Hi Fi YEAR BOOK

1963

PICKUPS · MOTORS · TUNERS · SPEAKERS ·
AMPLIFIERS · MICROPHONES · RECORDERS

10/6

Hi-Fi Year Book

1963 Edition

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INDEX

INTRODUCTION

NUMBER EIGHT in its annual series, **Hi-Fi Year Book** for 1963 records an interesting landmark—the definite drive on the part of American audio manufacturers to establish their products in the British market. In the last edition (1962) we noted the arrival of several American pickups, but this year we find competition from the USA in almost all main sections of the directories in this book—pick-ups, tape recorders, radio tuners, amplifiers and speakers. Only the transcription turntable field remains without its American challenge.

One of the most likely reasons for this is the whisper of FM *multiplex* stereo, for the Americans have already a twelve months start on us and have good production experience, following several years of experimental work; whereas English manufacturers have so far no definite market in view, and can certainly not be blamed for not spending money and time on something which might easily turn out to be a non-starter for another year or so. This is where we have allowed a potential competitor to score, and it is a natural follow-up procedure for an exporting manufacturer to urge a trial of product "*b*" when interest is shown in product "*a*". In this way a door can be opened.

Competition for Quality

American pickups have, in general, had a good reception over here; and keen interest has already been shown in American tuners and multiplex adaptors. We welcome this, for one of the finest spurs to improved quality is competition among good products; and we most certainly cannot resent competitive attention to our market from a country in which so many English made hi-fi products have been well received and so firmly established.

In the following pages our contributor, Ralph West, refers to the good, solid background of English hi-fi products, and his article prompted us to read backwards through the annual volumes of this book. We noted while doing so that the number of overseas products listed in the directories has increased very steadily over the years. In the first edition (1956) we counted a bare half dozen, with such names as *Ortofon*, *Lenco*, *Lorenz* and *RCA*. Today, of course, the list of products from the Continent of Europe cover turntables, microphones, pickups, tape recorders and accessories in considerable number; and, reciprocally, English products are selling in greatly increased quantities all over Europe.

The Selective Hi-Fi Market

The hi-fi market is a very selective one, and it is a market in which price is by no means the main factor in selection; indeed, provided only that the quality is in keeping with the price, there is a growing demand for equipment in the higher price bracket. It was a lack of appreciation of this point which hit a number of manufacturers a year or so back, when we saw the coming and going of so-called hi-fi products which were too quickly thrown together for what was mistakenly believed to be an easy market—an arena in which there is no place for an article which is "made down to a price". Quality—genuine quality—must be put before all things; and those manufacturers who had the faith to build up to strict standards, and to maintain those standards in the face of all the band-waggon competition, are the ones whose names have become household words. There are many in the pages of this book, and they are as well known abroad as they are at home.

Some people like to dig back into the past: other consider it a waste of time, and prefer to concentrate upon what the future may have to offer. We find it refreshing to look back along the line because we think that past progress has its proper place as a background

for looking ahead. In terms of hi-fi we like to recall that there were enthusiastic experimenters at work nearly twenty years ago. Their programme material lay in the noisy shellac grooves of 78 *rpm* discs, and their pickups—a great advance on previous devices—were comparably "lightweight" with a tracking pressure measured in ounces.

There is still more on the Disc . . .

For the past seven years, in the columns of our monthly journals, we have repeatedly returned to an old theme only six months or so after some notable advance had seemed to take much of the sting out of it—namely, "*there is far more on the well recorded disc than all but a very few people manage to reproduce*". With pickups now tracking satisfactorily at two grams or less, and with stylus tip radii of 0.005 inch, we can still repeat that theme. Just as the newcomer to hi-fi begins to learn what it is all about on the day that his ears tell him that he could be getting better results, so do the experts become disatisfied with what they have designed to be "the last word", and learn to realise its shortcomings by a similar process.

Several years ago it was considered by many quite knowledgeable people that—for all practical purposes—the ultimate had been reached in fulfilling the requirements of sound reproduction for the home; but what nonsense has already been made of that point of view. To begin with, a dozen and more factors cropped up which had not even been apparent before, and this re-started serious thinking in almost every hi-fi department. Stereo forms only a broad heading in that list: the inherent stresses in pressed discs is an example from another quarter. Pickup and cutter stylus rake angle is another recent one.

So it will go on; and if we could see the pages of a **Hi-Fi Year Book** ten years hence there is no doubt whatever that we should be most impressed by the writings and the equipment specifications. No one could begin to guess what would be found, but much of it would make our present problems look fairly easy. And yet, with a final thought for those remarks in Ralph West's article which begins on page 5, it would be a fairly safe bet to say that much of the equipment we should find in use would have been bought today, or a year or so ago. That is one of the attractions of the hi-fi hobby; although it leads its enthusiasts on an apparently endless trail, it does not continually demand the purchase of a new outfit—only a few new bits and bobs as the whim dictates!

The Money and the Choice

This year thousands more enthusiasts will be taking up hi-fi sound reproduction as a hobby—some starting in a big way, like the reader who wrote, quite modestly: "*I don't mind spending up to about* £400 *so long as I can be sure that it is money well spent*"—others starting in a very small way, like another reader who said: "*I ought not really to buy anything just yet, but I've waited too long already. Tell me the most important unit to start with, to begin the changeover from my radiogram. Then I can spend the next five years or so on progressive development.*" Well, the many hundreds of items listed in this Year Book cater handsomely for newcomers in either of these categories—and for the stages in between.

THE HI-FI SCENE—1963

by Ralph West

IT is interesting to look back at the first *Hi-Fi Year Book* (1956) and at the first two or three copies of *Hi-Fi News*. Even a newcomer to Hi-Fi would not feel himself in strange territory. Most of the modern names are there, and only a very few have since faded out. Several items are still current and unchanged, several more have only had a slight face lift. Certainly there must be thousands of these seven-year-old items still doing a perfectly satisfactory job and by no means about to be pensioned off, or needing excuses for their present performance.

Built to Last

This characterises the whole art of high fidelity sound reproduction as practised in this country—a good honest job, built to last. It used to characterise a much wider spectrum of our national life, but modern thought tends to favour things of limited life, "good for trade" they say. A funny thought, but when transistor design looks like becoming stabilised, they will have to institute research into methods of ensuring that a transistor will automatically die after *x* years! To be more serious, though, the audio equipment we are pleased to call high fidelity is designed specifically to do a certain job reliably and consistently for an indefinite period. There is, of course, a small range of quality and performance within this bracket, dependent on cost,—just as there is a price range amongst, say, high quality cars. The audible difference between the very best and the cheaper high fidelity equipment is small. If it is a large difference then the cheaper stuff is just not high fidelity.

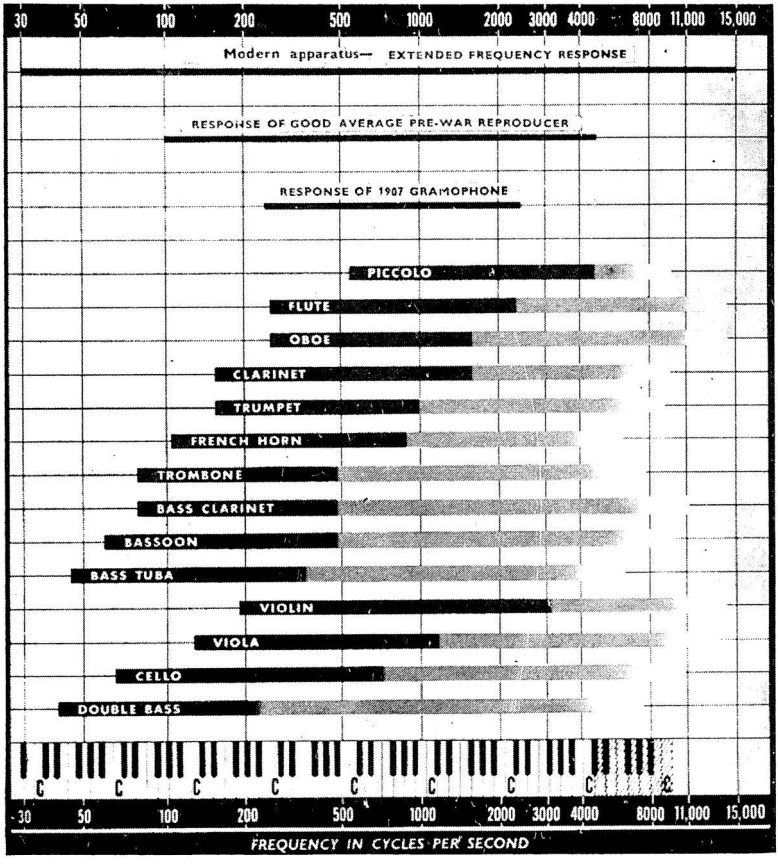
At its best it represents the finest that can be done with modern skill and knowledge, and only enthusiasts ever make the grade. Lest anyone should suspect high fidelity designers are too conservative in their outlook, let us remind ourselves that violin design has not progressed since 1715 and our only complaint is that we cannot even do quite as well to-day! One can quite safely advise "Get a Stradivarius and you will never wish for anything better". In our field we could not go quite as far as that, but the advice "get the best you can afford from this short list of apparatus and you are not likely ever to become dissatisfied", has proved sound, time and time again.

There has been progress, of course, during these seven years, steady progress, though. On the whole, new apparatus has only been offered to the public when it really did represent something better than hitherto. During this time stereo (disc) burst upon us and disorganised things for a while, but this has now settled down and we can still say gimmicks, so far, have had no place in high fidelity in this country.

Why not Transistors?

Most likely some folk may be wondering why we have not already got lots of high fidelity transistor amplifiers. The answer is simply this, transistor amplifiers cannot produce better quality than our *best* valve amplifiers, and even if they could we would not hear the difference. On the score of cost they are at a disadvantage at the moment, but transistors will get cheaper as more are made and used. Again, at present, complete amplifiers cannot be very much smaller and lighter, if adequately cooled and housed for reliable working in all sorts of temperatures. When silicon power transistors are as cheap as output valves we shall no doubt be buying transistor

AUDIO FREQUENCIES



★ *This chart shows the audio ranges of various instruments, with harmonics shaded—and shows the need for good equipment.*

TABLE 1

Tonic Sol-fa	Doh	Re	Mi	Fa	Sol	La	Ti	Doh
Vibration Nos.	24	27	30	32	36	40	45	48
Interval between adjacent Notes		9/8	10/9	16/15	9/8	10/9	9/8	16/15
Interval from Key Note		9/8	5/4	4/3	3/2	5/3	15/8	2
Philosophical Scale	256	288	320	341.33	384	426.66	48	512
Helmholtz Scale, Key C	C	D	E	F	G	A	B	C¹

TABLE 2

Note	C	D	E	F	G	A	B	C¹	D¹
Diatonic	256	288	320	341.3	384	426.6	480	512	576
Interval		1.125	1.11	1.067	1.125	1.11	1.125	1.067	1.125
Equal Temperament	256	287.4	322.5	341.7	383.6	430.6	483	512	575
Interval		1.12	1.12	1.06	1.12	1.12	1.12	1.06	1.12

amplifiers instead of valve amplifiers, but even that will not make all valve amplifiers ready for the scrap heap.

Amplifiers

Amplifiers are not one of our major worries, nor have they been since about 1945 when Harold Leak surprised everyone with his "Point One". Progress since then has been mainly a matter of other people finding out how to do it properly, and a fuller understanding of some of the more subtle points. The final goodness is, roughly speaking, limited by the output transformer. That item has now reached such a high state of development that the transformerless output stage, so convenient with transistors, has nothing more to offer on the score of quality. We could replace some of the amplifier circuitry by equivalent transistor circuitry right now, but it is not often worthwhile. It is probable, however, that very few new valve amplifiers will be designed. To those about to buy good valve amplifiers we can say carry on and do so. Even if three or four manufacturers come out with transistor amplifiers at the next Audio Show, apart from a possible loss of status symbol you will be at least as well off as the other fellow for the next five years!

Radio Tuners

Radio tuners have altered little for some years and, thanks to the BBC, they provide much of our best listening material. There is no doubt about it, the VHF/FM transmissions have been most successful. It seems almost like a bad dream when we recall the days when the only *reliable* source of good quality sound for demonstration purposes was a hand-picked selection of 78 rpm discs (and later some LPs). With the old A.M. long and medium wave transmissions, we could never be sure whether it was us or the BBC producing the distortion, so we usually blamed our own equipment!

FM also needs an Aerial!

Today, even with all the potential advantages of FM, some people still blame their equipment in spite of the fact that they are too lazy to use a decent FM aerial. While a few feet of wire trailing out of the aerial socket will produce plenty of sound, they will be lucky if it is clean sound and free from distortion. Few people will need an elaborate outdoor aerial, but no-one, however close to the transmitter, ought to work with anything less than a correctly oriented dipole. Odd bits of wire have poor or non-existent directional properties. They pick up all manner of odd bits of reflected signal from all directions. These signals arriving at slightly different times, depending where they have come from, can produce the most unpleasant distortion. This has all been said before, but it needs saying often. The very high gain of an FM receiver is misleading as it makes it impossible to judge aerial efficiency by the size of signal produced by the receiver.

Further to this, as and when we can listen to more multiplex stereo, it will be necessary to be even that little bit more particular with our aerial systems to get equally good results. Preliminary trials suggest that people living in a good signal area, and with reasonable aerials, will not notice any deterioration of the sound. Those a bit farther away may need to act on the advice above.

Stereo by Multiplex

The present multiplex tests are encouraging, but until the BBC makes its official pronouncement, we may not see any FM stereo receiver units. Nevertheless stereo adapter units are sure to appear, for many existing FM units already have an output socket labelled "MPX" or something like it. Those that have not can quite easily be fitted with one and there is a good chance their performance will be good enough to provide satisfactory stereo. Some receivers may need aligning more accurately if they are several years old or have had any new valves fitted.

Switched Tuner

There is still only one switched FM tuner designed to pick up (BBC) Television Sound as well. This is a pity as TV sound is often first class as transmitted, but usually horribly mangled by the time it comes out of the average TV speaker. There are surely enough programmes to make this worthwhile for many people, but we must not ask for this facility on bands 4, 5 and 6 at the same time!

Disc is our other main source of programme material and, apart from the advent of stereo, it has not altered very much in seven years. Where we have been careful, many of our earliest LP discs (and our earliest stereos) are still fit to be played in public without talking about archives. This is remarkable because some of these must have been weaned on heavier and stiffer pickups than we now enjoy. Another remarkable fact has emerged: many of these early LP discs and the earliest stereo discs obviously had traces of distortion here and there, some had more than traces, or so

we thought. Almost without exception these same discs will now play perfectly on our modern pickups. This shows most strikingly the progress made in pickup design in the last five years. Decca were about the first really to make the grade, but they are now in illustrious company, enough to satisfy everybody's likes, dislikes, and fancies.

Low Playing Weights

A lot of hot air is still being talked about magic tone arms and of playing weights approaching perilously close to zero, but designers are now showing a greater understanding of their mechanics. With playing weights under 5 grammes, friction and other disturbing forces, as measured near the stylus, must be kept to a very small proportion of 5 grammes. Two per cent of this (i.e. 0.1 gram) *ought* to be a maximum figure. This is quite easily surpassed with modern bearings and really fine lead wires, but it cuts out completely auto-stops and record changers. That is, of course, only one of the reasons why we do not consider record changers to be high fidelity equipment.

Pickups and Arms

Looking still more critically at pickup design, it is not possible to specify the performance of a pickup head without specifying equally rigidly the mechanical constants of the arm and bearings. In other words, a really good design must incorporate head and arm as a complete instrument. Very few head designs, if any, are complete with the necessary damping built in so it is a matter of luck whether they are truly satisfactory when used with any selected or existing tone arm. Admittedly, many are lucky. Lifting devices are now generally accepted as essential and are often built into the arm mechanism, which seems the sensible thing to do.

Disc materials have improved of late. Their manufacturers seem to have solved the static charge problem at last, and they no longer act as electrostatic dust precipitators. We still need our Dust Bugs or equivalents, however, both with our older discs and to keep our new discs really clean, as dust will still settle on them.

Stereo Material

Stereo material is gaining ground and showing considerable enterprise. For the 'pop' recordings, no holds are barred, and some truly remarkable effects are produced, but unfortunately some of the more serious music uses synthesised stereo, i.e. more than two microphones. The noises are lovely, but the sound picture often doesn't make sense. It probably would if our brains were programmed for half a dozen ears well spread out instead of two about six inches apart. Maybe it is a matter of taste, but six inches in front of the conductor's head appears to be the favourite position for the microphone—real hyper fi! Such recordings, however, can sound really beautiful when played in a large hall—where one can get far enough away from the loudspeakers to get the right perspective.

Nevertheless we have a wonderful range of music for our delight that will last indefinitely with reasonable care. If we can *hear* no distortion and no background noise, then apart from the orchestral performance itself maybe it could be deemed perfect. Can we improve on that? We shall, because a standard that satisfies us at any one time, but is not itself perfection, will in due course cease to satisfy, and we will then have to do better.

Turntable Units

Of the five gram motor manufacturers named in the first Year Book, three are still in this field doing as good a job or better. They have been joined by two more from the continent of at least comparable performance, so we are not badly off for really good motors. So far we have lost two of British manufacture and gained none, but there are whispers of good news. While this country is noted for its excellent domestic type record players and changers, it would be a pity if we had to rely heavily on imported machines when we need something really good. I think the faithful *Garrard* 301 has had the longest run unchanged of any motor, long may it continue. The *Connoisseur* motors have gradually "grown up" in appearance and finish during this time, but there are still many old Two Speed models still working perfectly after eight and more years!

Speakers and Ears

We now only need a pair of speakers to start enjoying our high fidelity. This is the most difficult section of the whole system. All the other items can be tested in the laboratory and, if the tests are sufficiently detailed, then we can specify the performance we shall get. In the present state of the art (note the word *art*) the loudspeaker has to undergo a further test before it can be accepted. It must be listened to! Whether this is just an indication that we have not yet realised all the things we should calculate beforehand and measure in the

laboratory, or something deeper, is not known. It is probably something deeper, as it involves our aesthetic appreciation, and that in turn involves the most complex parts of our brain. The laboratory work does help tremendously, of course. It saves time by showing whether or not a certain course of action is likely to be useful or even possible; it produces accurate measurements for comparison and control, but it can't be sure whether we shall like the final result. One day we may know enough to design a loudspeaker from first principles! Despite this we have many excellent loudspeakers and our thanks are mainly due to these enthusiastic people with sensitive ears and a lot of patience.

Try Speakers Carefully

Although it is still as much an art as a science, the laws of nature are inflexible and the better we know them the better we can cooperate. This is probably why we are now able to enjoy sounds from quite small loudspeakers that would have produced favourable comment from nine-cubic-foot monsters seven or eight years ago. This is a good thing these days, where the cult of miniaturisation and microminiaturisation seems to have infected house designers too. Even so a good modern big speaker still sounds better than a good modern little speaker. A pair of them also sound so much better than one that it is worth having two even for mono use only. Perhaps it is because nearly all the things we listen to produce sound from a larger area than say a hole 6–10 inches in diameter. Even the human voice is no exception, as the whole area of the head, neck and chest, back and front, also radiate a measurable proportion of the sound heard.

Choice of a speaker is very much a personal matter, so we can only repeat the advice, hear it often, hear it played softly, hear it when sitting down, and if possible hear it in your own home before saying yes.

What New?

Anything revolutionary round the corner? not very likely, but one never knows. If there is, it will not make everything we now enjoy sound any worse so we need not worry. Again there are plenty of speakers years old that would compare favourably with the latest designs. Voigt's domestic corner horn of 1936 for instance would romp through such a contest. Lucky those with a pair and room for them both! Of more recent date, seven years' ago though, the Quad Full Range Electrostatic still holds its own and shows no sign of being superseded. Quite a few more are now catching up with these two, so there is a wider variety of sizes and shapes etc. to choose from. New materials for cones, surrounds, and magnets etc. keep on turning up and helping the designer produce a lighter or cheaper or smaller job, or one with slightly improved performance for our benefit.

Tape Recorders

A relative newcomer to high fidelity is tape recording. At professional level it has been high fidelity all along, but at domestic level on the whole it has not been up to that standard. Now that the new-toy novelty has worn off, all but the cheapest domestic type machines will easily give quality comparable with domestic record players. With extra care, understanding and practice some of these machines will produce tapes which, if played back via a good amplifier and speaker system, would definitely rank as high fidelity.

Mono and Stereo

With the better machines, say over about £60 mono, and approximately £100 stereo, and again with the necessary care, really first rate recordings can be made by the amateur. For twice this money and upwards come the real professional machines. They will do first rate work more easily and more consistently as is obviously necessary, but not necessarily very much better, unless maintained in perfect condition. For the more serious professional work, higher tape speeds are always used which not only give a wider frequency response, but less distortion and a better signal-to-noise ratio.

Amateur Recording

When using some of the medium priced machines working at 7½ inches per second and, say, a ribbon microphone costing under £10 mono or under £20 stereo, enough care and practice will give tape quality strictly comparable with the best disc quality. Of course, access to musical performances of a high enough standard is not always easy, but some very good tapes have been made from amateur performances, and school concerts etc. As long as these are made on good tape, preferably not double play (to avoid undue print-through) they will have a life at least as long as disc. If care is taken to avoid magnetised heads, background noise will remain as it was and it can be inaudible at normal listening levels. It is very difficult to keep a disc completely free of clicks for very long.

The subject of tape and tape recording cannot be mastered in a day or two, but it can

be a very worthwhile addition to our high fidelity enjoyment. The very wide frequency range of modern discs will probably not be attained at $7\frac{1}{2}$ in/sec, but a signal *really clean* to 10 or 12 Kc/s can give more lasting pleasure than the chromium plated sound from many discs where the stylus only just manages (?) to stay in the groove near the centre of the disc on a loud passage! I must not say more or I shall have Cecil Watts after me, and after all I am comparing a carefully recorded tape, an original, with less than the best disc reproduction.

Good Home-Made Tapes

Again, it is possible for a good home-made tape original to sound better than a commercial pre-recorded tape bought over the counter, as the latter will usually be a copy of a copy at least.

The EMI stereo tapes, some of which first appeared in 1955, will make the beginnings of an excellent stereo tape library. The stereo is very good and uses the principles first laid down by Blümlein. It all feels very real and is easy to listen to. It is a pity that it has taken us so long to find out what we have been missing. There are some good modern tapes available, too, that can be added to that collection.

Our final advice is as before: Buy from a reputable source the best you can afford and you are not likely to become dissatisfied with your gear. We stress again *the best you can afford* because you may well become more critical with time and be able to appreciate more of the finer qualities of sound. The experience of the last seven years shows that none of the better equipment has become out of date or appreciably below our highest current standards during that time, so it has been good money well spent!

Kits

Lastly, excellent kits are available for those with more time and less money. They are engineered so that any normal being, not necessarily technical, can build them. The final result in looks and performance are right in the top class. They are cheaper only because you have provided some of the labour.

STEREO FROM DISCS—1963

By John Goddard

BY FAR the most important source of high quality musical sounds outside the concert hall is the stereophonic disc record. In just over four years the major gramophone companies have built up a massive repertoire of twin channel recordings, and the point has now been reached where (for serious works) the sales of stereo records match those for mono. Unfortunately, the large majority of people who buy these records have no idea of the superb reproduction which they are capable of providing; the one-piece stereogram which is the normal replay instrument generally provides a mere travesty of true stereo.

Most readers of the articles in this Year Book are members of a fortunate minority who possess, or plan to possess, stereo reproducing equipment of at least reasonable performance, and who are concerned to obtain the best value for money—or the best regardless of cost—at each link in the reproducing chain. Strictly speaking the first link is the turntable, as our discs must be rotated before we can get anything from the grooves, but the first item actually handling the precious stereo signals is the pickup, and this is the most crucial part of any stereo record playing system. The exact behaviour, within a few millionths of an inch, of a minute spherical diamond tip in relation to the immensely complex undulations of two groove walls can make or break the eventual sound coming from the loudspeakers.

Considerable Distortion

To people who have studied the mechanical and geometrical problems arising from the attempt to make a stylus tip follow a stereo groove with *complete* accuracy, it seems that *break* rather than *make* should be the operative term. Even with the very best pickups presently available, the amount of distortion introduced during heavy orchestral passages—particularly at the inner grooves of discs—is something like a hundred times that quoted for the best power amplifiers. This does not mean that the sound *as heard* is poor—on the contrary, the best discs played with one of the top half dozen pickups via properly positioned wide-range speakers produce a quality of sound which seems utterly astounding to the untutored ear. Thus we have a paradox: despite considerable distortion—greater in fact than that obtained from mono discs—we seem to hear better sound than ever before.

The Adaptable Ear

This comes about because the human hearing system (ear, inner-ear, brain and the resulting mental images) is immensely tolerant as well as being incredibly subtle. We can detect differences in tonal quality between two loudspeakers, or two musical instruments, which would baffle physical evaluation, yet in the absence of a direct comparison our ears ascribe "realism" to sounds which are being reproduced rather poorly. This subjective acceptance of the imperfect is enhanced enormously in stereo reproduction by the spacial element and sense of acoustic "ambience" which accompany the best recordings.

It is also aided by the limited nature of the distortions introduced by the better pickups; in general these are confined to the upper frequencies and are not accompanied by significant intermodulation lower down. Thus, although a few highly trained listeners can hear the very slight "haze" or "edge" present when reproducing stereo discs on wide-range speakers, for most it is non-existent or it is unconsciously interpreted as part of the general background scrapings, hissings, buzzings and creakings produced by any orchestra.

However, we are concerned with the quest for better sound, and it has to be admitted that top quality master tape recordings have a

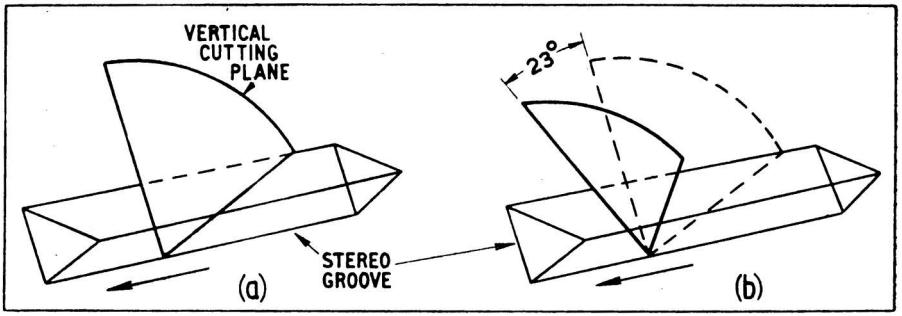


Fig. 1. *The nominally vertical cutting plane used on stereo discs may be anything from truly vertical (a) up to 23° forward cant (b).*

freshness which is seldom heard from discs. To some extent this is due to the various stages between the original tape and the commercial pressing, but there is little doubt that in 1963 the pickup is by far the weakest element in this chain. Until the beginning of 1962 there was only one recording company issuing stereo discs of *consistently* high quality, but now, owing largely to the installation of better cutting machines, most major companies are producing superb records. The significant differences between the products of the various companies are no longer ones of recorded quality as such, but relate to microphone techniques and the resulting presentation of the stereo "sound stage"; there is thus now genuine competition at an aesthetic rather than a mechanical level (see the article on speakers in this volume).

Vertical Recording Rake Angle

The one exception to the above statement concerns the question of vertical recording rake angle. This varies from company to company and does contribute in a small way to differences in reproduced sound quality. The "vertical" motion of the cutting stylus may be anywhere between 0° (truly vertical) and 23°, as in **Fig. 1.** There is a proposal to standardise at 15°, and *EMI* records are now being cut in such a manner that a pickup with a "vertical" stylus motion of 15° is suitable. The RIAA in USA has recommended voluntary adoption of this same angle; until now most American discs have been cut at 20–23°. *Deutsche Grammophon* are near enough to the proposed standard at 10°, leaving only the *Decca* and *Philips* groups at 0°. Some evidence produced by B. B. Bauer of the *CBS* Laboratories (USA) early this year suggests that the vertical cutting angle problem is more complex than has been thought. If substantiated, his findings show that records supposedly cut at 0° actually have a *backward* rake of 15°, which makes matters even worse. It is to be hoped that 1963 will see some agreement on this issue.

It is very difficult to produce a pickup having a "vertical" stylus motion which is truly vertical. Most cartridges employ a cantilever to couple the stylus to the generating mechanism, and with these there is bound to be an error-angle (**Fig. 2**). Lack of coincidence between the angles used in recording and reproduction quite definitely leads to distortion (C. R. Bastiaans, "Further Thoughts on Geometric Conditions in the Cutting and Playing of Stereo Discs," *AES Journal*, January, 1963) and though this distortion is not normally noticeable it can become a major factor on discs recorded at a high level with passages containing instruments such as trumpets playing loudly. Using a cartridge where the fore and aft angle can be easily varied, the reduction of distortion on such passages as the vertical error is minimised is quite audible.

To the hi-fi novice the foregoing paragraphs may seem to paint a rather sombre picture of stereo from discs, so it should be pointed out that at least five of the pickups listed in the pages following this article will produce a quality of sound which can convert the uncommitted music lover to stereo records after only two or three minutes listening. If the loudspeakers to be used are not of the highest quality, the number of pickups which may be recommended is increased, though from the record wear viewpoint there are probably not more than a dozen units which are absolutely safe.

What to look for

What are the factors to look for in a good stereo pickup? First, make sure it employs a reliable arm. If a pickup is of the integrated type, with head and arm supplied together as one unit, one can usually take it that the arm will do justice to the head; if, however, a cartridge is bought separately it must be used with an arm which permits it to work at the

correct downward pressure without appreciable unwanted forces due to friction or bad balancing. With a good arm the effective friction at the head should never be more than 5% of the proposed playing weight. If a high compliance cartridge is to be used (above 20×10^{-6} cm/dyne) the mass of the mounting shell and its associated fittings should be low—avoid heavy metal castings like the plague. The total effective mass of the arm and head as "seen" at the stylus resonates with the lateral and vertical compliances. and if the mass is too high the resonances occur at very low frequencies, leading to possible trouble with certain types of warped disc.

Mechanical impedance

The ability of a pickup to track the recorded groove depend on the *mechanical impedance* at the stylus tip. Impedance in this context means opposition to motion, and at low frequencies the undulating record groove meets this opposition in the form of *stiffness* of the stylus suspension. The less stiff or more compliant the stylus, the less effort is needed to hold the tip firmly in contact with both groove walls. Thus the greater the *compliance* the lower the downward pressure required for satisfactory tracking at low frequencies. The largest amplitudes of groove modulation occur at low frequencies, and if allowance is made for the maximum deviations found in practice a simple relationship can be established between compliance and tracking weight. However, at high frequencies the impedance offered by the stylus is a function of its effective inertia (or tip mass as it is commonly called) which means that when maximum low and high frequency signals coincide, additional pressure or more compliance is needed. Making allowance for these factors, we arrive at the compliance/pressure relationship depicted in **Fig. 3.**

To see whether a cartridge has adequate compliance for its stated playing weight, simply read off the compliance against the pressure. The *lateral* compliance should be at least that given by the graph, though the *vertical* compliance may be between a third and a half of the lateral figure, because in practice the recorded low frequency amplitudes are more restricted in the vertical direction. Readers will find plenty of pickups in the following pages which satisfy these requirements.

The other element in the mechanical impedance, effective tip mass, is a far more difficult customer. To increase compliance is easy; to reduce tip mass is extremely difficult. When the groove walls change direction very rapidly, which they do at high frequencies with heavy modulation, the stylus has to be accelerated at rates of 1000 g or more. This acceleration is opposed by the inertia of the stylus and its trappings, so that the lower the *tip mass* the lower the downward pressure needed to maintain correct groove contact. A similar calculation to that carried out for compliance, again making all due allowances for the worst conditions, leads to the graph of **Fig. 4.**

Whereas most good cartridges will satisfy the compliance requirements of **Fig. 3,** hardly any meet the tip mass demands of **Fig. 4.** How is it, then, that pickup manufacturers get away with it? The answer is simple: failure to track at low frequencies (inadequate compliance) results in immediately audible "buzzing" distortion or even groove jumping; but non-tracking at high frequencies (excessive tip mass) just adds a little to the already considerable distortion resulting from geometrical tracing errors due to a stylus of finite tip size.

The Available Lee way

As noted earlier, the ear is fairly tolerant of moderate amounts of high frequency distortion, so that failure to comply with the ideal demands of **Fig. 4.** (unless by a factor of two or more) seldom leads to audible distortion except on very difficult passages. The writer has one stereo record of a large chorus which at one particular point demands a pressure of $2\frac{1}{2}$ gms for a pickup with a tip mass of 1 mg if audible breakup is to be avoided. This is exceptional, but it rather bears out the calculations.

With most pickups, long before anything

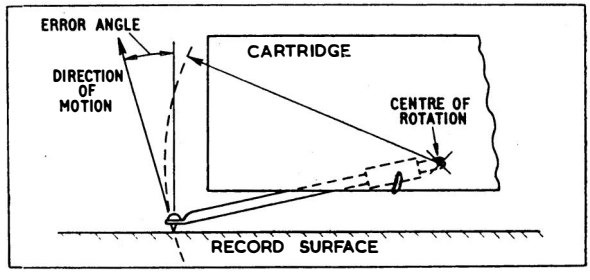


Fig. 2. *Any pickup employing a cantilever type of stylus mounting will have an angle of 'vertical' motion which is not truly at right-angles to the record surface.*

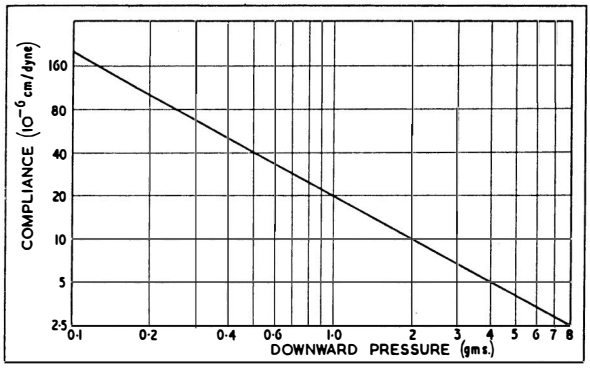


Fig. 3. *This graph shows the relationship between playing weight and the minimum lateral compliance needed to cope with the most difficult records. The vertical compliance may be lower by a factor of* 2–3.

audible happens the stylus will actually be leaving the groove walls on high frequency peaks, and the resulting impacts on re-contact will accelerate record wear. For this reason, if for no other, it is wise to adopt a conservative attitude on the question of playing weights versus tip mass.

It might now seem that the choice of pickup is hopelessly limited, but in practice it is usually possible to increase the playing weight above the recommended value to improve high frequency tracking, though a limit is set here by the steady frictional wear on the groove—not to be confused with the wear under dynamic conditions due to poor tracking. For a stylus tip radius of 0.5 thou the downward pressure should not normally exceed about 3 gms, so there is not much room manoeuvre between excessive *frictional* record wear at high pressures and excessive distortions and *dynamic* record wear due to high tip mass at lower pressures.

Dodging a Difficulty

The problem is complicated still further if we require to track at a pressure which introduces no permanent deformation of the record material—that is in the elastic rather than the plastic region; for a 0.5 thou tip this brings the pressure below $1\frac{1}{2}$ gms. For these reasons the problem is usually politely ignored, as the road to improvement is the difficult and expensive one of drastic reductions in effective tip mass. There are a few pickups with a tip mass of 1 mg or less, and provided these are used at a playing pressure of at least $2\frac{1}{2}$ gms per milligram of tip mass they will track all but the worst type of over-recorded "pop" record.

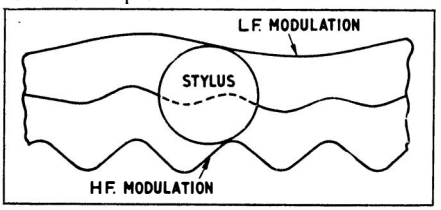


Fig. 5. *A spherical tipped stylus of* 0.5 *thou. radius or more is incapable of following the recorded waveform at very high frequencies; this results in tracing distortion.*

Cutting and Replay Differences

Another important factor must be taken into account when choosing a stereo pickup for the highest quality of reproduction: stylus radius. Geometrical tracing errors were mentioned earlier, and these arise from the discrepancy between a chisel-shaped cutter used when recording and an essentially spherical tip used for replay. At high frequencies the dimensions of the stylus where it contacts the groove walls are comparable with the recorded wavelength, resulting in inability of the stylus to follow accurately the recorded undulations (**Fig. 5**). This failing is called tracing distortion, and it can be shown that it is more prevalent with stereo grooves than with mono for a given stylus size. The smaller the stylus radius the less the distortion, so that the common practice of using 0.7 thou tips is to be deplored if we want the very highest stereo sound quality. The increased distortion at the inner grooves can be clearly heard when switching from 0.5 to 0.7 thou tips fitted to otherwise identical cartridges. So, when making a choice, look upon a 0.5–0.6 thou tip as the *maximum* size.

Some Records . . .

Apart from the cheap mass-produced cartridges used in record players and radiograms, where the main requirement is to work at sufficient pressure to operate inferior changer mechanisms, the only justification for the use of tip radii greater than 0.5 thou for stereo is the poor shaping of some record grooves. Records should be cut with a sharp

vee at the groove bottom, permitting the smaller stylus to sit correctly on both walls without skating around (**Fig. 6**). The last two years have seen most British record manufacturers join *Decca* in cutting grooves cleanly enough to take 0.5 thou styli. Across the Atlantic improvements have been slower, but a radius of 0.6 thou is now able to cope with most American discs, and in the second half of 1962 several firms actually started offering cartridges with 0.5 thou styli. For once the Americans are four clear years behind the English!

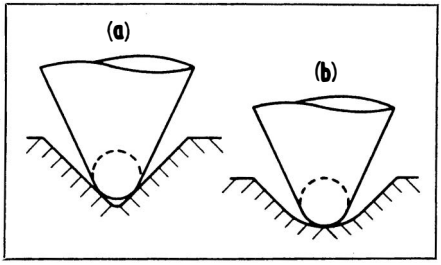


Fig. 6. *A correctly cut groove will permit a stylus of small radius to sit correctly on the two walls as at (a). A poor groove (b) allows the stylus to slide about out of control unless its radius is increased.*

Half Thou—and Smaller

As disc cutting and pressing improve still further we may look forward to the time when a stylus radius of considerably less than 0.5 thou will be feasible. Even now experimental pickups fitted with tips having radii as low as 0.3 thou perform quite happily on many discs, particularly *Decca* pressings. Perhaps the best solution would be the use of an elliptical stylus tip with its major axis at right angles to the groove; this would combine ability to cope with poorly cut grooves, with the smaller radius needed for low tracing distortion. (**Fig. 7**). Elliptical styli were used in this way for high quality reproduction of 78s, and recent information suggests that a diamond tip with 0.6 thou major and 0.3 thou minor axes is a practicable proposition.

In the meantime we must put up with a certain amount of tracing distortion, comforted by recent *Decca* experiments conducted by J. Walton which seem to show that another form of distortion, due to the interaction of tip mass with certain non-linear properties of the record material, actually cancels tracing distortion in certain circumstances. As readers will have gathered by now, stereo record reproduction is not a simple process!

So far we have not even mentioned the various basic types of pickup transducer—crystal, ceramic, moving iron, moving magnet and moving coil. Often, far too much attention is paid to the nature of the generator, when the basic limitations on performance are set by the mechanical impedance at the stylus tip. A more sensible approach is to consider how easily a low stylus impedance may be achieved with alternative transducers, having regard to the various limitations which arise in each case.

To date, the only type of pickup in which the generating element may be situated *at the stylus* while maintaining a low effective tip mass is the *moving iron* or variable reluctance. Only a very small piece of ferrous material needs to be moved in this type of pickup, so that mechanical decoupling by means of a long cantilever is not essential. Two pickups in the highest category using this system are the *Decca ffss* and the *EMI* EPU 100, which achieve a tip mass of 1 mg or less. The great advantage with these is that the generating member follows the stylus motion *exactly* due to the very close coupling; in consequence these two pickups have a flatter frequency response at high frequencies than any others currently available. Channel separation is also very good. The main disadvantages are:

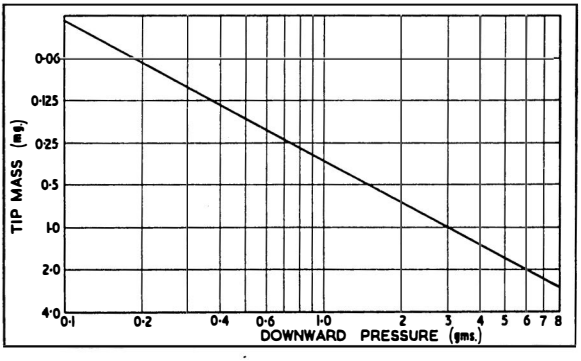


Fig. 4. *For perfect tracking at high frequencies the effective tip mass should not exceed the figures given here for various downward pressures. Very few pickups live up to this stringent specification if used at their recommended pressures.*

very small armature which must be kept central in the pole piece assembly; low voltage output; rather prone to hum pickup.

The moving magnet system, as used in many American cartridges, employs a cantilever to decouple the relatively large mass of the magnet from the stylus. The cantilever itself is usually a light alloy tube, flattened at one end to accommodate the stylus and carrying the tiny magnet towards the other end; a damping material around the magnet provides the compliance. With careful choice of dimensions and materials it is possible to achieve a very low effective tip mass, while the compliance tends, if anything, to be rather unnecessarily high. Two cartridges of this type which may be put with the very best units are the *ADC-1* and the *Shure* M33-5, with tip masses around 0.5 mg and 1.0 mg respectively. The frequency response with this type of unit tends not to be absolutely flat, due to cantilever resonances which introduce a slight dip between 6–10 Kc/s and a small rise around 12–15 Kc/s. The deviation is usually within ±3 dB, however, and separation is excellent over the whole range. Performance is to some extent dependent on temperature.

Ortofon SPU/GT

There is only one moving coil stereo pickup at present available in the UK, the *Ortofon* SPU/GT. This uses the cantilever principle to decouple a pair of coils from the stylus and achieves an effective tip mass of 1 mg. The application of the moving coil principle to a stereo pickup involves some extremely skilful precision engineering, so it would be misleading to generalize about this type from one example; but in this particular case the performance is outstanding in every respect. The voltage output from the built-in transformers is more than twice that obtained from other high quality magnetic types, suggesting that it should be possible to produce a moving coil pickup with even lower tip mass and higher compliance, yet still having a useful output.

Last on our list come the crystal and ceramic types. The ceramic material is a sort of man-made crystal having more consistent characteristics than the conventional type and in consequence it is fast becoming the first choice for crystal-type pickups with any pretentions to high quality. A bar of ceramic is very stiff by pickup compliance standards, so that considerable decoupling via a compliant material is essential if a low mechanical impedance is to be obtained at the stylus. By sacrificing output voltage it is quite possible to push the effective tip mass down below 1 mg and raise the compliance to a correspondingly high value.

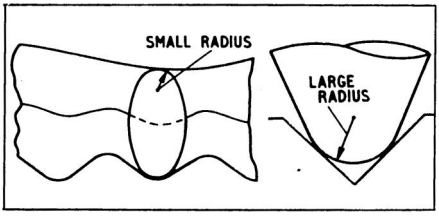


Fig. 7. *A possible solution to the tracing distortion problem is the use of an elliptical tip. The larger radius prevents 'bottoming' in poorly cut grooves, while the smaller radius gives improved tracing at high frequencies.*

Decca Deram—Acos Hi-Light

The *Decca* Deram and *Acos* Hi-Light have established themselves on these lines and have been joined this year by a new *Connoisseur* cartridge of similar type. Even with their reduced output compared with other crystal pickups, these units require much less amplifier gain than magnetic types, and are ideally suited for use with equipment in the medium price bracket which does not pretend to be of the highest quality. A big disadvantage of nearly all crystal and ceramic pickups is their inconsistency of performance, both from one sample to another of the same nominal type and with changing temperature; this is mainly due to the very large element of decoupling between stylus and generators. To sum up for the reader who now wishes to choose his stereo pickup, we will make five general points.

1. If you can possibly afford it, buy a model with an effective stylus tip mass of 1 mg or less and with sufficient compliance to meet the requirements of **Fig. 3.**

2. Unless you have a large collection of older mono discs which do not reproduce cleanly with a 0.5 thou stylus, do not be tempted by the 0.7 thou tip.

3. If the rest of your equipment is of high quality, and your speakers have a very wide frequency range, choose one of the best magnetic pickups rather than a ceramic type.

4. Listen to a wide range of stereo records played through equipment similar to your own before finally deciding on a pickup.

5. Whichever pickup you choose, make sure that the associated arm will do it justice.

DIRECTORY OF PICKUPS AND ARMS

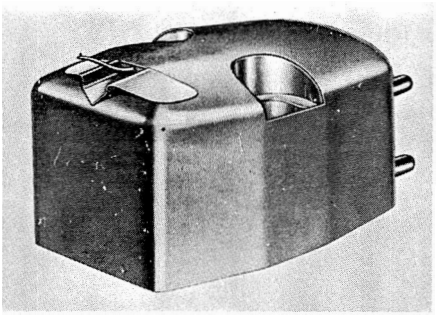
★ In the abridged specifications of this directory, the following abbreviations are used for economy of space: **S.p.**—recommended stylus pressure; **mg.**—milligram; **gm.**—gram; **Rec. load**—recommended resistive load; **mV**—millivolt. In all cases where decibel limits for frequency response and frequency for stated separation are given by manufacturer, these are included. Output is usually referred to a recorded velocity of 1 cm/sec.; this figure should be multiplied by five for the practical music output. ■ denotes stereo equipment.

AUDIO DYNAMICS CORPORATION, New York, U.S.A. Sole U.K. agents: KEF Electronics Ltd., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: KEF Maidstone.

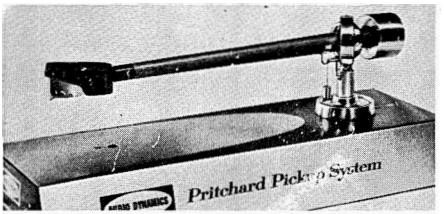
■**ADC Professional Cartridge.** Stereo cartridge. Moving magnet. ½ in. fixing centres. Stylus 0.6 thou. diamond. S.p. 0.75-1.5 gm. Tip mass 0.5 mg. Compliance 25×10^{-6} cm/dyne. Range 10 c/s-20 Kc/s ±2 dB. Separation 30 dB, 50 c/s-7 Kc/s. Output 1.27 mV. Rec. load 47 K. Price £20 10s. (U.K. purchase tax £3 5s. 9d.). Replacement stylus assembly £9 (U.K. purchase tax £1 8s. 10d.).

■**ADC-3 Stereo Cartridge.** Moving magnet. ½ in. fixing centres. Stylus 0.7 thou. diamond. S.p. 2-5 gm. Tip mass 0.8 mg. Compliance 15×10^{-6} cm/dyne. Range 10 c/s-20 Kc/s ±3 dB. Separation 30 dB, 50 c/s-7 Kc/s. Output 1.8 mV. Rec. load 47 K. Price £12 (U.K. purchase £1 18s. 6d.).

■**ADC Pritchard Pickup Arm.** Complete low inertia arm with side-thrust compensator and anti-drag lead-out arrangement. Price £24 (U.K. purchase tax £3 17s.).



ADC Professional cartridge



ADC Pritchard Pickup arm

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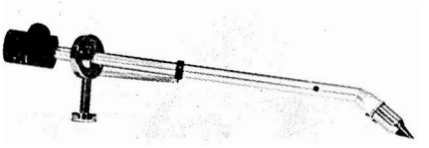
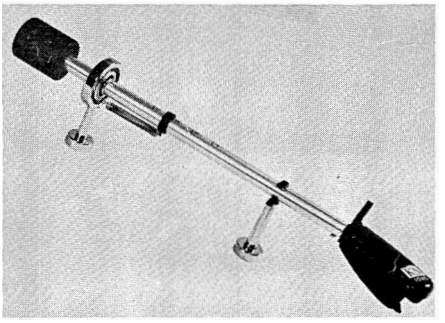
BANG & OLUFSEN, Struer, Denmark. Sole U.K. importers: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444.

■**Stereodyne SP.1.** Stereo cartridge. Moving iron. Plug-in. Stylus 0.7 thou. diamond. S.p. 2-4 grm. Range 30 c/s-15 Kc/s ±2 dB. Separation 22 dB min. Output 7 mV. Rec. load 47 K. Price £5 5s. 9d. (U.K. purchase tax 17s. 8d.). Replacement styli 0.5, 0.7, 1.0, 3.0 thou. diamonds. Price £2 2s. 9d. (U.K. purchase tax 7s. 2d.).

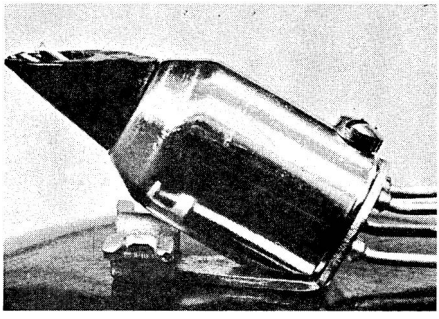
■**ST/L Complete Stereo Pickup.** Characteristics as for Stereodyne cartridge. Price £12 12s. (U.K. purchase tax £2 2s.).



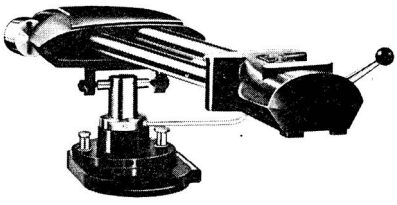
B & O ST/P arm and head



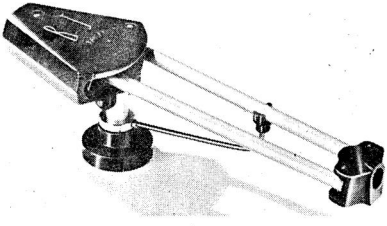
B & O ST/A pickup arm



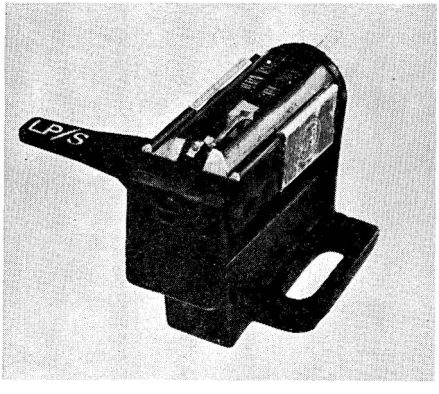
B & O Stereodyne cartridge



B.J. Super 90 *arm*



B.J. Tan/II arm



Acostereo 81 *cartridge*

■**ST/A Arm.** Arm with plug-in shell fitted with SP.1 cartridge and will take all standard cartridges. Price £13 1s. (U.K. purchase tax £2 3s. 6d.).

■**ST/P Arm.** Professional 12 inch arm complete with SP.2 cartridge. Price £13 11s. 6d. (U.K. purchase tax £2 5s. 3d.).

★

BURNE-JONES & COMPANY LTD., 18 Brunswick Road, Sutton, Surrey.

B.J. Tan/11 arm. Designed to overcome tracking error. Total tracking error less than 1 degree. Height adjustable. Price on application.

B.J. Super 90 Mk. II pickup arm. Two models. 12 in. and 16 in. Price (including two plug-in shells to carry standard cartridges)

B.J. plug-in shell for holding cartridges. Price on application.

★

COSMOCORD LTD., Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 27331. Cables: Cosmocord, Waltham Cross.

■**Acostereo 71-5.** Stereo crystal cartridge. Stylus 0.7 thou. diamond. Sp. 3-4 gm. Range 40 c/s-12 Kc/s. Output 140 mV. Rec. load 2 Meg. Price £2 (U.K. purchase tax 6s. 5d.).

■**Acostereo 73-2.** Stereo/mono crystal cartridge. Turnover type. Stylus, sapphire or diamond. S.p. 3-4 gm. Range 40 c/s-12 Kc/s. Output 150 mV. Rec. load 2 Meg. Price (two sapphires) £1 15s. (U.K. purchase tax 5s. 8d.); (sapphire/diamond) £2 4s. 7d. (U.K. purchase tax 7s. 2d.).

■**Acostereo 81.** Stereo/mono ceramic cartridge. Turnover type. Stylus, sapphire or diamond. S.p. 3-5 gm. Range 50 c/s-14 Kc/s ±4 dB. Output 90 mV. Rec. load 2 Meg. Price (two sapphires) £2 (U.K. purchase tax 6s. 5d.); (diamond/sapphire) £2 9s. 1d. (U.K. purchase 7s. 11d.).

HGP 39-3. Slide-on mono head for discontinued Black Shadow pickup. Stylus, sapphire or diamond. S.p. 4-6 gm. Range 30 c/s-16 Kc/s. Output 300 mV. Rec. load 2 Meg. Price (sapphire) £1 12s. (U.K. purchase tax 5s. 2.); (diamond) £2 1s. 1d. (U.K. purchase tax 6s. 7d.).

Acos GP67-1. Mono crystal cartridge. Turnover type. Stylus sapphire. S.p. 4-6 gm. Range 30 c/s-14 Kc/s. Output 200 mV. Rec. load 2 Meg. Price (sapphire/sapphire) 18s. (U.K. purchase tax 2s. 11d.); (diamond LP/sapphire 78) £1 7s. 1d. (U.K. purchase tax 4s. 4d.).

Acos Hi-Light. Complete pickup with stereo and mono plug-in heads. Stylus 0.5 thou. diamond. S.p. 2 gm. Tip mass 0.9 mg. Compliance 6×10^{-6} cm/dyne. Range 20 c/s-20 Kc/s ±3 dB. Output 40 mV. Rec. load 2 Meg. Ultra-lightweight adjustable arm. Price £17 9s. (U.K. purchase tax £2 16s. 1d.).

★

DECCA RADIO & TELEVISION, Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

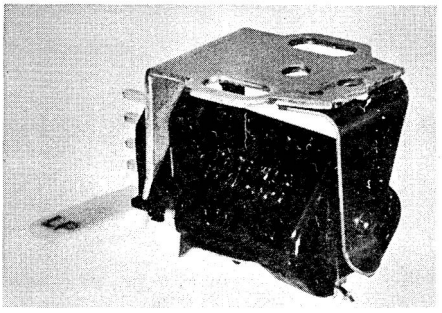
Deram Cartridges. Stereo/mono, transcription/autochange ceramic cartridges. Stylus 0.5 thou. diamond. S.p. 3-5 gm. Tip mass, 1 mg. Compliance 6×10^{-6} cm/dyne lateral, 3.5×10^{-6} vertical. Range 40 c/s-12 Kc/s ±3 dB. Output 50 mV./cm/sec. Rec. load 2 Meg. Price (stereo-mono transcription cartridge) £4 1s. 4d. (U.K. purchase tax 13s. 2d.); (stereo-mono autochange cartridge) £3 3s. 4d. (U.K. purchase tax 10s. 2d.).

Also available: other heads, with 1 thou. diamond for mono LPs; with 2.8 thou. sapphire for 78s.

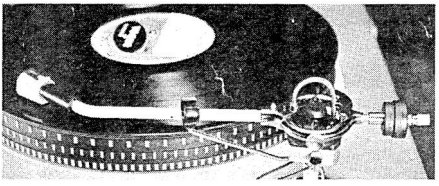
Deram Transcription Arm. For use with above cartridges. Price £4 10s. 6d. (U.K. purchase tax 14s. 6d.). Complete Deram pickup (cartridge and arm combined) £8 11s. 11d. (U.K. purchase tax £1 7s. 7d.).

ffss Pickup. Stereo pickup with slide-on head. Variable reluctance. Stylus 0.5 thou. diamond. S.p. 3.5 gm. Range 30 c/s-20 Kc/s ±1 dB. Output 1.4 mV/cm/sec. stereo, 1 mV/cm/sec. mono. Rec. load 50 K. Price (arm) £4 10s. 6d. (U.K. purchase tax 14s. 6d.); (Stereo head) £11 15s. 3d. (U.K. purchase tax £1 17s. 9d.); (Mono head) £8 11s. 11d. (U.K. purchase tax £1 7s. 7d.). Complete *ffss* pickup (head and arm combined) £16 5s. 9d. (U.K. purchase tax £2 12s. 3d.).

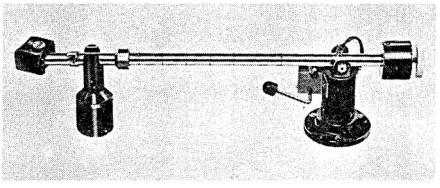
Professional Pickup. Stereo pickup with slide-on head. (Will take Mk. I and Mk. II heads.) Variable reluctance. Stylus 0.5 thou. diamond. S.p. 3.5 gm. Tip mass less than 1 mg. Compliance 10×10^{-6} cm/dyne lateral,



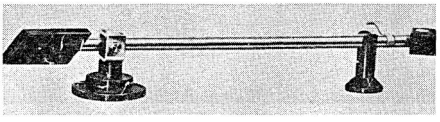
Acostereo 73.2 cartridge



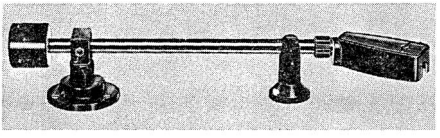
Acos Hi-Light arm and head



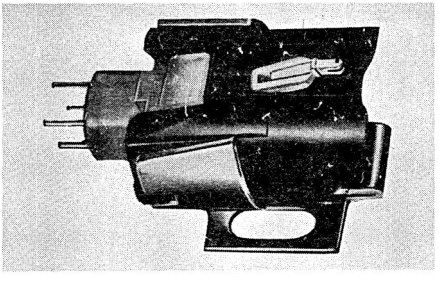
Decca Professional arm and head



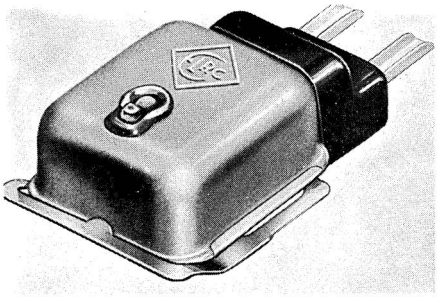
Decca ffss arm and head



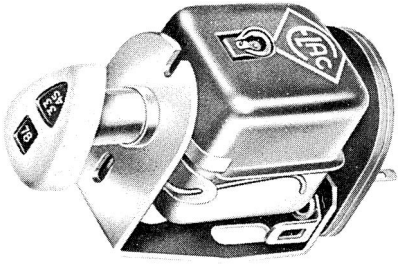
Decca Deram Transcription arm



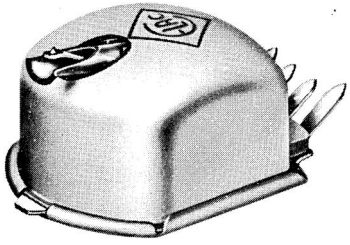
Decca Deram cartridge



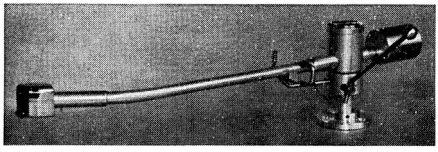
Elac MST I mono



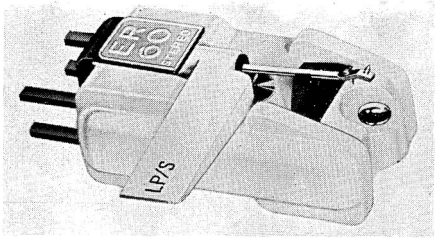
Elac MST 2 *mono*



Elac STS 310 *stereo*



E.M.I. EPU 100 *arm and head*



E.R. 60 *stereo ceramic*

2×10^{-6} vertical. Range 40 c/s-16 Kc/s ± 1 dB. Separation min. 20 dB at 1 Kc/s, 15 dB at 50 c/s and 12 Kc/s. Output 1.2 mV/cm/sec. Rec. load 50 K. Arm has built-in lowering device and pressure adjustment. Price (arm £15 16s. 8d. (U.K. purchase tax £2 10s. 10d.); (Mk. II head) £13 2s. 5d. (U.K. purchase tax £2 2s. 1d.). Complete Professional pickup (head and arm combined) £28 19s. 1d. (U.K. purchase tax £4 12s. 11d.).

★

ELAC. Electroacustic Gmbh., Kiel, West Germany. U.K. importers: The High-Fidelity Centre, 61 West Street, Dorking, Surrey. Tel.: Dorking 4229.

■**Elac STS222.** Stereo cartridge. Moving magnet. $\frac{1}{2}$ inch fixing centres. Stylus 0.7 thou. sapphire or diamond. S.p. 3-5 gm. Tip mass 1.9 mg. Compliance 5.1×10^{-6} cm/dyne. Range 20 c/s-20 Kc/s (up to 10 Kc/s ± 2 dB). Separation 24 dB at 1 Kc/s. Output 2 mV. Rec. load 33-51 K. Price (sapphire) £9 9s. (U.K. purchase tax £1 1s.); (diamond) £12 3s. 8d. (U.K. purchase tax £1 7s.).

■**Elac STS310.** Stereo cartridge. Moving magnet. $\frac{1}{2}$ inch fixing centres. Stylus 0.5 thou. diamond. S.p. 2-5 gm. Tip mass 1.8 mg. Compliance 5.6×10^{-6} cm/dyne. Range 20 c/s-22 Kc/s (up to 10 Kc/s ± 2 dB). Separation 28 dB at 1 Kc/s. Output 2 mV. Rec. load 33-51 K. Price £14 10s. 10d. (U.K. purchase tax £1 13s.).

■**Elac KST106.** Stereo crystal cartridge. Sprung capsule. Stylus 0.7 thou. sapphire or diamond. S.p. 5-7 gm. Lateral compliance 3.4×10^{-6} cm/dyne. Range 20 c/s-16 Kc/s. Separation 20 dB at 1 Kc/s. Output 200 mV. Rec. load 0.5-1 Meg. Price (sapphire) £1 17s. 6d. (U.K. purchase tax 4s. 4d.); (diamond) £4 (U.K. purchase tax 9s. 4d.).

Elac MST2. Mono magnetic cartridge. $\frac{1}{2}$ inch fixing centres. Stylus, sapphire or diamond 1 thou., 78 sapphire 2.6 thou. S.p. 6-8 gm. Tip mass 2.5 mg. Lateral Compliance 5.1×10^{-6} cm/dyne. Range 20 c/s-20 Kc/s ± 2 dB. Output 5.5 mV. Rec. load 37 K. Price (sapphire) £4 12s. 6d. (U.K. purchase tax 10s. 9d.); (diamond) £7 5s. 10d. (U.K. purchase tax 17s.).

Elac MST1. Mono magnetic cartridge. Single type available with either microgroove or 78 stylus. Characteristics as for appropriate half of MST2.

ELECTRONIC REPRODUCERS (COMPONENTS) LTD., Hedley Road, St. Albans, Herts. Tel.: St. Albans 50701. Cables: Saphobear, St. Albans.

■**E.R.5SB-A.** Stereo ceramic turnover cartridge. Sapphire or diamond stylus (LP), sapphire 78. S.p. 3-5 gm. Compliance 1.3-1.5 × 10^{-6} cm/dyne. Range 100 c/s-10 Kc/s. Output 130 mV. Rec. load 1 Meg. Price (sapphire) £1 8s. (U.K. purchase tax 4s. 6d.); (diamond) £2 8s. (U.K. purchase tax 7s. 8d.).

■**E.R.60.** Stereo ceramic cartridge. Turnover. Output voltage 140 mV. Range 40-12,000 c/s. S.p. 5.6 gm. Load imp. 1 Megohm. Price (sapphire) £1 8s. (U.K. purchase tax 4s. 6d.); (diamond) £2 8s. (U.K. purchase tax 7s. 8d.).

★

E.M.I. distributor: Clarke & Smith Manufacturing Co. Ltd., Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic Wallington.

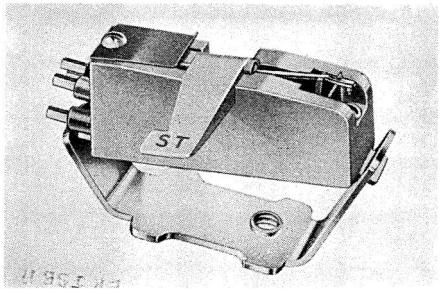
■**E.M.I. EPU100.** Complete stereo pickup. Variable reluctance type. Stylus diamond, 0.5-0.6 thou. stereo, 0.8-1.0 thou. mono LP, 2.5-3.0-78. S.p. pre-set at 2.5 gm. Tip mass 1 mg. Compliance 7 × 10^{-6} cm/dyne lateral, 3.5 × 10^{-6} vertical. Range 30 c/s-20 Kc/s. Separation 20 dB at 1 Kc. Output 1.5 mV. Rec. load 50-100 K. Arm features built-in lowering device with all movement on a viscous damped uni-pivot. Price (stereo) £16 8s. 9d. (U.K. purchase tax £2 16s. 1d.).

★

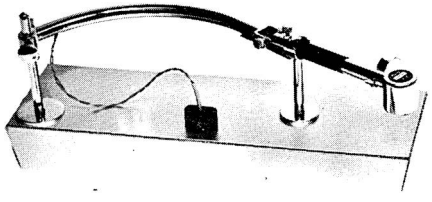
EMPIRE SCIENTIFIC CORPORATION, Long Island, New York, U.S.A. U.K. importer: de Villiers (Electronic World) Ltd., 16-20 Strutton Ground, London, S.W.1. Tel.: Abbey 5960. Cables: Devils, London, S.W.1.

■**Empire 880P.** Stereo/mono cartridge. Moving magnet. ½ inch fixing centres. Stylus 0.6 thou diamond. S.p. ¼-5 gm. Tip mass 0.5 mg. Compliance 30 × 10^{-6} cm/dyne. Range 15 c/s-20 Kc/s ±2 dB. Separation 30 dB. Output 2 mV. Rec. load 47 K. Price £18 (U.K. purchase tax £2 18s. 6d.).

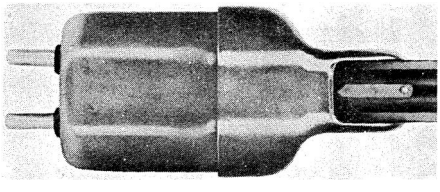
■**Empire 108.** Stereo/mono cartridge. Moving magnet. Styli, diamond 0.7 thou., 1 thou., 2.7 thou. S.p. 1-5 gm. Compliance 6 × 10^{-6} cm/dyne. Range 25 c/s-18 Kc/s. Separation 20 dB. Output 1.6 mV. Rec. load 47 K. Price £13 10s. (U.K. purchase tax £2 4s. 2d.).



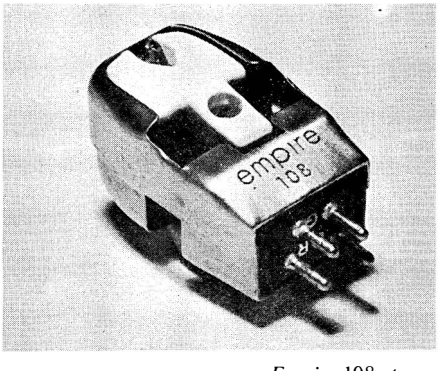
E.R. 5SB-A stereo ceramic



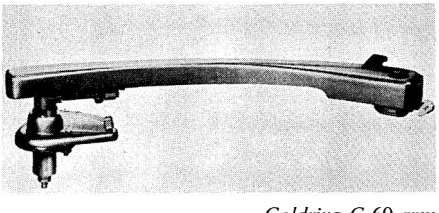
Expert arm and head



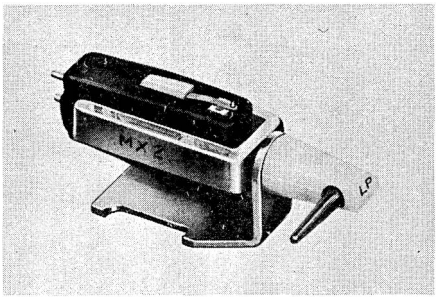
Empire 880 P. stereo



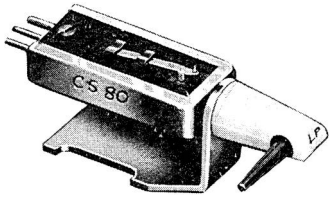
Empire 108 stereo



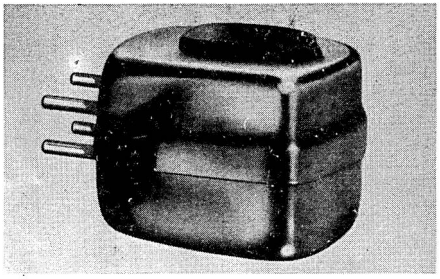
Goldring G 60 arm



Goldring MX2 crystal



Goldring CS 80 ceramic stereo



Goldring 700 stereo

EXPERT PICKUPS LTD., 84D Belsize Lane, London, N.W.3. Tel.: Swiss Cottage 6324.

Moving Coil Pickups. Approx. 0.75 mV output. Impedance 10 ohms. Transformer or transistorised input required to most pre-amps. Plug-in heads for Expert and SME arms, with 0.001 (LP) or 0.0025/0.003 (78). Similar type, but angled for miniature thorns. Price £7 12s. 6d. U.K. P.T. £1 6s. 8d. Stylus positioning coincides with Decca FFSS head mounted on SME D2 adaptor. Price £9 (U.K. purchase tax £1 11s. 6d.).

The Expert Arm. Now fitted with SME type 4-pin adaptor. The head section can be raised at right angles to the arm portion, permitting the greatest facility for use with miniature thorns. Price £4 10s. (U.K. purchase tax 15s. 9d.).

GARRARD ENGINEERING & Manufacturing Co. Ltd., Newcastle Street, Swindon, Wilts. Tel.: Swindon 5381. Cables: Garrard, Swindon. Telex: 44-271.

EV26A. Stereo ceramic turnover cartridge. Sapphire or diamond stylus. Output voltage 100 mV. S.p. 3-6 gm. Price £1 15s. 6d. (U.K. purchase tax 5s. 10d.).

★

GOLDRING MANUFACTURING CO. (Great Britain) Ltd., 486/488 High Road, Leytonstone, E.11. Tel.: Leytonstone 8343. Cables: Echovox, London.

MX2. Crystal turnover cartridge fitted with diamond or sapphire l.p. and sapphire 78 styli. $\frac{1}{2}$ in. fixing centre. Load imp. 1 Megohm. Output voltage 500 mV. Range 30-16,000 c/s. S.p. 5-7 gm. Price £1 1s. (U.K. purchase tax 3s. 5d.).

CM60. Ceramic turnover cartridge fitted with diamond or sapphire l.p. and sapphire coarse groove styli. Load imp. 1 Megohm. Output voltage 200 mV. Range 30-14,000 c/s ±2 dB. S.p. 6-8 gm. Price £1 5s. (U.K. purchase tax 4s. 1d.).

MX1/D. Turnover crystal cartridge fitted with diamond l.p. and sapphire 78 styli. Output voltage 500 mV. Range 30-16,000 c/s. S.p. 5-7 gm. Load imp. 1 Megohm. Price £1 17s. 6d. (U.K. purchase tax 6s. 1d.).

SX10/D. Stereo turnover cartridge. Fitted with diamond l.p. and sapphire 78 styli. Output voltage 150 mV. Range 30-14,000 c/s. Load imp. 1 Megohm. S.p. 4 g.m. Price £2 5s. (U.K. purchase tax 7s. 4d.).

CS80. Stereo/mono ceramic turnover cartridge. Stylus, 0.7 thou. sapphire or diamond for stereo/LP and 2.5 thou. for 78. S.p. 2-4 gm. Compliance 4×10^{-6} cm/dyne. Range 30 c/s-14 Kc/s. Separation 20 dB (1 Kc/s), 10 dB (10 Kc/s). Output 200 mV. Rec. load 1-2 Meg. Price (sapphire) £1 15s. (U.K. purchase tax 5s. 8d.); (diamond) £2 11s. 6d. (U.K. purchase tax 8s. 5d.).

CS90. Stereo ceramic cartridge. Stylus 0.7 thou. diamond. S.p. 2 gm. Compliance 8×10^{-6} cm/dyne. Range 30 c/s-18 Kc/s. Separation 25 dB (1 Kc), 10 dB (10 Kc/s). Output 70 mV. Rec. load 1-2 Meg. Price to be announced.

"580". Variable reluctance turnover cartridge. Diamond stylus for l.p. sapphire for 78. Output voltage 3.2 mV. Range

20-18,000 c/s. S.p. 6-7 gm. Load imp. 68,000 ohms. Price £4 4s. (U.K. purchase tax 13s. 8d.).

"600". Variable reluctance turnover cartridge ½ in. centre, mounting holes. Diamond stylus for l.p. sapphire for 78. Output voltage 3.2 mV. Range 20-21,000 c/s ±2 dB. S.p. 5 gm. Load imp. 68,000 ohms. Price £8 8s. (U.K. purchase tax £1 7s. 4d.).

■700 Mk. 2. Magnetic variable reluctance stereo cartridge. Diamond 0.0007 in. stylus (replaceable at works only). Load imp. 50 K ohms per channel. Output voltage 3 mV rms per channel. Range 40-16,000 c/s. S.p. 3-4 gm. Price £7 7s. (U.K. purchase tax £1 3s. 11d.).

■Pickering 380A. Moving magnet stereo cartridge with ½ inch fixing centres. Stylus 0.7 thou. diamond. S.p. 2 gm. Output 3 mV. Price £12 12s. (U.K. purchase tax £2 0s. 11d.).

■G60. Transcription arm wired for stereo. Incorporates new slide-in head that will accommodate most cartridges. Height adjustable and S.p. variable from 2 gm. upwards. Price £3 (U.K. purchase tax 9s. 9d.).

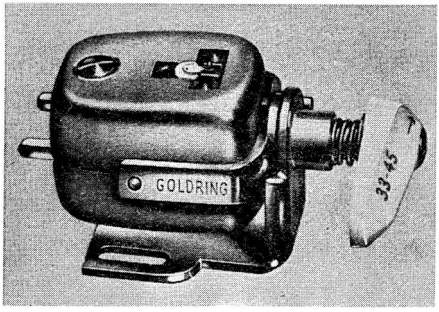
■Lenco L70. Stereo and mono transcription pickup arm. S.p. adjustable. Price £6 6s. (U.K. purchase tax £1 0s. 6d.).

■Lenco L80. Stereo and mono transcription pickup arm. 12 in. model for use with 16 in. records. S.p. adjustable. Price £8 8s. (U.K. purchase tax £1 7s. 4d.).

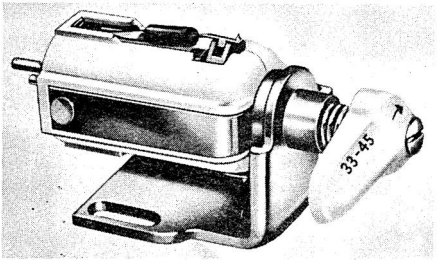
★

INSTRUMATIC LTD., Grove Works, Elmgrove Road, Weybridge, Surrey. Tel.: Weybridge 46464/42559.

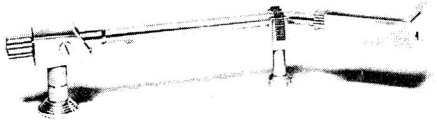
Worden Articulated Pickup Arm. Radially operated single arm with articulated head piece. Tracking correct to ±¼°. Vertical and lateral friction less than 50 mg. Adjustable counterbalance weight, also provision for height adjustment. Detachable head-shell and Decca adaptor. Price complete with one head £14 7s. (U.K. purchase tax £2 7s. 9d.). Extra shells 15s. (U.K. purchase tax 2s. 6d.). Decca ffss adaptor 7s. 6d. (U.K. purchase tax 1s. 3d.).



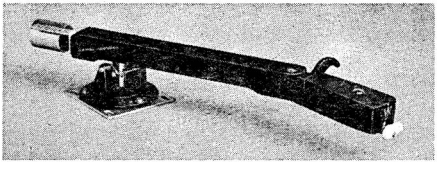
Goldring 580 cartridge



Goldring SX 10/D stereo



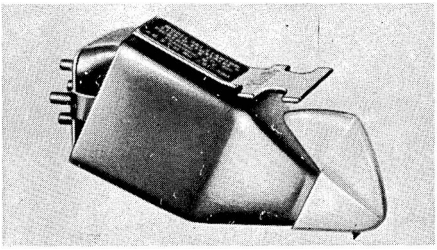
Lenco L70 arm



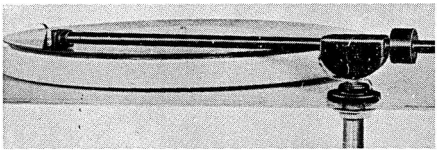
Worden Articulated Arm

H. J. LEAK & CO. LTD., 57/59 Brunel Road, East Acton, London, W.3. Tel.: Shepherds Bush 1173. Cables: Sinusoidal, Ealux, London.

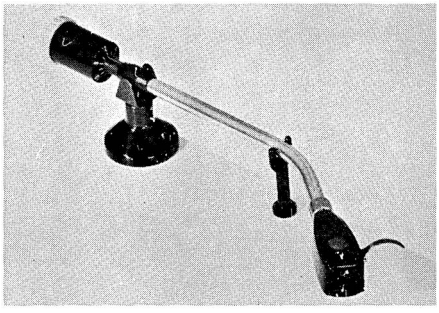
Dynamic Pickup Mk. II. Moving coil, interchangeable heads, both with diamond stylus. Output voltages l.p. and 78, 8 mV (at transformer secondary). Range 40-20,000 c/s ±1 dB. S.p. l.p. 3 gm, 78, 5 gm. Load imp. 50,000-100,000 ohms. Price, with two heads £16 (U.K. purchase tax £2 9s. 11d.).



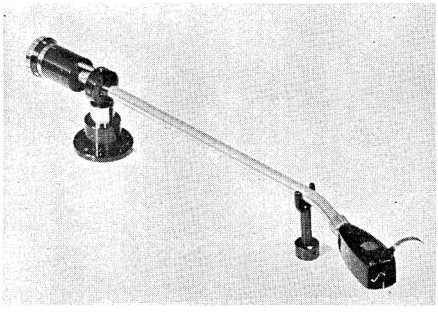
Pickering 380*A stereo*



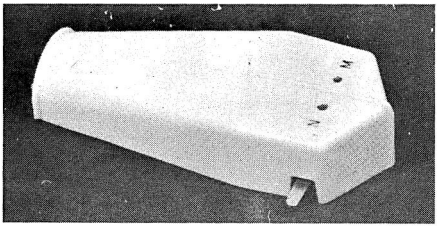
Leak Dynamic arm and head



Ortofon SKG 212 *arm*



Ortofon RMG 309 *arm*



Philips AG 3301 *crystal stereo*

ORTOFON. Fonofilm Industri A/S Copenhagen. Distributed in the U.K. by Metro-Sound (Sales) Ltd., 19a Buckingham Road, London, N.1. Tel.: Clissold 8506/7. Cables: Metrosound, London.

Type A. Moving coil. Interchangeable head with vertical coils. Diamond stylus. Output voltage l.p. 0.5 mV. Range 20-14,000 c/s ±2 dB. S.p. 5-7 gm. Load imp. 2 ohms (transformer required). Price £7 5s. (U.K. purchase tax £1 3s. 3d.).

Type C. Moving coil as above. Diamond stylus. Output voltage l.p. 0.3 mV. Range linear 20-20,000 c/s. S.p. 3 gm. Load imp. 2 ohms (transformer required). Price £14 (U.K. purchase tax £2 4s. 10d.).

Transformer for use with above pickups. Price £2 7s. 6d.

■**SPU/G.** Moving coil stereo cartridge. Diamond stylus 0.00065-0.0007. Output voltage 0.5 mV. Range 20-20,000 c/s. Separation 20-25 dB. S.p. 2 gm. Rec. load 2 ohms. Price £18 (U.K. purchase tax £2 17s. 9d.).

■**SPU/GT.** Moving coil cartridge with built-in transformers. Diamond stylus. Channel sep. 20-25 dB. Range 20-20,000 c/s. Load imp. 50 K ohms. S.p. 2 gm. Output voltage 2 mV. Available with pure stereo 0.0005 or 0.00065 diamond for use with mono/stereo. Price £20 (U.K. purchase tax £3 4s. 2d.).

■**SKG/212.** 12 in. pickup arm with adjustable playing weight. Price £4 15s. (U.K. purchase tax 15s. 3d.).

■**SMG/212.** 12 in. pickup arm for stereo and mono cartridges. Playing weight adjustable from 0-12 gm. Price £10 (U.K. purchase tax £1 12s. 1d.).

RKG/309. 16 in. pickup arm. Details as for SKG/212. Price £17 (U.K. purchase tax £2 14s. 8d.).

■**RMG/309.** 16 in. pickup arm. Details as for SMG/212. Price £21 (U.K. purchase tax £3 7s. 6d.).

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PHILIPS ELECTRICAL LIMITED, Century House, Shaftesbury Avenue, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps.

AG.3016. Crystal head fitted with sapphire styli. Output voltage 100 mV. Range 30-

15,000 c/s. S.p. 7-10 gm. Load imp. 470,000 ohms. Price 15s. 6d. (U.K. purchase tax 2s. 6d.).

AG.3401. Stereo magnetodynamic head with diamond stylus. Output voltage 2 mV per channel. Range 20-18,000 c/s. S.p. 3-5 gm. Load imp. 68,000 ohms. Price £7 6s. 7d. (U.K. purchase tax £1 3s. 7d.).

AG.3301. Crystal stereo pickup cartridge with turnover head. Sapphire styli. Output voltage 120 mV per channel. Load imp. 470,000 ohms per channel. Price £1 6s. 4d. (U.K. purchase tax 4s. 3d.).

AG.3060. Crystal stereo pickup. Diamond stylus. Output voltage 120 mV per channel. S.p. 4-6 gm. Load imp. 470,000 ohms per channel. Price £3 5s. 2d. (U.K. purchase tax 10s. 6d.).

AG.3063. Stereo crystal head. Microgroove only. Sapphire 0.7 thou. stylus. Load imp. 470 K ohms per channel. Output voltage 120 mV. Range 30-12,000 c/s. S.p. 4-6 gm. Price £1 3s. 3d. (U.K. purchase tax 3s. 9d.).

AG.3302. Stereo crystal turnover head. Sapphire styli, l.p. 0.7 thou.; 78, 3 thou. Load imp. 470 K ohms per channel. Output voltages 120 mV. Range 30-12,000 c/s. S.p. 4-6 gm. Price £1 6s. 4d. (U.K. purchase tax 4s. 3d.).

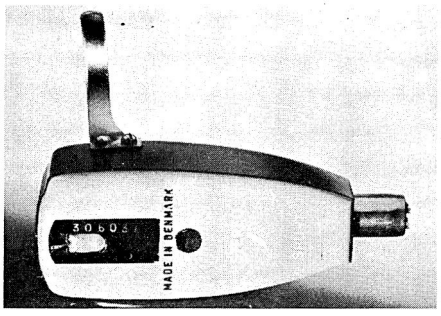
AG.3304. Stereo crystal turnover head. Styli: 3 thou. sapphire for 78, diamond 0.7 thou. for microgroove. Load imp. 470 K ohms per channel. Output voltage 120 mV. Range 30-12,000 c/s. S.p. 4-6 gm. Price £3 5s. 2d. (U.K. purchase tax 10s. 6d.).

A.G.3305. Stereo crystal turnover head. Details as for AG.3302 but with diamond 0.7 thou. stylus for microgroove. Price £3 5s. 2d. (U.K. purchase tax 10s. 6d.).

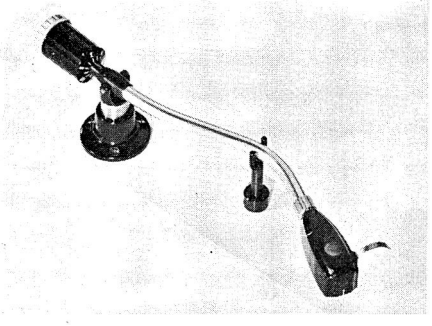
AG-3402 5-Contact Stereo Magneto-dynamic pickup. Microgroove only, 0.7 thou. diamond stylus. Output voltage 2 mV per channel. Range 20-18,000 c/s. S.p. 3-5 gm. Price £7 6s. 7d. (U.K. purchase tax £1 3s. 7d.).

★

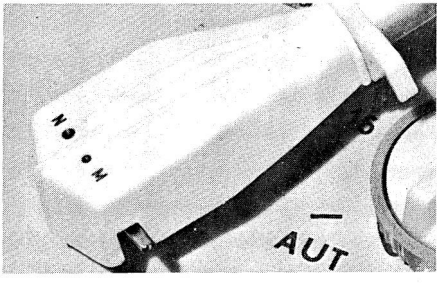
PICKERING. See Goldring Manufacturing Co. Ltd.



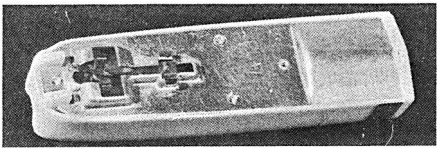
Ortofon SPU-G/T stereo head



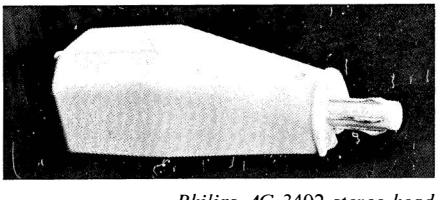
Ortofon SMG/212 arm



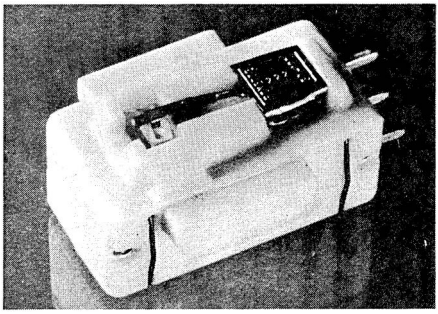
Philips AG 3302 *stereo head*



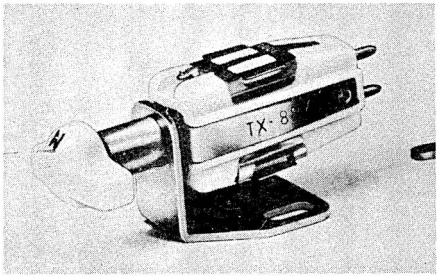
Philips AG 3060 *stereo head*



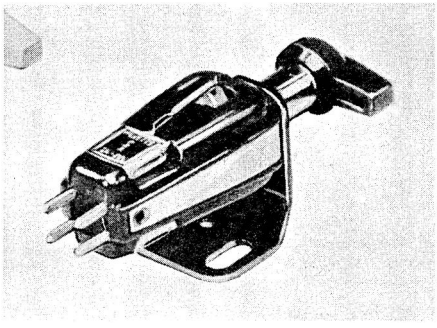
Philips AG 3402 *stereo head*



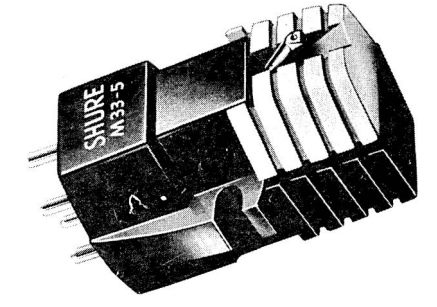
Ronette BF-40 stereo



Ronette TX88 mono cartridge



Ronette stereo 105 cartridge



Shure M33-5 stereo cartridge

RONETTE. U.K. distributors: H. K. Harrisson & Co. Ltd., 73 Great Titchfield Street, London, W.1. Tel.: Museum 5861, Welbec 9453. Cables: Empirian, Audley.

DC-395. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 meg. 100 pfd. Output voltage 1,000 mV. Range 30,6,000 c/s. S.p. 6-10 gm. Price £1 10s. (U.K. purchase tax 4s. 10d.).

DC-284-OV. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 meg. 100 pfd. Output voltage 230 mV. Range 30-10,000 c/s. S.p. 6-10 gm. Price £1 10s. (U.K. purchase tax 4s. 10d.).

DC-284-T. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 meg. 100 pfd. Output voltage 600 mV. Range 30-8,000 c/s. S.p. 6-10 gm. Price £1 10s. (U.K. purchase tax 4s. 10d.).

DC-284-P. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 meg. 100 pfd. Output voltage 105 mV. Range 30-12,000 c/s. S.p. 4-8 gm. Price £1 10s. (U.K. purchase tax 4s. 10d.).

DC-395-S. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 meg. 100 pfd. Output voltage 1,450 mV. Range 30-6,000 c/s. S.p. 10 gm. Price £1 10s. (U.K. purchase tax 4s. 10d.).

TX-88. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 meg. 100 pfd. Output voltage 150 mV. Range 30-20,000 c/s. S.p. 2-8 gm. Price £1 15s. (U.K. purchase tax 5s. 8d.).

■**BF-40.** Stereo single sided crystal cartridge. Sapphire 0.75 thou. stylus. Load imp. 1 meg. 100 pfd. Output voltage 180 mV. Range 30-12,000 c/s. S.p. 5-7 gm. Price £2 10s. (U.K. purchase tax 8s.).

■**Stereo 105.** Stereo crystal turnover cartridge. Sapphire stylus. Load imp. 1 meg. 100 pfd. Output voltage 250 mV. Range 30-12,000 c/s. S.p. 3-6 gm. Price £2 11s. (U.K. purchase tax 8s. 2d.).

■**Stereo 106.** Stereo crystal turnover cartridge. Details as for 105 but output voltage 580 mV. Price £2 11s. (U.K. purchase tax 8s. 2d.).

■**Stereo 208.** Stereo crystal turnover cartridge. Details as for 105 but output voltage 750 mV. Range 30-6,000 c/s. S.p. 6-10 gm. Price £2 11s. (U.K. purchase tax 8s. 2d.).

SHURE ELECTRONICS LTD., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 6361.

■**M7D Custom Stereo Dynetic Cartridge.** Moving magnet. Diamond stylus 0.7 thou. Load imp. 47,000 ohms. Output voltage 1 mV. Range 20-15,000 c/s. S.p. 4-7 gm. Price £9 11s. 3d. (U.K. purchase tax £1 10s. 9d.).

■**M77 Professional Stereo Dynetic Cartridge.** Moving magnet. Diamond stylus 0.7 thou. Load imp. 47,000 ohms per channel. Output voltage 2 mV. Range 20-17,000 c/s. S.p. 3-6 gm. Price £10 12s. 6d. (U.K. purchase tax £1 14s. 1d.).

■**M3D Professional Stereo Dynetic Cartridge.** Moving magnet. Diamond stylus 0.7 thou. Load imp. 47,000 ohms. Output voltage 1 mV. Range 20-15,000 c/s ±3 dB. S.p. 3-6 gm. Price £18 1s. 3d. (U.K. purchase tax £2 17s. 11d.).

■**M33-5 Professional Stereo Dynetic Cartridge.** Moving magnet. Diamond stylus 0.5 thou. Load imp. 47,000 ohms per channel. Output voltage 1.2 mV. Range 20-20,000 c/s. S.p. ¾-1.5 gm. Price £14 17s. 6d. (U.K. purchase tax £2 7s. 9d.).

■**M212 Studio Stereo Dynetic Pickup.** Complete unit with moving magnet head. Diamond stylus 0.7 or 0.5 thou. Load imp. 47,000 ohms. Output voltage 0.9 mV. Range 20-20,000 c/s ±2.5 dB. S.p. 1.5-2.5 gm. Price £36 2s. 6d. (U.K. purchase tax £5 15s. 11d.).

