functions.
- ★ The most important of these is to monitor the recorded tape a fraction of a second after it is made, and if necessary compare it, by throwing a switch, with the signal before it is recorded. This allows the recording engineer to make certain that he has made a first-class recording before the artists leave the studio, without the necessity of waiting while another run through is made.
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- ★ In a similar manner the original signal may be fed back and re-recorded resulting in an echo, the time constant of which is controlled by the speed of the tape and the distance apart of the heads.
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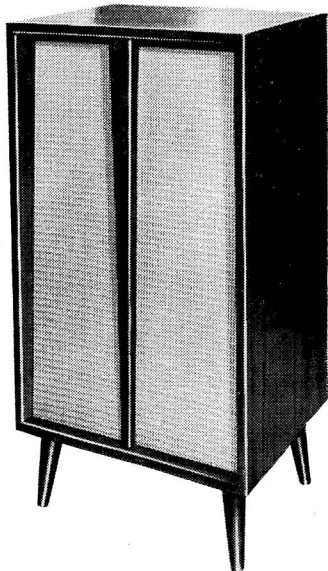
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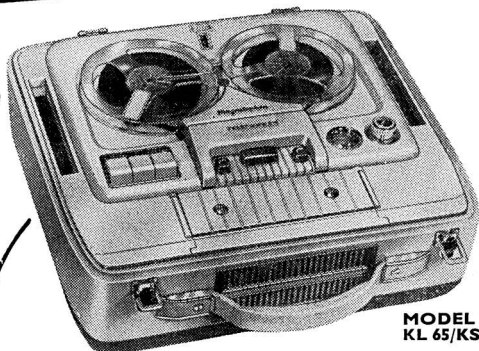
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**MODEL
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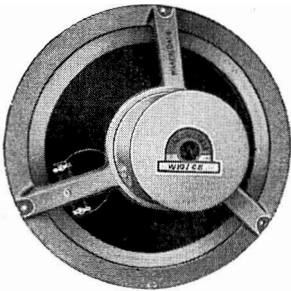
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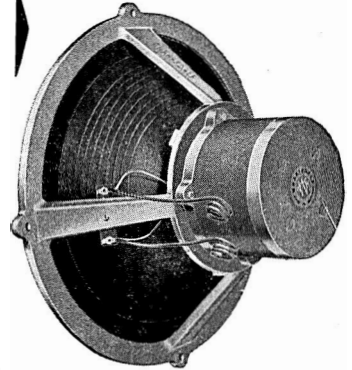
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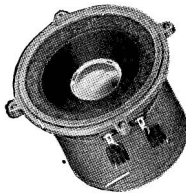
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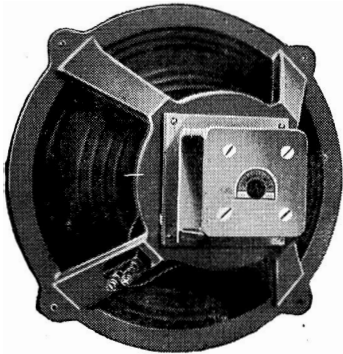
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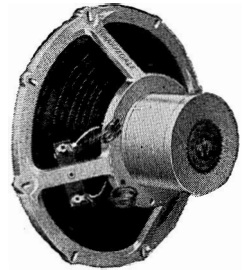
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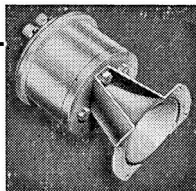
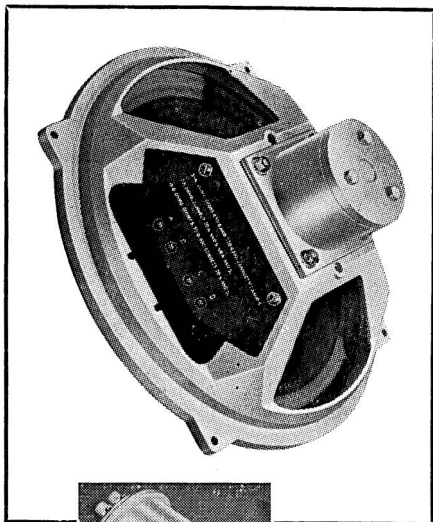
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MODEL H.F.1012 10" Die-cast unit, 12,000 gauss magnet. Fitted with cambric cone, and universal impedance speech coil providing instantaneous matching at 3, 7.5 and 15 ohms. Handling capacity, 10 watts. Frequency response, 30 c.p.s.-14,000 c.p.s. Bass resonance, 35 c.p.s. **£4 · 19 · 9** (inc. P.T.)

T.10 TWEETER UNIT Moving coil pressure type. Speech coil impedance, 15 ohms. Response, 200/14,000 c.p.s. Flux density, 14,000 gauss. Handling capacity, 5 watts. Dispersion angle, 90°. **£4 · 4 · 0** (inc. P.T.)