■**M232** and **M236** Precision Tone Arms. Suitable for monaural and stereo heads. S.p. 0-8 gm. Price M232 (12 in.) £12 15s. (U.K. purchase tax £2 0s. 11d.); M236 (16 in.) £13 16s. 3d. (U.K. purchase tax £2 4s. 4d.).

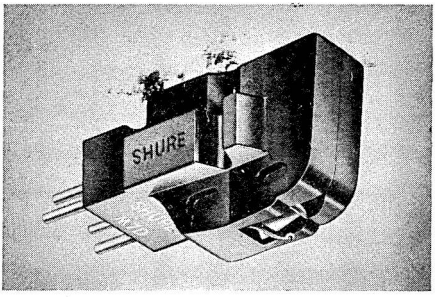
★

S.M.E. LTD., Steyning, Sussex. Tel.: Steyning 2228.

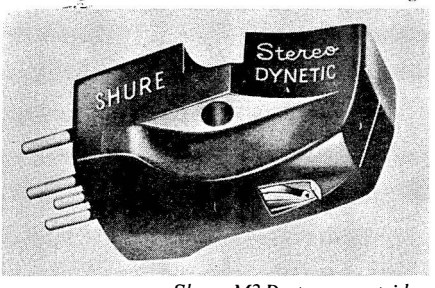
Model 3009 (9 in.). Series II precision pick-up arm. Extremely low vertical and lateral friction. Hydraulically damped lowering control. Rapidly adjustable for a wide range of cartridges and heads. Price complete with shell S.1 £19 10s. (U.K. purchase tax £3 5s.).

Model 3012 (12 in.). Series II precision pick-up arm. Details as above. Price complete with shell S.1 £21 (U.K. purchase tax £3 10s.).

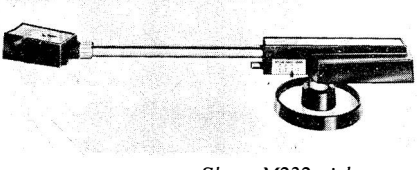
S.1 shell: Black plastic with mounting hardware. Price 15s. 6d. (U.K. purchase tax 2s. 7d.).



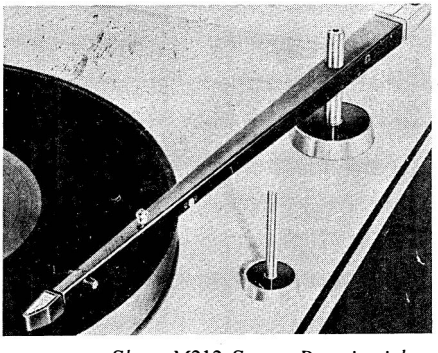
Shure M70 stereo cartridge



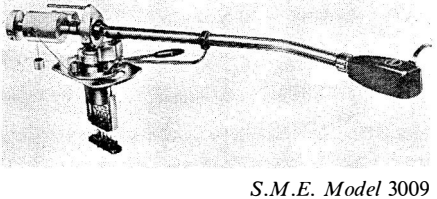
Shure M3D stereo cartridge



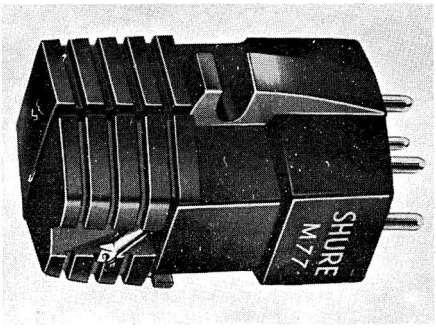
Shure M232 pickup arm



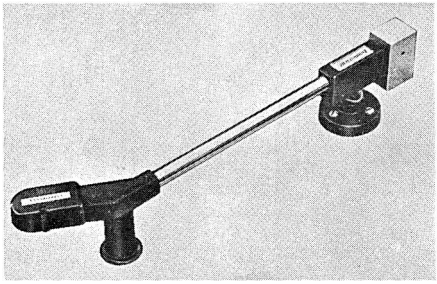
Shure M212 Stereo Dynetic pickup



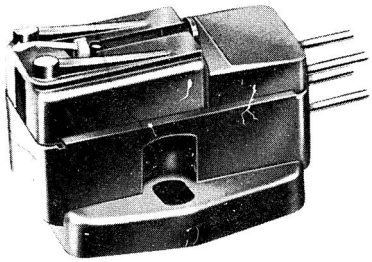
S.M.E. Model 3009



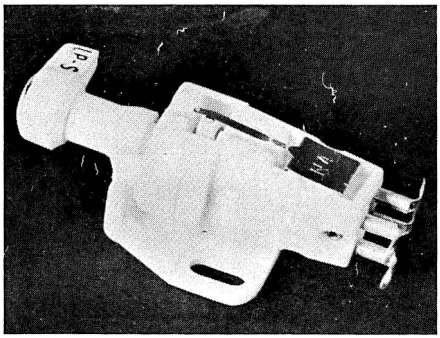
Shure M77 stereo cartridge



Connoisseur Mk III arm and head



Connoisseur stereo ceramic cartridge



Reuter St. D.I stereo cartridge

A. R. SUGDEN & CO. (Engineering) Ltd., Market Street, Brighouse, Yorkshire. Tel.: Brighouse 2142. Cables: Connoisseur, Brighouse.

■**Connoisseur Super Lightweight Pickup Mk. III.** Suitable for monaural and stereo heads. Height adjustable. Heads available: Mk. II monaural, magnetic, with choice of 1, 2.8, 3.5 thou. stylus; stereo ceramic with 0.5 thou. diamond stylus. Price arm only £3 (U.K. purchase tax 10s.).

■**Connoisseur Stereophonic Pickup Arm CS1.** Also suitable for monaural heads. Height adjustable. Pickup lifting device fitted. Price arm only £3 15s. (U.K. purchase tax 12s. 6d.); complete with stereo head £9 15s. (U.K. purchase tax £1 12s. 5d.).

■**Connoisseur Stereo Head.** Ceramic cantilever system. Diamond stylus 0.5-0.6 thou. Output 20 mV. Load imp. 50,000-100,000 ohms. Range 20-16,000 c/s ±2 dB. Channel separation 20/25 dB. S.p. 3½-4 gm. Price £6 (U.K. purchase tax 19s. 11d.). Prices of Mark II heads available. Mark II L.P. Diamond £6 10s. (U.K. purchase tax £1 1s. 7d.); Mark II Std. or L.P. Sapphire £3 10s. (U.K. purchase tax 11s. 8d.).

■**Connoisseur Stereo Ceramic cartridge.** ½ in. fixing centres. S.p. 1½-3 gm. Tip mass 1 mg. F.R. 30 c/s-16 Kc/s. Separation 20-25 dB. Output 80-100mV into 1-2 Meg. load, or 20-30 mV with constant velocity characteristic into 50-100 K load. Easily replaceable diamond armature. 4 terminal output. Price £4 10s. (U.K. Purchase Tax 14s. 3d.),

★

TANNOY PRODUCTS LTD., West Norwood, London, S.E.27. Tel.: Gipsy Hill 1131. Cables: Tannoy, London.

Variuctance. Turnover cartridge. Output voltages: l.p: 10-12 mV; 78 18-20 mV. Range 20-16,000 c/s ±2 dB. S.p. 5-6 gm. Load imp. 50,000 ohms. Price, with 2 diamonds £12 (U.K. purchase tax £2 3s. 4d.); with 1 diamond and 1 sapphire £9 10s. (U.K. purchase tax £1 14s. 3d.); with 2 sapphires £7 (U.K. purchase tax £1 5s. 3d.).

Single stylus version of Variuctance for l.p. also available. Price with diamond £6 15s. (U.K. purchase tax £1 4s. 4d.).

■**Vari-twin Mk. II.** Magnetic stereo cartridge. Balance 4-pole system. Diamond stylus 0.5 or 0.7 thou. Output voltage 7 mV

per channel. Range 30-15,000 c/s ±1.5 dB. S.p. 4 gm. Load imp. 100,000 ohms. Inductance 350 mH. Price £9 19s. (U.K. purchase tax £1 15s. 11d.).

★

THORENS. Distributed in the U.K. by Metro-Sound (Sales) Ltd., 19a Buckingham Road, London, N.1. Tel.: Clissold 8506/7. Cables: Metrosound, London.

BTD-12S Pickup Arm. With air-brake, raise/lowering device, adjustable stylus pressure. Price £13 10s. (U.K. purchase tax £2 8s. 9d.).

★

TRIANON ELECTRIC LTD., 3 Violet Hill, London, N.W.8. Tel.: Maida Vale 2255.

■**The All Balanced Pickup Arm 2400.** Suitable for stero or mono cartridges. Tone arm length 9 in. Interchangeable heads. Price £10 (U.K. purchase tax £1 13s. 4d.).

■**Reuter St.D.1.** Crystal turnover stereo cartridge sapphire stylus. Range 30-13,000 c/s ±3 dB. S.p. 3-5 gm. Load imp. 1 Megohm. Price £1 10s. (U.K. tax 5s.).

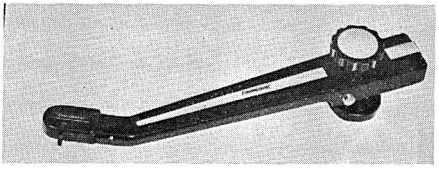
■**Reuter St.D.2.** Crystal turnover stereo cartridge. Sapphire stylus. Range 30-16,000 c/s ±3 dB. S.p. 3-4 gm. Load imp. 1 Megohm. Price £1 10s. (U.K. purchase tax 5s.).

■**Reuter St.D.3.** Crystal stereo cartridge. Sapphire stylus. Range 30-13,000 c/s ±3 dB. S.p. 3-5 gm. Load imp. 1 Megohm. Price £1 10s. (U.K. purchase tax 5s.).

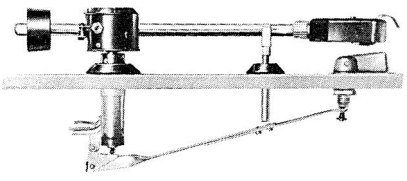
Trianette 100. Mono crystal cartridge. Turnover LP/78. Stylus, standard sapphire (diamond extra). S.p. 5 gm. Range 30-12,000 c/s. Output voltage 160 mV. Rec. load 5 Meg. Price £1 5s. (U.K. purchase tax 4s. 2d.).

★

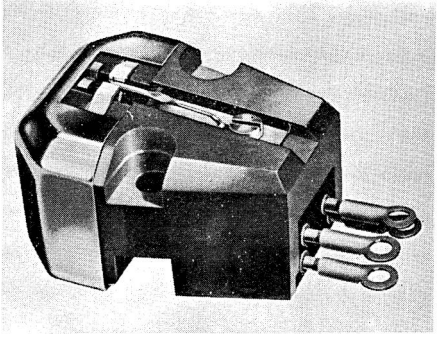
WORDEN. See Instrumatic Ltd.



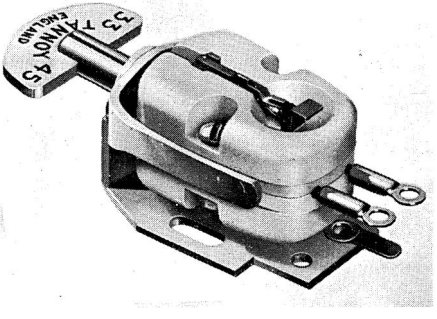
Connoisseur stereo arm CSI



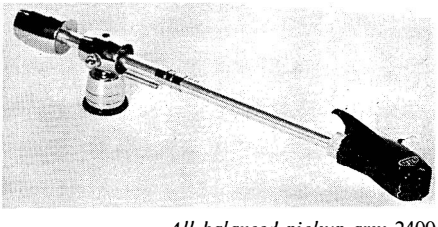
Thorens BTD–12S pickup arm



Tannoy Vari-twin Mk II cartridge

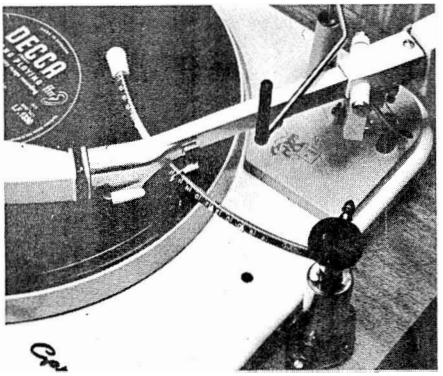


Tannoy variluctance cartridge

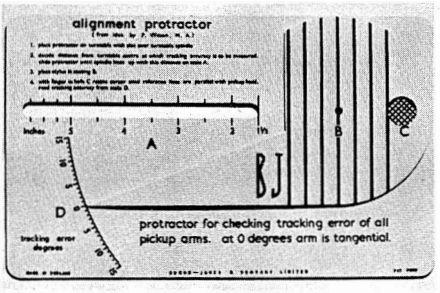


All balanced pickup arm 2400

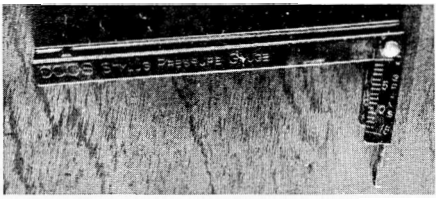
PICKUP ACCESSORIES



Auriol pickup control Mk II



B.J. Alignment Protractor



Acos Stylus pressure gauge

Colton Antistaticloth

AURIOL (GUILDFORD) LTD., Farnham Trading Estate, Farnham, Surrey. Tel.: Farnham 3366.

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 1s. 3d. (U.K. purchase tax 10s. 3d.).

Auriol Pickup Control Mk. II. This is dimensionally similar to the above but the arm will swing clear of the turntable to allow its use with the Autochanger/Manual player units. Price £3 12s. (U.K. purchase tax 12s.).

★

BANG & OLUFSEN, Struer, Denmark. Sole U.K. importers: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444.

Pickup lift type P.L. for Bang & Olufsen arms only. Hydraulic operation. Price £2 12s. (U.K. purchase tax 9s. 9d.).

★

BURNE-JONES & CO. LTD., 18 Brunswick Road, Sutton, Surrey.

Counterweight Unit. The addition of this unit to a B.J. pickup arm permits speed and accuracy in weight compensation. Price on application.

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

★

COLTON & CO. (LAPIDARIES) LTD., The Crescent, Wimbledon, London, S.W.19. Tel.: Wimbledon 9401.

Antistaticloth. A soft cloth impregnated with an anti-static material, for cleaning records. Price 3s.

Colton E.P. record centre adaptors (45 r.p.m.). Small plastic centre pieces which enable E.P. records to be used again on slim spindle changers after the large centre piece has been removed. Price 3s. per packet of one dozen (U.K. purchase tax 6d.).

★

COSMOCORD LTD., Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 27331.

Acos Changer Dust Bug. Developed in conjunction with Cecil Watts. Clips on to changer arms. Price 17s. 6d. (U.K. purchase tax 2s. 11d.).

Acos Stylus Pressure Gauge. A spring balanced gauge calibrated 0-15 gm. Accurate to within 0.5 gm. Price 9s. 6d. (U.K. purchase tax 1s. 7d.).

★

DECCA RADIO & TELEVISION, Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

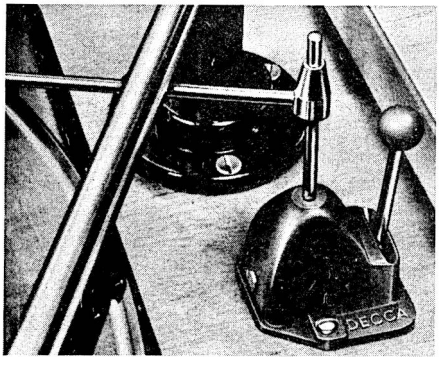
Decca Microlift. A device for raising and lowering a manual pickup arm at any point on the record for minimising risk of damage either to record or stylus through handshake. Easy to fit to any back-pivoted pickup. It does not hinder record handling by overlapping the turntable. Price £1 5s. 10d. (U.K. purchase tax 4s. 2d.).

★

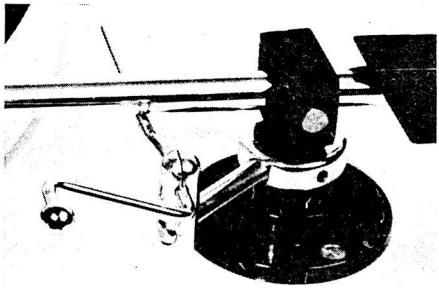
M. B. FITCH, distributed by The Metro-Sound (Sales) Ltd., 19a Buckingham Road, London, N.1. Tel.: Clissold 8506/7. Cables: Metrosound, London, N.1.

"Hi-Jack" Model "D". A raising and lowering device specially designed for direct attachment to the Decca *ffss* pickup pedestal. All metal chrome plated construction, positive stops in gully raised and lowered positions. Price £1 2s. 6d. (U.K. purchase tax 3s. 8d.).

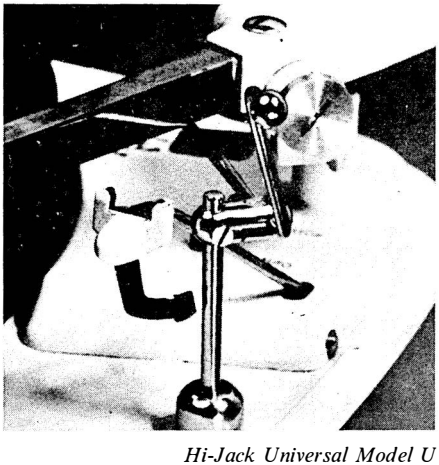
"Hi-Jack" Universal Model "U". A raising and lowering device specially suited for use with the Garrard 4HF motor unit for which no extra fixing hole is required. 1½ in. height adjustment by means of sliding head. All metal chrome plated construction. One $\frac{3}{16}$ in. hole needed for fixing. Price £1 2s. 6d. (U.K. purchase tax 3s. 8d.).



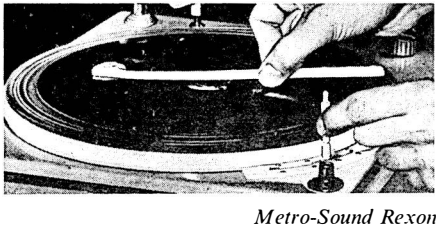
Decca Microlift



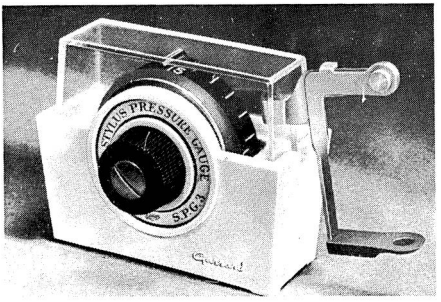
Hi-Jack Model D



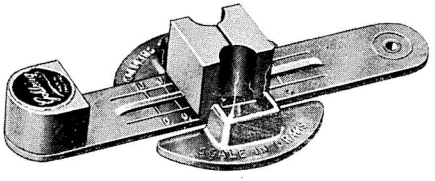
Hi-Jack Universal Model U



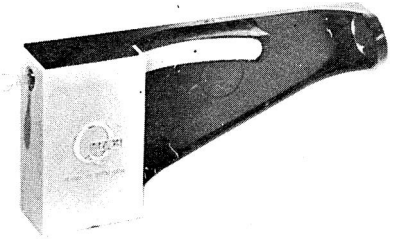
Metro-Sound Rexon



Garrard S.P.G.3



Goldring STB.1



Q-Max Stylovue

Watts Manual Parastat

Watts Dust Bug

GARRARD ENGINEERING & Manfg. Co. Ltd., Newcastle Street, Swindon, Wilts. Tel.: Swindon 5381. Cables: Garrard, Swindon.

S.P.G.3. Stylus pressure gauge. 0-12 grammes with $\frac{1}{2}$ gramme indication. Price 15s. 3d. (U.K. purchase tax 2s. 6d.).

★

GOLDRING MANUFACTURING CO. (Great Britain) Ltd., 486/488 High Road, Leytonstone, E.11. Tel.: Leytonstone 8343. Cables: Echovox, London.

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 7d.).

Stylus microscope designed especially for the examination of pickup styli; it has variable magnification from ×50 to ×150 providing illumination both under and behind the stylus tip. A clip is fitted to hold any stylus in position under the lens. Price on application. Trade only.

★

METRO-SOUND (SALES) LTD., 19a Buckingham Road, London, N.1. Tel.: Clissold 8506/7 (Sole agents for U.K.).

Rexon. An automatic record cleaning device which cleans discs as they are being played. A lightweight arm resembling that of a moulded plastic pickup with a head carrying a pad on a self-adhesive base. Price 17s. 6d. (U.K. purchase tax 2s. 10d.). Replacement pads price 2s. per set of three. (U.K. purchase tax 4d.).

★

Q-MAX (ELECTRONICS) LTD., Napier House, High Holborn, London, W.C.1. Tel.: Holborn 8534.

Stylovue. A device for projecting a magnified shadow of a stylus on to a screen facilitating inspection of a stylus in situ. Powered by torch batteries. Price £1 4s.

★

RIMINGTON VAN WYCK LTD., 42/3 Cranbourn Street, London, W.C.2. Tel.: Gerrard 1171.

Clendisc. An anti-static cleaner and preserver for records. Price 3s. 9d. Clendisc record cleaning pad. Price 2s. 11d. including tax.

Cecil Watts latest aid to record care, "The Parostatik"

CECIL E. WATTS LTD., Darby House, Sunbury-on-Thames, Middx. Tel.: Sunbury 3252.

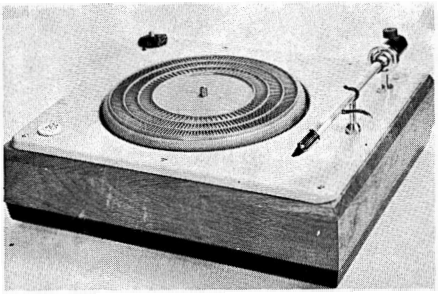
The "Dust Bug". Claimed to be the most efficient method of removing all static and dust from records as they are played. Instantly fitted, suitable for all types of records. Record quality is improved, surface noise and wear reduced. Price 17s. 6d. (U.K. purchase tax 2s. 11d.). Note: A model suitable for use on autochangers is produced in co-operation with Cosmocord Ltd.

The "Parastat". For cleaning both sides of an l.p. disc simultaneously and making it inert to all static charges. Principally for trade use. Price Mk. II £18 10s. (U.K. purchase tax £3 1s. 8d.).

"Parostatik" regd. Disc Preener. For record maintenance where antistatic agents are not desirable (where stylus pressure is less than 2 gms.). Price £6s. 9d. (U.K. purchase tax 1s. 1½d.).

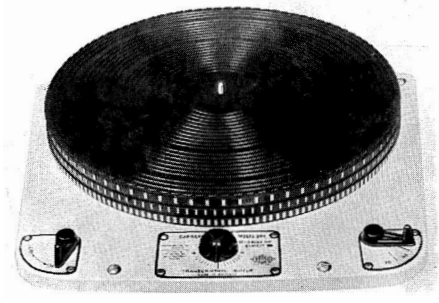
Manual Parastat. Manual Model Parastat record cleaning machine. For the cleaning and application of antistatic agents to LP records. Price £2 5s. (U.K. purchase tax 7s. 6d.).

DIRECTORY OF MOTOR UNITS



B20 Model 608 V

Elac Miraphon 17H



Garrard 301

Goldring GL 58/P

BANG & OLUFSEN, Struer, Denmark. Sole U.K. importers: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444.

Model 609V transcription turntable. Four speeds. Belt driven. Stroboscopic mat fitted to turntable mounted in teak case complete with B. & O. ST/L pickup. Price £25 9s. (U.K. purchase tax £4 4s. 10d.).

Model 609VF. As above but less Teak case. Price £23 18s. (U.K. purchase tax £3 19s. 8d.).

★

DECCA RADIO & TELEVISION, Ingate Place, Queenstown Road, S.W.8. Tel.: Macaulay 6677.

Decola Separates Playing Desk. Speeds 33, 45, 78 r.p.m., variable $\pm 2\frac{1}{2}\%$. Incorporates the Garrard 301 and Microlift together with the Decca *ffss* pickup mounted on a $\frac{3}{4}$ in. motor-board in cabinet. Price £52 9s. 8d. (U.K. purchase tax £8 8s. 4d.).

★

ELAC. Electroacustic Gmbh., West Germany. U.K. importers: The High Fidelity Centre, 61 West Street, Dorking, Surrey. Tel.: Dorking 4229.

Miraphon 17H. Four speeds with automatic shut-off. Magnetic pickup cartridge STS220 with diamond stylus. Studio tone arm with adjustable stylus force (2-6 gm.). Extremely heavy balanced turntable of 12 in. dia. Driven by special hysteresis motor, 220 volts 50 c/s or 110 volts 60 c/s. Dimensions: $14\frac{1}{2} \times 12\frac{1}{2}$ in. Price £41 6s. 8d. (U.K. purchase tax £5 11s. 6d.).

★

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

Model 301 Transcription Motor. Three speeds. Variable speed adjustment. Price £17 14s. 6d. (U.K. purchase tax £2 17s. 8d.).

Stroboscopic Turntable, extra cost, £1 4s. 9d. (U.K. purchase tax 4s.).

Garrard 4HF. Four speed record player complete with pickup arm. 12 in. pressed steel turntable. Rheostat speed control ±3%. Automatic stop may be disconnected. Price with GC8 cartridge £14 13s. 3d. (U.K. purchase tax £2 7s. 8d.).

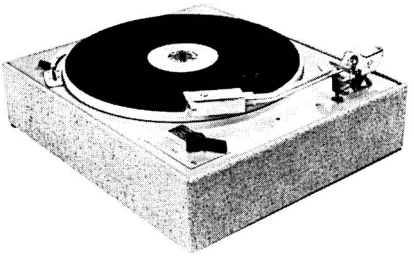
Laboratory Series Type A Turntable. Transcription type record player with facilities for changing records if required. Heavy sandwich type non-magnetic turntable and weight counter balanced pickup arm. Price, less pickup head, £15 18s. (U.K. purchase tax £2 11s. 9d.).

Garrard Laboratory Type A

★

GOLDRING MANUFACTURING CO. (Great Britain) Ltd., 486/488 High Road, Leytonstone, London, E.11. Tel.: Leytonstone 8343.

Lenco Transcription Unit GL58. Continuously variable speed adjustment with pre-selected stops for 16, 33⅓, 45, and 78 r.p.m. Groove location arm lowers pickup on to record as on/off is operated. Fitted with G.60 arm. Price £13 15s. (U.K. purchase tax £2 4s. 8d.).



Goldring GL70/ P

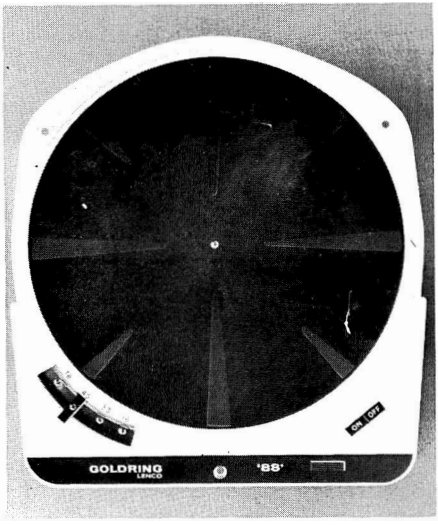
GL70 Transcription Unit. Non-ferrous turntable, weight 8 lb. Speed may be continuously adjusted from above 80 r.p.m. to below 30 r.p.m. and from 15 to 18 r.p.m. Pre-set standard speeds. 4-pole constant velocity motor (15 watts). W & F max. 0.2%. Incorporates L.70 pickup arm. Pick-up lowering device. Price £22 10s. (U.K. purchase tax £3 13s. 2d.).

Both the GL58 and GL70 are now available on plinths. Price, GL58/P £15 15s. (U.K. purchase tax £2 11s. 2d.); GL70/P £25 10s. (U.K. purchase tax £4 2s. 11d.).

Connoisseur Type B

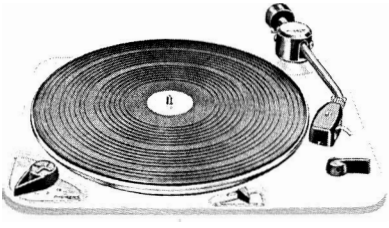
Goldring 88. Four speeds, continuously variable. Stroboscope supplied. Can be used with any pickup. Total wow and flutter at each speed less than 0.2% rms. Less than 1% variation for 13% change in mains voltage. 8 lb. non-ferrous turntable. Push button on/off switch. Neon indication light. Price £15 4s. 6d. (U.K. purchase tax £2 9s. 6d.).

Connoisseur Craftsman 2 speed



Goldring 88

Connoisseur Craftsman 3 *speed*



Thorens TD 135

Thorens TD 124

A. R. SUGDEN & CO. (Engineers) Ltd., Market Street, Brighouse, Yorkshire. Tel.: Brighouse 2142. Cables: Connoisseur, Brighouse.

Connoisseur Transcription Motor Type B. Three speeds 33⅓, 45 and 78 r.p.m. with a 4% variation on all speeds. Precision ground and lapped revolving shafts. All bearings adjustable. Large stroboscopic disc beneath the turntable viewed through mirror with its own internal light source. Price £20 10s. (U.K. purchase tax £3 13s.).

Connoisseur "Craftsman" two speed transcription motor. Operates at 33⅓ and 45 r.p.m. fixed speeds. Full 12 in. turntable of non-ferrous material. All bearings are adjustable throughout the life of the unit. Synchronous motor. Price £14 (U.K. purchase tax £2 6s. 6d.).

Connoisseur "Craftsman" three speed transcription turntable. Requires minimum mounting space. Heavy non-ferrous 12 in. turntable. 33, 45 and 78 r.p.m. 4% variation on all speeds. Neon lit stroboscope fitted. Dynamically and electrically balanced synchronous motor. All bearings are adjustable. Price £18 10s. (U.K. purchase tax £3 5s. 11d.).

★

THORENS. Distributors: Metro-Sound (Sales) Ltd., 19a Buckingham Road, London, N.1. Tel.: Clissold 8506/7. Cables: Metrosound, London, N.1.

TD124. Speeds 78, 45, 33⅓, 16⅔ r.p.m., variable ±3%. Total wow and flutter 0.07% rms. Rumble, −38 dB referred to 1 cm/sec. Built-in neon stroboscope and levelling device. Inertia controlled drive system with clutch action and two-step speed reduction. Price £32 10s. (U.K. purchase tax £5 17s. 4d.).

TD135. Speeds 78, 45, 33⅓, 16⅔ r.p.m. variable ±3%. Metal stroboscope disc. BTD-125 pickup arm incorporated. Total wow and flutter 0.12% rms. Rumble, −36 dB referred to 1 cm/sec. Precision built 4-pole motor. Special in-built levelling device. Arm raise/lower air brake control. Price £30 (U.K. purchase tax £5 8s. 4d.).

STEREO SPEAKER PROBLEMS

by John Crabbe

ALTHOUGH a good clean pair of signals with reasonable frequency range and adequate channel separation is essential for proper stereo reproduction, the amount of *stereo enjoyment* available to the listener is entirely dependent on the loudspeakers and their setting. A nominally stereo signal may be free from distortion and background noise, and have a wide frequency and dynamic range, yet in reproduction it may sound little more than inflated mono or—in bad cases—like ordinary mono from whichever happens to be the nearer speaker. In other words, all the efforts of the stereo-Hi-Fi enthusiast can be wasted right at the very last link in the chain—even in the air between loudspeakers and listener.

What is "Best"?

The difficulties of obtaining a first-class stereo image, due to wide variations in speaker radiation patterns and room acoustics, have lead to a great deal of controversy over what is the "best" type of speaker for stereo. As in most arguments, the protagonists have tended to polarise to two extreme points of view. known in this case as the "direct" and "reflected" schools of thought. Briefly, the "direct" school maintains that the speakers should be forward-facing and as far as possible independent of their surroundings, particularly at middle and high frequencies; the "reflected" people say exactly the opposite—that the sound should be heard entirely by reflection from the walls of the listening room.

Before we consider the arguments in detail it might be helpful to take a look at these same ideas as applied to mono reproduction, especially as a rather similar—if less fierce—battle raged some years ago.

Apart from a sense of depth, due to the apparent distance of performers, there are no inherent spacial properties in a single-channel system, and in consequence the theoretically correct method of presenting the sound is from a single point. For years, speaker manufacturers accepted this thesis and produced one reflex enclosure after another, with the unit or units mounted at the front for forward-facing use. However, many amateurs and some of the less rigid-minded manufacturers were not satisfied. The ear cries out for space and freedom in reproduced sound, and no matter how perfect the technical specification or measured performance of a speaker, from the viewpoint of musical enjoyment an orchestra emanating from an area of less than one square foot is little short of monstrous. The limitations of the "point-source" type of sound are further aggravated by the natural tendency of the higher frequencies to form into a narrow beam, with unpleasant effects for the listener who happens to be on the beam, and with a lack of brilliance for those who are not.

The first efforts to overcome these limitations were directed towards removal of the HF beam. Several systems of dispersal were employed, and for a while slots and diffusers of various sorts were very popular. These were more or less successful in directing the high frequencies evenly over a wide angle, but unless, as a result, some sound was reflected from the nearby walls, the apparent sound-source remained as small as ever.

The "Sprayed" Sound

The next stage involved facing one or more treble units back into a corner, and/or the mounting of full range speaker units horizontally in the *tops* of enclosures. Cabinets with sloping back panels were produced so that the drive units "sprayed" the middle and high frequencies on to the corner or walls at the rear. Arrangements of this sort were far more dependent on the shape and acoustic properties of the listening room, and the *measured* performance of such systems was invariably inferior to that of the point-source types; *but* they gave a vastly more pleasing overall effect in terms of sheer musicality. At last the sound was opened out to some extent, and

although solo instruments tended to become rather large and vague, on most programme material the added sense of freedom was a great relief.

Some listeners (especially the type who enjoyed listening to loudspeakers more than listening to music) still preferred the forward facing units. Also, many manufacturers were afraid of the variations in performance which would result from the use of speakers in a reflecting system, so they stuck to the traditional reflex box, quoting in justification academic statements about the theoretical superiority of a single small sound-source. Other manufacturers, to their credit, faced the challenge of spaciousness and produced a variety of mountings, the three most popular arrangements being: (1) multi-unit systems in which the middle and treble speakers are faced upwards or back; (2) columns with drive units at the top, some with conical diffusers above them; and (3) reflex enclosures or folded tapered columns with a single full-range unit angled back at the walls.

Now this little piece of history provides a cautionary tale to be borne in mind when discussing speakers for stereo; its moral is that the theoretically correct solution is not necessarily the best from the listener's point of view.

The Spreadout Sound

The problem of space in stereo reproduction is entirely different from that posed by monophonic systems. Assuming everything to be correct, the illusion of sounds spread *between* the two speakers comes about automatically, whether the two individual sound-sources are small or large. The key words here are *assuming everything to be correct*, and this is a rather rash assumption in many cases. With recordings made in the Blümlein tradition, using coincident-pair microphones, the differences between the two signals are confined almost entirely to amplitude, with phase and time delays excluded. Provided that these amplitude differences can be maintained in the eventual radiated sound pattern, the apparent positions of sounds between the speakers will be correctly determined.

Now the first big difficulty with speakers for stereo is the achievement of the type of acoustic radiation pattern which satisfies these requirements. If two identical speakers are used, and if the listener sits on the centre line so that speakers and listener form an approximate equilateral triangle, it follows that any intensity differences heard by the listener must be due to recorded differences; so this arrangement does fulfill the theoretical specification. However, only one person can sit exactly on the centre line, and listeners to left or right tend to get a stronger signal from the nearer speaker; this shifts the stereo picture to one side, except for those parts of the signal which are very predominantly in the opposite channel.

The Brittain Approach

The solution to this further problem was discovered some years ago by Hugh Brittain of *GEC*. With most forward-facing speakers the middle and high frequencies tend to beam, with a fall-off of intensity to either side. If such speakers are arranged as in **fig. 1,** a listener in the shaded area will either be central (which is OK) or he will be nearer to the axis of the *further* speaker. This means that the tendency for the *nearer* speaker to sound louder is counteracted by the increased intensity on the beam of the other one; thus, in theory, a "central" sound image remains central over a wide listening area.

This arrangement is very dependent on the precise manner in which the sound intensity declines as one moves off the axis, and much work has been done on forward-facing

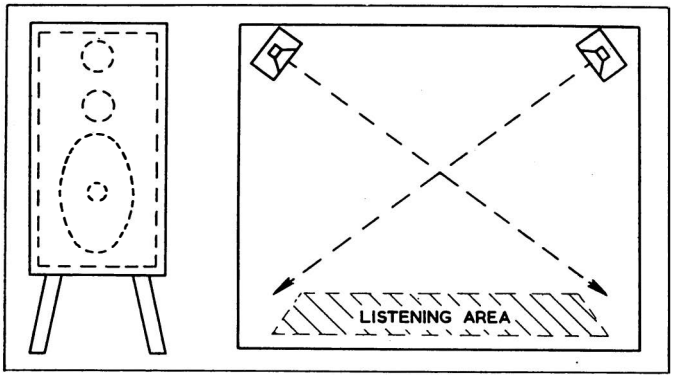


Fig. 1. *An enclosure of the type shown on the left, with forward facing units, should be used in the Hugh Brittain manner shown on the right for maximum stereo effect over a wide area.*

speakers to achieve the ideal radiation pattern or "lobe". It is possible, with a small number of commercial models, to obtain the desired effect with considerable accuracy provided that some care is taken in finding the correct angles and positions in any particular domestic setting. Unfortunately, with many speakers the lobe is unsatisfactory and only an approximate "Brittain-effect" can be obtained; furthermore, stereo recordings made with spaced microphones are not so amendable to this treatment, though it must be admitted that some such recordings are not amendable to *any* sort of treatment!

However, with good recordings and everything just right there is no doubt that forward-facing speakers used in this manner will produce some very exciting stereo, with precise pin-pointing of instruments and tremendous "presence". Yet, despite this, many people find this arrangement uncomfortable to listen to for any length of time. Why should this be so? There are three main reasons, one concerning high frequency beams, one related to interference effects and image shifting, and one to do with recording techniques.

Fatigue from the Beam

Although the Hugh Brittain arrangement avoids placing any listeners actually *on* the high frequency beam of either speaker, there is something about the quality of sound from most units (and all *cone* units) which is tiresome for the ear if heard directly from the speaker without any randomisation by reflection. This is a difficult point to prove theoretically because of the completely subjective nature of the evidence, but it is a fact that for very many people "direct" listening is somewhat exhausting, *despite* the apparent detachment of the sound from the two speakers. Some speakers are worse than others in this respect, and the smoother the response the less troublesome the effect. Electrostatic and ribbon treble units are generally easier to listen to than cones, but even with these a certain strain can arise which is removed by randomising the wavefront.

Interference effects are more easily explained. If an identical signal is fed to both speakers (central image) and the listener rotates his head from side to side, at certain frequencies the signals at the two ears go in or out of phase, with corresponding shifts of apparent direction. The effect can be demonstrated artificially by walking across the far end of the listening room, "sideways on" to the speakers so that one ear only is in use; if a mono signal of, say, an oboe playing sustained notes is used, the apparent sound level will

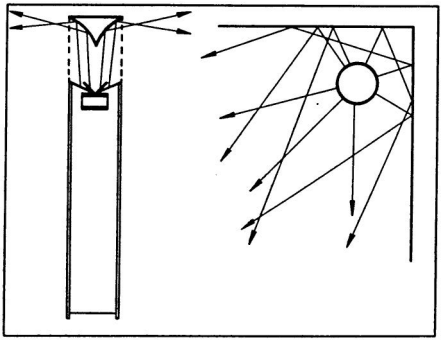


Fig. 2. *The column type of speaker usually employs a reflector above the cone to distribute high frequencies horizontally. When stood near a corner, the sound is diffused as shown on the right.*

jump up and down rapidly as one moves across, illustrating the in-and out-of-phase effect perfectly. Now in actual listening we do not normally rotate our heads from side-to-side, but we do make a number of small involuntary movements; it could well be that the anomalous auditory effects arising from these movements contribute to the general sense of strain.

Recording techniques are the last of the three flies in our stereo ointment. Quite apart from recordings made with widely spaced microphones, which—in the absence of a central microphone to fill the hole in the middle—can hardly be thought of as truly stereophonic at all, there is the type of production which uses microphones very close to the orchestra to achieve an impressive "close up" view. This sort of recording, frequently practised by one of the two major British companies, produces an over-brilliant, unmusical sound, lacking the acoustic "ambience" which is the greatest single asset of stereophonic reproduction.

The Ambience Comes, too

The most satisfying stereo recordings provide a wonderful sense of the studio in which the original performance took place, enabling one to imagine that the end of the listening room opens into the concert hall itself, with the orchestra "out there" in the hall. This gives a richness and "atmosphere" which was never heard in reproduced sound before the advent of stereo. Unfortunately, this priceless gain is almost completely thrown away in the type of recording using over-close microphones, together with all semblance of natural string tone. The only situation where this type of recording reproduces well is in a large hall, where some ambience is *added*

to the recorded sound, but most records are played in small domestic rooms.

The relevance of all this to the stereo speaker problem is simply this: the type of recording in question, especially in its more extreme form, sounds very impressive for a few minutes, but its overbearing "presence" and flatness soon make it intolerable to the sophisticated listener *when reproduced on forward-facing speakers* in a domestic setting. Thus we see that there are three factors militating against the forward-facing system, which jointly account for the scepticism of those who place listening comfort above theoretical perfection.

The Alternatives

What are the alternatives? As with mono, various types of reflection arrangement may be used to diffuse the sound before it sets out toward the listener. The most popular of these employ a column to house the speaker unit with a reflector placed above (**Fig. 2**). Middle frequencies diffuse out and around in all directions, while high frequencies are reflected into a horizontal plane, but travel

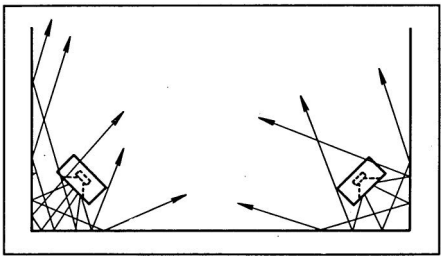


Fig. 3. *Conventional reflex enclosures may be used for "reflected" stereo by facing them back into the corners of the room.*

out equally over 360° to be scattered from the surrounding walls. The listener thus receives some sound directly from the speaker and some from its surroundings. An even larger element of diffusion is achieved by reflecting *all* the sound from the surroundings, either by facing normal reflex cabinets towards the wall (**fig. 3**) or by using specially designed enclosures in which the drive unit is mounted in a sloping panel. A well-known example of the latter is the *Decca* Corner Speaker (now, alas, discontinued commercially) designed by Ralph West, while a recent design using the same general principle is the *Paraline* (**fig. 4**) described by Rex Baldock in *Hi-Fi News*, April, 1963. The *Paralines* are designed as a stereo pair and give quite remarkably fine results for the outlay involved.

As with forward-facing speakers, these diffused systems have both advantages and drawbacks. The big *advantage* is "easy

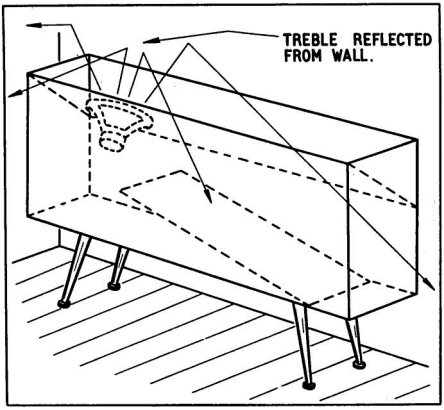


Fig. 4. *The left-hand one of a pair of Paraline speakers as designed by R. N. Baldock. The rear of the cone is loaded by a tapered folded pipe, while middle and high frequencies are heard by reflection from the cone front.*

listening" with a pleasant, almost ethereal type of sound quality. The high frequency beam is completely scattered and randomised, and the wavefronts are so broken up that movements of the head have no noticeable effect on the sound or the image position; also, the over-brilliant close-microphone type of recording is "tamed" to a very considerable extent and given at least some element of depth. The big *drawback* is some loss of stereo positional information and a generally less precise quality to the sound. Instruments which would be accurately pin-pointed in the alternative system can be located only rather vaguely, and the whole stereo sound stage is inclined to move over if one is off centre (though a similar inclination exists with an imperfect Brittain system).

It is a matter of taste

It has been argued in favour of the "reflected" system that positional information is not of the first importance, and indeed it is true that in the concert hall—unless one is very near to the orchestra—it is usually necessary to use eyes rather than ears to locate a particular instrument. It must be admitted, however, that enjoyment is lessened to some small extent if positioning is vague rather than definite. Some people find vague positioning rather agitating, and one well-known critic and audio engineer has said that stereo is "impossible" with non-directional speakers; this same man plays a musical instrument himself, however, and is used to the extreme directionality of surrounding players. For most people the statement is absurd, as it can be said with certainty that stereo of very satisfying

quality can be obtained using reflected sound. It is perhaps significant that Ralph West, who has probably listened to more loudspeakers than anyone else in the business, and who is frequently able to play back tape recordings of concerts and operas within minutes of listening to the original performances, himself uses reflected-sound type speakers for his own private enjoyment.

Readers will see from all this that there are good arguments on both sides, and will be cautioned not to be over-impressed by the predominance of forward-facing speakers offered by manufacturers in the following pages.

For Do-it-Yourselfers

For the home constructor who is prepared to do some experimenting there is, in fact, a middle way between the two extremes. Of the three objections to the "direct" type of sound, the one relating to recording techniques could be waived on the grounds that one should not buy the type of record in question anyway; or we may hope that the offending recording engineers will eventually change their ways.

This leaves the "unpleasant" and the "interfering" aspects of the high frequency beams to be dealt with, and a seemingly effective treatment is to randomise the wave-

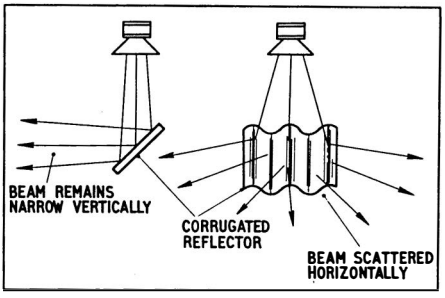


Fig. 5. *The high frequency beam of a speaker may be effectively diffused in the horizontal plane by means of a corrugated reflector suitably angled.*

fronts in the horizontal plane sufficiently to remove significant phase/interference effects, without *completely* sacrificing the directional elements which form the basis of the Hugh Brittain system; at the same time the beams are *not* diffused vertically, so that full treble brilliance is maintained and reflections from floor and ceiling are avoided. A speaker system using this principle has been evolved by the present winter (*Hi-Fi News*, April–June, 1962) and performance bears out the theory.

This "controlled randomisation" is achieved quite simply by means of a corrugated reflector of such size and position that sound energy above about 1 Kc/s is treated in the manner

Fig. 6. *This innocent-looking wall contains a massive concrete speaker system, completely hidden by an acoustically transparent fabric.*

described, while lower down the spectrum a fairly diffuse distribution occurs. In the original design the speaker cone faces down towards the reflector through a short middle frequency horn; but this is not essential, and the system should work with any arrangement whereby the sound is moderately diffused at lower frequencies and the cone position permits reflection of the HF beam into a horizontal plane. The basic arrangement is shown in **fig. 5,** the *minimum* size for the reflector being about 6 ins square. The correct angle is found by using first, a plain flat object in place of the corrugated reflector and positioning it so that the HF beam follows the Hugh Brittain pattern; this is most easily accomplished using white noise (hiss), arranging for the maximum concentration to occur just in front of the far side of the listening area in each case (**fig. 1**).

Reflector Details

Having established the angle and position, the corrugated reflector replaces the plain one, with its corrugations arranged vertically when viewed along the "axis" previously achieved. From the viewpoint of the sound wavefront the reflecting surface undulates across its *width*, thus scattering the beam horizontally, but is flat in the *height* dimensions, thus retaining the beam vertically. Perspex, asbestos, and similar materials are available in suitable form, an appropriate corrugation pitch being 3 ins. Over the frequency range where the reflector is effective, the breakup and diffusion of the beam are sufficient to overcome the listening fatigue mentioned earlier, yet a certain amount of concentration still occurs to give good stereo directionality. A 6 inch wide reflector only becomes effective above 1 Kc/s, and where sufficient space is available a larger size is preferable.

It is difficult for manufacturers to offer speakers using ideas of this sort, as the increase in *overall* size would be impracticable, but for the amateur who is prepared to spend some time it is well worth experimenting with various directional techniques. As always in sound reproduction, there is room for many opinions on what constitutes the most pleasing subjective effect, and stereo has opened up the debate again as far as speakers are concerned. One man's high precision stereo is another's ear-ache, and an airy vague sound is delightful for some and a nightmare of indecision for others. One thing should always be borne in mind: using a first-class signal, most good speakers of *any* type will sound excellent *for a while*, but whether they will give the sort of stereo you will wish to live with for years is another matter.

One final note on speakers for stereo, a psychological point: if possible, speakers should be heard but not seen. There is nothing more intimidating than a pair of all-too-prominent loudspeakers standing out in front as solid evidence to one's sense of sight, while trying to convince one's ears that sounds are coming from points in between. The stereo illusion can be aided enormously by the simple expedient of disguising or hiding the speakers.

Here again, the home enthusiast is at a considerable advantage over commercial manufacturers. The variations in domestic architecture are endless, permitting countless arrangements of speakers in alcoves, cupboards, recesses, etc. Provided the overall need for flexibility in treble distribution arrangements is catered for, it should be possible for the enterprising amateur to put the speakers out of site in a large number of cases.

The Pattern May Change

As smokeless zones become more widespread, increasing numbers of homes will abandon the solid fuel fire, thus depriving the chimney breast of its traditional function. When this happens the seating may be moved to the other end of the room and the two recesses used for speaker accommodation. Plasticised fabrics with acoustically transparent properties are available which can be used, if necessary, to erect partitions. With a little imagination, ways can be devised whereby the visual aspect of stereo speakers can be improved (or obliterated) in any room of fair size. As an example of what can be done, **fig. 6** shows part of the end wall of a room which actually houses a pair of massive concrete folded horns. The complete structures are built in 10 inch deep recesses, and the chimney breast level is continued across, with a fabric covering the whole wall. An uninformed person is quite unaware that anything is there—until the orchestra strikes up. This is admittedly rather extreme, but stereo does lead one on . . .

DIRECTORY OF SPEAKERS AND ENCLOSURES

●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: **H.C.**—handling capacity; **c/o**—cut-off; **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 1—DRIVE UNITS

RICHARD ALLAN Radio Ltd., Bafflette House, Taylor Street, Batley. Tel.: Batley 1123/1308/4033. Cables: Acoustics, Batley.

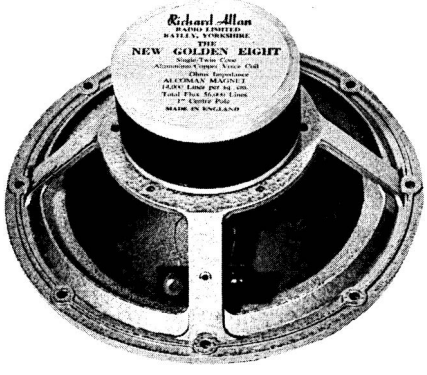
New Bronze Eight. 8 in. Paper cone. Paper or foam surround. Voice coil 1 in. Gap flux 12,500 gauss. Total flux 50,000 maxwells. H.C. 5 watts. v.c.i. 15 ohms. F.R. foam surround 45-10,000 c/s, paper surround 60-10,000 c/s. r.c.f. Full range unit. With tweeter inner cone. Aluminium voice coil. Range extends to 17,000 c/s. Price, paper surround £2 15s. (U.K. purchase tax 8s. 10d.); foam surround £3 (U.K. purchase tax 9s. 7d.).

New Golden Eight. 8 in. Paper cone. Paper of foam surround. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 56,000 maxwells. H.C. 6 watts. v.c.i. 15 ohms. F.R. foam surround 45-10,000 c/s, paper surround 60-10,000 c/s. r.c.f. Full range unit. With tweeter inner cone and aluminium voice coil, range extends to 17,000 c/s. Price, paper surround £3 7s. 6d. (U.K. purchase tax 10s. 10d.); foam surround £3 12s. 6d. (U.K. purchase tax 11s. 7d.). Aluminium or copper voice coil available.

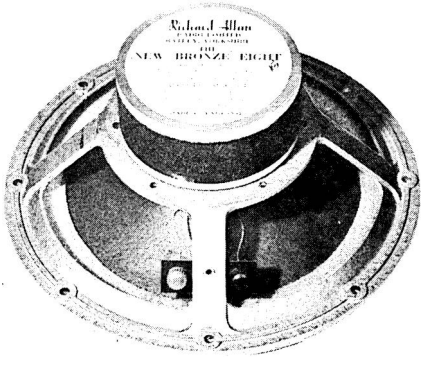
Bronze Ten. 10 in. Paper cone. Voice coil 1½ in. Gap flux 12,500 gauss. Total flux 73,000 maxwells. H.C. 8 watts. v.c.i. 15 ohms. F.R. 40-5,000 c/s (bass cone) or 40-9,000 c/s (wide range cone). Price, standard surround, £4 10s. (U.K. purchase tax 14s. 5d.); foam surround £4 17s. (U.K. purchase tax 15s. 7d.).

Golden Ten. 10 in. Paper cone. Voice coil 1½ in. Gap flux 14,000 gauss. Total flux 82,000 maxwells. H.C. 8 watts. v.c.i. 15 ohms. F.R. 40-5,000 c/s (bass cone) or 40-9,000 c/s (wide range) cone. Price, standard surround, £5 5s. (U.K. purchase tax 16s. 10s.); foam surround £5 12s. (U.K. purchase tax 17s. 11d.).

Bronze Twelve. 12 in. Paper cone. Foam surround. Voice coil 2 in. Gap flux 12,500 gauss. Total flux 162,000 max-



Richard Allan New Golden 8



Richard Allan New Bronze 8

wells. H.C. 12 watts. v.c.i. 15 ohms. F.R. 25-5,000 c/s. r.c.f. 1,100 c/s. Price £9 9s.

Golden Twelve. 12 in. Paper cone. Foam surround. Voice coil 2 in. Gap flux 14,000 gauss. Total flux 182,000 maxwells. H.C. 15 watts. v.c.i. 15 ohms. F.R. 25-5,000 c/s. r.c.f. 1,100 c/s. Price £12 12s.

410T. Tweeter. 4 in. Paper cone and surround. Voice coil $\frac{9}{16}$ in. Gap flux 10,000 gauss. Total flux 15,000 maxwells. H.C. 3 watts. v.c.i. 15 ohms. F.R. 2,000-17,000 c/s. r.c.f. 5,000 c/s. Price £1 5s. (U.K. purchase tax 4s.).

610. 6$\frac{1}{2}$ in. Paper cone. Foam surround. Voice coil $\frac{3}{4}$ in. copper. v.c.i. 5 or 15 ohms. Gap flux 10,000 gauss. Total flux 25,000 maxwells. H.C. 4 watts. F.R. 80 c/s-12 Kc/s. Price £1 10s. 6d. (U.K. purchase tax 4s. 11d.).

1014. 10 in. Paper cone. (Twin cone available.) Foam or paper surround. Voice coil 1 in. copper or aluminium. v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 56,000 maxwells. H.C. 8 watts. F.R. Twin cones: with foam surround 40-17,000 c/s, with standard cone 55-17,000 c/s. Single cone: with foam surround 40-10,000 c/s, with standard cone 55-10,000 c/s. r.c.f. 5,000 c/s. Price (paper) £4 7s. 6d. (U.K. purchase tax 14s.); (foam) £4 12s. 6d. (U.K. purchase tax 14s. 10d.). Tweeter cone 5s. 0d. (U.K. purchase tax 10d.).

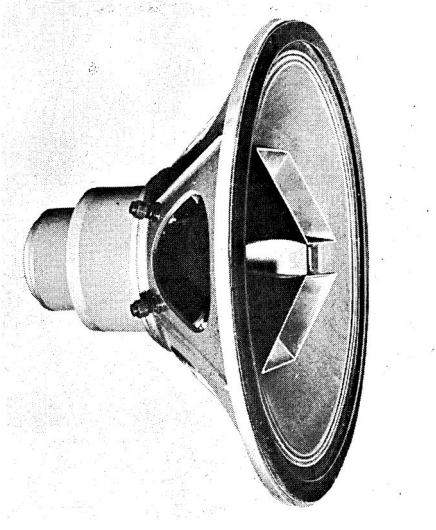
ASSOCIATED ELECTRICAL INDUSTRIES Ltd., Electronics Apparatus Division, Sound Equipment Group, 132/5 Long Acre, London, W.C.2. Tel.: Temple Bar 8040. Cables: Soundequi, Lesquare, London.

A.E.I. 12A. 12 in. Paper cone. Fabric surround. Voice coil 1$\frac{3}{4}$ in. Gap flux 14,400 gauss. Total flux 122,000 maxwells. H.C. 18 watts. v.c.i. 15 ohms. F.R. 50-10,000 c/s. Price £14.

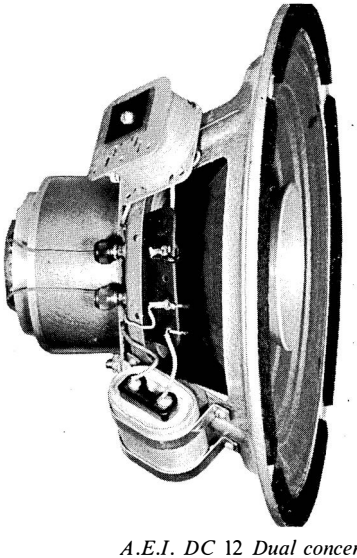
A.E.I. 12B. 12 in. Paper cone. Foam surround. Voice coil 1$\frac{3}{4}$ in. Gap flux 14,400 gauss. Total flux 122,000 maxwells. H.C. 12 watts. v.c.i. 15 ohms. F.R. 40-10,000 c/s. Price £14 14s.

A.E.I. DC12 Dual Concentric. 12 in. Paper cone. Fabric surround. Voice coils (L.F.) 1$\frac{3}{4}$ in. (H.F.) 1.56 in. Gap flux (L.F.) 10,000 gauss (H.F.) 13,000 gauss. Total flux (L.F.) 85,000 maxwells (H.F.) 49,000 maxwells. H.C. 15 watts. v.c.i. 15 ohms. F.R. 50-14,000 c/s. Built-in crossover 1,500 c/s. Price £25.

A.E.I. K10A. Dual Concentric. 18 in. Paper cone. Felt surround. Voice coils (L.F.) 2$\frac{1}{2}$ in. (H.F.) 1.56 in. Gap flux (L.F.) 14,300 gauss (H.F.) 16,700 gauss. Total flux (L.F.) 285,000 maxwells (H.F.) 63,000 maxwells. H.C. 25 watts. v.c.i. 10 ohms. F.R. 30-17,000 c/s. Separate filter unit. 1,700 c/s. Price on application.



A.E.I. K 10A Dual concentric



A.E.I. DC 12 Dual concentric

BAKERS "SELHURST" Radio, 523 London Road, Thornton Heath, Surrey. Tel.: Thornton Heath 7798.

12 in. de-luxe fibre curvilinear cone, bakelised apex. Foam surround. Voice coil 1½ in. Gap flux 15,000 gauss. H.C. 15 watts. v.c.i. 3 or 15 ohms. F.R. 20-15,000 c/s. Price £9 10s.

12 in. Ultra de-luxe fibre curvilinear cone, bakelised apex. Foam surround. Voice coil 1½ in. Gap flux 17,000 gauss. Peak H.C. 20 watts. v.c.i. 15 ohms. F.R. 18-20,000 c/s. Price £15 15s.

Ultra Twelve. 12 in. fibre curvilinear cone, bakelised apex. Foam surround. Voice coil 1½ in. Gap flux 17,000 gauss. Aluminium voice coil and drive. H.C. 20 watts. v.c.i. 15 ohms. F.R. 20-25,000 c/s. Price £17 10s.

15 in./CS Auditorium. Fibre cone, bakelised apex. Foam surround. Voice coil 2 in. Gap flux 15,000 gauss. H.C. 15 watts. v.c.i. 8 or 15 ohms. F.R. 20 c/s-13 Lc/s. r.c.f. 5,000 c/s. Also supplied with normal roll surround rated at 25 watts. Price £18.

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BANG & OLUFSEN, Struer, Denmark. Sole U.K. Importers: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444.

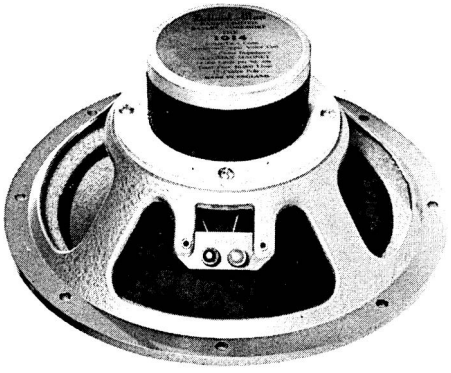
B & O Toroidal Tweeter. Omni-directional. Comprising 2 moving coil units facing inwards on to a double cone reflector. Response: 2,000-20,000 c/s. Series capacitor incorporated. Size 4½ in. high, 3 in. diameter. Price £5 19s. 1d. (U.K. purchase tax 19s. 11d.).

★

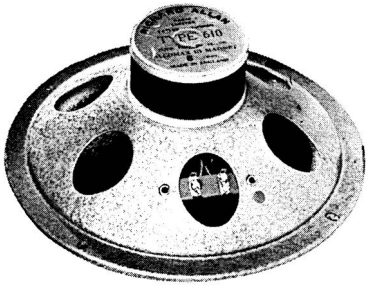
DUODE Ltd., 16 Brunswick Road, Sutton, Surrey.

Duode 12E. 12 in. Linen moulded cone. Foamed plastic surround. Voice coil 1.5 in. Gap flux 17,000 gauss. Total flux 190,000 lines. H.C. 30-15 watts. v.c.i. 15-8-5 ohms. F.R. 20-16,000 c/s. Price £12.

Duode 12D. 12 in. Linen moulded cone. Foamed plastic surround. Voice coil 1.5 in. Gap flux 14,500 gauss. Total flux 130,000 lines. H.C. 15 watts. v.c.i. 30-15-8-5 ohms. F.R. 20-16,000 c/s. Price £9.



Richard Allan type 1014



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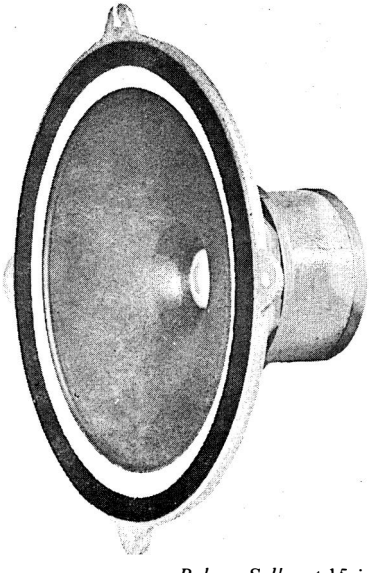
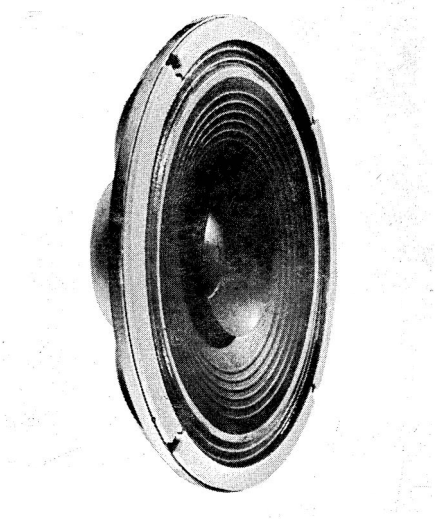
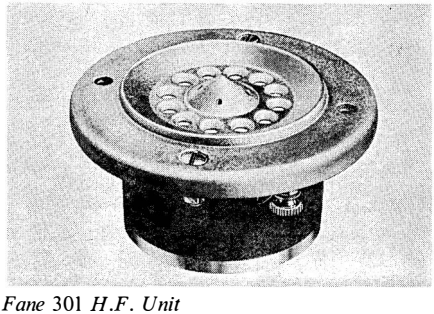


Bakers Selhurst 15 *in/CS*

Eagle CX 3000



Eagle CR12AE



Fane 301 *H.F. Unit*

EAGLE Products. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606. Cables: Reldab.

CR12AE. 12 in. coaxial. Paper cone, plastic treated surround. 2 in. aluminium voice coil. V.c.i. 16 ohms. Total flux 85,000 maxwells. H.C. 10 W. F.R. 30 c/s-16 Kc/s. c.f. 1,800 c/s. Price £8 8s.

8A7. 8 in. coaxial. Paper cone, plastic treated surround. 1 in. aluminium voice coil. v.c.i. 16 ohms. Total flux 53,000 maxwells. H.C. 6 W. F.R. 50 c/s-16 Kc/s. Price £3 17s. 6d. (U.K. Purchase Tax 7s.)

CX300. 12 in. coaxial. Paper cone, plastic treated surround. 3 in. aluminium voice coil. v.c.i. 16 ohms. Gap flux (woofer) 12,000 gauss; (tweeter) 10,500 gauss. Total flux (woofer) 200,000 maxwells; (tweeter) 18,000 maxwells. H.C. 15 W. F.R. 30 c/s-16 Kc/s. c.f. 2,500 c/s. Price £12 12s.

CR30AE. 12 in. coaxial with additional tweeter. Paper cone, plastic treated surround. 2½ in. aluminium voice coil. v.c.i. 16 ohms. Gap flux (woofer) 10,500 gauss; (tweeter) 11,000 gauss. Total flux (woofer) 15,000 maxwells; (tweeter) 13,000 maxwells. H.C. 10 W. F.R. 30 c/s-16 Kc/s. c.f. 1,800 c/s and 5,000 c/s. Price £10 10s.

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ELAC. Electro Acoustic Industries Ltd., Stamford Works, Broad Lane, Tottenham, London, N.15. Tel.: Tottenham 0505/9. Cables: Elac London, N.15.

Elac Type 8N/148 (N/832). 8 in. Exponential paper cone. Paper surround, integral with cone. Voice coil 1 in. copper. v.c.i. 15 ohms. Gap flux 12,000 gauss. Total flux 48,300 maxwells. H.C. 5 watts. F.R. 55 c/s-11 Kc/s (loaded conditions). r.c.f. High frequency crossover 8,000 c/s. Price £2 8s. (U.K. purchase tax 7s. 9d.).

Elac 8RM/205 (Ceramic magnet). 8 in. Exponential paper cone, plus inner cone. Paper-plasticised surround. Voice coil 1 in. copper. v.c.i. 3 ohms. Gap flux 10,000 gauss. Total flux 40,300 maxwells. H.C. 5 watts. F.R. 55 c/s-12 Kc/s. r.c.f. High frequency crossover 8,000 c/s. Price including tax £3 3s.

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FANE ACOUSTICS Ltd., Hick Lane, Batley, Yorks. Tel.: Batley 1578. Cables: Fane, Batley.

Fane Model 121. 12 in. Paper cone. Foam surround. Voice coil 2 in. Gap flux 12,000 gauss. Total flux 160,000 maxwells.

H.C. 20 watts. v.c.i. 15 ohms. F.R. 30-5,000 c/s. r.c.f. 2,000 c/s. Price £9.

Fane Model 121A. Details as above, but aluminium voice coil. F.R. 30-10,000 c/s. r.c.f. 5,000 c/s. Price £9 9s.

Fane 301 High Frequency Unit. Aluminium cone. Voice coil ¾ in. Gap flux 17,000 gauss. H.C. 12 watts. v.c.i. 15 ohms. F.R. 1,500-17,000 c/s. r.c.f. 2,000 c/s. Price £3 15s.

Model 151. 15 in. loudspeaker. Paper cone. Foam surround. Voice coil 3 in. Gap flux 14,000 gauss. Total flux 361,000 maxwells. H.C. 35 watts. v.c.i. 15 ohms. F.R. 20-3,500 c/s. Price £18.

Model 122/12. 12 in. Paper cone. Foam rubber surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 12,000 gauss. Total flux 160,000 maxwells. H.C. 15 watts. F.R. 20 c/s-5 Kc/s. r.c.f. 2,000 c/s. Price £7 10s.

Model 122/14. 12 in. paper cone. Foam rubber surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 187,000 maxwells. H.C. 20 watts. F.R. 20-5,500 c/s. r.c.f. 2,000 c/s. Price £9.

Model 122/17. 12 in. Paper cone. Foam rubber surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 17,000 gauss. Total flux 227,000 maxwells. H.C. 25 watts. F.R. 20 c/s-7 Kc/s. r.c.f. 4,000 c/s. Price £12.

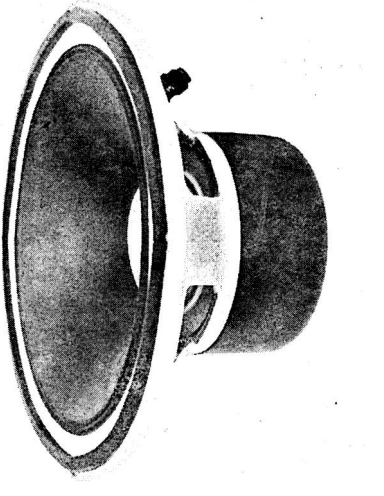
Model 153. 15 in. (Ceramic magnet.) Heavy duty paper cone. Foam rubber surround. Voice coil 3 in. (copper). v.c.i. 15 ohms. Gap flux 14,500 gauss. Total flux 375,000 maxwells. H.C. 35 watts. F.R. 20-2,500 c/s. r.c.f. 1,500 c/s. Price £16 10s.

Model 152/12. 15 in. Paper cone. Paper surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 12,000 gauss. Total flux 160,000 maxwells. H.C. 20 watts. F.R. 25 c/s-4 Kc/s. r.c.f. 2,000 c/s. Price £10.

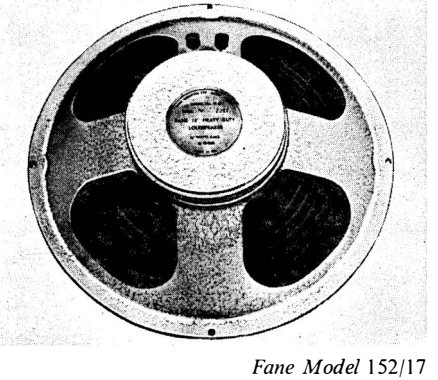
Model 152/14. 15 in. Paper cone. Paper surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 187,000 maxwells. H.C. 25 watts. F.R. 25 c/s-5 Kc/s. r.c.f. 2,000 c/s. Price £12.

Model 152/17. 15 in. Paper cone. Paper surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 17,000 gauss. Total flux 227,000 maxwells. H.C. 30 watts. F.R. 25 c/s-6 Kc/s. r.c.f. 3,000 c/s. Price £15.

Elac Type 8N/148

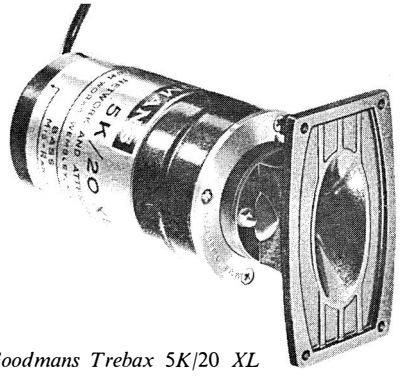


Fane Model 121A

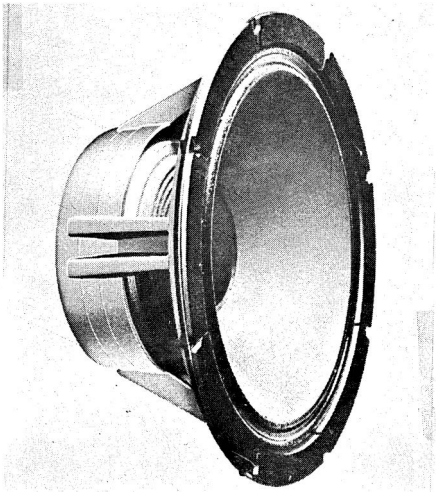


Fane Model 152/17

Goodmans Audiom 61



Goodmans Trebax 5K/20 *XL*



Goodmans Audiom 81

Model 183. 18 in. Paper cone. Voice coil 3 in. Gap flux 14,500 gauss. Total flux 375,000 maxwells. H.C. 60 W. F.R. 20 c/s-3 Kc/s. r.c.f. 2,000 c/s. Price £25.

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GOODMANS INDUSTRIES Ltd., Axiom Works, Wembley, Middx. Tel.: Wembley 1200. Cables: Goodaxiom, Wembley.

Axiette 8. 8 in. Paper cone. Plastic treated surround. Voice coil 1 in. Gap flux 13,500 gauss. Total flux 53,000 maxwells. H.C. 6 watts. v.c.i. 15 ohms. F.R. 40-15,000 c/s. Price £4 11s. (U.K. purchase tax 14s. 7d.).

Axiom 10. 10 in. Paper cone. Plastic treated surround. Voice coil 1 in. Gap flux 13,500 gauss. Total flux 53,000 maxwells. H.C. 10 watts. v.c.i. 15 ohms. F.R. 40-15,000 c/s. Price £5 8s. 6d. (U.K. purchase tax 17s. 5d.).

Axiom 80. 9½ in. Twin Diaphragm paper cone, free edge surround. Voice coil 1 in. Gap flux 17,000 gauss. Total flux 62,000 maxwells. H.C. 6 watts. v.c.i. 15 ohms. F.R. 20-20,000 c/s. Price £17 10s. (U.K. purchase tax £2 16s. 3d.).

Trebax. Horn-loaded pressure tweeter. Aluminium diaphragm. Voice coil 1 in. H.C. suitable for inclusion in systems of up to 25 watts. v.c.i. 15 ohms at 10 Kc/s. F.R. 2,500-20,000 c/s. r.c.f. 5 Kc/s. Price £6 4s.

Trebax 5K/20XL. Horn loaded pressure tweeter. Built in L/C crossover (5,000 c/s) and attenuator. Suitable for inclusion in systems of up to 20 watts. Dispersion angle 90°. Price £7.

Midax 650. Horn loaded pressure unit. Resin impregnated linen diaphragm. Die-cast horn. Voice coil 1½ in. H.C. suitable for systems up to 25 watts. v.c.i. 15 ohms. F.R. 650-8,000 c/s. r.c.f. 950 and 5,000 c/s. Price £9 10s.

Audiom 51 bass. 12 in. Paper cone. Voice coil 1¾ in. (4.4 cm.). v.c.i. 15-16 ohms. Gap flux 13,000 gauss. Total flux 87,500 maxwells. H.C. 15 watts. Fundamental resonance 35 c/s. Price £8 14s.

The Audiom 51 is available in three versions: Audiom 51 bass – details as above, for use as bass unit in high fidelity systems. Audiom 51

(75 c/s) – for particularly arduous conditions. Audiom 51 (55 c/s) – for special applications.

Audiom 61 bass. 12 in. Paper cone. Voice coil 1¾ in. (4.4 cm.). v.c.i. 15-16 ohms. Gap flux 16,500 gauss. Total flux 185,000 maxwells. H.C. 20 watts. Fundamental resonance 35 c/s. Price £13 14s.

The Audiom 61 is available in three versions: Audiom 61 bass – details as above, for use as bass unit in high fidelity systems. Audiom 61 (75 c/s) – for particularly arduous conditions. Audiom 61 (55 c/s) – for special applications.

Axiom 201. 12 in. Twin diaphragm paper cone. Plastic treated surround. Voice coil 1¾ in. (4.4 cm.) (aluminium). v.c.i. 15-16 ohms. Gap flux 13,000 gauss. Total flux 87,500 maxwells, H.C. 15 watts. F.R. 30 c/s-16 Kc/s. Built-in mechanical crossover at 5,000 c/s. Price £10 7s.

Axiom 301. 12 in. Twin diaphragm paper cone. Plastic treated surround. Voice coil 1¾ in. (4.4 cm.) (aluminium). v.c.i. 15-16 ohms. Gap flux 16,500 gauss. Total flux 185,000 maxwells. H.C. 20 watts. F.R. 30 c/s-16 Kc/s. Built-in mechanical crossover of 5,000 c/s. Price £14 10s.

Audiom 81 bass. 15 in. Paper cone. Plastic treated surround. Voice coil 3 in. (7.6 cm.). v.c.i. 15-16 ohms. Gap flux 14,000 gauss. Total flux 269,000 maxwells. H.C. 25 watts. Fundamental resonance 25 c/s. Price £25.

The Audiom 81 is also available in 60 c/s version for special purposes.

The Audiom 81 bass (details above) with 25 c/s fundamental resonance is specially designed for use as the bass unit in a multiple system (with Midax and Trebax). In this case it must be mounted in the correct size of enclosure.

Audiom 90 bass. 18 in. Paper cone. Voice coil 2½ in. (6.35 cm.). v.c.i. 15-16 ohms. Gap flux 14,500 gauss. Total flux 267,000 maxwells. H.C. 50 watts. Fundamental resonance 35 c/s. Price £29 15s.

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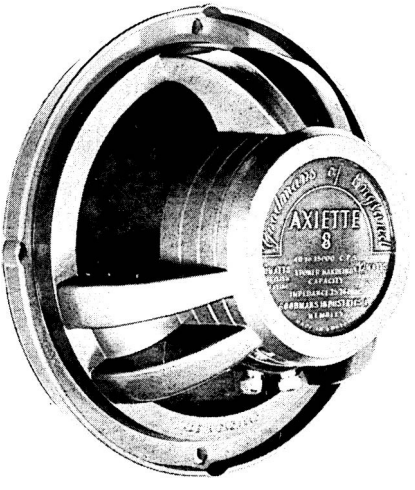
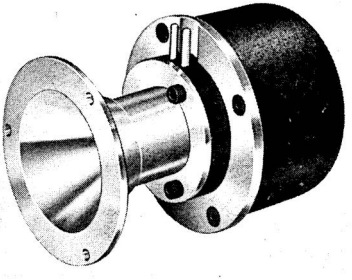
GRAMPIAN REPRODUCERS Ltd., Hanworth Trading Estate, Middx. Tel.: Feltham 2657/8/9. Cables: Reamp, Feltham.

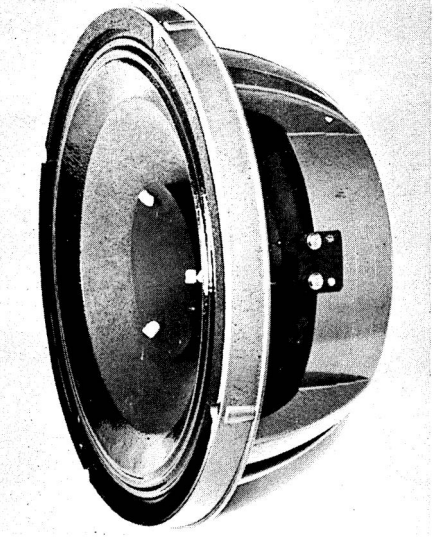
Grampian 1255/15. 12 in. Paper impregnated cone and surround. Voice coil 1¾ in. Gap flux 14,500 gauss. Total flux 130,500 maxwells. H.C. 10 watts. v.c.i. 15 ohms. F.R. 35-15,000 c/s. Price £9 10s.



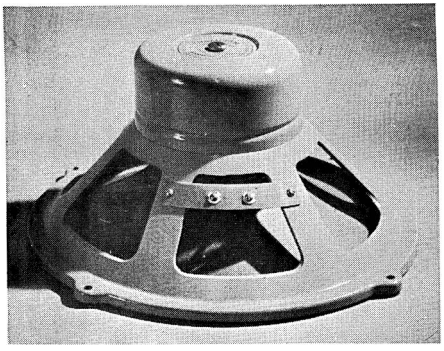
Goodmans Axiette 8



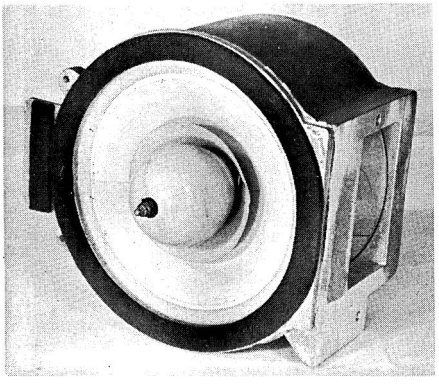
Goodmans Trebax H.F. unit



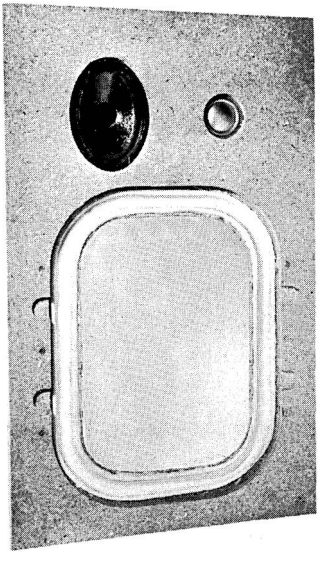
Goodmans Axiom 201



Grampian 1255/15



Lowther PM3



KEF K1 Baffle

KEF ELECTRONICS Ltd., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: Kef, Maidstone.

K1 Baffle. 16 × 12 in. Exp. polystyrene cone. Plastic coated cloth surround. Voice coil 2 in. Gap flux 12,700 gauss. Total flux 165,000 maxwells. 6 × 4 in. Tri-ply cone. Plastic coated cloth surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,000 maxwells. 1½ in. Melinex dome. Melinex roll surround. Voice coil 1½ in. Gap flux 15,000 gauss. Total flux 53,500 maxwells. H.C. 25 watts rms 50 watts peak. v.c.i. 8-16 ohms. F.R. 20-375 c/s; 375-3,000 c/s; 3,000 upwards. r.c.f. 375-3,000 c/s. Price £28 complete.

B139. 13 × 9 in. Exp. plastic and aluminium cone. Plastic coated fabric surround. Voice coil 2 in. (copper). v.c.i. 8-16 ohms. Gap flux 12,000 gauss. Total flux 165,000 maxwells. H.C. 15 watts. F.R. 30 c/s-4 Kc/s. r.c.f. 2,000 c/s. Price £11 10s.

T15 tweeter. 1½ in. Melinex dome. Melinex surround. Voice coil 1½ in. (aluminium). v.c.i. 8-16 ohms. Gap flux 15,000 gauss. Total flux 53,500 maxwells. H.C. 15 watts. Treble only. F.R. 600-15,000 c/s. r.c.f. 1,000 c/s. Price £6.

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LORENZ. See Technical Supplies Ltd.

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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 37 mm. Gap flux 17,500 gauss. Total flux 196,000 maxwells. H.C. 6 watts. v.c.i. 16 ohms. F.R. 30-18,000 c/s. Price £18 18s.

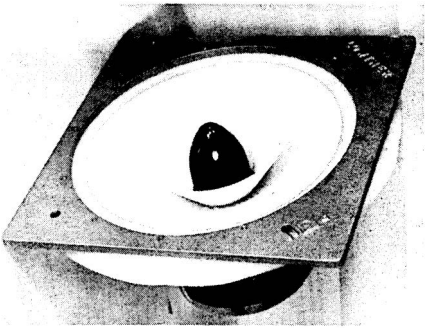
P.M.2 Mk. I. 6 in. Selected paper cone. Plastic surround. Voice coil 37 mm. Gap flux 21,000 lines per sq. cm. Total flux 281,000 maxwells. H.C. 6 watts. v.c.i. 15 ohms. F.R. 30-20,000 c/s. Price £30.

P.M.2. Mk. II. 6 in. Selected paper cone. Plastic foam surround. Voice coil 37 mm. Gap flux 23,000 gauss. Total flux 350,000 maxwells. H.C. 6 watts. v.c.i. 15 ohms. F.R. 25-22,000 c/s. Price £40.

P.M.2. Mk. III. Details as P.M.2 Mk. I but with special bracket for securing within Acousta-Twin Enclosure.

P.M.3. 6 in. Selected paper cone. Plastic surround. Voice coil 39 mm. Gap flux 22,000 gauss. Total flux 307,750 maxwells. H.C. 6 watts. v.c.i. 15 ohms. F.R. 20-20,000 c/s. Not sold separately from enclosure type T.P.1.

P.M.4. 6 in. Selected paper cone. Plastic surround. Voice coil 37 mm. Gap flux 24,000 gauss. Total flux 385,000 maxwells. H.C. 6 watts. v.c.i. 16 ohms. F.R. 25-24,000 c/s. Price £48.



Lowther PM2 Mk. 1

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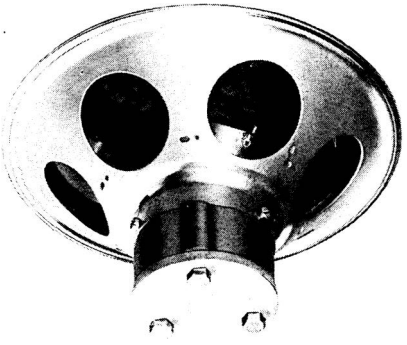
MORDAUNT Sound Reproducers, 32-34 Rupert Street, London, W.1. Tel.: Gerrard 1067.

Audistatic tweeter. Push Pull Electrostatic. Forward facing unit with crossover and mains supply. r.c.f. 1,500 c/s. F.R. 1 Kc/s-20 Kc/s. Size 12 × 11¼ × 5 in. Price £5.



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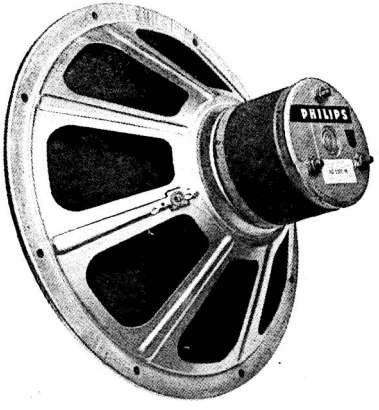
PHILIPS ELECTRICAL Ltd., Century House, Shaftesbury Avenue, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

9710M. 8 in. Dual cone. Paper corrugated surround. Voice coil 1 in. Gap flux 8,000 gauss. Total flux 97,000 maxwells. H.C. 10 watts. v.c.i. 7 ohms. F.R. 40-18,000 c/s. r.c.f. 500-1,000 c/s. Price £4 19s. 6d. (U.K. purchase tax 16s.)

Philips 9710 *M*

AD5200M. 12 in. Dual cone. Paper corrugated surround. Voice coil 1¼ in. Gap flux 11,000 gauss. Total flux 134,000 maxwells. H.C. 20 watts. Price £10 10s.



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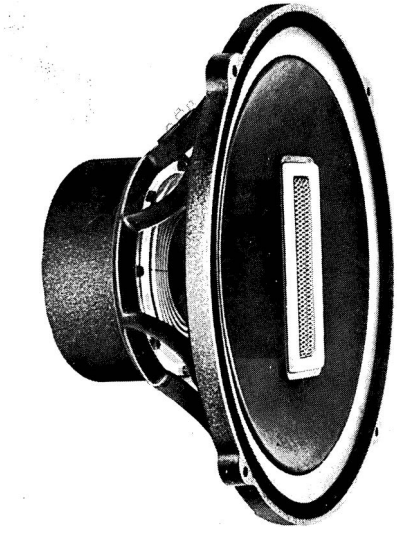
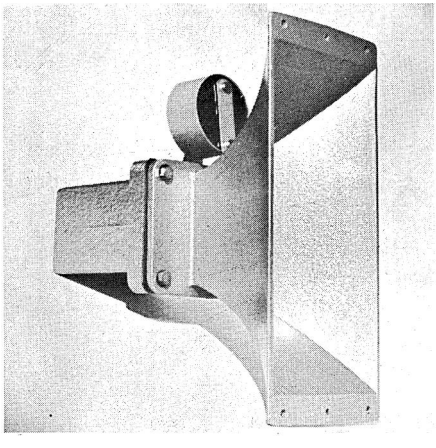
ROLA CELESTION Ltd., Ferry Works, Thames Ditton, Surrey. Tel.: Emberbrook 3402-6.

Colaudio 1550. 15 in. Paper cone. Foam surround. Voice coils (L.F.) 3 in. (H.F.) ¾ in. Gap flux (L.F.) 12,500 (H.F.) 14,500 gauss. Total flux (L.F.) 290,000 (H.F.) 73,500 maxwells. H.C. 25 watts. v.c.i. 15 ohms. F.R. 30-15,000 c/s. For use with 3K50 coupling unit. Price £32 10s. Coupling unit £2 19s. 6d.

Philips AD 5200 *M*



Rola Celestion Colaudio



Kelly Ribbon Mk. 2 H.F. Unit

Tannoy Monitor "Twelve"

ROMAGNA REPRODUCERS Ltd., Factory distributors: Stanley Kelly, Romagna, Bycullah Avenue, Enfield, Middlesex.

Kelly Ribbon H.F. Speaker Mk. 2. Horn loaded. Ribbon dimensions 6 × 1 cm. H.C. 10 watts. v.c.i. 15 ohms through transformer supplied. F.R. 2,000-20,000 c/s. r.c.f. 2,000 c/s. Price £10 10s.

L.F. Driver Mk. 1. 12 in. Metal cone. Free edge. Voice coil 2 in. Gap flux 14,000 gauss. Total flux 250,000 maxwells. H.C. 25 watts. v.c.i. 15 ohms. F.R. 35-2,000 c/s. r.c.f. 2,000 c/s. Price £14 14s.

L.F. Driver Mk. 3. Exponential form cone with foam surround. Gap flux 14,000 gauss. Total flux 95,000 maxwells. H.C. 20 watts. v.c.i. 15 ohms. F.R. 45-18,000 c/s. Price £10 10s.

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STENTORIAN. See Whiteley Electrical.

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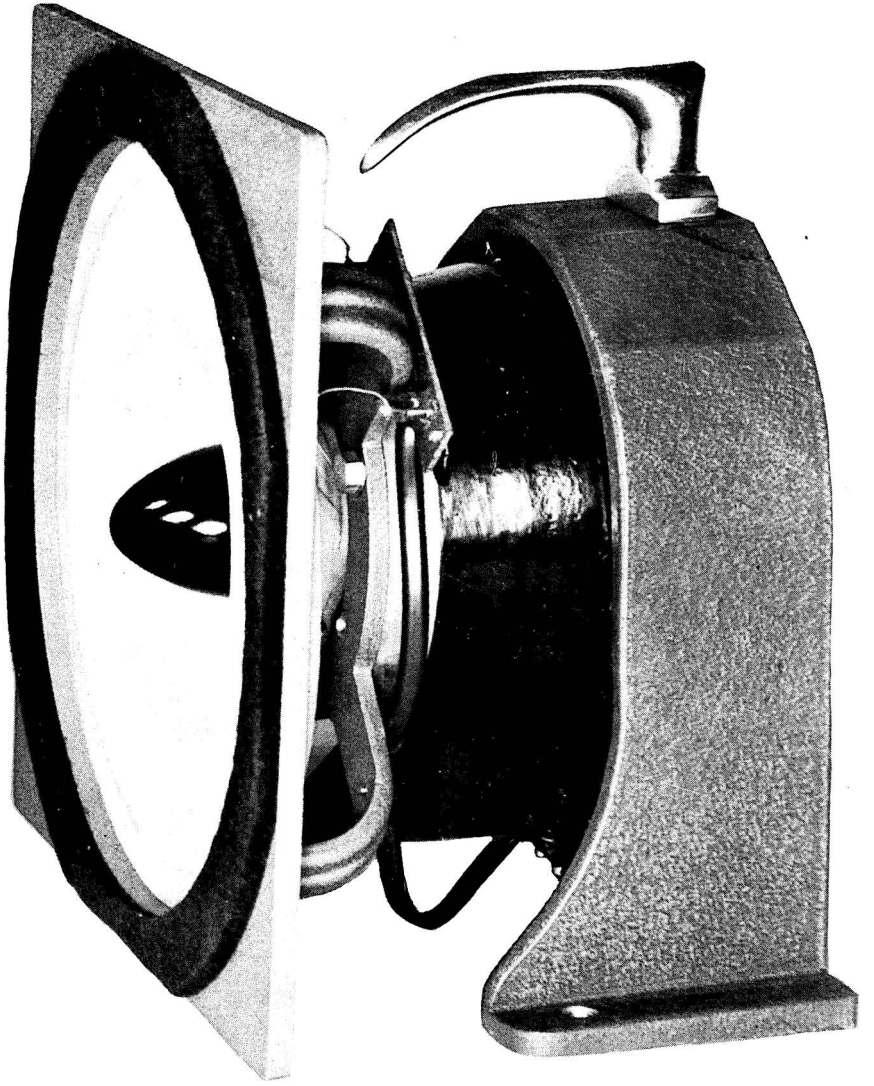
TANNOY PRODUCTS Ltd., West Norwood, London, S.E.27. Tel.: Gipsy Hill 1131. Cables: Tannoy, London.

Direct radiator. 12 in. Moulded fibre cone. Plastic treated surround. Voice coil 2 in. Gap flux 14,000 gauss. H.C. 15 watts. v.c.i. 20 ohms. F.R. 40-16,000 c/s. Price £14 14s.

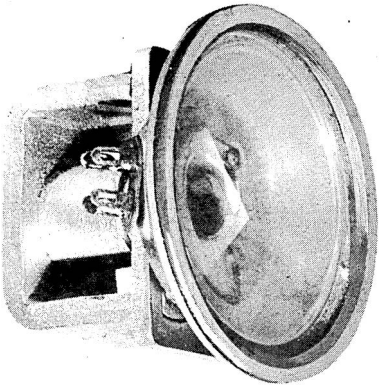
III LZ. 12 in. dual concentric. Moulded fibre cone. Plastic impregnated surround. Gap flux (L.F.) 10,000 (H.F.) 15,000 gauss. H.C. 10 watts. F.R. 23-20,000 c/s. r.c.f. (supplied) 1,700 c/s. Price £22 10s.

Monitor "Twelve". 12 in. Moulded fibre cone. Plastic treated surround. Voice coils (H.F. and L.F.) 2 in. Gap flux (L.F.) 11,500 (H.F.) 15,000 gauss. H.C. 30 watts. F.R. 25-20,000 c/s. r.c.f. 1,700 c/s. Price £30 15s.

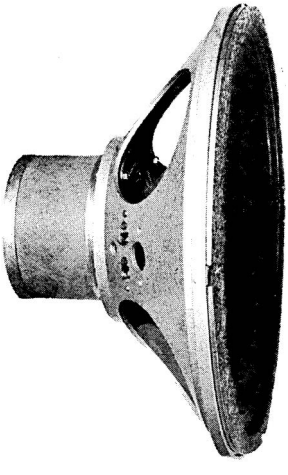
Monitor "Fifteen". 15 in. Moulded fibre cone. Plastic treated surround. Voice coils (H.F. and L.F.) 2 in. Gap flux (L.F.) 13,500 (H.F.) 18,000 gauss. H.C. 50 watts. F.R. 23-20,000 c/s. r.c.f. 1,000 c/s. Price £37 10s.



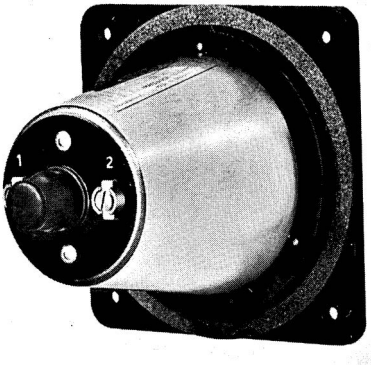
Lowther PM2 Mk. I



TSL-Lorenz LPH 65 H.F. Unit



Tannoy 12 in direct radiator



Vitavox TR 30 H.F. Unit

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. Permaflex surround. Voice coil 1 in. H.C. 8 watts, peak load 12 watts. v.c.i. 4.5 ohms. F.R. 35-12,000 c/s. Price £4 19s. 6d. (U.K. purchase tax 10s. 6d.).

LP. 312-2. 12 in. Reinforced ribbed paper cone. Permaflex surround. Voice coil 1½ in. H.C. 29 watts. v.c.i. tapped 4, 8, 16 ohms. F.R. 20 to above 17,000 with 2 type LPH65 treble speakers in a fitted bridge assembly. r.c.f. 3,000-5,000 c/s. Price £14 19s. 6d.

TSL-Lorenz Tweeter LPH 65. 2½ in. Special plastic cone. Plastic surround. Voice coil ½ in. H.C. 2 watts (H.F. only). v.c.i. 5.5 ohms at 800 c/s. F.R. 2,000 to above 17,000 c/s. r.c.f. 3,000-5,000 c/s. Price £1 8s. 6d. (U.K. purchase tax 4s. 7d.).

TSL-Lorenz LP45F. 1¾ in. Special compound cone. Permaflex surround. Voice coil 1½ in. Gap flux 9,500 gauss. H.C. 300 milliwatts. v.c.i. standard low impedance. F.R. 120-14,000 c/s. Price 18s. 8d. (U.K. purchase tax 3s. 2d.).

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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.) 1.78 in. (H.F.) 0.65 in. Gap flux (L.F.) 14,000 (H.F.) 12,000 gauss. Total flux (L.F.) 160,000 (H.F.) 15,000 maxwells. H.C. 15 watts. v.c.i. 15 ohms. F.R. 40-15,000 c/s nominal. Price £19 10s.

A.K.120. 12 in. Paper cone. Paper surround. Voice coil 1.78 in. Gap flux 14,000 gauss. Total flux 160,000 maxwells. H.C. 15 watts. v.c.i. 15 ohms. F.R. 40-12,000 c/s. r.c.f. 1,000 c/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. H.C. 40 watts. v.c.i. 15 ohms. F.R. 50-8,000 c/s. r.c.f. 500 c/s. Price £25.

T.R. 30. 3 in. cone. Gap flux 12,000 gauss. Total flux 15,000 maxwells. Suitable for a 15 W speaker system. F.R. 1,000-15,000 c/s. v.c.i. 15 ohms. Crossover frequency 2,000 c/s. Price £6 10s.

S2 High Frequency Pressure Unit. Diaphragm, pressure formed from lightweight aluminium alloy 3 in. diameter. Voice coil in gap flux of 16,000 gauss. H.C. above 200 c/s, 10 watts. Nominal F.R. 200-16,000 c/s. r.c.f. 500 c/s. Price £35.

High Frequency Dispersive Horn. Designed for use with S2 Pressure units. Cast in aluminium alloy, non-resonant. Cut off frequency 300 c/s. Price £17.

★

WHARFEDALE Wireless Works Ltd., Idle, Bradford. Tel.: Idle 1235-6. Cables: Wharfdel, Idle, Bradford.

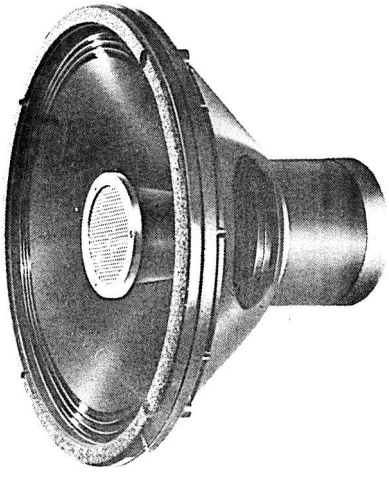
8 in. Bronze/FS/AL. Paper cone. Foam plastic surround. Voice coil 1 in. (aluminium). Gap flux 10,500 gauss. Total flux 41,500 maxwells. H.C. 4 watts. v.c.i. 2-3 ohms or 10-15 ohms. F.R. 40-12,000 c/s. Price £3 5s. (U.K. purchase tax 10s. 10d.).

Super 8/FS. 8 in. Paper cone. Foam plastic surround. Voice coil 1 in. Gap flux 14,500 gauss. Total flux 60,000 maxwells. H.C. 5 watts. v.c.i. 2-3 or 12-15 ohms. F.R. 40-12,000 c/s. Price £5 (U.K. purchase tax 16s. 8d.).

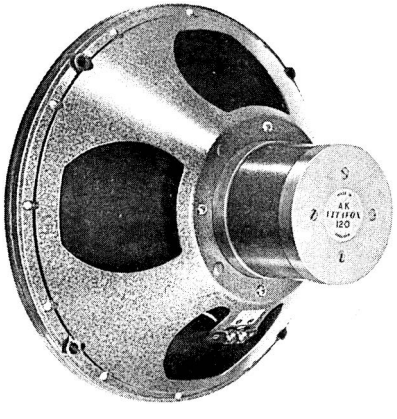
10 in. Bronze/FSB. Paper cone with bakelised apex. Foam plastic surround. Voice coil 1 in. Gap flux 10,500 gauss. Total flux 41,500 maxwells. H.C. 6 watts. v.c.i. 2-3 or 12-15 ohms. F.R. 35-10,000 c/s. Price £3 19s. 6d. (U.K. purchase tax 13s. 3d.).

Golden 10/RS/DD. 10 in. Double diaphragm assembly. Roll surround. Voice coil 1 in. Gap flux 14,500 gauss. Total flux 60,000 maxwells. H.C. 8 watts. v.c.i. 12-15 ohms. F.R. 30-20,000 c/s. Price £6 15s. (U.K. purchase tax £1 2s. 5d.).

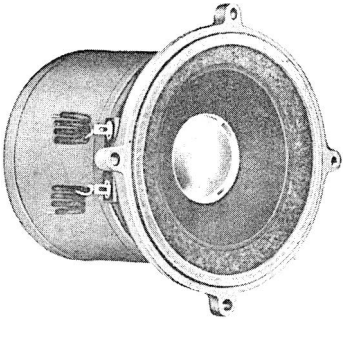
Super 10/RS/DD. 10 in. Paper (double diaphragm) cone. Roll surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 85,000 maxwells. H.C. 10 watts. v.c.i. 12-15 ohms. F.R. 30-20,000 c/s. Price £9 7s. 6d. (U.K. purchase tax £1 11s. 2d.).



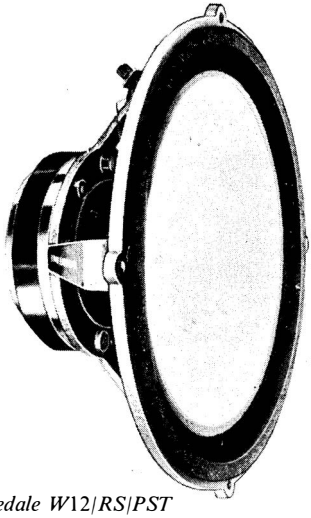
Vitavox DU 120 *Duplex Coaxial*



*Vitavox AK*120



Wharfedale Super 3 *H.F. Unit*

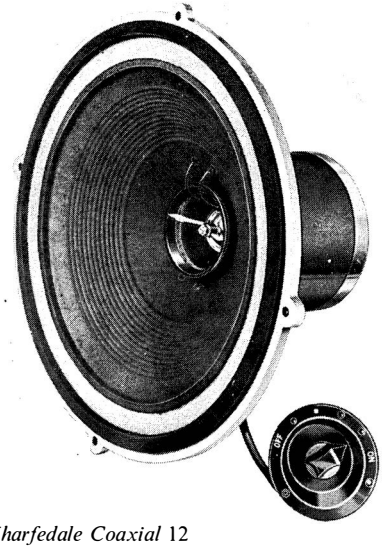


Wharfedale W12/RS/PST

Super 12/RS/DD. 12 in. Double diaphragm assembly. Roll surround. Voice coil $1\frac{3}{4}$ in. (aluminium). Gap flux 17,000 gauss. Total flux 190,000 maxwells. H.C. 20 watts. v.c.i. 12-15 ohms. F.R. 25-20,000 c/s. Price £17 10s.

W15/RS. 15 in. Paper cone. Roll surround. Voice coil 2 in. Gap flux 13,500 gauss. Total flux 180,000 maxwells. H.C. 20 watts. v.c.i. 12-15 ohms. F.R. 25-2,000 c/s. r.c.f. 800 c/s. Price £17 10s.

Super 3. 3 in. Bakelised paper cone with integral dome. Foam plastic surround. Voice coil 1 in. (aluminium). Gap flux 14,500 gauss. Total flux 60,000 maxwells. H.C. 6 watts above 1,000 c/s. v.c.i. 2-3 or 10-15 ohms. F.R. 1,000-20,000 c/s. r.c.f. 4,000 c/s. Price £5 (U.K. purchase tax 16s. 8d.).

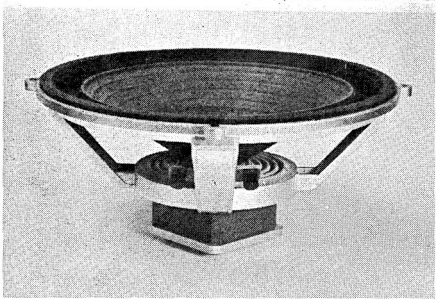


Wharfedale Coaxial 12

Coaxial 12. (L.F.) 12 in. (H.F.) 2 in. Paper cone. Roll surround. Voice coils (L.F.) $1\frac{3}{4}$ in. (H.F.) 1 in. Gap flux (L.F.) 14,000 (H.F.) 13,200 gauss. Total flux (L.F.) 155,000 (H.F.) 44,000 maxwells. H.C. 15 watts. v.c.i. 12-15 ohms only. F.R. 25-20,000 c/s. Price £25.

Super 8/RS/DD. 8 in. Double diapragm paper cone. Roll surround. Voice coil 1 in. (aluminium). v.c.i. 10-15 ohms. Gap flux 14,500 gauss. Total flux 60,000 maxwells. H.C. 6 watts, 12 watts peak. F.R. 40 c/s-20 Kc/s. Price £5 15s. (U.K. purchase tax 19s. 2d.).

PST/4. 4 in. Paper and polystyrene cone. Cloth surround. Voice coil $\frac{3}{4}$ in. v.c.i. 10-15 ohms. Gap flux 11,500 gauss. Total flux 28,800 maxwells. H.C. 5 watts, 10 watts peak. F.R. 300 c/s-15 Kc/s. r.c.f. 300 c/s. Price £2 15s. (U.K. purchase tax 9s. 2d.).



Wharfedale 10 "*Bronze*" *R/S*

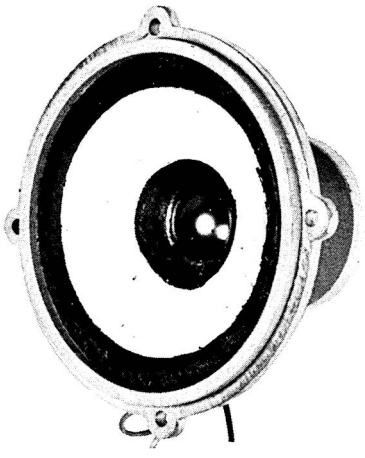
8 in. Bronze/RS. 8 in. Paper cone. Roll surround. Copper voice coil. v.c.i. 10-15 ohms. Gap flux 10,500 gauss. Total flux 41,500 maxwells. H.C. 5 watts, 10 watts peak. F.R. 40 c/s-10 Kc/s. Price £3 5s. (U.K. purchase tax 10s. 10d.).

10 in. Bronze/RS. 10 in. Paper cone. Roll surround. Voice coil 1 in. (copper). v.c.i. 15 ohms. Gap flux 10,500 gauss. Total flux 41,500 maxwells. H.C. 6 watts, 12 watts

peak. F.R. 35 c/s-4 Kc/s. r.c.f. 3,000 c/s. Price £3 19s. 6d. (U.K. purchase tax 13s. 3d.).

W12/RS/PST. 12 in. Paper and polystyrene cone. Roll surround. Voice coil 1¾ in. (copper). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 156,000 maxwells. H.C. 15 watts, 30 watts peak. F.R. 25 c/s-4 Kc/s. r.c.f. 3,000 c/s. Price £10 15s.

RS/12/DD. 12 in. Paper cone. Roll surround. Voice coil 1¾ in. (aluminium). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 156,000 maxwells. H.C. 15 watts, 30 watts peak. F.R. 25 c/s-17 Kc/s. Price £11 10s.



Wharfedale PST/4 H.F. Unit

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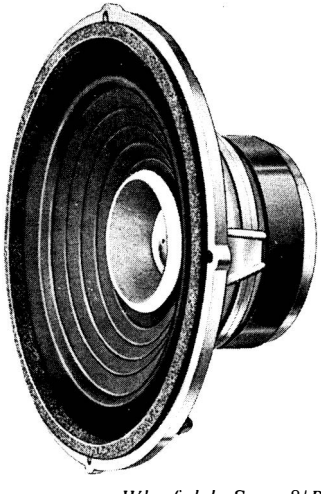
WHITELEY ELECTRICAL Radio Co. Ltd., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762-5. Cables: Whitebon, Mansfield.

Stentorian HF.812. 8 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. H.C. 5 watts. v.c.i. universal (3, 7.5 and 15 ohms). F.R. 50-12,000 c/s. Price £3 2s. 4d. (U.K. purchase tax 10s. 5d.).

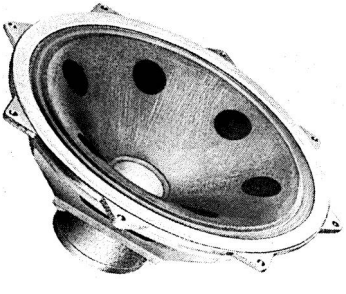
Stentorian Clunber. 9 in. Paper cone. Paper surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. H.C. 9 watts. v.c.i. 15 ohms. F.R. 100-13,000 c/s. Price £11 0s. 2d. (U.K. purchase tax £1 17s. 1d.).



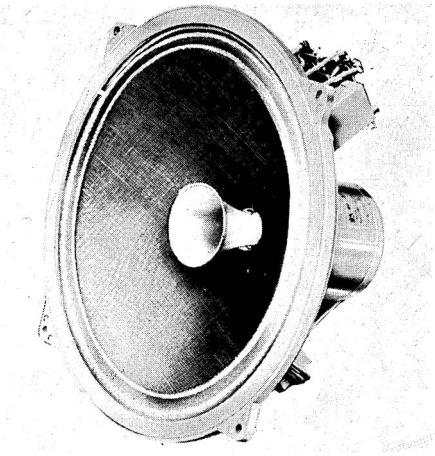
Wharfedale Super 8/RS/DD

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. H.C. 6 watts. v.c.i. universal 3 ohms, 7.5 ohms and 15 ohms. F.R. 50-14,000 c/s. Price £5 2s. 7d. (U.K. purchase tax 17s. 5d.).

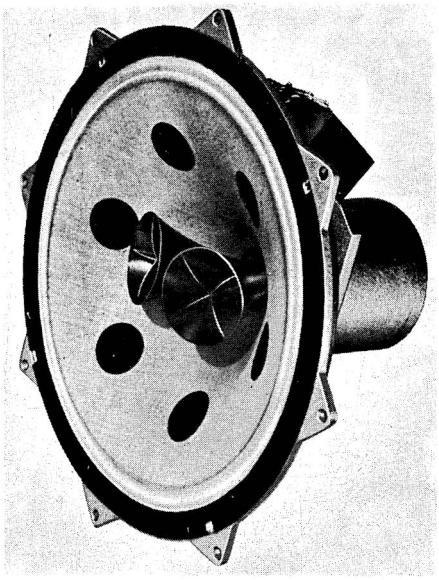
H.F.817. 8 in. Paper cone. Cambric surround. Voice coil 1 in. Gap flux 17,000 gauss. Total flux 67,000 maxwells. H.C. 10 watts in cabinet. v.c.i. 15 ohms. F.R. 60-22,000 c/s. Price £8 10s. 2d. (U.K. purchase tax (£1 8s. 7d.).



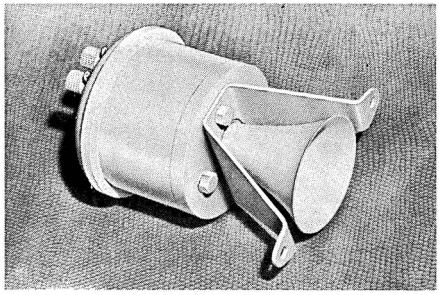
Whiteley H.F. 1514



Whiteley 10 *in. Concentric Duplex*



Whiteley 15 *in. Concentric Duplex*



*Whiteley T*10 *H.F. Unit*

H.F. 912. 9 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. H.C. 7 watts. v.c.i. universal (3, 7.5 and 15 ohms). F.R. 40-13,000 c/s. Price £3 6s. (U.K. purchase tax 11s.).

H.F.1012. 10 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. H.C. 10 watts. v.c.i. universal 3 ohms, 7.5 ohms and 15 ohms. F.R. 30-14,000 c/s. Price £3 14s. 10d. (U.K. purchase tax 12s. 8d.).

H.F. 1016. 10 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. H.C. 10 watts. v.c.i. 3, 7.5 and 15 ohms. F.R. 30-15,000 c/s. Price £5 19s. 9d. (U.K. purchase tax £1 0s. 3d.).

H.F.1016 Major. 10 in. Paper cone. Cambric surround. Voice coil 1 in. (aluminium). v.c.i. 15 ohms. Gap flux 16,000 gauss. Total flux 64,000 maxwells. H.C. 10 watts. F.R. 60 c/s-16 Kc/s or 30 c/s-16 Kc/s (depending upon cabinet). Price £7 13s. 7d. (U.K. purchase tax £1 5s. 11d.).

10 in. Concentric Duplex. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux (L.F.) 12,000 (H.F.) 13,000 gauss. Total flux 47,400 maxwells. H.C. 10 watts. v.c.i. 15 ohms. F.R. 30-14,000 c/s. r.c.f. 3,000 c/s built-in. Price £10 2s. 1d. (U.K. purchase tax £1 13s. 11d.).

H.F.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. H.C. 15 watts. v.c.i. 15 ohms. F.R. 25-14,000 c/s. Price £10 5s. 6d.

H.F.1216. Composite (paper and cambric) cone. Cambric surround. Voice coil 1½ in. Gap flux 16,000 gauss. H.C. 15 watts. F.R. 20-16,000 c/s. Price £15 15s.

15 in. Concentric Duplex. Composite (paper and cambric) cone. Cambric surround. Voice coil 2 in. Gap flux (L.F.) 14,000 (H.F.) 17,000 gauss. Total flux 350,000 maxwells.

H.C. 25 watts, v.c.i. 15 ohms. F.R. 20-18,000 c/s. r.c.f. 3,000 c/s built-in. Price £45.

H.F.1514. 15 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 2 in. Gap flux 14,000 gauss. Total flux 178,000 maxwells. H.C. 25 watts. v.c.i. 15 ohms. F.R. 25-5,000 c/s. r.c.f. 1,500-3,000 c/s. Price £26.

T.10 Tweeter. Aluminium cone and surround. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 44,000 maxwells. H.C. 5 watts. v.c.i. 15 ohms. F.R. 2,000-14,000 c/s. r.c.f. 3,000 c/s. Price £4 8s. 3d.

T.12 Tweeter. Aluminium cone and surround. Voice coil 1.5 in. Gap flux 17,000 gauss. Total flux 110,000 maxwells. H.C. 12 watts. v.c.i. 15 ohms. F.R. 2,000-17,000 c/s. r.c.f. 3,000 c/s Price £13 4s. 6d.

T.816. 8 in. Paper cone and surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. H.C. 15 watts. v.c.i. 15 ohms. F.R. 1,500 to 17,000 c/s. r.c.f. 1,500 c/s. Price £4 17s. 2d. (U.K. purchase tax 16s. 4d.).

T.359. 3½ in. Paper cone and surround. Voice coil 0.625 in. Gap flux 9,000 gauss. Total flux 14,900 maxwells. H.C. 15 watts with crossover. v.c.i. 5 or 15 ohms. F.R. 3,000-17,000 c/s. r.c.f. 3,000 c/s. Price £1 6s. 1d. (U.K. purchase tax 4s. 5d.).

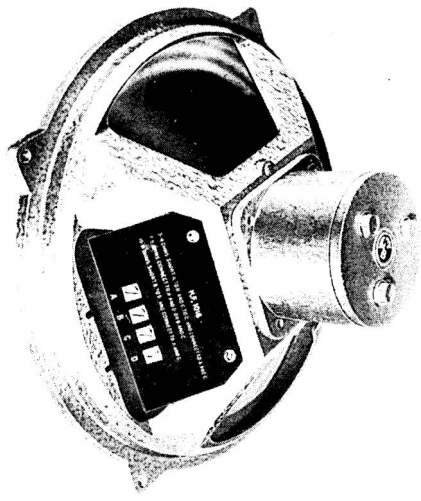
★

L. G. WOOLLETT & Co. Ltd., 21 Anerley Station Road, London, S.E.20. Tel.: Sydenham 9003.

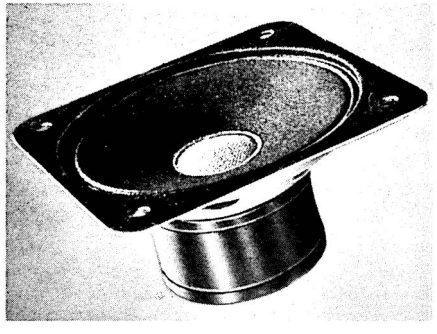
Dynamic Bass drive unit. Response 25-3,000 c/s. Price £33 12s.

Electrostatic Upper Register Speaker. Filter, mains polarising and matching included. H.C. 15 watts. F.R. from 1,500 c/s upwards. Built-in crossover integrated. Price £15 15s.

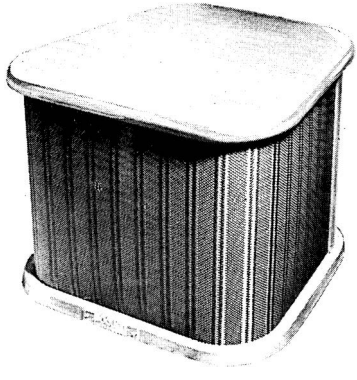
Details of any products announced after this section went to press are given in a special supplement at the end of the book.



Whiteley H.F. 1016



Whiteley T 359 *H.F. Unit*

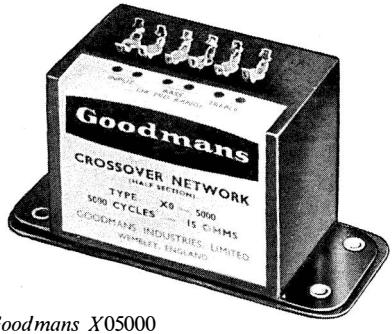


Woollett Electrostatic H.F. Unit

DIRECTORY OF SPEAKER ACCESSORIES

RICHARD ALLAN Radio Ltd., "Bafflette House", Taylor Street, Batley. Tel.: Batley 1123/1308/4033. Cables: Acoustics, Batley.

CN.104 Crossover Unit. A two-way half-section parallel network. Crossover frequency 5,000 c/s. All terminations 15 ohms. Price £2 2s.



*Goodmans X*05000

CN.1284 Crossover Unit. A three-way crossover with main crossover operating from half wave parallel network and subsidiary crossover capacity fed. Crossover frequencies 1,100 and 5,000 c/s. All terminations 15 ohms. Price £6 5s.

★

GOODMANS INDUSTRIES Ltd., Axiom Works, Wembley, Middx. Tel.: Wembley 1200. Cables: Goodaxiom, Wembley.

XO/5000-Crossover Unit. A two-way half-section crossover network, operating at 5,000 c/s. All terminations 15 ohms. Price £1 19s.

X0/950-Crossover Unit. A two-way half-section, crossover network, operating at 950 c/s. All terminations 15 ohms. Price £5 5s. 8d.

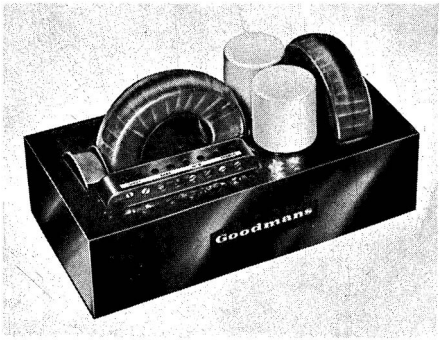
X0/950/5000. Crossover Network. A multiple crossover network comprising four half-section L.C. filters. Crossover frequencies are 950 c/s and 5,000 c/s. All attenuation rates are 12 dB/octave. All terminations 15 ohms. Price £7 0s. 6d.

ARU Units. These units combine 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 19s. 6d. to £4 4s.

★

ROMAGNA REPRODUCERS Ltd. Factory distributors: Stanley Kelly, Romagna, Bycullah Avenue, Enfield, Middlesex.

CO/1/15. Crossover Network. 3 Kc/s crossover frequency for 15 ohm loudspeakers and amplifiers. Balance control fitted, $\frac{1}{2}$ section networks giving 12 dB/octave cut-off. Maximum insertion loss 1 dB in pass band. Potted in cast aluminium case. Price £3 3s.



Goodmans 950/5000

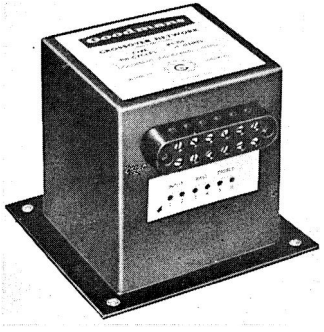
TECHNICAL SUPPLIERS Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel.: Shepherds Bush 2581. Cables: Teknika, London, W.12.

HLP2 Crossover Unit. Frequency of crossover 3,000 c/s. $\frac{1}{4}$ section. Rate of attenuation 6 dB per octave. LS matching, 15 ohm. Price £2 7s. 6d.

WHARFEDALE Wireless Works Ltd., Idle, Bradford, Yorks. Tel.: Idle 1235-6. Cables: Wharfdel, Idle, Bradford.

Loudspeaker Separators. $\frac{1}{4}$ section type. Operating at 1,000 or 3,000 c/s. 8 units available to cover from 2-16 ohms impedance. Slope 6 dB/octave. Size $7 \times 4 \times 3\frac{3}{4}$ 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/s. Max. input 30 watts. Slope 12 dB/octave. Size $9 \times 6 \times 5$ in. Weight $6\frac{1}{2}$ lb. 2 models. Price, 2-6 ohms, £11; 7-16 ohms, £8 10s. Also available with crossover at 400 and 5,000 c/s. 7-16 ohms only. Price £10.



Goodmans XO/950

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/s ±1 dB. Handling capacity 15 watts. Can also match speakers of different imps. to crossover unit in 2 or 3 speaker systems. Size $2\frac{7}{8} \times 2\frac{3}{4} \times 2\frac{3}{4}$ in. Weight $12\frac{1}{2}$ ozs. Price 13s. 6d.

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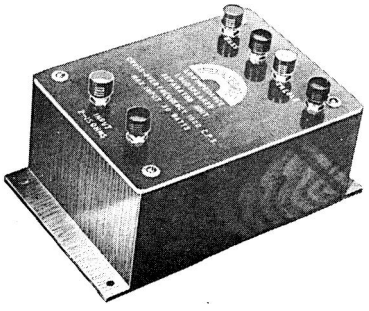
WHITELEY Electrical Radio Co. Ltd., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762-5. Cables: Whitebon, Mansfield.

CX500 Crossover Unit. A two-way half-section crossover network operating at 500 c/s. All terminations 15 ohms. Price £1 6s.



Wharfedale Separator Unit

CX1500. Crossover Unit. As CX500, but operating at 1,500 c/s. Price £1 18s. 3d.

CX3000 Crossover Unit. As CX1500, but operating at 3,000 c/s. Price £1 10s.

★

L. G. WOOLLETT & Co. Ltd., 21 Anerley Station Road, London, S.E.20. Tel.: Sydenham 9003.

XS2 Transformer permitting the use of one bass speaker with two electrostatic upper register speakers in a stereo system. Converts a 3 ohm speaker to 15 ohms or a 3 ohm amplifier to 15 ohms. Enables sensitivity of speaker to be reduced by 6 or 12 dB whilst maintaining a 15 ohm load on amplifier and heavy damping of speaker. F.R. 16-20,000 c/s ±0.3 dB. H.C. 15 watts. Size $3\frac{1}{2} \times 3\frac{1}{4} \times 2\frac{1}{2}$ in. Weight 2 lb. 9 oz. Price £2 18s. 6d.

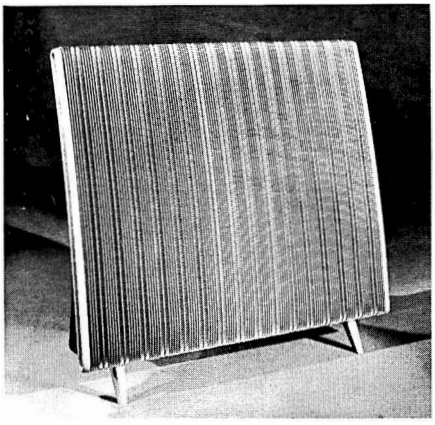
TSL HLP2 $\frac{1}{4}$ section

Details of any products announced after this section went to press are given in a special supplement at the end of the book.

PART 2—SPEAKER ENCLOSURES

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. Attentuation outside band asymptotic to 18 dB/8ve. Total integrated radiation at max. output equivalent to 95 phons in rooms



Quad Electrostatic

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 A.C. supplies 100-120 or 200-250 V. 50-60 c/s. Free standing unit requires no enclosure or cabinet. Weight 35 lb. Price £52 complete.

★

ACOUSTIC Research Inc., 24 Thorndike Street, Cambridge 41, Mass., U.S.A. Sole U.K. Importers: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444.

AR-3. Totally enclosed speaker system. F.R. 20 c/s-20 Kc/s. Input required 25 W. Incorporates 12 in. bass unit, 2 in. mid-range dome radiator, $1\frac{3}{8}$ in. high frequency dome radiator. Size 14 × 25 × $11\frac{3}{8}$ ins. Finished in oiled walnut or teak. Price £99.

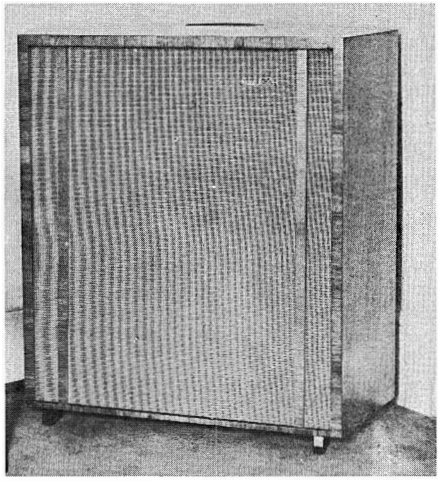
RICHARD ALLAN Radio . Ltd., Bafflette House, Taylor Street, Batley, Yorks. Tel.: Batley 1123/1308/4033. Cables: Acoustics, Batley.

Type 840. Reflex forward facing unit. Designed for shelf or floor mounting. Two drive units. 8 in. bass and 4 in. tweeter. Rec. Golden Eight and 410T. F.R. 45-17,000 c/s. Size 24 × 10 × 12 in. Weight 26 lb. Price £9.

Princess. Reflex forward facing unit. Designed for corner location. One 8 in. drive unit. Rec. Golden Eight. Response 60-10,000 c/s. Size 28 × 20 × 12 in. Weight 28 lb. Price £11 11s.

Duchess. Reflex unit designed for corner location. Upward facing tweeter, forward bass. Two drive units. 10 in. bass and 4 in. tweeter. Rec. Golden Ten and 410T. Crossover CN.104. Response 40-17,000 c/s. Size 30 × 25 × 17 in. Weight 48 lb. Price £15 15s.

Empress. Reflex unit designed for corner location. Upward facing tweeter, forward bass and middle units. Three drive units. 12, 8 and 4 in. Rec. Golden Twelve, 812F, and 410T. Crossover CN.1284. Response 25-17,000 c/s. Size 33 × 31 × 21 in. Weight 72 lb. Price (complete); £37 16s. (without units) £17 17s.



Richard Allan Empress

AUDIO SERVICES (Hi-Fi) Ltd., 82 East Barnet Road, New Barnet, Herts. Tel.: Barnet 6605.

Dyna-static. Infinite baffle. Forward facing. Two units: 13 × 8 in. bass unit; push-pull constant-charge electrostatic treble unit. Crossover 1,200 c/s. F.R. 30 c/s-20 Kc/s. Weight 60 lbs. Price £45.

Dyna-sonic. Infinite baffle. Forward facing. Three units: 10 in. bass unit; two 2½ in. tweeters. Crossover 2,000 c/s. F.R. 45 c/s-18 Kc/s. Price £25.

Dynastatic Studio. Infinite baffle. Forward facing. Three units: two 13 × 8 in. bass units; 2½ in. tweeter. Crossover 1,200 c/s. F.R. 30 c/s-20 Kc/s. Size 37½ × 21½ × 15 ins. Price on application.

★

BURNE-JONES & Co., Ltd., 18 Brunswick Road, Sutton, Surrey.

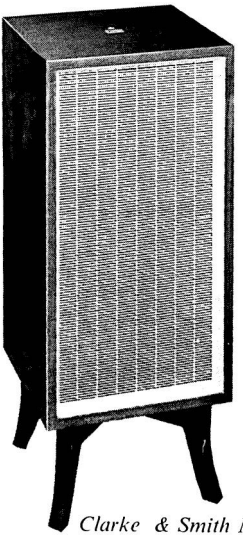
B.J. Treble 20. Omni-directional multi-horn. One 4 in. unit. Crossover built-in. Response 1,000-18,000 c/s. Size 6 × 5 in. Weight 1½ lb. Price £3 15s. plus tax.

B.J. Treble Twin. Omni-directional horn. Two 4 in. drive units. Crossover included. Response 900-18,000 c/s. Size 9 × 4¾ × 6 in. Weight 2 lb. Price £7 2s. 9d. plus tax.

★

CLARKE & SMITH Manufacturing Co., Ltd., High Fidelity Components Division, Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic, Wallington.

Model 519. Infinite baffle. Forward facing. One 13 × 8 in. drive unit, two 3 in. tweeters. DLSU/13/4 13 × 8 in. and DLSU/3/16 3 in. (both E.M.I.) recommended. Crossover XO 4500/4 (E.M.I.). Response 70 c/s-15 Kc/s ±3 dB. Size, with legs, 31 × 13 × 12¾ in. Weight approx. 40 lbs. Price £25 4s. each. Units used in the system are available separately. Price, per set £15 4s. 2s. (U.K. purchase tax 9s.).



Clarke & Smith Model 519

DAYSTROM LTD., Bristol Road, Gloucester.

Cotswold totally enclosed forward facing. (See Kits section.)

★

DECCA Radio & Television, Ingate Place, Queenstown Road, S.W.8. Tel.: Macaulay 6677.

Stereo Decola "Separates". Bass reflex, treble stacked and angled arrays. One bass 12 × 8 in. elliptical, six treble 2½ in. dia. circular units. Crossover 400 c/s. F.R. 30 c/s-20 Kc/s. Size 30½ × 20½ × 20½ in. Price (complete) £53 11s.

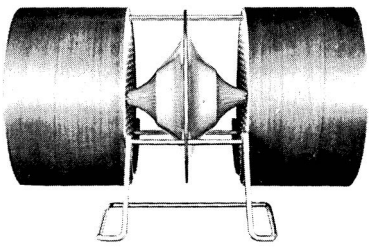
★

DESIGN FURNITURE Ltd., Carnwath Road, Fulham, London, S.W.6. Tel.: Renown 2217/8/9.

GD8. Approved by Goodman Industries Ltd. for Axiette 8. 8 in. loudspeaker. Size 31½ × 17½ × 8½ ins. Can be used vertically or horizontally. Walnut, sapele mahogany or teak finish. Price £11 10s.

GD10. Approved by Goodman Industries Ltd. for Axiom 10. Size 29 × 18 × 11½ ins. Can be used vertically or horizontally. Walnut, sapele mahogany, teak or rosewood finish. Price £12 5s.

GD12. Approved by Goodman Industries Ltd. for Axiom 201, Axiom 301, Triaxiom 1215 and 1220, Audiom 51 Bass and Audiom 61 Bass. Size 22½ × 35¼ × 14⅛ ins. Walnut, sapele mahogany, teak or rosewood finish. Price £14. (Acoustic Resistance Unit £3 5s. 6d. extra).



B. J. Treble Twin

ELECTRONIC & TELEVISION Industries Ltd., 7 Arkwright Road, Poyle Trading Estate, Colnbrook, Bucks. Tel.: Colnbrook 2764.

Lansing Rolls. Horn type. 12 in. bass, 2-2½ in. mid-range, 2-2½ in. H.F. Direct radiation front and rear. F.R. 20 c/s-20 Kc/s. Crossover 2,200 and 7,000 c/s. 15 ohms. Size 31 × 19½ × 16 in. Finish, sapele. Price £67 10s.

★

E.M.I. SOUND PRODUCTS Ltd., Blyth Road, Hayes, Middlesex. Tel.: Hayes 3888. Cables: Emisound.

Model No. EL100. Infinite baffle. Forward facing complete with legs, angled sides for corner siting. Two units, 2½ in. high frequency + 13½ × 8⅛ in. bass. Crossover 6,000 c/s. F.R. 77 c/s-15 Kc/s. Size 24 × 12 × 11½ in. Weight approx. 15 lb. Removable legs 6 in. long. Price £17 17s.

Model No. EL200. Infinite baffle. Forward facing, floor mounted. Three units, two 3⅜ in. H.F., one 13½ × 8⅛ in. bass. Crossover 4,500 c/s. F.R. 58 c/s-20 Kc/s. Size 27 × 12 × 14½ in. Weight approx. 22 lb. Price £26 5s.

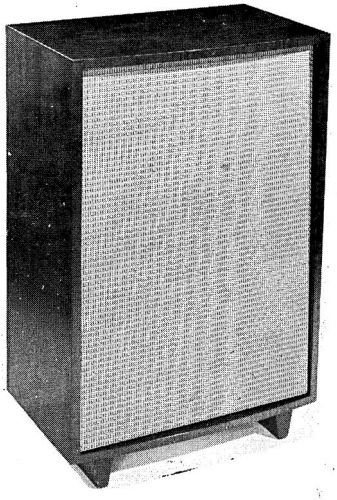
Model No. EL300. Infinite baffle. Forward facing, floor mounted. Castors supplied. Three units, two 3⅜ in. H.F., one 13½ × 8⅛ in. bass. Crossover 4,500 c/s. F.R. 38 c/s-20 Kc/s. Size 29 × 18 × 11½ in. Weight approx. 26 lb. Price £31 10s.

★

EXPERT GRAMOPHONES Ltd., Audio Works, 197 Laleham Road, Staines, Middx. Tel.: Staines 53761.

Acoustic column. Two units, 12 in. bass, separate tweeter. F.R. 35 c/s-18 Kc/s. Size 44 × 13¾ × 13¾ in. Price (complete) £33; (without units) £12.

Everest. Forward facing. Three units, 16 × 12 in. bass unit, 6 × 4 in. elliptical mid-range unit, spherical dome H.F. radiator.



Design Furniture GD 12

Expert Acoustic Column

F.R. 20 c/s-20 Kc/s. Size 32 × 11½ × 18½ in. Price (complete) £44 2s.; (without units) £12.

Olympus. Forward facing. Two units, 12 in. shallow cone, spherical dome H.F. radiator. F.R. 35 c/s-20 Kc/s. Size 32 × 11½ × 18½ in. Price (without units) £12. (complete) £29 8s.

★

FANE ACOUSTICS Ltd., Hick Lane, Batley, Yorks. Tel.: Batley 1578. Cables: Fane, Batley.

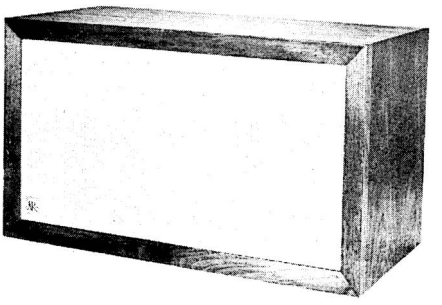
Trio. Cabinet-baffle, forward facing. Three drive units. 12 in., 8 in., and H.F. unit. Fane units rec. Crossover included. Response 40-17,000 c/s. Size 24½ × 24 × 8½ in. Weight 13lb. Price £17 10s.

Quartet. Cabinet-baffle, forward facing. Four drive units. 12 in., 8 in., and two H.F. units. Size 25½ × 25½ × 8¾ in. Weight 32 lb. Price £35. Cabinet only not supplied.

★

GOODMANS INDUSTRIES Ltd., Axiom Works, Wembley, Middlesex, England. Tel.: Wembley 1200. Cables: Goodaxiom, Wembley.

AL120. Bookcase Loudspeaker, forward facing. Baffle ARU loaded. One 12 in. Triaxial Loudspeaker. Crossover at 5,000 c/s built-in. Size 24 × 11½ × 14¼ in. Price £29 10s. complete.



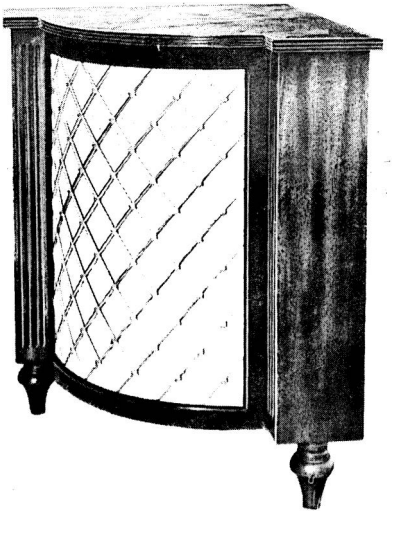
Acoustic Research AR-3

Eleganzia. Acoustically sealed enclosure, exceptionally slim. Forward facing. Two units, 12 in. bass unit especially designed for this enclosure, employing Goodmans Superfoam diaphragm, and one back-loaded midrange and H.F. unit. Two crossover units 900 c/s. F.R. 35 c/s-15 Kc/s. H.C. 15 watts. Impedance 15/16 ohms. Size 27 × 20 × 6¼ in. Weight 42 lb. Price £25 4s.

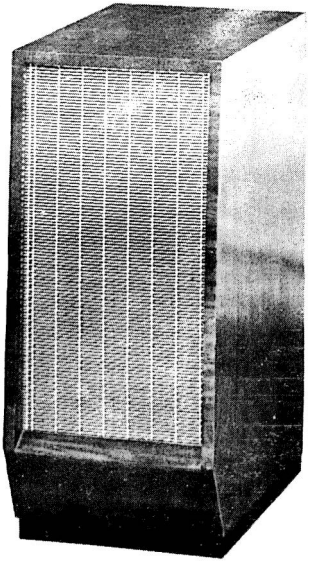
★

GRAMPIAN REPRODUCERS Ltd., Hanworth Trading Estate, Feltham, Middlesex. England. Tel.: Feltham 2657. Cables: Reamp, Feltham.

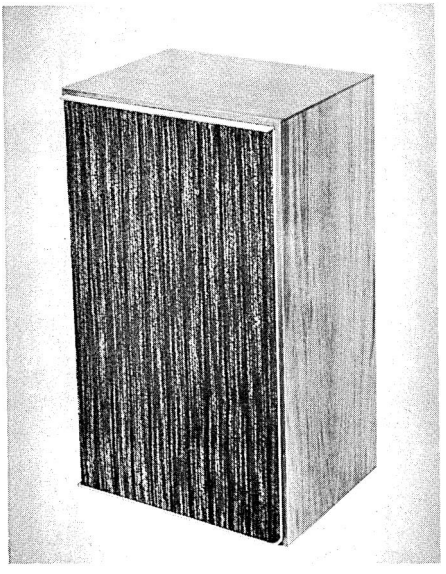
Grampian WS9. Totally enclosed, forward facing. Fitted with 9 in. drive unit.



Decca Decola Separates



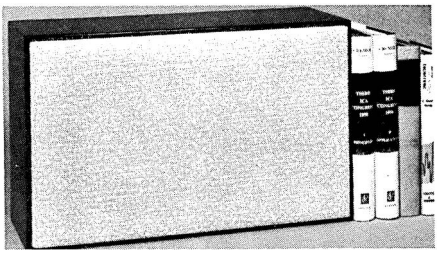
E.M.I. Model EL 200



Leak Sandwich

Handling capacity 7 watts. Size 23 × 12 × 12 in. Shaped for corner or wall position. Price £11 2s. 6d. (U.K. purchase tax £1 17s. 6d.), legs extra £1 2s. 6d.

Grampian CE12. Forward facing reflex, shaped for corner or wall position. One 12 in. unit. Grampian rec. 1255/15. Size 29 × 18 × 12¼ in. Price (complete) £23 10s.



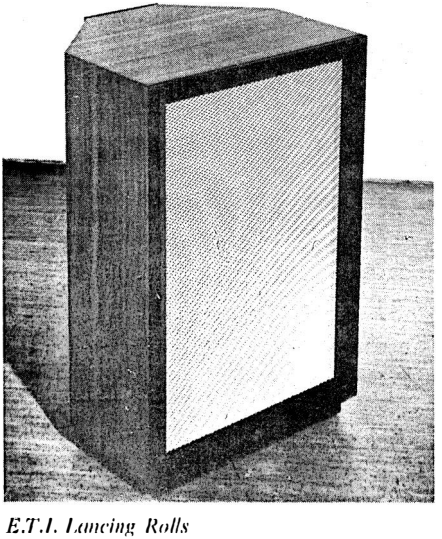
KEF Celeste

KEF ELECTRONICS Ltd., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: Kef, Maidstone.

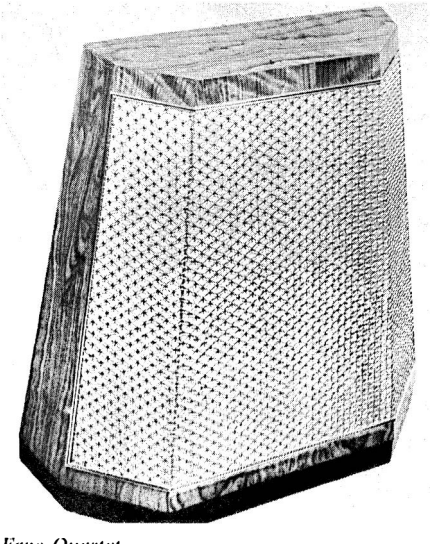
K1 Slimline. Pure acoustical resistance load. Forward facing. Three drive units, 16 × 12, 6 × 4, 1½ dia. in. Crossover 375 c/s and 3,000 c/s. Size 27 × 17 × 6¾ in. Weight 40 lb. Price £39.

K1 Monitor. Pure acoustical resistance load. Forward facing. Three drive units, 16 × 12, 6 × 4, 1½ dia. in. Crossover 375 c/s and 3,000 c/s. Response 20-20,000 c/s. Size 39½ × 17 × 14 in. Weight 70 lb. Price £52.

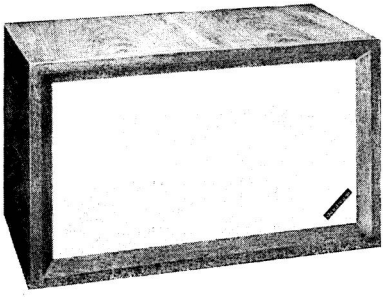
Celeste. Totally enclosed. Forward facing. Two drive units 13 × 9 in. and 1½ in. dia. Crossover 1,000 c/s. Size 18 × 10¾ × 6¾ in. Weight 24 lb. Price £22.



E.T.I. Dancing Rolls



Fane Quartet



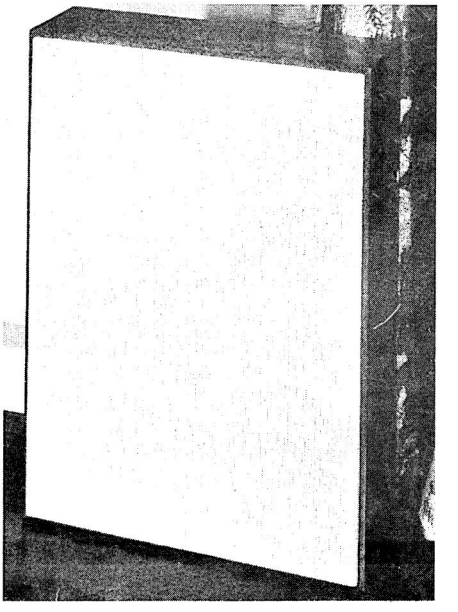
*Goodmans AL*120

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

Sandwich. Forward facing. Two units, bass 13 in., treble 3 in. Half section crossover filter. Cabinet can be placed in vertical or horizontal position. The unique sandwich construction diaphragm behaves as a rigid piston, thus eliminating break-up distortion and resulting in a remarkably smooth frequency response. Size 26 × 15 × 12 in. Weight 45 lb. Price £39 18s.

★

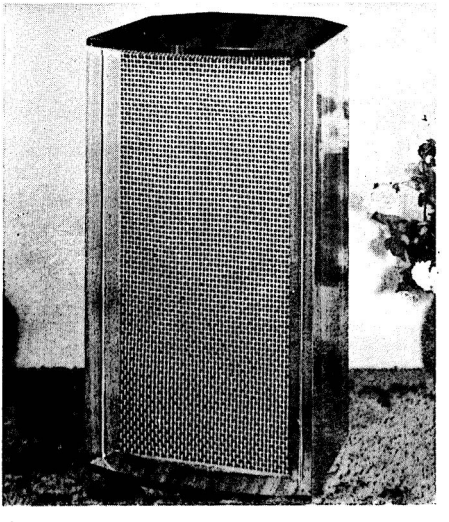
LOCKWOOD & Co. (Woodworkers) Ltd., 63 Lowlands Road, Harrow, Middx. Tel.: Byron 3704.



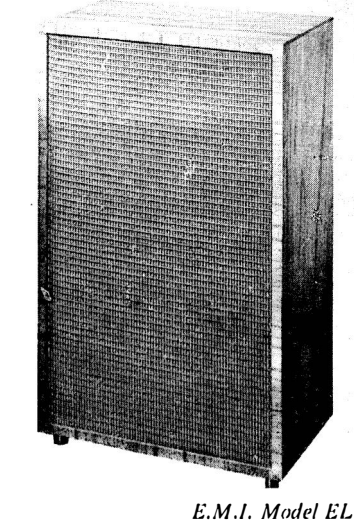
Goodmans Eleganzia

Mini-slim. Reflex, forward facing. 12 in. units. Rec. Tannoy 12 in. dual concentric, Tannoy III LZ dual concentric, Rola GL 12 and HF 1300 tweeter. Size $27\frac{1}{2} \times 19\frac{1}{2} 9\frac{1}{8}$ in. Price (with specified units) £51 15s., £43 10s., £36 10s.

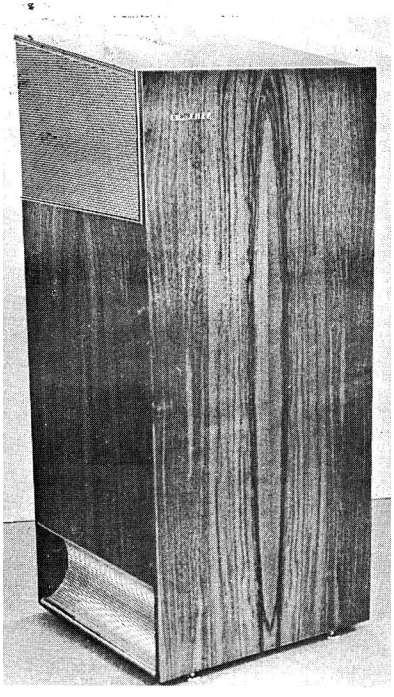
Minor Slim. Reflex, forward facing. 12 or 15 in. units. Rec. Tannoy 12 or 15 in. dual



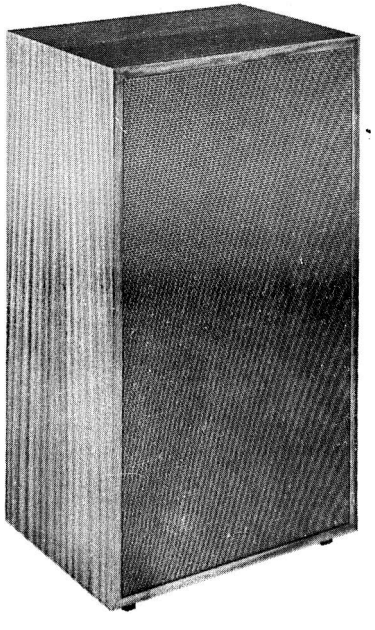
*Grampian WS*8



E.M.I. Model EL 300



Lowther Acousta Twin



Audio Services Dynastatic

concentric, and units listed for Mini-slim. Size 33⅛ × 20 × 11¼ in. Price (with specified units) £62 10s., £55 15s., £48 10s., £41 10s.

Major Slim. Reflex, forward facing. 12 or 15 in. units. Rec. Tannoy 12 in. and 15 in. dual concentric, Rola GL12 and HF1300 tweeter. Size 38 × 24 × 11¼ in. Price £68 10s., £61 15s., £46 10s.

These reproducers can also be supplied complete with units by Goodmans, K.E.F., Vitavox, Stentorian and Wharfedale. Prices on application.

★

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

Corner Reproducer TP1. Folded bass horn/direct h.f. horn type. One specially designed 6 in. pressure unit PM3. Acoustical crossover. Response 40-22,000 c/s. Size 47 × 32 × 31 in. from corner. Weight 70 lb. Price of standard Model A £98. Model B £106 approx.

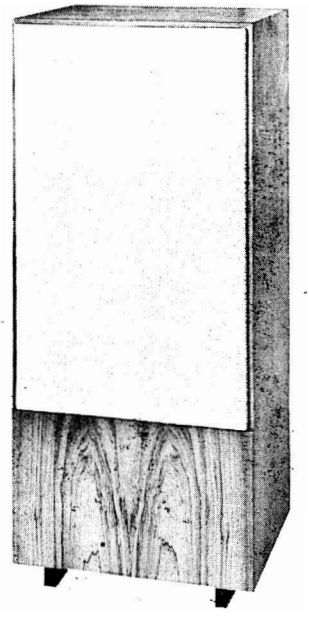
Acousta Cabinet. Models FH/V, FH/H. Folded horn type, forward facing, with rear folded horn. Vertical on runners, or horizontal on 12 in. legs. One unit, 6 in. or 8 in. Rec. Lowther PM6. Response 40-18,000 c/s. Size 32 × 18¼ × 14½ in. Weight 60 lb. Price without unit £19 19s.

This enclosure is also available in a "Do-it-yourself" kit form. Price £14 14s. ex works.

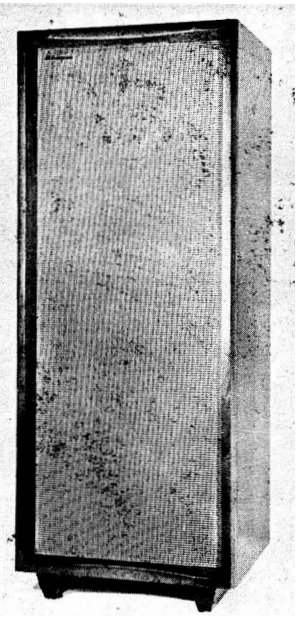
Audiovector. Compound horn. Upward facing mid- and high-frequency horn with rear folded horn. One 6 in. unit. Acoustic crossover. Range 40-22,000 c/s. Rec. PM2 PM2 Mk 11 or PM4. Size 26½ × 19 × 34 in. Weight 75 lb. Price with specified units £96, without units £48.

Acousta-twin. Dual folded horn. Side facing and rear folded horn system for monaural and stereo reproduction. Two PM6 or PM2 Mk 3 8 in. drive units. Acoustic crossover. Response 40-18,000 c/s. Dimensions 40 × 16½ × 18 in. Price £35 enclosure only. £72 16s. or £95 complete.

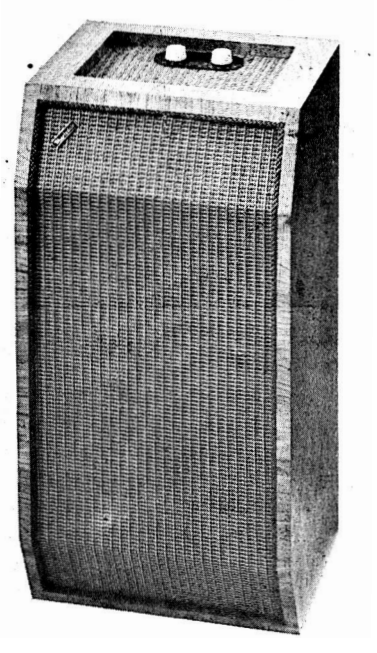
Corner Acousta. Folded horn. Rearward facing into corner. Bass outlets coupling into corner of room. One 8 in. high flux unit. Rec. Lowther PM6. F.R. 40 c/s-18 Kc/s. Size 32 × 9½ × 18 in. Price (without unit) £19 19s.



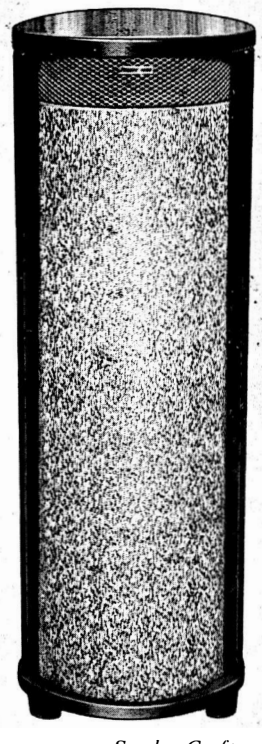
KEF Monitor



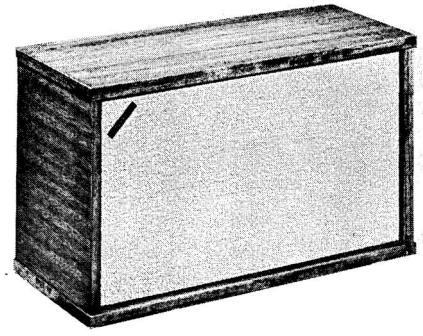
Mordaunt Arundel



Wharfedale W.2



Sugden Craftsman Major



Tannoy III LCZ

MORDAUNT Sound Reproducers, 32-34 Rupert Street, London, W.1. Tel.: Gerrard 1067.

Arundel. Totally enclosed. Forward facing. Two units, 12 in. bass, ribbon tweeter. Crossover 2,750 c/s. F.R. 30 c/s-25 Kc/s. H.C. 12/15 watts. Size 36 × 15 × 12 in. Weight 46 lb. Price £40 19s.

Warwick. Totally enclosed. Forward facing electrostatic/dynamic. Two units, 12 in. bass, push-pull electrostatic tweeter. Crossover 2 Kc/s. F.R. 50 c/s-20 Kc/s. H.C. 6/10 watts. Size 32 × 17 × 11 in. Weight 40 lb. Price £30 9s.

Conway. Totally enclosed. Forward facing. Two units, 12 in. bass, ribbon tweeter. Crossover 2,750 c/s. F.R. 30 c/s-25 Kc/s. H.C. 12/15 watts. Size 36 × 26½ × 12 in. Weight 50 lb. Price £50 8s.

Edinburgh. Totally enclosed. Forward facing. Four units, two 12 in. bass units, two ribbon tweeters. Crossover 2,750 c/s. F.R. 30 c/s-25 Kc/s. H.C. 25/30 watts. Size 36 × 26½ × 12 in. Weight 70 lb. Price £81 18s.

★

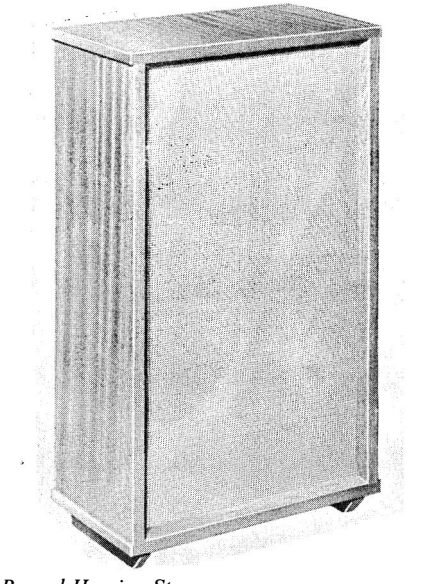
MUSICRAFT Audio Products Ltd., 13 King Street, Richmond, Surrey. Tel.: Richmond 6798.

F.E.H. 6 ft. folded horn. Forward facing. Two units: 8 in. drive unit, 3 in. H.F. unit. Rec. Goodmans Axiette 8 in., Wharfedale Super 3 in. Crossover 5,000 c/s. F.R. 30 c/s-17 Kc/s. Size 36 × 20 × 20 in. Price £40 19s.

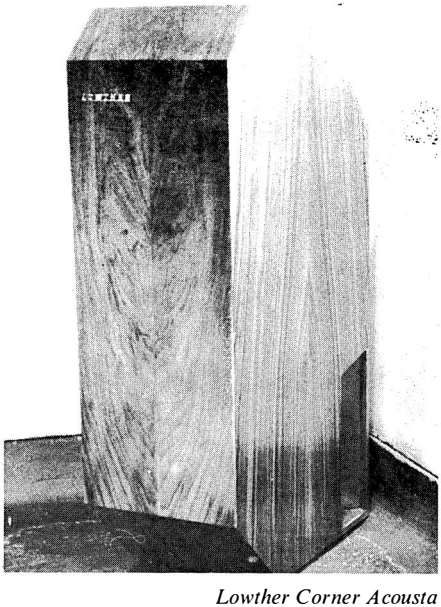
★

PAMPHONIC REPRODUCERS Ltd., Westmoreland Road, London, N.W.9. Tel.: Colindale 7131.

Pillar Type 778. Tuned column. Forward facing H.F. unit and upward facing L.F. unit, 6½ in. (L.F.), 4 in. (H.F.). Crossover 1,000 c/s single section. Response



Record Housing Strauss



Lowther Corner Acousta

35 c/s to 12 Kc/s. Size 37½ × 12 × 12 in. Price £14 12s. 3d. (U.K. purchase tax £2 8s. 8d.).

S.1. Cabinet type, forward facing. Elliptical 10 × 6 in. concentric cone unit. Size 15 × 12 × 11 in. Price £9 (U.K. purchase tax £1 10s.).

★

PYE LIMITED, High Fidelity Division, P.O. Box 49, Cambridge. Tel.: Cambridge 58985. Cable: Pyrad, Cambridge.

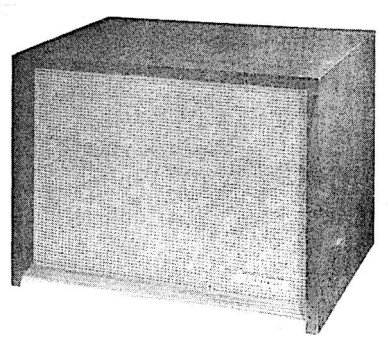
Mozart Minor HF9BS. Distributed vent reflex. Two drive units, 12 in. bass and 10 × 6 in. elliptical. Air coupled in pat. arrangement. Crossover included. Response 50-15,000 c/s. Size 28 × 13 × 10¾ in. Price £20 9s. 6d.

★

RADFORD ELECTRONICS Ltd., Ashton Vale Estate, Bristol 3. Tel.: Bristol 662301/2.

Bookshelf. Sealed enclosure, forward facing. Two units, 13 in. elliptical flat piston polystyrene and pressure tweeter. Crossover 3 Kc/s. F.R. 80 c/s-13 Kc/s ±5 dB. Size 19 × 11 × 7¼ in. Price £24.

Lounge. Controlled release, forward facing. Three units, two 13 in. flat piston



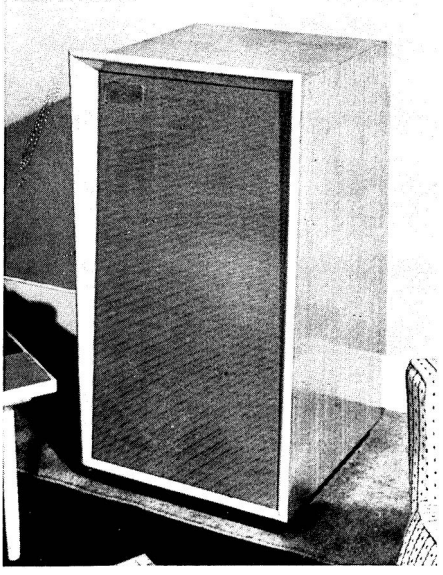
Pamphonic S1

polystyrene units and one pressure unit. Crossover 3 Kc/s. F.R. 60 c/s-15 Kc/s ±6 dB. Size 30 × 24 × 7½ in. Price £42 10s.

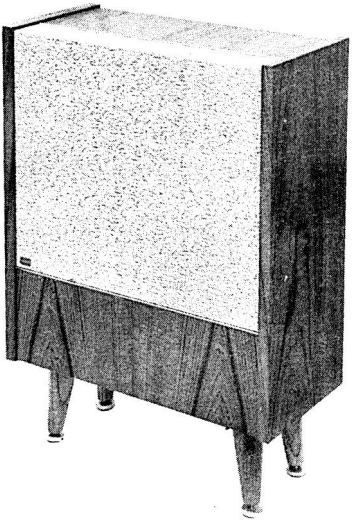
Studio. Controlled release, forward facing. Six units, four 13 in. flat piston polystyrene units and two pressure units. Crossover 3 Kc/s. F.R. 40 c/s-15 Kc/s ±6 dB. Size 36 × 30 × 7½ in. Price £75.

★

RADON Industrial Electronics Company Ltd., Radon Works, Brookland Trading Estate, Orme Road, Worthing, Sussex. Tel.: Worthing 1063. Cables: Radon, Worthing.



Musicraft FEH



Lockwood Mini-Slim

Companion 6. Vented. Acoustically damped. Forward facing. One 8 in. or 10 × 6 in. elliptical unit. Rec. 8 in. Goodmans Axiette or Wharfedale 8/145. Will also take Goodmans Elliptical speaker. F.R. 40 c/s-15 Kc/s. Cabinet finished in satin mahogany, hand French polished, baffle and front gently angled, hand-made. Size 30 × 11 × 10 in. tapering to 8¼ in. at top. Price (with Goodmans Axiette) £17 (U.K. purchase tax £1 12s. 1d.). Price (without unit) £12 18s.

★

RECORD HOUSING, Brook Road, London, N.22. Tel.: Bowes Park 7487.

Nordyk. Reflex forward facing. One drive unit. Rec. 8-in. Goodmans and Wharfedale. Response 40-15,000 c/s. Price, cabinet only, £6 15s.

Viking. Reflex forward facing. Two drive units. 8 or 10-in. plus tweeter. Response 40-15,000 c/s. Size 32 × 19 × 12 in. Price, cabinet only, £10 10s.

Strauss. Reflex forward facing. Two drive units. 10 in. plus any tweeter. Rec. Goodmans Axiom 10. Response 40-15,000 c/s. Size 32 × 18 × 11 in. Price £10 19s.

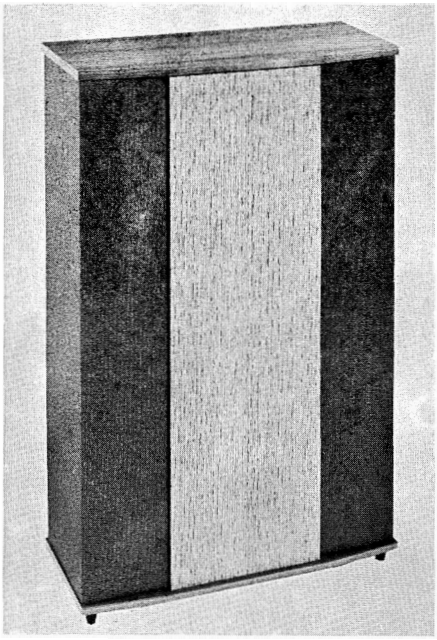
Quarterwave. Folded horn. Forward facing. Two units: 12 in. bass unit; Kelly ribbon speaker. Crossover included. F.R. 30 c/s-16 Kc/s. Size 32 × 18 × 11 in. Price approximately £37 16s.

★

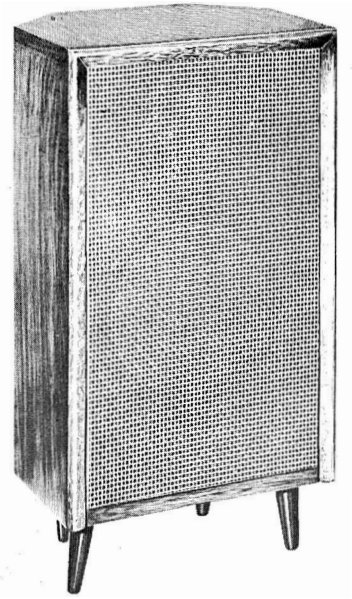
ROGERS DEVELOPMENT (Electrical) Ltd., 4-14 Barmeston Road, Catford, London, S.E.6. Tel.: Hither Green 7424/4340. Cables: Rodevco, London, S.E.6.

Mk. II Horn Enclosure. Folded exponential horn housing either the Lowther PM6 or PM2 Mk. III Pressure Units. Rear horn loading. Treble diffusor. Power handling capacity: 8 watts (PM6), 10 watts (PM2 Mk. III). Impedance: 15 ohms. Size 30½ × 12¾ × 29¾ in. Finish: Figured teak. Price (PM6) £45.; (PM2 Mk. 111) £56.

Cadet Mk. II Horn Speaker. Folded horn gives rear loading on 8 × 5 in. main unit. Middle frequencies from front of elliptical unit and highs from 3 in. unit. Crossover at 4 Kc/s. Response, 50 c/s-15 Kc/s. Impedance 15 ohms. Size 33½ × 20½ × 8¾ in. Price £22 10s.



Rogers Cadet Mk. II



Rola Celestion Colaudio II

ROLA CELESTION Ltd., Ferry Works, Thames Ditton, Surrey. Tel.: Emberbrook 3402. Cables: Voicecoil, Thames Ditton.

Colaudio II. Full range speaker system incorporating a bass and treble unit in one enclosure. Bass unit, 12 in. cone. Expanded plastic cone with treated fabric surround. Voice coil 1.75 in. Gap flux 11,500 gauss. Total flux 123,000 maxwells. H.C. 15 watts peak. v.c.i. 15 ohms. Treble unit, pressurised tweeter. Range 30-15,000 c/s. Enclosed crossover. Price £36 10s.

★

ROMAGNA REPRODUCERS Ltd. Distributor: S. Kelly, Romagna, Bycullah Avenue, Enfield, Middlesex.

Mk. I Reproducer. Reflex forward facing. Flat for mid-wall mounting. Two drive units, Kelly Mk. I bass unit and Mk. II ribbon. Crossover included. Response 35-20,000 c/s. Size 30 × 25 × 12 in. Weight 55 lb. Price complete £42.

Parva Enclosure. Imp. 15 ohms. H.C. 15 watts. F.R. 50 c/s-18 Kc/s ±2 dB. 35 c/s-20 Kc/s ±4 dB. Sapele mahogany or Walnut. Fabric: Tygan. Size 30 × 25 × 12 in. Weight 60 lb. Price £42.

THE SOUNDCRAFT Co., 1 Stanley Road, Bromley, Kent. Tel.: Ravensbourne 5673.

Stanley. Forward facing folded horn. One 8-in. drive unit. Size 31½ × 12 × 13¾ in. Price, cabinet only, £13 13s.

Langdon. Forward facing folded horn. One 8-in. drive unit. Size 33 × 15 × 16 in. Price, cabinet only, £17 17s.

FH12. Forward facing folded horn. Two drive units, 8 in., 10 or 12 in. and tweeter. Size 32½ × 14 in. Depth according to speaker fitted. Price, approx. £15 15s.

★

STENTORIAN. See Whiteley Electrical.

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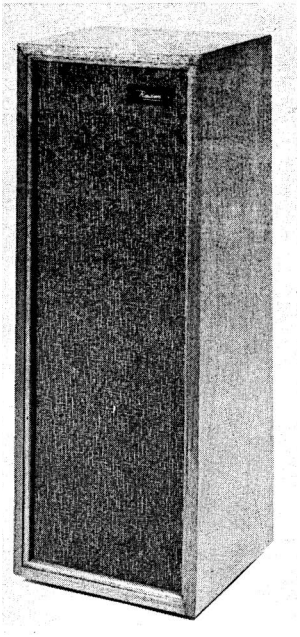
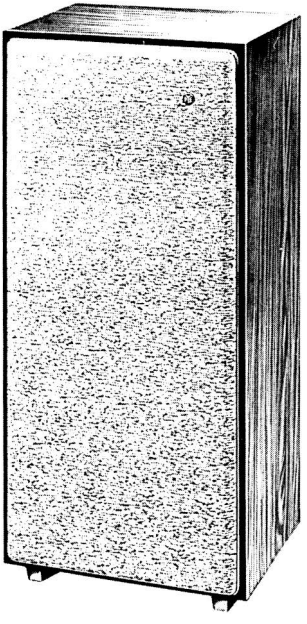
A. R. SUGDEN & Co. (Engineers) Ltd., Market Street, Brighouse, Yorks. Tel.: Brighouse 2142. Cables: Connoisseur, Brighouse.

Connoisseur Craftsman Minor. Column reflex with upward facing ports. Omnidirectional 360°. 15 ohms impedance at 400 c/s.



Radon Companian 6



Pye Mozart Minor HF9BS

One unit, 8 in. foam surround with H.F. dome. 812/FS recommended. Response 40-12,000 c/s. Size 36 × 11½ in. max. dia. Weight 17 lb. Price, enclosure, £9 18s. 9d.; 8 in. unit for above 812/FS £2 1s. 3d. (U.K. purchase tax 7s. 4d.).

Connoisseur Craftsman Major. Column reflex with upward facing ports. Omni-directional 360°. 15 ohms impedance at 400 c/s. One 8 in. foam surround unit, one 3 in. tweeter. G8/FS and LPH/65 recommended. Capacitor filter. Response 30-17,000 c/s. Size 43 × 14½ in. max. dia. Price, enclosure only, £14 15s.; G8/FS £2 15s. (U.K. purchase tax 9s. 9d.); LPH/65 £1 8s. 6d. (U.K. purchase tax 5s. 1d.).

★

SYMPHONY AMPLIFIERS Ltd., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314/5.

Symphony Bass Reflex Cabinets. A range of forward facing systems to take 8, 10 or 12 in. units. Price, ready built, £5 10s. to £12 10s. Also available in Kit form.

Symphony Infinite Baffle. Forward facing. One 8 in. unit. Rec. Wharfedale Super 8RS/DD. F.R. 35 c/s-30 Kc/s. Size 24 × 12 × 12 in. Weight 12 lb. Price, in white wood, £5 10s. Veneered wood £3 extra.

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

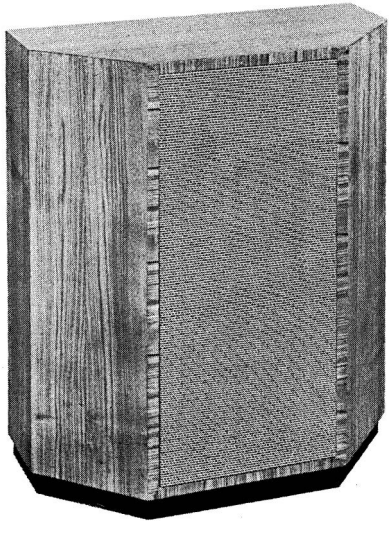
Chatsworth II. Aperiodic enclosure for corner placing. One Monitor 12 drive unit. Size 36½ × 20 ½ 12¾ in. 4 in. legs. Price £49 15s.

Canterbury. Reflex, with forward facing unit, dual throated ports, for corner placing. One 12 in. dual concentric unit, or direct radiator. Size 37 × 25 × 17 in. Price, with dual concentric, £57 15s.; with direct radiator, £43 15s.

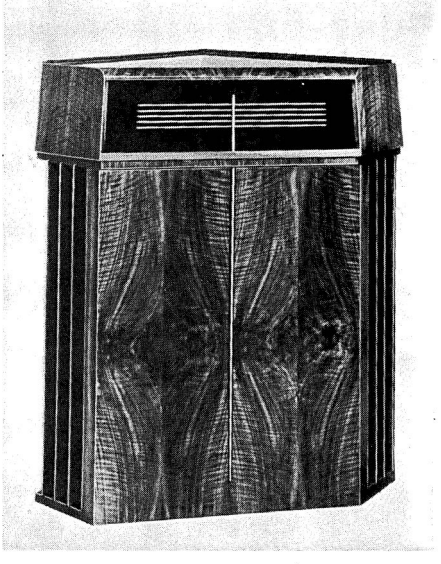
York. Reflex. Forward facing unit, dual throated ports, for corner placing. 12 in. or 15 in. dual concentric unit. Response 35-20,000 c/s. Size 45½ × 32 × 22½ in. Price, with 12 in. unit, £66; with 15 in. £75.

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 × 38 × 29 in. Price £122.

Guy R. Fountain Autograph. Folded horn. Front and rear horn-loaded unit, forward facing for corner placing. 15 in. dual con-



Romagna Parva



Vitavox Klipshorn

centric unit. Response 20-20,000 c/s. Size 58½ × 43 × 26½ in. Price £165.

III LZC. Infinite baffle forward facing. Tannoy III LZ dual concentric unit. Response 30-20,000 c/s. Size 14 × 10¾ × 23¼ in. Price £32 10s.

★

TRUPHET & McDONNELL Ltd., Old School Works, Wrotham, Kent. Tel.: Borough Green 2560.

Delius 12 & 15 Reflex. Semi-omnidirectional. One bass unit with one or more mid-range or tweeter units. Delius 12 or 15 in. speaker enclosure. Rec. Tannoy dual concentric 12 or 15 in. Other units fitted to order. F.R. 30 c/s-18 Kc/s. Size (Delius 12) 37 × 23 × 15 in. Weight approx. 60 lb. (Delius 15) 39 × 28 × 19 in. Weight approx. 75 lb. Price (Delius 12) £63. Enclosure only, £33 12s.; (Delius 15) £78 15s. Enclosure only, £45 5s.

★

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

Klipshorn. Double channel horn system. Folded L.F. horn with K15/40 drive unit. Forward facing H.F. horn with S.2 pressure unit. Crossover at 500 c/s with incorporated divided network. Response 30-15,000 c/s. Size 51 × 30 × 27 in. Weight 210 lb. Price, complete with drive unit, £165.

★

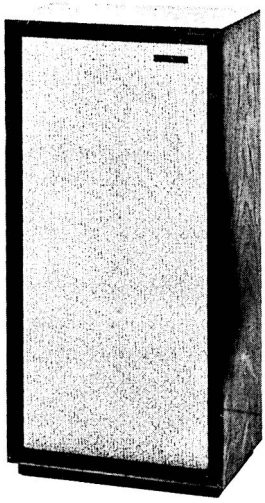
WESTREX Company Ltd., 152 Coles Green Road, Cricklewood, London, N.W.2. Tel.: Gladstone 5401. Cables: Westelcol.

Westar 100 Reflex. Two units, H.F. 3 in. diaphragm, L.F. 15 in. Crossover and equaliser 750 c/s. H.F. radiator is associated with a slant-plate acoustic lens to spread the sound horizontally. Size 38 in. high, 18 in. deep, front 24 in. wide, back 16½ in. wide. Weight 100 lb. Price (industrial 2326A) £75; (Teak veneer finish 2326B) £80.

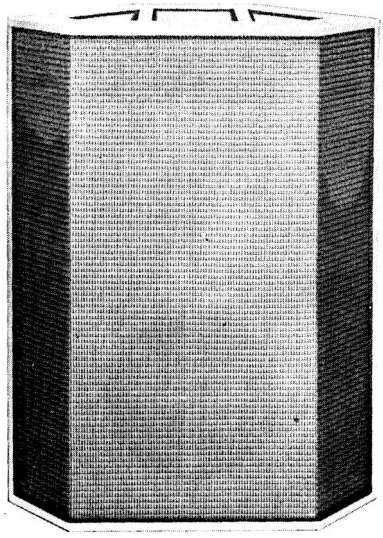
★

WHARFEDALE Wireless Works Ltd., Idle, Bradford. Tel.: Idle 1235-6. Cables: Wharfdel, Idle, Bradford.

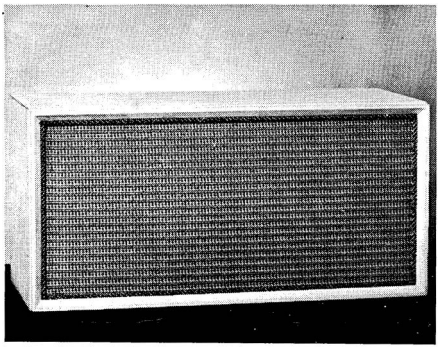
PST/8. Damped reflex, forward facing. One 8 in. drive unit. Rec. Super 8/RS/DD



Tannoy Rectangular Chatsworth



Wharfedale Airedale



Wharfedale PST/8

or 8 in. Bronze FS/AL. Size 24 × 12 × 12 in. Weight 17 lb. Price, without unit £7 10s. whitewood, or £10 10s. veneered and polished.

AF/12/RS. Reflex, forward facing. One 12 in. drive unit. Rec. Coaxial 12, Super 12/RS/DD, W12/RS/PST. Response 30-20,000 c/s with Coaxial 12. Size 36½ × 23 × 14¼ in. Weight 61 lb. Price £24 10s. (Whitewood £20).

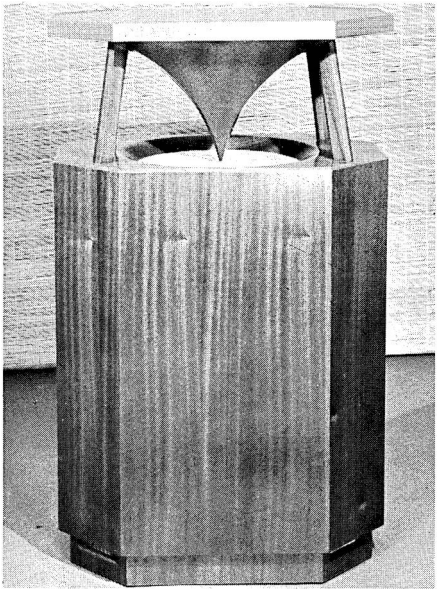
SFB/3. Sandfilled baffle. 3 drive units. 12 and 10 in. units facing forwards. 3 in. H.F. unit facing upwards for omnidirectional treble distribution. Response 35-20,000 c/s. Size 34 × 31 × 12 in. Weight 64 lb. Price, with units, £39 10s. (not sold separately).

"Omni-directional" 3-speaker corner system. Sandfilled reflex enclosure, bass unit facing forward, separate mid-range and treble unit facing upward. 15 in., 8 in. and 3 in. units. Rec. W15/RS, Super 8/FS, Super 3. Response 20-20,000 c/s. Size 48 × 34 in. Weight 160 lb. Price, with specified units, £73 10s.; sandfilled panel only, £31; twin treble cabinet, £8 15s.

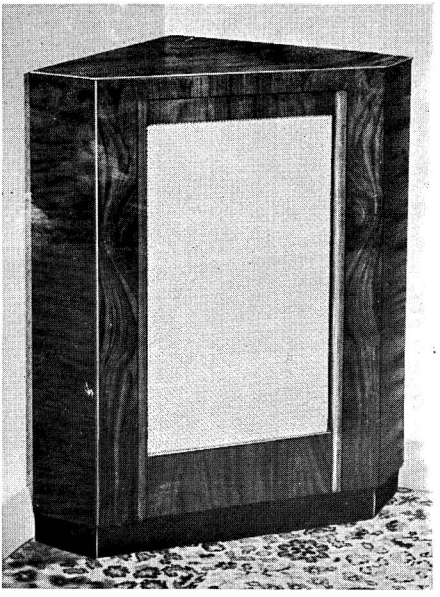
Slimline 2. Reflex. Two speaker system with crossover. 12 in. and 4½ in. units. Size 25 × 20 × 7 in. Weight 31 lb. Price £22 10s.

W2. Two-speaker system, incorporating WLS/12 and Super 5 with vol. control. Crossover 1,000 c/s. Size 23½ × 14 × 12 in. Price, veneered, complete, £29 10s.

W3. Three-speaker system, incorporating WLS/12, a 5 in. Bronze, and Super 3. Separate vol. controls for the two H.F. units. Crossover 1,000 c/s. Size 28 × 14 × 12 in. Price, veneered, complete, £39 10s.



Truphet & McDonnell Delius



Whiteley Senior Corner Console

W4. Four-speaker system, incorporating WLS/12, two 5 in. Bronze, and Super 3. H.F. units are arranged for omni-directional radiation and have independent mid and treble vol. controls. Size 35 × 24 × 12 in. Price veneered, complete, £49 10s.

Airedale Reflex. Omni-directional. Three units, 15 in. bass, 8 in. middle, 3 in. treble. Crossovers 400 and 5,000 c/s. F.R. 20 c/s-20 Kc/s. Size 39 × 28½ × 14 in. Weight 91 lb. Price £65.

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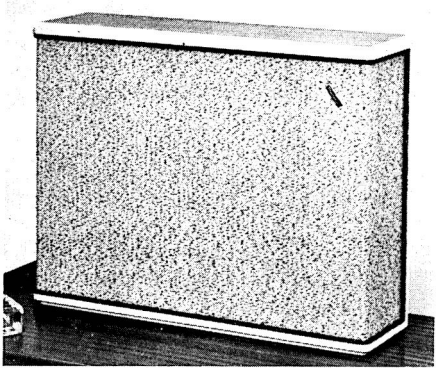
WHITELEY ELECTRICAL Radio Co. Ltd., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762/3/4/5. Cables: Whitebon, Mansfield.

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/s. Response HF816, 50-14,000 c/s; HF1012 and T10 30-14,000 c/s. Size 33 × 22½ × 18½ in. Price, without units, £10 10s.

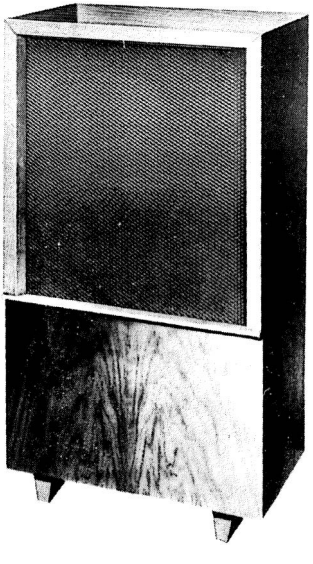
Stentorian Senior Corner Console. Bass reflex for corner position. 10 in. or 12 in. drive unit with tweeter, if required. Crossover 3,000 c/s. Response with HF1012 and T10 30-40,000 c/s; with HF1214 and T12 25-17,000 c/s. Size 35 × 30 × 19 in. Price, without units, £12 12s.