If required, a suitable cross-over network is available at 30/-

...AND A MOST ATTRACTIVE CONTEMPORARY CABINET

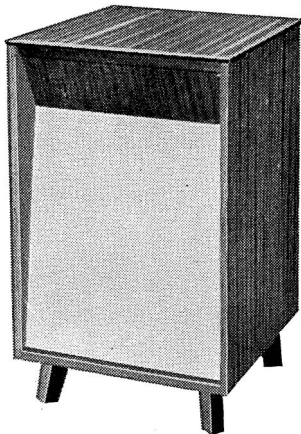
★ The Stentorian High Fidelity range includes speakers (from 8" to 15" dia.), tweeter units, ready-to-assemble cabinets (contemporary and traditional styling) from £5 10s. to £16 16s., the W.B.12 Amplifier and the new W.B. VHF/FM Tuner. See and hear them at all leading Hi-Fi dealers: in case of difficulty, write to our London office (109 Kingsway, W.C.2) for name of nearest stockist. The complete range is demonstrated at this address every Saturday between 9 a.m. and 12 noon.

"Prelude" Bass Reflex Console Cabinet

One of our new series of contemporary style cabinets in satin-striped sapele veneers. Supplied in ready-to-assemble form and put together in a few minutes with a screwdriver. Provides absolute realism in reproduction when used with Stentorian 8" or 10" units. Provision for Tweeter unit.

Size: 33" x 19" x 19½"

Price: **£11 · 11 · 0**



Stentorian

WHITELEY ELECTRICAL RADIO CO. LTD · MANSFIELD · NOTTS



**A loudspeaker system
of unique performance
remarkable in its ability
to keep faith with the sound
it reproduces**

ACOUSTILENS 20/80



Regd. TRADE MARK

*Available for inspection and demonstration at most
retailers of really high fidelity equipment
throughout the country*

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DIRECTORY OF HI-FI DEALERS

IMPORTANT NOTE: The following list is of shops where stocks of equipment are known to be kept, and where facilities for demonstration exist. It is not necessarily a complete list, and we invite new dealers to submit details for future publications.

LONDON AREA

BERRYS (SHORT WAVES) LTD., 25 High Holborn, W.C.1

B.K. PARTNERS LTD., 229 Regent Street, W.1

CITY SALES & EXCHANGE LTD., 93 Fleet Street, E.C.4

ELECTRONICS (FLEET ST.) LTD., 152/3 Fleet Street, E.C.4

B. B. EVANS, 148-162 Kilburn High Road, N.W.6

C. C. GOODWIN LTD., 7 The Broadway, Wood Green, N.22

GRAMOPHONE EXCHANGE, 121-123 Shaftesbury Avenue, W.C.2

H. C. HARRIDGE, 8 Moor Street, Cambridge Circus, W.1

HARRODS LTD., Knightsbridge, S.W.1

HOLLEY'S RADIO, 285 Camberwell Road, S.E.5

ALFRED IMHOF, 112 New Oxford Street, W.1

LARG & SONS LTD., Hanover House, 76/77 High Holborn, W.C.1

LEE ELECTRONICS, 400 Edgware Road, W.2

JOHN LEWIS & CO. LTD., Oxford Street, W.1

LEWIS RADIO, 120 Green Lanes, Palmers Green, N.13

MODERN ELECTRICS LTD., 164 Charing Cross Road, W.C.2

MUSICRAFT, 80-82 Uxbridge Road, Ealing, W.13

PETER JONES, Sloane Square, S.W.1

PREMIER RADIO CO., 23 Tottenham Court Road, W.1 ; 207 Edgware Road, W.2

QUALITY MART, 8 Dartmouth Park Avenue, N.W.5

RADIO CENTRE, 33 Tottenham Court Road, W.1

RIMINGTON VAN WYCK LTD., 42-43 Cranbourn Street, W.C.2

SELFRIDGES LTD., Oxford Street, W.1

H. L. SMITH & CO. LTD., 287-9 Edgware Road, W.2

A. L. STAMFORD, 98 Weymouth Terrace, E.2

TELE-RADIO (1943) LTD., 189 Edgware Road, W.2

JOHN TRAPP LTD., 371 Green Lanes, Palmers Green, N.13 ; 15 Crouch End Broadway, N.8

WEBBS RADIO, 14 Soho Street, W.1

BATH (SOMERSET)

C. MILSOM & SON, North Gate

BIRKENHEAD

JAMES McKENZIE LTD., 27/29 Grange Road West

BIRMINGHAM

GRIFFIN RADIO LTD., 122 Bristol Street, B'ham 5

HOLLICK & TAYLOR, 16 Grosvenor Road, Handsworth Wood, B'ham 20

JEWKS & CO., 293 Broad Street, B'ham 1

WALKER BROS., 27 Temple Row, B'ham 2

C. H. YOUNG, 110 Dale End, B'ham 4

BOURNEMOUTH (HANTS)

RONALDSON, 205 Seabourne Road, Southbourn

BRADFORD

BROWN, MUFF & CO. LTD., 55 Margaret Street

BRIGHTON (SUSSEX)