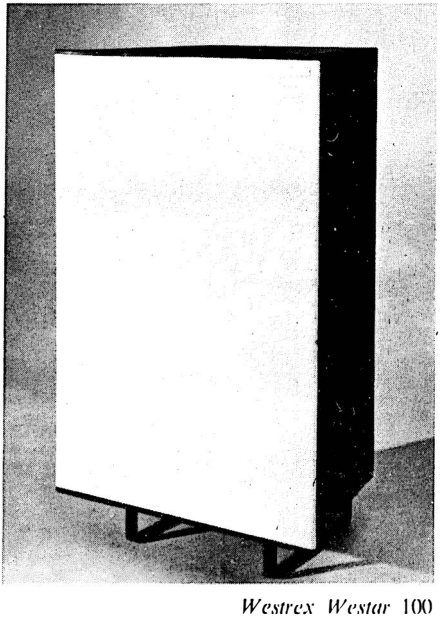
Wharfedale Slimline 2

Stentorian Sloping Dual Front. Tweeter housing, reversible, either forward or rear facing. One 8 in. unit. Rec. T816. Response 1,000-17,000 c/s. Size 13 × 10½ × 7½ in. Price, without unit, £4 1s. 6d.

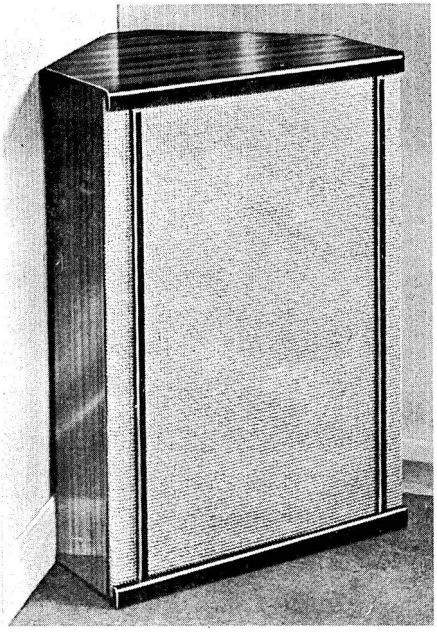
Stentorian Prelude Horn Loaded. Folded horn, forward facing. One 8 in. drive unit.



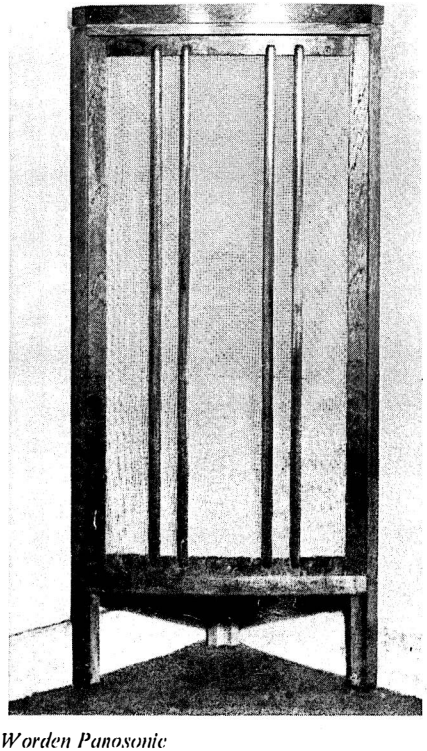
*Wharfedale AF*12 *Reflex*



Westrex Westar 100



Whiteley Junior Corner Console



Worden Panosonic

Rec. HF817. Response 60-22,000 c/s. Size 35 × 18¾ × 16¾ in. Price, without units, £20.

Stentorian Junior Column. Reflex upward facing omni-directional. One 6 in. unit. Rec. HF610. Response 100-11,000 c/s. Size 36 × 9 × 9 in. Price, without unit, £11.

Stentorian Senior Column. Reflex upward facing omni-directional. One 8 in. unit. Rec. HF816. Response 60-14,000 c/s. Size 57 × 13½ × 13½ in. Price, without unit, £20.

Thoresby Reflex. Forward facing. One 8 in. or 10 in. unit + tweeter. Rec. HF816, HF1012, HF1016. Price (with HF1012+T10+CX3000) £23 9s. 3d.; (without units) £12 12s.

★

L. G. WOOLLETT & Co. Ltd., 21 Anerley Station Road, London, S.E.20. Tel.: Sydenham 9003.

Electrostatic-Dynamic. A full range loudspeaker system incorporating a dynamic bass speaker and an electrostatic mid and upper frequency unit. Response 25-20,000 c/s. Price £46 4s.

★

WORDEN Audio Developments Ltd., 54 Chepstow Road, London, W.2. Tel.: Bayswater 4996.

Panosonic Reproducer. Double horn, with central diffusing chamber. Corner reproducer, designed for omni-directional radiation. One 10 in. unit. Rec. Wharfedale W10 (available specially modified). F.R. below 40 c/s to over 14 Kc/s. Size 56 × 24 × 15½ in. (to corner). Polished light or dark mahogany or walnut. Price (without unit) £30–£33 according to finish. Unit price £9 7s. 6d. (U.K. purchase tax £1 11s. 2d.).

Details of any products announced after this section went to press are given in a special supplement at the end of the book.

AMPLIFIERS

by W. Morle

"AMPLIFIER" is the generic name given to a multitude of sins committed by engineers, from the time of Graham Alexander Bell down to the anonymous prince of commerce who recently sold me, as an amplifier, what could better be described as an electric heater. Amplifiers come in innumerable shapes, sizes and kind; big ones, small ones; amplifiers, such as virtual earth amplifiers which virtually do not amplify at all, amplifiers such as equalisation amplifiers which may give out less than they get, and amplifiers, such as badly designed negative feedback amplifiers, which amplify with such enthusiasm as occasionally to burst into continuous oscillation.

The pre-audio need . . .

The need for a suitable means for amplifying voltage or current has existed almost as long as the use of electricity itself. To take the case of Bell as an example, his prodigious achievement in making a telephone transmitter and receiver which would work in conjunction to reproduce sound could scarcely have ranked as a major invention if Bell had had at his disposal some contrivance which would effectively magnify his electric currents. Since those early days, much time and great ingenuity have been spent in developing many forms of amplifying devices, culminating, in the field of audio equipment today, in amplifiers of very high electrical performance and pre-amplifiers and associated equipments which can be fairly said to give to the user a facility of control that satisfies all the reasonable needs that can arise. This highly developed equipment, accepted by the engineer as the standard of design and by the user as a commonplace piece of equipment, is apt to conceal the fact that there are many forms of amplifiers and that good as is its electrical performance, modern pre-amplifiers and power amplifiers are not without disadvantages.

Stanley Kelly has pointed out, for example, that a well made modern transistor hearing aid very often has a performance which is as good as that of the ordinary acoustic ear trumpet which is now little more than an object of ridicule. Again, the transistor amplifier is of the same order of efficiency as the Brown carbongranule amplifier which preceded it by some 30-odd years. The Brown amplifier in effect consisted of a telephone earpiece driving the diaphragm of a carbon granule microphone, the output current of which was fed directly to a loudspeaker. It worked, and the quality of reproduction, or absence of it, was not so bad when judged by the standards of its day.

. . . and the need for noise!

Wireless set users in those now far off days wanted quantity, not quality; the electrical gramophone was unheard of and the acoustic gramophone was the standard by which wireless set quality was judged. (It was only a very few years ago that a doyen of the gramophone industry, demonstrating an acoustic gramophone of *circa* 1930, remarked "I doubt that electrical engineers will ever be able to achieve a quality quite like that"). When it comes to the modern power amplifier, that also meets the standards of its day, but the standard is a new one, and now the fulfilment of a very high technical specification for the amplifier is regarded as being the most important factor.

Comparative 1963 Bliss

By this standard, the modern amplifier is a very fine achievement and a large variety of amplifiers is available to the audio enthusiast, the performance of which is consistently high,

the imperfections being detectable only with elaborate test gear usually far beyond the reach of the average user, or by the ear of a keenly critical user. In the chain of equipment necessary for the electrical reproduction of sound, be it from gramophone, tape recorder or microphone, the amplifier with its pre-amplifier is probably the strongest link, introducing the least distortion, and least imposing its own characteristics upon the quality of the reproduced sound.

A few disadvantages

This is not to say that the power amplifier is otherwise without disadvantages. For example, some qualities which might be appropriate to a photogenic blonde are not so desirable in an amplifier: modern amplifiers are heavy, hot and expensive. In addition, in terms of power efficiency, measured as audio power output in relation to mains supply input, they are inefficient. These disadvantages are probably a small price to pay for the technical excellence of the amplifiers, but though these disadvantages may be tolerated now it might well mean that if new forms of amplifiers arise, where these disadvantages are absent, the present pre-eminence of the valve power amplifier as we know it may come to an end. It may therefore help to give a more critical view of the amplifier if we look to see what is required of it, in conjunction with its pre-amplifier.

The Basic Problem

Fundamentally the problem of amplification is a very simple one in that we have a very small voltage, representing the output of a gramophone pickup, or tape recorder, or microphone, and we wish to operate a loudspeaker from it. We need to produce enough power to operate the loudspeaker satisfactorily and so we need something which will enable the small voltage to operate the power stage. It is customary to think of these preliminary stages between the input source and the power output stage as being voltage amplifying stages. There is nothing very difficult about stepping up a voltage by the simple device of a transformer, so that there is the tempting prospect of driving the power stage directly from the source by a suitable transformer, somewhat in the way shown in **Fig. 1**. As an example, assume that we have a gramophone pickup which produces an output of 10 millivolts and we need 10 volts to drive the power stage of the amplifier; all we want, apparently, is a transformer giving a voltage step-up of 1,000 to 1.

There is obviously a catch and the catch is, of course, that the transformer produces not only the desired voltage change but produces also a change of impedance as between the terminals of its input and output windings. Moreover, this change of impedance is proportional to the square of the voltage ratio so that with the transformer having a voltage ratio of 1,000 to 1 it would produce an impedance change of 1,000,000 to 1. If the pickup had an impedance which was as low as 10,000 ohms, the secondary winding of the transformer would offer to the input of the power stage an impedance of 10^{10} ohms. It needs little explanation that even if such a transformer could be designed its performance would be outrageously bad.

The Solution

Thus, we need a voltage amplifier which does not produce great changes of impedance as between its input and output, and the solution lies, as we well know, in the valve. It will be seen that if the input and output impedances of our desired amplifying device are to be roughly the same, and there is to be a greater voltage at the output than there is at the input, then there is a greater power at the output, considered as watts or microwatts, than there is at the input. In other words, what we have referred to as the amplifying device must in fact be a power amplifier and not merely a voltage amplifier. With the valve the input impedance is so very high, in the range of megohms, and the input voltage, and hence the current in the input of the valve, is so low that the input power is too small to be of practical significance and is normally ignored in design considerations. On the other hand, the transistor, now achieving its place as an amplifying device in substitution for, or complementary to, the valve, requires a different treatment in design. The lower input and output impedances of the transistor and its requirement of a measurable input current for satisfactory operation, considerably alters the basis of design of transistor amplifiers in comparison with their valve counterparts.

Fifty Years of Valves

The thermionic valve has been the staple amplifying device of radio and audio engineers for the last 50 years. It is a somewhat grimly revealing fact that almost as soon as valves were made, patents were taken out almost simultaneously in different parts of the world for the use of the valve as an oscillator. The conflicting requirements of gain and stability in an amplifier were very early appreciated. But for all its faults, the valve was virtually the key that opened the door to progress in the fields of what we now know as radio and audio.

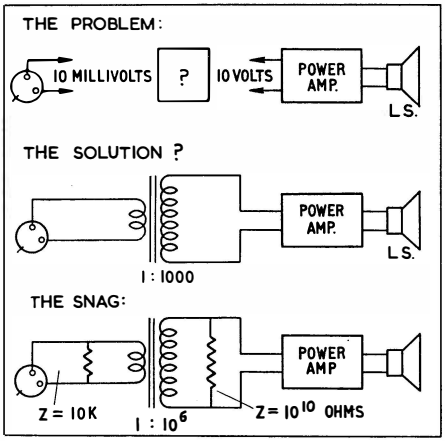


Fig. 1. *Unfortunately a transformer raises the impedance by the square of the voltage ratio.*

Stimulated by the first World War, there followed a stream of brilliant inventions on what are now regarded as fundamentals, and looking back it is difficult to appreciate that there were ever patents on such features of circuit design as push-pull, the super heterodyne receiver, frequency modulation, and even resistance-capacitance coupling. In this connection it is also somewhat curious to note that the invention of push-pull amplification was made some years before that of resistance capacitance coupling, so that the latter coupling is the "new" circuit. The advent of broadcast transmission gave the radio industry the fillip it needed and by the early thirties a stereoptye radio receiver had emerged, which in the general arrangement of its stages was not very different from that of the conventional broadcast receiver superhet design of today.

Early Radiograms

As yet, audio had not emerged as a separate field of activity. There were some elegant radio gramophones made as "prestige" models by some of the more reputable firms, the performance of which would be tolerable even today and there were a good many more radio gramophones which were less elegant in design, but in general the gramophone was still regarded as being tied to its radio brother. Already the need for—or the sales value of—adequate power output was being appreciated and even in 1930 the Columbia Model 302 radiogramophone had a power output of over 5 watts, though at that time such an output was regarded as remarkable. Quality of reproduction was also something which was becoming very much to the fore in the advertising of radio-gramophones, although the quality at the time was characterised by the euphemism of "mellowness", involving an appalling degree of top cut and a bass resonance which had to be heard to be believed. Figures of distortion were never publicised even if they were known though one American receiver sold in this country had attached to it a tag which bore the revealing information of "98.4% Pure Tone".

Radio/Audio

The middle and late thirties, up to the beginning of the World War II, saw tremendous commercial activity in the field of radio but the impact of all this activity on the achievements in electrical design was small; such changes as took place were more of a gradual evolution of improvement with the object of giving the public a cheap, rather than a good, radio receiver. Audio was still part and parcel of radio and although in immediately pre-war times advanced designs of audio reproduction equipment were known there was little high quality gramophone reproducing equipment available for the enthusiast to purchase. Designs there were; for example, in 1939 there was a published design of an equipment, for home construction, with pre-amplifier stages with wide range tone control, and a push-pull amplifier with negative feedback. It bore a very close resemblance to its present, 20-years older, equivalent. Public address amplifiers were available, but were scarcely suited to the needs of the domestic user.

Radiation of Distortion

There was one important contribution to the performance of amplifiers that occurred in the years immediately preceding the war, consisting in the use of negative feedback as a means of reducing distortion. The principles of negative feedback were established by the classic papers by Black and Nyquist and in communication equipment the principle was gradually adopted with the object of securing amplifiers of highly linear characteristics, necessary to avoid interference and "cross-talk" between channels. The technique began to find its way into radio receivers, though largely for its novelty and sales value, and in some circuits variable negative feedback was used, the degree of feedback varying with the setting of a volume control or tone control potentiometer.

By the beginning of the War, the modern audio power amplifier could be said to have arrived. The amplifier had evolved in design to the now common arrangement of low

level pre-amplifier stages, input stage, phase splitter and push-pull output. Cinema engineers at that time were making high power amplifiers with a good frequency response and "clean" output, the best of which have since been found to have distortion levels which would be acceptable even by modern standards.

Post-war Improvements

Immediately after the war further improvements took place, though these were concerned principally with those made possible by improved components, such as transformers and valves, the circuits being essentially the same. This is not intended to belittle the work of those pioneers, after the war, who took their courage in their hands and went out to sell quality to a public that had been conditioned for many years to accept less than the best available. Those men were able to show that new standards of appreciation and performance were overdue, and for their part the public was able to demonstrate how ready it was to listen to (or even buy) better equipment. The electric gramophone had at last severed its umbilical cord with radio and was an instrument in its own right.

This stimulus to quality came largely from the improved audio amplifiers available which in turn gave to and found impetus in improvements in loudspeakers and pickups. The improved performance in amplifiers was due largely to the use of heavy negative feedback, coupled with better designs of output transformer which enabled such degrees of feedback to be used with stability. Better transformer core materials also contributed to the general improvement. D. T. N. Williamson's

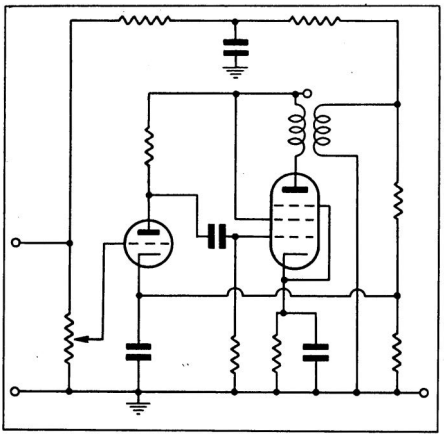


Fig. 2. *A variable gain and negative feedback circuit in use around* 1937.

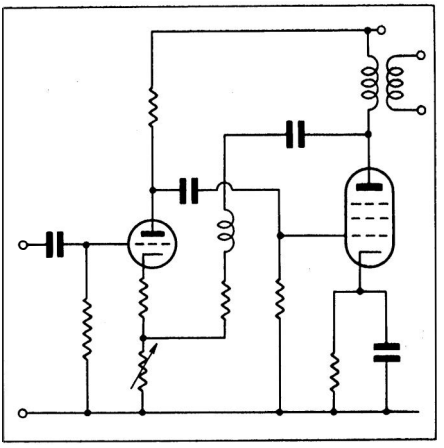


Fig. 3. *Combined gain and tone control circuit using an inductor in feedback path* (1938).

famous articles on high quality amplifiers and pre-amplifiers helped to promote a wide interest in audio reproduction, and helped to set the public taste. By the time the microgroove record arrived, audio amplifiers of adequate performance were ready to take fullest advantage of the superior, and relatively noise-free, reproduction it afforded.

Performance

The reason for dealing at some length with the evolution of the modern amplifier up to this point, is principally to indicate that at each stage engineers have been on the whole fairly content with the results of their work, and this is no less true today than in the past. In fairness to the engineers, they set themselves attainable targets; there is not much point in setting one's sights beyond the range of the bullets in the magazine. But this does usually mean, where manufacturers have to live in a cold, hard, commercial world, that the accepted standards of performance tend to follow rather than precede progress.

The modern amplifier is judged on performance, and principally by performance measured against electrical rather than acoustic standards. For example, it is normally regarded at the present time as being necessary that an amplifier should deliver not less than about 3 to 5 watts of audio output; an output in the order of 12 to 14 watts is very common and an output of 25 watts or over is by no means rare. These requirements are duplicated for each channel of a stereo equipment. Distortion, expressed as percentage total harmonics, is usually specified as being below about 0.5% and the best amplifiers achieve a

performance considerably better than this. The frequency response is required to cover at least the range of approximately 50 c/s to 20 Kc/s. and the amplifier is required also to deliver substantially its maximum rated output over this frequency range. Limits of intermodulation distortion and hum and residual noise, and margins of stability are also often specified.

Commonsense

It is very convenient to be able to reduce the performance of an amplifier to figures in some way, since such figures often enable comparisons to be made between the performance of different amplifiers, but at the same time it must be recognised these figures are not the whole story and that it is possible that an amplifier might have a performance fulfilling these minimum requirements mentioned and also have other unpleasant characteristics which would make it a very undesirable piece of equipment. For example, it might with certain input or output connections give rise to instability or intermittent distortion which would most seriously detract from its performance. In these respects, reliance is placed more upon the reputation of the manufacturer than on the specification of the amplifier which he offers.

A visitor from Mars would probably regard our present attitude with regard to the finish and construction of an amplifier as curious, to the point of being irrational. It seems to be required that an amplifier shall be nicely finished, in the sense of having plated or painted metal parts, and neat wiring is also esteemed. If an amplifier has been particularly neatly wired up, this is evidence of care having been spent on it in its manufacture, and a strong presumption that it will be more reliable in use but at the same time the neat wiring may very well detract rather than add to the performance of the amplifier, and this is surprising in view of the high value set upon technical performance. Again, despite this affection for neatness and tidiness in the detailed wiring and construction of the amplifier, other features of construction are accepted without criticism; the majority of amplifiers make no attempt to disguise what they are, and expose valves, capacitors and other components as a mere collection of parts on a metal carrier. In recent years the integrated type of amplifier has gone a long way to improve the appearance of amplifiers in this respect, but there are still many examples of the older type.

The chief features of modern amplifiers which are most likely to affect the future trend of design, and features which are at the present time accepted without much criticism, are the weight of the amplifier, the amount of heat that it produces in operation, and its expense.

What we Still Want

The present technical performance of amplifiers is probably adequate, although at the low frequency end of the operating range there are signs that trends in loudspeaker design are making life rather more difficult for the amplifier manufacturers. With present loudspeaker enclosures there is a tendency to use loudspeakers with lower and lower bass resonance frequencies, working into the region below 50 cps where the power output from the amplifier is beginning to fall off, and where correction by negative feedback becomes more difficult to apply because of phase shift arising principally from the characteristics of the output transformer.

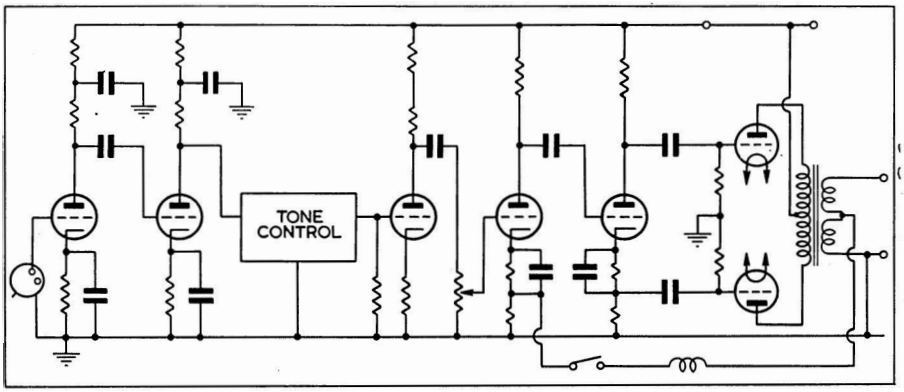


Fig. 4. *High quality amplifier circuit, somewhat simplified, in use just before the last war. Note the use of triodes throughout and the switched negative feedback. Tone control was of the passive type.*

The transistor power amplifier is now a commercially available article, and it is beginning to show by contrast where its advantages lie, particularly in relation to the shortcomings of the valve amplifier. The small size of the transistor amplifier is immediately apparent, and this is an advantage which exists even for those equipments where portability is not a prime requirement. Again, the cooler running of transistor amplifiers, due to the absence of the cathode heating current necessary with valves, is an immediate advantage. Despite these material benefits of transistor amplifiers, there is an even more important advantage in that the transistor may lead to a new era of amplifiers of which the output transformer is made unnecessary. In a valve power amplifier, the output transformer is probably the most important single component; it is very difficult to design adequately, and using the best materials and the best designs one arrives at an output transformer which is both bulky or expensive or both. The electrical performance of the valve amplifier is still marginally better than that of its transistor equivalent, but it would be a bold man who would forecast that this improvement will continue to be enjoyed by the valve amplifier. If present trends continue, it seems as though in a few years' time the new standards of performance of amplifiers will require that they be very small, cool-running, and capable of the long life which can be expected from a transistor.

Pre-Amplifiers—Present . . .

As a separate unit, the pre-amplifier is a comparatively recent introduction and was the complement of the power amplifier. As soon as it achieved its independence in this way, the number of facilities afforded rapidly multiplied. The simple bass and treble controls, giving both "cut" and "lift" were soon supplemented by top cut filters giving control of both cut-off frequency and rate of cut, bottom cut or rumble filters, and input selection controls with individually equalised inputs.

The distortion levels claimed for pre-amplifiers of this kind are very low and are realised in practice. Since the pre-amplifier stages operate at low level it is a much easier matter to design a good pre-amplifier than a good power amplifier, and a main problem of design is to decide what facilities to include.

The pre-amplifier is the means by which the user can adjust the final balance of reproduction to his personal taste, and while the cynical may sometimes look askance at the multiplicity of knobs on a modern control pre-amplifier and wonder if they are justified, reason says that if they enable the user to secure more enjoyment to his personal taste, no better reason for their existence is needed.

. . . and future

In design, pre-amplifiers are in a state of change at present, and the move towards transistor operation is more marked than with the power amplifier. The performance attainable with transistors is at least as good as with valves and in some respects is better. A stereo control unit is now available in the United States which claims a performance of plus zero, minus $\frac{1}{4}$ dB, change of output over a frequency range of 1 c/s to 1,000,000 c/s, with no measurable distortion. This seems to be overdoing it, by any standards, though no doubt such a performance would be welcome if one had it for free, as they say. Since the unit in question costs about £125 at the present rate of exchange, "for free" does not sound quite appropriate.

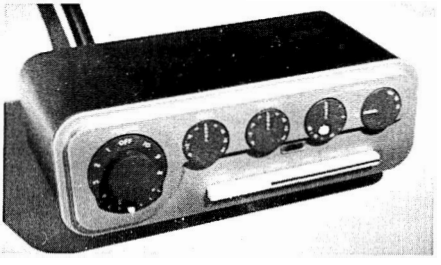
Where then do we stand, and what of the future? In terms of pure electrical excellence there is a little, barely significant room for improvement. Design of valve-operated equipment has reached almost the practical limit and the engineer has tortured the last milliwatt of power from his valves and the last decibel from his pre-amplifier. But the transistor is knocking very loudly on the door, and must be admitted very soon. The advantages of compactness, efficiency and cool-running, with equivalent or better performance, are irresistible, and when the costs of the two types of equipment are comparable the transition will occur. A good valve amplifier will continue to be a good amplifier, but the next few years are likely to have effect on its popularity, if not its performance.

DIRECTORY OF AMPLIFIERS & CONTROL UNITS

★The following abbreviations are used in this directory section: **H.D.**—Harmonic Distortion; <—less than; **H** and **N**—Hum and Noise; **P.a.t.**—Power supplies available for tuner; **R.M.S.**—root mean square; **N.L.**—Noise level; **Sel.**—Selector switch; **P.s.n.**—Power supply needed; ■—Stereo equipment.

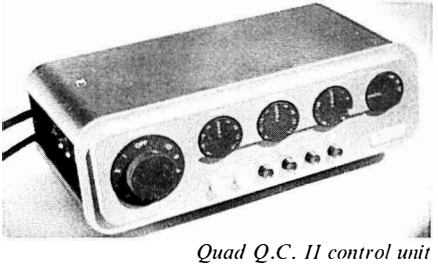
ACOUSTICAL MANUFACTURING Co. Ltd., St. Peter's Road, Huntingdon, Hunts. Tel.: H'don 361 and 574. Cables: Acoustical.

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. Size 10½ × 3½ × 6½ in. To operate with Quad II power amp or similar. Price £19 10s.



Quad 22 *Stereo control unit*

■**Quad 22 Control Unit.** Inputs: radio/tape 70 mV at 100 K; mic. 1.5 mV at 100 K; pickup dependent on adaptor unit used. Vol. and on/off bass, treble, filter slope, filter switch 5, 7, and 10 Kc/s. Push-button selection of channels, mono-stereo, and record equalisation. H.D. <0.02%. H and N —70 dB total, P.a.t. 330 V 35 mA each tuner, 6.3 V 3 amps. Size 10½ × 3½ × 6 in. Price £25. To operate with QUAD II amplifiers.



Quad Q.C. II control unit

Quad II Amplifier. 15 watts. Dist. total 3rd harmonic and higher. <0.1% at 12 watts. Input for spec. output 1.4 V. R.M.S. for 15 watts. Response 20-20,000 c/s ±0.2 dB; 10-50,000 c/s ±0.5 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 12½ × 4¾ × 6½ in. To operate with Q.C.II or Q.22 control units. Price £22 10s.

Quad II Power amplifier

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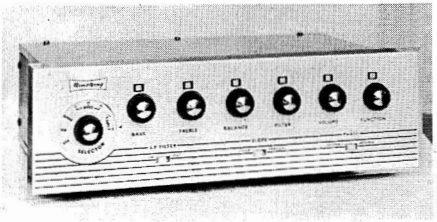
ALLEGRO Sound Equipment Ltd., 91a Heath Street, Hampstead, N.W.3. Tel. Hampstead 6377.

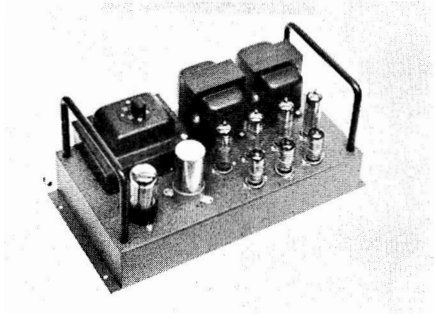
■**Allegro 66 Integrated Stereo Amplifier.** Inputs mic. 30 mV, tape 30 mV. 7 watts per channel. Dist. 0.5% at 4.3 watts. Response 25-20,000 c/s ±3 dB. N.L. —60 dB. Out. imp. 15 ohms. Output ECL82's. Size 13¼ × 9½ × 5¼ in. Price £29 8s.

Allegro 66 *Integrated stereo*

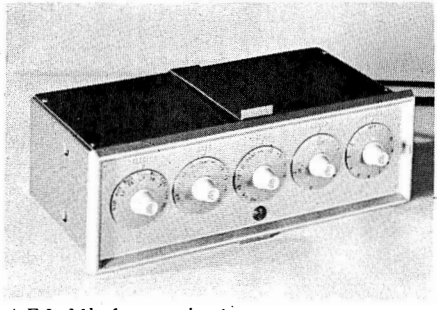


Armstrong PCU27 stereo control unit

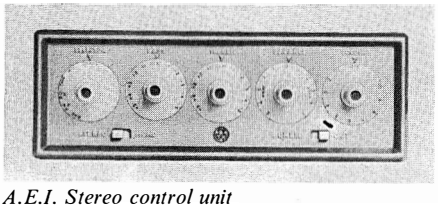
Armstrong PCU25 stereo control unit



Armstrong A20 stereo amplifier



A.E.I. Mk. 1 control unit



A.E.I. Stereo control unit

ARMSTRONG Audio Ltd., Warlters Road, Holloway, N.7. Tel.: North 3213/4.

■**PCU25 Stereo Control Unit.** Inputs: tape 100 mV, tape 3 mV. Aux. 100 mV, radio 100 mV; gram. 3.5 mV, mic. 1.8 mV. Switched rumble filter, variable treble filter. Push buttons. Output 410 mV. 6 position sel., volume, bass, treble, balance, rumble filter, treble filter. H.D. <0.1%. H and N 61 dB (pickup input of 3.5 mV sensitivity). Power supplied by A20 amplifier. Response 15-22,000 c/s within 1 dB. Treble control operates as variable filter when filter switched in. To operate with A20 power amplifier. Size $10\frac{1}{2} \times 4\frac{1}{2} \times 7\frac{1}{2}$ in. Weight 4 lb. Price £21.

■**PCU27 Stereo Control Unit.** Inputs: Auxiliary 2 mV. Microphone 2 mV. Radio 80 mV; Gram 80 mV, Gram 0.7 mV; Gram 3.5 mV; Tape 130 mV; Tape 2 mV. 8 position sel., bass, treble, balance controls, filter switch, slope switch, rumble filter, vol. phase, function. Tape outputs, stereo and mono. H.D. less than 0.1%. H and N −62 dB. Power supplies required H.T. 300 volts at 8 mA. L.T. 6.3 volts at 2 amps. Size of front panel $14\frac{1}{2} \times 4\frac{1}{2}$ in. To operate with A20 amplifier. Price £28 10s.

■**A20 Stereo Power Amplifier.** 12 watts nom. 25 watts max. per channel. H.D. <0.1%. Input for spec. output 410 mV. Response 15-22,000 c/s within 1 dB. Feedback 29 dB. N.L. 80 dB. Out. imp. 4, 8 and 16 ohms. Output two EL84s. Ultra-linear. Power supplies required A.C. 100-125 V and 200-250 V. To operate with PCU25 stereo control unit. Size 14 × 7 × 7 in. Price £23 12s. 6d.

Jubilee Mk. 2 Tuner Amplifier Chassis. 8 watts. H.D. 0.5%. Input: pickup 180 mV. Response 20-30,000 c/s ±2 dB. Feedback 15 dB, N.L. 68 dB. Out. imp. 3, $7\frac{1}{2}$, 15 ohms. Output two ECL82s. Self-powered A.C. 200-250 V. Size 12 × 7 × 8 in. Price £24 7s. (U.K. purchase tax £3 18s.). (Also see Tuners Section.)

■**Stereo 12 Mk. 2 A.M./F.M. Tuner Amplifier Chassis.** For full details of this, see Directory of Radio Tuners.

Details of any products announced after this section went to press are given in a special supplement at the end of the book.

A.E.I. Ltd., Sound Equipment Group, Electronic Apparatus Division, 132/5 Long Acre, London, W.C.2. Tel.: Temple Bar 3444. Cables: Soundequi, Lesquare, London.

Hi-Fi Control Unit Mk. I. Inputs: mic. 5 mV; tape head 5 mV; pickup 6 and 250 mV; equalised tape 180 mV; radio 180 mV. 8-position sel., filter, bass, treble, volume and on/off. H.D. <0.05%. H and N −86 dB. P.a.t. 320 V 30 mA, 6.3 V 3 amps. Size $10\frac{1}{4} \times 3\frac{5}{16} \times 5\frac{1}{2}$ in. Price £17 10s. To operate with A.E.I. Hi-Fi Amplifier, or similar.

Hi-Fi Power Amplifier Mk. I. 20 watts nominal, 30 watts peak. Dist. <0.05%. Input for 20 watts 100 mV. Response 20-20,000 c/s ±1 dB. Feedback 24 dB. N.L. −80 dB. Out. imp. 4, 8 and 15 ohms. Output EL34s. Ultra-linear. Size $10\frac{3}{4} \times 5\frac{1}{2} \times 6\frac{3}{4}$ in. Price £24 10s. To operate with A.E.I. Hi-Fi Pre-amp. or as a pair with Stereo Control Unit.

■Stereo Hi-Fi Control Unit. Inputs: stereo and mono pickup, stereo tape, radio, mic. spare. 6-position sel. bass, treble, balance, vol., on/off. Rumble filter. H.D. less than 0.05% at 10 watts. H and N −85 dB. P.a.t. 200 V 80 mA, 6.3 V 3 amps. Size $10\frac{1}{4} \times 5\frac{1}{2} \times 3\frac{5}{16}$ in. To operate with A.E.I. stereo amplifier or two mono amplifiers. Price £22 9s.

■Stereo Power Amplifier. 10 watts each channel, 15 watts max. Dist. less than 0.05% at 10 watts. Input for spec. output 100 mV. Response 20-20,000 c/s ±1 dB. 24 dB feedback. N.L. −dB relative to 10 watts. Out. imp. 4, 8 and 61 ohms. Output EL84s ultra-linear. Size $12\frac{3}{4} \times 10 \times 7\frac{3}{4}$ in. To operate with A.E.I. stereo control or similar. Price £29.

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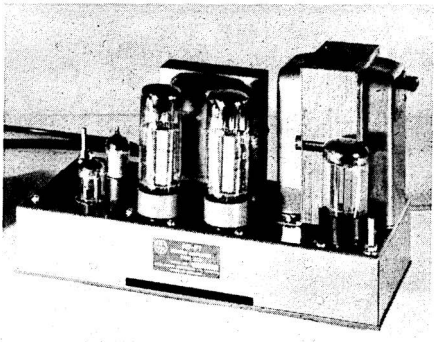
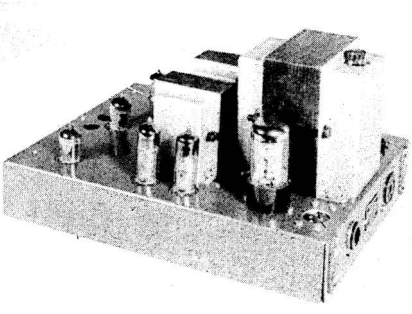
ASSOCIATED ELECTRONIC ENGINEERS Ltd., 10 Dalston Gardens, Stanmore, Middx. Tel.: Wordsworth 4474/5/6. Cables: Astronic, Stanmore.

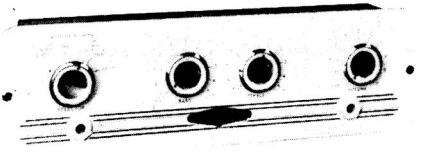
Astronic A1332 Control Unit. Inputs: mic. 20 mV; gram. A.E.S., *ffrr*, NARTB 10-20 mV; radio/tape 220 mV. 6-pos. sel., treble, bass, vol. and on/off, gram. input attenuator. Tape record and playback socket. H and N −70 dB. Size $12 \times 3\frac{3}{8} \times 1\frac{7}{8}$ in. To operate with A1333 power amp. Price £9 10s. 6d.



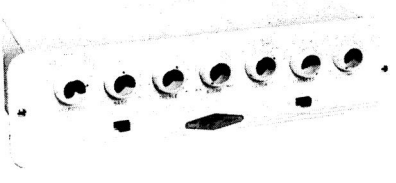
A.E.I. Mk. 1 power amplifier



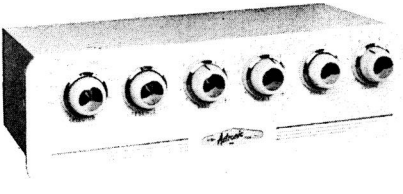
A.E.I. stereo power amplifier



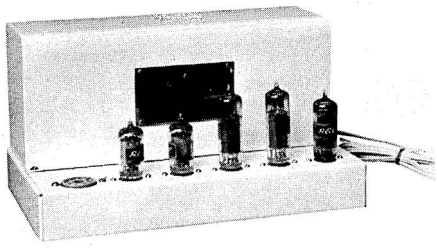
Astronic A 1332 control unit



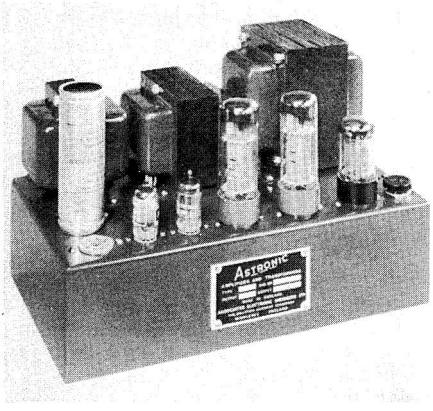
Astronic A1432 control unit



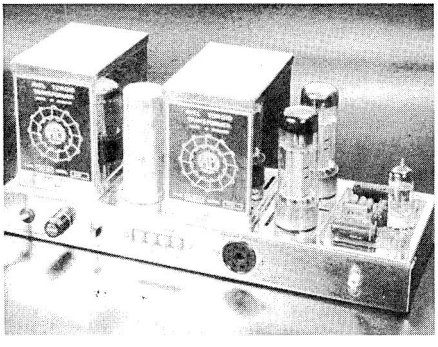
Astronic A1434 stereo control unit



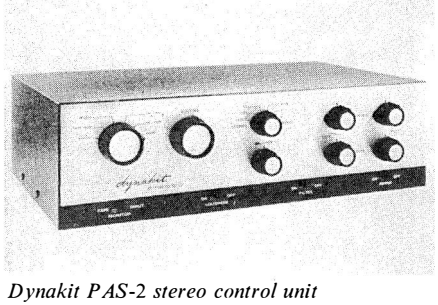
Astronic A1333 power amplifier



Astronic A1440 power amplifier



Avel-Dynaco Mk. IV amplifier



Dynakit PAS-2 stereo control unit

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/s. Slope 6-30 dB/octave. Loudness −18 dB max. Presence +6 dB, 2-3 Kc/s. Rumble filter. Variable PU attenuator. Socket for direct replay from tape head. H.D. not measureable. H and N − 65 dB. Size $11\frac{1}{2} \times 3\frac{1}{2} \times 5\frac{1}{4}$ in. 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 V R.M.S. Response 20-20,000 c/s ±0.5 dB. Feedback 18 dB. N.L. −72 dB. Out. imp. $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 ohms. Output N709s or EL84s. Ultra-linear. Size $11\frac{1}{2} \times 6\frac{1}{4} \times 6$ in. 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, PU 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 $11\frac{1}{2} \times 3\frac{1}{2} \times 6$ in. To operate with amplifiers A1333 Mk. I and Mk. II or A1440. Price £22 5s.

■**Astronic A1444 Combined Stereo Unit.** 4 watts. Dist. 2%. Inputs: radio, tape and L.P. discs. 150 mV; 78 discs. 350 mV. 4-position sel., bass, treble, volume and on/off. Out. imp. 3 and 15 ohms. Size $11\frac{1}{2} \times 8\frac{3}{4} \times 3\frac{1}{4}$ in. Price £24 3s.

Atlas A1440. 20 watts nominal, 35 watts max. Dist. 0.1%. Input for spec. output 0.25 volts. Response 20-20,000 c/s ±5 dB. Feedback 30 dB. N.L. −85 dB. Out. imp. $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 ohms. Output EL34s. Ultra-linear. Size $13 \times 7\frac{1}{4} \times 8\frac{1}{2}$ in. Price £37 16s. To operate with amplifiers A1332, A1432, and A1434.

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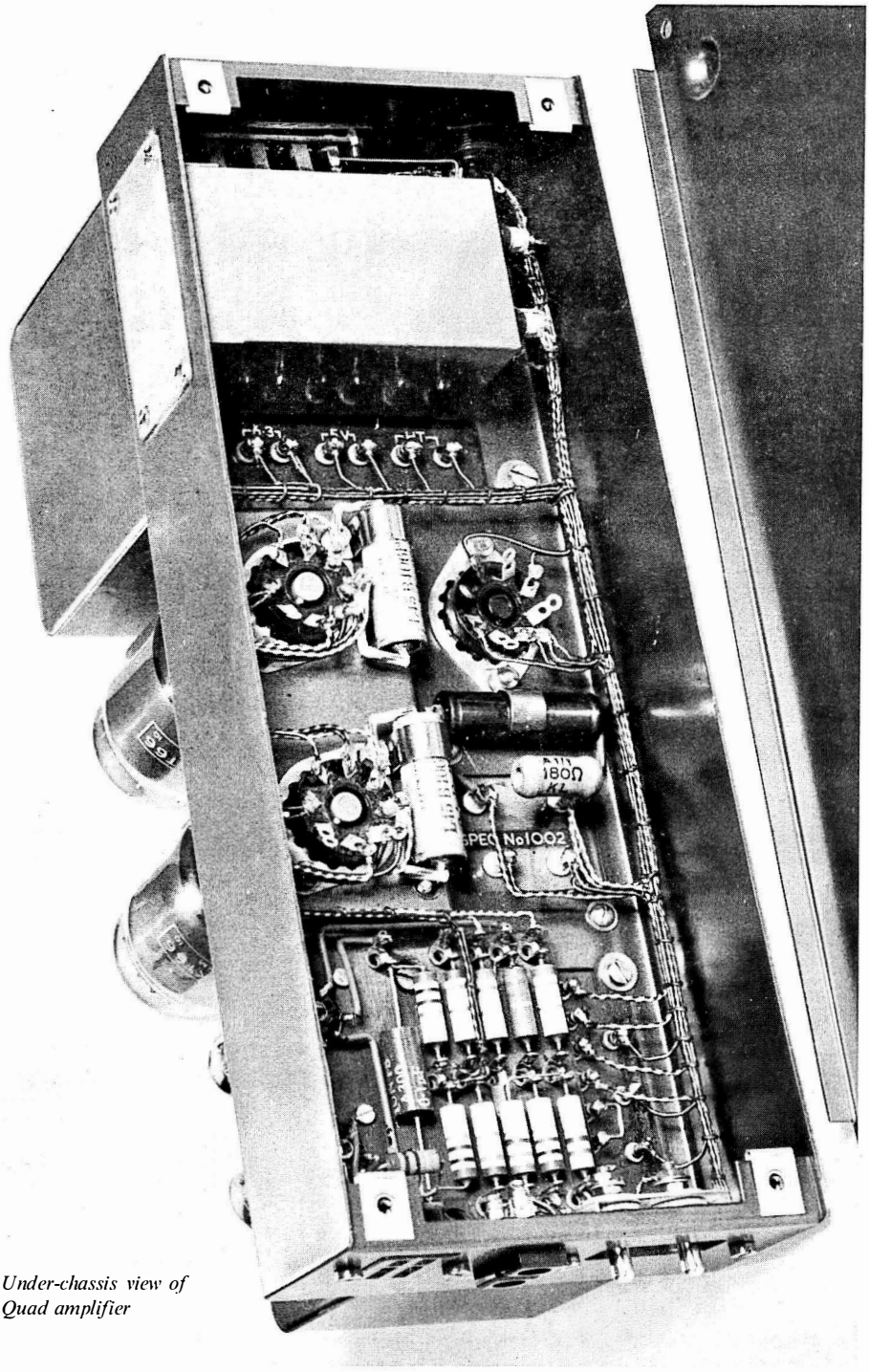
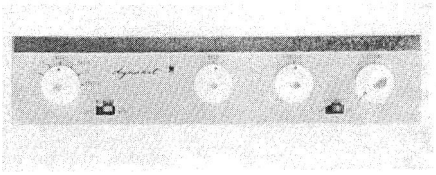
AVELEY ELECTRIC Ltd., Ayron Road, Aveley Industrial Estate, South Ockendon, Essex. Tel.: South Ockendon 3444. Cables: Avel, Ockendon.

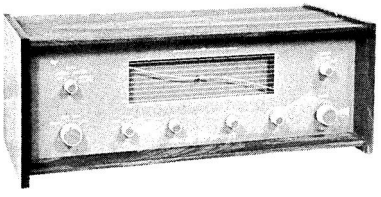
Dynakit PAM-1 Mono. Free-standing Control Unit. Inputs: pickup, radio, tape. Output 2 V max. 6 pos. sel., bass, treble, volume, tape monitor switch, loudness switch,



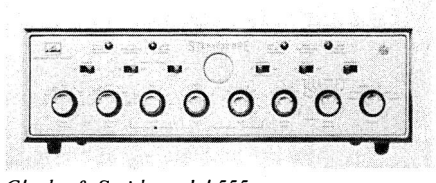
Under-chassis view of Quad amplifier



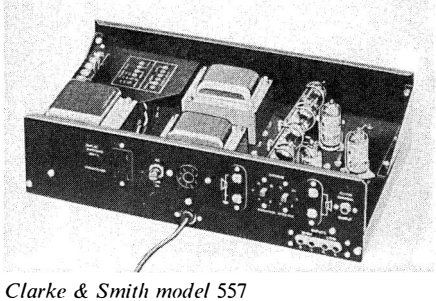
Dynakit PAM-1 control unit



B. & O type 608 integrated stereo



Clarke & Smith model 555



Clarke & Smith model 557

hum balance. H. and N. 70 dB down on 10 mV cartridge. Power supplies required D.C. 200 to 400 V at 4 mA, A.C. 6 V at 0.75 amp. A.C. Response ±0.5 dB 10-40,000 c/s. D.C. heater supply. To operate with Avel-Dynaco Mk. IV power amplifier. Size 12 × $2\frac{5}{8}$ × $6\frac{1}{8}$ in. Weight $4\frac{1}{2}$ lb. Price £22 14s. 1d.; available in kit form £17 14s. 1d.

■**Dynakit PAS-2 Stereo Control Unit. Free-standing.** Inputs: mic., tape, radio. Scratch filter. Output 2 V max. 6 pos. sel., volume, balance, blend, ind. tone controls for each channel, tape monitor switch, loudness switch. H.D. unmeasurable. I.M. dist. <0.05% at full output. H and N −70 dB down. Self-powered. Response ±0.5 dB 10-40,000 c/s. D.C. heater supply. To operate with two Mk. IV power amplifiers or Avel-Dynaco stereo 70. Size 13 × $3\frac{3}{4}$ × $7\frac{3}{4}$ in. Weight 8 lb. Price £35 9s. 7d.; also availabe in kit form £28 7s. 11d.

Avel-Dynaco Mk. IV Amplifier. 30 watts nom., 50 watts max. H.D. L.F. range <0.25%, high range 15,000 c/s <1%, mid range <0.1%. Input for spec. output 1.4 V. Response ±0.5 dB from 20-60,000 c/s. Feedback 20 dB overall. N.L. 90 dB down on 30 watts. Out. imp. 4, 8, 16 ohms. Output matched EL34s. Ultra-linear. Power supplies required A.C. 0-200/240 V. To operate with PAM-1 or PAS-2 Control units. Size 5 × 14 × $6\frac{1}{2}$ in. Price £35 9s. 1d.; also available in kit form £31 14s. 1d.

■**Avel-Dynaco "Stereo 70" Amplifier.** 35 watts per channel, 40 watts max. H.D. as for Mk. IV. Input for spec. output 1.4 V each channel. Response ±0.5 dB 20-60,000 c/s. Feedback 20 dB both channels. N.L. 90 dB below 30 watts out. Out. imp. 4, 8 or 16 ohms. Output EL34s. Ultra-linear. Power supplies required 200-240 V A.C. Size 10 × 13 × $6\frac{1}{2}$ in. Price £66 13s.; also available in kit form £60 8s. 1d.

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BANG & OLUFSEN, Denmark. Sole U.K. distributors: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444.

■**Type 608 Integrated Stereo Amplifier.** 15 watts per channel. Inputs: pickup, 2 mV; tape 100 mV; radio 100 mV. Bass, treble, balance controls with visual display showing effect of tone controls. Transistorised input stage. Response 20-20,000 c/s ±1 dB. Distortion, <0.5% at 10 watts. 16 dB feedback. Crosstalk, ±50 dB between channels. N.L. −60 dB. Output ECL85s. Out. imp. 15 ohms. Size approx. 15 × 9 × 6 in. Price £52 12s.

■**Type GF2.** Transistorised stereo pick-up pre-amplifier. Sensitivity: 7 mV input for 0.5 V output per channel. N.L. −62 dB. Price £5 17s.

★

CHAPMAN (Ultrasonics) Ltd. See Derritron (Ultrasonics) Ltd.

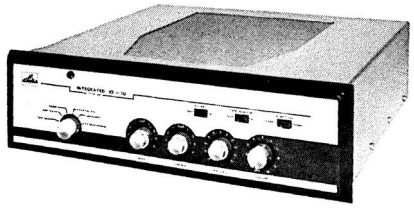
CLARKE & SMITH Manufacturing Co. Ltd., High Fidelity Components Division, Melbourne Road, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic, Wallington.

■**Model 555 Stereoscope. Integrated Stereo Amplifier.** 10 watts per channel. Inputs: pickup 2 mV magnetic; 60 mV crystal; tape 3 and 150 mV; microphone 2 and 20 mV; tuner 150 mV. H.D. 0.1%, 10 watts at 1,000 c/s. Response 20-20,000 c/s ±1 dB. Power amp. 40-5,000 c/s at full output. Feedback 34 dB. N.L. main amp. 80 dB below full output, radio inputs 60 dB below full output. Out. imp. 4 and 16 ohms. Output EL84s. Ultra-linear. Self-powered. Size 4 × 14 × 13¾ in. Price £66 3s.

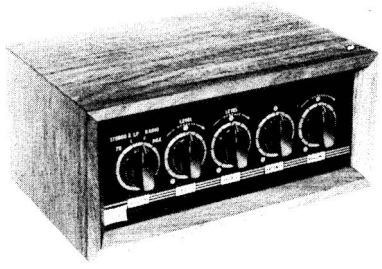
■**Model 556 Stereoscope.** Stereo Control Unit. Inputs: as for 555. Scratch and rumble filters. Output cont. variable from 100 mV to 3 V for specified input sensitivities. Input selectors: two bass, two treble, two volume, two master loudness, output monitor, junction switch, scratch filters, filter slope, rumble filter, tape monitor, pickup selector. H.D. <0.1% for 6 V output. H and N: low sens. inputs better than 66 dB down. Power supply required 110/250 V at 50 or 60 c/s. Response ±1 dB 20-20,000 c/s. Size 4 × 14 × 10½ in. Weight 14 lb. To operate with Model 557 or Model 657 amplifier. Price £40 19s.

■**Model 557. Stereo Amplifier.** 10 + 10 watts stereo. H.D. 0.1% for 10 watts at 1 Kc/s. Power take off 300 V unsmoothed through 100 ohms at 8 mA max. and 6.3 V heaters, 2 amps. max. Response 20-20,000 c/s ±1 dB. Feedback 22 dB. N.L. 80 dB below full output. Out. imp. 4 or 16 ohms. Output EL84s. Ultra-linear. Self-powered. Size 4 × 14 × 8¾ in. To operate with Model 556 or 599 Control Units. Price £31 10s.

tape 470K, 3 mV; mag. pickup 68K, 2 mV; crystal/ceramic pickup 33K, 60 mV; aux. 470K, 100 mV; radio 470K, 100 mV; mic. 470K, 2 mV; tape monitor 1M, 500 mV. Output 0.5 V. Controls: volume, bass, treble, balance, input selector. Filters: high pass 30 c/s, low pass 7 Kc/s. Response 40 c/s to 20 Kc/s (depending upon input). Noise equivalent to 0.8 μV on R.I.A.A. input. P.s.n. 300 V D.C. 15 mA, 6.3 V A.C. or D.C. 1.8 A. Tape monitor facilities. To operate with Model 657 or Model 557. Size, 4 × 14 × 7 in. Price £27 6s.



Clarke & Smith Model 655

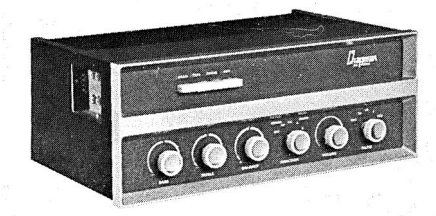


Decola Separator control unit

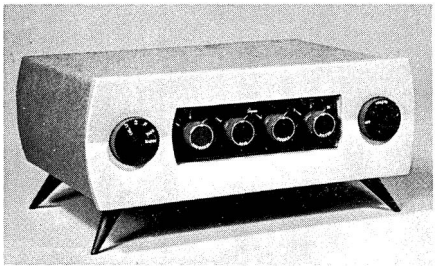
Decca Decola separator amp

<**H.M.V. 657.** Stereo Power Amplifier. Output 10 watts per channel. Distortion 0.2% for 10 watts at 1 Kc/s. Response 30 c/s-20 Kc/s ±1 dB. Derived centre channel signal, 1 V at rated output. Noise −80 dB referred to 10 watts. Input 500 mV. LS matching, 4 or 16 ohms. Output stages, EL84s ultra linear push pull. P.s.n. 200-250 V 50 c/s. Size 4 × 14 × 8¾ in. To operate with control unit Model 656, 556. Price £25 4s.

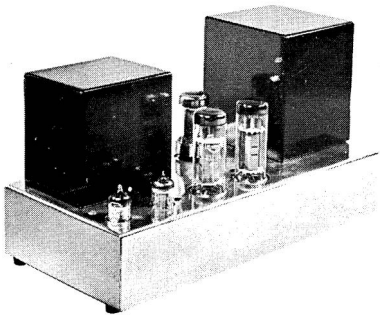
■**Model 655.** Stereo Integrated Amplifier. Specification as for Models 656 and 657. Free-standing. Size 4 × 14 × 13¾ in. Price £44 2s.



Derritron Stereo 306 *integrated*



Derritron 105 *integrated*



Derritron 205 *amplifier*

DECCA Radio & Television, Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

■**Stereo Decola "Separates" Control Unit.** Inputs: pickup 14 mV; radio 60 mV; aux. 30 mV. Output 90 mV. Controls selector, bass, treble, balance, volume. Filters high pass 40 c/s. Response 40 c/s-25 Kc/s. P.s.n. 280 V D.C. 8 mA, 37.5 V D.C. To operate with "Separates" power amplifier. Size 11 × 7½ × 5¼ in. Price £23 2s.

■**Stereo Decola "Separates" Power Amplifier.** Output 12 watts per channel. Distortion 1% at 10 watts. Response 30 c/s-25 Kc/s ±1 dB. Noise −75 dB referred to 12 watts. Input 90 mV. LS matching, 15 ohms. P.s.n. 100-250 V A.C. To operate with "Separates" control unit. Price £37 16s.

DERRITRON (Ultrasonics) Ltd., 24 Upper Brook Street, London, W.1. Tel.: Hyde Park 2291.

205 Amplifier. 20 watts from 30-20,000 c/s. Dist. <0.05% at 20 watts. Response 2-100,000 c/s ±1 dB. Feedback 30 dB. N.L. −89 dB at 20 watts. Out. imp. 15 ohms. Output EL34s. Ultra-linear. Price £34.

305 Stereo Control Unit. Inputs: pickup and tape 4.5 mV; radio 100 mV; aux. 100 mV. 4-position sel., bass, treble, volume, balance, filter. H.D. <0.1%. H and N −50 dB. Rumble filter. Size 12 × 4⅛ × 6¼ in. To operate with 305 amplifier or 2 × 205 amplifiers. Price £18 18s.

■**305 Stereo Amplifier.** 8 watts per channel, 15 watts peak. Dist. <0.1%. Input for spec. output 350 mV. Response 30-20,000 c/s ±0.2 dB. Feedback 10 dB. N.L. −80 dB. Out. imp. 3 and 15 ohms. Output EL84s. Ultra-linear. Size 12 × 7 × 5 in. To operate with 305 pre-amplifier. Price £21.

105 Combined Control Unit and Amplifier. 10 watts nominal, 20 watts peak. Inputs: pickup 10 and 50 mV; radio and tape 100 mV. Selector, bass, treble, filter, loudness control, volume and on/off. Rumble filter. Dist. <0.1%. Response 30-20,000 c/s ±0.2 dB. N.L. −80 dB. Out. imp. 3 and 15 ohms. Output EL84s. Ultra-linear. Size 12 × 4⅛ × × 8½ in. Price £29 18s.

■**Stereo 306 Integrated Amplifier.** Pre-amp. details: Inputs: pickup 4 mV 68K; aux., radio, tape 120 mV. Output 8 watts. Controls, bass, treble, filter, function, volume, input selection. Filters, high pass 30 c/s, low pass 10 Kc/s and 5 Kc/s. Response 40 c/s-20 Kc/s ±1 dB. Noise, pickup −50 dB, others −60 dB. Free-standing. Power amp. details: Distortion less than 0.1%. Feedback 15 dB. LS matching 15 ohms. Output stages ECL86s. P.s.n. 200-250 V 50 c/s A.C. Size 14½ × 9¼ × 5½ in. Price £36.

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EXPERT Gramophones Ltd., Audio Works, 197 Laleham Road, Staines, Middlesex. Tel.: Staines 53761.

■**Mk. I Stereo Control Unit.** Inputs 250 mV sensitivity. Switched bass, treble, function controls. Distortion less than 0.1%. Size

12 × 3½ × 3 in. Suitable for all types of crystal and ceramic cartridges. To operate with Expert stereo amplifier. Price £12.

■**Model 62 Stereo Control Unit.** Input to suit any combination of sensitivity, impedances and characteristic. Output 200 mV. Filter, high pass −15 dB at 10 c/s. Distortion less than 0.01 %. Crosstalk −40 dB at 1 Kc/s. "Audiorama" giving pseudo-stereo effects from mono signals. Size 13¼ × 5¼ × 6¼ in. To operate with two Expert standard amplifiers or any stereo amplifier of 200 mV sensitivity. Price £36 15s.

■**Stereo Amplifier.** Output 8 watts. Distortion 0.1 % at 8 watts. Response 30 c/s-20 Kc/s ±1 dB. Feedback 28 dB. Noise −80 dB referred to 8 watts. LS matching, 15 ohms. Output stages ECL86s. Size 12 × 9 × 6½ in. To operate with Stereo Mk. I control unit. Price £21.

Standard Amplifier. Output 12 watts. Distortion 0.1 %. Response 20 c/s-25 Kc/s ±0.5 dB. Feedback 30 dB. Noise −80 dB at 8 watts. Input 200 mV. LS matching, 15 ohms. Output stages EL84s, ultra linear. Size 12 × 9 × 6½ in. To operate in pairs with stereo control unit model 62 or singly with the Expert mono control unit. Price £21.

★

FISHER Radio Corporation, Long Island City 1, New York, U.S.A. Distributed by Lockwood & Co. (Woodworkers) Ltd., 67 Lowlands Road, Harrow, Middx. Tel.: Byron 3704.

The full range of Fisher amplifiers and control units is supplied to special order. Details on request.

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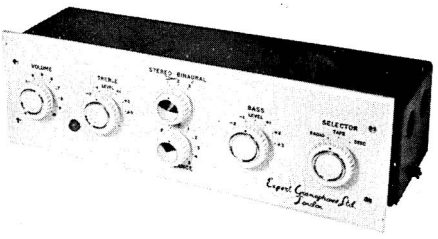
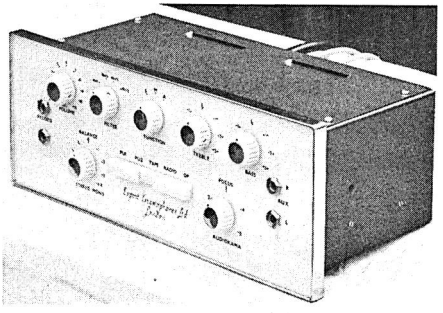
GOODSELL LTD., 40 Gardner Street, Brighton. Tel.: Brighton 26735.

■**Stereo II Control Unit.** Inputs: pickup 7 mV stereo; radio 150 mV; tape 3 mV. Selector switch, vol., bass, treble, on/off. H.D. 0.1 %. Size 13 × 7½ × 3¾ in. Price £27 15s.

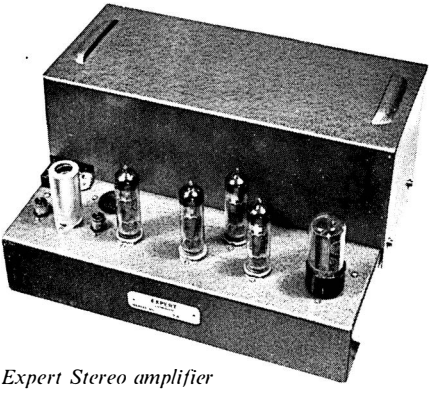
■**Stereo III Control Unit.** Inputs: pickup 60 mV, radio and tape 100 mV. Push-button selector, ganged bass, treble, volume



Expert Mk. 1 stereo control unit



Expert model 62 Stereo C.U.

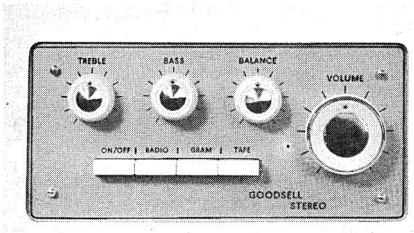


Expert Stereo amplifier

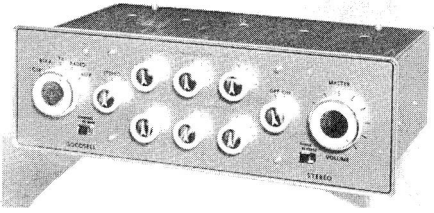
controls. H and N −65 dB. To operate with Goodsell "Mullard" stereo amplifier. Price £9 15s.

GW25 Amplifier. 20 watts. Dist. 0.1 %. Input for spec. output 1.5 V. Response 20-100,000 c/s. Feedback 20 dB. N.L. better than −75 dB. Out. imp. 3, 8 and 15 ohms. Output KT66s. Ultra-linear. Size 14 × 10 × 7 in. Weight 35 lb. To operate with PFA control unit. Price £33 10s.

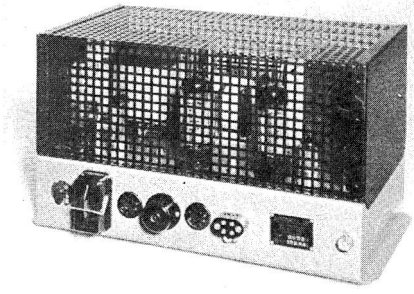
■**"Mullard" Stereo Control Unit.** Details as per Mullard 2-valve design. To operate with Goodsell "Mullard" amplifier. Price £16 15s.



Goodsell stereo III control unit

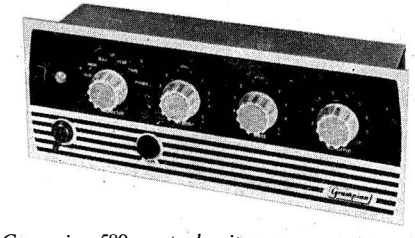


Goodsell Stereo II control unit



Goodsell GW25 amplifier

Grampian 582 control unit



Grampian 580 control unit

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

Grampian 582 Control Unit. Inputs: pickup 15 mV; radio 200 mV; tape 500 mV. Selector switch, bass, treble, vol. Size $10\frac{1}{4} \times 4 \times 5\frac{1}{2}$ in. Price £14. To operate with "Ten Fifteen" Amplifier.

Grampian 580 Control Unit. Similar to 582, but for crystal pickups. Sensitivity 600 mV, radio 500 mV. Price £8 5s.

Grampian 10-15 Amplifier. 10 watts nom., 15 watts peak. Dist. 0.1% at 10 watts. Input for spec. output 50 mV. Response 30-20,000 c/s ±1 dB. Feedback 20 dB. N.L. −65 dB below full output. Out. imp. 4, 8, 15 ohms. Output EL84s. Ultra-linear. Size $11 \times 7\frac{1}{2} \times 6\frac{1}{2}$ in. To operate with "580" and/or "582" control unit. Price £18.

■**Grampian 590/2 series.** Stereo Unit. 7 watts per channel, 10 watts peak. Dist. 1%. H and N −60 dB. Inputs: pickup 0.5 V at 1 Megohm, tuner and tape 1 V at 0.5 Megohm. Sel., switch, balance, bass, treble. Out. imp. 4 and 15 ohms. Size: chassis $10\frac{7}{8} \times 3\frac{7}{8} \times 13$ in., wood surround $12\frac{1}{4} \times 5\frac{3}{4} \times 13$ in. Price 590/2 (control unit and two 584 amplifiers), £32, wood surround £2.

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JASON ELECTRONIC DESIGNS Ltd., Kimberley Gardens, Harringay, London, N.4. Tel.: Stamford Hill 5477.

J10 Combined Control Unit and Power Amplifier. Inputs: mic. 1 mV; tape 0.5 V; radio 0.4 V; PU 1.0 V and crystal PU. 6-pos. sel., treble, bass, vol. P.a.t. 270 V at 10 mA, 6.3 V at 0.3 A. Output 10 watts nom., 15 watts max. Dist. 0.1%. Response 30-30,000 c/s ±2 dB. N.L. better than 55 dB (mic. input). Out. imp. 15 ohms (other imps. to order). Output EL84s. Ultra-linear. Size $11\frac{1}{4} \times 8\frac{1}{4} \times 4\frac{3}{8}$ in. Price £24.

■**J2-10. Integrated Stereo Amplifier, Mk. III.** Inputs: pickup 3 mV and 60 mV; tape 1.5 mV; radio 60 mV; mic. 5 mV. 5-position sel. switch; bass, treble, vol., balance, function, 9 Kc/s and 6 Kc/s filter. H.D. less than 0.1%. H and N −55 dB. Rumble filter. 10 watts per channel, 15 watts max. 18 dB feedback. Out. imp. 4, 8, 15 ohms. Output EL84s. Size $15 \times 4\frac{3}{8} \times 12$ in. Price £40 19s.

KERR McCOSH & Co. Ltd., 435 Sauchiehall Street, Glasgow, C.2.

■**DSI Stereo Control Unit.** Inputs: Pick-up and tape head 4 mV; crystal pickup and tape 140 mV; mic. 1.5 mV. Sel. switch; on/off; separate vol., treble, bass for each channel; flat/tone control. Tape record sockets. Size $12\frac{1}{2} \times 4\frac{1}{2} \times 10\frac{1}{4}$ in. Price £34.

C.W.A.10 Amplifier. 10 watts. Dist. 0.1% at 10 watts. N.L. −85 dB at 10 watts. Response, 25-30,000 c/s ±0.2 dB, 2-200,00 c/s ±1 dB. Out. imp. 7 and 15 ohms. Size $11\frac{1}{2} \times 7\frac{3}{4} \times 4\frac{1}{2}$ in. Price £24.

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H. J. LEAK & Co. Ltd., 57-59 Brunel Road, East Acton, London, W.3. Tel.: Shepherds Bush 1173. Cable: Sinusoidal, Ealux, London.

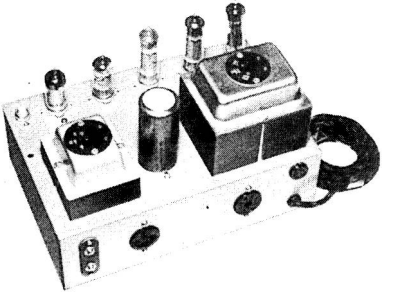
"Point One Plus" Control Unit. Inputs: tape 50 mV or mic. 4 mV; tuner 50 mV; PU 9.5 mV. 6-pos. sel., 4 record equal, treble, bass, vol., mains on/off. Switch filter 4, 6 and 9 Kc/s. Input level control for PU, tuner. Tape record and replay sockets on front and rear. H.D. <0.01%. H and N −66 dB. Size $11\frac{1}{2} \times 4\frac{7}{16} \times 5$ in. To operate with TL/12 Plus, TL/25 Plus or TL/50 Plus amplifier. Price £12 12s.

"Varislope III" Control Unit. Inputs: tape 50 mV or mic. 4 mV; tuner 50 mV; pickup I, 9 mV; pickup II, 9 mV. 6-pos. sel., 4 record equal and change-over switch for pickup I/pickup II. Treble, bass, vol., mains on/off. Switched low pass filter 4, 6 and 9 Kc/s plus Vari-slope control. Rumble filter cut/in. Input level controls for tuner, pick-up I, pickup II. Tape input sockets on front and back panels. H.D. <0.01%. H and N −66 dB. Size $11\frac{1}{2} \times 4\frac{7}{16} \times 5$ in. To operate with TL/12 Plus, TL/25 Plus, and TL/50 Plus amp. Price £15 15s.

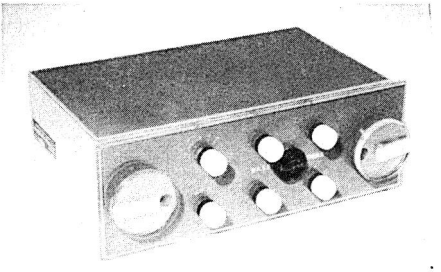
"Point One" TL/12 Plus Amplifier. 12 watts. Dist. 0.1%. Input for spec. output 125 mV. Response 20-20,000 c/s ±0.25 dB. Feedback 26 dB. N.L. −84 dB. Out. imp. 4, 8 and 16 ohms. Output EL84s. Ultra-linear. Size 10 × 8 × 6 in. To operate with Varislope III or Point One Plus control units. Price £18 18s.

"Point One" TL/25 Plus Amplifier. 25 watts. Dist. 0.1%. Input for spec. output 125 mV. Response 20-20,000 c/s ±0.25 dB. Feedback 26 dB. N.L. −83 dB. Out. imp. 4, 8 and 16 ohms (other imps. to order). Out-

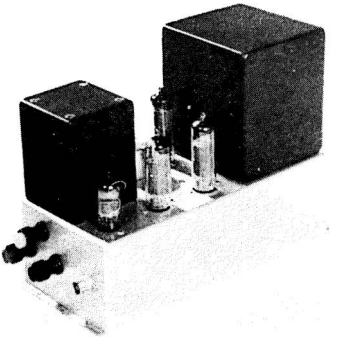
Grampian 590/2 *integrated stereo*



Grampian 10-15 *amplifier*



*Kerr McCosh DS*1 *stereo control unit*



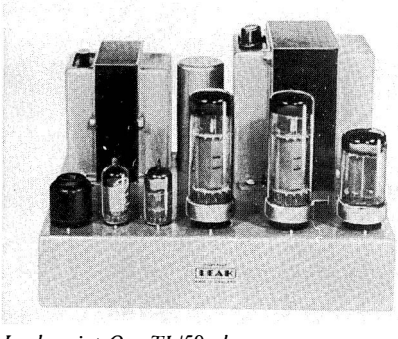
Kerr McCosh C.W.A. 10 *amplifier*

Jason J2-10 integrated stereo

Leak varislope III control unit

Leak Point One stereo C.U.

Leak Varislope stereo C.U.



Leak point One TL/50 plus

put EL34s. Ultra-linear. Size 10 × 8 × 6¾ in. To operate with Varislope 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/s ±0.25 dB. Feedback 26 dB. N.L. −84 dB. Out. imp. 4, 8 and 16 ohms (other imps. to order). Output KT88s. Ultra-linear. Size 11½ × 9 × 6¾ in. To operate with Varislope III or Point One Plus control units. Price £33 12s.

■**Varislope Stereo Control Unit.** Twin channel inputs: Pickup I, 3.5 mV or 35 mV; pickup II, 3.5 mV or 350 mV; tape 3 mV; tuner 50 mV or 250 mV; mic. 2 mV; extra 50 mV or 1 V (all mono and stereo), sel. switch. Function switch. Bass, treble, vol., on/off. Switched low pass filter 4, 6, 9 Kc/s plus Varislope control. Rumble filter cut/in. Balance control. Tape sockets for recording H.D. 0.01%. H and N −60 dB. Size 11½ × 4½ × 6½ in. To operate with any Leak amplifiers. Price £25.

■**"Point One Stereo" Control Unit.** Twin channel inputs for PU, 3.5 mV; tuner 50 mV, auxiliary 50 mV; tape head 3 mV; mic. 2 mV. Function 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 −60 dB. Size 11½ × 4 7/16 × 5 in. To operate with any Leak amplifiers. Price £21.

■**"Point One" Stereo 20 Amplifier.** 11 watts each channel. Dist. 0.1% on each channel. Input for spec. output 125 mV. Response 20-20,000 c/s. Feedback 24 dB. N.L. −80 dB. Out. imp. 4, 8 and 16 ohms. Output EL84s. Ultra-linear. To operate with "Point One Stereo" or "Varislope Stereo" control units. Price £30 9s.

■**"Point One" Stereo 50 Amplifier.** Details as for Stereo 20 but 25 watts each channel. Price £42.

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LEE PRODUCTS (G.B.) Ltd., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

Elpico AC88. Inputs: mic. 4 mV; radio, pickup and tape 100 mV. 10 watts nom., 16 watts max. Dist. 0.5% at 10 watts. Response 50-20,000 c/s ±3 dB. N.L. −55 dB. Out. imp. 3-15 ohms. Out. EL84s. Ultra-linear. Size 14 × 7½ × 8 in. Price £25 4s.

■Dulci SP-55 Amplifier. Input sensitivity: 200 mV for 3 watt output per channel. Output 8 watt peak (4 watts per channel). H.D. better than 0.5% total harmonic content. H and N −70 dB. Response ±1 dB from 40-25,000 c/s. Size 11½ × 6 × 7½ in. Weight 13 lb. 12 oz. To operate with Stereo-Five preamplifier control unit. Price £15 15s.

Dulci DPA-15 Amplifier. 12 watts nom., 15 watts max. H.D. total harmonic below 0.3% at 10 watts. Response at 1 watt within 5 dB 3-50,000 c/s, at 10 watts within 1 dB 30-15,000 c/s. H and N 75 dB below 10 watts. Out. imp. switchable 3-5, 6-8, 12-16 ohms. Output EL84s. Ultra-linear. Size 11⅛ × 6 × 7½ in. To operate with DPA-15 control unit. Price £15 15s.

■Dulci GA-505. Integrated Stereo Amplifier. 4 watts nom., 5 watts per Channel max. H.D. better than 1% at 4 watts per channel. N.L. −55 dB. Out. imp. 3 or 15 ohms. Output two ECL86s. Power supply required A.C. 230 V, 40-60 cycles. Size 12¾ × 3¾ × 6½ in. Price £18 18s.

■Stereo-Five Control Unit. Inputs: radio and tape 100 mV; pick-up 50 mV −2 volts (adjustable); radio and tape 250 K ohms; pick-up 1 megohm (for low sensitivity pick-ups the TA-6 Transistor Pre-amplifier plugs into the back of the Stereo-Five). Separate bass, treble, balance and volume controls together with six-position selector switch. Size 12¾ × 3½ × 5 in. Price £11 11s. To operate with two DPA-15 or SP-55 amplifier.

DPA-15 Control Unit. Inputs: microphone 1.5 mV, 2 meg.; tape replay 100 mV, 100 K ohms; radio 1, 100 mV, 100 K ohms; radio 2, 300 mV, 560 K ohms. Separate bass, treble and volume control together with six-position selector switch. Size 12¾ × 3¾ × 5½ in. Price £9 9s. To operate with DPA-15 amplifier.

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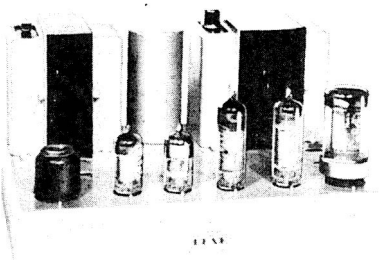
LOWTHER MANUFACTURING Co., Lowther House, St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

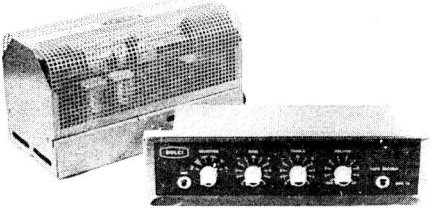
Lowther No. 2 Control Unit. Inputs: mic. 15 mV; PU 15 mV; radio 250 mV. 4-pos. sel., treble, bass, vol., on/off. Mic./tape input socket. H.D. 0.1% on 1 V R.M.S. H and N −60 dB. Size 10¼ × 2½ × 3½ in. To operate with LL15. Price £10 10s.



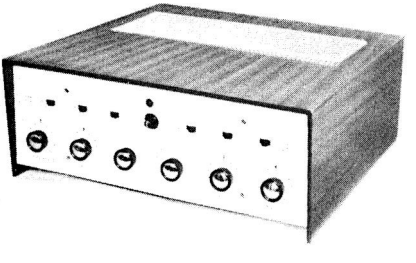
Leak Point One TL/12 plus

Dulci Stereo-Five control unit

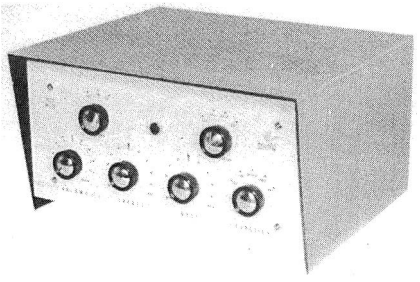
Dulci GA505 integrated stereo



Dulci DPA 15 C.U. and amplifier

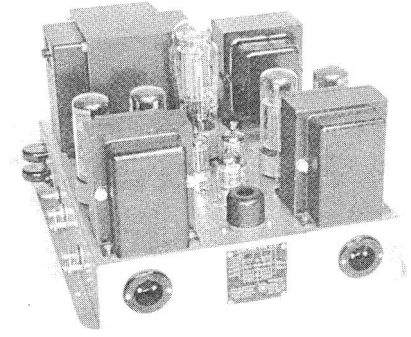


Lowther Integrated stereo

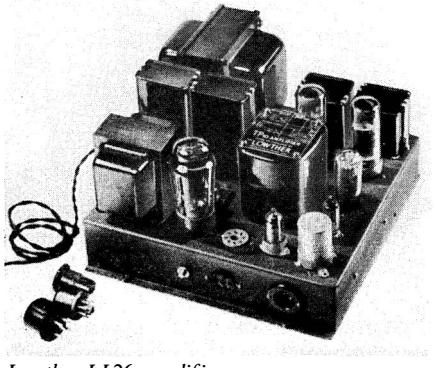


Lowther Mk. 1V control unit

Lowther LL15 amplifier



Lowther LL15S stereo amplifier



Lowther LL26 amplifier

Master Control Unit Mk. II. Inputs: mic., PU and tape head 3 mV; radio, tape and 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 −90 dB. Size $10\frac{1}{2} \times 5\frac{1}{2} \times 7\frac{1}{2}$ in. To operate with LL15, LL26 and similar power amp. Price £24.

Lowther LL15 Amplifier. 16 watts. Dist. <0.1%. Input for spec. output 0.75 V. Response 20-40,000 c/s ±1 dB. Feedback 20 dB. N.L. −85 dB. Out. imp. 16 ohms with adjustment. Output EL34s. "Lowther Linear" (screen and anode feedback). P.a.t. Size 12 × 6 × 6 in. To operate with MCU Mk. IV or control unit No. 2. Price £27 10s.

Lowther LL26 Amplifier. 26 watts. Dist. <0.1%. Input for spec. output 0.75 V. Response 20-70,000 c/s ±1 dB. Feedback 22 dB. N.L. −85 dB. Out. imp. 16 ohms with adjustment. Output EL34s. "Lowther Linear". Size 11 × 12 × $7\frac{1}{2}$ in. Weight 33 lb. To operate with MCU Mk. IV. Price £47.

Lowther Mk. IV Control Unit. Inputs: mic. 3 mV; pickup 3 mV −300 mV; radio and aux. 100 mV. 5 pos. sel., vol., bass, treble, filter, equalisation. Filters: 9, 7 and 4.5 Kc/s. H.D. >0.5%. H and N −65 dB. Output cathode follower 1 V r.m.s. To operate with Lowther LL15 Mk. 1. Size $10\frac{1}{4} \times 4\frac{5}{8} \times 7$ in. Price £20.

■**Lowther Mk. I Stereo Control Unit.** Input as for Master Control Unit Mk. IV. Tape input sockets. H.D. 0.1%. Dual low pass filters. Dual output balanced and balance controls between channels. Size as MCU Mk. IV. To operate with LL15S power amp. Price £40.

■**Lowther LL15S Stereo Amplifier.** 15 watts output on each channel. Dist. 1%. Input for spec. output 0.75 V. Response 20-40,000 c/s ±1 dB. N.L. −85 dB. Out. imp. 8.4 or 16 ohms. Output EL34. "Lowther Linear". Size 11 × 12 × $7\frac{1}{2}$ in. To operate with SCU Mk. I control unit. Price £47.

■**Lowther Integrated Stereo Amplifier.** 10 watts per channel. Inputs: mic. 2 mV, pickup 2 mV; tape 100 mV; radio 100 mV; aux. 100 mV. H.D. 0.2% at 10 watts. Response 30-30,000 c/s ±1 dB. N.L. −45 dB. Output imp. 16 ohms. Price £60.

ORTOFON A/S, 5 Trommesalen, Copenhagen V. U.K. distributors: Metro-Sound (Sales) Ltd., 19a Buckingham Road, London, N.1. Tel.: Clissold 8506. Cable: Metrosound London.

■KS601 Integrated Stereo Amplifier. Pre-amp. details: Inputs F.M., tape, aux. 100 mV; mic. 2 mV; pickup 2 mV at 1 Kc/s. Controls selector switch, mono/stereo, volume, balance, bass, treble. Filter high pass 20-10 c/s (adjustable).

Power amp. details: Output 15 watts per channel. Distortion less than 1%. Response 20 c/s-20 Kc/s ±1 dB. Feedback 20 dB. Noise 7 mV at 3 ohm output. LS matching 3, 7 and 16 ohms. Output stages, two 6973s per channel. P.s.n. 220 V A.C. on request 110 V A.C. Price £95.

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PAMPHONIC REPRODUCERS Ltd., Westmoreland Road, London, N.W.9. Tel.: Colindale 7131.

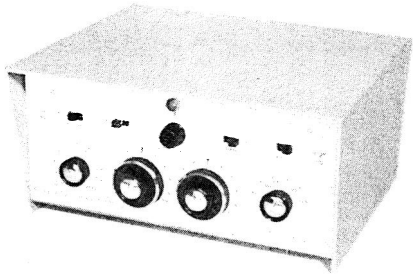
1002B Control Unit. Inputs: mic. 2-3 mV; radio/tape 60 mV; PU 6-8 mV. Push-button sel. 9 pos. (6 gram.). Cut off filter 4, 7, 12 Kc/s and "out". Terminals for tape input. H and N 60 dB below 0.5 V. Size $10\frac{1}{4} \times 4\frac{1}{4} \times 7\frac{1}{2}$ in. To operate with 2001 power amp. Price £25 4s.

2001A Control Unit. Inputs: 3-120 mV depending on input. 6-pos. sel. Pre-set 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 0.5 V. To operate with 2001 power amp. Price £12 12s.

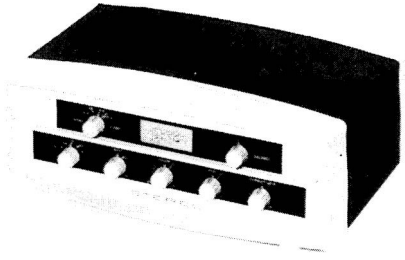
2001 Amplifier. Mono. Output 25 watts. Dist. at 1,000 c/s, 0.05% at 15 watts. Input for spec. output 0.5 V. Response substantially flat 2-100,000 c/s. Feedback 28 dB. N.L. 90 dB below full output. Out. imp. 3.75, 6.6, 10 and 15 ohms. Output KT66s. Ultra-linear. To operate with 2001A or 1002B control units. Price £29 8s.

■3000 Stereo Amplifier. Output 7.5 watts per channel. Dist 0.5%. Inputs: radio 1 V; tape 0.5 V; pickup crystal stereo. Response. 50-15,000 c/s. Feedback 20 dB. N.L. −57 dB. Out. imp. 15 ohms each channel. Ultra-linear. Size $14 \times 9\frac{3}{4} \times 4\frac{1}{2}$ in. Price £31 10s.

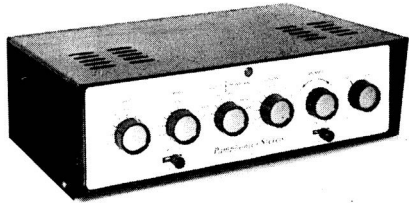
■Stereo Amplifier Model 3001. Output 7.5 W. Distortion 0.5% at 1 Kc/s. 6 W. F.R. 40 c/s-20 Kc/s ±1 dB. H & N −60 dB (all input sockets). Inputs: mag. pu. 4-6 mV, 56 K: crystal pu 150 mV, 780 K: tape or radio 1, 400 mV, 100 K: tape or radio 2, 1 V, 100 K. Out. imp. 15 ohms. Output stages EF 86,



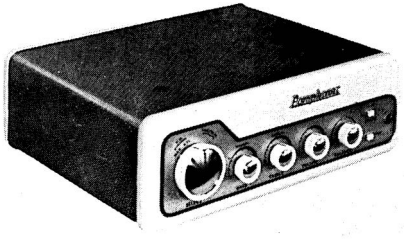
Lowther Stereo control unit



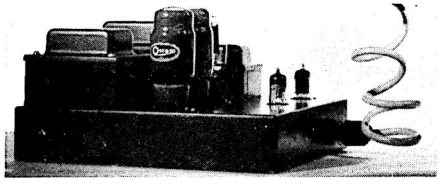
Ortofon KS601 integrated stereo



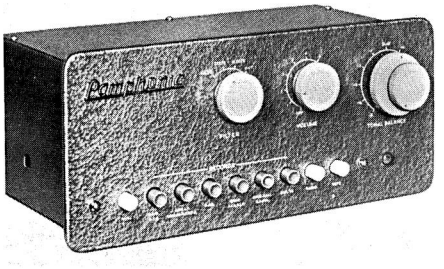
Pamphonic 3000 integrated stereo



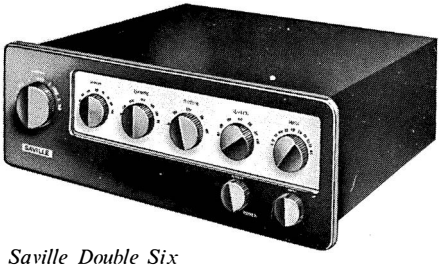
Pamphonic 3001 integrated stereo



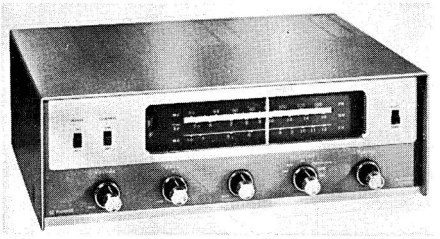
Pamphonic 2001 amplifier



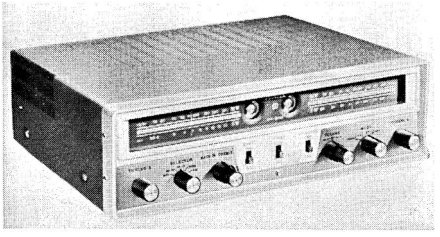
Pamphonic 1002*B control unit*



Saville Double Six



Pioneer FM-B 100



Pioneer 6*M-Q*141

*Pye Mozart HF*10 *amplifier*

ECC 81, ECL 82 (2) per channel. Controls: bass, treble, volume, balance, sel. Free-standing, or mounted in cabinet. Size 13 × 10¼ × 4¼ ins. Weight 18½ lbs. Price £38 10s.

★

PERIOD HIGH FIDELITY Ltd., 28 South Street, Mayfair, London, W.1. Tel.: Grosvenor 4686.

■**Saville Double Six. Integrated Stereo Amplifier.** Inputs: pickup 5 and 100 mV; tape 100 mV; tuner 100 mV; mic. 4 mV. 6-pos. sel., bass, treble, balance, vol. controls. H.D. <0.25% at 1 Kc/s 4 watts. H and N better than −55 dB (main amp. better than −70 dB relative to nominal output. 6 watts per channel. Response 25-25,000 c/s ±1 dB, ref. 1 Kc/s. Low pass filter 5, 7 and 10 Kc/s. Filter slope control. 12 dB feedback. Out. imp. 15 ohms or to order. Output ECL83s. Ultra-linear. Size 13 × 8 × 3¾ in Price £38 17s.

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PIONEER Electronics Corporation. Distributors: B. Adler & Sons (Radio(Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606. Cables: Reldab.

■**SM-Q141.** Combined stereo amplifier/tuner. Output 14 W. Distortion less than 1%. F.R. 40 c/s-100 Kc/s ±1 dB. N.L. pu over 45 dB; aux. over 50 dB. Output imp. 4, 8, 16 ohms. Output stages 6BQ5 single, 2 channels. P.s.n. 200-250 V. AM/FM variable tuning. F.R. (AM) 535-1605 Kc/s, 3.8-12 Mc/s; (FM) 80-108 Mc/s. A.F.C. Foster-Seeley discriminator. M.E. Multiplex conversion facilities. Aerial imp. 300 ohms. Size 16 4/5 × 13 3/5 × 5 3/5 in Price approx. £70 including purchase tax.

FM-B100. Combined mono amplifier/tuner. Output 10 W. Distortion less than 1%. F.R. 20 c/s-30 Kc/s ±1 dB. N.L. −75 dB at 8 W. Output imp. 4, 8 ,16 ohms. Output stages 2 × 6 BM8 push/pull. P.s.n. 200-250 V, 50 c/s. AM/FM variable tuning. F.R. (AM) 535-1605 Kc/s, 3.8-12 Meg; (FM) 80-108 Mc/s. A.F.C. Foster-Seeley discriminator. M.E. Multiplex conversion facilities. Aerial imp. 300 ohms. Size 10½ × 10⅝ × 4¾ ins. Price £49 plus tax.

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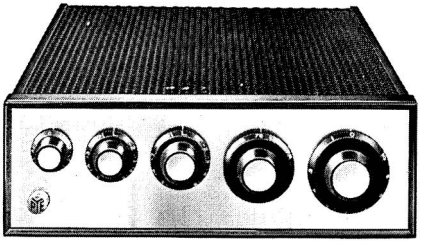
PYE LIMITED, High Fidelity Division. P.O. Box 49, Cambridge. Tel.: Cambridge 58985. Cables: Pyrad, Cambridge.

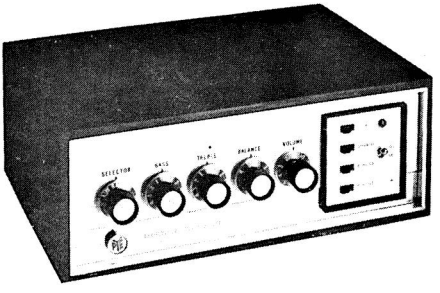
HF10 Mozart Self-contained Control Unit and Power Amplifier. Inputs: tape 100 mV; radio 100 mV; PU 15, 8 and 8 mV on each of the 3 curves at 1,000 c/s, special compensation

for all makes of PU. 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/s and 9 watts. H and N main amp. −70 dB; tape, radio −60 dB; PU −55 dB. Output 10 watts nom. Response 3-70,000 c/s ±3 dB. Feedback 3 main loops over output stage 5, 8 and 14 dB. Out. imp. 4, 8 and 15 ohms. Output one EL34. Integrated single-ended ultra-linear. Size $10\frac{1}{2} \times 3\frac{1}{2} \times 5\frac{1}{2}$ in. Price £23 12s. 6d. Also available in metal case for shelf mounting. HF10M £25 4s.



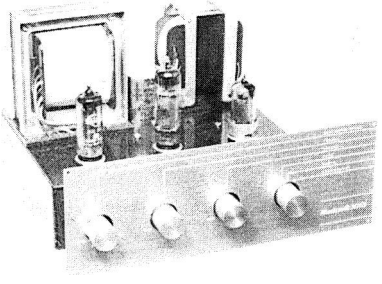
Pye Mozart Stereo HFS20

■**Mozart Stereo Amplifier and Control Unit. HFS20.** Inputs: pickup 7 mV; radio and tape 100 mV. Col., bass, treble, balance, on/off, selector switch. H and N −58 dB. 8 watts per channel nominal, 9 watts max. Dist. 0.2%. Response 20 c/s-20 Kc/s ±2 dB. Feedback 34 dB. Out. imp. 4, 8 and 15 ohms. Output EL34. Size 4 × $10\frac{1}{2}$ × 11 in. Price (chassis) £36 15s.; (metal cased) £38 6s. 6d. Mounted in cabinet with provision for motor (HFP3) £47 5s.



Pye HS30T stereo amplifier

■**HFS30T.** Integrated transistorised stereo amplifier. Output 15 W at 15 ohms, 18 W at 8 ohms. Distortion 0.7% total at 10 W, 1% at 15 W, over range 50 c/s-8 Kc/s. F.R. 15 c/s-35 Kc/s (pre-amp), 30 c/s-20 Kc/s (power amp). N.L. −65 dB (pre-amp), −95 dB (power amp). LS imp. 15, 8 ohms. P.s.n. 110-250 V, 50-60 c/s. Inputs: mag. pu. 7 mV; crystal/ceramic pu 120 mV; radio, aux. 100 mV. Controls: bass, treble, loudness, balance, high pass and low pass filters, mono/stereo switch. Low pass filter 6 dB/octave from 5 Kc/s; high pass filter −3 dB at 50 c/s, slope increasing to 12 dB/octave. Available as chassis $11\frac{1}{2} \times 3\frac{1}{2} \times 8\frac{1}{4}$ ins. behind front panel; or in veneered box $12\frac{3}{4} \times 4\frac{3}{4} \times 8\frac{3}{4}$ ins. Price on application.



Musicraft MM3

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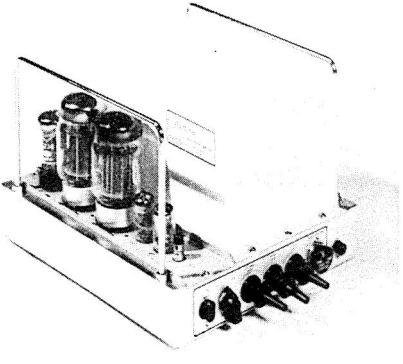
MUSICRAFT Audio Products Ltd., 13 King Street, Richmond, Surrey. Tel.: Richmond 6798.

M.M.3. Integrated mono amplifier. Output 3 W. Distortion 1%. F.R. 35 c/s-30 Kc/s. Feedback 20 dB. N.L. −55 dB. Output imp. 15 ohms. Output stages EL84. P.s.n. 230 V AC. Inputs: pickup, radio, tape 100 mV. Controls: sel, bass, treble, volume. Free standing. Size 8 × 6 × 6 ins. Price £15 15s. 0d.



Radford MA25 Mk. 2 amplifier

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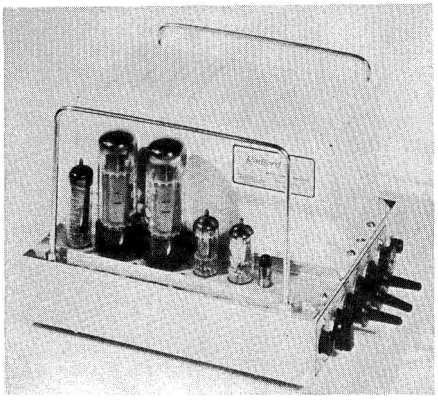
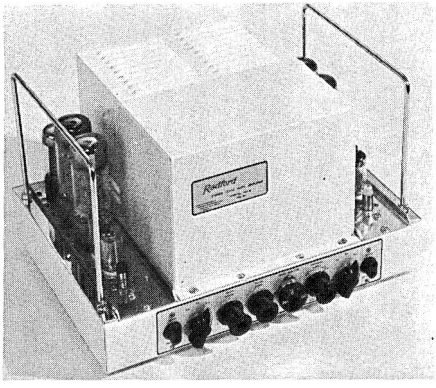
RADFORD ELECTRONICS Ltd., Ashton Vale Estate, Bristol 3. Tel.: Bristol 662301/2.

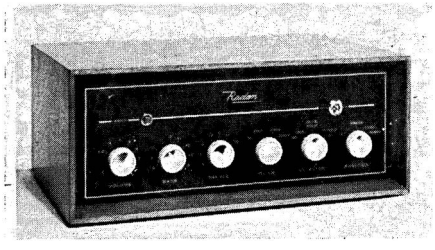
MA 15 Mk. 2. Amplifier. 15 watts nom. H.D. 0.05% at 15 watts. Input for spec.



Radford MA 15 amplifier



Radford STA 15 stereo amplifier



Radon R 600S integrated stereo

output 500 mV. Response 20-20,000 c/s ±1 dB. Feedback 25 dB. N.L. better than 90 dB down on nominal output. Out. imp. 4, 8 and 16 ohms. Output EL34. Ultra-linear. Self-powered. Size 8 × 9¾ × 7¼ in. To operate with SC2 and SC3 control units. Price £23 10s.

MA 25 Mk. 2. Amplifier. Output 25 watts nom. 35 watts max. H.D. 0.05% at 25 watts. Input for spec. output 500 mV. Response 20-20,000 c/s ±1 dB. Feedback 26 dB. N.L. −90 dB in rated output. Out. imp. 4, 8 and 16 ohms. Output KT88. Ultra-linear. Self-powered. Size 9 × 10¾ × 8 in. To operate with SC2 and SC3 control units. Price £29 10s.

STA 15 Stereo Amplifier. Identical spec. per channel as MA 15 Mk. 2. Size 13½ × 9 × 7¾ in. Price £38 10s.

SC2 Stereo Control Unit. Inputs: Pickup 4 mV 68 K.; Aux. 1; 100 mV or 250 mV/250 K. appr.; aux. 2, 250 mV or 500 mV/250 K appr. Output 500 mV. Controls: treble, bass, volume, balance. Push button selection. Filters, high pass 35 c/s, low pass 7 Kc/s. Response 40 c/s-20 Kc/s ±1 dB. N.L. Better than 65 dB. P.s.n. 5 mA 300 V, 1.2 A, 6.3 V. Cathode follower outputs, channel-to-channel fade balance control. To operate with STA 12, STA 15, STA 20, STA 40, or two MA 15 Mk. 11 and MA 25 Mk. 11. Sizes 8½ × 10½ × 3¾ in. Price £27 10s.

SC 3 Stereo Control Unit, three channel. Inputs: pickup and mic. 3 mV 68 K.; tap mon. 500 mV; aux. 1, 100 mV or 250 mV; aux. 2, 250 mV or 500 mV/250 K appr. Output 500 mV. Controls: treble, bass, volume −L and R pre-set gain. 3rd channel gain. Push button selection. Filters, high pass 35 c/s, low pass 7 Kc/s. Response 40 c/s-20 Kc/s ±1 dB. N.L. better than 65 dB. P.s.n. 7 mA. 300 V, 1.8 A. 6.3 V. Composite 3rd channel with separate gain control. Cathode follower output on all three channels. To operate with three power amplifiers, or one mono amplifier and one dual amplifier. Size 8½ × 10½ × 3¾ in. Price £34.

STA 20 Stereo Power Amplifier. Output 30 watts per channel. Distortion 0.05%. Response 20 c/s-20 Kc/s ±1 dB. Feedback 26 dB. N.L. −20 dB. Input less than 500 mV. LS matching, 4, 8, 16 ohms. Output stages 2 × EL34. Self powered. To operate with any pre-amp. Price £67 10s.

STA 40 Stereo Power Amplifier. Output 60 watts per channel. Distortion less than 0.1%. Response 20 c/s-20 Kc/s ±1 dB. Feedback 26 dB. N.L. −20 dB. Input less than 500 mV. LS matching, 4, 8, 16 ohms. Output stages 2 × KT 88. Self-powered. To operate with any pre-amp. Price £85.

ISTA 30. Stereo amplifier. Output 30 W. Continuous rating at less than 0.1% distortion and 40 W continuous rating at less than 1.0% distortion, mid-band frequencies. Power response 30 W at less than 1% distortion from 20 c/s-15 Kc/s. Input 250 mV- 4 V pre-set gain, 40 W output. Output 4, 8, 16 ohms. Mains input 105-140 V, 210-260 V; 50-60 c/s. Price £67 10s.

ISTA 60. Stereo amplifier. Output 60 W continuous rating at less than 0.1% distortion and 75 W continuous rating at less than 1.0% distortion, mid-band frequencies. Power response 60 W at less than 1% distortion from 20 c/s to 15 Kc/s. Input 250 mV-4 V pre-set gain, 75 W output. Output 4, 8, 16 ohms. Mains input 105/140 V, 210/260 V; 50-60 c/s. Price £85.

SC5. All transistor stereo control unit. Sensitivity 4 mV for 2 V output. Pre-set gain on each channel. Suitable for driving any power amplifier requiring up to 2.5 V input. Low distortion and noise. Usual input facilities. Energised from amplifier power supply or battery. Price £27 10s.

SC5M. As SC5 but includes power supply for mains operation. Price £32 10s.

SC 4-20. Integrated stereo amplifier. All transistor. Output 20 W at 0.1% distortion. 25 W at 1.0% distortion per channel. Input sensitivity 5 mV and 100 mV disc. 100/500 mV aux. Price £55.

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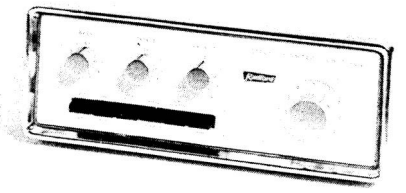
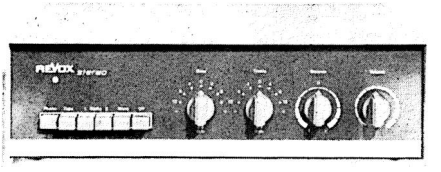
RADON Industrial Electronics Co. Ltd., Brooklands Trading Estate, Orme Road, Worthing, Sussex. Tel.: Worthing 1063. Cables Radon, Worthing.

R. 600S Integrated Stereo Amplifier. Pre-amp. details: inputs tape 2.5 mV, 1 K; aux. 100 K or 1 K. Crystal pickup 6 K. Mag. pickup 100 K. Output 10 watts. Free-standing. Power amp. details: distortion 0.15% at 10 watts; 0.07% at 4 watts. Response 20 c/s-20 Kc/s. Feedback 65 dB. N.L. 75 dB below full output power with input shorted. LS matching, 15 ohms. Output stages AD1405 in push pull. Size 14 × 10 × 6 in. Price £42 2s.

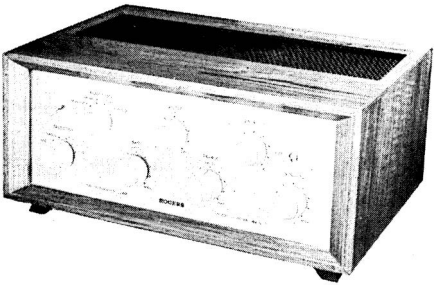
R. 610M Integrated Mono Amplifier. Pre-amp. details: tape 2.5 mV, 1 K.; aux. 100 K or 1 K.; crystal pickup 6 K.; mag. pickup 100 K. Output 10 watts. Controls: volume, bass, treble, filter, selector. Filters, low pass 6 Kc/s, 10 Kc/s, 20 Kc/s. Free-standing. Power amp. details: distortion 0.15%; response 20 c/s-20 Kc/s ±1 dB and above. Feedback 65 dB. N.L. 75 dB below full output power with input shorted. LS matching, 15 ohms. Output stages AD 140s in push pull. Fully transistorised and integrated in wood case. Size 14 × 10 × 6 in. Price £35 14s.



Radford SC 2 Stereo control unit



Revox Model 40 integrated stereo



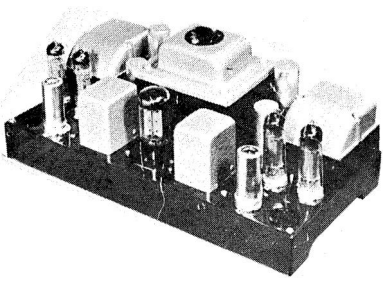
Rogers HG 88 Mk. II integrated stereo

Rogers RD Cadet II stereo control unit

REVOX (U.K. Concessionaires) Ltd., 296 Kensington High Street, London W.14. Tel.: Western 4343.

Model 40 Integrated Stereo Amplifier. Pre-amp. details: inputs: pickup 5 mV, 100 K.; tape 1.2 V, 300 K; radio 150 mV, 220 K. Controls: bass, treble, 7 stages of 4 dB at 50 c/s and 10 Kc/s ±12 dB. Push button

Rogers RD Junior III stereo C.U.



Rogers RD Junior Stereo amplifier

inputs: pickup, tape, radio 1 and 2, mono. Free-standing. Power amp. details: output 10 watts per channel, 12.5 watts peak; distortion less than 0.5% at 10 watts, 1 Kc/s. Response 30 c/s-20 Kc/s ±1 dB. N.L. better than −60 dB relative to 5 mV pickup input. LS matching, 4, 8 or 16 ohms. P.s.n. about 80 watts. Size 16 × 10 × 5 in. Price £50 8s.

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ROGERS DEVELOPMENT (Electronics) Ltd., 4-14 Barmeston Road, Catford, S.E.6. Tel.: Hither Green 7424 and 4340. Cables: Rodevco, London, S.E.6.

RD Cadet Mk. II Mono Control Unit. Inputs: disc. flat 10 and 200 mV, disc. comp. 8 and 160 mV; radio 40 and 200 mV; tape 100 mV; aux. 5 and 20 mV; Push button selector, bass, treble, filter, volume—On/Off. Tape panel socket. Size 8½ × 5¼ × 5 in. To operate with RD Cadet Mk. II mono amplifier. Price £11.

RD Cadet Mk. II Mono Amplifier. 7 watts. Harmonic distortion 0.25%. Input sensitivity for 7 watts 600 mV. Feedback, 20 dB. Hum and noise 0.75 dB below 7 watts. P.a.t. 250 V at 40 mA, 6.3 V at 2.2 A. Out. imp. 4, 8 and 16 ohms. Output ECL86s. Size 12¾ × 4¼ × 4½ in. To operate with RD Cadet Mk. II mono control unit. Price £12.

■RD Cadet Mk. II Stereo Control Unit. Inputs: disc. 75 mV; radio 75 mV; tape 75 mV. Push-button selector, bass, treble, function and balance. Volume and separate On/Off switch. Size 8½ × 5¼ × 5 in. To operate with RD Cadet Mk. II Stereo amplifier. Price (including amplifier) £26 15s.

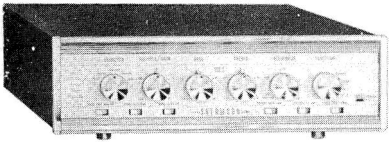
■RD Cadet Mk. II Stereo Amplifier. 6 + 6 watts. Harmonic distortion 0.25%. Peak output 7 + 7 watts. Response 20-20,000 c/s ±1 dB. Out. imp. 4 or 16 ohms. Feedback: 18 dB. Hum and noise 75 dB below 6 watts. Output: ECL86s. Size 12 × 6 × 4¼ in. to operate with RD Cadet Mk. II Stereo control unit. Price (including control unit) £26 15s.

■RD Junior Mk. III Stereo Control Unit. Inputs: disc. 4 or 80 mV. RIAA or flat. Provision second mono pickup. Tape: 4 mV (CCIR) 25 mV (flat) radio: 100 mV, aux. 2.5 or 30 mV. Panel socket for tape record and replay, mic. Push-button selector, bass, treble, filter, function, balance, volume and On/Off. Hi-pass filter. Mono/stereo disc switch. Output: ECC83s. Size 11¾ × 7¼ × 5½ in. To operate with RD Junior stereo amplifier. Price £22 10s.

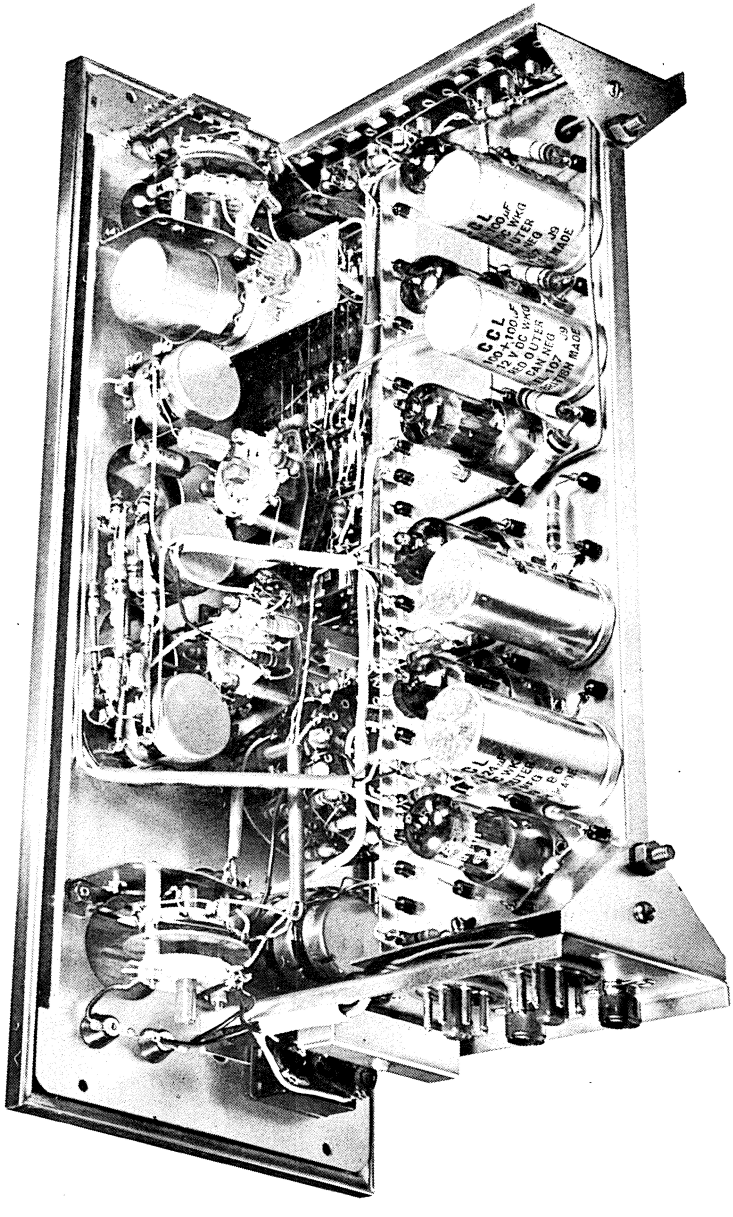
■RD Junior Stereo Amplifier. 12 + 12 watts nominal 15 + 15 watts peak. Harmonic distortion 0.2% at 12 watts. Input sensitivity 750 mV for 12 watts. Response, 20-20,000 c/s ±0.25 dB. Feedback 20 dB. Hum and noise: 0.85 dB below 12 watts. Out. imp. 4, 8 or 16 ohms. Output: ECC83s. Size 14 × 8 × 5⅜ in. To operate with RD Junior Mk. III stereo control unit. Price £27 5s.

■HG88 Mk. II Combined Stereo Amplifier and Control Unit. 12 + 12 watts. 14 + 14

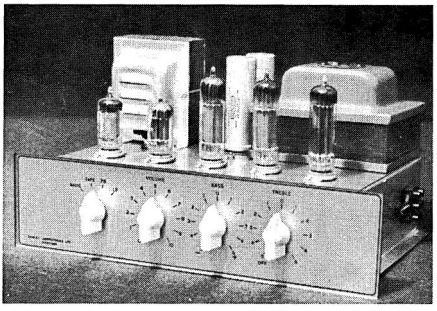
Sherwood S 5500 II integrated stereo



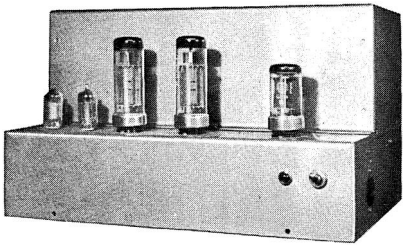
Sherwood S-5000 II integrated stereo



Underside of Rogers HG88 Mk II integrated stereo amplifier



Shirley Jupiter SB/1-15E



Shirley SB/7-30s amplifier

watts peak output. Harmonic distortion 0.25% for 12 watts. Hum and noise: 80 dB below 12 watts. Response, 30-20,000 c/s ±1 dB. Feed-back: 16 dB. Out. imp. 4, 8 or 16 ohms. Inputs: disc. 4 or 80 mV (RIAA) 6 or 120 mV (flat) radio 120 mV tape 4 or 20 mV (CCIR) 20 or 120 mV (flat). 5-position selector. Function, bass, treble, filter, volume, On/Off, balance. Size 15⅝ × 10¾ × 7 in. Price: Chassis £40; Teak case model £43 10s.

■**Master Stereo Control Unit Mk. II.** Remote Balance/Volume control unit, with comprehensive range of facilities. Price to be announced.

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H. H. SCOTT, 111 Powdermill Road, Maynard, Mass., U.S.A. U.K. distributors: Elstone Electronics Ltd., Edward Street, Templar Street, Leeds 2. Tel.: Leeds 35111.

■**299C Integrated Stereo Amplifier.** Pre-amp. details: inputs: tape (NARTB corrected) 3 mV; mag. pickup 3 mV or 9 mV; radio and aux. 0.5 V. Controls: treble, bass, volume. Filters, high pass 20 c/s, low pass 5 Kc/s. Response 20 c/s to 20 Kc/s. Noise −80 dB high level input, equiv. to 10 μV on low level. Derived centre channel provided. Free-standing. Power amp. details: output 20 + 20 watts. Distortion 0.8%. Response 20 c/s-20 Kc/s ±1 dB. Noise −80 dB. Input 3.0 mV. LS matching, 4, 8 or 16 ohms. Output stages, 7591s (2 for each channel). P.s.n. 210-250 V A.C. Size 15½ × 5 × 13 in. Price £142 16s. (Cabinet extra.)

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SHERWOOD Electronic Laboratories Inc., U.K. distributors: Audioson Ltd., Orchard House, Orchard Street, London, W.1. Tel.: Mayfair 5431.

S-5000 II Integrated Stereo Amplifier. Pre-amp. details: inputs: tuner 0.25 V; tapehead 1.6 mV; pickup 1.2 mV. Controls: sel., balance/gain, bass, treble, loudness, function. Switches: tape monitor, Hi-filter, Lo-filter, phase reverse, presence-rise. Response 20 c/s-20 Kc/s ±½ dB. H. and N.: tuner −90 dB, pickup −72 dB. D.C. filament supply. Free-standing but can be mounted. Power amp. details: output 80 watts music power. (Each channel, 40 watts music power, 36 watts continuous, 72 watts peak.) H. D. less than 0.6%. Feedback 16 dB. LS matching, 4, 8, 16 ohms. Output stages, four 7868s. Self-powered 220-240 V. Size 14 × 4 × 13½ in. Price £79 10s. without case. Walnut-tone leatherette case £2 10s.

S-5500 II Integrated Stereo Amplifier. Like the S-55000 II, but output 64 watts music power. (Each channel 32 watts music power, 30 watts continuous, 60 watts peak), and no presence-rise. Price £67 10s.

■**S-8000 II.** Combined stereo amplifier/tuner. Output 30 W. IM distortion .1½%. Full range of inputs and controls. FM sensitivity: 1.8 μV for −30 dB distortion and noise. Flywheel tuning, interchannel hush circuitry, stereo indicator light. Size 16¼ × 4 × 14 ins. Price £138 10s.

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SHIRLEY LABORATORIES Ltd., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

Jupiter SB/1-15E Self-contained Control Unit and Power Amplifier. Inputs: radio, tape, PU 78 and L.P. Output 15 watts nom. 25 watts max. Input approx. 10 mV for 15 watts. Treble, bass, vol. Response 45-35,000 c/s ±1 dB. N.L. −80 dB. Dist. 0.2% at 10 watts and 1,000 c/s. Out. imp.

15 ohms or as requested. Output EL84s. P.a.t. 250 V at 35 mA, 6.3 V at 2 A. Size 10 × 7 × 6½ in. 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/s ±1 dB. Output EL34s. Price £33 12s.

■PA 4/86 Stereo Control Unit. Inputs: pickup 3 and 50 mV; radio 100 mV; tape 3 mV and 0.5 volts, selector switch, bass, treble, volume, balance. H.D. 0.1%. H and N −58 dB. Price £21 1s. To operate with SF/10 amplifier, or two SB/7-30.

SB/7-30s Amplifier. 20 watts nominal, 35 watts max. Dist. 0.1%. Input for spec. output 2.5 volts. Response 34-40,000 c/s ±0.3 dB. N.L. −80 dB. Out. imp. 15 ohms. Output EL34. Ultra-linear. Size 11 × 7½ × 8 in. Price £29 8s.; 28 watt version £32 11s. To operate with PA 4/86 Control Unit.

■2SB/10. Integrated Stereo Amplifier. Inputs: magnetic and crystal pickup; tape direct from high impedance head and from tape recorder; radio. Sel. switch, bass, treble, volume, balance controls. 7 watts per channel. Output ECL86s. Price £45 3s.

■2SB/12. Integrated Stereo Amplifier. 12 watts per channel, 20 watts peak. Output EL84s. Other details at 2SB/10. Price £48 6s.

■2SB/50. Integrated Stereo Amplifier. 25 watts per channel, 40 watts peak. Output KT88s. Response 35-35,000 c/s ±1 dB at 25 watts. Dist. 0.05% at 25 watts. Other details as 2SB/10. Price £84.

■SF/10. Integrated Stereo Amplifier. Inputs: pickup, radio, tape from head, tape recorder, mic. Equalization for two or three tape speeds. Output 12 watts per channel, 18 watts peak. Dist. 0.1%. Treble and bass lift and cut. Facility for playing on both channels from monaural source. Independent controls throughout. Price £57 15s.

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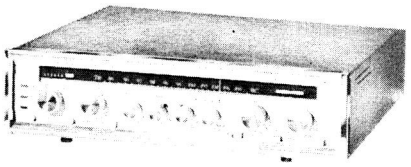
H. L. SMITH & Co. Ltd., 287/289 Edgware Road, London, W.2. Tel.: Paddington 5891/7595.

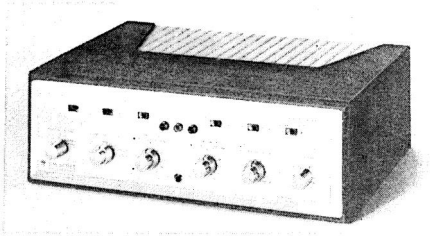
Cooper-Smith Mk. II Control Unit. Inputs: radio 100 mV; PU 3 mV variable; mic. 1.5 mV; tape 100 mV. 6 pos. sel. (3 record equal.), treble, bass, vol. on/off. Switch filter 6, 8 and 10 Kc/s. Co-axial tape replay switch. H.D. 0.1% or less at 1,000 c/s. H and N −80 dB. Rumble filter 12 dB cut at 30 c/s. Size 10 × 3½ × 6½ in. To operate with B.P.I. power amp. Price kit £7 17s. 6d. Assembled and tested £10 17s. 6d.

Cooper-Smith B.P.I. 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/s ±1 dB. Feedback 18 dB. N.L. 90 dB below max. output. Out. imp. 3.75 and 15 ohms. Output 6BQ5s or EL84s. Ultra-linear. Size 12 × 7 × 7½ in. To operate with Cooper-Smith Mk. II control unit. Price kit £12 5s. Assembled and tested £14 5s.

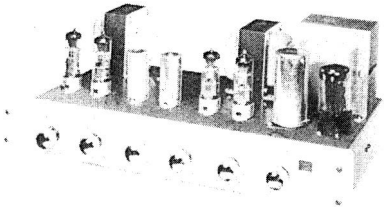
Cooper-Smith "Prodigy" Combined Amplifier and Control Unit. Inputs: pickup 8 mV var.; radio and tape 100 mV, 6 watts, 9 watts max. Dist. 0.2%. Response 30-25,000 c/s ±1 dB. Feedback 15 dB. N.L. −70 dB. Out. imp. 3¾, 7½ and 15 ohms. Output ECL82s. Ultra-linear. Size 10½ × 7× 5½ in. Price kit £12 10s. Assembled and tested £15 15s.



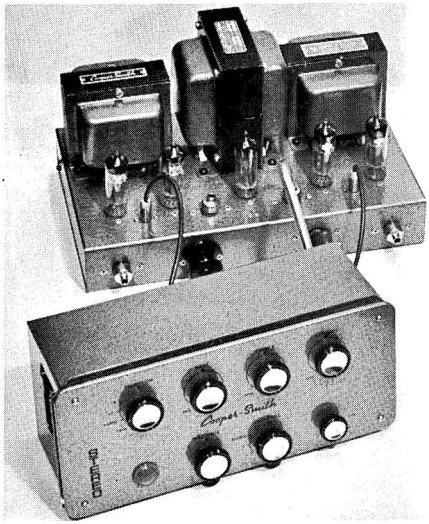
Sherwood S-8000 II



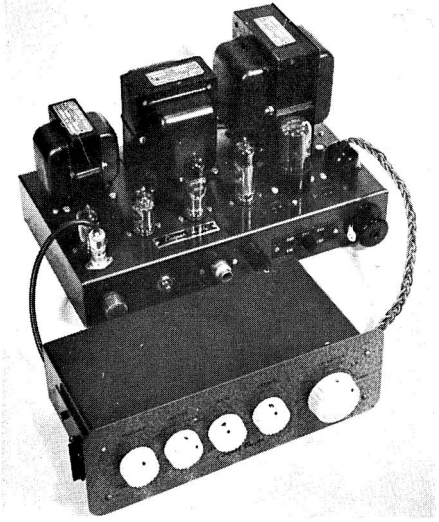
Scott 299c integrated stereo



Stern integrated 10 + 10



Cooper-Smith C.U. and amplifier



Cooper-Smith Mk. II C.U. and BP1 amp.

■**Cooper-Smith Stereo Control Unit.** Inputs: pickup 3 mV var.; tape 100 mV; radio 100 mV. 4 position sel., bass, treble, vol., balance. H.D. 0.15%. H and N −60 dB. Size 10½ × 4½ × 3½ in. To operate with Cooper-Smith stereo amplifier. Price kit £12 12s. Assembled and tested £15.

■**Cooper-Smith Stereo Amplifier.** 6 watts per channel, 9 watts peak. Dist. 0.2% at 6 watts. Input for spec. output 800 mV. Response 40-25,000 c/s at 6 watts. 15 dB feedback. N.L. −80 dB. Out. imp, 3.75, 7.5, 15 ohms. Output ECL82s. Size 12 × 7 × 6¾ in. To operate with Cooper-Smith stereo control unit. Price kit £13 13s. Assembled and tested £16.

■**Smith "Threesome" 3W. Integrated Stereo Amplifier.** Inputs: 300 mV per channel. 3 watts rated, 4 watts max. H.D. *3% at 3 watts. Response 60-20,000 c/s ±3 dB. Feedback 12 dB. N.L. 65 dB down at 3 watts. Out. imp. 3.75 and 15 ohms. On/off and treble cut and volume controls. Sel. switch. Output ECL82s. Self-powered. Size 8½ × 7¼ × 3½ in. Price assembled and tested £12 12s. (Kit price £9 12s.)

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STENTORIAN. See **Whiteley Electrical.**

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STERN RADIO Ltd., 109 Fleet Street, London EC4. Tel.: Fleet Street 5812-3. 23 Tottenham Court Road, London, W.1. Museum 6128-9.

Mullard Pre-Amplifier Tone Control Unit. Inputs: pickup 5 mV and 13 mV (Magnetic), 70 mV and 200 mV (Crystal); radio 300 mV, tape (1) 300 mV; tape (2) 3 mV; mic. 3 mV, 6-pos. sel., bass, treble, vol. P.s.n. 300 V at 3 mA, 6.3 V at 0.6 amps. Employs two EF86s. To operate with the 5-10 and similar power amplifiers. Size 9½ × 4½ × 2⅜ in. Price £9 10s. Also available in kit form.

■**Mullard Dual Channel Pre-Amplifier.** Inputs: pickup 5-15 mV and 70-220 mV; tape 4 mV; radio and aux. 330 mV. 5-pos. selector, bass, treble, vol. and balance. Output 250 mV per channel. Dist. less than 0.15%. Employs four EF86s. P.s.n. 6.3 V at 1 amp., 250/350 V at 6 mA. Size 11 × 5 × 4 in. Price £15. Also available in kit form.

■**Mullard "10-10" Stereo Amplifier.** 10 watts per channel. H.D. < 0.2%. Input for spec. output. 23 mV. Response at 10 watts 20-60,000 c/s ±3 dB. Feedback 20 dB. N.L. −65 dB. Out. imp. 15 ohms, alternative 3.75 or 7.5 ohms. Output two ECL86s in each channel. Ultra-linear. Size 14 × 6½ × 6¼ in. To operate with Mullard Dual Channel pre-amplifier. Price £20. Kit £16.

■**Mullard "10-10" Stereo Amplifier with Passive Control Unit.** Output 10 watts per

channel. H.D. < 0.2%. Input for spec. output, passive unit 250 mV. Response 20-60,000 c/s ±3 dB. Feedback 20 dB. N.L. −65 dB. Out. imp. 15 ohms (alternative 3.75 or 7.5 ohms). Output two ECL86s in each channel. Ultra-linear. Size, with passive unit attached, 14 × 8½ × 6¼ in. Price £24. Kit £20.

Mullard 3-valve Pre-amplifier. Mono. Inputs: mag. pu 7 mV, 12 mV; crystal 150 mV, 270 mV; tape head 2.5 mV; mic. 7.5 mV; radio 250 mV; aux. 250 mV. Output 250 mV. Controls: sel., treble, bass, volume. Filters, high pass 160 c/s, 80 c/s, 40 c/s, 20 c/s; low pass, 5 Kc/s, 7 Kc/s, 9 Kc/s, flat. H and N: mag. and crystal −58 dB; tape head −47 dB; mic. −44 dB; radio and aux. −60 dB. P.s.n. 6 mA at 250 V. 1 A at 6.3 V. Jacks on front panel. Auxiliary input. Record output. Ferroxcube inductor in filter circuit. To operate with Stern/Mullard range power amplifiers (mono). Size 11 × 4 × 4 in. Front panel, 12¼ × 4½ in. Price £13 13s. Kit £10.

Mullard 5-10 Mono Amplifier. Output 10 watts. HD 0.1%. Response 30 c/s-15 Kc/s ±1 dB. Feedback 26 dB. N.L. −65 dB. Input 40 mV. LS matching, 3.75 or 15 ohms. Output stages 2 × EL84. Self-powered (A.C. mains 200-250 V). Size 10 × 7 × 7 in. To operate with Stern/Mullard 2 or 3 valve pre-amplifiers. Price £13 10s. Kit £10. Alternative model with partridge output transformer available £1 6s. extra.

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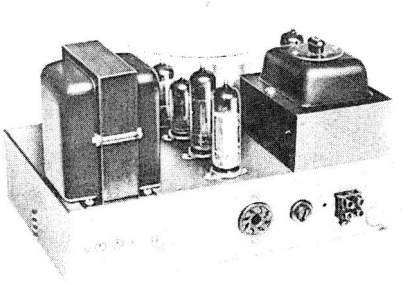
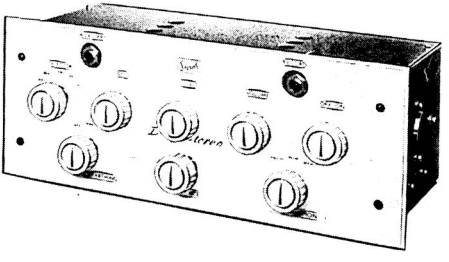
SYMPHONY AMPLIFIERS Ltd., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314/5.

Symphony No. 2 Integrated Amplifier Mk. 4. 8 watts, 10 watts max. Dist. less than 0.2% at 6 watts. Input for spec. output 130 mV. Response 20-20,000 c/s ±1 dB. 26 dB feedback. N.L. −85 dB. Out. imp. 3, 7.5 and 15 ohms. Output 6L6s (triode strapped). Size 12 × 7 × 9½ in. Price £18 18s.

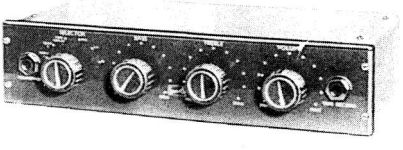
■**Symphony Integrated Stereo Amplifier.** 5 watts per channel. Dist. 0.3%. Input for spec. output 50 mV. Response 30-20,000 c/s ±1 dB. 22 dB feedback. N.L. −80 dB. Out. imp. 15 ohms. Output 6 BW6s. Self-powered. Size 12 × 7 × 9½ in. Price £23 2s.



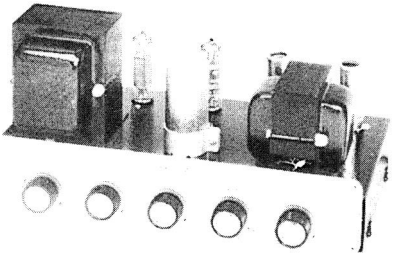
Stern 5-10 *amplifier*



Stern Mullard Stereo control unit



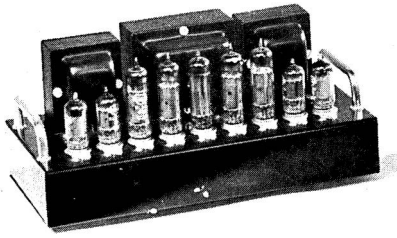
Stern Mullard control unit



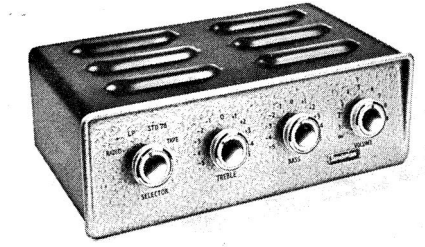
Tripletone Hi-Fi Major

■**No. 2 Stereophonic Amplifier.** Output 10 watts per channel. H.D. 0.15%. Response 20 c/s-20 Kc/s ±1 dB. Feedback 27 dB. N.L. 75 dB below. Input 3 mV. LS matching, 15 ohms. Output stages El84s in push-pull. P.s.n. 200-250 V A.C. Self-powered. Size 13 × 4½ × 9½ in. Price £33 12s. (integrated).

Archon SP31 stereo control unit

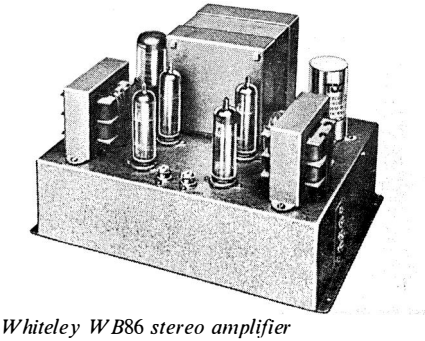


Archon SL101 stereo amplifier



Whiteley WB8 integrated amplifier

Whiteley WB stereo control unit



Whiteley WB86 stereo amplifier

TANSLEY-HOWARD Ltd., 144 Holland Park Avenue, London, W.11. Tel.: Bayswater 2848.

■**Archon SP31. Stereo Control Unit.** Inputs: pickup 1, 7 or 70 mV variable, 2, 7 mV; tape 60 mV; radio 60 mV variable. Sel. balance, treble, bass, filter controls. H.D. 0.05%. H and N −61 dB. Rumble filter. Size 12 × 6 × $2\frac{3}{8}$ in. To operate with SL 101 stereo amplifier. Price £20 9s. 6d.

■**Archon SL101. Stereo Amplifier.** 10 watts per channel. Dist. 0.2% at 10 watts. Input for spec. output 200 mV. Response 3-50,000 c/s ±1 dB. 22 dB feedback. N.L. −80 dB. Out. imp. 3, 7 and 15 ohms. Output EL84s. Size 12 × 6 × $5\frac{1}{2}$ in. To operate with SP31 stereo control unit. Price £29 8s.

★

TRIPLETONE Manufacturing Co. Ltd., 241a The Broadway, Wimbledon, S.W.19. Tel.: LIBerty 1189.

Hi-Fi Major. Integrated Amplifier. Inputs: High imp., pick up and microphone. Mixing facilities. 12 watts, 15 watts max. Dist. 0.15%. Response 15-20,000 c/s ±1 dB. Negative feedback 32 dB. N.L. −80 dB. Output imp. 2-3 or 15 ohms switchable. Output EL84s. Size 12 × $5\frac{3}{4}$ × 6 in. Price £15 18s. 9d.

D.P. 12 Power Amplifier. 12 watts nom. 15 watts max. H.D. 0.15%. Input 500 mV for 10 watts. Response 15-50,000 c/s ±0.25 dB. Feedback 16 dB. N.L. −80 dB. Out. imp. 2-3 or 15 ohms switchable. Output EL84s. To operate with stereo C.P.1 or Mono C.P.2. Size 12 × 6 × $5\frac{3}{4}$ in. Price £12 6s.

■**C.P.1. Stereo Control Unit.** Inputs: stereo and LP 100 mV, 78 records 250 mV; radio 250 mV, tape 100 mV, all for 500 mV out. 6 position sel, bass on/off, middle, treble, volume. Tape output sockets up to 2 V available. H.D. 0.1%. Response 30-20,000 c/s ±1 dB. N.L. −60 dB. To operate with D.P. 12s or Stereo 8-8 power chassis. Size 11 × $3\frac{1}{2}$ × $2\frac{1}{2}$ ins. Price £9 7s. 6d.

C.P.2 Monaural Control Unit. Details as C.P.1 Stereo Unit but Mono only. Price £9 7s. 6d.

Tripletone Stereo 12-12 comprises two D.P. 12s and the C.P.1. Stereo control unit. Details as above. Price £33 19s. 6d. for three units.

★

VORTEXION Ltd., 257/263 The Broadway, Wimbledon, London, S.W.19. Tel.: Liberty 2814, 6242/3. Cables: Vortexion "Wimble" London.

30/50 Watt Amplifier. Can deliver 50 W of speech and music or over 30 W of continuous sine wave. Main amplifier has response of 30 c/s-20 Kc/s ±1 dB; 0.1% distortion. Outputs 4, 7, 5, 15 ohms, 100 V line. Models are available with two, three or four mixed inputs for low impedance balanced line microphones, pickup or guitar. Price £59.

120/200 Watt Amplifier. Can deliver its full audio-power at any frequency in the range of 30 c/s-20 Kc/s ±1 dB. Less than 0.2% distortion at 1 Kc/s. Can be used to drive mechanical devices for which power is over 120 W on continuous sine wave. Input 1 mW, 600 ohms. Output 100-120 V or 200-240 V. Additional matching transformers for other impedances are available. Price £112.

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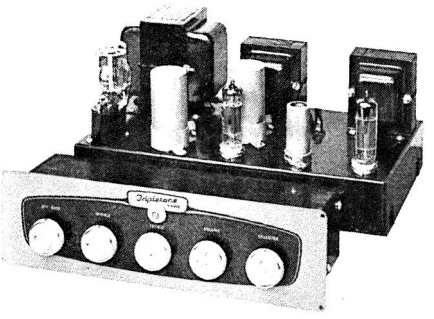
WELLINGTON ACOUSTIC Laboratories Ltd., Farnham, Surrey. Tel.: Farnham 6461/4961.

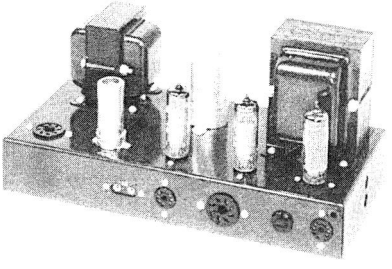
WAL Gain. Impedance matching transistor pre-amp, battery operated (3,000-hour life). Noise and distortion too low to measure, gain better than 100. Suitable for use with low output PU or for direct connection to tape head, mic. etc. Size $3\frac{5}{8} \times 2\frac{1}{8} \times 2\frac{1}{8}$ in. Price £5 10s.

Stereo WAL Gain. Transistorised stereo pre-amplifier. To match pickups, tape or mic., at 50,000 at 3,500 ohms. Battery life 1,000 hrs. Size $7 \times 2\frac{1}{8} \times 2\frac{1}{2}$ in. Price £7 10s.

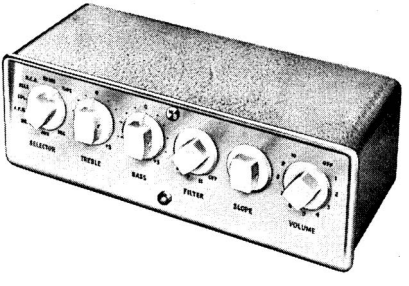
Wal Hi-Gain, Transistorised pre-amplifier. Battery operated (1,000 hour battery life). F.R. ±1 dB 30-25,000 c/s. Built-in switched CCIR equalisation for monitoring, dubbing, high gain, amplification for moving coil mics. etc. Size $6\frac{7}{8} \times 2\frac{1}{8} \times 2\frac{1}{2}$ in. Price £7 16s.



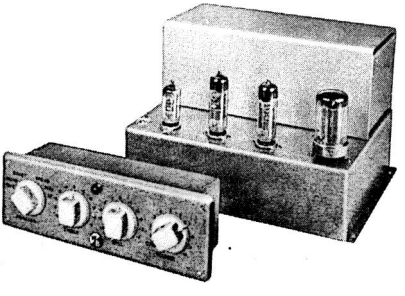
Tripletone C.P.1. stereo C.U. and amp.



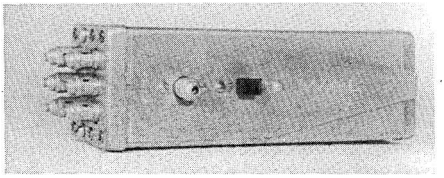
Tripletone DP 12 amplifier



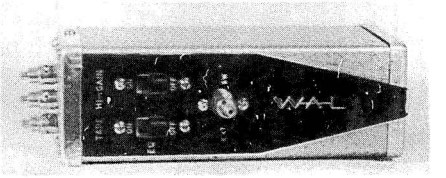
Whiteley WB Major control unit



Whiteley WB 12 amp and standard C.U.



Stereo WAL Gain



WAL Hi-Gain

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 −70 dB at 10 watts. Size 9 × 3⅛ × 3¾ in. To operate with WB12 power amp. Price £9.

Stentorian WB12 Major Control Unit. Inputs: mic. 2.5 mV; PU; radio 100 mV; tape 100 mV; aux. 50 mV. 9 pos. sel. (5 record equal), treble, bass, vol. on/off switched filter at 5.7 and 11 Kc/s; filter slope. Tape input socket. H.D. 0.3%. H and N −70 dB. Size 11⅝ × 4½ × 4 in. To operate with WB12 power amp. Price £19 10s.

WB12 Amplifier. 12 watts nom., 15 watts max. Dist. at 1,000 c/s. 0.12%. Response 20-20,000 c/s ±0.15 dB. Feedback 25 dB. N.L. −80 dB at 10 watts. Out. imp. 3 and 15 ohms. Output EL84s. Ultra-linear P.a.t. 250 V at 50 mA, 6.3 V at 1.5 A. Size 10⅞ × 8 × 7 in. To operate with WB Major or Standard control units. Price £18 10s.

■**WB Stereo Control Unit.** Inputs: pickup 2.5 and 100 mV; radio and tape 50 mV. Selector switch, bass, treble. H.D. 0.2%. H and N −70 dB. Size 11¾ × 4 × 7½ in. Price £22 15s. To operate with WB8S, or two WB12.

■**WB8S Stereo Amplifier.** 6-8 watts per channel. Dist. 0.2%. Input for spec. output 650 mV. Response 40-15,000 c/s ±0.5 dB. Feedback 20 dB. N.L. −60 dB. Out. imp. 3 and 15 ohm. Output ECL82s. Ultra-linear. Size 10⅞ × 6¼ × 10½ in. Price £23 15s. operate with WB Stereo Control Unit.

WB8 Combined Amplifier and Control Unit. 8 watts, 10 watts max. Dist. 0.3%. Inputs: pickup 100 mV; radio and tape 50 mV. Response 30-20,000 c/s ±2.5 dB. Feedback 15 dB. N.L. −60 dB. Out. imp. 3 and 15 ohms. Output ECL86s. Ultra-linear. Size 11¾ × 7½ × 4 in. Price to be announced.

Type 12/14. Power amplifier. Output 12 W (15 W max). Distortion 0.12% at 1 Kc/s. F.R. 20 c/s-20 Kc/s ±0.15 dB. Feedback 25 dB. N.L. −80 dB at 10 W. Out. imp. 3 and 15 ohms. Output stages EL84s. Ultra-linear P.a.t. 250 V at 50 mA, 6.3 V at 1.5 A. Price to be announced.

■**Stereo/mono control unit.** Inputs: pickup, radio, tape, aux by sel. switch. Separate bass and treble tone control. Built-in filters. Balance control. On/off switch. To operate with Type 12/14 amplifier. Price to be announced.

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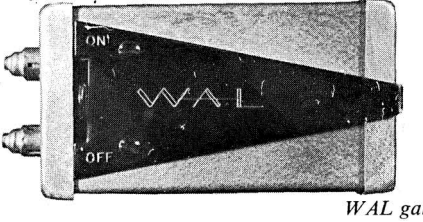
WORDEN Audio Developments Ltd., 54 Chepstow Road, London, W.2. Tel.: Bayswater 4996.

■**Stereo Transistorised Control Unit.** Inputs: pickup, 4, 10, 8 and 20 mV; radio, 250 mV; mic. or tape, 1.4 mV per channel. Output 250 mV per channel. Controls: sel., bass, treble, stereo-mono, combined volume-balance, on/off. Response 15 c/s-25 Kc/s. Pickup inputs all equalised, radio and mic. flat. Channel separation better than 55 dB. P.s.n. self-powered 9 V. Free-standing or for cabinet mounting. To operate with companion 4 W stereo main amplifier, or any amplifiers with input sensitivity of 250 mV or less. Size 8¾ × 8¼ × 2⅜ in. Front panel 9 × 3 in. Price £18 18s. Companion stereo main amplifier to the above Control Unit. Price and specification on request.

Worden Transistorised Stereo C.U.



WAL gain

RADIO TUNERS

By Arthur Wayne *

THE WORD tuner, as most of us know, is the label attached to a device for sorting out desired radio-frequency signals from the multiplicity of such traffic currently agitating the aether. This somewhat bold statement should perhaps be qualified, insofar as some of the traffic is *ordered*, i.e. it consists of deliberately regular repetitive variations around a mean signal, in amplitude, frequency, phase etc. These variations are known as "modulation", whereby intelligence of one sort or another is communicated; while some is random, when the signal is generally radiation of impulsive character, manifesting itself, after detection, as bangs, clicks, fizzles and the like.

The Job of the Tuner

From the listener's point of view, every radiation other than the required specimen is a distraction; and the tuner's job is to open the widest door to the wanted signal while shutting it firmly in the faces of the rest. All the other activities of a tuner—amplification, frequency changing, detection etc.—are merely face-lifts, ancilliary to the basic task of grabbing the victim, and *only* the victim, and getting it firmly under control. This is really a composite affair, in which the actual victim must be helped by being given the correct identification label, as it were, and also endowed with sufficient vigour to get to the opened door; and the function of the "transmitter" is to see to these important details.

There is but one means of sending communications across considerable distances without the intervention of wires, and that is by electromagnetic waves, which range from the very small, about 0.00002 inch, when they are known to us as light, to the longest radio waves in regular use, measuring about 2,500 yards; and a transmitter is a machine for manufacturing these waves *at a certain specified length or frequency*, and throwing them out into space. The tuner, if properly adjusted will respond *to this frequency only*, and after accepting the signal, amplifying it and extracting its significant information, make this information suitably available for its designated purposes.

Modulation Systems

Here we come to the information itself, which, as mentioned above, is conveyed in the form of intentional variations of certain parameters, or in other words superimposed modulations at, in our particular case, audio frequency. Only two of the many possible modulation systems are of interest to us, amplitude (A.M.) and frequency (F.M.) and it can be stated that each method can give as good audio quality as the other—indeed to the maximum resolving power of our equipment and ears, provided that the conditions suitable for such perfection or a near approximation to it are present.

AM Disadvantage

On FM such an approximation is comparatively common, but AM suffers from certain restrictions, at least on the usual long and medium wave-bands, that render true high-fidelity under existing conditions impossible of attainment. For acceptable hi-fi reproduction from whatever source, an audio-frequency range in the combined apparatus of at least 50 c/s to 10,000 c/s is essential. So far as tuners and amplifiers are concerned, no difficulty exists here; but, owing to the large number of powerful AM transmitters of great coverage broadcasting in the long and medium wave-bands, interference between adjacent stations—i.e. adjacent in wavelength, hence "adjacent-channel interference"—will occur unless severe limitations on radiated bandwidth be imposed; and, by international

*Shirley Laboratories Ltd.

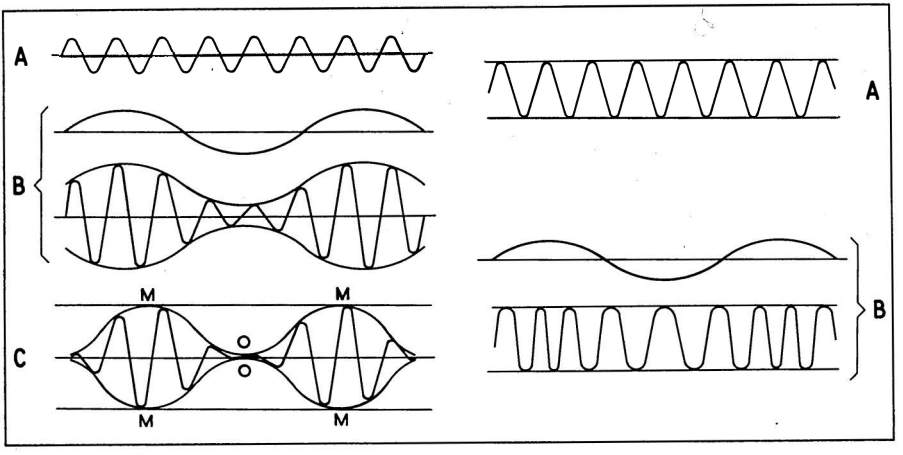


Fig. 1 (*left*) *illustrates amplitude modulation* (*AM*). *The original RF at A is modulated by AF as at B, while C shows peak modulation. A and B of* **Fig. 2** (*right*) *show corresponding FM conditions.*

agreement, this bandwidth is fixed at around 9 Kc/s, that is 4½ Kc/s on either side of the transmitter's carrier frequencies.

This, of course, means that if the pass-band of the tuner is greater than 4.5 Kc/s the possibility of adjacent-channel interference is always present—and, it may be added, almost certain—and the pass-band should preferably be less. But this is not all. Impulse interference of all kinds, which may emanate from the multiplicity of electrical apparatus in use, as well as from natural phenomena such as lighting, is generally AM in character, and being of steep-fronted waveform, can be shown mathematically to be comprised of frequencies extending, within limits, up to infinity; so, however selective an AM tuner may be, it *must* respond to this type of interference. (It is possible to minimize its effects by applying a momentary paralyzing bias, triggered by the interference itself, as is done in certain equipment, but this is a palliative not a cure.)

Reflected Interference

Another disadvantage arises from the fact that, under certain conditions, particularly those obtaining after dark, reflection of radio waves via ionizing layers in the upper regions of the atmosphere may cause interference even from distant transmitters with carriers spaced 9 Kc/s away from the wanted station; and the resultant beat note can be as distressing and is more persistent than the other forms of interference, thus contributing to the unsuitability of ordinary AM as a source of entertainment. However, the variety of programmes available on the long and medium wave-bands may justify the disadvantages if such variety be more important than quality.

It must not be overlooked that superb quality *is* possible on AM as is well attested by many of the television sound transmissions; but the television bands do offer the correct conditions for realizing the possibilities possessed by any of the current transmitting systems, in the shape of an almost unrestricted band-width, or at least as much as a transmitter could reasonably use.

Bandwidth

Assuming that one's sights are set at, say, an upper audio bandwidth of 10–15 Kc/s, it will be understood that this frequency is a constant whatever the frequency of the carrier with which it is associated; but whereas at medium and long waves the total available bandwidth available for a great number of transmitters is measured in *thousands* of c/s—from about 160 Kc/s to 1,500 Kc/s—Bands 1, 2 and 3, the television and FM bands, have 27, 12½ and 32 *million* c/s respectively in which the programmes may disport themselves. Admittedly, vision requires a far greater bandwidth than does sound; but even so, with vision spaced from sound by 3.5 mc/s, lebensraum is not going to create many problems for audio. But there is a very substantial bonus to be added. All entertainment high-frequency (i.e. short-wave) broadcasts are essentially for local consumption, the range of such transmissions being comparable with the optical ranges between station and receiver aerials, apart from occasional freak conditions; and this, of course, reduces the possibility of adjacent-channel interference to vanishing point. Indeed, so marked is this advantage that

all UK television stations radiate on or very near the same frequency in each respective channel, and the same applies, to a rather lesser degree, to the FM transmissions.

Dynamic Range

However, there is one important detail in which FM is superior to even VHF/AM, this being in the matter of dynamic range. Reducing the problem to its bare essentials, consider the wave-forms of an AM signal as shown in **Fig. 1**. **Fig. 1A** is a representation of an unmodulated carrier, to which is applied, in **Fig. 1B**, modulation in the form of a simple sine-wave. It will be seen that the effect of the modulation is to vary the steady carrier voltage within the limits indicated, which are supposed to be ± half the original carrier amplitude. In **Fig. 1C** the applied modulation has swung the carrier between O and M, O being no signal at all, and M the maximum output possible from the transmitter. But assume that the modulating signal is even greater than that shown in **Fig. 1C**; quite clearly there cannot be less than nothing radiated, nor will overload on the peaks balance matters, and what does happen is complete cut-off on the bottoms and flattening on the tops of the modulation envelopes with very severe distortion. Every care is taken in studio control-rooms to keep the audio dynamic range within such limits as to prevent the transmitter being driven beyond 100% modulation. In other words, the ranges between the quietest *pp* and loudest *ff* are deliberately restricted, with resultant degradation in programme.

Now, FM as the name implies, modulates the carrier by variations in frequency and not amplitude (indeed, the FM tuner is so designed as to be as little affected by amplitude variations as possible). This will be clear from **Fig. 2**, where **Fig. 2A** again represents the carrier in the absence of modulation. In **Fig. 2B** it will be seen that the modulating signal, instead of altering the shape of the carrier envelope, bunches up or spreads out the frequencies present as the carrier; and if the bunching and spreading occurs 500 times per second, and the detector (or more properly, *de*—modulator) in the tuner suitably interprets the bunches etc., then a 500 c/s note will have been transmitted and received.

Signal to Noise

To increase strength of modulation, the bunching is made tighter, while to decrease it, the converse is performed, to the state where there is hardly any bunching at all; and as there is no apparent limit to either situation, it would seem that overloading on FM is impossible. As a matter of fact, this statement, owing to pass-band limitations, is not strictly true; but that it *is* true in a very wide sense is clear enough to those who have compared FM with AM broadcasts of the same programmes.

The matters of signal-to-noise ratio and interference remain to be discussed. As we have already seen, AM is by its very nature prone to interference, which sometimes so degrades the wanted signals as to render listening for pleasure an impossible occupation. But is FM any better in this respect? Categori-

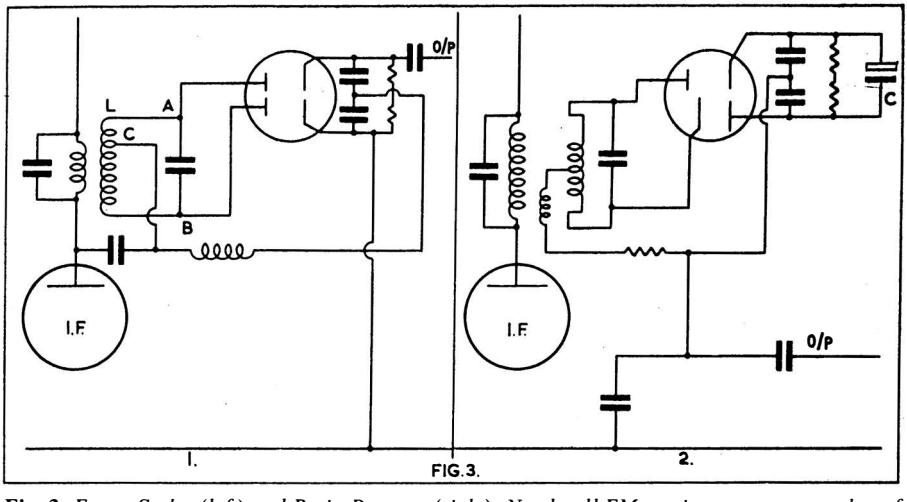


Fig. 3. *Foster-Seeley (left) and Ratio Detector (right). Nearly all FM receivers use one or other of these for de-modulation. Foster-Seeley needs prior limiting, but the Ratio circuit is its own limiter.*

cally, yes, immensely so; and this freedom from interference is one of the main reasons for the adoption of the system for broadcasting.

We have seen that impulse interference, being chiefly AM in character, is rejected by an FM receiver. Actually, the rejection does not occur in the receiver as a whole, but in the demodulator and associated circuits. There are two demodulators commonly in use in domestic equipment, these being the Foster-Seeley and the ratio detector, both of which are shown in **fig. 3**. There is quite clearly more than an accidental resemblance between the two, the main difference being in the arrangement of the diodes, which in the ratio-detector are "series aiding".

The Ratio Detector

The ratio detector is inherently insensitive to AM, and actually behaves as a dynamic limiter, while the Foster-Seeley, being responsive to both AM and FM even at its centre-frequency, must be fed with a signal of constant *amplitude*; one or two "limiter" valves are incorporated, in tuners making use of this detector, for precisely this purpose. There are various forms of limiter, but that almost universally used in FM tuners is the grid limiter, which is an ordinary pentode amplifier run with low anode and screen volts. If its control grid be connected as in a leaky-grid detector, a voltage builds up on it sufficient to bias the valve to cut-off except on the input peaks; and as the peaks cannot exceed a certain pre-determined value dependent on circuit design, output, after a level usually well below that ordinarily available, remains constant. The chief disadvantage of the grid limiter is the necessity for a fairly high input voltage, which demands considerable previous amplification, this in turn calling for greater complexity in the tuner as a whole.

The ratio detector, being, as we have noted, insensitive to AM, can dispense with a limiter for satisfactory operation; but neither suppression nor limiting are ordinarily quite so effective as with the limiter—Foster-Seeley combination, although with careful design the differential can be reduced to negligible proportions under the conditions of signal available over most of the UK service areas.

Drift

At first sight, it would appear that, apart from the limitation in programme material, FM provides the answer to almost every radio reception problem. In some ways it does, but this delectable situation has to be paid for in the form of added complication in the circuitry. Drift as well as amplification are problems not very serious in low and medium frequency work, but are real headaches in VHF operation. Amplification is fairly obvious, and techniques for providing it are now commonplace; but drift has ruined many a promising tuner. The trouble is due to proportion once again, as will be clear when it is considered that, in the tuned circuits, particularly those covering the oscillator in the tuner, variations of x capacitance and y inductance are negligible when applied to $100x$ and $100y$. However, x and y have an entirely different complexion when viewed from $10x$ and $10y$.

Stability

Unfortunately, x and y are fairly constant and not proportional; and great care must be taken to reduce x and y to $x/10$ and $y/10$, if not eliminate them altogether, if stability in a VHF tuner is to be attained. As many folk know to their cost, success has not always been achieved, and oscillators of unimpeachable stability are not consistently apparent in

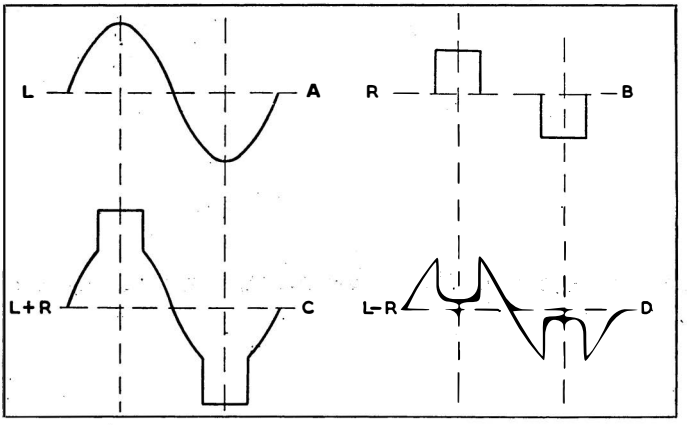


Fig. 4. *The meaning of sum and difference signals in stereo. If left-hand channel carries a sine-wave (A) and right-hand a square-wave (B), then L+R will look like C and L−R like D.*

cheaper equipment. The problem is perhaps more clearly appreciated if we consider the basic tuned circuit formula, where f = 159200 Kc/s/LC (L = μH, C = pF). If L and/or C are small, constant ± increments, due usually to temperature changes, will affect the final result far more than if L and C are large.

Automatic Frequency Control

Two common methods of controlling the variations are in use, either by careful construction and the incorporation of components affected in opposite directions by a common disturbance, or by accepting the difficulties as they are and installing a watchdog to compensate them automatically, this animal being known to us as AFC, Automatic Frequency Correction (or Control). Either of the methods can be effective, and many of the better tuners are completely stable almost from the moment of switching on.

AM and FM combined. These provide a fair compromise, in so far as AM programmes can be received on such units with standard fidelity and reasonable freedom from interference during the daylight hours, while the FM sections, although rarely quite so effective as specialized FM tuners, are entirely satisfactory in most of the areas covered by the BBC transmissions. It must not be overlooked that a good FM aerial can give a signal gain of up to 6 dB, so if reception is below expectations, the proper array should be fitted. The best type for prevailing conditions varies with the locality, and advice from a reputable specialist erector should be sought in cases of perplexity.

Stereo

The title of this section should by rights be "Time-Division-Multiplex-Stereo-FM", as it is by now almost certain that the Zenith-GE Time-Division Multiplex system of broadcasting will be adopted by the controlling authority in Europe, the EBU, as it has already by the FCC in USA. However, and for the record, the Engineering Information Department of the BBC has, in a letter to me, categorically stated that the BBC has "*no plans for commencing regular stereophonic broadcasting in the foreseeable future*" but the usual little bird has recently been cheeping into my ear that this pronouncement may perhaps be rather on the conservative side, and that it is not always possible to see around a quite close corner; so the experimenter can safely go ahead with a not unreasonable assurance that he won't be wasting his time. Meanwhile, experimental test transmissions are being carried out at the time of writing (March 1963).

The TDMFMS System

Some description of the TDMFMS system should be of interest. Basically, the idea is quite simple, consisting merely of transmitting, in a section of the deviation band normally unoccupied, a second—the stereo—signal simultaneously with the usual—mono—signal, with the proviso that, for stereo reception, each signal appears at its appropriate output channel, but that the two combine without the necessity for further circuit complication in a mono receiver, i.e. the signals must be *compatible*. This could be effected by transmitting a sum signal—the L+R channels in the studio—on the main carrier, and a difference signal—L−R on a *sub*-carrier operating as mentioned above, so that a standard mono receiver would then respond to the mixed signals, as is at present normal, while only a stereo tuner with the necessary auxiliary cir-

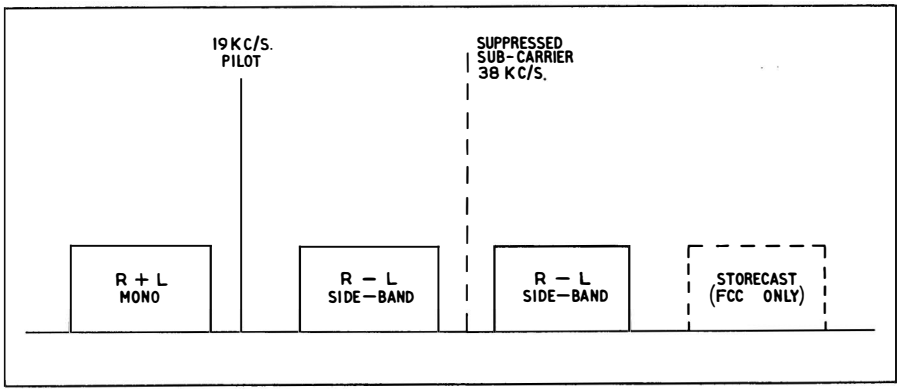


Fig. 5. *Disposition, in terms of frequency, of modulating components in a multiplex signal. Mono (R+L) occupies the normal AF band, the* 19 *Kc/s pilot is just above this, while difference signal (R−L) forms side-bands around* 38 *Kc/s.*

BBC VHF STATIONS

Stations	*Frequencies (Mc/s)* *Light*	*Third/ Network Three*	*Home*	*Version of Home Service*	*Effective Radiated Power (kW) (each prog.)*
Blaen-plwyf	88.7	90.9	93.1	Welsh	60
Divis	90.1	92.3	94.5	N. Ireland	60
Douglas	88.4	90.6	92.8	North	3.3
Dover	90.0	92.4	94.4	London	0.5-6.5*
Fort William	89.3	91.5	93.7	Scottish	1.5
Holme Moss	89.3	91.5	93.7	North	120
Kinlochleven	89.7	91.9	94.1	Scottish	0.002
Kirk o'Shotts	89.9	92.1	94.3	Scottish	120
Les Platons	91.1	94.75	97.1	West	0.5-1.4*
Llanddona	89.6	91.8	94.0	Welsh	3-12*
Llandrindod Wells	89.1	91.3	93.5	Welsh	1.3
Llangollen	88.85	91.05	93.25	Welsh	5-11*
Londonderry	88.3	90.55	92.7	N. Ireland	4.9-6.3*
Meldrum	88.7	90.9	93.1	Scottish	60
North Hessary Tor	88.1	90.3	92.5	West	60
Orkney	89.3	91.5	93.7	Scottish	3-20*
Oxford	89.5	91.7	93.9 95.85	Midland West	3.2-22*
Peterborough	90.1	92.3	94.5	Midland & East Anglian	1-21*
Pontop Pike	88.5	90.7	92.9	North	60
Redruth	89.7	91.9	94.1	West	1.1-9*
Rosemarkie	89.6	91.8	94.0	Scottish	3-12*
Rowridge	88.5	90.7	92.9	West	60
Sandale	88.1	90.3	94.7 92.5	North Scottish	120
Sutton Coldfield	88.3	90.5	92.7	Midland	120
Skye (temp.)	—	—	93.9	Scottish	—
Tacolneston	89.7	91.9	94.1	Midland & East Anglian	120
Thrumster	90.1	92.3	94.5	Scottish	0.1-10*
Wenvoe	89.95	96.8	94.3 92.125	Welsh West	120
Wrotham	89.1	91.3	93.5	London	120

(* Directional aerial)

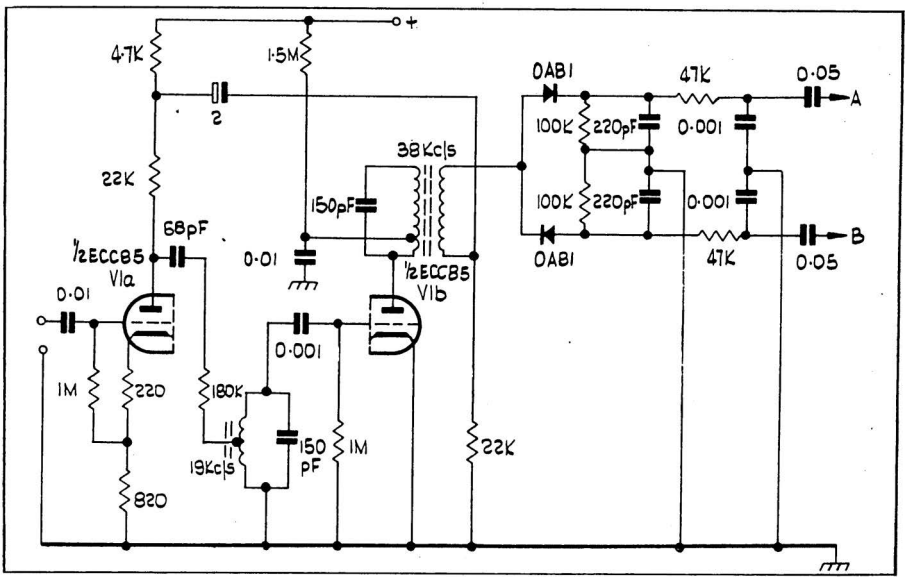


Fig. 6. *Multiplex adaptor circuit employing one valve and two diodes. V1a amplifies the total signal, while V1b derives a 38 Kc/s carrier from the 19 Kc/s pilot signal. Diodes and associated components sort out the two channels.*

cuits would be capable of extracting the difference signals.

The sub-carrier would be above audio-frequency, so that, in mono reception conditions, it would be effectively filtered out by the normal de-emphasis circuits. On stereo, of course, the sub-carrier modulation would need to be taken off ahead of the main de-emphasis network, demodulated by its own detector, and after individual de-emphasis, the two channels brought to their respective output terminals. **Fig. 4** should clarify any difficulty in visualizing the sum and difference signals. If **Fig. 4A** is a carrier, and **4B** the modulating signal, then **4C** and **4D** are L+R and L−R respectively.

In TDM, L and R channels are alternately sampled by either a switching system or one that, on detailed analysis, displays the characteristics proper to a sequential switching system. (L+R) is then transmitted on the full carrier in the normal way, i.e. at up to ±75 Kc/s deviation, while (L−R) modulates the sub-carrier, which in the Zenith-GE system operates at 38 Kc/s. This sub-carrier itself is suppressed, leaving only the modulating wave-form in the shape of side-bands. At the same time a pilot sub-carrier at half the main sub-carrier frequency, 19 Kc/s, is radiated to provide the necessary information required by the stereo tuner-adaptor to reinstate the 38 Kc/s sub-carrier when demodulation occurs, the half-frequency being chosen for reasons connected with signal-noise ratio and ease of signal extraction. Looked at another way, the pilot is a synchronizing signal for locking the receiver's local 38 Kc/s oscillator to the transmitter. The choice of 19 Kc/s will be appreciated from **Fig. 5** which shows, in diagrammatic form, the distribution of signal within the band. It will be remarked here that FCC requirements differ slightly from those of EBC, as a sub-channel—dotted in **Fig. 5**—for the transmission of background music, known as "Storecasting", has long been a feature of the American scene. Also, pre-emphasis is retained at 75 μS and not at the European 50 μS.

The actual stereo receiver is an ordinary mono tuner up to and including the de-modulator. Channel 1, L+R, goes to one input of a matrix network, which is less esoteric terminology could be described as a sorter-outer; but channel 2, L−R, must be subjected to the following operations: it is given the previously suppressed 38 Kc/s sub-carrier; this carrier is synchronized with the transmitter sub-carrier, or rather the carrier that it had before suppression—shades of Alice!—and then it is fed to the matrix network for sorting-out into correct relationship with Channel 1. All these, added together, are quite a complicated business, particularly if consideration has to be given in the circuitry to the storecast band; but for most of the purposes of the hi-fi addict's experimental

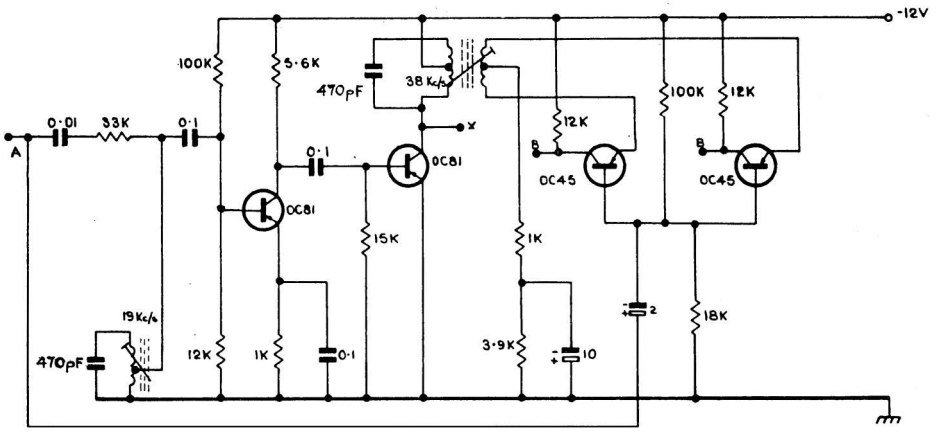
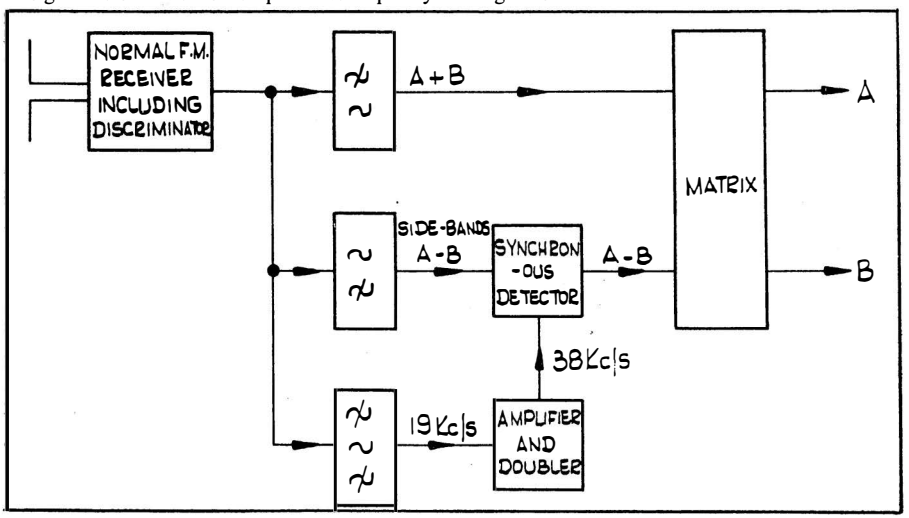


Fig. 7. *Transistorised multiplex adaptor. Signal (before de-emphasis) is fed in at A, and outputs come from BB' normal de-emphasis is then required. An indicator circuit to show when a multiplex signal is present can be fed from X.*

activities, a much less elaborate type of circuit will do all that is needed, and **Fig. 6** covers this requirement. Certain refinements ordinarily incorporated in commerical apparatus have been omitted in the interests of simplicity of construction and ease of adjustment; but it may be assumed with confidence that the finished unit will give perfectly satisfactory results. **Fig. 7** is the diagram of a transistorised adaptor which came to hand just as we went to press, while **Fig. 8** shows, in block form, what the stereo demodulator has to do.

The anxious reader may reasonably enquire as to the penalties of stereo FM, now that the prizes have been so glitteringly displayed. Apart from the cost of the adaptor or stereo tuner, the price is a considerable deterioration in signal-noise ratio as compared to a purely monophonic system. Where, as in most of the BBC service areas, the input signal level is high, listening will not be affected to any significant degree except perhaps in situations where much traffic is present, when unsuppressed cars may prove troublesome. The cure is a higher and/or more efficient aerial; but in those locations where reception is already difficult, stereo FM, as a form of entertainment, can be completely dismissed.

In conclusion, it is my pleasure to thank Mullard Ltd. and the Zenith Corporation for much detailed information freely given—from Zenith, over 200 pages of it, with graphs, schematics, figures, etc.!, and three slim volumes from Mullard—and to both organisations for permission to reproduce the various diagrams.



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; **A.G.C.**—Automatic gain control; **Mc/s**—Megacycles; **ind.**—Indicator; **disc**—Discriminator; **imp.**—Impedance; **det.**—Detector.

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. 330 V at 27 mA; 6.3 V at 1.85 amps. Size $10\frac{1}{2} \times 3\frac{1}{2} \times 6$ ins. Price £21 (U.K. puchase tax £3 18s. 9d.).

A.M. II Tuner. Variable tuning. Range 5.8-18.5 Mc/s. 185-588 and 800-2070 metres. Magic Eye ind. P.s.n. 330 V at 35 mA; 6.3 V at 1.2 A. Size $10\frac{1}{2} \times 3\frac{1}{2} \times 6$ in. Price £24 (U.K. purchase tax £4 10s.).

★

ARMSTRONG Audio Ltd., Warlters Road, Holloway, London, N.7. Tel.: North 3213/4.

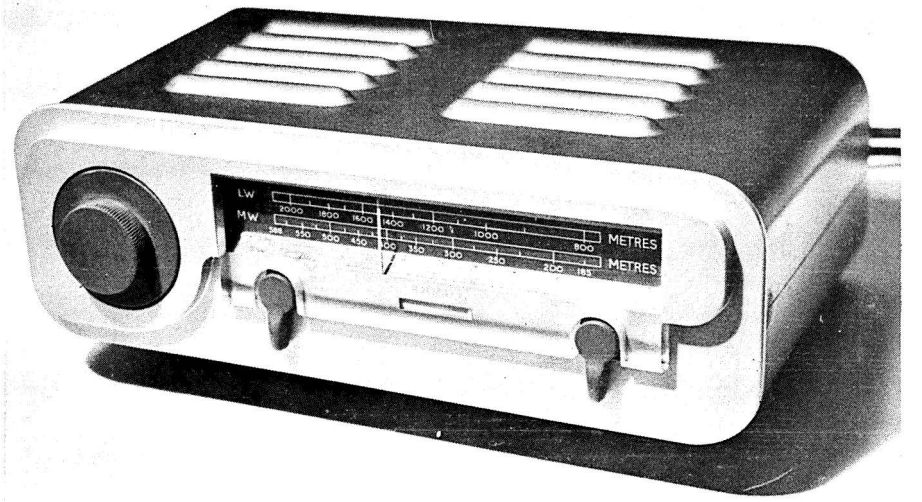
F.M. Tuner T4B. Variable tuning. Range 87-108 Mc/s. A.F.C. Ratio disc. Self-powered A.C. 200-250 V. Size $10\frac{1}{2} \times 4\frac{1}{2} \times 7\frac{1}{2}$ in. Price £17 11s. 6d. (U.K. purchase tax £2 16s. 6d.).

F.M. Tuner T4C (as T4B but without case). Price £15 9s. 6d. (U.K. purchase tax £2 9s. 6d.).

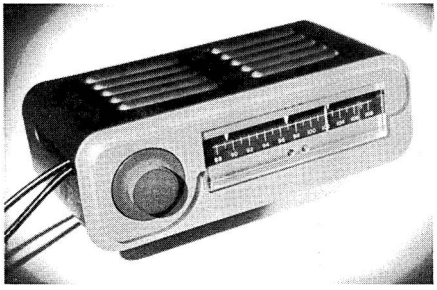
A.M./F.M. Tuner. ST3 Mk. 2. Variable tuning. Range F.M.: 87-108 Mc/s; A.M.: M.W. 187-570 metres, L.W. 1053-2,000 metres. A.F.C. Ratio disc. Miniature bright line ind. Self-powered A.C. 200-250 V. Size $12\frac{3}{8} \times 5\frac{1}{2} \times 7\frac{1}{2}$ in. Price £22 1s. 3d. (U.K. purchase tax £3 10s. 9d.).

A.M./F.M. Jubilee Mk. 2. Tuner amplifier chassis. Variable tuning. Range F.M.: 87-108 Mc/s; A.M.: M.W. 187-570 metres, L.W. 1053-2,000 metres. A.F.C. Ratio disc. EM. 81 ind. Self-powered A.C. 200-250 V. Size 12 × 7 × 8 in. Price £24 7s. (U.K. purchase tax £3 18s.). Also see Amplifier Section.

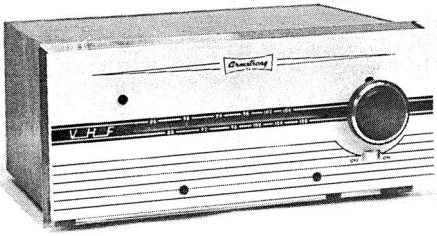
Stereo 12 Mk. 2 A.M./F.M. Tuner amplifier chassis. Variable tuning. Range 87-108 Mc/s, 187-570, 1053-2,000 metres. A.F.C. Ratio disc. Magic Eye ind. Self-powered. Size $14\frac{1}{4} \times 9 \times 5\frac{1}{2}$ in. Price £34 13s. 9d. (U.K. purchase tax £5 11s. 3d.).



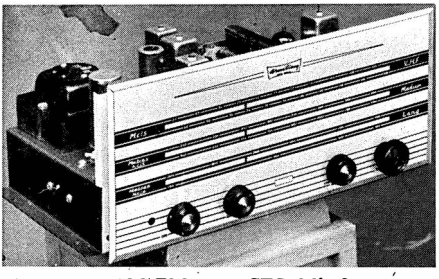
Acoustical AM tuner covering short, medium and long wave bands



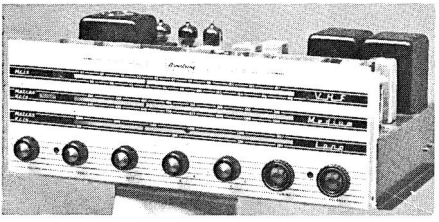
Acoustical FM tuner



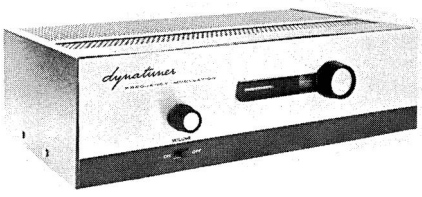
Armstrong FM tuner T4B



Armstrong AM/FM tuner STB Mk. 2



Armstrong Stereo 12 Mk. 2 AM/FM



Aveley Dynatuner FM-1

AVELEY ELECTRIC Ltd., Ayron Road, Aveley Industrial Estate, South Ockendon, Essex. Tel.: South Ockendon 3444. Cables: Telex 24120 Avel Ockendon.

F.M. Dynatuner FM-1. Free tuned. Range 88-108 Mc/s. Drift-free design F.C. Balance bridge discriminator. Magic eye ind. Self-powered. Size 13 × $3\frac{3}{4}$ × $7\frac{5}{8}$ in. Price £44 12s. (U.K. purchase tax £8 7s. 3d.). Also available in kit form £38 12s. (U.K. purchase tax £7 4s. 9d.).

★

BANG & OLUFSEN, Struer, Denmark. Sole U.K. importers: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444.

"Minette" 609 F.M. Tuner. Free tuned. Range 87.5 Mc/s-100.5 Mc/s. A.F.C. may be switched in or out. Ratio detector. Tuning indicator EM87 magic eye. Prepared for multiplex stereo. Aerial imp. 75 ohms. Output variable. P.s.n. 220-240 V. A.C. 50 c/s. Size 18.4 × 8 × 4.25 in. Price £25. (U.K. purchase tax £4 13s. 9d.).

★

CHAPMAN (Ultrasonics) Ltd. See Derritron (Ultrasonics) Ltd.

★

CLARKE & SMITH Manufacturing Co. Ltd., High Fidelity Components Division, Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic, Wallington.

Model 658. A.M./F.M. Tuner. Variable tuning: separate for A.M. and F.M. Range F.M. 87.5-108.5 Mc/s; A.M. 184-575 m. and 1110-2,050 m. Balanced ratio detector. Tuning indicator EM 84 magic eye. Multiplex conversion facilities. Aerial imp. 75 ohms. Output 100 mV. Also O/P for lower sensitivity amplifiers. Self-powered. Size $14\frac{1}{4}$ × $8\frac{3}{4}$ × $3\frac{3}{4}$ in. Price £26 19s. 6d. (U.K. purchase tax £4 12s. 1d.).

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DECCA Radio & Television, Ingate Place, Queenstown Road, S.W.8. Tel.: Macaulay 6677.

Decola "Separates" F.M. tuner. Variable tuning. Range 86-108 Mc/s. Tuning indi-

cator magic eye. P.s.n. 200 V D.C. 20 mA, 6.3 V A.C. Size 11 × 5¾ × 5¼ in. Price £17 3s. 10d. (U.K. purchase tax £2 15s. 2d.).

★

DERRITRON (Ultrasonics) Ltd., 24 Upper Brook Street, London, W.1. Tel.: Hyde Park 2291.

F.M. Tuner FM90. Switched, 4 positions. Range 87.5-100 Mc/s. A.F.C. ratio disc. P.s.n. 250 V at 40 mA; 6.3 V at 2 A. Size 5 × 4½ × 6½ in. Price £14 9s. (U.K. purchase tax £2 10s. 6d.).

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. 250 V at 40 mA; 6.3 V at 2 A or self-powered. Size 12 × 4⅛ × 6¼ in. Price £17 6s. 8d. (U.K. purchase tax £3 0s. 8d.). Self-powered £20 5s. 7d. (U.K. purchase tax £3 11s.).

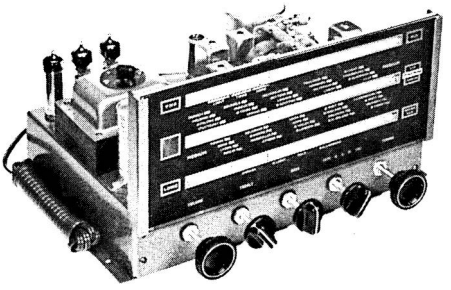
FM95 A.M./F.M. Tuner. Variable tuning. Range 87.5-100 Mc/s, 195-550 and 800-2,000 metres. A.F.C. Ratio det. EM84 ind. P.s.n. 250 V at 30 mA; 6.3 V 2 amps. Size 12 × 4⅛ × 8½ in. Price £21 5s. 10d. (U.K. purchase tax £3 14s. 6d.). Self-powered version £24 6s. 8d. (U.K. purchase tax £4 5s. 2d.).