JOHN KING (FILMS) LTD., East Street

LANES, 11 Gardner Street

LYON & HALL, 92 Western Road

BRISTOL (SOMERSET)

BRISTOL & WEST RECORDING SERVICES LTD., Park Row

BURY ST. EDMUNDS (SUFFOLK)

LEESONS PHOTOGRAPHIC LTD., Opposite the Abbeygate

CAMBRIDGE

K.P. CAMERA SHOP, 12a Kings Parade

G. P. REECE, 1-2 Peas Hill

UNIVERSITY RECORDINGS, 16 Burleigh Place

CARDIFF

J. GOUGH & CO. LTD., 148-154 North Road

CHESTERFIELD (DERBYSHIRE)

BLACKS RADIO STORES LTD., 55 Lower Pavement

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CREWE

MILLER & PALIN LTD., Odeon Buildings, 11 Delmar St

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DERBY

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J. KERR, 262 Woodlands Road, C.3

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CHARLES PERRITT LTD., 242 Freeman Street

FRED W. WOOD LTD., 24a Bull Ring

GUILDFORD

J. A. TOWNSEND LTD., 5 Tunsgate

HALIFAX

D. R. SMITH, 44b Pellon Lane

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HIGH WYCOMBE (BUCKS)

M. W. KEEN, The Chantry Studio, Paul's Row

KEIGHLEY (YORKS)

J. S. RAMSBOTTOM & CO. LTD., Cooke Lane

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R. K. APPLEBY, 5 Crown Passage

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BEAVER RADIO LTD., 60-62 Whitechapel

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COVENTRY RADIO, 189 Dunstable Road

MANCHESTER

FORSYTH BROS. LTD., 126/8 Deansgate

HIGH FIDELITY DEVELOPMENTS LTD., 144 Oxford Rd.

NORTHERN ELECTRONIC COMPONENTS, 227b Oxford Road

RARE RECORDS LTD., 5/7 Barton Sq., St. Ann's Sq.

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PALMERS, 106 Newport Road

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NOTTINGHAM

ALEX OWEN, 51 Carrington Street

OXFORD

HORNS, 6 South Parade

LOWE & OLIVER, Ship Street

L. WESTWOOD, 46 George Street

PETERBOROUGH

CAMPKIN'S (formerly Camera & Cine Centre), 28

Cumbergate, (opp. G.P.O.)

ROY SPACKMAN, 42 Cowgate

PLYMOUTH

ALBERT E. FORD, 84 Cornwall Street

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FENWICKS, Great Brickkiln Street

PODMORE LTD., 19 Merridale Road

VOLTIC RADIO, Queen's Arcade

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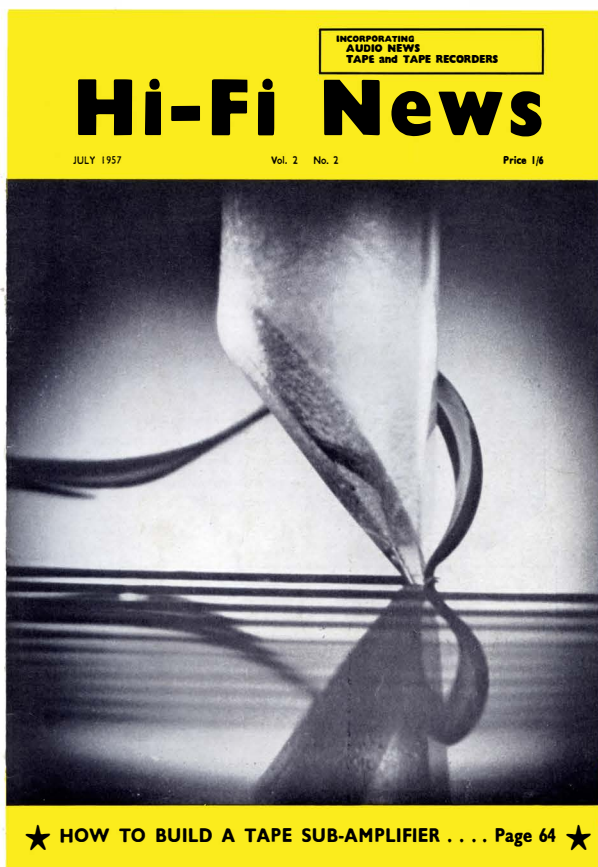
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BARNES & SPICER, 4 Connaught Buildings, Chapel Rd.

BOWER & WILKINS LTD., 1 Becket Buildings,
Littlehampton Road**WREXHAM**HIGH FIDELITY DEVELOPMENTS LTD., P.O. Stores,
Garden Village

FOR THE SOUND ENTHUSIAST

★ *Hi-Fi News* is the leading British monthly journal for all Hi-Fi enthusiasts. Finely produced, and profusely illustrated, it brings you all the latest news and reviews in the most interesting and comprehensive form. 2/- MONTHLY



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