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. 200/250 V at 40/50 mA or self-powered. Size 13½ × 6½ × 9 in. Price £26 12s. 4d. (U.K. purchase tax £4 13s. 2d.). Self-powered £29 13s. 3d. (U.K. purchase tax £5 3s. 9d.).

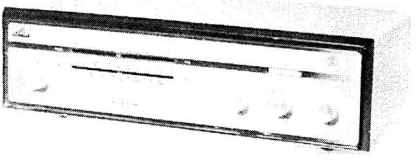
A.M./F.M. Tuner S5/FM. Free tuned. Range (F.M.) 87.5 100 Mc/s; (A.M.) 16-50, 195-550, 800-2,000 metres. Ratio det. plus limiter. Magic eye tuner ind. P.s.n. 200/250 V at 40/50 mA or self-powered. Size 13½ × 6½ × 9 in. Price as S5E/FM above.

A.M./F.M. S6BS/FM. Free tuned. Range (F.M.) 87.7-108 Mc/s; (A.M.) 6 bandspreads: 11, 13, 16, 19, 25, and 31 metres; also 15-43, 43-140, 175-570 metres wide band ratio det. Magic eye ind. Self-powered. Size 13¾ × 13 × 8⅛ in. Price £52 10s. (U.K. purchase tax £9 3s. 9d.).

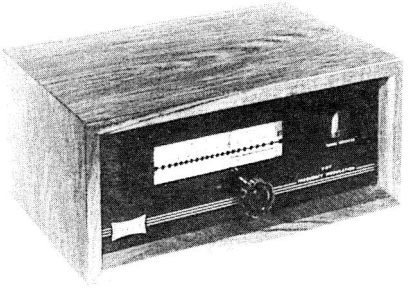
A.M. Tuner S6BS. Free tuned. Range 6 bandspread ranges: 11, 13, 16, 19, 25, and 31 metres, also 13-43, 43-140, 175-570 metres. Magic eye ind. P.s.n. 250 V at 30/40 mA; 6.3 V at 1.5 A, or self-powered. Size 13¾ × 11 × 8⅛ in. Price £32 19s. 2d. (U.K. purchase tax 5 15s. 4d.) or £37 8s. 2d. self-powered (U.K. purchase tax £6 11s.).



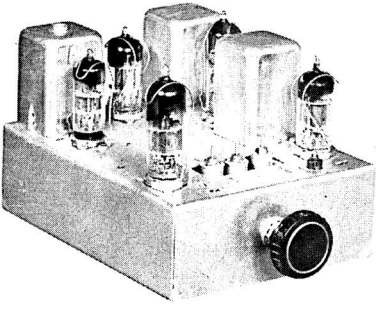
Armstrong AM/FM Jubilee Mk. 2



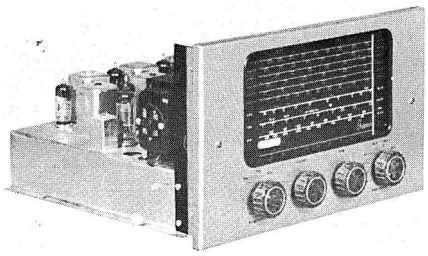
H.M.V. 558 AM/FM tuner



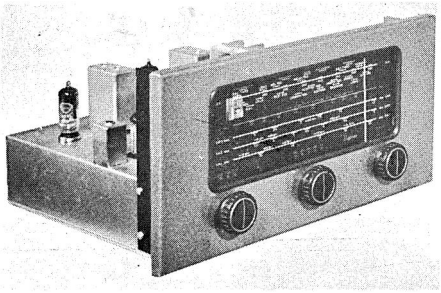
Decola "Separates" FM tuner



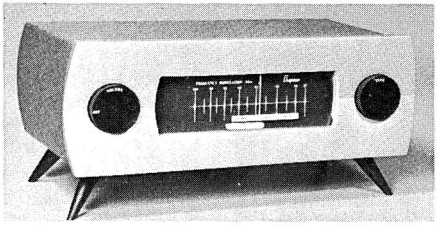
Derritron FM90



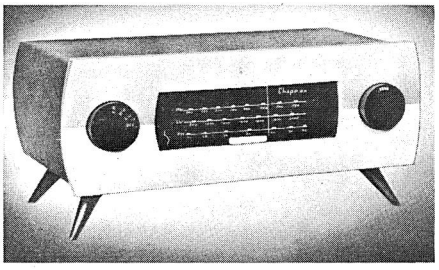
Derritron S6BS/FM AM/FM tuner



Derritron S5E/FM AM/FM tuner



Derritron FM91 FM tuner



Derritron FM 95 AM/FM tuner

Leak Trough-Line II

FISHER Radio Corporation, Long Island City 1, New York, U.S.A. Distributed by Lockwood & Co. (Woodworkers) :td., 67 Lowlands Road, Harrow, Middx. Tel.: Byron 3704.

The full range of Fisher tuners is supplied to special order. Details on request.

★

GOODSELL Ltd., Gardner Street, Brighton, Sussex. Tel.: Brighton 65752.

F.M. Tuner FMT701. Manual tuning (permeability). Range 85-100 Mc/s. Ratio det. Magic eye ind. P.s.n. 250 V at 20 mA. Price £10 10s. (U.K. purchase tax £1 14s. 2d.).

★

GRAMPIAN REPRODUCERS Ltd., 19 Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657. Cables: Reamp, Feltham.

F.M. Tuner 571. Free tuned. Range 85-98 Mc/s. Ratio det. Magic eye ind. P.s.n. 300 V at 35/40 mA, 6.3 V at 2.5 amps. Size $10\frac{1}{4} \times 5\frac{1}{2} \times 6\frac{1}{4}$ in. Price £17 10s. (U.K. purchase tax £2 18s. 11d.).

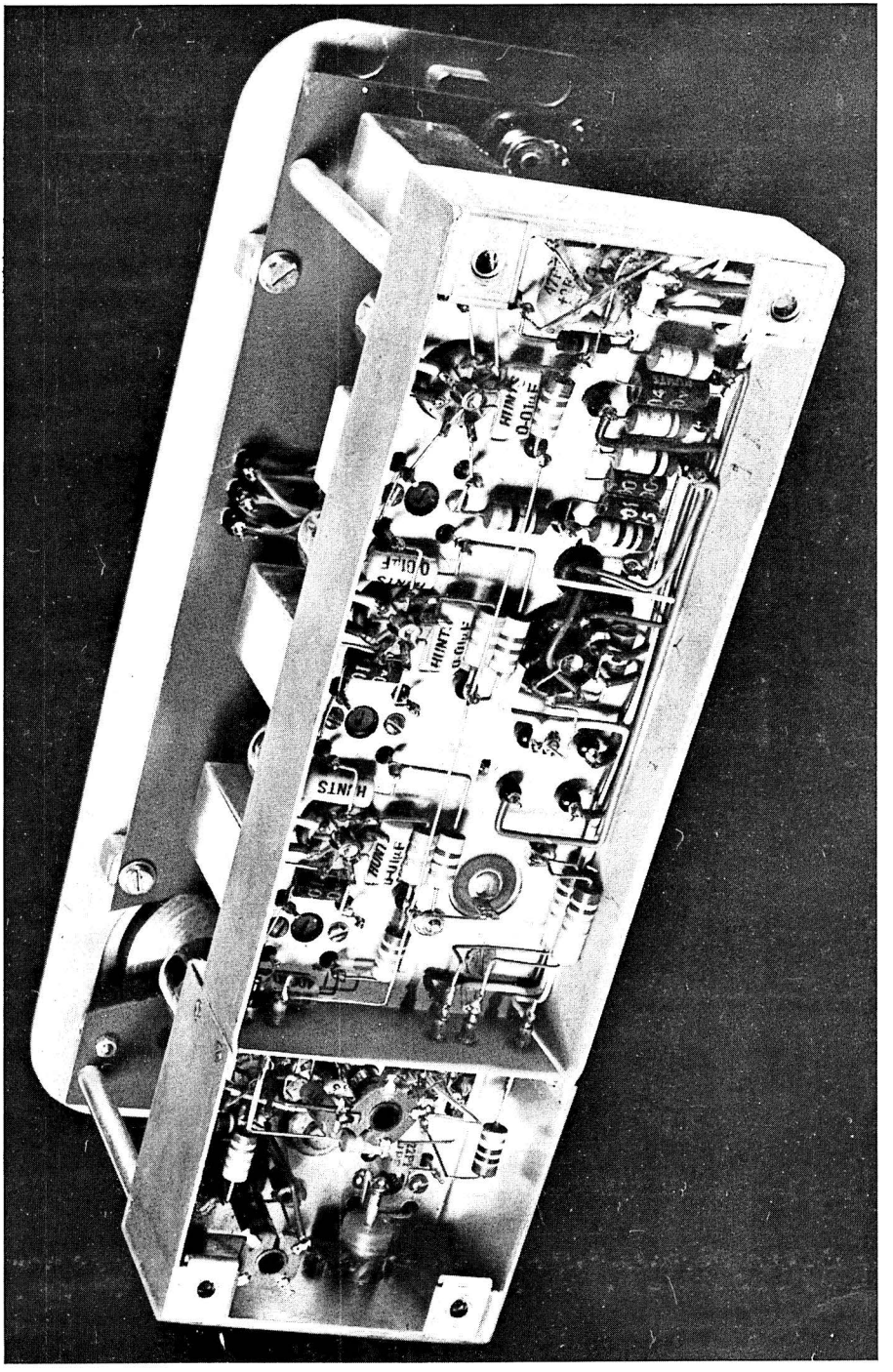
★

JASON Electronic Design Ltd., Kimberley Gardens, London, N.4. Tel.: Stamford Hill 5477.

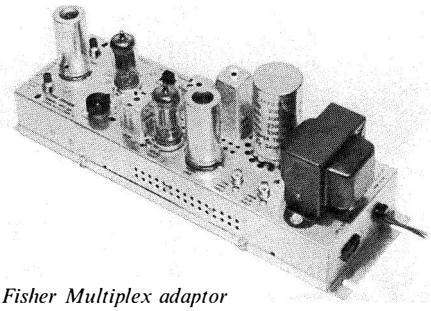
F.M. Tuner FMT/4. Variable tuning. Range 88-108 Mc/s. Transistor amplified. A.F.C. Ratio detector. Multiplex adaptor output. Self-powered. Size $11\frac{1}{4} \times 6\frac{5}{8} \times 4\frac{3}{8}$ in. Better than 5 μV for 40 dB quieting. Price £17 5s. (U.K. purchase tax £2 15s. 4d.).

JTV/2 F.M. and A.M./TV Sound Tuner. Switched turret tuning. Automatic frequency control. Range 88-96 Mc/s, plus all Television channels. Discriminator. Self-powered. Size $11\frac{1}{4} \times 6\frac{5}{8} \times 4\frac{3}{8}$ in. 10 μV for 40 dB quieting. Price £19 4s. (U.K. purchase tax £3 1s. 7d.).

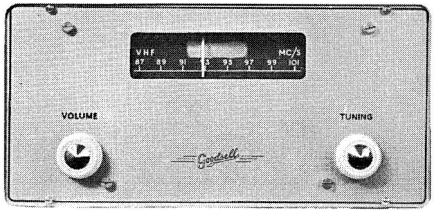
Monitor. F.M. and A.M./TV Sound Tuner. Switched tuning. A.F.C. Range 40-212 Mc/s. Foster-Seeley disc. P.s.n. 230 V at 35 mA; 6.3 V at 1.5 A. Size $5 \times 5\frac{1}{2} \times 7$ in. Price £14 5s. (U.K. purchase tax £2 5s. 8d.).



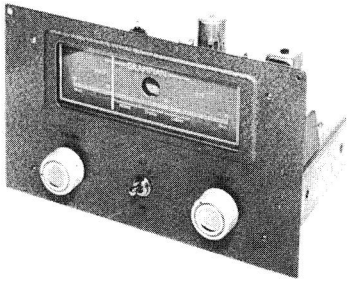
Inside view of the Acoustical variably tuned FM tuner



Fisher Multiplex adaptor



Goodsell FMT 701



Grampian 571 *FM tuner*

Jason FMT/4 *tuner*

Jason JVT/2 *tuner*

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

F.M. Tuner, Trough-Line 11. Variable tuning. Range 88/108 Mc/s. A.F.C. giving tuning stability from the instant of switching on. Foster-Seeley disc. Magic eye ind. Self-powered. Size $11\frac{1}{2} \times 4\frac{1}{2} \times 7\frac{3}{4}$ in. Price £25 (U.K. purchase tax £4 7s. 6d.).

★

LEE PRODUCTS (Great Britain) Ltd., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

Dulci H4T-55 A.M./F.M. Tuner. Variable tuning. Range: L.W., 1,100-1,800 m.; M.W., 195-550 m.; S.W., 6-18 Mc/s; F.M., 88-108 Mc/s. A.F.C. locks over 100 Kc/s. Ratio detector. Tuning indicator EM84. Facilities for external multiplex connection. Aerial imp. 75 ohms. Output 8 V adjustable. P.s.n. 200-250 V A.C. Size $12\frac{13}{16} \times 3\frac{11}{16} \times 10\frac{1}{4}$ in. Price to be announced.

Dulci FMT-5 F.M. Tuner. Variable tuning. Range 88-108 Mc/s. A.F.C. locks over 100 Kc/s. Foster Seeley discriminator. Facilities for external multiplex connection. Aerial imp. 75 ohms. Output 10 V adjustable. P.s.n. 200-250 V A.C. Size $12\frac{5}{8} \times 3\frac{3}{16} \times 9\frac{3}{4}$ in. Price £18 13s. 6d. (U.K. purchase tax £2 19s. 11d.).

★

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

F.M. Tuner Mk. V Self-Powered. Twin gang tuning, horizontal scale. Range 87.5-108 Mc/s. A.F.C. Foster-Seeley disc. Switched ind. 50 c/s injection. Self-powered. Size $13\frac{1}{4} \times 5\frac{1}{2} \times 5$ in. Price £24 10s. (U.K. purchase tax £4 2s. 6d.).

F.M. Tuner Mk. V. Variable tuning. Range 87.5-108 Mc/s. A.F.C. Foster-Seeley disc. Switched A.F.C. and hum check ind. P.s.n. 250 V 30 mA; 6.3 V 2 amps. Size $10\frac{1}{4} \times 4\frac{3}{4} \times 7$ in. Price £22 (U.K. purchase tax £3 14s. 1d.).

PAMPHONIC REPRODUCERS Ltd., Westmoreland Road, London, N.W.9. Tel.: Colindale 7131.

640 F.M. Tuner. Variable tuning. Range 86-103 Mc/s. Ratio det. Magic eye ind. P.s.n. 200 V at 30 mA, 6.3 V at 2 amps. Size (panel) $9\frac{3}{16} \times 3\frac{3}{4}$ in. Price £15 15s. (U.K. purchase tax £2 12s. 6d.).

F.M. 646. Variable tuning. Range 88-108 Mc/s. A.F.C. Ratio det. Self-powered. Size $6 \times 13 \times 4\frac{1}{4}$ in. Price £21 13s. 3d. (U.K. purchase tax £3 12s. 3d.).

★

PYE LTD., High Fidelity Division, P.O. Box 49, Cambridge. Tel.: Cambridge 58985. Cables: Pyrad, Cambridge.

A.M./F.M. Tuner HFT113. Variable tuning. Range (F.M.) 88-108 Mc/s (A.M.) 190-550 metres. A.F.C. detect. Self-powered. Size $10\frac{1}{2} \times 3\frac{3}{8} \times 5$ in. Price (chassis) £28 7s. (U.K. purchase tax £3 18s. 5d.); (metal case) £39 9s. (U.K. purchase tax £4 4s. 2d.).

F.M. Tuner Mozart HFT.109. Variable tuning. Range 88-108 Mc/s. A.F.C. Self-powered. Size $10\frac{1}{2} \times 3\frac{3}{8} \times 5$ in. Price (chassis) £23 12s. 6d. (U.K. purchase tax £3 5s. 3d.); (metal case) £25 14s. 6d. (U.K. purchase tax £3 11s. 2d.).

★

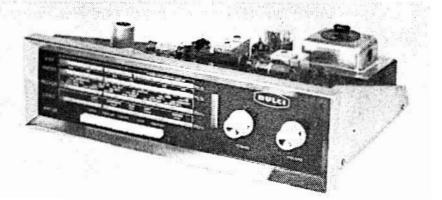
RADFORD ELECTRONICS Ltd., Ashton Vale Estate, Bristol 3. Tel.: Bristol 662301/2.

FMT 1 F.M. Tuner. Variable tuning. Range 88-108 Mc/s. Ratio Detector (wide band 1.5 Mc/s). Magic eye, illuminated bar type. Outlet for multiplex adaptor. Aerial imp. 75 ohms. Output 250-500 mV. Self-powered. Size $10\frac{1}{2} \times 3\frac{3}{4} \times 9$ in. Price £30 (U.K. purchase tax £5 12s. 6d.).

★

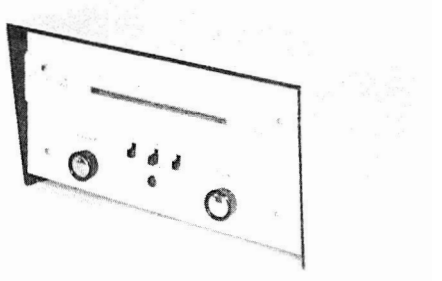
ROGERS DEVELOPMENTS (Electronics), Ltd., Rodevco Works, 4-14 Barmeston Road, Catford, S.E.6. Tel.: Hither Green 7424 and 4340. Cables: Rodevco, London.

R.D. Junior Mk. II Variable F.M. Receiver. Variable tuning. Printed circuit coil pack. Range 87-107.5 Mc/s. A.G.C. Foster-Seeley

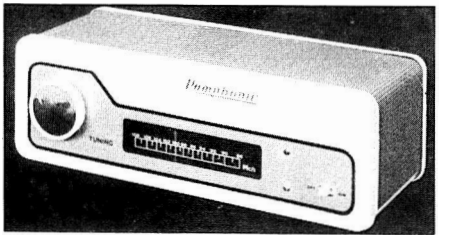


Dulci H4T-55 AM/FM tuner

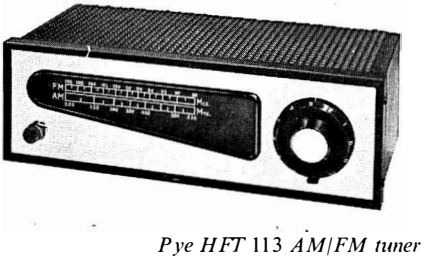
Dulci FMT-5 FM tuner



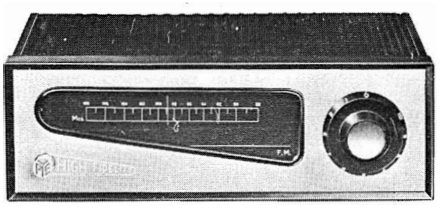
Lowther FM tuner Mk. V



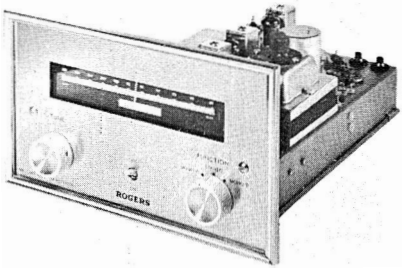
Pamphonic 646 FM tuner



Pye HFT 113 AM/FM tuner



Pye Mozart HFT109 FM



Rogers Variable FM tuner chassis

Rogers RD Junior Variable FM tuner

disc. Twin limiters. Tuning Indicator. Twin Cathode Follower Output. Self-powered. Provision for multiplex adaptor. Size $8\frac{5}{8} \times 5\frac{3}{8} \times 10\frac{3}{8}$ in' To operate with any Rogers Control Unit. Available in Teak case to match HG88 Mk. II. Price (chassis model) £21. (U.K. purchase tax £3 11s. 8d.); (teak case model) £24 7s. 6d. (U.K. purchase tax £24 7s. 6d.

F.M. Tuner R.D. Junior Switched. Switched tuning. Range 87-96 Mc/s. A.F.C. Foster-Seeley disc. P.s.n. 250 V 35 mA; 6.3 V 1.7 amps. Size $9 \times 5\frac{3}{8} \times 5\frac{3}{8}$ in. Price £12 10s. (U.K. purchase tax £2 2s. 8d.).

Model C power pack for switched F.M. unit. Price £4 10s.

★

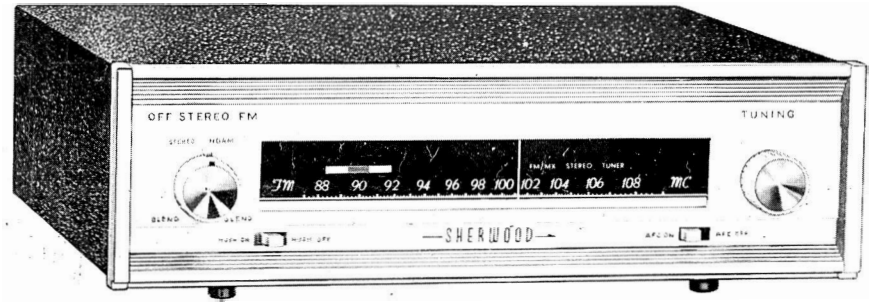
SHERWOOD Electronic Laboratories, Inc., U.S.A. Distributors: Audioson Ltd., Orchard House, Orchard Street, London, W.1. Tel.: Mayfair 5431.

S-3000 III F.M. Tuner. Variable tuning. Range 87.5-108.5 Mc/s. A.F.C. Foster-Seeley discriminat . A.G.C. provides inter-channel "hush". Tuning Indicator EM84 Acro-beam. Power supply and chassis space for A3MX Multiplex adaptor. Aerial imp. 300 ohms. Output 2 V at 100% F.M. Self-powered, 240 V. Size $14 \times 4 \times 10\frac{1}{2}$ in. Price £54 10s. including tax.

A3MX Multiplex Adaptor for S-3000 III tune. Price £17 10s.

S3MX Multiplex Adaptor, self-powered, for use with all modern F.M. tuners. Price £25 18s.

S-8000 II. Amplifier/tuner chassis. See Amplifier Section.



Sherwood S-3000 III FM tuner with provision for Multiplex reception

SHIRLEY LABORATORIES Ltd., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

F.M. Tuner R/6. Variable tuning. Standard range. Ratio det. Magic eye ind. P.s.n. 200-300 V 30 mA; 6.3 V 2.5 amps. Price £20 plus tax.

★

SYMPHONY AMPLIFIERS Ltd., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314.

FM2 F.M. Tuner. Variable tuning. Range 88-100 Mc/s. A.F.C. Foster-Seeley discriminator. Tuning indicator EM84 strip. Aerial imp. 75 ohms. Output 1 V. P.s.n. self-powered version 200-250 A.C., unpowered version 250 V at 35 mA, 6.3 V at 1.5 A. Dimensions 13 × 4 × 4¾ in. Enclosed in steel cabinet. Price (unpowered) £16 16s. including purchase tax; (self-powered) £18 18s. including purchase tax.

No. 2 A.M./F.M. Tuner. Variable tuning. Range 87-101· Mc/s, 16-50, 190-550, and 1,000-2,000 m. Ratio detector. Magic eye. Self-powered. Size 13½ × 8½ × 7½ in. Price £24 including purchase tax.

★

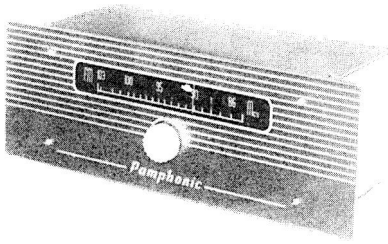
TANSLEY-HOWARD Ltd., 144 Holland Park Avenue, London, W.11. Tel.: Bayswater 2848.

Archon PF41 F.M. Tuner. Variable tuning. Range 88-108 Mc/s. A.F.C. Self-powered. Size 12 × 6 × 2⅜ in. Panel 12½ × 3 in. Price £18 15s. (U.K. purchase tax £3 7s. 9d.).

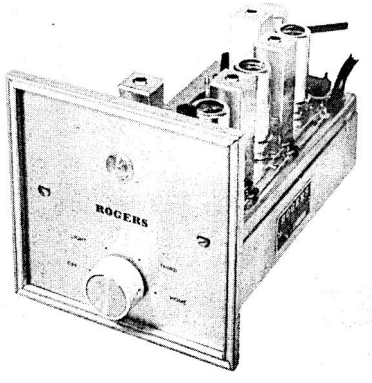
★

TECHNICAL SUPPLIERS Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel.: Shepherds Buch 2581. Cables: Teknika, London, W.12.

F.M. TSL. Fully transistorised. Variable tuning. Range 87.5-108.5 Mc/s. A.F.C. Sensitivity 0.6 mV. Selectivity 350 -c/s band-

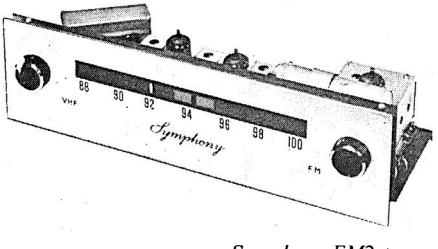


Pamphonic FM 640 tuner



Rogers RD Junior Switched tuner

Sherwood S3MX Multiplex adaptor



Symphony FM2 tuner

width. Powered by one 9 V and one 3 V battery. Size 8 × 2½ × 7¼ in. Weight 3 lbs. Price £19 9s. 6d. (U.K. purchase tax £3 4s. 1d.).

International Mk. IV F.M. Tuner. Variable tuning. Range 87-109 Mc/s. A.F.C. Ratio detector. Aerial imp. 75/90 ohms. Output 500 mV. P.s.n. 110 V to 250 V A.C. Size 12 × 6¼ × 3¼ in. Price £15 14s. 6d. (U.K. purchase tax £2 12s. 10d.).

★

TRIPLETONE Manufacturing Co. Ltd., 241a The Broadway, Wimbledon, S.W.19. Tel.: Liberty 1189.

Tripletone F.M. Tuner. Variable tuning. Range 86-104 Mc/s. A.F.C. Ratio Detector. Aerial imp. 70-80 ohms. Output 500 mV. Cathode follower output. P.s.n. 200-250 volts A.C. for powered version. 250 V D.C. at 25 mA and 6.3 V at 2 A for unpowered version. Size 11 × 6½ × 3 in. Price (unpowered) £11 17s. 11d. (U.K. purchase tax £2 1s. 7d.); (powered) £13 7s. 8d. (U.K. purchase tax £2 6s. 10d.).

★

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

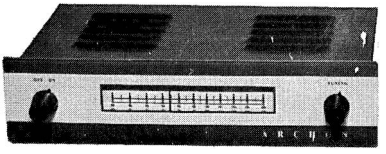
W/B Stentorian F.M. Tuner Mk. II. Variable permeability tuning. Range 88-108 Mc/s. Foster-Seeley disc. P.s.n. 200-240 V at 45 mA, 6.3 V at 2 amps. Size 11⅜ × 4 × 7½ in. Price £16 2s. 9d. (U.K. purchase tax £2 14s. 3d.).

VHF FM tuner. Pre-set station selection. Instant choice of Home, Light or Third. Full A.F.C. Output for Multiplex stereo systems. Prices to be announced.

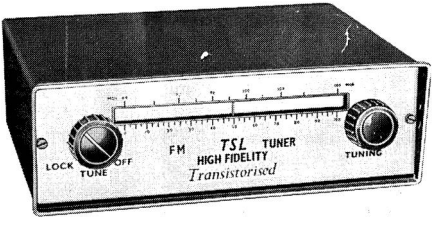
★

ZENITH Radio Corporation. U.K. distributors: Street, London, W.1. Tel.: Grosvenor 4901. Cables: Ramsaco Telex London.

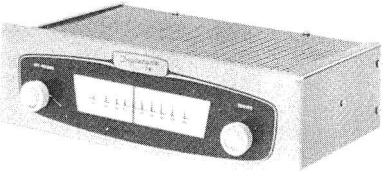
MHT15 Stereo F.M./A.M. Tuner. Range A.M. 550 to 1,600 Kc/s, F.M. 88 to 108 Mc/s. A.F.C. Ratio detector. Limiter. Multiplex incorporated. Aerial imp. 300 ohms. Sensitivity 2-3 μV at 30 dB quieting. P.s.n. 110 V. Dimensions 13½ × 6 × 10 in. Price £52 10s. (U.K. purchase tax £8 8s. 5d.).



Archon PF41 FM tuner

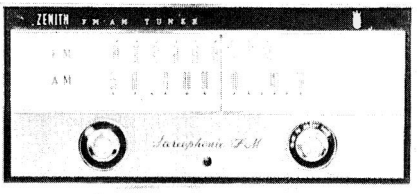


TSL transistorised FM tuner



Tripletone FM tuner

Slentorian Mk. II FM tuner



Zenith MHT 15 Stereo tuner

MICROPHONES AND STEREOPHONY

By M. L. Gayford *

IN THE Directory of microphones which follows this article, a large number of types will be found listed. They fall into three main categories as regards the directional (polar) response—i.e. omnidirectional, bi-directional and unidirectional (cardioid).—The last two (directional) types give more discrimination against interfering noises and unwanted echoes or reverberation but must, of course be addressed on the correct (live) axis as opposed to the dead axis. They are generally more liable to disturbance by wind, breath noise or mechanical shock than are the more robust omnidirectional types of microphone. The reader will probably be able to make a choice to suit his own requirements. Most types of microphone may be used in pairs for stereophonic recording, using a dual channel tape recorder, etc. However, there are certain matching requirements, and the type of microphone selected for stereophony is, of course, dependent on the precise stereo set-up to be used. These questions will be discussed in more detail later in this article.

It will be noted that the matching requirements for stereo apply throughout the channels. Hence the amplifiers and dual track tape recorder used must generally be carefully matched for gain, frequency response and phase delay. Most dual track tape recorders will be found suitable, but for the best results it is advisable to check head alignment etc., very carefully.

Stereophonic Techniques

Stereo amplifiers are usually provided with accurately matched ganged gain controls, tone controls etc., a small balancing control being provided in order that minor differences in loudspeaker sensititivity, etc., may be taken up. Balance may be achieved by adjusting the control so as to centralise a single talker or soloist who is supposed to be on the centre axis of the "sound stage".

Stereophonic sound reproduction marks the highest pinnacle to which the art has progressed so far. It is accepted that more than one reproducing channel is needed for complete satisfaction if anything more ambitious than the simplest sound source is to be reproduced. In normal hearing we listen with two ears to a number of simultaneous sound sources which may occupy almost any position relative to our heads.

In monophonic (single channel) sound reproduction, in its simplest form, the sound is picked up by a single microphone and reproduced by a single loudspeaker. Auditory conditions may be improved by the judicious use of several loudspeakers in the listening room. This helps to dilute the "hole-in-the-wall" effect inherent when only one microphone and loudspeaker are used and, as we know, very good monophonic reproduction can be obtained when the best modern equipment is used. However, directional information regarding the various sound sources normally involved in most "sound pictures" has been lost, together with the relative directionality between both the main direct sound sources and the reverberant or interfering background noise. The net result is that the brain is not able to correlate correctly the acoustic signals sensed by the ears, and thus listening to monophonic sound reproduction generally tends to be a slightly unnatural experience. when compared to the real thing.

The Added Dimension

A modern stereophonic system is able to add a good measure of directional information to the sound reproduction and thus goes some of the way towards adding "another dimension" to the sound reproduction. For economic reasons, stereo is still normally restricted to two channels and it is obviously not possible fully to recreate in the listening room the complex sound field represented by, say, a full orchestral or choral performance in a concert hall. In the cinema, where six channels may be used and reproduction takes place in a relatively large auditorium, a potentially much more satisfying performance should be obtainable. Loudspeakers placed above and below the main channel reproducers and also behind the audience may be brought into play by the use of magnetic tape time delay units, in order to place sound sources in their appropriate positions relative to a listener. There is obviously a great deal of scope for experiment in the use of multi-channel stereo recording and appropriately time-delayed

*Standard Telephones & Cables Ltd.

auxiliary loudspeakers. The latter technique originated in the Philips Laboratories and has been termed *ambiophony*. Nevertheless, given careful attention to detail throughout, some exceedingly good two channel stereo may be achieved. We will now consider stereo systems in more detail.

Basic Stereo Systems

One of the first successful stereo systems was a three channel arrangement using three spaced microphones and three spaced loudspeakers. This was considered to be an economic approach to the production of the "curtain of sound" which would result if an infinite number of microphones comprised a plane across the original studio, the corresponding loudspeakers forming an equivalent plane across the listening auditorium. Any given sound source generally will be nearer to one microphone than to the others and will thus give a larger direct sound signal in that channel, which is also phase advanced compared to the other channels by an amount equivalent to 1 millisecond per foot of differential distance between the source and microphones. This is, of course, due to the speed of sound being one foot per millisec.

In order to get an accurate sound image location it is necessary to have an overall inter-channel match of 1 to 2 dB and as accurate a phase match as possible ($\frac{1}{2}$ millisecond approx.). Thus it is seen that the stereophonic effect produces a virtual sound image by means of inter-channel amplitude and phase differences. The positional accuracy of the image depends on the degree to which the channels are matched, on the acoustical characteristics of the listening room, and on the position of the listener relative to the loudspeakers.

It is unfortunately true for most systems that a good stereo effect is only obtained around the centre area of the listening room. This effective area can obviously be extended with a five or six channel system as used in the cinema, where a larger auditorium is also used. For commercial and economic reasons the original three channel spaced microphone system was later reduced to a two channel spaced system. The spacing of the microphones can be adjusted from a few inches apart to a spacing of several feet. Good positional accuracy of sound sources at either side of the sound "stage" is obtainable, but there is a tendancy towards a "hole in the middle" or "concavity effect" whereby a source moving across the stage tends to recede in the centre or to follow a concave path. Some earlier stereo recordings were made with exaggerated microphone spacing in order to give a noticeable stereo effect on poor domestic systems which often used a single cabinet housing the two loudspeakers, thus giving inadequate spacing. When reproduced on a good system with proper spacing of the loudspeakers, the stereo effect was, of course, exaggerated and was described as "ping-pong stereo". Refinements of the spaced microphone recording technique include the fading in of extra microphones, cross mixing between channels and other manipulations designed to produce what is considered to be an optimum stereo effect for the particular performance or instant concerned. **Fig. 1** shows a spaced microphone system in block schematic form.

Close Microphone Placing

Contemporary with the original experimental three channel spaced microphone stereophony, A. D. Blümlein of EMI made the important discovery that two bidirectional or cardioid microphones may be mounted as close together as possible with their polar

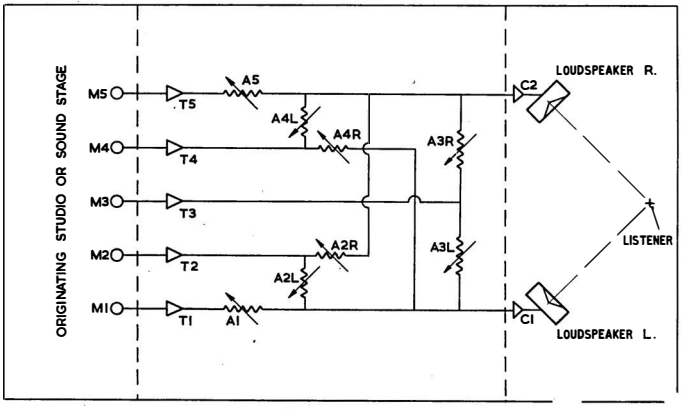


Fig. 1. *When several microphones are used across the "sound stage" (M1—M5) their outputs may be cross-mixed to produce satisfactory stereo in the eventual two channels C1 and C2.*

lobes of maximum response aimed at 45° on either side of the centre line between the microphones and the centre of the sound stage, and will then give a good two channel stereo effect.

Fig. 2 shows the arrangement. It will be seen that a central sound source will give equal signals in the two channels. A source to the left will give a larger signal in the left hand channel than in the right hand channel and vice-versa for a source to the right of the centre line.

There will be substantially no phase difference between the channel signals because the two microphones are close together, the time difference at the two microphones being negligible for any sound source within the sound stage area. Difficulties may arise with simple gradient bidirectional microphones for sources at angles such that sound is incident in the rear lobe of one microphone. This will cause a 180° phase change in the appropriate channel. Apart from some spurious effects of this sort, the stereo signals in the two channels will appear as amplitude differences at the two loudspeakers.

Time Differences

Blümlein argued that the inter-channel amplitude differences are mainly responsible for the stereo effect in any system, the inter-channel phase differences tending to be swamped by random phase changes due to room effects. Actually an effective amplitude-to-time conversion occurs at the listener's ears. This is supported by the theory that binaural sound location is largely due to time differences at the two ears. **Fig. 3** shows how the aural conversion occurs.

Unless the microphone units are very small, as with miniature capacitor capsules, the spacing between the crossed microphone pair will not be negligible. Thus some unwanted interchannel time differences will be introduced in addition to the wanted amplitude differences. For most microphones, it is better to mount them closely side by side as a crossed pair, rather than one above the other. With vertical microphone spacing, sound sources displaced in the vertical plane appear to be displaced horizontally when the sound is reproduced by the usual spaced loudspeakers. Thus an actor's voice and his footsteps might appear to come from different parts of the stage. With side-by-side microphones, slight lateral positional errors will pass unnoticed.

Crossed Microphone Technique

Fig. 4 shows a crossed ribbon microphone pair mounted horizontally a small distance apart. The microphones are nominally pointed at + 45° and − 45° respectively to the "sound stage" centre line. In practice, the angles and the distance of the crossed pair from the scene of action or sound stage may be varied until a satisfactory "coverage" and stereo effect are obtained.

A variation of the crossed microphone technique known as the "mid-side" or M-S arrangement has been used on the continent. Here a cardioid faces forward and a bi-directional microphone is arranged at right angles, its dead axis lying on the centre line and its maximum lobes at + 90° and − 90°. The sum of the microphone outputs is taken for the left hand stereo channel and the difference of the outputs for the right hand channel. Thus the two channel signals for a central sound source are 1 + 0 and 1 − 0 i.e. they are equal. For an extreme left hand signal at + 90°, the channel signals are $\frac{1}{2} + \frac{1}{2}$ and $\frac{1}{2} - \frac{1}{2}$ i.e. 1 and 0, which is correct; similarly for a − 90° signal. Sum and difference operations on signals are simply performed by

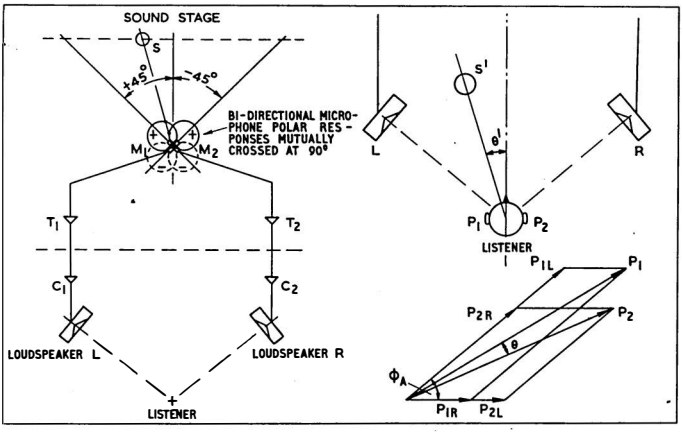


Fig. 2 (*left*), *geometry of coincident microphone system.* **Fig. 3** (*right*), *analysis shows how unequal sound pressures produce the effect of inter-aural time differences.*

suitable series aiding and opposing connections of double wound balanced-primary input transformers.

There are a large number of other stereo circuit manipulations which can be carried out by the use of sum-and-difference techniques. In one example, the sum signal is taken in the case of a stereophonic broadcast, so as to provide a "compatible" monophonic signal derived from the stereo equipment. It is often not possible to obtain anything like optimum quality of reproduction by such a subterfuge but the results may be considered to be acceptable in a great many cases. In other set-ups, relative gain adjustments to the sum and difference signals, followed by a further sum and difference process to reconstitute the individual channels, are used to adjust the location of the reproduced sound images where this is considered necessary. This may sometimes be done with advantage during a tape recording dubbing session. The same effect may be obtained by cross-mixing the normal stereo channels. See **Fig. 1.**

The M-S System

One possible difficulty in the M-S system may be that of obtaining a sufficiently good match over the whole frequency range between microphones of different types. A match to better than 2 dB over most of the frequency scale is desirable for the highest stereo quality. A good match between a bidirectional and a cardioid microphone is most likely to be obtained with one of the miniature capacitor stereo microphones in which individual adjustment of the polar characteristics is possible. These are, however, among the most expensive microphones on the market.

The amateur will probably most easily obtain well-matched microphones with accurate polar curves by using a pair of identical crossed ribbon microphones. In some set-ups, sound reflections from the rear or side walls of the studio or signals from sources at very wide angles may cause spurious images and other disconcerting effects. In these cases, crossed cardioids may be tried.

As regards the relative virtues of spaced microphones and crossed microphones, it is very difficult to generalise. So much depends on individual acoustic conditions, the nature of the sounds to be reproduced and the type of stereo effects desired. For spectacular left-to-right movement spaced microphones may be advantageous. The spacing can readily be varied and omnidirectional moving coil microphones may be used if desired. Some serious experimenters have found, however, that more clear-cut sound images are produced by crossed directional microphones. In this connection, it was estimated that the basic "resolution" of the best stereo system was about 1/10 of the sound stage width. In practice this represents quite precise image location.

Polarity Checking of Stereo Systems

The importance of correct phasing of all microphones in use in a given set-up is well known. In monophonic work, wrongly phased microphones are liable to give rise to bass cancellation when their outputs are mixed in together. At low frequencies the free wave sound pressures within the space of half a wavelength are in-phase. ($\frac{1}{2}$ wavelength at 50 c/s = 11 ft. approx.). Thus all good microphones are supplied having correctly phased and identified terminals. Hence correct wiring of the microphones and amplifiers will normally ensure correct monophonic and/or stereo phasing, but it is still valuable to be able to carry out on-the-spot phasing checks on any set-up. One monophonic check is to bring the microphones or loudspeakers fairly close together and to listen for a reduction of bass on phase reversal.

In a stereo set-up, an overall system phasing check can be made by listening carefully to the reproduction of a single talker or soloist who is placed on the centre axis of the sound stage. Correct overall phasing will give a stereo image which is undoubtedly central, an out-of-phase condition giving a vague image which it is impossible to place in any definite location. This latter method is often used to check loudspeaker and amplifier etc. phasing on domestic stereo systems, it being necessary merely to have available a suitable speech or solo recording.

An interesting method which has been used in stereo recording studios is to connect the X plates of an oscilloscope to one channel and the Y plates to the other. In-phase signals give a correlated trace at an oblique angle, whilst out-of-phase signals give a random trace to which it is impossible to assign any particular direction. This arrangement also is said to give a more general check on the degree to which the studio set-up is giving a good stereo effect. Definite well co-ordinated traces indicate good localisation of images, whilst an excessive amount of randomisation of the trace indicates poor localisation. An experienced observer may be able to use this oscillographic technique as a valuable addition to normal stereo programme monitoring.

Headphone Stereo Listening

There is quite a vogue for stereo earphone listening, even though it is not completely

satisfactory. Among other things, the sound field does not have access to both ears with the diffracting effect of the head in between.

Suitably matched high quality earphones are desirable. Moving coil types are preferred on account of the lower harmonic distortion at high sound levels, and the objection stated above may be partly met by a frequency-discriminating cross-mixing circuit connecting the two earphones which has been used by B. B. Bauer of CBS (*Hi-Fi News*, April 1963).

The attenuation of the circuit must have a certain value, and this can be reduced if required in order to dilute the exaggerated stereo effect of some of the "ping-pong" stereo recordings of the earlier stereo era. **Fig. 5** shows the circuit used.

Multi-microphone Stereo Techniques

So far, single spaced microphone arrays or a single pair of crossed microphones have been considered. However, as in monophonic sound pick-up, although a single microphone pair may be the ideal to aim for, and may be less likely to involve a risk of the unwanted or spurious effects which are liable to occur with multi-microphone set-ups, there are often occasions where more than one microphone pair must be used. Large orchestras, orchestral and choral ensembles, etc., have been found to need more than one stereo pair, or the addition of spaced microphones on either side of the central crossed pair, in order to give an appropriate "stage width" or to give proper localisation of particular individual parts of the ensemble.

The directional information due to the spaced microphones will, however, introduce inter-channel time differences into a system which normally depends on inter-channel amplitude differences for the stereophonic effects. The two effects may conflict, with the result that sound images may wander about. Hence the extra spaced microphones must be introduced with discretion and should preferably be

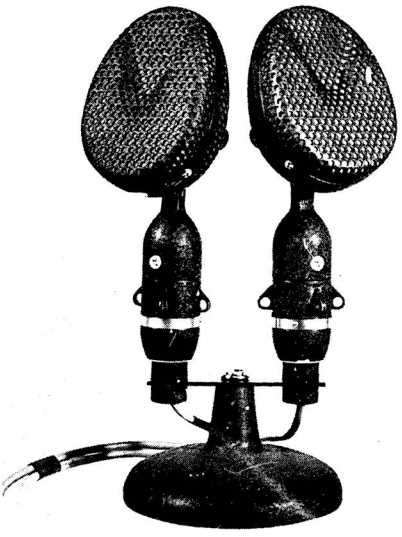


Fig. 4. *Crossed-pair of microphones for stereo.*

placed so as to avoid as far as possible any one instrument or soloist being picked up on both the spaced and the crossed microphones at comparable levels. In other words, the sound level on the nearest microphone should be arranged to be much higher than on the more distant microphones; i.e. it should be mounted close to the instrument or soloist required to be "placed". Alternatively, if the spaced microphones are introduced in order to give a general broadening of the sound stage, or to increase the reverberant sound pick-up, they should be placed at some distance from any prominent instrument or soloist. It may also be necessary to use additional microphones when moving artistes cross close to a central microphone pair. Without the addition of extra spaced microphones, an unduly abrupt transition from side to side may occur.

In general, 2 or 3 ft. distance from a microphone is a minimum distance of approach for

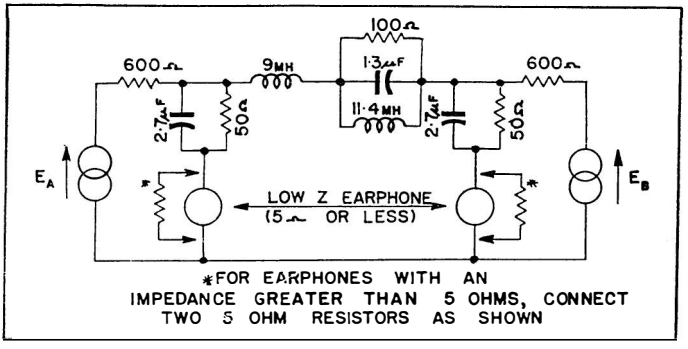


Fig. 5. *Circuit for headphone stereo listening. Left and right signals are fed in at EA and EB.*

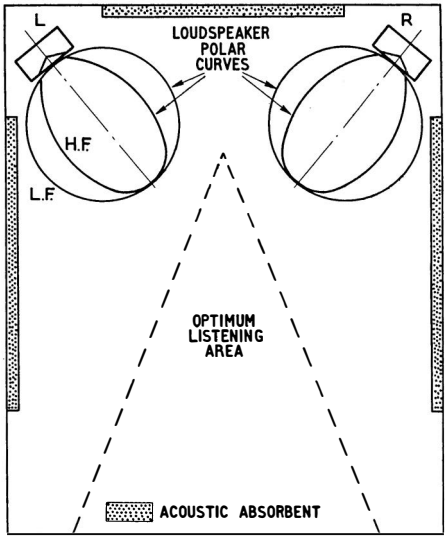


Fig. 6. *Arrangement of forward-facing speakers for good stereo listening over a large area.*

a moving artiste. The recording of *Belshazzars Feast* has been described in *Hi-Fi News*. (*Hi-Fi News* page 486 December 1959). A full symphony orchestra, a choir and an organ occupied a medium-sized hall, the orchestra being on the ground floor with the choir on a balcony. A crossed stereo microphone pair were suspended about 15 ft. above and slightly behind the conductor's head, an additional dual crossed pair of microphones being suspended before the balcony so as to pick up the choir. The "dead" rear axes of the crossed cardioids substantially reduced direct sound pick-up from the orchestra. Some single spaced microphones were suspended on either side of the hall, their outputs being faded into the appropriate stereo channels at low level, so as slightly to broaden the reproduced sound stage. Thus the requirement that the various parts of the ensemble should not appear at comparable strength on more than one microphone pair at once appears to have been met. The final recording was pronounced to be a very satisfactory stereophonic rendering of the work.

Domestic stereophonic reproduction

We have seen that there is obviously a fair amount of scope for experiment and manipulation of microphones, arrangement of artistes and cross-mixing etc. of the stereo signals during recording. Similarly, there is some latitude for experiment with the type and arrangement of loudspeakers and the acoustic treatment of the listening room. Most stereophonic recordings are balanced so as to give reasonable results for listeners sitting in the centre area between two loudspeakers spaced about 10 ft. apart, in a reasonably large living room. Ideally it is desirable to have some acoustic absorption, e.g. curtains, etc. on the wall behind the loudspeaker and on the side walls, so as to minimise reflections which may blur the sound images. **Fig. 6** shows a suggested plan.

There are no very hard-and-fast rules for the type of loudspeakers to be used. It has been suggested that there is an optimum shape for the polar response curve of the loudspeaker, approximating to that of a bidirectional unit, and also that the horizontal width of the cone or radiating aperture should ideally be restricted as far as possible, so as to minimise acoustic path differences between various parts of the radiating surface and a listener, particularly if the latter is seated slightly off the loudspeaker axis. If these path differences are appreciable, some loss of image sharpness may be experienced.

Amateur stereophonic recording

Various experimenters confirm that it is quite possible to make good stereo recordings under home conditions. It is obviously not desirable to lay down any hard and fast rules, as every set-up is likely to present its own particular problems. As we have already mentioned, simple crossed ribbon microphones are likely to be most satisfactory for amateur use. If necessary, an absorbing screen of cellulose wadding or cushioning about 1½ yards square may be placed behind the microphones so as to eliminate unwanted rear pick-up of sound reflections etc. If the sound sources are further than 10 to 20 ft. from the microphones, the use of transistorised preamplifiers may be desirable. Many good designs have been published (S. D. Berry. BBC Monograph No. 26. August 1959). It is suggested that the microphones are generally arranged if possible asymmetrically with respect to the room centre axis, so as to obtain an optimum stereophonic reverberant effect. Some people prefer to check balance by headphones, claiming that more unambiguous centring can be achieved by this means.

If amateur dramatic or operatic performances are to be recorded, the use of spaced microphones, one on each side of a central or near-central crossed pair, is often advantageous in extending the apparent stage width. As mentioned before, the mixing of the spaced microphones into the left and right hand channels must be performed judiciously, so as not to lose the sharpness of individual image location and to avoid anomolous effects.

DIRECTORY OF MICROPHONES

★ In these abridged specifications, the following abbreviations are used: **Imp.**—microphone source impedance. **Rec. load imp.**—recommended load impedance, and sensitivity is given in dB with reference to 1 volt/dyne/cm^2, unless otherwise stated. ■ Stereo.

AKG (Akustische und Kino-Gerate Ges. m.b.H.). Sole U.K. agents: Politechna (London) Ltd., 3 Percy Street, London, W.1. Tel.: Langham 6236. Cables: Polindust, London. Telex No. 23894.

D11N. Moving coil with cardioid directional pattern. Response 80-12,000 c/s. Imp. 200 ohms or 50 K ohms. Fitted with collapsible stand and 5 ft. screened cable. Price £6 10s.

D19C. Restyled version of the D19 finished in grey with silver grill. Moving coil with cardioid directional pattern and bass cut switch. Response 40-16,000 c/s, Imp. 60 or 200 ohms. Price £17 10s.

D58. Moving coil, close-talk microphone. Response 50-12,000 c/s. Sensitivity 0.1 mV/bar. Imp. 200 ohms. Price £11 10s.

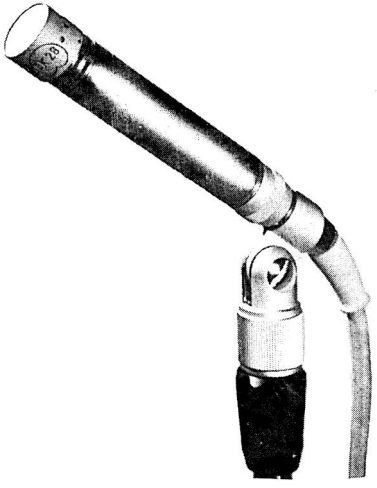
D12. Moving coil with cardioid directional pattern. Response 40-12,000 c/s ±4 dB. Front to back ratio 15 dB. Sensitivity −77 dB. Imp. 60 ohms, or to order. Price £34.

C12. Professional condenser. Sel. switch gives choice of 9 polar characteristics. Response 30-15,000 c/s ±3 dB. Sensitivity −60 dB. Imp. 50 and 250 ohms. Price £170.

C60. Miniature professional condenser. Response 20-30,000 c/s. Imp. 50 or 200 ohms. Available with mains power unit or re-chargeable battery supply unit. Price (mains) £92 10s.; (battery) £79 10s.

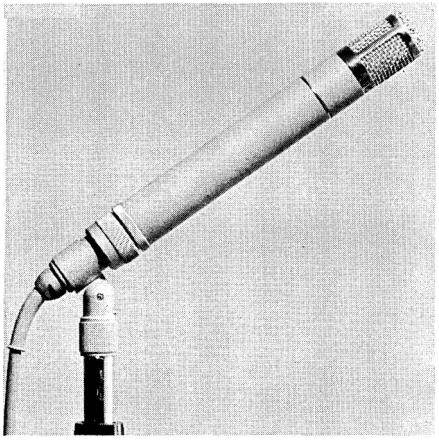
■**C24.** Stereo condenser. Sensitivity 1 mV/bar. Imp. 200 or 50 ohms. Response 30-20,000 c/s. Omni-directional cardioid; bi-directional; hyper-cardioid. Plus 5 intermediate patterns. Sensitivity approx. 1 mV per microbar (at 200 ohms output terminals) −33 dB re 1 milliwatt at a sound pressure of 10 dynes/cm^6. Crosstalk between channels <40 dB throughout entire range. Imp. <200 ohms when delivered. 50 ohms by changing solder connections. N.24 power supply unit. Remote control unit. Twin remote control cable. Price £230.

ST200. Microphone floor stand. Telescopic. Height 42 to 77 in. Three collapsible feet with main support locking device.



AKG C60 miniature condenser

AKG 60 fitted with W60 windshield



AKG C28A condenser

AKG D11N moving coil

AKG D12 moving coil

Anti-vibration characteristics. Microphone may be clamped to face any direction. Price £12 10s.

K58. Microphone headset. Incorporates microphone D58 and headset K50 (see Tape Recorder Accessories). Price £13 10s.

D7A. Moving coil. Omni-directional. Response 80 c/s-13 Kc/s ±5 dB. Sensitivity −74 dB (200 ohms), −52 dB (50 K). Imp. 200 ohms or 50 K available from built-in transformer. Price £3 15s.

C28A. Condenser studio. Cardioid or omni-directional. Response 30 c/s-30 Kc/s. Sensitivity (with GK28 cardioid capsule) −58 dB, (with GK26 omni-capsule) −60 dB. Imp. 50 ohms or 200 ohms, from built-in transformer. Low noise, professional standards, variations C29A, C30A. Price (including N12 power unit, 20 m. cable, and cable for the LF output) C28A £110, C29A £118, C30A £125 10s., C28/29/30A £130 10s.

■**D77A.** Stereo microphone. Moving coil with cardiodi directional pattern. Response 80 c/s-13 Kc/s, flat between 200 c/s-10 Kc/s. Imp. 200 ohms. Upper and lower halves of microphone detachable for A-B use. Both halves with degree calibrations for altering the basic angle of the stereophonic pick-up. Price £15 10s.

C12A. Professional condenser. Remote selection (may be located up to 300 ft. from mic); Control gives a choice of different directional characteristics. Selection can be made during programme pick-up. Response 20 c/s-20 Kc/s. Imp. 50 and 200 ohms. Price £139.

D17. Moving coil with cardioid pattern. Response 50 c/s-15 Kc/s ±3 dB. Front to back ratio 18 dB. Imp. 200 ohms. Price (including flexible shaft adaptor) £24 10s.

D19E. Moving coil with cardioid directional pattern. Response 40 c/s-16 Kc/s. Built-in transformer provides 3 different impedances: 50, 200 ohms, 50 K. Price £21 10s.

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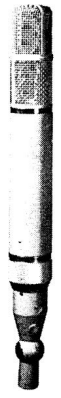
AUDIX B. B. Ltd., Bentfield End, Stansted, Essex. Tel.: Stanstead 3132. Cables: Audix, Stansted.

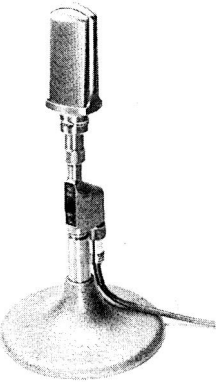
Pearl LD14. Moving coil. Omnidirectional. Response 95 c/s-18 Kc/s. Sensitivity −54 dB. Output imp. 30-200 ohms. Transformer fitted. Price £9 10s.

Pearl LD18. Moving coil. Omnidirectional. Response 80 c/s-18 Kc/s. Sensitivity −54 dB. Output imp. 30-200 ohms. Transformer fitted. Price £10 10s.

Film Industries 78A



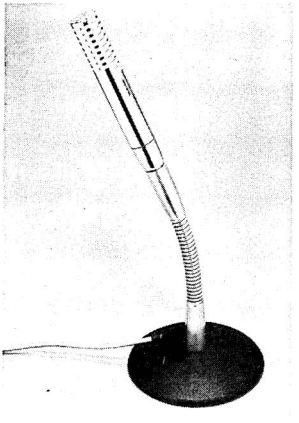
AKG C24 stereo



Grampian GR1

STC 4106-A

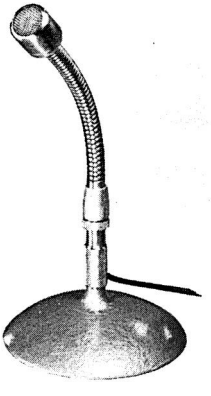
Lustraphone VR165NS



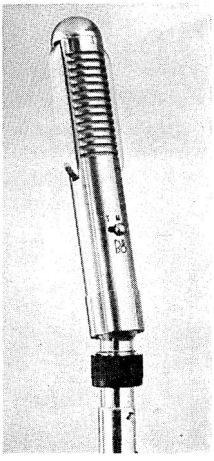
Pearl C8

Lustraphone VR64

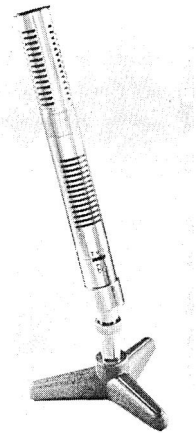
Reslo Type VRT



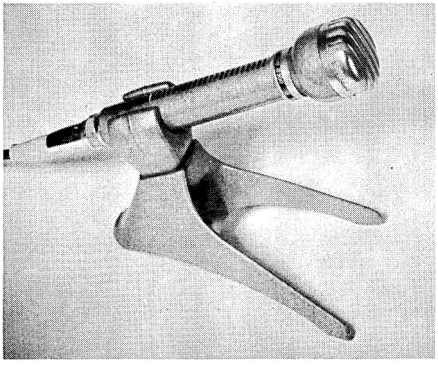
Trix G7852/F



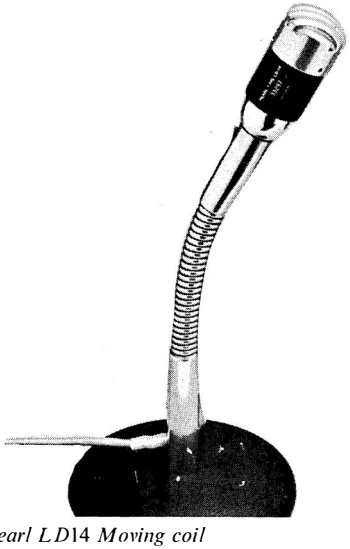
B and O BM3



B and O SM5



AKG D19B Moving coil



Pearl LD14 Moving coil

Pearl RD16. Moving coil. Cardioid. Response 50 c/s-18 Kc/s. Sensitivity —54 dB. Output imp. 30-200 ohms. Transformer fitted. Price £11 15s.

Pearl RD34. Moving coil. Cardioid. Response 30 c/s-20 Kc/s. Sensitivity —54 dB. Output imp. 30-200 ohms. Transformer fitted. Price £12 2s.

Pearl RD32. Moving coil. Cardioid. Response 60 c/s-18 Kc/s. Sensitivity —55 dB. Output imp. 30-200 ohms. Price £22 10s.

Pearl C2. Condenser. Response 20 c/s-18 Kc/s. Sensitivity —55 dB. Output imp. 200 ohms. Price £62.

Pearl C12. Condenser. Response 100 c/s-16 Kc/s. Sensitivity —50 dB. Output imp. 200 ohms. Price £60.

Pearl 8CK. Condenser. Response 20 c/s-18 Kc/s. Variable directivity. Sensitivity —60 dB. Output imp. 200 ohms. Price £72.

Pearl CK. Condenser. Response 20 c/s-18 Kc/s. Sensitivity —55 dB (cardioid), —60 dB (omnidirectional). Output imp. 200 ohms. Price £66.

Pearl C8. Condenser. Response 20 c/s-18 Kc/s (cardioid), 20 c/s-16 Kc/s (omnidirectional). Sensitivity —55 dB. Output imp. 200 ohms. Price £64. Complete with power supply unit, £82.

Pearl ST6. Stereo condenser. Response 20 c/s-16 Kc/s. Sensitivity M channel —55 dB, S channel —60 dB. Output imp. 200 ohms. Price £142.

E3000. Power Supply Unit for microphones 8CK, C2, C8, CK. Price £20. E3100. Power Supply Unit for microphone ST6.

Flexible Swan-neck connectors. For dynamic microphones. Model 1903/K2 less switch, 3 pole connector. Length 175 mm. Price £3 18s. 1903S/K2 with switch. 3 pole connector. Length 220 mm. Price £4 5s.

★

BANG & OLUFSEN, Struer, Denmark. Sole U.K. Importers: Aveley Electric Ltd., Ayron Road, South Ockendon, Essex. Tel.: South Ockendon 3444. Cables: Aersale.

BM3. Ribbon. Response: music 30-13,000 c/s ±2.5 dB, speech bass cut below 1,000 c/s (2 position switch). Impedance 50 ohms. Price £14 10s.

BM4. As BM3 with variable output impedance, 50, 250, and 40,000 ohms. Price £16.

■**Stereophonic Microphone Assembly.** Comprises two B & O ribbon microphones, plus stereophonic baffle assembly. Price £34 5s., with type BM3. £37 5s., with type BM4.

■**SM5.** Stereo microphone. Response 30-13,000 c/s ±2.5 dB. Imp. 150 ohms per channel. Price to be announced.

★

CADENZA. See Simon Equipment Ltd.

★

COSMOCORD Limited, Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 27331. Cables: Cosmocord, Waltham Cross.

Acos Mic. 39-1. Crystal. Response 40-15,000 c/s ±6 dB. Sensitivity −60 dB. Imp. equals capacity of 800 pF. Rec. load imp. not less than 4.7 megohm. 8 ft. cable. Desk or floor stand adaptor available. Price £3 3s.

Acos Mic. 40. Ceramic. Response 30-6,000 c/s. Sensitivity −60 dB. Imp. 2-5 megohms. Price £2. Crystal details as for Mic. 45. Price £1 15s.

Acos Mic. 45. Crystal. Response 30-6,000 c/s. Sensitivity −50 dB. Imp. 2-5 megohms. Price £2.

■**Acos Stereo Mic. 44.** Crystal. Response 50-12,000 c/s. Directional Pattern (Dual Fig. 8)Fig. 8). Sensitivity −70 dB. Imp. 2-5 megohms. Price £6 6s.

Cos Mic. 39 Dynamic. Moving coil. Omni-directional. Response 80 c/s-10 Kc/s ±3 dB. Sensitivity −80 dB (200 ohms), −54 dB (50 K). Transformer fitted, dual impedance. Price £7 10s.

Acos Mic. 55. Crystal. Response 20 c/s-10 Kc/s. Sensitivity −58 dB. Rec. load imp. not less than 1 Meg. Price to be announced.

Acos Mic. 60. Crystal. Response 20 c/s-10 Kcs. Sensitivity −58 dB. Rec. load imp. not less than 1 Meg. Price £2 2s.

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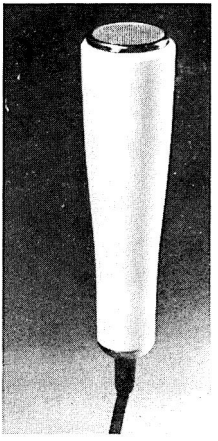
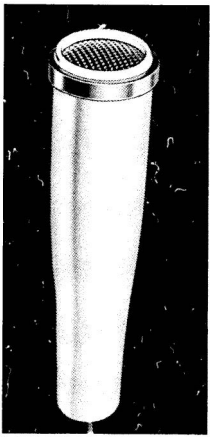
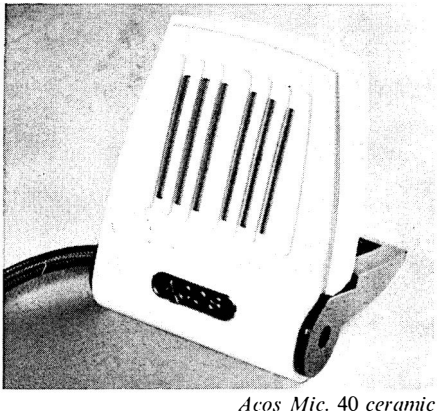
DERRITRON Ltd. See Reslosound.



Acos Mic 39-1

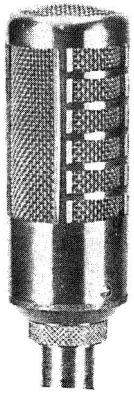


Acos Mic 60

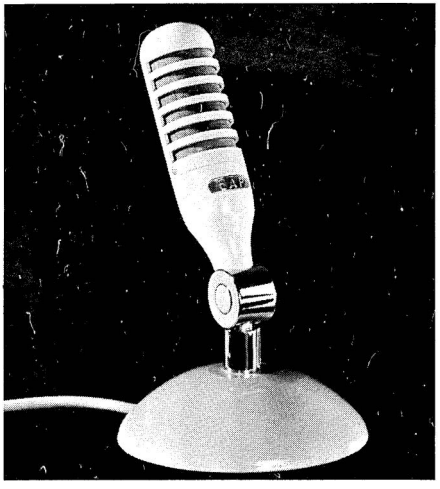


Acos Mic. 40 *ceramic*

Acos Mic. 45 *stereo*



Film Industries M8



Elizabethan Ribbon

Grundig G.M.C. 3 condenser

ELECTROVOICE. See K.E.F. Electronics Ltd.

★

ELIZABETHAN (Tape Recorders) Ltd., Bridge Close, Oldchurch Road, Romford, Essex. Tel.: Romford 64101. Cable address: Elizabethan, Romford.

Elizabethan. Ribbon. Response 50-12,000 c/s. Sensitivity —56 dB. Imp. 50,000 ohms. Built-in transformer. Price £7 17s. 6d.

★

FILM INDUSTRIES Ltd., 90 Belsize Lane, London, N.W.3. Tel.: Hampstead 9632/3. Cables: Troosound, London.

M7. Moving coil. Response 60-9,000 c/s. Imp. 20 ohms. 12 ft. twin screened cable standard, other lengths if required. Table, desk and floor stands available. Price £7 15s. With on/off switch £9 7s. 6d.

M8. Ribbon. Response 50-13,000 c/s. Figure of eight polar diagram. Available matched to all impedances up to 57 K. Plug and socket joint between microphone head and flexible, fitted with 12 ft. of twin-screened cable, other lengths if required. Table, desk and floor stands available. Price, all impedances, £8 15s. With on/off switch £10 7s. 6d.

M8A. Ribbon. Unit as type M8 but without plug and socket connection between mic. head and flexible, this being one unit. A small desk stand is provided, which is removable, enabling other stands to be used. Available in all impedances up to 57 K. Price £8.

★

FORTIPHONE Ltd., Components Division, 124/126 Denmark Hill, London, S.E.5. Tel.: Brixton 8977.

MI. Miniature magnetic. Source imp. 2,500 ohms. Omni-direction. Price £1.

FM-9. Miniature magnetic. Response 200-4,000 c/s for 6 dB down. Sensitivity —74 dB at 1,000 c/s. Source imp. 2.5 K ohms at 1,000 c/s. Price 17s.

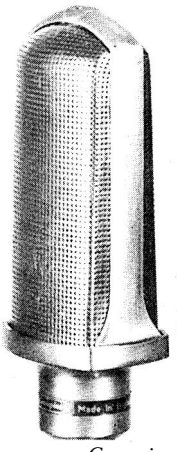
GRAMPIAN REPRODUCERS Ltd., Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657/8. Cables: Reamp, Feltham.

DP4/H. Moving coil. Response 50-15,000 c/s. Sensitivity −52 dB, −70 dB, −86 dB, for high, medium and low impedance. 50,000, 600 and 25 ohms. Tubular case. Price, including lead: high or medium impedance £9, low impedance £8.

DP6. Moving coil. Omni-directional. Response 200 c/s-15 Kc/s. Sensitivity −87 dB (25 ohms), −75 dB (200 ohms), −50 dB (600 ohms), −52 dB (50 K). Built-in transformer fitted to all but low impedance model. Price (low impedance) £8; (other three models) £9.

GR1. Ribbon. Unequal figure of eight. Response 40 c/s-15 Kc/s. Sensitivity −90 dB (25 ohms), −81 dB (200 ohms), −76 dB (600 ohms), −58 dB (50 K). Imp. 25, 200, 600 ohms, 50 K. Built-in transformer. Easily replaceable ribbon. Price (including lead, swivel holder, case) £11 10s.

GR2. Details as for GR1, but equal figure of eight response.



Grampian GR2 ribbon

★

Grampian DP4/H moving coil

GRUNDIG (Great Britain) Ltd., Newlands Park, Sydenham, S.E.26. Tel.: Sydenham 2211.

GCM3. Condenser mic. to match range or Grundig recorders. Price £6 6s.

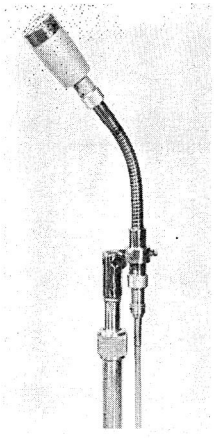
GDM18. Moving coil. Response 100-11,000 c/s. Sensitivity 2.2 mV per micro bar. Source imp. 55 K ohms. Built-in transformer. Price £7 7s.

GM1L. Moving coil microphone. Response 100-8,000 c/s. For use with TK1 Tape Recorder. Price £3 3s.

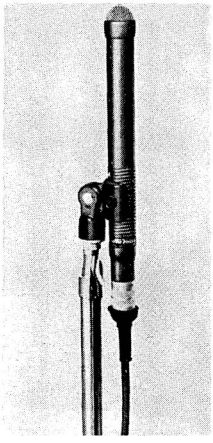
GDSM202. Moving coil. Figure of eight. Response 80 c/s-13 Kc/s ±5 dB. Sensitivity −54 dB. Imp. 50 K. Transformer fitted. Transformers integral with plugs, each unit may be detached and used independently. Price £14 14s.

GDM 12. Moving coil. Omnidirectional. Response 100 c/s-11 Kc/s ±5 dB. Sensitivity 0.15 mV per microbar at 200 ohms, 2.2 mV per microbar at 55 K. Imp. 200 ohms and 55 K. Price £7 7s.

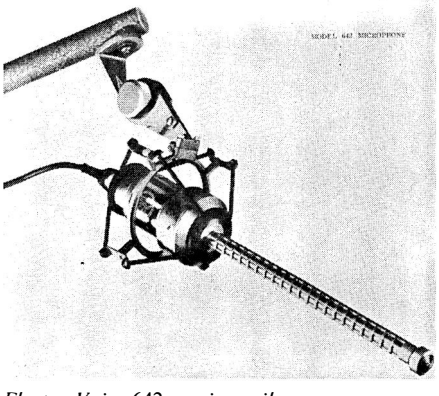
Grundig GDM 18 moving coil



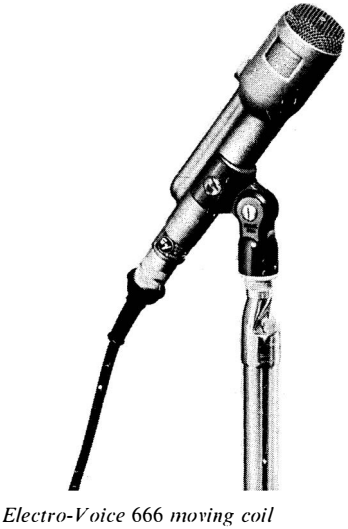
Grampian DP/6



Electro-Voice 655C



Electro-Voice 642 moving coil



Electro-Voice 666 moving coil

KEF ELECTRONICS Ltd., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: KEF.

Electro-Voice 642. Moving coil. Cardiline, unidirectional. Response 30 c/s-10 Kc/s. Sensitivity —68 dB. Imp. 50, 150 and 250 ohms. Transformer fitted. Cardioid up to 500 c/s, sharply directional above. Price on application.

Electro-Voice 655C. Moving coil. Omnidirectional. Response 40 c/s-20 Kc/s. Sensitivity —77 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Very slim design with non-reflecting finish for TV work. Price on application.

Electro-Voice 633. Moving coil. Omnidirectional. Response 70 c/s-10 Kc/s. Sensitivity —57 dB. Imp. high or 150 ohms. Transformer fitted. Price on application.

Electro-Voice 666. Moving coil. Cardioid. Response 40 c/s-15 Kc/s. Sensitivity —75 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Slim cardioid with single moving element. Price on application.

Electro-Voice 649B. Moving coil. Omnidirectional. Response 100 c/s-9 Kc/s ±3 dB. Sensitivity —81 dB. Imp. 50-250 ohms. Transformer fitted. Only 1½ oz. less cable. Price on application.

Electro-Voice 668. Moving coil. Cardioid. Response 30 c/s-16 Kc/s. Sensitivity —78 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Specially designed for boom operation. Price on application.

Electro-Voice 652. Moving coil. Omnidirectional. Response 100 c/s-7 Kc/s. Sensitivity —80 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Semi-rigid tube microphone. Price on application.

★

LEE PRODUCTS (G.B.) Ltd., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

M416. Ribbon. Response 30-13,000 c/s. Source imp. 15-30 ohms. Price £7 15s.

M63. Moving coil. Source imp. 15-30 ohms or high. Omni-directional. Price £8 17s. 6d.

B-72/1110. Crystal. Response 80-16,800 c/s. Source imp. 100 K ohms. Price £5 12s. 6d. With table stand.

B-92/1110. As above but with Floor stand. Price £9

★

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

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

Master C51. Moving coil. Response 50-8,000 c/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/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 100-14,000 c/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 100-14,000 c/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.

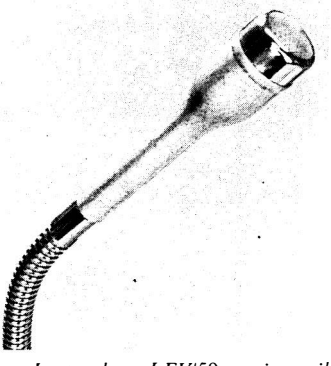
Lavalier LV/59. Neck halter moving coil. Response 100-14,000 c/s. Low, line and high imp. Price £8 18s. 6d.

LD/66. Moving coil. Response 70-12,000 c/s. Sensitivity — 88, — 75, and — 52 dB, for low line and high imp. respectively. Price £4 2s. 6d., low imp., £4 12s. 6d., line and high imp.

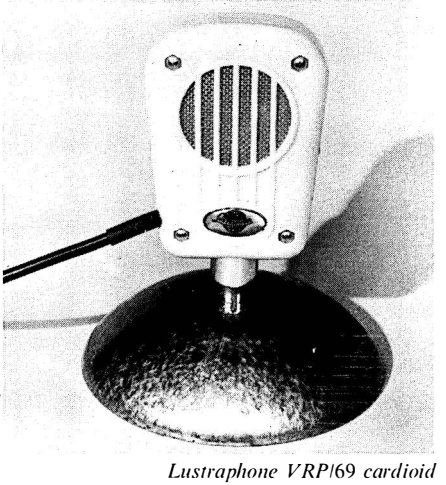
Tubular Hand TH59/SB. Moving coil with switch. Response 150-14,000 c/s. Sensitivity — 88 dB at 25 ohms, — 75 dB at 600 ohms, and — 54 dB at 50,000 ohms. Transformer as required. Price £8 18s. 6d.

Studio VR/53. Ribbon velocity. Response substantially flat to 14,000 c/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.

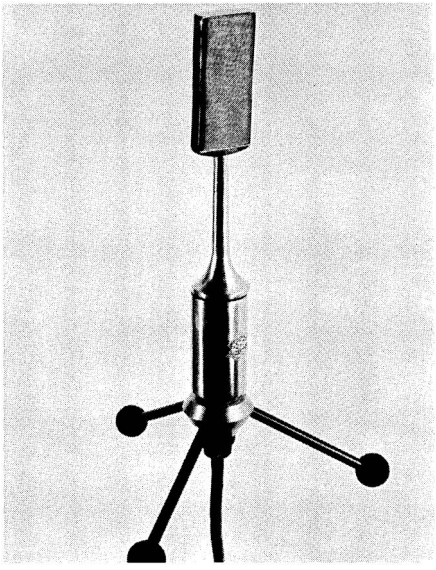
Lustraphone LD/66 moving coil



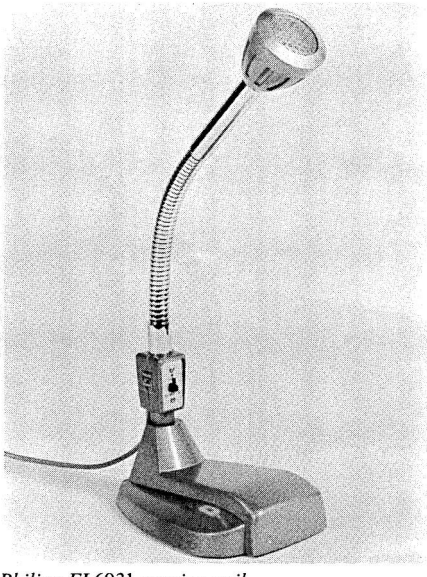
Lustraphone LFV/59 moving coil



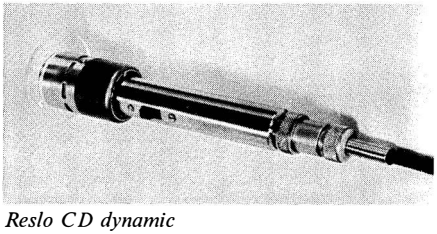
Lustraphone VRP/69 cardioid



Lustraphone VR/70 ribbon



Philips EL6031 moving coil



Reslo CD dynamic

Ribbonette VR/64. Ribbon. Response substantially maintained up to 13,000 c/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.

■Stereomic VR/65. Dual head ribbon. Response 50-13,000 c/s. Sensitivity Stereo — 90 dB at 20 ohms. Source imp. 2 × 300 ohms. Internal transformer. Price £31 10s.

■Stereolus VR/65NS. Dual head ribbon. Response 50-13,000 c/s. Sensitivity stereo — 90 dB at 20 ohms. Price £15 15s.

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

Chest Harness D159/B.S. Moving coil. Response, substantially flat from 150-14,000 c/s. Source imp., low, line, high. 6 ft. cable. Price £11 11s.

Velodyne VC52/THSB. Noise cancelling moving coil with switch. Response rising to 1,700 c/s, flat to 3,500 c/s then falling. Source imp. 25 ohms or as required Transformer as necessary. Price £8 18s. 6d.

Micridyne Model VR/70. Ribbon velocity. Figure of eight. Response substantially flat 50 c/s-14 Kc/s. Sensitivity: Low impedance, 90 dB; high impedance, 56 dB. Imp. as required. Transformer as required. Very small model. Price (low impedance) £10 10s.; (high impedance) £11 11s.

Contadyne Model CMC/68. Moving coil. Small contact microphone with noise cancelling feature. Imp. 70 ohms at 1 Kc/s. Price £8 18s. 6d.

VRP69. Ribbon. Cardioid. F.R. Substantially flat, 50 c/s-13 Kc/s. Sensitivity (low imp.) —90 dB, (high imp.) —56 dB. Output imp. (low) 20-30 ohms; (line) 500-600 ohms, (high) up to 5 K. Slide-switch 1, cardioid/omnidirectional; slide-switch 2, speech filter in/out; slide-switch 3, phase reversing. Rotary controls: cardioid plus figure-of-eight, cardioid minus figure-of-eight. Price £32 11s.

★

PHILIPS ELECTRICAL Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables. Phillamps, London.

EL6014/00. Moving coil. Response 100-10,000 c/s. Sensitivity — 74 dB or — 57 dB. Source imp. 500 ohms or 25,000 ohms. Price £9.

EL6021. Moving coil. Response 60-15,000 c/s. Source imp. 50, 500, 10,000 ohms. Price £14.

EL6031. Hypercardioid moving coil. Response 70-15,000 c/s. Sensitivity — 74 dB or — 58 dB. Source imp. 500 ohms or 25,000 ohms. Price £19.

EL6040. Moving coil. Response 60-20,000 c/s. Source imp. 50,500 and 25,000 ohms. Price £27.

EL6050/01. Condenser. Cardioid or omni-directional. Response 50 c/s-10 Kc/s ±3 dB. Sensitivity —64 dB (50 ohms), —58 dB (200 ohms). Imp. 50, 200 ohms. Transformer fitted. Mic. insert fitted with swivelling head. Wind shield supplied. Price £125.

ET1045. Miniature moving coil. Halter. Omni-directional. Response 150 c/s-10 Kc/s ±3 dB. Sensitivity —88 dB. Imp. 50 ohms. 15, 30, 60 feet extension cables available. Quick release attachment of cable. Price £15, cable extra.

★

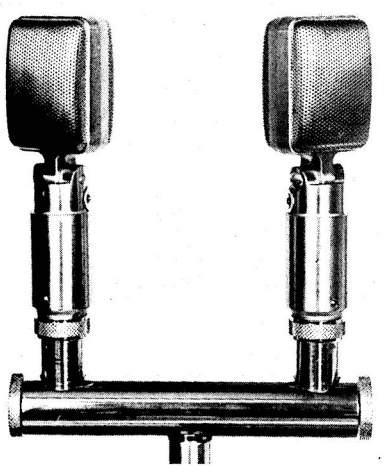
RESLOSOUND Ltd., 24 Upper Brook Street, London, W.1. Tel.: Hyde Park 2291. Cables: Derritron, London.

Reslo Type PR. Pencil ribbon. Response (nominal) ±3 dB, 70-12,000 c/s. Sensitivity 60 dB below at 40 K ohms. Source imp. PRL 30-50 ohms; PRM 250 and 600 ohms; PRH 30-50 and 35 K ohms. Built-in transformer. (M and H tapped dual impedance.) Price PRL £8 8s.; PRM and PRH, £8 18s. 6d.

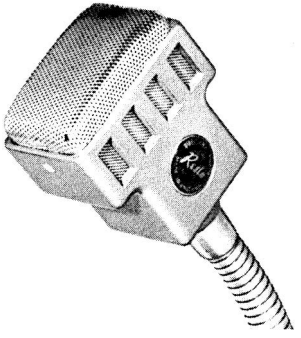
Accessories: Type **GE1.** Transistor coupler unit, for use between any impedance microphone (unbalanced) and the high impedance (nominal 100,000 ohms) microphone input of tape recorder or power amplifier. Response within 1 dB 40-20,000 c/s. Price £7 7s.

Reslo SR1 Studio. Studio quality ribbon. Figure of eight, but can be modified by filter pad provided for high quality speech. Response 30 c/s-20 Kc/s ±2 dB. Sensitivity 73 dB below for 300 ohms model SR1/M. Imp (SR1/L) 30-50 ohms, (SR1/M) 300 ohms. Transformer included in tubular base. Price £38 17s. (including accessories).

Reslo VRT. Miniature high-quality ribbon. Figure of eight, can be modified by filter pads.

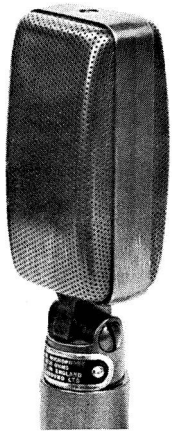


Two Reslo RBT/L for stereo

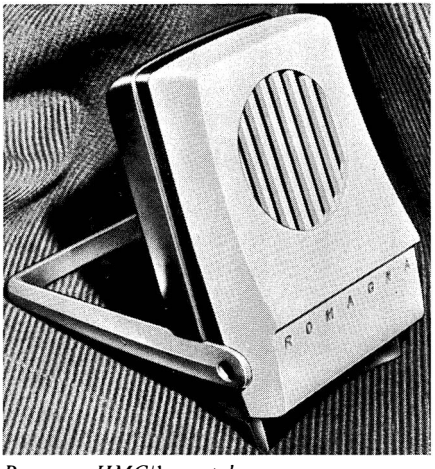


Reslo CR ribbon

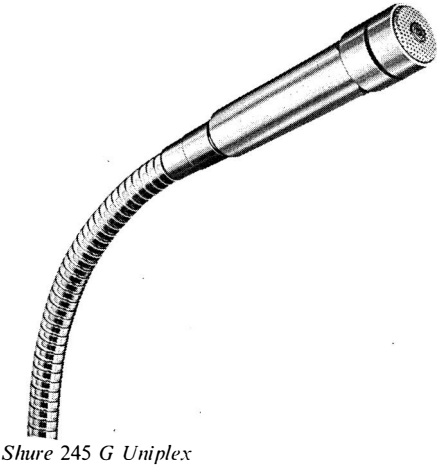
Reslo PRL ribbon



Reslo Studios SR1 ribbon



Romagna HMC/1 crystal



Shure 245 G Uniplex

Response 40 c/s-16 Kc/s ±4 dB. Sensitivity 81 dB below for 300 ohm model VRT/M. Imp. (VRT/L) 30-50 ohms, (VRT/M) 300 ohms. Transformer included in tubular base. Small size, realistic quality, able to change characteristic by fitting optional acoustic filter pads. Price £15 15s. (including cable set and other accessories).

Reslo RBT Series. High quality miniature ribbon. Figure of eight, modified as required by filter pads. Response 30 c/s-16 Kc/s ±3 dB. Sensitivity 58 dB below for high impedance model (nominal 40 K). Imp. (Model L) 30-50 ohms, (Model M dual impedance) 250 and 600 ohms, (Model H dual impedance) 30-50 ohms and 40 K. Transformer in base casting. Model TS (with switch) also available. Price RBT/L £10 2s.; RBT/M & H £10 12s. 6d.; Model TS £2 5s. extra.

Reslo CD. Moving coil, cardioid. Response 100 c/s-10 Kc/s ±5 dB. Sensitivity 49 dB below for Model H (nominal 40 K). Imp. (Model L) 40 ohms, (Model M) 250 and 600 ohms, (Model H) 30-50 ohms and 40 K. Transformer in medium and high impedance models. Optional perspex ring for speech presence. Price CD/L £10 15s. 6d.; CD/M and CD/H £11 6s.

A "Hand" model with switch is also available, model CDHS. Price CDHS/L £13 2s. 6d.; CDHS/M & H £13 13s.

Type **LTU1.** Line coupling transformer unit, for use between a low impedance microphone (15 to 50 ohms) and the high impedance (nominal 100,000 ohms) microphone input of tape recorder or power amplifier. Response ±1 dB, 50-15,000 c/s. Price £4 4s.

Types **MT101** and **MT102.** Line coupling transformer for chassis or unit mounting, for use between a low impedance microphone (MT101 for 15-50 ohms, MT102 for 250-600 ohms) and the high impedance (nominal 100,000 ohms) microphone input of tape recorder or power amplifier. Response ±2 dB, 50-15,000 c/s. Price, MT101 £2 12s. 6d. MT102 £2 18s.

Microphone stands: **Floor model.** Fixing to base by collar and nut. Min. height 38 in.; max. height 60 in. Weight 12 lb. Price £6 15s. 6d. **Table model.** Min. height 16 in.; max. height 26 in. Weight 2¼ lb. Price £3 17s. 6d. **Desk model** (round). Height 5½ in. Base dia. 6¾ in. Weight 22 oz. Price £1 17s. Desk base model (optional switch). **Type SR.** Pressure Mazak die-

casting arranged with cable slot and recessed to accept Reslo standard 3 pin external run plug. Size $4\frac{1}{2} \times 3\frac{1}{4}$ in. Price £1 7s. 6d. Type **SF** supplied with alternative silent cushioning in place of rubber feet fitted to SR model. Price £1 12s. 6d. Slide switch for muting when microphone is permanently fitted to desk base, price 12s. 6d.

Other accessories available include mounting units, cables, reducers, adaptors etc.

★

ROMAGNA REPRODUCERS Ltd. Distributor: S. Kelly, Romagna, Bycullah Avenue, Enfield, Middx.

HMC/1. Crystal. Response 80-8,000 c/s. Sensitivity —54 dB. Source imp. 2,000 p.f. Price £1 5s.

★

RONETTE. Distributors: H. K. Harrisson & Co. Ltd., 73 Great Titchfield Street, London, W.1. Tel.: Museum 5861, Welbeck 9453.

Ronette MM-65. Crystal. Omni-directional. Response 30 c/s-10 Kc/s. Imp. 5 Meg. 300 pF. Small and rugged. Price £2 5s.

★

SHURE ELECTRONICS Ltd., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 6361.

55S Small Unidyne. Cardioid moving coil. Response 50-15,000 c/s. Sensitivity —57 dB at high impedance. Source imps. 35-50, 150-250 ohms, and high. Switched transformer built-in. Price £27 13s. 4d.

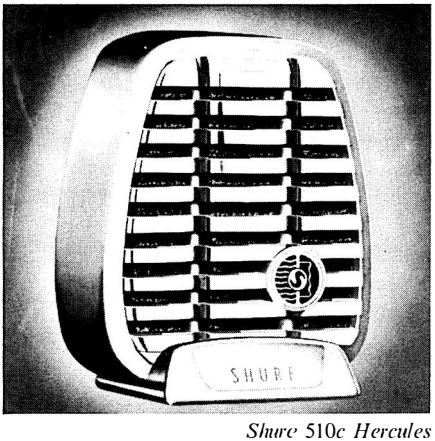
510C Hercules. Controlled magnetic. Response 100-7,000 c/s. Sensitivity —52.5 dB. Source impedance, high. Price £5 13s. 4d.

535 Slendyne. Moving coil. Response 60-13,500 c/s. Sensitivity —61 dB. Source imps. 50-250 ohms and high. Switched built-in transformer. Price £24 6s. 8d.

545 Unidyne III. Cardioid moving coil. Response 50-15,000 c/s. Sensitivity —55 dB. Source impedance 25-250 ohms and high. Built-in transformer. Price £28 6s. 8d.

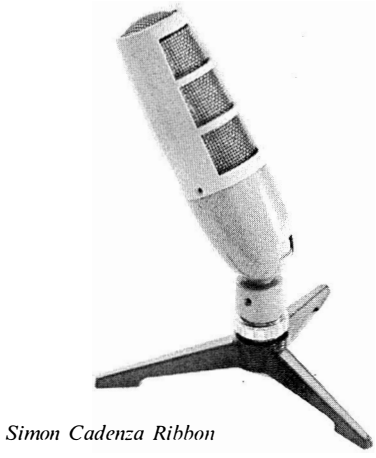
Sonodyne II Model 540S. Moving coil microphone. Response 60-10,000 c/s varable. High output. Price £16 13s. 4d.

Shure 55S Small Unidyne



Shure 510c Hercules

Shure 545 Unidyne III



Simon Cadenza Ribbon

SIMON EQUIPMENT Ltd., 48 George Street, Portman Square, W.1. Tel.: Welbeck 2371. Cables: Simsale, London.

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

Cadenza Crystal. Response 30-8,000 c/s. Sensitivity —47 dB. Optimum load 10 megohms. Minimum load 1 megohm. Price £3 13s. 6d.

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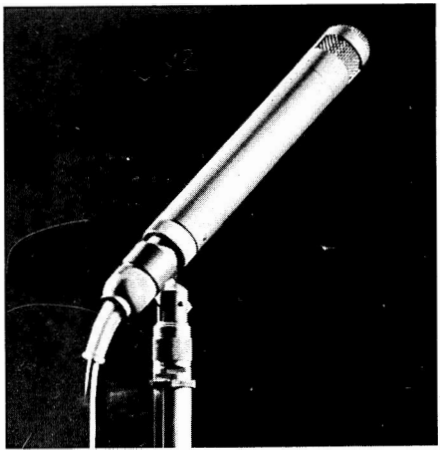


S.T.C. 4108 *condenser*

S.T.C. LTD., Electromechanical Division, West Road, Harlow, Essex. Tel.: Harlow 21341.

4021-J. Spherical omnidirectional moving coil. Flat response 30-15,000 c/s. Impedance 30 ohms. Sensitivity —80 dB. Price £24.

4032-G. Moving coil hand microphone. Flat response 40-10,000 c/s. Impedance 30 ohms. Sensitivity —78 dB. Windshield available. Price £23.

4033-A. Cardioid microphone. Moving coil and ribbon elements which can be used individually or in combination. Flat response 30-10,000 c/s. Impedance 50 ohms. Sensitivity —80 dB. Front to back ratio 15 to 20 dB. Price £54.

S.T.C. 4033 *moving coil and ribbon*

4035-D. Moving coil. As 4032 above, but for stand mounting. Price £23.

4037-A. Moving coil unobtrusive "Pencil" microphone. Flat response 30-15,000 c/s. Impedance 30 ohms. Sensitivity —84 dB. Price £24 (long model).

4037-C. As 4037-A, but short model. Price £23 10s.

4038-A. Studio ribbon microphone. Accurate figure of eight polar response. Flat response 30-15,000 c/s. Impedance 30 ohms. Sensitivity —85 dB. Non-linear distortion 0.1%. Controlled transient response. Price £43 10s.

4104-B & C. Commentator's lip microphone. High degree of noise cancellation. Flat response 70-10,000 c/s. Impedance 30 ohms. Output −82 dB ref. 1 V for 10 dynes/cm². Price £70.

4105-A. Cardioid moving coil. Flat response 60-10,000 c/s. Impedance 30 ohms. Sensitivity −82 dB. Front to back ratio 15 to 20 dB. Price £22 10s.

4106-A. Moving coil. Flat response 30-12,000 c/s. Sensitivity −85 dB. Source imp. 30 ohms. Price £49 10s.

4108. Condenser. Cardioid. Response 30 c/s-20 Kc/s. Sensitivity −60 dB. Imp. 30 or 300 ohms. Transformer fitted. Small directional studio microphone. Price £110.

4112. Lavalier and general purpose tubular microphone. Moving coil. Omnidirectional. Response 60 c/s-10 Kc/s. Sensitivity −85 dB. Imp. 30 ohms. Light weight, slender appearance. Price to be announced.

★

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

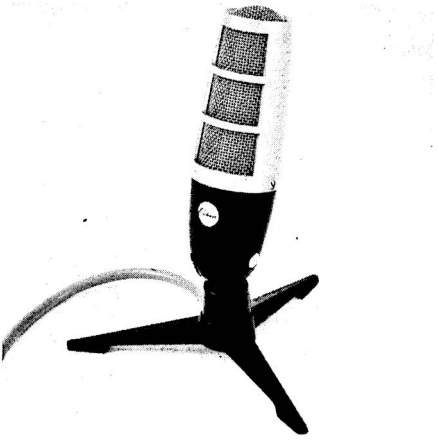
Slendalyne. Single Element Ribbon. Cardioid. Response 50 c/s-12 Kc/s ±3 dB. Sensitivity −82 dB. Imp. 600 ohms. Transformer fitted. High front to rear discrimination 15 dB. Price £25.

Slendalyne. Moving Coil. Omni-directional. Response 30 c/s-12 Kc/s ±3 dB. Sensitivity −75 dB. Imp. 600 ohms. Transformer fitted. High quality applications under most adverse conditions. Price £14 10s.

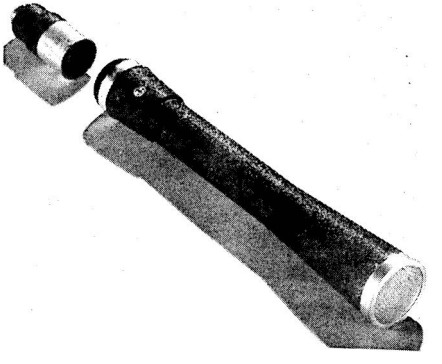
Slendalyne. Velocity Ribbon. Figure of eight. Sensitivity −76 dB. Imp. 600 ohms. Transformer fitted. Good damping and shock resisting. Price £10 10s.

★

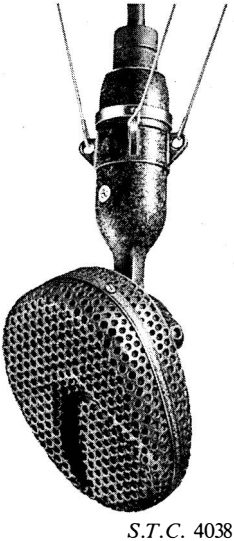
TECHNICAL SUPPLIERS Ltd., Hudson House, 63 Goldhawk Road, Shepherds Bush, London, W.12. Tel.: Shepherds Bush 2581/4794. Cables: Teknika, London.



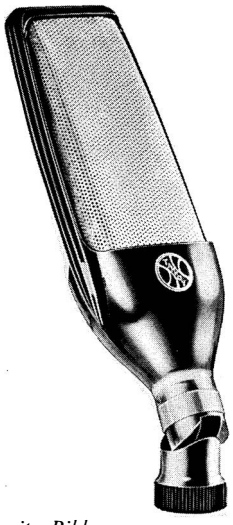
Simon Cadenza crystal



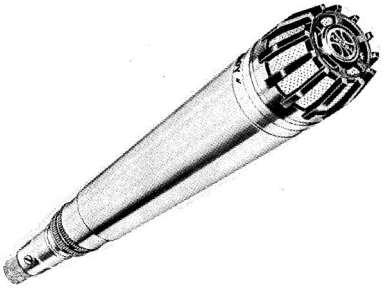
S.T.C. 4037-*A moving coil*



S.T.C. 4038 *A ribbon*



Tannoy Velocity Ribbon



Tannoy Slendalyne moving coil

Tannoy Slendalyne ribbon

M1. Dual impedance moving coil. Response 60-13,000 c/s. Sensitivity —72 dB at 200 ohms, —52 dB at 50,000 ohms. Built-in transformer. Price £4 4s.

MX3. Crystal. Response 50-13,000 c/s. Sensitivity —52 dB. Source imp. 0.5 to 5 meg. Price with stand and cable £2 5s.

★

TELLUX Ltd., Avenue Works, Gallows Corner, Colchester Road, Romford, Essex. Tel.: Ingrebourne 43971. Cables: Tellux, Romford.

MD21. Moving coil. Spherical. Response 50-15,000 c/s. Sensitivity — 53 dB. Source imp. 200 ohms. Transformer optional. Price £13 2s. 6d.

MD201. Moving-coil. Near-spherical. Response 50-13,000 c/s. Sensitivity — 53 dB. Source imp. 200 ohms. Transformer optional. Price £20 9s. 6d.

MD3T. Moving coil. Spherical. Response 50-10,000 c/s. Sensitivity — 61 dB. Source imp. 200 ohms. Price £24 13s. 6d.

MD3M. Moving coil. Spherical. Response 50-10,000 c/s. Sensitivity — 67 dB. Source imp. 200 ohms. Price £27 6s.

MD31. Moving coil. Near-spherical. Response 50-12,000 c/s. Sensitivity — 59 dB. Source imp. 200 ohms. Price £24 3s.

MD4. Cardioid moving coil hand mic. Noise cancelling. Response 50-10,000 c/s. Sensitivity—more than 76.5 dB. Source imp. 200 ohms. Price £15 4s. 6d.

MD42. Cardioid moving coil hand mic. Noise cancelling. Response 200-10,000 c/s. Sensitivity—more than 80 dB. Source imp. 200 ohms. Price £11 1s. 6d.

MD403. Moving coil. Uni-directional. Response up to 12,000 c/s. Sensitivity — 56 dB. Source imp. 200 ohms. Transformer optional. Price £7 17s. 6d.

MD405. Cardioid moving coil. Uni-directional. Response 100-14,000 c/s. Sensitivity — 55 dB. Source imp. 200 ohms. Price £15 4s. 6d.

MD407. Moving coil. Cardioid. Response 100 c/s-12 Kc/s. Sensitivity at 1 Kc/s approx. 1.15 mV per microbar. Imp. 200 ohms. Price £8 8s.

MD408. Cardioid moving coil. Directional. Response 100-14,000 c/s. Sensitivity — 55 dB. Source imp. 200 ohms. Price £10 10s.

MD421. Moving coil directional studio mic. Response 30-17,000 c/s. Source imp. 200 ohms. Transformer optional. Price £17 6s. 6d.

MD43. Moving coil voice mic. Source imp. 200 ohms. Price £6 6s.

MD53. Moving coil. Spherical. Sensitivity — 53 dB. Source imp. 200 ohms. Transformer optional. Price £5 15s. 6d.

MD7. Moving coil. Source imp. 200 ohms. Sensitivity—more than 76.5 dB. Transformer optional. Price £4 4s.

MD82. Tele-microphone for studio use. Club-shaped. Response 50-13,000 c/s. Sensitivity — 62 dB. Source imp. 200 ohms. Price £54 12s.

■**MDS1.** Stereo mic. incorporating two dynamic units. Response — 15,000 c/s. Sensitivity — 57 dB. Source imp. 200 ohms. Price £21 10s. 6d.

(Sensitivity given in this range is relative to 1 mw/10 dyne/cm².)

★

TRIANON Electric Ltd., 3 Violet Hill, London, N.W.8. Tel.: Maida Vale 2255.

SE101. Crystal hand mic. Response 50-12,000 c/s. Source imp. 1 meg. ohm. Price £1 15s.

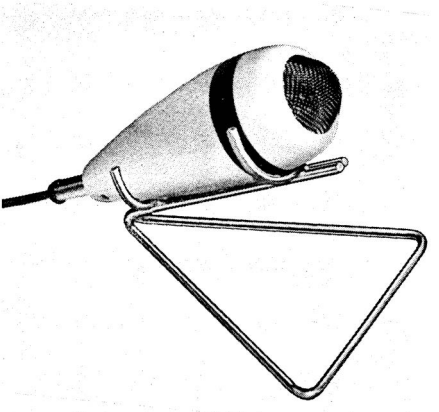
SE102. As above but table model version. Price £1 15s.

Diana. Crystal. Response 50-12,000 c/s. Price £3 3s. (Moving coil version available.)

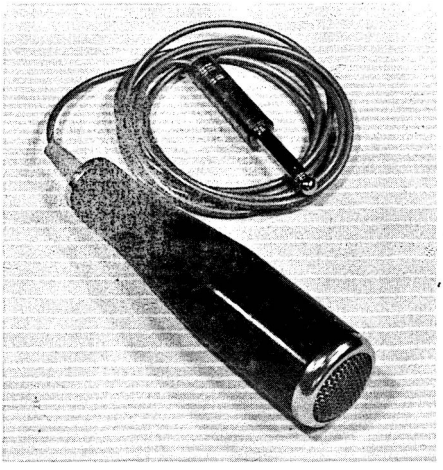
★

TRIX ELECTRONICS Limited, 1-5 Maple Place, London, W.1. Tel.: Museum 5817. Cables: Trixadio, Wesdo, London.

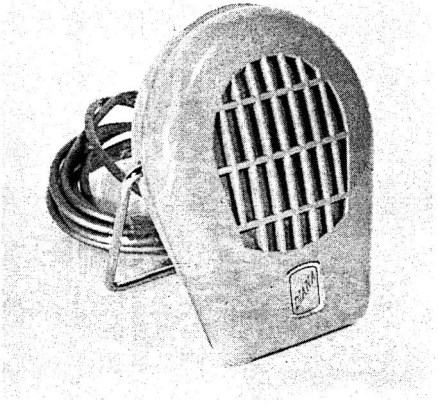
G7871. Two models D and C. Moving coil. Response 50-8,000 c/s. Source imp. 30 ohms. G7871/D 18 ft. cable, with switch. G7871/C 18 ft. cable, 3-pin locking type plug. Stands as required. Price: D £7 15s. C £9 2s. 6d.



TSL MX3 crystal



Trianon SE101 crystal



Trianon Diana crystal

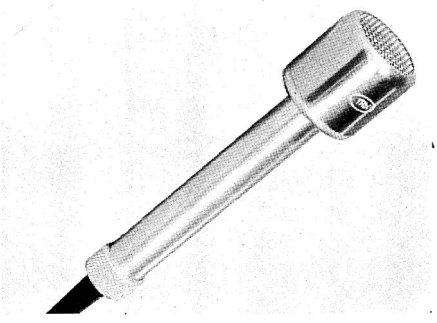
Trix G7871C moving coil

G7823. Ribbon. Response 50-12,000 c/s. Source imp. 30 ohms. 18 ft. cable, 3 pin locking type plug. Stands as required. Price £9 12s. 6d.

G7852. Moving coil. Response 50-9,000 c/s. Source imp. 30 ohms. Cable and connector, G7975/H hand type, or G7976/S stand fitting. G7977/N neck sling attachment. Price, microphone £7 15s.; G7975/H £1 10s.; G7976/S £1 10s.; G7977/N 12s. 6d.

G7852/F. Moving Coil. Similar to G7852 but incorporating flexible stem. Cable and connection G7976/S for stand fitting. Price, microphone £8 5s.; G7976/S £1 10s.

M88. Moving coil. Omni-directional. Response 50-17,000 c/s. Source imp. 30 ohms. Price £26 10s.



Trix G7854 moving coil

G7854. Moving Coil. Response 100 c/s-11 Kc/s. Imp. 30 ohms. Hand-type, complete with cable. Price £7 7s. Can be used with neck sling attachment G7977/N, also with stand fitting with swivel clip attachment G.7979/C, 18s. 6d.

M76A. Moving coil. Cardioid. Response 100 c/s-15 Kc/s. Sensitivity — 63 dB. Imp. 30 ohms. Attenuation—rear to front, — 20 dB. Price £19 15s.

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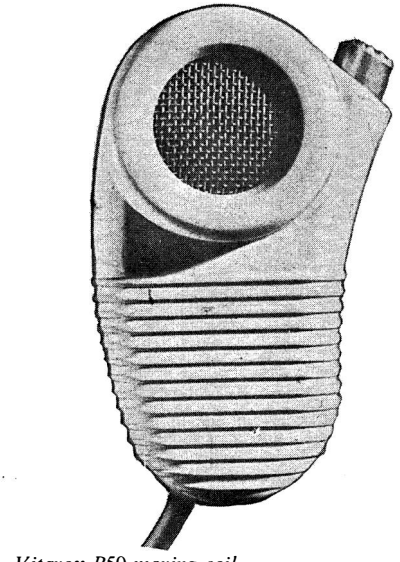


Vitavox B50 moving coil

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

B50. Moving coil. Response 60-8,000 c/s. Sensitivity —85 dB. Source imp. 25 ohms. 6 ft. cable. Price, with control switch, £6 10s.

B51. Crystal. Response 60-8,000 c/s. Sensitivity —50 dB. Source imp. 1 megohm. 6 ft. cable. Price, with control switch, £5 10s.

B54. Moving coil. Response 60-8,000 c/s. Sensitivity —85 dB (excluding transformer). Source imp. according to built-in transformer 200, 500, 10,000, 100,000 ohms. Price, complete with control switch, £8.

Type A. Moving coil. Response 60-8,000 c/s. Sensitivity —68 dB. Source imp. 25 ohms. Rec. load imp. 25 ohms. Price £9 9s.

DIRECTORY OF MAGNETIC TAPE

THIS year the number of different grades and types of magnetic recording tape available is greater than ever before, and the owner of a recorder who merely wishes to "buy a reel of tape" may easily become perplexed. Briefly, there are three important factors to consider when selecting a tape: base material, thickness and magnetic coating. The material and thickness determine the mechanical properties of the tape, while the electrical performance depends on the quality of magnetic coating.

There is little that the amateur can do in the matter of coating quality other than follow the general rule that better things are usually more expensive. Higher quality tapes will give more *consistent* results in terms of recording level, frequency response and signal-to-noise ratio, while absence of small bubbles and other physical irregularities will minimise drop-out due to this cause. Whatever tape is chosen there will be an optimum high frequency bias current for the particular recorder in use if the highest undistorted level is to be recorded.

On the mechanical properties, more specific guidance is possible. Tape should be flexible, tough and disinclined to stretch or shrink, and the best performer in this respect is undoubtedly polyster. Next comes PVC, then acetate. These differences are also reflected in the price. This does not mean that the cheaper tapes are no use, but that for the very highest quality a little more outlay is necessary.

Tape thickness is the last factor of importance. In decreasing thickness, tapes are called Standard, Long, Double and Triple Play. With any given base material, the thinner tapes are naturally more flexible, and for quarter-truck working, where drop-out is more prevalent, Standard tape is normally too stiff to ensure continuous close contact with the tape head in the recorder. So the rule here is: Standard play for full or half-track use, but Long or Double play for quarter-track. A certain amount of print-through between turns on the reel may be experienced with Double and Triple Play tapes, and the latter should only be used when playing time is the main consideration.

AGFA A. G., Leverkusen, W. Germany. Agfa Ltd., 27 Regent Street, London, S.W.1. Tel.: Regent 8581.

PE31. Long Play. Polyester base. Spool sizes: 3 in., 210 ft.; 5 in., 900 ft.; 5¾ in., 1,200 ft.; 7 in., 1,800 ft.; 10 in., 3,280 ft. Prices: 9s., £1 8s., £1 15s., £2 10s., £4 8s. 6d.

PE41. Double Play. Polyester base. Spool sizes: 3 in., 300 ft.; 5 in., 1,200 ft., 5¾ in., 1,800 ft.; 7 in., 2,400 ft.; 10 in., 4,600 ft. Prices: 13s. 9d., £2 0s. 3d., £2 17s. 6d., £3 16s. 6d., £7 2s. 6d.

PE65. Triple Play. Polyester base. Spool sizes: 3 in., 450 ft.; 4 in., 900 ft.; 4¼ in., 1,200 ft.; 5 in., 1,800 ft.; 5¾ in., 2,400 ft.; 7 in., 3,600 ft. Prices: £1 2s. 6d., £1 19s., £2 6s. 3d., £3 6s. 3d., £4 8s., £6 13s. 9d.

All tapes are supplied on reels with leader and contact strips. Extra leader strip is supplied White, Red or Green at 3s. 9d. for 80 ft. The 10 in. spools listed are for users of Revox tape recorders. Agfa Plastic Cases are available for storing 5 in., 5¾ in. and 7 in. spools of tape.

★

BASF Chemicals Ltd., 5a Gillespie Road, London, N.5. Tel.: Canonbury 2011.

LGS 52. Standard Tape. Spool sizes: 3 in., 150 ft.; 4 in., 300 ft.; 5 in., 600 ft.; 5¾ in., 900 ft.; 7 in., 1,200 ft.; 8¼ in., 1,800 ft. Prices: 7s. 6d., 13s. 6d., £1 1s., £1 8s., £1 15s., £2 17s. 6d.

LGS 35. Long Play. Spool sizes: 3 in., 210 ft.; 4 in., 450 ft.; 4¼ in., 600 ft.; 5 in., 900 ft.; 5¾ in., 1,200 ft.; 7 in., 1,800 ft.; 8¼ in., 2,400 ft. Prices: 9s., 14s. 6d., £1 1s., £1 8s., £1 15s., £2 10s., £3 12s. 6d.

LGS 26. Double Play. Spool sizes: 3 in., 300 ft.; 4 in., 600 ft.; 4¼ in., 900 ft.; 5 in., 1,200 ft.; 5¾ in., 1,800 ft.; 7 in., 2,400 ft. Prices: 14s., £1 5s., £1 10s., £2 2s., £2 15s., £2 17s. 6d.

PES 18. Triple Play. Spool sizes: 3 in., 450 ft.; 4 in., 900 ft.; 4¼ in., 1,200 ft.; 5 in., 1,800 ft. Prices: £1 2s., £1 19s., £2 9s., £3 6s.

★

C.B.S. INTERNATIONAL, 12-16 Watling Street, London, E.C.4. Tel.: City 2238.

CIP 6 Standard 5 in., 600 ft., 17s. 6d.; CIP 9 5¾ in., 900 ft., £1 3s.

LP 9 Long play. 5 in., 900 ft., £1 1s.; LP 12 5¾ in., 1,200 ft., £1 5s.; LP 18 7 in., 1,800 ft., £1 15s.

CMXP 12 Double play. 5 in., 1,200 ft., £1 8s.; CMXP 18 5¾ in., £2 7s.; CMP 24 7 in., 2,400 ft., £2 16s.

CIP-12PR Professional 7 in., 1,200 ft., £1 7s. 6d.

Triple Play Tape is also available. Details and prices on application.

★

DE VILLIERS (Electronic World) Ltd., 16-20 Strutton Ground, Westminster, London, S.W.1. Tel.: Abbey 5960.

Standard Play. Acetate base. Spool sizes: 3 in., 175 ft. Price: (4 spools) 18s., (12 spools) £2 8s.; 4 in., 300 ft. Price: (4 spools) £1 6s.; 5 in., 600 ft. Price: (2 spools) £1 6s.; 5¾ in., 850 ft. Price: (per spool) 16s.; 7in., 1,200 ft. Price: (per spool) 19s.

Long Play. Acetate base. Spool size: 7 in., 1,800 ft. Price £1 8s.

Long Play. Polyester base. Spool sizes: 3 in., 225 ft. Prices: (4 spools) £1 2s.; (12 spools) £3; 4 in., 450 ft. Price: (2 spools) £1 1s.; 5 in., 900 ft. Price: (2 spools) £1 15s.; 5¾ in., 1,200 ft. Price: (per spool) £1 4s.; 7 in., 1,800 ft. Price: (per spool) £1 11s.

Double Play. Special polyester base. Spool sizes: 3 in., 375 ft. Price: (4 spools) £2, (12 spools) £5 8s.; 4 in., 600 ft. Price: (2 spools) £1 10s.; 5 in., 1, 150 ft. Price: (per spool) £1 7s.; 5¾ in., 1,750 ft. Price: £1 15s.; 7 in., 2,400 ft. Price: (per spool) £2 5s.

ELECTRO - TECHNO - DYNAMICS, 101 Leadenhall Street, London, E.C.3. Tel.: Avenue 6982.

Ferrodynamic Brand 5. Acetate base. Spool sizes: 5 in., 600 ft., 16s.; 5 in., 800 ft., 18s. 6d.; 5¾ in., 1,200 ft., £1 3s. 6d.; 7 in., 1,200 ft., £1 5s.; 7 in., 1,800 ft., £1 15s. Mylar Dupont: 3 in., 300 ft., 13s.; 5 in., 1,200 ft., £1 17s. 6d.; 7 in., 1,200 ft., £2; 7 in., 1,800 ft., £2 4s.; and 7 in., 2,400 ft., £3. Super quality Mylar Dupont 7 in., 2,400 ft., £3 10s.

★

E.M.I. TAPE Ltd., Blyth Road, Hayes, Middx. Tel.: Hayes 3888. Cables: Emitape, London.

"44". Cellulose acetate. Standard play. Spool sizes: 3¼, 5, 5¾, 7 in. Price: 6s. 9d., 18s., £1 4s. 6d., £1 10s.

"77". PVC. Professional grade. Standard play. Spool sizes: 5, 5¾, 7, 8¼, 10½, 11½ in. Price: £1 10s., £1 15s. 6d., £2 8s., £3 13s. 6d., £5 4s. 9d., £4 19s. 6d.

"88". PVC. Standard play. Spool sizes: 3, 3¼, 4, 5, 5¾, 7, 8¼, 10½, 11½ in. Price: 7s. 6d., 7s. 6d., 10s. 6d., £1 1s., £1 8s., £1 15s., £2 17s. 6d., £3 18s. 9d., £3 13s., 6d.

"99". PVC. Long play. Spool sizes: 3, 3¼, 4, 5, 5¾, 7, 8¼, 10½ in. Price: 9s. 6d., 9s. 6d., 14s. 6d., £1 8s., £1 15s., £2 10s., £3 12s. 6d., £5 10s.

"100". Polyester. Double play. Spool sizes; 3¼, 4, 5, 5¾, 7 in. Price: 17s., £1 5s., £2 5s., £2 17s. 6d., £4.

★

A. C. FARNELL Ltd., Vicar Lane, Leeds 2. Tel.: Leeds 35111.

Irish 195. Acetate. Standard play. Spool sizes: 3, 5, 5¾, 7 in. Price: 4s. 11d., 17s., £1 3s., £1 7s. 6d.

Irish 196. Acetate. Long play. Spool sizes: 5, 5¾, 7 in. Price: £1 4s. 6d., £1 7s., £1 19s. 6d.

Irish 211. Acetate. Standard play. Spool sizes: 5, 5¾, 7 in. Price: £1 1s., £1 8s., £1 15s.

Irish 231. Mylar. Standard play. Spool sizes: 5, 7 in. Price: £1 6s., £2 5s.

Irish 241. Mylar. Long play. Spool sizes: 3, 5, 5¾, 7 in. Price: 9s., £1 8s., £1 15s., £2 10s.

Irish 251. Tensilized Mylar. Double play. Spool sizes: 3, 4, 5, 5¾, 7 in. Price: 13s. 9d., £1 5s., £2 5s., £2 12s. 6d., £4.

★

FERRANIA, Milan. Sole U.K. distributors: Neville Brown & Co. Ltd., Electrin House, 93/97 New Cavendish Street, London, W.1. Tel.: Langham 7161.

R42. Cellulose acetate. Standard play. Spool sizes: 3, 3¼, 5, 5¾, 7 in. Price: 5s. 6d., 8s. 6d.; 18s., £1 4s. 6d., £1 10s.

LD3. Cellulose acetate. Long play. Spool sizes: 3, 3¼, 5, 5¾, 7 in. Price: 7s. 6d., 12s. 6d., £1 5s., £1 12s., £2 10s.

MLD3. Polyester. Long play. Spool sizes: 3, 3¼, 5, 5¾, 7 in. Price: 8s. 6d., 12s., £1 8s., £1 15s., £2 10s.

MDD4. Polyester. Double play. Spool sizes: 3, 3¼, 5, 5¾, 7 in. Price: 12s., £1 2s., £2 5s., £2 17s. 6d., £4.

High Output. Cellulose acetate. Standard play. Spool sizes: 3, 3¼, 5, 5¾, 7 in. Price: 7s. 6d., 12s. 6d., £1 5s., £1 12s., £2 10s.

PR4. Professional cellulose acetate. Spool size: 10½ in. Price: £4 10s.

★

GEVAERT Ltd., Great West Road, Brentford, Middx. Tel.: Isleworth 2131. Cables: Artoveg, Brentford-Hounslow.

Gevasonor Type M. Acetate. Standard play. Spool sizes: 4, 5, 5¾, 7, 8¼, 10 in. Price: 10s. 6d., 18s., £1 3s. 6d., £1 10s., £2 3s. 6d., £2 15s.

Gevasonor Type LR. Acetate. Long play. Spool sizes: 3, 4, 5, 5¾, 7, 8¼, 10 in. Price 7s. 6d., 13s. 6d., £1 4s., £1 8s. 6d., £2 2s., £2 15s., £4.

Gevasonor Type LRP. Tensilized polyester. Long play. Spool sizes: 3, 4, 5, 5¾, 7, 8¼, 10 in. Price: 9s., 16s., £1 8s., £1 15s., £2 10s., £3 5s., £4 15s.

Gevasonor Type DP. Tensilized polyester. Double play. Spool sizes: 3, 4, 5, 5¾, 7 in. Price: 14s., £1 5s., £2 5s., £2 15s., £4.

Gevasonor Type Tr.P. Tensilized polyester. Triple play. Spool sizes: 3, 4, 5 in. Price: £1 1s. 6d., £1 18s. 6d., £3 5s. 6d.

★

ILFORD Ltd., Ilford, Essex. Tel.: Ilford 3000.

Ilfotape. Long Play. PVC. Spool sizes: 5, 5¾, 7 in. Price £1 8s., £1 15s., £2 10s.

★

KODAK Ltd., Kodak House, Kingsway, London, W.C.2. Tel.: Holborn 7841.

T100. Standard play. 'Tri-acetate base. Price (5-in. spool, 600 ft.) 18s. 0d.; (7-in. spool, 1,200 ft.) £1 10s.

V150. Long play. PVC base. Price (3¼-in. spool, 300 ft.) 11s. 0d.; (5-in. spool, 900 ft.) £1 8s.; (7-in. spool, 1,800 ft.) £2 10s.

P200. Double Play. Polyester base. Price (3¼-in. spool, 400 ft.) 17s. ; (5-in. spool, 1,200 ft.) £2 5s.; (7-in. spool, 2,400 ft.) £4.

P300. Triple play. Extra thin polyester base. Price (3-in. spool, 450 ft.) £1 1s. 6d.; (3¼ in. spool, 600 ft.) £1 7s. 6d.; (5 in. spool, 1,800 ft.) £3 5s. 6d.; (7 in. spool, 3,600 ft.) £5 15s.

★

LEE PRODUCTS (Great Britain) Ltd.—(Concessionaires of Audio Devices Inc. (U.S.A.), 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

Audiotape. A range of 8 grades and thicknesses for amateur and professional use. Spool sizes: 3, 3¼, 4, 5, 5¾, 7 in.

★

MINNESOTA MINING and Manufacturing Company, 3M House, Wigmore Street, London, W.1. Tel.: Hunter 5522. Cables: Minnesota, London.

Scotch 111. Acetate. Standard play. Spool sizes: 3¼, 4, 5, 5¾, 7 in. Price: 6s. 9d., 9s., 18s., £1 4s. 6d., £1 10s.

Scotch 311. PVC. Standard play. Spool sizes: 3¼, 5, 5¾, 7 in. Price: 7s. 6d., £1 1s., £1 8s., £1 15s.

Scotch 102. Polyester all-purpose. Spool sizes: 5, 5¾, 7 in. Price: £1 2s. 9d., £1 10s. 3d., £1 18s.

Scotch 150. Polyester. Long play. Spool sizes: 3¼, 4, 5, 5¾, 7, 8¼ in. Price: 9s. 6d., 14s. 6d., £1 8s., £1 15s., £2 10s., £3 12s. 6d.

Scotch 200. Tensilized polyester. Double play. Spool sizes: 3¼, 4, 5, 5¾, 7 in. Price: 17s., £1 5s., £2 5s., £2 17s. 6d., £4.

★

MSS RECORDING Company Ltd., Colnbrook, Bucks. Tel.: Colnbrook 2431.

MSS Standard. Spool sizes: 3, 3¼, 4, 5, 5¾, 7, 8¼ in. Price: 5s. 6d., 9s., 10s. 6d., £1, £1 7s. 6d., £1 15s., £2 10s.

MSS Long Play. Spool sizes, 3, 3¼, 4, 5, 5¾, 7, 8¼ in. Price: 8s. 6d., 11s., 14s. 6d., £1 8s., £1 15s., £2 10s., £3 10s.

MSS Double Play. Spool sizes: 3, 5, 5¾, 7 in. Price: 10s. 6d., £2 5s., £2 17s. 6d., £4.

★

PHILIPS Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

Philips Standard Play. Green PVC. Spool sizes: 4, 5, 5¾, 7 in. Price: 13s. 6d., £1 1s., £1 8s., £1 15s.

Philips Long Play. Red PVC. Spool sizes: 3, 4, 5, 5¾, 7 in. Price: 9s., 14s. 6d., £1 8s., £1 15s., £2 10s.

Philips Double Play. Blue PVC. Spool sizes: 3, 4, 5, 5¾, 7 in. Price: 14s., £1 5s., £2 2s., £2 12s. 6d., £3 17s. 6d.

Philips Triple Play. Grey. Spool sizes: 3, 4 in. Price: £1 2s., £1 19s.

★

R.C.A. Great Britain Ltd., Lincoln Way, Windmill Road, Sunbury-on-Thames, Middx. Tel.: Sunbury-on-Thames 5511.

R.C.A. Red Seal Professional. ¼ in. tape. 1.0 mil. Long Play. Acetate base. Spool sizes: 5, 7, 10½ in. Price: £1 7s. 6d., £2 4s. (£4 for NAB hub spool), £5.

1.5 mil. Professional Grade. Acetate. Spool sizes: 3, 5, 7, 10½ in. Price: 6s., 19s., £1 10s. (£3 5s. for NAB hub), £4 2s. 6d.

Snap-Load Cartridge Mylar. Polyester base. 560 ft., £2 2s. 6d.

0.75 mil. Tensilized Extra-long Play Mylar. Polyester base. Spool sizes: 3, 5, 7, 10½ in. Price: 14s., £2 5s., £4, £9 10s.

0.5 mil. Extra-long Play Mylar. Polyester base. Spool sizes: 5, 7 in. Price: £2, £3 10s.

1.0 mil. Long Play Mylar. Polyester base. Spool sizes: 3, 5, 7, 10½ in. Price: 9s., £1 10s., £2 10s. (£4 17s. 6d. for NAB metal hub), £5 17s. 6d.

1.5 mil. Professional Grade Mylar. Polyester base. Spool sizes: 5, 7, 10½ in. Price: £1 5s., £2 (£4 5s. for NAB metal hub), £5 5s.

1.0 mil. Long Play Mylar. ½ in. Polyester base. 10½ in spool with NAB metal hub. 3,600 ft. Price: £12 15s.

NAB spools have 3 in. centre holes.

★

SONY. Tellux Ltd., Avenue Works, Gallows Corner, Colchester Road, Romford, Essex. Tel.: Ingrebourne 43971.

SY Standard play. Acetate base. Spool sizes: 3 in, 200 ft.; 5 in., 600 ft.; 5¾ in., 850 ft.; 7 in., 1,200 ft. Prices: 6s., 16s., £1 2s., £1 8s.

MY Long Play. Polyester base. Spool sizes: 3 in., 260 ft.; 5 in., 900 ft.; 7 in., 1,800 ft. Prices: 8s. 6d., £1 5s 6d., £2 5s. 6d.

SOUNDCRAFT Magnetics Ltd., Haddenham, Bucks. Tel.: Haddenham 384 & 422.

Standard. Standard play. Tri-acetate base. Spool sizes: 3, 5, 5¾, 7 in. Price: 5s., 17s., £1 3s., £1 7s. 6d.

Standard 50. Long play. Tri-acetate base. Spool sizes: 3, 5, 5¾, 7 in. Price: 7s. 6d., £1 4s. 6d., £1 7s., £1 19s. 6d.

Plus 50. Long play. Mylar base. Spool sizes: 3, 5, 5¾, 7 in. Price: 9s., £1 8s., £1 15s., £2 10s.

Plus 100X. Double play. Mylar base. Spool sizes: 3, 5, 5¾, 7 in. Price: 13s. 6d., £2 2s., £2 12s. 6d., £3 17s. 6d.

★

TAPE RECORDERS (Electronics) Ltd., 784/788 High Road, Tottenham, London, N.17. Tel.: Tottenham 0811. Cables: Taperec, London.

Sound Sonocolor WHS. PVC. Standard play. Spool sizes: 3, 3¼, 4, 5, 5¾, 7, 9¾ in. Price: 8s., 9s. 6d., 13s. 6d., £1 1s., £1 8s., £1 15s., £3 15s.

Sound Sonocolor WSM. PVC. Long play. Spool sizes: 3, 3¾, 4, 5, 5¾, 7, 9¾ in. Price: 9s. 6d., 14s. 6d., 16s. 6d., £1 8s., £1 15s., £2 10s., £5 5s.

Sound Sonocolor WDT. PVC. Double play. Spool sizes: 3, 3¼, 4, 4¼, 5, 5¾, 7 in. Price: 14s., £1 1s., £1 5s., £1 11s. 6d., £2 2s., £2 12s. 6d., £3 17s. 6d.

Super Synchro-Cine. Black lines printed on yellow backing for synchronizing cine films. 5 in. spool with mirror £2 15s., without mirror £2 10s.

★

TELEFUNKEN.—Sole U.K. distributors, Welmec Corporation Ltd., 147/148 Strand, London, W.C.2. Tel.: Temple Bar 3357. Cables: Welmcor, London.

Telefunken Long Play. PVC. Spool sizes: 5, 5¾, 7 in. Price: £1 8s., £1 15s., £2 10s.

Telefunken Double Play. PVC. Spool sizes: 5, 5¾, 7 in. Price: £2, £2 10s., £3 15s.

★

TOPCO ENTERPRISES, 101 Sydenham Avenue, Belfast 4, N. Ireland.

Burgess 111. Acetate base. Standard Play. Spool sizes: 3, 4, 5, 5¾, 7 in. Prices: 7s. 6d., 9s. 6d., 17s. 6d., £1 3s., £1 7s. 6d.

Burgess 150. Polyester/Mylar base. Long play. Spool sizes: 3, 5, 5¾, 7 in. Prices: 9s., £1 5s., £1 12s., £2 7s.

Burgess 102. Polyester/Mylar base. All purpose. Spool sizes: 5, 7 in. Prices: £1 1s., £1 15s.

Burgess 190. Acetate base. Long play. Spool sizes: 5, 5¾, 7 in. Prices: £1 1s., £1 5s., £1 15s.

Burgess 200. Tensilized Polyester/Mylar base. Double play. Spool sizes: 3, 5, 5¾, 7 in. Prices: 12s., £2 2s., £2 15s., £3 8s.

Burgess 141. Acetate base. Stereo quality. Standard. Spool sizes: 5, 7 in. Prices: 18s. 6d., £1 10s.

Burgess 140. Acetate base. Stereo quality. Long play. Spool sizes: 5, 7 in. Prices: £1 4s., £2.

★

ZONAL FILM (Magnetic Coatings) Ltd., Zonal House, Westfields Road, Acton, London, W.3. Tel.: Acorn 6841. Cables: Zonogram, London, W.3.

Zonatape. Acetate standard play, 3, 5, 5¾, 7 in. Price: 5s. 3d., 18s., £1 4s. 6d., £1 10s.

Zonatape. PVC Standard play. Spool sizes: 3, 5, 5¾, 7 in. Price 5s 9d., £1 1s., £1 8s., £1 15s.

Zonatape. Polyester base. Extra play. Spool sizes: 3, 5, 5¾, 7 in. Price: 9s., £1 8s., £1 15s., £2 10s.

Zonatape. Sprocketed tape ¼ in. Length to order. Price 1¼d. per ft.

Length of tape in feet	*Type of spool*	*Maximum playing times in hours and minutes*											
		1 Track				*2 Tracks*				*4 Tracks*			
		15 i/s	$7\frac{1}{2}$ i/s	$3\frac{3}{4}$ i/s	$1\frac{7}{8}$ i/s	15 i/s	$7\frac{1}{2}$ i/s	$3\frac{3}{4}$ i/s	$1\frac{7}{8}$ i/s	15 i/s	$7\frac{1}{2}$ i/s	$3\frac{3}{4}$ i/s	$1\frac{7}{8}$ i/s
3,600	$8\frac{1}{4}$″ DP	48	1 36	3 12	6 24	1 36	3 12	6 24	12 48	3 12	6 24	12 48	25 36
2,400	7″ DP $8\frac{1}{4}$″ LP	32	1 4	2 8	4 16	1 4	2 8	4 16	8 32	2 8	4 16	8 32	17 4
1,800	5″ TP 7″ LP $8\frac{1}{4}$″ S	24	48	1.36	3.12	48	1.36	3.12	6.24	1.36	3.12	6.24	12.48
1,700	$5\frac{3}{4}$″ DP	22	47	1 30	3 1	45	1 30	3 1	6 2	1 30	3 1	6 2	12 5
1,200	5″ DP $5\frac{3}{4}$″ LP 7″ S	16	32	1 4	2 8	32	1 4	2 8	4 16	1 4	2 8	4 16	8 32
900	4″ TP 5″ LP	12	24	48	1 36	24	48	1 36	3 12	48	1 36	3 12	6 24
850	$5\frac{3}{4}$″ S	11	22	45	1 30	22	45	1 30	3 1	45	1 30	3 1	6 2
600	4″ DP 5″ S	8	16	32	1 4	16	32	1 4	2 8	32	1 4	2 8	4 16
450	3″ TP 4″ LP	6	12	24	48	12	24	48	1 36	24	48	1 36	3 12
400	$3\frac{1}{4}$″ DP	5	10	21	42	10	21	42	1 25	21	42	1 25	2 50
300	$3\frac{1}{4}$″ LP 4″ S	4	8	16	32	8	16	32	1 4	16	32	1 4	2 8
200	$3\frac{1}{4}$″ S	$2\frac{1}{2}$	5	10	21	5	10	21	42	10	21	42	1 25
150	3″ S	2	4	8	16	4	8	16	32	8	16	32	1 4

Note: *The 4 tape thicknesses are listed as S (Standard), LP (Long Play), DP (Double Play) and TP (Triple Play).*

THINKING ABOUT TAPE

by Graham Balmain *

THE BIGGEST news in audio tape recording during the last year or two has undoubtedly been the firm and widespread adoption of quarter-track working at low tape speeds, followed—a long way behind—by the appearance of several brands of triple-play tape and the first £5 tape recorder. My own personal bouquets go firstly, for surprises, to the German firm who, on a domestic-class recorder, threw out a faithful fifteen-year-old direct tape drive system in favour of the indirect idler-flywheel system; replaced pressure pads with a velveteen band; designed spool clutches which really did maintain a constant tape tension and dissipate snatch; incorporated sensible recording pre-emphasis at low speeds; and, on the three-head models, fitted record and playback heads designed separately for optimum performance.

Intelligence

My second bouquet, for commonsense, goes to the Oslo firm who designed a first-class narrow-track tape mechanism but even so, recognising that it must still allow the tape to weave a little, made the record head tracks several thou' wider than the playback. My third bouquet, for honesty, goes to the designer of heads who said in public: "... within reasonable limits any well-designed and well-finished head performs very much like any other well-designed and well-finished head, and there is not really very much to choose between dozens of widely different approaches to the subject ... the man who really makes a good magnetic head is the craftsman in the workshop ..."

If these items didn't exactly hit you between the eyes at the time, don't worry too much. Except perhaps for the £5 tape recorder, they could hardly be classed as banner headline material even in the (let's face it) restricted sphere of high-fidelity enthusiasm. The truth is that magnetic recording has always seemed as curiously remote from the rest of hi-fi as hi-fi is from life in general; taken for granted, like the plumbing, and likewise not investigated too deeply. Even tape enthusiasts feel this gulf from time to time, as though the ghost of Hilaire Belloc walked around them:

Ignorance

"Lord Edgware tried to mend the electric light
Himself. It struck him dead, and serve him right!
It is the business of the wealthy man
to give employment to the artisan."

But I doubt such Edwardian sentiments would survive the do-it-yourself atmosphere of any self-respecting hi-fi household faced with problems in pickups or preamplifiers. Then why should it be magnetic recording which always seems, like the events it reproduces, to have been in suspended animation for about half a century, and yet at the same time to be so complex that science can't quite have caught up yet? Perhaps because it has, in a way, and because it is.

A.C. Biassing

On the one hand there have been only two significant technical advances since Poulsen's Telegraphone appeared in 1898. The first was the discovery of AC-biassing in the U.S.A. in 1921; the second was the development of oxide-coated tapes in Germany in 1927. Both remained in obscurity until their revelation in 1945. The whole thing was, on the face of it, so simple and obvious that only commercial

*MSS Recording Co., Ltd.

interests in other recording techniques could have caused it to be neglected for so long.

On the other hand, it is now the other techniques which seem simple and obvious by comparison with the progressively-revealed subtlety of the basic physical processes of magnetic recording. This may be partly due to one's being able to see what goes on in recordings made on discs, film and so on, at least under the microscope if not with the naked eye, whereas there is no direct visual evidence whatever of any change in a magnetic tape after it has been recorded and no sign of the influence which changes it. But for all that, recording on an oxide-coated tape is still a much more complex process than the others, even without the complicating influence of AC bias.

The New Materials

The realisation that this was so came comparatively recently, following post-war research work on the then new magnetic sintered powder materials. These consist of masses of separate magnetic particles dispersed densely and evenly throughout binder substances, the mixture being compressed and baked hard. Tape coatings are similar in structure except that they are flexible and that the magnetic particles are packed less densely.

The results showed there to be marked differences in behaviour between the new materials and the conventional homogeneous ones. This virtually killed many of the early attempts at explaining magnetic recording in terms of a magnetic hysteresis loop which represented the average or bulk properties of the material, for it became necessary to examine what went on in very small volumes of powder dispersions as they passed the gap in the recording head, and ideally to make the behaviour of the individual particles themselves account for the recording performance.

The First Explanation

The first plausible hypothesis to do so was published in 1956 by J. F. Doust and explained to readers of *Hi-Fi News* in the issues of February–April 1961. Its main virtue was its relative simplicity as a model of coating behaviour, combined with the fact that it arose from mathematical analysis of the problem which could be extended to confirm many of the normal features of magnetic recording with greater accuracy than had generally been obtained from previous analyses. In particular it explained the mechanism of AC-biassing in terms which were readily understandable, a point where previous models became either hopelessly complicated or inaccurate or both.

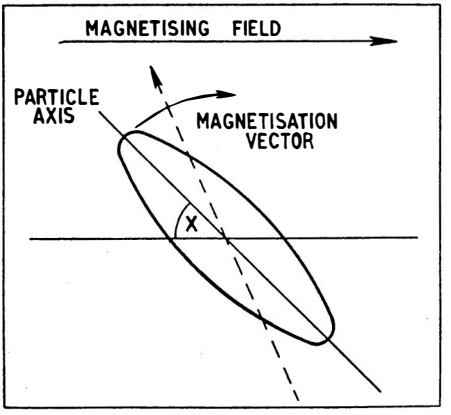


Fig. 1. *The critical field needed to reverse a vector depends on the angle X, and is found to be a minimum at 45°. Dashed arrow represents the magnetisation vector.*

The particle hypothesis runs briefly as follows: The most important property of the particles in a tape coating is that they are permanently magnetised in one direction or the other along their lengths (tape particles are generally cigar-shaped, or "acicular"). This magnetisation is represented by a magnetic vector like a small pivoted bar magnet inside the particle which can be forced out of place by a sufficiently strong applied magnetic field but which always reverts to the nearer axial direction when the field is removed. Thus the only permanent change an external field can make is to reverse the vector, when the field initially opposes it. A field acting substantially in the same direction as the vector can make no permanent change, of course.

Vector Peculiarities

The second important property of the particles is that the ease with which their vectors can be reversed depends on the initial angle between their axes and the field direction (**fig. 1**). The critical field is highest for particles which are parallel to or at right-angles to the field and lowest for those at 45° to it. The 45° vectors are therefore the first to be reversed as the applied field increases, at about half the value needed for those at 0° and 90°.

Assuming a mass of equal particles randomly oriented and distributed (in three dimensions, remember) you will see that any desired proportion of vectors can be reversed by choosing a suitable value of applied field above the lowest critical field. In other words the residual magnetisation of the mass can be varied continuously between zero and saturation

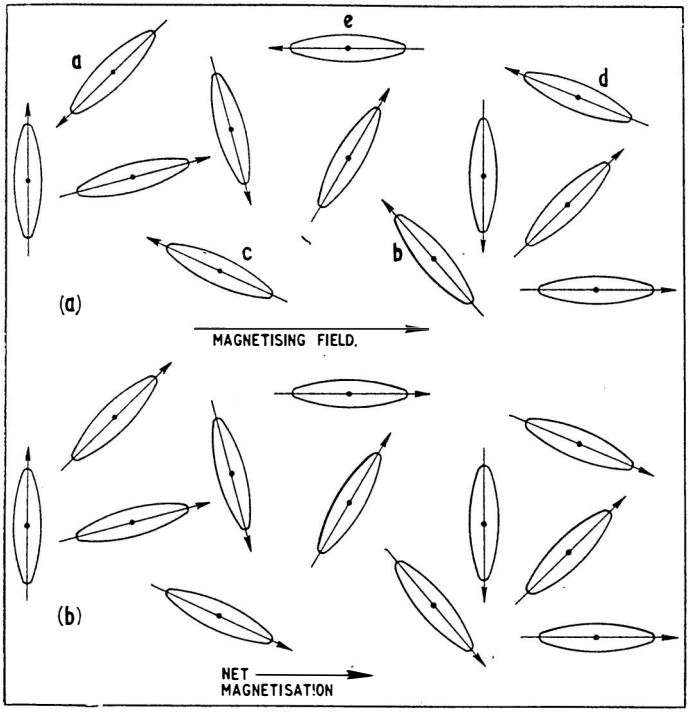


Fig. 2. *Magnetising a tape. Field applied to erased section (a) reverses vectors a–e, leaving a net megnetisation as in (b) after its removal. This tape element is now saturated.*

(**fig.** 2) by adjusting the applied field between a minimum and a maximum value; or it can represent from point to point along a tape coating the instantaneous value of the field surrounding the gap in a head across which the tape passes.

Particle variations . . .

On this basis the magnetisation curve of a tape coating would look like **fig.** (**3a**). However, the particles in a practical coating are not equal but vary in shape over a range, and this causes some spread of the critical field value for each particle orientation. Taking it into account produces the more familiar "transfer characteristic" curve shown in **fig.** (**3b**).

The function of AC-biassing in increasing sensitivity and reducing distortion caused by the central kink is explained by its bringing the vectors of the 45° particles to an easily-reversible state in its steady high-frequency field of critical peak value. As individual 45° particles pass the recording gap their vectors will reverse continuously until, somewhere on the trailing side of the gap, the field intensity will have decayed to just below the critical value. In the absence of any further influence the net magnetisation of the tape will be zero because vectors will return to random directions. But if a comparatively steady (e.g. audio-frequency) field is added to the high-frequency bias field, the total field swings become unsymmetrical, larger numbers of vectors will settle in the direction of the greater peak field than in the other and an element of tape will be magnetised in this direction. The greater the audio field, the more vectors will be pressed into service and the stronger will be the magnetisation of the element. The amplitude response to audio frequency signals will thus be substantially linear until there are few particles left to influence and the tape begins to saturate (**fig. 4**).

. . . and alignment

Apart from explaining this and other basic behaviour, the hypothesis also predicts the effects of aligning the particles in the coating along its length: a sharpening of the "knee" and "ankle" of the curve; an increase in the slope of the curve, limited only by the range and distribution of particle shapes; and a two-fold increase in its total height because all the vectors now contribute fully to longitudinal magnetisation (**Fig. 3b**). The latter means a 6 dB gain in available output, although in practice only 2-3 dB of this can be realised because complete orientation is presently impossible. Imagine 20,000 million acicular particles in each square inch of wet coating trying to turn into line *without* getting tangled up occasionally! Some 4 dB can be gained in

sensitivity (output/input) due to the increased slope of the curve, however.

At this point someone is surely thinking about the "spherical" particles which are used in at least one kind of tape; how does the hypothesis explain their behaviour? Perfectly well, in fact. The lattice structure of such materials is essentially cubic instead of hexagonal, which means that the magnetisation vectors can settle in any one of six or eight preferred directions instead of only two, and two of those directions at least must be near enough to the long axis of the tape to allow satisfactory large contributions to the longitudinal magnetisation. The mathematics is slightly different but the overall result much the same. Deliberate mechanical alignment of spherical particles is neither possible, because of their unfavourable shape, nor necessary, because, a favourable if not ideal vector orientation is always achieved.

This hypothesis had its faults, of course, as have all which leave out some premises because they are not known or not realised. In this case it led to some incorrect results when abnormal operating conditions were specified. For an example, let us examine the mechanism of AC erasure, which is generally achieved by running the recorded tape through a high-frequency field whose peak value is at least enough to saturate the tape in both directions; that is, to reverse all the vectors continuously (**Fig. 5**).

Erasure

As the tape passes out of the erasing gap area it experiences a progressive lessening of the peak field and at some point beyond it the 0° and 90° particles will not experience further vector reversals because the peak field has fallen below the critical value. Because of their differing aspect ratios and positions in the coating, some vectors will come to rest in one direction and some in the opposite direction. A little further on particles at, say, 1° and 89° will behave similarly, and so on until the peak field has fallen below the lowest critical value and all the vectors have come to rest in statistically random directions (within any limits set by deliberate particle alignment). No organised information now remains on the tape.

The Model

According to the hypothesis, if we now add to the erasing field a direct field which is greater than the difference between two successive alternate peaks of the decaying field, the vectors will experience a total field whose peaks in one direction are always significantly greater than those in the other. When they finally come to rest they will therefore always do so in the direction of the greater peak, since the other peak will have been too small to reverse them on the previous $\frac{1}{2}$-cycle. In other words, the tape coating will be saturated in one direction by what is usually an insignificant direct field, and we know from experience that this does not happen. A similar but less severe effect would occur if a similar small direct field were added to the biassing field. (Incidentally, if this were done the sensitivity of the tape to audio-frequency signals would be many times greater than it is.)

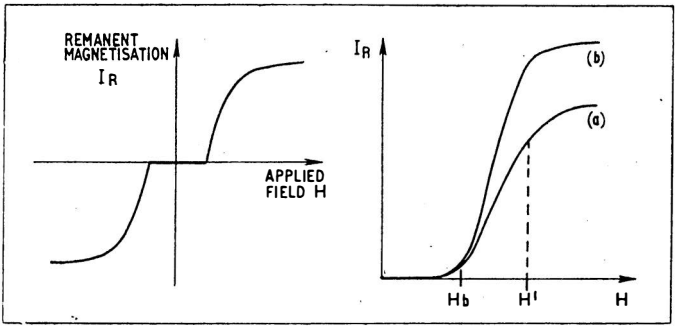


Fig. 3. *left* (*a*) *magnetisation curve of tape randomly oriented particles of equal length/width ratio. right* (*b*) *upper half of a curve with particles of varying length/width ratio,* (*a*) *randomly oriented and* (*b*) *re-oriented. Hb is typical peak HF bias field and H' maximum recording field.*

Although it would certainly have been realised theoretically soon enough, the reason for these and other anomalous results was actually discovered accidentally by the team doing the experimental work on the hypothesis and subsequently confirmed in theory. Priority in the discovery is not claimed—in fact it probably occurred to several workers at about the same time—but the way it arose in this case may interest readers as an example of how these things sometimes happen.

A physical model had been designed to illustrate the hypothesis in two dimensions as far as it related to orientation effects. The model consisted of a vertical board pierced and bushed to take a number of light spindles, each of which carried at the back of the board a bar magnet and at the front a white

arrow. The front of the model is shown in **Fig. 6**; some readers may have seen it at the 1960 London Audio Fair.

Arrows for Vectors

Each spindle also carried at the back a simple bistable mechanism which, in the absence of any other force, caused the arrow to point in either of two preferred opposite directions. The arrows were arranged to point initially in random directions coincident with the axes of acicular "magnetic particles" painted on the front of the board. They thus represented the magnetic vectors associated with the particles, which vectors can, as postulated, be reversed by applying a magnetic field of critical strength dependent on their respective orientations. The model "vectors" also could be reversed by means of a magnetic field, each magnet being surrounded by a coil mounted parallel to all the other coils and connected in series with them.

What went wrong was that, as magnet assemblies were added to the board, they began to affect each other until finally there wasn't one "vector" coincident with its particle axis. By dint of removing some assemblies and "adjusting" the rest, but without much thought—the opening of the Audio Fair was only some 30 hours away—the arrows were persuaded into their expected positions and thereafter behaved much as expected.

The Missing Premise

Despite this startling and very clear demonstration of the principle by the model as designed, an hour or two passed before it occurred to someone that if the magnets inter-acted on the macroscopic scale the vector might well affect each other on the sub-microscopic scale of the particles also. This, you see, was the missing premise; the hypothesis treated each particle vector as being unaffected by the presence of its neighbours, whereas we soon realised that the effective field acting on a particular vector in a mass was not equal to the external applied field but

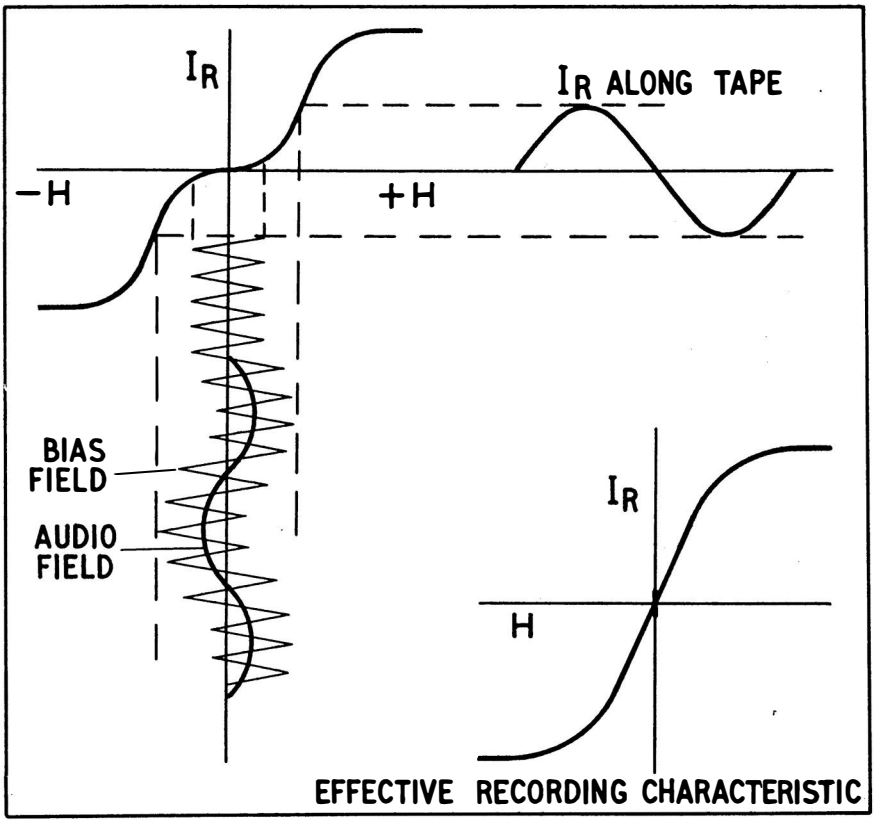


Fig. 4. *Bulk behaviour of a tape coating with AC bias. Particle behaviour is explained in the text.*

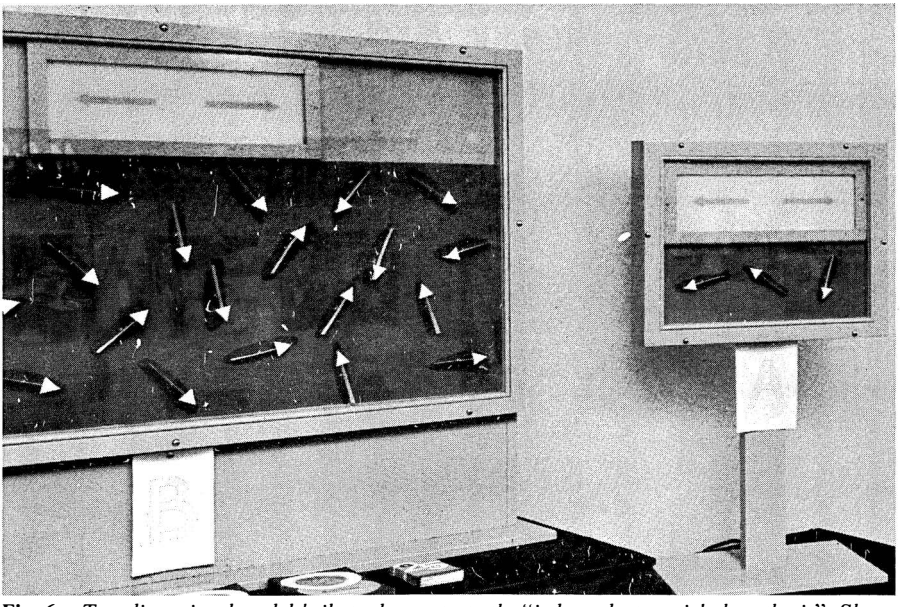


Fig. 6. *Two-dimensional model built to demonstrate the "independent particle hypothesis". Shown at the London* 1960 *Audio Fair.*

to that plus or minus whatever local field due to other vectors happened to exist at that point.

To be fair, the possibility of something like this happening had occurred to our brainier members some time previously, but they had no idea of the exact disposition of the particles or of their field in the tape coating and thus no idea of the possible extent to which it might affect behaviours. We still haven't, in a precise sense, although a statistical analysis can give some guidance.

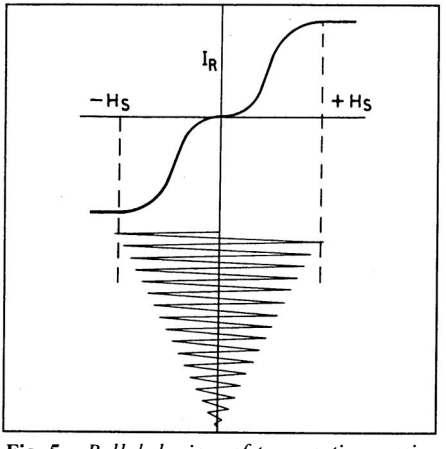


Fig. 5. *Bulk behaviour of tape coating passing through an erasing field of maximum peak value* $\pm Hs$*, sufficient to saturate the tape.*

The idea of vector interaction has now been built into the hypothesis, and with contributions from workers in several establishments and at least two countries, it has been extended to cover many more of the known phenomena of the process.

The snag so far as you and I are concerned is that these things are getting no easier to understand. The "independent particle hypothesis" is at once an understandable, almost pictorial model and a reasonably exact analysis within the limits of normal interest. Interaction theory immediately qualifies and complicates the pictorial model to the extent that, for exact analysis, we are forced to put all the relevant information on a three-dimensional (Preisach) chart of some kind and find out what we want to know by graphical methods (**Fig. 7**). These are amenable enough in themselves; what the results mean in terms of coating behaviour is much less easy to visualise, although suitable models will probably suggest themselves as understanding of interaction behaviour grows.

However, having got this far we might as well have a shot at a qualitative explanation of the interaction hypothesis. Starting from the same general particle model as before, we postulate in addition that each vector is acted upon by a field which is the effective sum of the individual fields due to all the surrounding vectors. Assuming again a random distribution

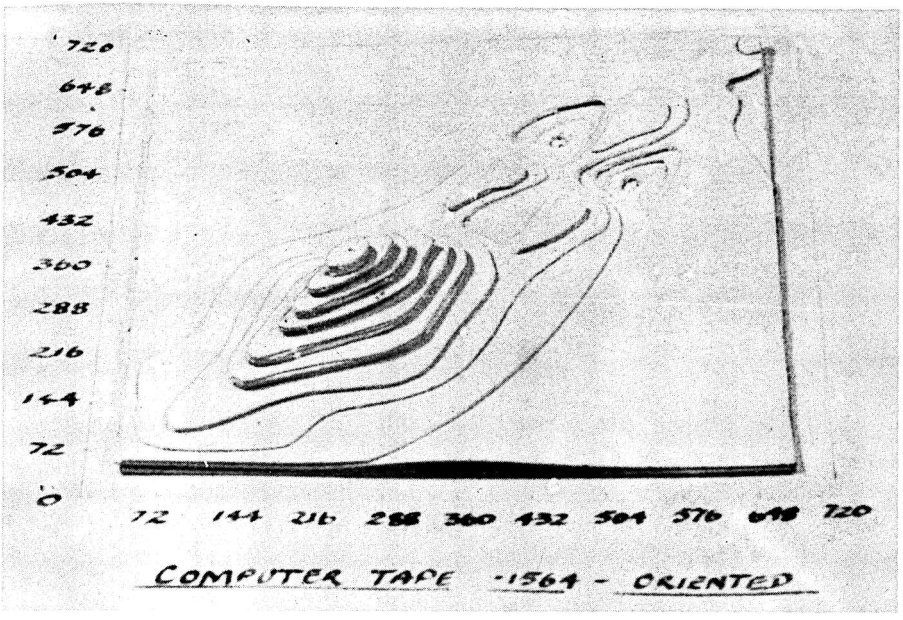


Fig. 7. *This is a rough example of a Preisach diagram, a three-dimensional graph showing the proportions of the particles in an assembly (on the vertical scale) experiencing varying degrees and directions of interaction field (on the horizontal plane). This one refers to a brand of data tape.*

of particle positions and orientations in the coating, the interaction field experienced by the vectors will evidently vary randomly in direction and strength from particle to particle; in some the interaction field will aid the vector, in others oppose it, and in a few there will be no interaction field.

The effect of an external field will be much as before. Individual vectors may be more or less easy to reverse, according to whether the local interaction field opposes or aids them respectively, but this will merely have the effect of a third random factor influencing the value of the critical field for each particle. The general shape of the magnetisation curve remains very similar to that previously predicted, the only changes being somewhat longer and gentler curves at the knees and ankles and a slightly reduced slope, both due to the greater possible range of critical field values.

The vectors also react in the same way as before to the application of a pure AC biassing field. The difference now is that the addition of the relatively steady audio-frequency field causes a net magnetisation in keeping with the amount expected considering its value and the slope of the transfer characteristic, instead of the disproportionate amount predicted before. The random interaction fields help the applied field to reverse some vectors more easily, it is true, but they also oppose it in others, so that there is no longer any predicted certainty that vectors subjected to an apparently sufficiently asymmetrical diminishing bias field *will* come to rest in the direction of the greater applied field peak. There is only the certainty that a definite proportion of them will, corresponding to the degree of bias waveform asymmetry, that is, to the value of the audio field. The same argument applies to the erasing process and the case of the small added direct field which we examined before.

This picture is actually complicated further by the self-evident fact that any local change in the arrangement of vectors during recording will result in changes in the interaction field acting on a particular vector. And conversely, of course, reversing that particular vector will alter the fields experienced by others nearby. So the interaction fields vary not only in space but also in time at any particular point. The critical applied field for a given particle may therefore be different each time a tape is freshly recorded. Thus one can never say exactly what the field conditions are at any point in the coating, but only that a certain proportion of the particles will probably be working under certain conditions, another proportion under other conditions, and so on. It is this local uncertainty which makes interaction behaviour so difficult to visualise

in detail and which makes devices such as the Preisach diagram essential. For everyday explanation and understanding the independent particle model is still to be preferred, provided one can ignore its anomalies without forgetting its limitations.

Interaction theory gives an accurate analysis over a wider range of conditions than before, but is still incomplete. We may well find the complete explanation of some phenomena (such as print-through, a time- and temperature-dependent effects) has to be based on the analysis of electron spins and molecular interactions. This implies a further scaling-down of the same order as that between bulk properties and particle behaviour. Further applications of tape and improvements in it will undoubtedly follow such knowledge just as present ones have arisen from what we learned a year or two ago. The study and use of micro-structure is already well-established in other subjects, notably in solid-state electronics, and we must be prepared for something analogous in ours.

While much work on the present recording process and much more on other technical aspects has been going on, engineers have also been thinking about the ultimate capabilities of magnetic recording in respect of storage efficiency and comparing it with other systems. Naturally such thinking is mainly concerned with the storage of data, but anything which helps to record twice as much data in a given space will also help to record a given sequence of sounds at half the speed or on a track half as wide as before. Magnetic sound recording is already pretty efficient from this point of view; a 4-track record on B in. tape can contain about three times as much information per unit volume as a long-playing disc record and about ten times as much as a magnetic digital recording on the same tape, but only one-tenth as much per unit volume as a video tape picture recording and the various types of photographic record.

The theoretical limit for any medium is set by the number of controllable units it contains. Most materials contain some 10^{23} atoms per cubic centimetre. If we could reverse the electron spin in each individual atom at will, we should have a storage capacity of 10^{23} bits/cc, about 10^{17} times as much as our 4-track record. Even scaling down to the more conceivable target of using each individual particle in a modern tape coating to register a bit, instead of using many thousands per bit, would give us something like 10^{12} bits/cc—in the order of ten times better than the human nervous system, which is active enough, goodness knows. Surprisingly enough this figure is rather *less* than that predicted for magnetic data recording when all conceivable improvements in hardware and methods have been realised, so we might assume under these conditions that somewhere about 10^{15} bits/cc would be available from the use of individual particles.

How this would effect the possibilities for audio recording, assuming a conceivable method of using each particle, is anyone's guess at the moment. Since we cannot yet ensure that the particles are distributed evenly in the coating to the degree which would be required, let alone influence each separately, there is obviously a good deal of work to be done before we can consider such methods seriously.

Getting more sound recorded in a given volume of tape in the immediate future is obviously going to be more a matter of improvements in mechanisms, tapes and heads, to allow yet lower speeds and narrower tracks, than the adoption of any wildly sophisticated techniques. But there is little point in carrying tape "miniaturisation" much beyond four or five times its present degree (even ignoring the price factor) unless the size of the necessary driving mechanism can also be reduced significantly and yet retain present performance levels. When this point is reached it might be well worth considering coding the programme material and using high-density digital techniques to carry the process further. If the exercise is worthwhile at all, that is. Analogue data recording systems are already used which could record audio signals in coded form, in principle at least.

Solid-state electronics would really come into full use here, as they are much happier handling pulses and acting as switching units than they are struggling with analogue signals. A start in this latter direction has already been suggested in the form of a transistor audio-frequency power amplifier using pulse techniques literally from input to output, and apparently having some advantages over conventional types (*Wireless World*, Feb. '63).

For the moment, however, we must be content with improving what we have: mechanisms, tapes and heads designed for conventional AR-biassed recording. Here, paradoxically, it is data recording which will probably show us the way ahead, if only because that is where much of the money is now and where much more of it will be in the future. Financially and technically, improvements in audio recording and reproduction will probably become a sideline, even a mere by-product of research into data recording techniques. This is a tremendously active field and we ought to watch it carefully.

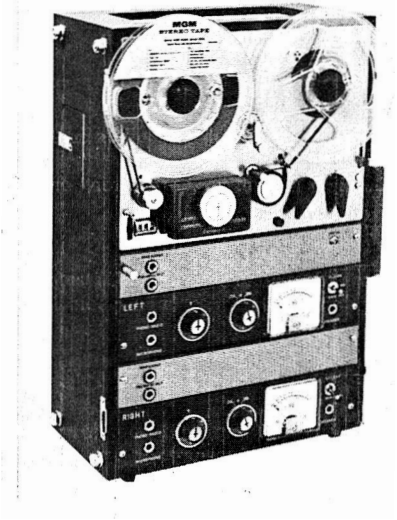
DIRECTORY OF TAPE RECORDERS

★ The abbreivations used for the specifications in this directory are as follows: **F.R.**—frequency response; **i/s**—inches per second; **P.s.n.**—power supply needed; <—better than; **M.E.**—magic eye; **W. & F.**—wow and flutter; **Replay char.**—replay characteristic; **H & N**—hum and noise. ■—Stereo equipment.

PROFESSIONAL and SEMI-PROFESSIONAL

AKAI. Distributors: R. Marking & Co. Ltd., 197 Streatham Road, Mitcham, Surrey. Tel.: Mitcham 4044/5.

■**Akai M6.** Stereo/mono recorder. ½ and ¼ track. Speeds 15, 7½, 3¾ i/s. W. & F. less than 0.07% at 15 i/s. H and N <45 dB. F.R. 30 c/s-20 Kc/s at 7½ i/s, ±3 dB, 40 c/s-14 Kc/s at 3¾ i/s ±3 dB. Replay char. NARTB. Outlet from replay head and pre-amp. One motor (hysteresis synchronous). 7 in. spools, 2½ mins. for 1,200 ft. Two V.U. meters. Size 14 × 20½ × 8¼ in. Weight 46½ lb. Auto-stop, pause control, vertical operation. Price (including two dynamic microphones, two recording leads) £136 10s.



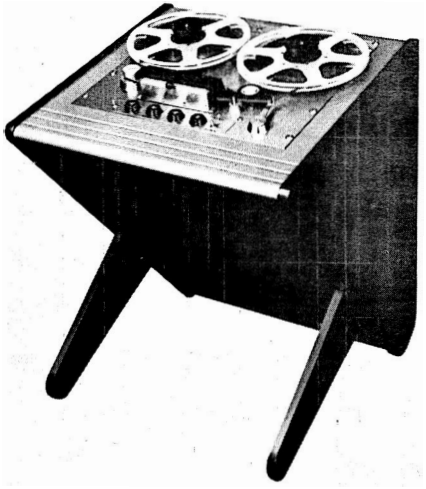
Akai M6 stereo.

★

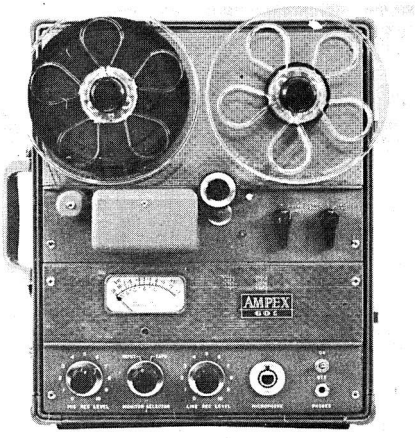
AMPEX (Great Britain) Ltd., 72 Berkeley Avenue, Reading, Berkshire. Tel.: Reading 55341. Cables: Videotape, Reading.

Ampex 300 Series. Prof. recorders. One to eight tracks. Speeds 15 and 7½ i/s. 3 motors. 14 in. spools up to 1 in. wide. F.R. 15 i/s, 30-18,000 c/s; 7½ i/s, 40-12,000 c/s, both ±2 dB. Large scale V.U. meter. H and N −60 dB full track, −55 dB multi-track. W. & F. less than 0.1% at 15 i/s. Prices on application.

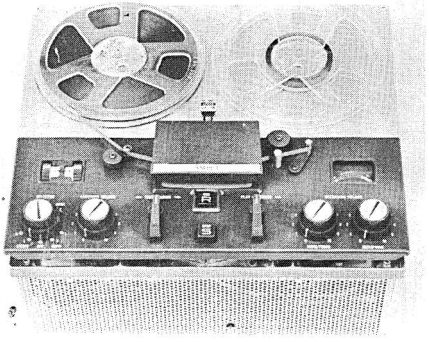
Ampex 351. Prof. recorder in console, portable or rack-mounted form. Full or half track. Speeds 15 and 7½ i/s, or 7½ and 3¾ i/s. 3 motors. 10½ in. N.A.B. spools. F.R.: 15 o/s, 30-18,000 c/s; 7½ i/s, 40-12,000 c/s; 3¾ i/s, 50-8,000 c/s, all ±2 dB. Large scale V.U. meter. H and N −70 dB full track, −65 dB half track at 15 i/s. W. & F. less than 0.15% at 15 i/s. Size (console) 48 × 24 × 28 in. Weight 168 lb. Price (15 and 7½ i/s) on application.



Ampex 352 console.



Ampex 601 prof. portable.



Ampex FineLine 1200.

EMI RE 301 stereo.

Ampex 352. Prof. reproducer only in console or rack-mounted form. Full or half track, or stereo. Speeds 15 and 7½ i/s. 3 motors. 10½ in. N.A.B. spools. F.R.: 15 i/s, 30-18,000 c/s; 7½ i/s, 40-12,000 c/s, both ±2 dB. H and N −70 dB full track, −65 dB half track. W. & F. less than 0.15% at 15 i/s. Size (console) 35 × 24 × 24 in. Weight 109 lb. Price on application.

■**Ampex 354.** Professional console recorder. Speed 15 and 7½ i/s or 7½ and 3¾ i/s. 3 motors. 10½ in. N.A.B. spools. F.R. 15 i/s 30-18,000 c/s; 7½ 40-12,000 c/s ±2 dB. 2 V.U. meters. H and N −65 dB. W. & F. 0.15% at 15 i/s. Price on application.

Ampex 601. Prof. portable recorder. Speed 7½ i/s. One motor. 7 in. spools. F.R. 40-10,000 c/s ±2 dB. Large scale V.U. meter. H and N −55 dB full track, −50 dB half track. W. & F. less than 0.17%. Size 16½ × 13¾ × 8 in. Weight 28 lb. Price £295.

■**Ampex 601-2.** Stereo version of Ampex 601. Size 24½ × 13 × 8 in. Weight 42 lb. Price £486.

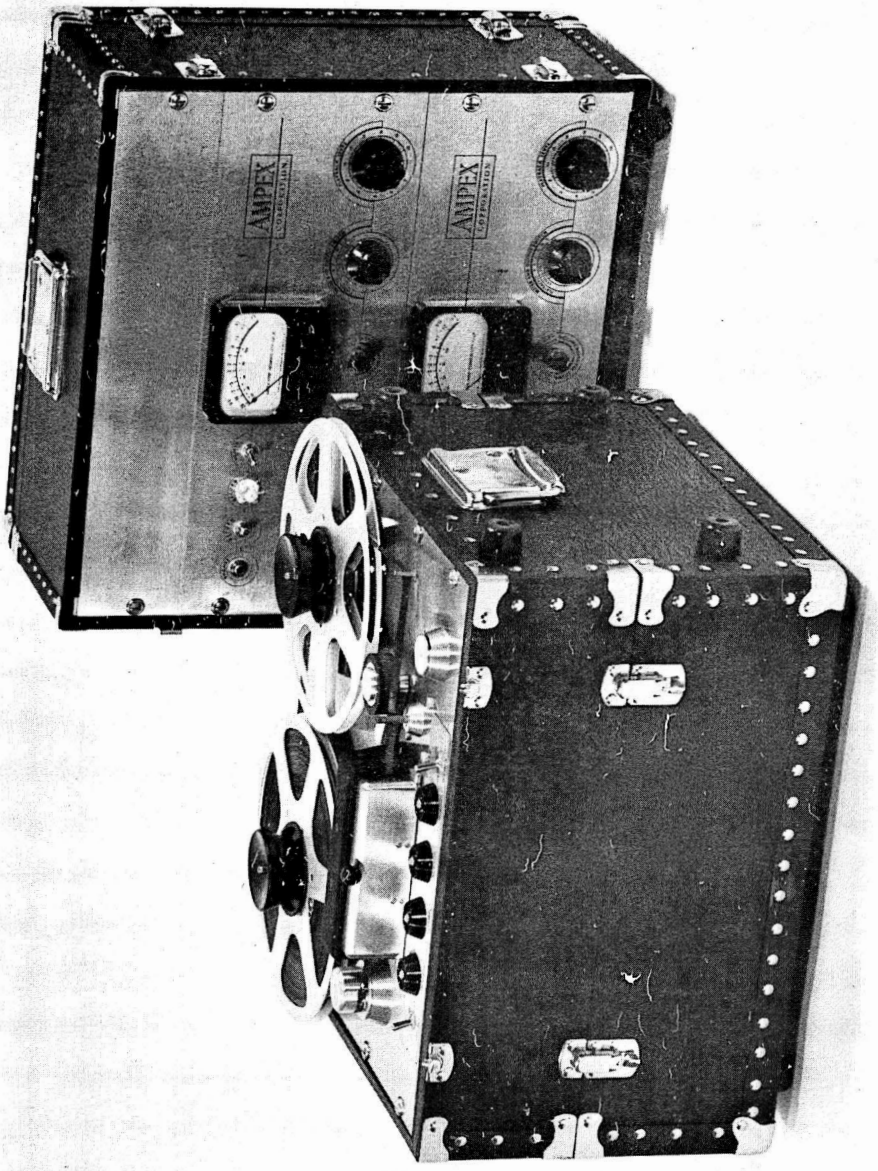
■**Fine Line Ampex 1200.** Four-track stereo. Speeds 7½ i/s and 3¾ i/s. One motor. 7 in. spools. F.R. ±2 dB. 7½ i/s 50-15,000 c/s; 3¾ i/s 50-7,500 c/s. Level meter. S-N <−55 dB at 7½ i/s, <−50 dB at 3¾ i/s. W. & F. <0.2% r.m.s. at 7½ i/s. Built-in mixing facilities. Built-in pair of amplifier speakers available. Mono or stereo ¼-track record and replay. Size 9 × 15 × 17½ in. Weight 36 lb. Price list on application.

Where prices are not quoted, this is because of wide variations according to configuration required.

★

DYNATRON Radio Ltd., St. Peter's Road, Furze Platt, Maidenhead, Berks. Tel.: Maidenhead 23331.

■**Specialist 1200.** Stereo/mono recorder using Reflectograph deck. ½ track. Speeds 7½, 3¾ i/s. W. & F. 0.15%. H & N −50 dB. F.R. 35 c/s-15 Kc/s at 7½ i/s ±3 dB, 35 c/s-9 Kc/s at 3¾ i/s ±3 dB. Replay char. CCIR. Outlet from pre-amp. Three motors. 8¼ in. spool, 1 min. rewind. Level meter. Separate records/playback amplifiers and heads. Dual speed sync. capstan motor. Superimpose. Variable bias. Three channel electronic mixing. Built-in echo effect. Continuous



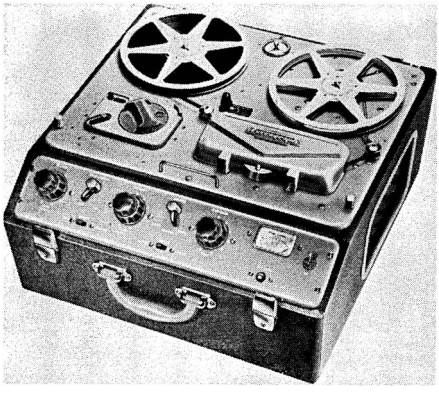
Ampex Model 351-2 professional portable stereo recorder

monitoring from input or tape through inbuilt speaker or phones. Variable speed wind. Foil auto-stop. Clock counter. 10 × 6 in. speaker 15 ohms. Fully independent bass, treble, record and playback controls. Size 20½ × 18 × 11¼ in. Weight 42 lb. Price £145 19s.

★

EMI ELECTRONICS Ltd., Hayes, Middx. Tel.: Hayes 3888. Cables: Emidata, London.

■**TR52/D.** Prof. portable stereo/mono recorder. Speeds 7½ and 3¾ i/s. One motor 7 in. spools. F.R. 7½ i/s, 50-10,000 c/s; 3¾ i/s, 50-6,000 c/s, both ±2 dB. W. & F. less than 0.25% at 7½ i/s. Crosstalk −45 dB. V.U. meter. Size 20 × 17½ × 13½ in. Weight 80 lb. Price £245.



Ferrograph 422 stereo

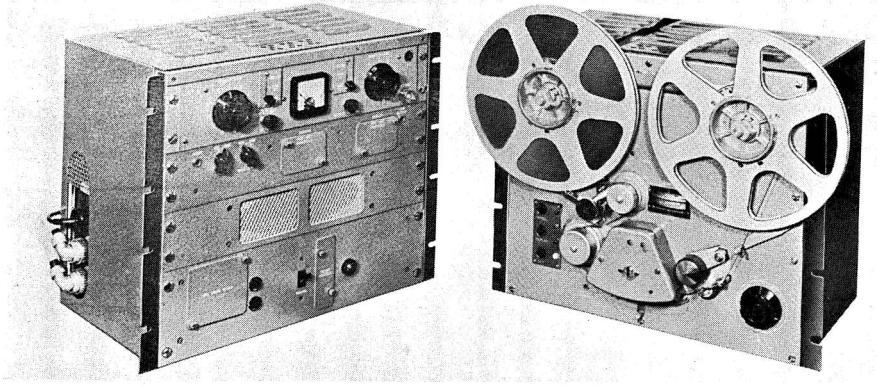
TR90. Prof. recorder for rack, console or trolley mounting. Speeds 15 and 7½ i/s, or 7½ and 3¾ i/s. Three motors. 10½ in. spools. F.R. 15 i/s, 50 c/s-15 Kc/s; 7½ i/s 50 c/s-10 Kc/s; 3¾ i/s, 50 c/s-6 Kc/s, all ±2 dB. Level meter. Size and weight (rack version) mechanical unit 13½ × 19 × 15½ in., 75½ lb.; amplifier unit, 13½ × 19 × 15½ in., 53½ lb. Price from £625.

RE301. Stereo/mono recorder in transportable rack or trolley form. ½ track. Speeds 15, 7½ i/s, or 7½, 3¾ i/s. W. & F. 0.2% at 15 i/s, 0.25% at 7½ i/s, 0.3% at 3¾ i/s. H & N 50 dB below peak level. F.R.: 15 i/s, 50 c/s-15 Kc/s; 7½ i/s, 50 c/s-10 Kc/s; 3¾ i/s, 50 c/s- 6 Kc/s (all ±2 dB). Replay char. CCIR. Inputs: mic. 30/50 ohms, less than 100 μV for peak recording level. Line floating and bridging for 600 ohms, less than 200 mV for peak record level. One motor. 8¼ in. spool. 1¾ min. rewind. Plug-in record and replay amplifiers. V.U. meter. Size 14 3/16 × 19¼ × 18⅛ in. Weight 97 lb. Price £278.

★

FERROGRAPH Co. Ltd., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 1981/2/3. Cables: Britferro, London, S.E.

■**Model 422U.** Stereo/mono recorder. ½ track. Speeds 7½, 3¾ i/s. W. & F. 0.15% at 7½ i/s, 0.2% at 3¾ i/s. H & N 52 dB. F.R. 7½ i/s, 40 c/s-15 Kc/s ±3 dB; 3¾ i/s, 50 c/s-10 Kc/s ±3 dB. Replay char. NARTB, CCIR. Inputs: 1 Meg., 2 mV; 0.5 Meg., 350 mV per channel. Output 1 V at 5 K per channel. Three motors. 8¼ in. spools, 1 min. rewind.



EMI TR90 monaural recorder in rack mounting form

Level meter. Stereo recording and playback with monitoring on both channels. Echo effects. Recording from track to the other. Supply 200/250 V, 50 c/s. Size 18½ × 17½ × 9¾ in. Weight 48 lb. Price £115 10s.

■**Model 422E.** Details as for Model 422U, but for operation at 110 V, 50 c/s.

■**Model 424A.** Details as for Model 422U, but for operation at 117 V, 60 c/s, and with ¼ track playback.

■**Model 424U.** Details as for Model 422U, but with ¼ track playback.

■**Model 424E.** Details as for Model 422E, but with ¼ track playback.

Model 5A/N. Mono recorder. ½ track. Speeds 7½, 3¾ i/s. W. & F. 0.16% at 7½ i/s, 0.2% at 3¾ i/s. H & N 45 dB. F.R. 7½ i/s, 40 c/s-15 Kc/s ±3 dB; 3¾ i/s, 40 c/s-10 Kc/s ±3 dB. Replay char. CCIR. Inputs: 1 Meg., 3 mV; 80 K, 15 mV. Outlet from replay head or pre-amp. Three motors. 8¼ in. spools, 1 min. rewind. Level meter. Switches from wind-on to wind-back without stopping. 2½ watt output. Interchangeable heads. Size 18½ × 17½ × 9¾ in. Weight 50 lb. Price £89 5s.

★

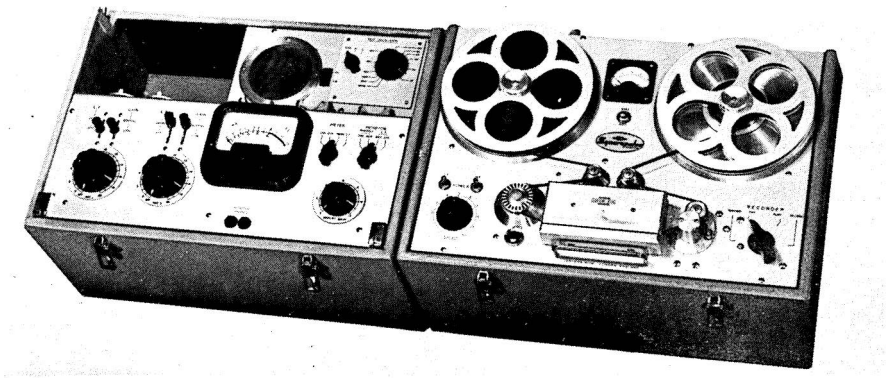
LEEVERS-RICH Equipment Ltd., 319b Trinity Road, Wandsworth, London, S.W.18. Tel.: Vandyke 9054. Cables: Leemag, London, S.W.18.

Model E. No. ER141M. Prof. reproducer console. 15 and 7½ i/s. 3 motors. 11½ in. spools. F.R.: 15 i/s, 50-15,000 c/s; 7½ i/s, 50-10,000 c/s, both ±2 dB on CCIR test tape. Size 24 × 24 × 36 in. Weight 200 lb. Price £500.

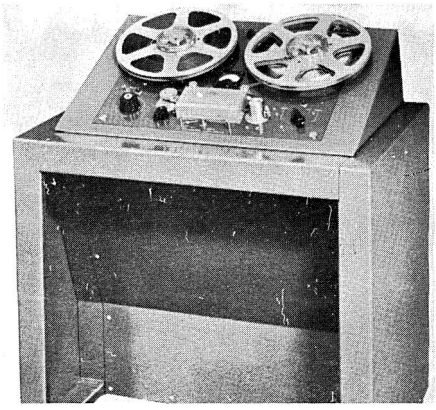
Model E. 141M. Prof. recorder console. Speeds 15 and 7½ i/s. Three motors. 11½ in. spools. F.R. 15 i/s 50-15,000 c/s; 7½ i/s 50-10,000 c/s, both ±2 dB. V.U. level meter. H and N < -55 dB unweighted. W. & F. $< 0.15\%$ at 15 i/s. Outlet from pre-amp. Size 24 × 24 × 36 in. Weight 205 lb. Price £640.

Model E. 141P. Prof. transportable recorder. Details and specifications as for

EMI TR 52-2 portable stereo.



Leevers-Rich Model CS No. C8621P portable Syncropulse recorder



Leevers-Rich Series E console

E. 141M. Size, recorder 21 × 17 × 11½ in.; amplifier 18¾ × 14½ × 10¾ in. Weight, recorder 71 lb.; amplifier 25 lb. Price £615.

Model E. No. E141R. Complete rack mounting prof. recorder. 15 and 7½ i/s. 3 motors. 11½ in. spools. F.R.: 15 i/s 50-15,000 c/s; 7½ i/s, 50-10,000 c/s, both ±2 dB. V.U. level meter. Other details as for E. 141M. Size 19 × 17½ × 10 in. Weight 50 lb. Price £545.

Model E. No. E121P. Prof. portable recorder. Spec. as for E141R. In two cases, 20 × 17 × 11½ in. and 15 × 18 × 10 in. Weight 79 lb. Price £660.

Model C. Model C621P. Prof. portable recorder. 15 i/s. 3 motors. 9½ in. spools. F.R.: 50-15,000 c/s ±2 dB. V.U. level meter. Size 13 × 18 × 10 in. Weight 73 lb. P.s.n. 12 V battery or auxiliary mains unit. Price £450.

Revox F36 stereo

Model CS. No. CS621P. Syncropulse recorder, for magnetic recording in sync. with cameras, etc. Spec. as for C621P. In two cases both 13 × 18 × 10 in. Total weight 73 lb. P.s.n. as C621P. Price £550.

■**Model E. No. E242P.** Complete portable dual channel recorder. 3 motors. 15 and 7½ i/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/s, 50-15,000 c/s ±2 dB. Size 2 cases 16 × 20 × 11 in. Total weight 80 lb. Price £765. M console version, £790.

All "E" Tape mechanisms are now press button operated.

★

PAMPHONIC Reproducers Ltd., Westmoreland Road, London, N.W.9. Tel.: Colindale 7131.

Reflectograph Model A. Semi-prof. recorder. Speeds 7½ and 3¾ i/s. Three motors. 8¼ in. spools. F.R. 7½ i/s 35-15,000 c/s; 3¾ i/s 35-9,000 c/s, both ±2 dB. Level meter. H and N −55 dB. W. & F. <0.15%. Outlet from pre-amp. Size 20 × 16 × 10 in. Weight approx. 50 lb. Price £110 5s.

■**Model B.** Similar specification to Model A but fitted with ¼ track heads and facility for playing back ¼ track or ½ track prerecorded stereo tapes with additional amplifier. Now only to special order. Price £120 15s.

Reflectograph Model D. Half track tape player. Speeds 7½ and 3¾ i/s. Three motors. 8¼ in. spools. F.R. 7½ i/s 35-15,000 c/s; 3¾ i/s 35-9,000 c/s, both ±3 dB. H and N −50 dB. W. and F. 0.15%. Outlet from pre-amp. 250 mV. Size 20 × 16 × 10 in. Weight approx. 50 lb. Price £78 15s.

Reflectograph Model EA. Half track tape player. Speeds 7½ or 3¾ i/s to order. Three motors. 8¼ in. spools. F.R. to NAB standard. H and N −50 dB. W. and F. 0.2% total. Output from pre-amp 250 mV. Automatic track reversal. Fitted with automatic start for clock control operation. Size 20 × 16 × 10 in. Weight approx. 50 lb. Price £99 15s.

Reflectograph Model S. Semi-prof. recorder. ½ track. Stacked erase, record and playback heads. Speeds 7½, 3¾ i/s. W. & F. 0.13% at 7½ i/s, 0.18% at 3¾ i/s. H & N −55 dB at 3% distortion. F.R. 35 c/s-15 Kc/s ±2 dB, 7½ i/s; 35 c/s-10 Kc/s ±2 dB, 3¾ i/s. Replay char. 7½ i/s, CCIR; 3¾ i/s, NARTB. Inputs: Mic 600 ohms balance or unbalanced as required, 6 mV; Radio not less than 10 K unbalanced 0.25 V. Two outlets from stacked playback head, one from pre-amp. Three motors: 8¼ in. spools, less than 45 seconds rewind. Level meter. Twin input mixers. Switched tracks. Plays back bottom track, but operator can record and playback on top track. On playback both tracks heard together. Size 20 × 16 × 10 in. Weight approx. 50 lb. Price (complete with phones and boom microphone) £125.

★

REVOX (U.K. Concessionaires) Ltd., 296 Kensington High Street, London, W.14. Tel.: Western 4343.

■**F36.** Stereo recorder. Available ½ track and ¼ track. Speeds 7½, 3¾ i/s. W. & F. <0.1%. H & N less than −55 dB. F.R. 7½ i/s, 40 c/s-15 Kc/s; 3¾ i/s, 40 c/s-12 Kc/s (+2 dB −3 dB). Replay char. DIN. Inputs: mic 1 Meg, 3 mV; radio 1 Meg, 50 mV; diode 7 K, 5.5 mV. Outlet from pre-amp., 700 mV cathode follower. Three Papst motors. 10 in. spools, 80 secs for 2,400 ft. M.E. two-in-one with continuous monitoring of both channels. Switchable superimpose. 6 watt monitoring amplifier. Size 14 × 16 × 20 in. Weight 42 lb. Price (cased) £117 12s.; (uncased) £112 7s.

■**A60.** Stereo/mono recorder. ½ or ¼ track. Speeds 7½, 3¾ i/s. W & F <0.1%. Spools up to 10½ in. NAB. Minutes and seconds counter, cueing facility, plug-in amplifiers and head assemblies, photo-electric end of tape stop. Price to be announced.

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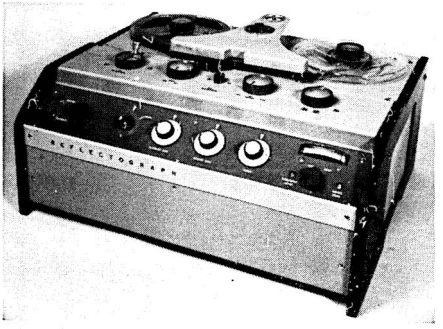
SONY. Sole U.K. distributors: Tellux Ltd., Avenue Works, Gallows Corner, Colchester Road, Romford, Essex. Tel.: Ingrebourne 43971.



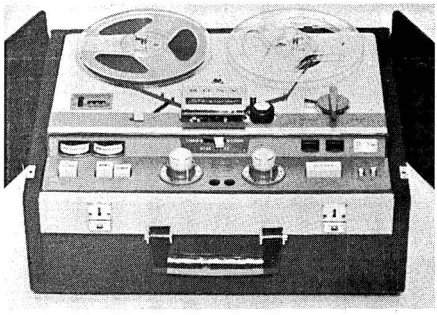
Reflectograph model S

■**Sony 521.** Semi-prof. four-track and twin-track recorder. Speeds 7½ and 3¾ i/s. One motor. 7 in. spools. F.R. 7½ i/s 30-18,000 c/s; 3¾ i/s 30-12,000 c/s. Two V.U. meters. S-N <50 dB. W. & F. 7½ i/s <0.15%; 3¾ i/s <0.25%. Outlet from pre-amp. Size 16½ × 16 × 8 in. Weight 49 lb. Price £130 4s.

Sony 777. Transistorised prof. recorder. Speeds 7½ and 3¾ i/s. Three motors. 7 in. spools. F.R. 7½ i/s 30-18,000 c/s; 3¾ i/s 30-10,000 c/s. V.U. meter. S-N <−50 dB. W. & F. 7½ i/s <0.15%; 3¾ i/s <0.2%. Outlet from replay head. Push button remote control. Size 16½ × 16 × 10½ in. Weight 42 lb. 4 oz. Price £187 19s.

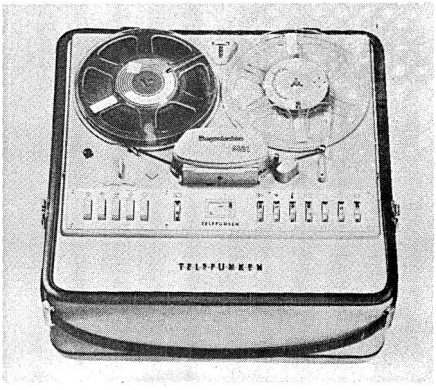
Sony Speaker System Model SS-80. Specially designed to match Model 521. Full range 8 in. co-axial dynamic speakers. Frequency range 40 c/s-18 Kc/s. Size 18 15/16 × 15 × 11 in. Price £38 6s. 6d. a pair, including Purchase Tax.

Sony 777

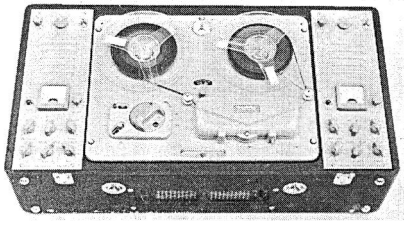


Sony 521 stereo

Tandberg Series 6 stereo



Telefunken M24



Vortexion CBL stereo

TANDBERG. U.K. distributors: Elstone Electronics Ltd., Edward Street, Templar Street, Leeds, 2. Tel.: Leeds 3-5111.

■**Tandberg Series 6.** Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. F.R. 30-20,000 c/s. $\frac{1}{4}$ track. 7 in. spools. H and N −55 dB. W. & F. 0.1% M.E. level ind. Outlet from pre-amp. Superimposing. Size $15\frac{1}{4} \times 11\frac{7}{8} \times 6$ in. Weight 25 lb. Price £115 10s. Alternative half track model also available £115 10s.

★

TELEFUNKEN. Sole U.K. distributors, Welmex Corporation Ltd., 147 Strand, London, W.C.2. Tel.: Temple Bar 3357. Cables: Welmcor, London.

Magnetophon M24. Studio recorder. Half track. Speeds $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. 3 motors. $8\frac{3}{4}$ in. spools. F.R. 30-18,000 c/s. $7\frac{1}{2}$ i/s, 40-15,000 c/s. $3\frac{3}{4}$ i/s. H and N −50 dB. W. & F. 1.5% at $7\frac{1}{2}$ i/s. Size according to cabinet. Prices from £208 19s.

★

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

Model WVA. Complete semi-pro. mono recorder.. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W & F: $7\frac{1}{2}$ i/s, 0.16%; $3\frac{3}{4}$ i/s 0.2%. H & N (after erasure) −50 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-12 Kc/s (all ±3 dB). Replay char. CCIR. Inputs: mic., 12 μV on 30 ohms; gram/radio 20 mV on $\frac{1}{2}$ Meg. Output 15 ohms at $3\frac{1}{2}$ W. Three motors. $8\frac{1}{4}$ in. spools, less than 1 min. rewind for 1,750 ft. tape. Level meter. Size $8\frac{1}{4} \times 22\frac{1}{2} \times 15\frac{3}{4}$ ins. Weight 51 lbs. Pause control. Price £93 13s.

■**Model WVA/S.** Details as for WVA, but facilities for stereo playback. Price £112 10s.

Model WVB. Details as for WVA, but facilities for monitoring, adding echo, superimpose. Price £110 3s.

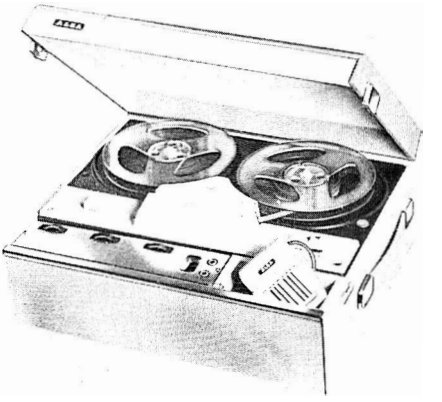
■**Model CBL.** Stereo/mono recorder. $\frac{1}{2}$-track, with $\frac{1}{4}$-track playback also available. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W & F: $7\frac{1}{2}$ i/s, 0.16%; $3\frac{3}{4}$ i/s, 0.2%. H & N (after erasure) −50 dB. F.R.: $7\frac{1}{2}$ i/s, 40 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-12 Kc/s (all ±3 dB). Replay char. CCIR. Inputs: mic 40 μV on 30 ohms; gram/radio 100 mV on $\frac{1}{2}$ Meg. (mixable on each amplifier). Output 15 ohms at $3\frac{1}{2}$ W each amplifier. Three motors. $8\frac{1}{4}$ in. spools, less than 1 min. rewind for 1,750 ft. tape. Level meter. Size $16\frac{3}{8} \times 27\frac{1}{2} \times 8\frac{5}{8}$ ins. Weight 69 lbs. Pause control, monitoring, echo, superimpose. Price £160.

GENERAL PURPOSE TAPE RECORDERS

AD AURIEMA Ltd., Empire House, 414 Chiswick High Road, London, W.4. Tel.: Chiswick 2205.

Cipher I. Mono recorder. ½ track. Speeds 7½, 3¾, 1⅞ i/s. W. & F. 0.2%. F.R. 70 c/s-10 Kc/s. Inputs for mic., radio/gram. Outlet from pre-amp. One motor. 5 in. spools. M.E. 117 V operation only. Price £51 9s.

Cipher V. Mono recorder. ½ track. Speeds 3¾, 1⅞ i/s. W. & F. 0.25%. H & N −48 dB. F.R. 3¾ i/s, 70 c/s-8 Kc/s; 1⅞ i/s, 70 c/s-4 Kc/s. Replay char. CCIR. High level inputs. Outlet from pre-amp. One motor. 5 in. spool, 1 min. rewind. M.E. Price £30 19s. 6d.



Alba R14

★

AKAI. Distributors: R. Marking & Co. Ltd., 197 Streatham Road, Mitcham, Surrey. Tel.: Mitcham 4044/5.

Akai 69. Mono recorder. ½ track. Speeds 7½, 3¾ i/s. W. & F. <0.1%. H & N −50 dB. F.R. 7½ i/s, 30 c/s-12 Kc/s ±2 dB. Replay char. NARTB. Outlets from replay head or pre-amp. One 4 pole induction motor. 7 in. spools, 2½ mins. for 1,200 ft. Level meter. Pause control, vertical operation. Size 16½ × 13½ × 10 in. Weight 33 lb. Price (including microphone, tape, and recording lead) £82 19s.

Allegro Contessa

★

ALBA (Radio / Television) Ltd., Tabernacle Street, London, E.C.2. Tel.: Clerkenwell 1322. Cables: Abalgramo, Ave, London.

R15. Mono recorder. ¼ track. Speed 3¾ i/s. W. & F. <0.4%. H & N −40 dB. F.R. 100 c/s-10 Kc/s ±4 dB. Input: 3 mV, 100 K. Outlet from pre-amp. One motor. 5¾ in. spool. DM70 level indicator. Mixing. Size 12 × 5¼ × 13½ in. Weight 20 lb. Price £28 7s.

R14. Details as for R15, but ½ track model. Price £25 4s.

Brenell Mk5 Type M

ALLEGRO Sound Equipment Ltd., 91a Heath Street, Hampstead, London, N.W.3. Tel.: Hampstead 6377.

Contessa. Collaro Studio deck. F.R. 7½ i/s, 30-10,000 c/s ±3 dB. 3 motors. 7 in. spools. M.E. level ind. W. and F. 0.15%. H and N −45 dB. Monitoring. Superimposition. Size 15½ × 15 × 8 in. Weight 25 lb. Price £44 2s. Four track version available.

★

BANG & OLUFSEN, Denmark. Sole U.K. distributors: Aveley Electric Ltd., Ayron South Ockendon, Essex. Tel.: South Ockendon 3444.

Belcanto Portable tape recorder. 3¾ i/s. One motor. 5¾ in. spools. F.R. 40-11,000 c/s ±2.5 dB N −50 dB. M.E. level ind. Separate tone controls. 6 watts output. c/s ±2.5 dB H & N −50 dB. M.E. level ind. 25 lb. Complete with moving coil microphone and tape. Price £56 7s. 9d.

★

BRENELL Engineering Co. Ltd., 1a Doughty Street, London, W.C.1. Tel.: Holborn 7356-7-8.

Mk. 5. Series 2. 15, 7½, 3¾ and 1⅞ i/s. 3 motors. 8¼ in. spools. F.R. 15 i/s, 40-15,000 c/s, ±2 dB. 7½ i/s, 40-14,000 c/s; 3¾ i/s, 40-11,000 c/s; 1⅞ i/s, 40-6,000 c/s. ±3 dB. M.E. level ind. (Meter available.) H and N −45 dB. W and F 0.05% at 15 i/s. Hi-fi outlet at 200 mV. Straight-through amp. Switched frequency correction. Pause control and monitoring. Size 18 × 18 × 8 in. Weight 38 lb. Price £72 9s., with meter £77 14s.

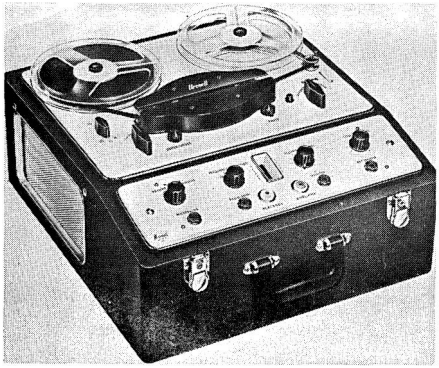
Mk. 5. Type M. Speeds 15, 7½, 3¾, 1⅞ i/s. Three motors. 8¼ in. spools. F.R. 15 i/s, 40-20,000 c/s; 7½ i/s, 40-18,000 c/s; 3¾ i/s 40-13,000 c/s; 1⅞ i/s, 40-6,000 c/s. Level meter. H and N −45 dB. W and F 1⅞ i/s, <0.25%; 3¾ i/s, <0.15%; 7½ i/s, <0.1%. Outlet from re-amp. Mixing. Superimposing. Tape monitoring. Input monitoring. Size 18 × 17 × 9 in. Weight 40 lb. Price £92 8s.

★

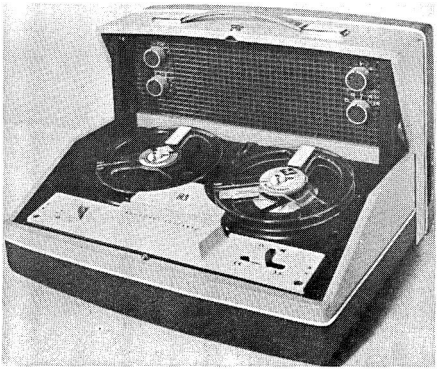
BRITISH RADIO CORPORATION Ltd., 21 Cavendish Place, London, W.1. Tel.: Langham 9291.

HMV 2204. Mono recorder. ¼ track. Speeds 3¾, 1⅞ i/s. W. and F. <0.2%. F.R. 3¾ i/s, 60 c/s-12 Kc/s; 1⅞ i/s, 60 c/s-6 Kc/s. Replay char. CCIR. Inputs: 1.5 mV, 10 Meg; 1.5 mV, 22 K; 75 mV, 1 Meg. Outlet from pre-amp. 500 mV, 22 K. One four-pole motor. 5¾ in. spools. 2½ min. rewind. EM87 level indicator. Auto-stop. Remote pause. Tape position indicator. Piano key controls. Superimposition. Size 15½ × 14¼ × 7¼ in. Weight 20 lb. Price to be announced.

Marconiphone 4200. Mono recorder. ¼ track. Speeds 3¾, 1⅞ i/s. W. and F. <0.2%. F.R. 3¾ i/s, 60 c/s-12 Kc/s; 1⅞ i/s, 60 c/s-6 Kc/s. Replay char. CCIR. Inputs: 1.5 mV, 10 Meg; 1.5 mV, 22 K; 75 mV, 1 Meg. Outlet from pre-amp. 500 mV, 22 K. One four-pole motor. 5¾ in. spools, 2½ min. rewind. EM87 level indicator. Auto-stop. Remote



Brenell Mk5 Series 2



B & O Belcanto

pause. Tape position indicator. Piano key controls. Superimposition. Size 12½ × 7¼ × 14 in. Weight 19 lb. Price £34 13s.

★

BUSH Radio Ltd., Power Road, London, W.4. Tel.: Chiswick 6491. Cables: Supasetz, London, W.4.

TP50. Mono recorder with BSR TD2 deck. ¼ track. Speeds 3¾ i/s. W. and F. <0.2%. H and N <−40 dB. F.R. 80 c/s-10 Kc/s. Inputs: mic 0.35 mV, ½ Meg; radio 25 mV, 250 K. Separate outlet from second track of replay head. One motor. 5¾ in. spool 2¾ min. rewind. 'Spirit-level' type M.E. Monitor socket for phones. Pause control, digital counter. Size 7¼ × 14 × 13¾ in. Weight 25½ lb. Price (including microphone) £39 18s.

★

CLARKE & SMITH Manufacturing Co. Ltd., Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252/7.

TR634. Transistorised mono recorder. ¼-track. Speeds 7½, 3¾ i/s. W & F. 7½ i/s, 0.2%; 3¾ i/s, 0.3%. H & N; 7½ i/s, −50 dB; 3¾ i/s, −48 dB. F.R. 7½ i/s, 50 c/s-15 Kc/s; 3¾ i/s, 50 c/s-9 Kc/s (±3 dB). Replay char. CCIR. Inputs 1½ mV, 15 μV, 60 mV. Out let from pre-amp. 15 ohms, 70 V line and 1 V at 5 K. Three motors. 8¼ in. spools. Level meter. Mixing. Tone controls. Size 17½ × 17 × 10 ins. Weight 45 lbs. Price £108 3s.

TR635. 7 in. spools. Weight 41 lbs. Other details as for TR634. Price £90 6s.

CINECORDER. See K.G.M. Electronics Ltd.

★

CONTRONICS Ltd., Garth Works, Deepcut Bridge Road, Blackdown, Nr. Aldershot, Hants. Tel.: Deepcut 236.

Carol TR4. Mono recorder. ½ track. Speed 3¾ i/s. W. and F. 0.4%. F.R. 50 c/s-8 Kc/s. Replay char. CCIR. Inputs: mic, radio, gram. Outlet from pre-amp. One motor. 5¾ in. spools. M.E. Line outlet. Size 13¾ × 12¾ × 7 in. Weight 20 lb. Price £20 9s. 6d.

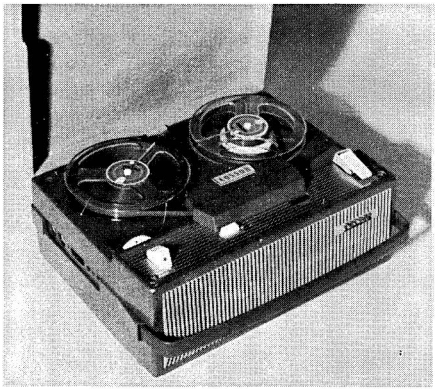
★

COSSOR Radio & Television Co. Ltd., 233 Tottenham Court Road, London, W.1. Tel.: Gerrard 2931.

CR1605. Mono recorder. ¼ track. Speeds 7½, 3¾, 1⅞, 1 5/16 i/s. W. and F. <0.2% at 3¾ i/s. H and N −40 dB. F.R. 7½ i/s, 60 c/s-16 Kc/s; 3¾ i/s, 60 c/s-13 Kc/s; 1⅞ i/s, 60 c/s-10 Kc/s; 1 5/16 i/s, 60-4, 500 c/s (all ±3 dB). Inputs: mic 1 mV, 1 K; diode 3 mV, 20 K; gram 150 mV, 500 K. Outlets from replay head or pre-amp. One motor. 7 in. spools. Moving coil meter. Pause control. Parallel track. Monitoring by loudspeaker or headphones. Straight amplifier. Stereo output. Extension loudspeaker output. Transistor amplifier. Size 17 × 15¾ × 8¼ in. Weight 26 lbs. Price (with microphone and tape) £65 2s.

Bush TP50

Marconiphone 4200

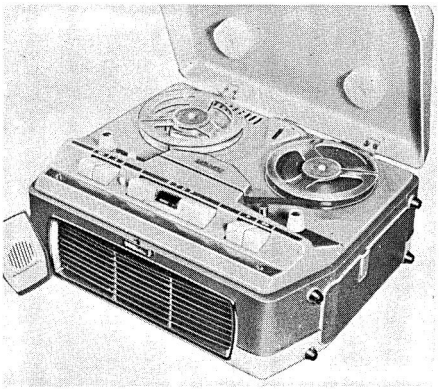


Cossor CR1603

CR1602. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. $<0.3\%$. H and N -40 dB. F.R. 60 c/s-13 Kc/s ± 3 dB. Inputs: mic 3 mV, 100 K; radio 3 mV, 1 Meg; gram 150 mV, 1 Meg. Outlets from replay head or pre-amp. One motor. 7 in. spools. M.E. Parallel tracks. Pause control. Monitoring. Stereo output. Straight amp. Extension loudspeaker output. Size $15\frac{1}{4} \times 12\frac{1}{2} \times 6\frac{3}{4}$ in. Weight 19 lb. Price £39 18s. (with microphone and tape).

CR1603. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. H and N -40 dB. F.R. 80 c/s-13 Kc/s. Inputs: mic 0.4 mV, 1.5 K; gram 100 mV, 680 K; diode 2 mV, 20 K. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. Moving coil meter. Extension loudspeaker output. Transistorised amplifier. Size 12 $\times$ $10\frac{1}{2} \times 6$ in. Weight 11 lb. Price (with microphone and tape) £29 8s.

Diawa DE-30



Cossor CR1602

CROMPTONS (Manchester) Ltd., 29 Minshull Street, Manchester 1.

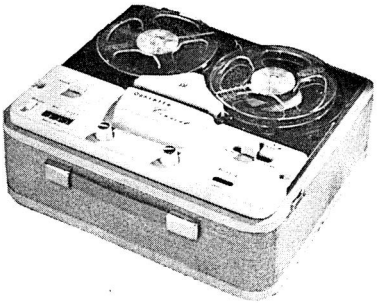
Diawa DE-30. Portable recorder. $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. F.R. 70-11,000 c/s at $7\frac{1}{2}$ i/s. 7 in. spools. Price £46 14s. 6d.

★

C.W.S. Ltd., Radio and Television Department, Alma Park, Warley Street, Upminster, Essex. Tel.: Upminster 3200.

Defiant T12. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. $<0.2\%$. H and N -40 dB at 1 Kc/s. F.R. 100 c/s-8 Kc/s ± 3 dB. Compromise replay characteristic. Inputs: mic 4 mV, radio 100 mV. One motor. $5\frac{3}{4}$ in. spools, 3 min. rewind. EM84 tuning indicator. Superimpose. Size 14 $\times$ 13 $\times$ 6 in. Weight 19 lb. Price £26 5s.

Cossor CR1605



Dansette Consort

Defiant T12R. Details as for T12, but in addition digital tape indicator. Price £27 6s.

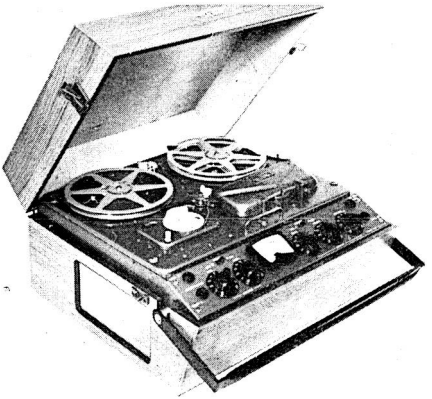
★

DANSETTE Products Ltd., 112-116 Old Street, London, E.C.1. Tel.: Clerkenwell 2133. Cables: Plusagram, London.

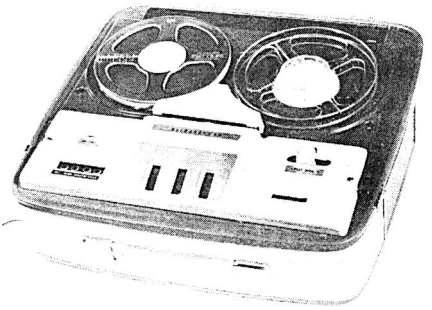
Consort. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F 0.4%. H and N −50 dB. F.R. 60 c/s-10 Kc/s. Replay char. CCIR. Inputs: high imp. for mic., medium imp. for radio/gram. One motor. $5\frac{3}{4}$ in. spools. $3\frac{1}{2}$ min. rewind. M.E. Size 14 × $12\frac{1}{2}$ × 7 in. Weight $16\frac{1}{2}$ lb. Price £23 2s.

★

DIAWA. See Cromptons (Manchester) Ltd.



Clarke & Smith TR 634



Elizabethan Popular 200

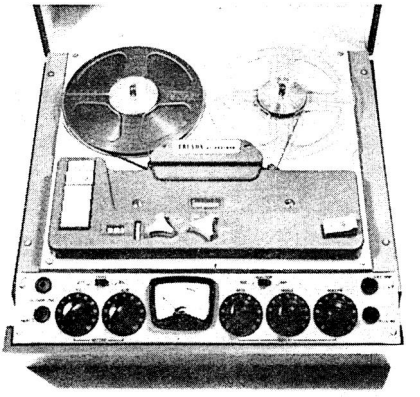
EKCO Radio & Television Ltd., Ekco Works, Southend-on-Sea, Essex. Tel.: Southend-on-Sea 49491. Cables: Ekco, Southend-on-Sea.

Model RT366. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. F.R. 90 c/s-8 Kc/s ±3 dB. One motor. $5\frac{3}{4}$ in. spools. M.E. Inputs: mic, radio. Size $7\frac{7}{16}$ × $13\frac{3}{4}$ × $11\frac{11}{16}$ in. Weight 22 lb. Price £29 8s.

★

ELIZABETHAN (Tape Recorders) Ltd., Bridge Close, Oldchurch Road, Romford, Essex. Tel.: Romford 64101. Cables: Elizabethan, Romford.

Popular 200. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. 0.4%. F.R. 60 c/s-10 Kc/s. Inputs: mic 2 mV, gram 200 mV. Outlet from pre-amp. One motor.



Clarke & Smith TR 635

Emicorda Stereo model ET40

$5\frac{3}{4}$ in. spools. "Fluid light" level indicator. Superimpose. Size 15 × 14 × 5 in. Price £23 2s.

Popular 400. Details as for 200, but $\frac{1}{4}$ track model. No superimpose. Price £26 5s.

LZ30. Mono recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 0.15% at $7\frac{1}{2}$ i/s. H and N −40 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-14 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-6 Kc/s. Inputs: mic 2 mV, gram 200 mV. Outlet from pre-amp. One motor. 7 in. spools. "Fluid light" level indicator. Automatic stop. Size $14\frac{1}{2}$ × $16\frac{1}{2}$ × 6 in. Weight 25 lb. Price £33 12s.

LZ29. Mono recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 0.15% at $7\frac{1}{2}$ i/s. H and N −40 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-14 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-6 Kc/s. Inputs: mic 2mV, gram 200 mV. Outlet from pre-amp. Three motors. 7 in. spools. "Fluid Light" level indicator. Pause control. Size $15\frac{1}{4}$ × $16\frac{1}{2}$ × $6\frac{1}{2}$ in. Weight 29 lbs. Price £37 16s.

★

EMI SOUND PRODUCTS Ltd., Blyth Road, Hayes, Middx. Tel.: Hayes 3888. Cables: Emisound.

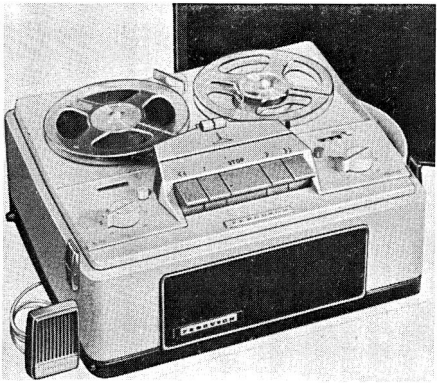
■**"Emicorda" Stereo Model ET40.** Mono recorder with full stereo replay facilities. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, <0.15%; $3\frac{3}{4}$ i/s, <0.3%. H and N <−40 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-15 Kc/s ±3 dB; $3\frac{3}{4}$ i/s, 60 c/s-10 Kc/s ±3 dB. Replay char. CCIR. Inputs: high imp. radio and mic. Sensitivity: mic 2 mV, radio 500 mV. Outlets from replay head or pre-amp. Two "squirrel cage" motors. 7 in. spools, $1\frac{1}{2}$ mins. for 1,800 ft. Level meter. Pause control. Superimpose. Clock counter. Sep. loudspeaker enclosures. Twin-track replay for pre-recorded stereo tapes. Size $24\frac{1}{4}$ × $9\frac{3}{8}$ × $16\frac{3}{4}$ in. Weight 58 lb. Price £78 15s.

★

FERRANTI Radio & Television Ltd., 41/47 Old Street, London, E.C.1. Tel.: Clerkenwell 1261. Cables: Ferrall/Cent. London.

RT1069. Mono recorder. $\frac{1}{4}$ track. Speeds $3\frac{3}{4}$ i/s. W. and F. <0.2%. Replay char. CCIR. Inputs: 0.6 mV, 1 Meg; 60 mV, 0.7 Meg. One motor. BSR deck. $5\frac{3}{4}$ in. spools. 3 mins. rewind. M.E. Size 14 × $12\frac{1}{2}$ × $7\frac{1}{2}$ in. Weight 22 lb. Price (including microphone and tape) £33 12s.

Ferranti RT 1069



Ferguson model 3202

FERGUSON. Thorn Electrical Industries Ltd., Ferguson Division, Thorn House, Upper St. Martin's Lane, London, W.C.2. Tel.: Temple Bar 2444. Cables: Eleclampo, Lesquare, London.

Ferguson Model 3200. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. $<0.2\%$. H and N <-40 dB. F.R. 60 c/s-10 Kc/s ± 5 dB. Replay char. extension of CCIR. Inputs: mic 1.5 mV, 10 Meg; radio 1.5 mV, 22 K; gram 75 mV, 1 Meg. Outlet from pre-amp. 500 mV, 22 K, fully compensated. One motor. $5\frac{3}{4}$ in. spool, $2\frac{1}{2}$ mins. rewind. M.E. Pause control. Piano key controls to permit tape "inching". Digital position indicator. Size $14\frac{1}{2} \times 12\frac{3}{4} \times 7$ in. Weight 18 lb. Price £27 6s.

Ferguson Model 3200

Ferguson Model 3202. Mono recorder. $\frac{1}{4}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $<0.3\%$ at $1\frac{7}{8}$ i/s and 0.2% at $3\frac{3}{4}$ i/s. H and N <-40 dB. F.R. $3\frac{3}{4}$ i/s, 60 c/s-12 Kc/s ± 5 dB; $1\frac{7}{8}$ i/s, 60 c/s-6 Kc/s ± 5 dB. Replay char. extension of CCIR. Inputs: mic 1.5 mV, 10 Meg; Radio 1.5 mV, 22 K; gram 75 mV, 1 Meg. Otulets from replay head, and pre-amp. 500 mV, 22 K, fully compensated. One motor. $5\frac{3}{4}$ in. spools, $2\frac{1}{2}$ mins. rewind. M.E. Pause control. Piano key controls to permit tape "inching". Digital position indicator. Superimposition. Remote pause control. Automatic stop. Size $14\frac{1}{2} \times 12\frac{3}{4} \times 7$ in. Weight 18 lb. Price £34 13s.

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FIDELITY Radio Ltd., 11/13 Blechynden Street, London, W.11. Tel.: Park 0131.

Argyll Major-4. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. 0.4%. H and N -50 dB. F.R. 60 c/s-10 Kc/s. Replay char. CCIR. Inputs: mic 2 mV, radio/gram 200 mV. Outlet from replay head 2 mV. One motor. $5\frac{3}{4}$ in. spools, 3 mins. rewind. M.E. Superimpose, monitoring. Size $15\frac{1}{2} \times 14\frac{3}{4} \times 7\frac{5}{8}$ in. Weight 22 lb. Price £30 19s. 6d.

Fidelity Argyll Minor-4

Argyll Minor Twin. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. 0.4%. H and N -50 dB. F.R. 60 c/s-8 Kc/s. Replay char. CCIR. Inputs: mic 4 mV, radio 200 mV. One motor. $5\frac{3}{4}$ in. spools, 3 mins. rewind. M.E. Size $15 \times 12 \times 6$ ins. Weight 16 lb. Price £23 2s.

Argyll Minor-4. $\frac{1}{4}$ track version of Argyll Minor. Price £25 4s.

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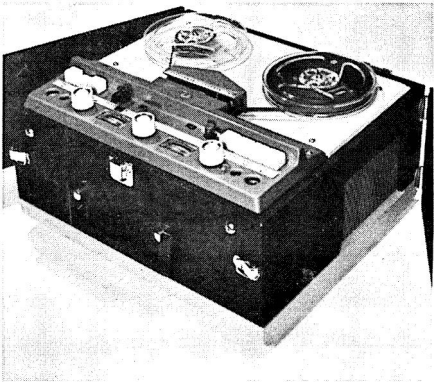
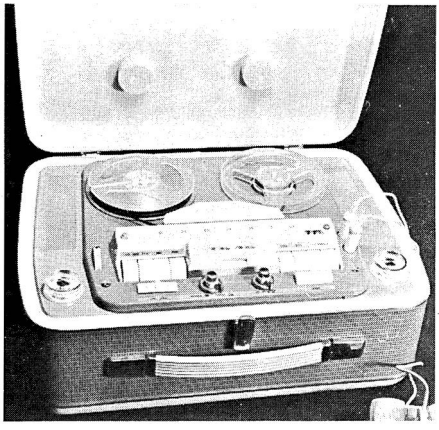
FINEX (Overseas) Ltd., 7 West End Lane, Kilburn Bridge, London N.W.6. Tel.: Maida Vale 6905.



Nicoder Model 551



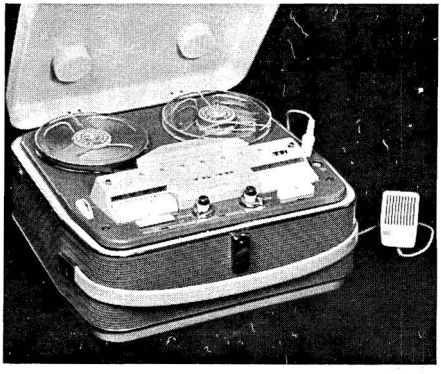
Grundig TK 46 stereo

■**Nicoder Model 551.** Stereo/mono recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. 0.3%. H and N <-45 dB. F.R. 50 c/s-14 Kc/s. Replay char. CCIR. Inputs: Aux 500 K, mic 50 K. Output 10 W. Outlet from pre-amp. One motor. 7 in. spool, 2 mins. rewind. Two VU meters. Two speakers. Size $14\frac{3}{4} \times 12\frac{1}{4} \times 7\frac{3}{4}$ in. Weight approx. 28 lb. Price £75 12s.

★

GENERAL SONIC Radios, 92 Caledonian Road, London, N.1. Tel.: Terminus 0322.

Sonic V. Collaro deck. $\frac{1}{4}$ track. 3 speeds. 7 in. spools. F.R. $7\frac{1}{2}$ i/s. 40-12,000 c/s ± 3 dB. M.E. level ind. W. and F. 0.15%. H and N -45 dB. Tone controls, superimposition, pause key. Outlet from pre-amp. Two loudspeakers fitted. Output 5.3 watts. Size $16 \times 16 \times 9\frac{1}{4}$ in. Weight 33 lb. Price £52 10s.



Grundig TK40

G. H. GILKES & Co. Ltd., Trafford House, Talbot Road, Old Trafford, Manchester 16. Tel.: Trafford Park 1242. Cables: Gilkes, Manchester 16.

Pakasound Connoisseur. Mono recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 0.2% at $7\frac{1}{2}$ i/s. H and N <-70 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-10 Kc/s ± 3 dB; $3\frac{3}{4}$ i/s, 60 c/s-8 Kc/s ± 3 dB. Replay char. CCIR. Inputs: mic 5 mV, 1 Meg; radio 400 mV, 1 Meg. LS outlet parallel with monitor control. Three motors. 7 in. spool, 3 mins. 3 secs. rewind for 1,200 ft. EM85 level indicator. Pause control, superimpose, monitor control. Size $17 \times 15 \times 8$ in. Weight 32 lb. Price £49 7s.

Pakasound Enthusiast. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. H and N <-60 dB. F.R. 60 c/s-8 Kc/s ± 3 dB. Replay char. CCIR. Inputs: mic 5 mV, 1 Meg; radio 400 mV, 1 Meg. LS outlet switched. One motor. $5\frac{3}{4}$ in. spool, $2\frac{1}{2}$ mins. rewind. EM85 level indicator. Size $14 \times 12 \times 8$ in. Weight 19 lb. Price £33 12s.

★

THE GOSHO CO. Ltd., Stone House, Bishopsgate, London, E.C.2. Tel.: Bishopsgate 5901/5. Cables: Gosho, London.

Nishikura Model F. Combination tape recorder and record player. Speeds $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s (continuously adjustable $2\frac{3}{4}$-$7\frac{1}{2}$ i/s). One motor. 7 in. spools. F.R.: $7\frac{1}{2}$ i/s 50-13,000 c/s; $3\frac{3}{4}$ i/s 50-8,000 c/s; $2\frac{3}{4}$ i/s 50-6,000 c/s. M.E. level ind. W. and F. $<0.2\%$ at $7\frac{1}{2}$ i/s. Outlet from replay head. Outlet from pre-amp. Built-in MW/SW radio. Plug-in three-speed gram unit. May be used as telephone/P.A. amplifier. Size $18 \times 13 \times 7$ in. Price £95.

Grundig TK 14

Ricoh Synchrofax Sheet Recorder. Records and plays back on magnetically coated sheet of paper. Sheet size $11\frac{3}{4} \times 8\frac{1}{4}$ in. Maximum recording time 4 minutes. F.R. approx. 100-8,000 c/s. M.E. level indicator. Recordings may be duplicated with printing attachment; the recording can also be erased and the sheet used again. Reverse side of sheet may be used for printed, typed or written notes. Outlet direct from replay head. P.s.n. 100 V, 50 or 60 c/s. Size $15\frac{1}{2} \times 10 \times 6$ in. Weight 24 lb. Price £65.

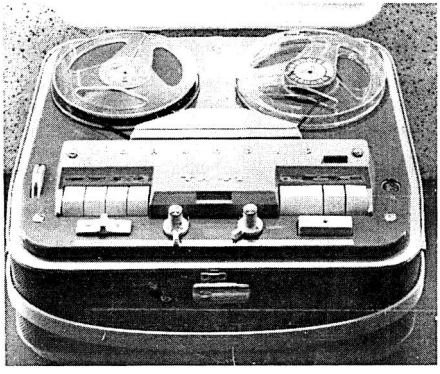
★

GRUNDIG (Gt. Britain) Ltd., Newlands Park, Syndenham, S.E.26. Tel.: Sydenham 2211.

TK14. Speed $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. F.R. 40-12,000 c/s +3 −5 dB. M.E. level ind. W. and F. ±0.2%. H and N −50 dB. Size $14\frac{3}{4} \times 11\frac{1}{2} \times 6\frac{3}{4}$ in. Weight 20 lb. Price £36 15s.

TK18. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. less than 0.25%. H. & N. −47 dB. F.R. 40 c/s-12 Kc/s +3-5 dB. Replay char. CCIR. Inputs: mic 2.5 mV-45 mV/1.5 Meg; radio/gram 120 mV-2.4 V/1 Meg. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. Completely automatic volume control. Size $14\frac{3}{4} \times 11\frac{1}{2} \times 6\frac{3}{4}$ ins. Weight 20 lbs. Price £40 19s.

TK23. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. ±0.2%. H and N −47 dB. F.R. 40 c/s-12 Kc/s. Replay char. NARTB. Inputs: mic 2 mV, 500 K; radio diode 11 mV, 40 K; gram 450 mV, 1 Meg. Outlets from channel 3 and 4 head only, or pre-amp. One motor. $5\frac{3}{4}$ in. spools. M.E. Pause control. Size $14\frac{3}{4} \times 11\frac{1}{2} \times 6\frac{3}{4}$ in. Weight 20 lb. Price (including microphone) £47 5s.

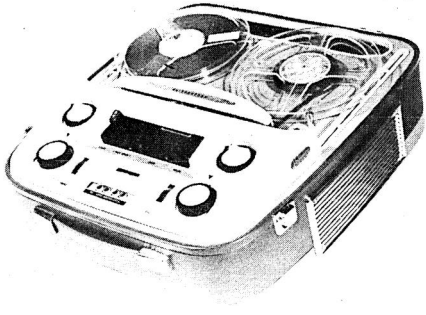


Grundig TK41

KGM Cinecorder Model A

TK40. 4 track. Speeds $1\frac{7}{8}$, $3\frac{3}{4}$ and $7\frac{1}{2}$ i/s. One motor. 7 in. spools with lid off, $5\frac{3}{4}$ in. spools with lid on. F.R. $1\frac{7}{8}$; 60 to 10 Kc/s. $3\frac{3}{4}$; 60 to 15 Kc/s. $7\frac{1}{2}$; 60 to 18 Kc/s. S-N 45 dB. W. and F. ±1% at $7\frac{1}{2}$ i/s. Facilities: Inching, Cine-socket, Built-in tape cleaner, indicator re-set, automatic stop, remote control, mixing facilities, monitoring, synchronous recordings and superimposition. Price £78 15s. (including tape and microphone).

TK41. Mono recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, ±0.1%; $3\frac{3}{4}$ i/s, ±0.12%. F.R. $7\frac{1}{2}$ i/s, 60 c/s-18 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-15 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s. Replay char. NARTB. Outlet from pre-amp. One motor. 7 in. spools (without lid), $5\frac{3}{4}$ in. spools (with lid). Rewind (double play tape) 1,700 ft. 2 mins. 40 secs. M.E. Pause control. Inching. Built-in tape cleaner. Automatic stop. Remote control. Size $16\frac{1}{8} \times 15 \times 7\frac{5}{8}$ in. Weight $28\frac{1}{2}$ lb. Price (including microphone) £78 15s.



Elizabethan LZ29

K-B TT40 Twin Four

TK46. Stereo/mono recorder. $\frac{1}{4}$" track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ in. W. and F. $7\frac{1}{2}$ i/s, $\pm 0.1\%$; $3\frac{3}{4}$ i/s, $\pm 0.12\%$; $1\frac{7}{8}$ i/s, $\pm 0.2\%$. F.R. $7\frac{1}{2}$ i/s, 60 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-9 Kc/s (all ± 3 dB). Replay char. NARTB. Outlet from pre-amp. One motor. 7 in. spools (without lid), $5\frac{3}{4}$ in. spools (with lid). Rewind (double play tape) 2 mins. 40 secs. M.E. Pause control. Synchronous and multiple synchronous recordings. Echo. Size $20 \times 15\frac{3}{4} \times 8\frac{1}{4}$ in. Weight 33 lb. Price £103 19s. (microphone extra).

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HMV. See British Radio Corporation Ltd.

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K.G.M. ELECTRONICS Ltd., Bardolph Road, Richmond, Surrey. Tel.: Richmond 7171. Cables: Kelec, Richmond, Surrey.

Cinecorder Model A. Mono recorder with B.S.R. deck. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. 0.4%. F.R. 60 c/s-10 Kc/s. Replay char. CCIR. Two channel mixing with two inputs per channel. 4 watt, 15 ohm output. One motor. $5\frac{3}{4}$ in. spools. 10 in. elliptical speaker housed in detachable lid with 24 ft. cable. Separate bass and treble controls. Boost and cut. Superimposition. "Shift-rack" tape control for dual recordings. Tapelift/Pause control for cueing, cross-fading. Remote control. Accessories: microphones and extension cables, perforated Cinetape, tape sprockets, tape/film synchronisers. Size $16\frac{1}{2} \times 14 \times 8\frac{1}{2}$ in. Weight 28 lb. Price £75.

★

KOLSTER-BRANDES Ltd., Footscray, Sidcup, Kent. Tel.: Footscray 7733. Cables: Matchtone, Sidcup.

K-B TT40 "Twin Four". Four track. Speed $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. F.R. 50-12,000 c/s. M.E. level ind. H and N -40 dB below full output. W. and F. 0.2%. Outlet from replay head. Size $13\frac{3}{4} \times 12\frac{1}{4} \times 6\frac{3}{4}$ in. Weight 20 lb. 8 oz. Price £41 9s. 6d.

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KORTING. See Technical Suppliers Ltd.

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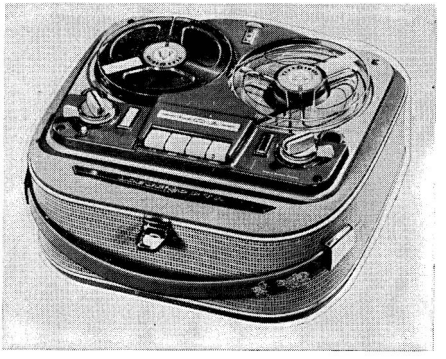
LEE PRODUCTS (G.B.) Ltd., Elpico House, Longford Street, London, N.W.1. Tel.: Euston 5754. Cables: Leprod, London, N.W.1.

Elpico TR/702. B.S.R. Monardeck. $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. F.R. 80-8,000 c/s. H and N -40 dB. W. and F.

Elpico TR/704



Optacord 403

<0.25%. M.E. level ind. Outlet from pre-amp. stage. Size 15 × 12½ × 6 in. Weight 18 lb. Price £24 13s. 6d.

Elpico TR/704. B.S.R. Monardeck. Four track. 3¾ i/s. One motor. 5¾ in. spools. F.R. 80-8,000 c/s. H and N −40 dB. W. and F. <0.25%. M.E. level ind. Outlet from pre-amp. stage. Size 15 × 12½ × 6 in. Weight 18 lb. Price £30 9s.

Elpico/Geloso G.257. Speed 1⅞ i/s. One motor. 3¼ in. spools. F.R. 80-6,000 c/s. H and N <−40 dB. M.E. level ind. Size 10¼ × 6½ × 4 in. Weight 6 lb. 14 oz. Price £25 4s.

Elpico/Geloso G.258. 3¾, 1⅞ and 1 5/16 i/s. One motor. 5 in. spools. F.R. 50-12,000 c/s. H and N −40 dB. W. and F. <0.2%. M.E. level ind. Size 13 × 8¾ × 6¼ in. Weight 12¾ lb. Price £40 19s.

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LOEWE-OPTA. Sole U.K. Distributors, Highgate Acoustics, 71/73 Great Portland Street, London, W.1. Tel.: Museum 2901.

Optacord 403. Portable tape recorder. ½ track. 3¾ and 1⅞ c/s, 5¾ in. spools, F.R. 40-16,000 c/s at 3¾ i/s; 40-8,000 c/s at 1⅞ i/s. M.E. level ind. Size 14¼ × 13¾ × 7¼ in. Weight 21 lb. Price £47 5s.

Optacord 412. Mains/battery portable recorder. ½ track. 3¾ i/s, 4¼ in. spools, F.R. 52-12,000 c/s. M.E. level ind. Operates from five 1.5 V batteries, car batteries or mains. Size 15½ × 9¼ × 4½ in. Weight 9 lb. Price £49 7s.

Optacord 414. Details as for Optacord 412, but meter indicator instead of M.E. Price £49 7s.

Magnavox TM840

Philips EL 3541

MAGNAVOX Electronics Co. Ltd., Alfred's Way, By-Pass Road, Barking, Essex. Tel.: Rippleway 5533.

Magnavox TM840. Mono recorder. ¼ track. Speeds 7½, 3¾, 1⅞ i/s. 7 in. spools. Level meter. W. and F. 0.15%. F.R. 7½ i/s, 40 c/s-16 Kc/s; 3¾ i/s, 40 c/s-11 Kc/s; 1⅞ i/s, 60 c/s-5 Kc/s (all ±2 dB). Replay char. CCIR. Tone controls. Superimposition. Outlet from pre-amp. 3½ watt output. Size 15½ × 9 × 14 in. Weight 32 lb. Price £51 9s.

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MARCONIPHONE. See British Radio Corporation Ltd.

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NICODER. See Finex (Overseas) Ltd.

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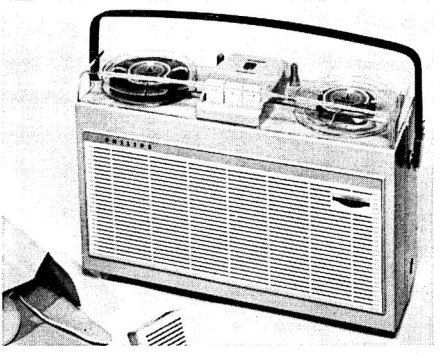
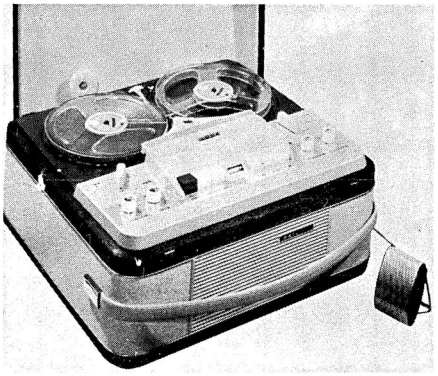
PHILCO (Great Britain) Ltd., 21 Cavendish Place, London, W.1. Tel.: Langham 9291.



Philips EL 3514



Philips EL 3549

Philco 5200. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. F.R. 50 c/s-10 Kc/s. Inputs: 2 mV, 10 Meg or 22 K; 100 mV, 1 Meg. Outlet from pre-amp. 500 mV, 22 K. One motor. $5\frac{3}{4}$ in. spools, 3 mins. rewind. Electronic level indicator. Superimpose. Size $13\frac{3}{4} \times 11\frac{3}{4} \times 6\frac{3}{4}$ in. Weight $18\frac{1}{4}$ lb. Price £26 5s.

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PHILIPS Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

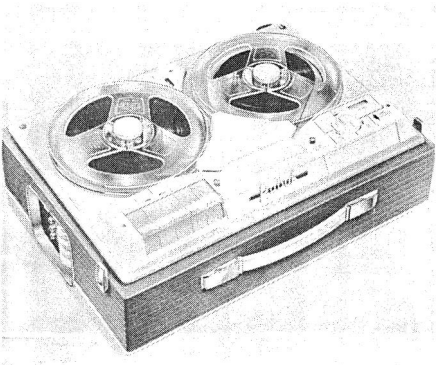
EL3514. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. H and N −40 dB. F.R. 80 c/s-10 Kc/s ±3 dB. Inputs: mic 0.2 mV, 3 K; radio 3 mV, 50 K; gram 130 mV, 2.2 Meg. Outlet from pre-amp. One motor. 5 in. spools. M.E. Extension loudspeaker output. Size $9\frac{3}{4} \times 13\frac{1}{2} \times 4\frac{3}{4}$ in. Weight $10\frac{1}{2}$ lb. Price (with microphone and tape) £28 7s.

Philips EL 3534 stereo

■**EL3534.** Stereo recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. < 0.2% at $3\frac{3}{4}$ i/s. H and N −40 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-16 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s; $\frac{15}{16}$ i/s, 60-4,500 c/s (all ±3 dB). Inputs: mic. 1 mV, 1 K; diode 3 mV, 20 K; gram 150 mV, 500 K. Outlets from replay head or pre-amp. One motor. 7 in. spools. Moving coil level meter. Transistor amplifier. Multiplay. Loudspeaker and phones. Extension speaker output. Size 10 × $18\frac{1}{2}$ × 15 in. Weight 35 lb. Price (with stereo microphone and tape) £96 12s.

EL3541. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. < 0.3%. H and N −40 dB. F.R. 60 c/s-13 Kc/s ±3 dB. Inputs: mic. 3 mV, 100 K; radio 3 mV, 1 Meg; gram 150 mV, 1 Meg. Outlets from replay head or pre-amp. One motor. 7 in. spools. M.E. Pause control. Parallel track facility. Monitoring. Stereo output. Straight amp. Extension loudspeaker output. Size $6\frac{3}{4}$ × $14\frac{1}{4}$ × 12 in. Weight 18 lb. Price (with microphone and tape) £37 16s.

EL3549. Mono recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. < 0.2% at $3\frac{3}{4}$ i/s. H and N −40 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s; $\frac{15}{16}$ i/s, 60-4,500 c/s (all ±3 dB). Inputs: mic. 1 mV, 1 K; diode 3 mV, 20 K; gram 150 mV, 500 K. Outlets from replay head or pre-amp. One motor. 7 in. spools. Moving coil level meter. Pause control. Parallel track. Monitoring by loudspeaker or phones. Straight amp. Stereo output. Transistor amplifier. Extension loudspeaker output. Size $8\frac{1}{4}$ × $16\frac{1}{2}$ × $15\frac{1}{2}$ in. Weight 26 lb. Price (with microphone and tape) £65 2s.



Robuk RK3

PORTOGRAM Radio Electrical Industries Ltd., Audio Works, Paxton Road, Tottenham, London, N.17. Tel.: Tottenham 7683/4/5.

Minitape. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. F.R. 50-9,000 c/s. M.E. level ind. H and N −50 dB. W. and F. 0.2%. 3 watts output. Size $14\frac{1}{2} \times 12\frac{1}{4} \times 6\frac{3}{4}$ in. Weight 18 lb. Price with tape and mic. £24 3s.

Audiotape. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. Three motors. 7 in. spools. F.R. ±3 dB; $7\frac{1}{2}$ i/s, 40-12,000 c/s; $3\frac{3}{4}$ i/s, 40-9,000 c/s; $1\frac{7}{8}$ i/s, 40-7,000 c/s. H and N −60 dB. W. and F. 0.15%. Outlet from pre-amp. Mixing. Superimposing. Straight-through amplifier. 3 watts output. Size $18\frac{1}{2} \times 16\frac{1}{4} \times 9\frac{3}{4}$ in. Weight 38 lb. Price with tape and mic. £47 5s.

Audiotape. $\frac{1}{4}$ track model also available. Specification as for $\frac{1}{2}$ track version.

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REPS. (Tape Recorders) Ltd., 118 Park Road North, South Acton, London, W.3. Tel.: Acorn 4141.

R.10. Collaro Studio deck. $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. F.R. $7\frac{1}{2}$, 40-16,000 c/s ±3 dB; $3\frac{3}{4}$, 40-10,000 c/s; $1\frac{7}{8}$, 50-6,000 c/s. Level meter. H and N −50 dB. W. and F. 0.1%. Size $15\frac{1}{2} \times 15 \times 9$ in. Weight 31 lb. Price (with tape, crystal mic., and recording lead) £61 19s. two track, £72 9s. four track.

Portogram Minitape

Reps R10

ROBUK Electrical Industries Ltd., 559/561 Holloway Road, London, N.19. Tel.: Archway 1022.

Robuk RK3. $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. Three motors. 7 in. spools. F.R. $7\frac{1}{2}$, 60-14,000 c/s ±3 dB; $3\frac{3}{4}$, 60-7,000 c/s ±3 dB; $1\frac{7}{8}$, 60-3,500 c/s. M.E. level ind. H and N −40 dB. W. and F. 0.2%. Outlet from pre-amp. stage. Size $16 \times 11\frac{1}{2} \times 7\frac{1}{4}$ in. Price £37 16s.

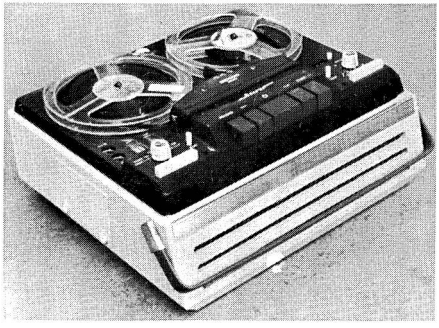
RK4. Details as for RK3, but alternative styling and colour scheme.

★

SIEMENS NORGE A/S, Rosenkrantzgt 11, Oslo, Norway. U.K. distributors: Denham & Morley Ltd., 173-175 Cleveland Street, London, W.1. Tel.: Euston 3656.

■**Siemens No. 10.** Stereo recorder. $\frac{1}{4}$ track. Speeds, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s,

Portogram Audiotape



Siemens No. 10

0.1%; 3¾ i/s, 0.13%; 1⅞ i/s 0.15%. H and N < −52 dB. F.R. .7½ i/s, 45 c/s-18 Kc/s; 3¾ i/s, 45 c/s-11 Kc/s; 1⅞ i/s, 45 c/s-7 Kc/s. Replay char. NARTB. Inputs: mic. 1 mV, 5 K; line 10 mV, 150 K; gram 50 mV, 680 K. Outlet from pre-amp. One motor (low noise, outside rotor). 7 in. spools, 2 min. rewind. Two VU meters with dB calibration. Pause control, sound on sound. Superimpose. Facility for playing both tracks through one speaker. Size 7 × 14 × 15 in. Weight 26 lb. Price to be announced.

★

SIMON Equipment Ltd., 48 George Street, London, W.1. Tel.: Welbeck 2371. Cables: Simsale, London.

SP/5. Speeds 7½ and 3¾ i/s. Three motors. 7 in. spools. F.R. ±3 dB. 7½ i/s 30-20,000 c/s; 3¾ i/s, 30-10,000 c/s. Level meter. H and N < −50 dB weighted against frequencies below 50 c/s. W. and F. 7½ i/s <0.15%; 3¾ i/s <0.2%. Monaural, can be converted to stereo. Re-record from one track to another. Monitoring of recorded signal. Outlet from pre-amp. Size 22½ × 20 × 9¼ in. Weight 45 lb. Price, monaural £97 13s.; stereo £111 6s.

SONY. Distributors: Tellux Ltd., Avenue Works, Gallows Corner, Colchester Road, Romford, Essex. Tel.: Ingrebourne 43971.

■**Sony TC464.** Stereo recorder. ¼ track. Speeds 7½, 3¾ i/s. One motor. 7 in. spools. F.R. 7½ i/s, 60 c/s-15 Kc/s; 3¾ i/s, 60 c/s-10 Kc/s. Two M.E. level indicators. Instant stop lever and 8 mm. synchronising facilities. Size 14¾ × 12⅜ × 6 5/16 in. Weight 26 lb. Price £75 12s.

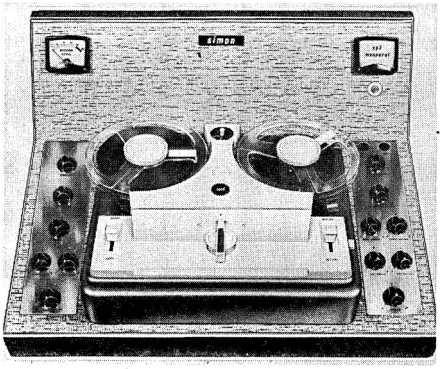
■**Sony 464S.** Stereo recorder. ¼-track. Speeds 7½ i/s, 3¾ i/s. F.R.: .7½ i/s, 40 c/s-15 Kc/s; 3¾ i/s, 40 c/s-10 Kc/s. Complete with two microphones, two speakers, two M.E. indicators. Size 23 × 14½ × 8 ins. Weight 37½ lbs. Price £98 14s.

Sony TC362B Portable Recorder. 7½, 3¾ and 1⅞ i/s. 7 in. spools. F.R. 7½ i/s, 40-15,000 c/s; 3¾ i/s, 50-9,000 c/s; 1⅞ i/s, 50-5,000 c/s. M.E. level ind. H and N −50 dB. W. and F. 0.3%. Mixing, Earphone monitoring. Weight 34 lb. Price £82 19s.

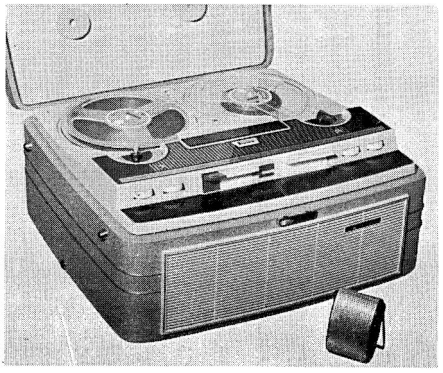
Sony TC262 Portable Recorder. 7½ and 3¾ i/s. 7 in. spools. F.R. 7½ i/s, 70-10,000 c/s; 3¾ i/s, 100-7,000 c/s. M.E. level ind. Earphone monitoring. Size 15 × 7 × 11 in. Weight 22 lb. Price £59 17s.

Sony TC111 Portable Recorder. 3¾ and 1⅞ i/s. 5 in. spools. F.R. 3¾ i/s, 70-8,000 c/s; 1⅞ i/s, 70-4,000 c/s. M.E. level ind. Size 8¾ × 4½ × 7¾ in. Weight 10 lb. Price inc. mic., tape, leads and carrying case £30 19s. 6d.

Sony TC101 Portable Recorder. 7½ and 3¾ i/s. 7 in. spools. F.R. 7½ i/s, 50-10,000 c/s; 3¾ i/s, 100-7,000 c/s. V.U. meter. Size 13 × 7 × 10¾ in. Weight 19 lb. Price £49 7s.



Simon SP5



Stella ST 459

Sony TC 801. Portable mono mains/battery recorder. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Output, 250 mW. Recording level/battery indicating meter. Push button function selector. Built-in microphone. Tape counter. Nine transistors. Microphone with "hold" button. Back spacer for review. Earphone. Weight 13 lb. Price £93 9s.

★

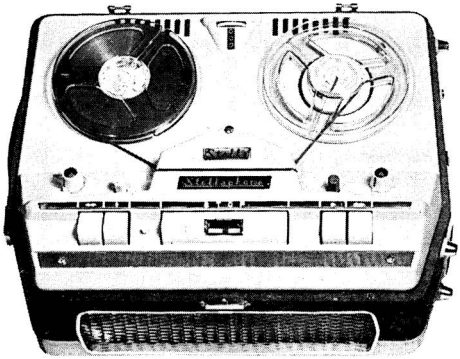
SOUND. See Tape Recorders (Electronics) Ltd.

★

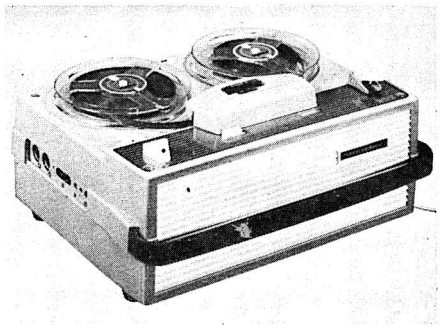
STELLA Radio & Television Co. Ltd., Astra House, 121-3 Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7086.

ST454. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. $<0.3\%$. H and N -40 dB. F.R. 60 c/s-13 Kc/s ± 3 dB. Inputs: mic. 3 mV, 100 K; Radio 3 mV, 1 Meg; gram 150 mV, 1 Meg. Outlets from replay head or pre-amp. One motor. 7 in. spools. M.E. Parallel track facility. Pause control. Monitoring. Stereo output. Straight amp. Extension loudspeaker output. Size $6\frac{3}{4} \times 15\frac{1}{4} \times 12\frac{1}{2}$ in. Weight 19 lb. Price £39 18s. (with microphone and tape).

ST456. Mono recorder. $\frac{1}{4}$ track. Speed $3\frac{3}{4}$ i/s. H and N -40 dB. F.R. 80-13 Kc/s. Inputs: mic. 0.4 mV, 1.5 K; gram 100 mV, 680 K; diode 2 mV, 20 K. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. Moving coil meter. Extension loudspeaker output. Transistorised amplifier. Size 12 × $10\frac{1}{4}$ × 6 in. Weight 11 lb. Price (with microphone and tape) £29 8s.



Stella ST454



Stella ST 456

ST459. Mono recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $1\frac{5}{16}$ i/s. W. and F. $<0.2\%$ at $3\frac{3}{4}$ i/s. H and N -40 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s; $1\frac{5}{16}$ i/s, 60-4,500 c/s (all ± 3 dB). Inputs: mic. 1 mV, 1 K; diode 3 mV, 20 K; gram 150 mV, 500 K. Outlets from replay head or pre-amp. One motor. 7 in. spools. Moving coil meter. Pause control. Parallel track. Monitoring (loudspeaker or phones). Straight amp. Stereo output. Transistor amplifier. Size 17 × $15\frac{3}{4}$ × $8\frac{1}{4}$ in. Weight 26 lb. Price (with microphone and tape) £65 2s.

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STEREOSOUND Productions Ltd., 12-14 Wakefield Road, Brighouse, Yorkshire. Tel.: Brighouse 1755.

Carousel Junior Radiotape. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. 60-9,000 c/s ± 3 dB. M.E. level ind. H and N -38 dB. W. and F. $\pm 0.25\%$. Size 23 × 20 × $10\frac{1}{2}$ in. Weight 27 lb. 8 oz. Price £30 9s. AM radio tuner (optional) £8. 8s.

Sony 464 CS

Sony TC 363B

Stuzzi Tricorder

Carousel Junior Radiotape (Mk. 11). Mono recorder in console cabinet. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. & F. 0.25%. H & N −38 dB. F.R. 60 c/s-9 Kc/s. Replay char. CCIR. Inputs: mic 2.5 mV, 1 Meg; gram 100 mV, 1 Meg. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. M.E. Size 23 × $10\frac{3}{4}$ × $22\frac{1}{2}$ ins. high, (including legs). Weight 26 lbs. Price £31 10s. Optional radio tuner (AM) £8 8s.

Carousel Unit-tape. Mono recorder in console cabinet. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. 0.25%. H and N −38 dB. F.R. 60 c/s-9 Kc/s. Replay char. CCIR. Inputs: mic. 2.5 mV, 1 Meg; gram 100 mV, 1 Meg. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. M.E. Optional record player (£9 19s. 6d.) and AM Radio (£8 8s.). Size 30 × $23\frac{3}{4}$ × 14 in. Weight 45 lb. Price £44 2s.

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STUZZI. U.K. distributors: Recording Devices Ltd., 44 Southern Row, Kensington, London, W.10. Tel.: Ladbroke 4775.

Stuzzi Tricorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ and $\frac{15}{16}$ i/s. Papst motor. $5\frac{1}{4}$ in. spools. F.R. $3\frac{3}{4}$ i/s, 40-16,000 c/s; $1\frac{7}{8}$ i/s, 40-8,000 c/s; $\frac{15}{16}$ i/s, 40-4,000 c/s. M.E. level ind. H and N −45 dB. W. and F. 0.25%. Mixing. Variable Superimposing, Monitoring and remote control. Size 13 × 10 × 6 in. Weight 18 lb. Price £66 3s.

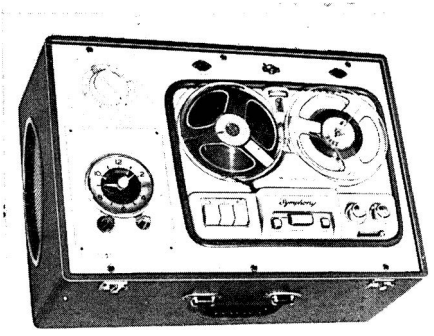
Stuzzi 401 de luxe. Mono recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. F.R. $7\frac{1}{2}$ i/s, 40 c/s-14 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-9 Kc/s. One Papst motor. 7 in. spools. M.E. level indicator. W. and F. 0.15% at $3\frac{3}{4}$ i/s. Outlet from pre-amp. Built-in stereo pre-amp. Inter-track transfer facilities. Superimposition. Price £61 19s.

Mannequin. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W & F 0.4%. H & N −30 dB. Inputs: mic, gram, radio, telephone adaptor. Straight-through amplifier facilities. One motor. $5\frac{3}{4}$ in. spools. M.E. Size $13\frac{3}{4}$ × $14\frac{3}{4}$ × $16\frac{3}{8}$ ins. Weight 18 lbs. Price £23 2s.

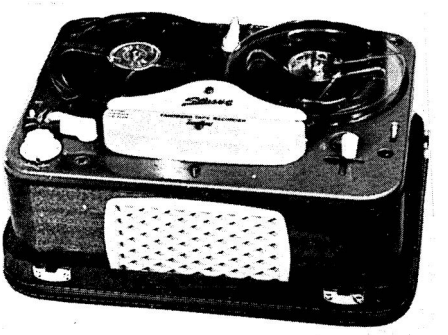
Junior 4M. Four track. B.S.R. Monardeck. $3\frac{3}{4}$ i/s. One motor. $5\frac{1}{4}$ in. spools. F.R. 90-9,000. M.E. level ind. H and N −30 dB. W. and F. 0.25%. Superimposing. Size $13\frac{3}{4}$ × $14\frac{3}{4}$ × $6\frac{3}{8}$ in. Weight 18 lb. Price £27 6s.

Sony TC 262

Stuzzi 401 de Luxe



Symphony Recorder



Tandberg 3B

SYMPHONY AMPLIFIERS Ltd., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314.

Symphony Pre-Sleep Learning recorder. Mono. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. F.R. $3\frac{3}{4}$ i/s, 40 c/s-16 Kc/s; $1\frac{7}{8}$ i/s, 40 c/s-8 Kc/s; $\frac{15}{16}$ i/s, 40 c/s- 4 Kc/s. Replay char. NARTB. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. Strip light level indicator. Built-in time control for three-ons and three-offs automatically. Incorporates Stuzzi deck and amplifier. Size 22 × 14 × 10 in. Weight 20 lb. Price £72 9s.

★

TANDBERG. U.K. distributors: Elstone Electronics Ltd., Edward Street, Templar Street. Leeds 2. Tel.: Leeds 35111.

Tandberg 3B. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. One motor. 7 in. spool. F.R. ±2 dB. $7\frac{1}{2}$ i/s, 40-16,000 c/s; $3\frac{3}{4}$, 50-9,000 c/s; $1\frac{7}{8}$, 70-4,000 c/s. M.E. level ind. H and N −55 dB. W. and F. 0.15% at $7\frac{1}{2}$ i/s. Low impedance outlet. Size 15 × $11\frac{5}{8}$ × $6\frac{5}{8}$ in. Weight, with case, 27 lb. Price £79 16s.

■**Tandberg 74.** Stereo/mono recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0.15%; $3\frac{3}{4}$ i/s, 0.2%; $1\frac{7}{8}$ i/s, 0.3%. H and N −53 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-5 Kc/s (all ±2 dB). Replay char. NARTB. Inputs: 7 mV; mic. 1.5 mV. One motor. 7 in. spools. 2 mins. rewind. Two EAM86 M.E.s. Pause control. Playback on one channel while recording on other channel. Size $15\frac{3}{8}$ × $11\frac{13}{16}$ × $6\frac{7}{8}$ in. Weight (instrument alone) $27\frac{1}{2}$ lb. (with carrying case) $32\frac{1}{2}$ lb. Price £97 13s.

■**Tandberg 72.** $\frac{1}{2}$ track version of Tandberg 74. Details as above, but H and N −56 dB.

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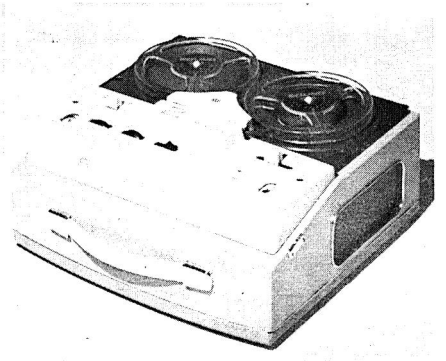
TAPE RECORDERS (ELECTRONICS) Ltd., 784-788 High Road, Tottenham, London, N.17. Tel.: Tottenham 0811-3. Cables: Taperec, London.

Tandberg 74 Stereo



Sound Riviera

Korting ML 128

Sound Master. Collaro deck. Four track. $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. F.R. 40-15,000 c/s ±3 dB at $7\frac{1}{2}$ i/s. Level meter. H and N −45 dB. W. and F. $<-0.15\%$. Outlet from pre-amp. stage 10 watts output. Mixing, monitoring, superimposing. Size $20\frac{1}{2} \times 17\frac{1}{2} \times 40\frac{1}{2}$ in. Weight 105 lb. Price £110 5s.

Sound Slimline One-Two. Speed $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. F.R. 80-12,000 c/s ±3 dB. M.E. level ind. H and N 40 dB. W. and F. $<0.2\%$. Outlet from pre-amp. Monitoring. Mixing. Superimposing. Straight-through amplifier. Size $13\frac{1}{2} \times 13\frac{1}{2} \times 5\frac{3}{4}$ in. Weight 19 lb. Price £33 12s.

Sound Slimline One-Four. Four-track version of Sound Slimline One-Two. Price £38 17s.

Sound Slimline Three-Two. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. Two motors. 7 in. spools. F.R. at $7\frac{1}{2}$ i/s ±3 dB. Amp. 10-18,000 c/s; Record-replay 80-13,000 c/s ±3 dB at $7\frac{1}{2}$ i/s. M.E. level ind. H and N −40 dB. W. and F. $<0.2\%$. Outlet from pre-amp. Superimposing Mixing. Monitoring. Straight-through amplifier. Size $13\frac{1}{2} \times 13\frac{1}{2} \times 6$ in. Weight 22 lb. Price £42.

Sound Slimline Three-Four. Four-track version of Sound Slimline Three-Two. Price £47 5s.

Sound Riviera. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. W. and F. 0.2%. H and N −38 dB. F.R. 70 c/s-6 Kc/s ±3 dB. Inputs: mic. 4 mV, 1 Meg; radio 200 mV, 1 Meg. Monitor outlet from pre-amp. One motor $5\frac{3}{4}$ in. spool, 1 min. rewind. M.E. Size $13\frac{1}{4} \times 14 \times 7$ in. Price £23 2s.

Riviera de Luxe. $\frac{1}{4}$ track version of Sound Riviera, but outlet from second track for stereo replay via Add-on unit. Price £26 5s.

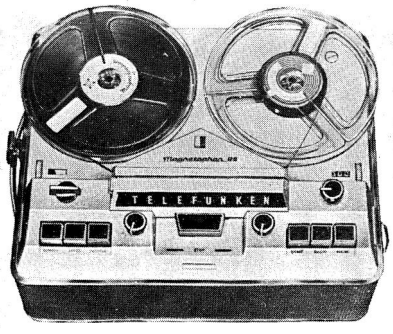
Riviera 3-Speed. Mono recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 0.15% at $7\frac{1}{2}$ i/s. H and N −38 dB. F.R. 70 c/s-12 Kc/s ±3 dB. Replay char. CCIR. Inputs: mic. 4 mV, 1 Meg; radio 200 mV, 500 K. Monitor outlet from pre-amp. Three motors. 7 in. spools, 1 min. rewind. M.E. Pause control. Size $15\frac{3}{4} \times 14 \times 7$ in. Price £30 9s.

Riviera de Luxe. $\frac{1}{4}$ track version of Sound from second track for stereo replay via Add-on unit. Price £32 11s.

■**Sound Stereo Add-on unit.** Model A47. Enables all Sound 4 track models to play back stereo tapes. Comprises a stereo amplifier giving over 3 W output. For use on 200-250 V 50 c/s A.C. mains. Complete with matched speaker, and housed in vinyl covered cabinet. Price £14 14s.

Details of any products announced after this section went to press are given in a special supplement at the end of the book.

Magnetaphon Automatic



Magnetaphon 98

TECHNICAL SUPPLIERS Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel.: Shepherds Bush 2581 and 4794. Cables: Teknika, London.

■**Korting MK.128.** Four track 3¾ i/s. One motor. 7 in. spools. F.R. 30-16,000 c/s ±2 dB. H and N −55 dB. W. and F. 0.08%. M.E. level ind. Stereo/mono record and playback. Two speakers. Outlet from pre-amp. Size 12¾ × 17½ × 7½ in. Weight 32½ lb. Price £71 8s.

■**Korting MT.157.** Four track. Stereo. Speeds 7½ and 3¾ i/s. One motor. 7 in. spools. F.R. 7½ i/s, 30-20,000 c/s; 3¾ i/s, 40-15,000 c/s. M.E. level ind. W. and F. <0.2% at 7½ i/s. Outlet from pre-amp. Third head for monitoring. Size 16½ × 13 × 7¾ in. Weight 29 lb. Price £89 5s.

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TELEFUNKEN. Sole U.K. distributors, Welmec Corporation Ltd., 147 Strand, London, W.C.2. Tel.: Temple Bar 3357. Cables: Welmcor, London.

Magnetophon 75K15. 3¾ and 1⅞ i/s. One motor. 5¾ in. spools. F.R. 60-16,000 c/s ±3 dB at 3¾ i/s; 60-9,000 c/s ± 3 dB at 1⅞ i/s. W. and F. 0.4% at 3¾ i/s. H and N <−40 dB. Fluorescent bar level ind. Automatic stop at end of tape by foils. Connections for synchronised control of automatic slide projector with Telechron 1 Universal unit available as an extra. Connection for remote control. Output from pre-amp. stage. Size 6¼ × 12½ × 12½ in. Weight 21 lb. Price, with tape, £52 10s.

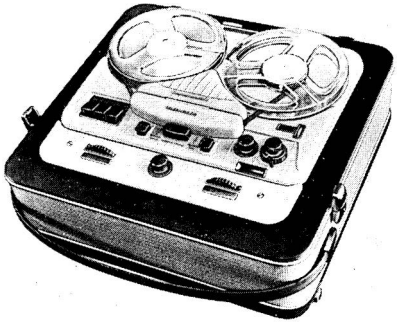
Magnetophon 95. Speeds 7½, 3¾, 1⅞ i/s. 7 in. spools. F.R. 7½ i/s, 30-18,000 c/s; 3¾ i/s, 30-16,000 c/s; 1⅞ i/s, 30-9,000 c/s. Fluorescent bar level ind. W. and F. 0.15% at 7½ i/s. H and N −40 dB. Outlet from pre-amp. Straight-through amplifier. Size 16¼ × 11½ × 7¾ in. Weight 24 lb. Price £61 19s.

Sound Slimline Three-Two

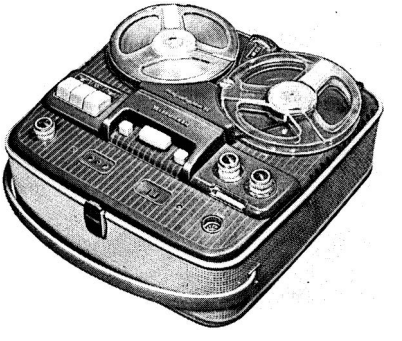
Magnetophon 96. Four track. Speeds 7½, 3¾ and 1⅞ i/s. One motor. 7 in. spools. F.R. 7½ i/s, 30-18,000 c/s; 3¾ i/s, 30-16,000 c/s; 1⅞ i/s, 30-9,000 c/s. Fluorescent bar level ind. H and N <−40 dB. W. and F. 0.15% at 7½ i/s. Outlet from pre-amp via radio socket. May be used with external amplifier for replaying stereo tapes. Size 16¼ × 11½ × 9 in. Weight 24 lb. Price £72 9s.

■**Magnetophon 97.** Four track stereo. Details as for Magnetophon 96. Price £99 15s.

Magnetophon Automatic. Mono recorder. ½ track. Speed 3¾ i/s. W. and F. <0.2%. H and N −40 dB. F.R. 40 c/s-14 Kc/s. Replay char. NARTB. Inputs: radio 3 mV, 47 K; mic. 3 mV, 470 K. Outlet from pre-amp. One motor. 5¾ in. spools, 4 min. rewind (double play tape). Fluorescent bar



Magnetaphon 85



Magnetaphon 75K, 15

Wyndsor International

level indicator. Recording level controlled automatically. Size $6\frac{1}{4} \times 12\frac{1}{2} \times 12\frac{1}{2}$ in. Price £52 10s.

■**Magnetophon 98.** Stereo recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0.15%; $3\frac{3}{4}$ i/s, 0.2%; $1\frac{7}{8}$ i/s, 0.3%. H and N $7\frac{1}{2}$ i/s, −55 dB; $3\frac{3}{4}$ i/s, −50 dB; $1\frac{7}{8}$ i/s, −45 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-18 Kc/s; $3\frac{3}{4}$ i/s, 30 c/s-16 Kc/s; $1\frac{7}{8}$ i/s, 30 c/s-9 Kc/s. Replay char. NARTB. Inputs: radio 2 mV, 47 K; mic. 2 mV, 2 Meg. Outlet from pre-amp. One motor. 7 in. spools, 4 min. rewind (long play tape). Fluorescent bar level indicator. Separate erase, record and playback heads facilitate "before" and "off" tape monitoring. Size $7\frac{3}{4} \times 16\frac{1}{4} \times 11\frac{1}{2}$ in. Price £99 15s.

Magnetophon 85 de Luxe. Mono recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0.15%; $3\frac{3}{4}$ i/s, 0.2%. H and N −55 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-18 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-16 Kc/s. Replay char. CCIR and NARTB, selected by switch. Inputs: radio 2 mV, 47 K; mic. 2 mV, 2 Meg. Outlet from pre-amp. One motor. 7 in. spools, 3 min. rewind (long play tape). Fluorescent bar level indicator. Mixing facilities. Size $8\frac{1}{2} \times 18\frac{1}{4} \times 16\frac{3}{4}$ in. Price £87 3s.

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TRUVOX Ltd., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng-Norphone N.W.10.

R82. Mono recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, <0.1%; $3\frac{3}{4}$ i/s, <0.15%; $1\frac{7}{8}$ i/s, <0.25%. H and N <−50 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-20 Kc/s; $3\frac{3}{4}$ i/s, 30 c/s-12 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-8 Kc/s (all ±3 dB). Replay char. CCIR. Inputs: 1 mV, 2 Meg; 150 mV, 500 K. Outlet from pre-amp. Three motors. 7 in. spools, 1 min. rewind. M.E. Pause, superimpose. "No Tape" auto-stop. Size $16\frac{1}{2} \times 16 \times 10$ in. Weight 36 lb. Price £57 15s.

R84. $\frac{1}{4}$ track version of R82. H and N <−45 dB. Price £61 19s.

R62. Mono recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0.25%; $3\frac{3}{4}$ i/s, 0.3%. H and N −40 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-14 Kc/s ±3 dB; $3\frac{3}{4}$ i/s, 40 c/s-10 Kc/s ±3 dB. Replay char. CCIR. Inputs: mic. 1.5 mV, 2 Meg; radio 150 mV, 500 K. Outlet from pre-amp. One motor. 7 in. spools, 2 min. rewind. M.E. Pause control, superimpose. Four digital counter, 4 W output, monitoring through speaker while recording. Mixing. Size 17 × 13 × 7 in. Weight 22 lb. Price £40 19s.

Uher Royal 784 stereo

Uher 712 Umatic

R64. $\frac{1}{4}$ track version of R62. Details and price as above.

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UHER. U.K. distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

Uher Universal. Mono recorder. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. F.R. $3\frac{3}{4}$ i/s, 50 c/s-18 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-8 Kc/s; $\frac{15}{16}$ i/s, 50 c/s-4 Kc/s; Replay char. NARTB. Outlet from pre-amp. High and low impedance inputs. One motor. $5\frac{3}{4}$ in. spools. Instrument level indicator. Price £87 3s. incl. remote controlled microphone and tape.

Uher 712 Umatic. Mono recorder. $\frac{1}{2}$ track. Speed $3\frac{3}{4}$ i/s. F.R. 40 c/s-16 Kc/s. Replay char. NARTB. Outlet from pre-amp. One motor. 7 in. spools, 1 min. rewind. Instrument level indicator. Transistorised. 2 W output. Switchable automatic modulation control. Size $18\frac{1}{2} \times 18 \times 7$ in. Weight 18 lb. Price £78 15s. including microphone and tape.

■**Uher Royal Model 784.** Transistorised stereo recorder. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W & F: $7\frac{1}{2}$ i/s, 0.15%. F.R. $7\frac{1}{2}$ i/s, 50 c/s-20 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-16 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-8 Kc/s; $\frac{15}{16}$ i/s, 50 c/s-4 Kc/s. Replay char. NARTB. Inputs: mic. 0.1 mV, 1 K; radio 1 mV, 20 K; gram 50 mV, 1 Meg. Outlet direct from replay head and pre-amp. One motor. 7 in. spool. Two level meters. Size $14\frac{3}{4} \times 13\frac{3}{4} \times 7$ ins. Weight 23 lbs.

Ultra Model 6200

Monitoring directly before and after head. Mixing. Echo effect. Price to be announced.

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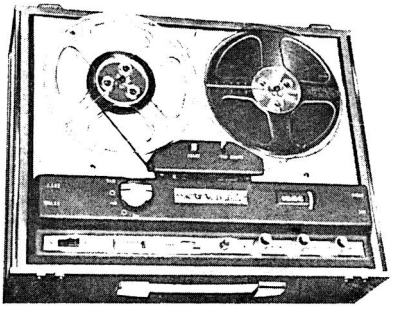
ULTRA Radio & Television Ltd., Television House, Ruislip, Middx. Tel.: Pinner 8761.

Model 6200. Mono recorder. $\frac{1}{4}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $3\frac{3}{4}$ i/s, 0.2%; $1\frac{7}{8}$ i/s, 0.25%. H and N −40 dB. F.R. $3\frac{3}{4}$ i/s, 60 c/s-12 Kc/s ±5 dB; $1\frac{7}{8}$ i/s, 60 c/s-6 Kc/s ±5 dB. Replay char. extension of CCIR. Inputs: mic. 1.5 mV, 10 Meg; gram 75 mV, 1 Meg; radio 1.5 mV, 22 K. Outlets from replay head or pre-amp., unused track is brought out to socket at rear, 500 mV, 22 K. One motor. $5\frac{3}{4}$ in. spools, $2\frac{1}{2}$ min. rewind. M.E. Pause control. Superimpose. Straight-through amp. Autostop. Remote control.

Truvox R84



Truvox R62

Wyndsor Heron

Wyndsor Trident

Aux. socket with 30 V D.C. supply for accessories. Size 7 × 12½ × 14 in. Weight 19 lb. Price £34 13s.

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WYNDSOR Recording Co. Ltd., (inc. Magnetic Recording Co.), 2 Bellevue Road, Friern Barnet, London, N.11. Tel.: Enterprise 2226/7. Cables: Wyndreco, London.

International. Mono recorder. ¼ track. Speeds 7½, 3¾ i/s. W. and F. <0.15% at 7½ i/s. H and N <−45 dB. F.R. 7½ i/s, 40 c/s-18 Kc/s; 3¾ i/s, 40 c/s-12 Kc/s. Replay char. CCIR. Inputs: mic. 1, 30 ohms; mic. 2, 1 Meg; gram/radio 1 Meg. Outlet from replay head. Three motors. 7 in. spools. 1 min. rewind. Prismatically illuminated record level meter. Pause control. Double track playback for superimpose. Vertical operation. 8 in. speaker. Mixing. Monitoring through speaker or phones. Size 15¾ × 19 × 18½ in. Weight 38 lb. Price (including ribbon microphone) £78 15s.

Heron. Mono recorder. ½ track. Speed 3¾ i/s. W. and F. <0.4%. H and N <−40 dB. Inputs: high and low sensitivity, both 1 Meg. One motor. 5¾ in. spools, 3 min. rewind. M.E. Superimpose, monitoring through microphone. Size 16¼ × 14½ × 5½ in. Weight under 17 lb. Price (including microphone and tape) £26 5s.

Trident. Mono recorder. ½ track. Speeds 7½, 3¾, 1⅞ i/s. F.R. 7½ i/s, 50 c/s-15 Kc/s; 3¾ i/s, 50 c/s-9 Kc/s; 1⅞ i/s, 50 c/s-7 Kc/s. Inputs: mic. and radio. Output 4 W. 7 in. spools. M.E. Superimpose. Monitoring through microphone. Pause control. Tone control. Digital counter for reset. Size 14½ × 15½ × 7¾ in. Weight (including microphone) 27 lb. Price £34 13s.

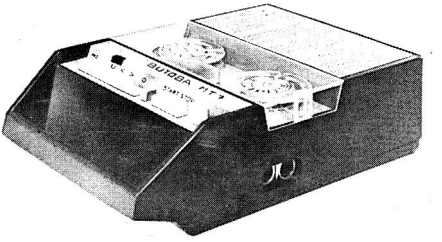
BATTERY OPERATED PORTABLES

BUTOBA—Sole U.K. distributors, Denham & Morley Ltd., Denmore House, 175 Cleveland Street, London, W.I. Tel.: Euston 3656. Cables: Denmorl, Wesdo, London.

Butoba MT5. Transistorised battery portable. Speeds $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. $\frac{1}{2}$-track. W. and F. $3\frac{3}{4}$ i/s, 0.11%; $1\frac{7}{8}$ i/s, 0.16%. H and N −57 dB. Replay char. CCIR. Inputs: 200 mV, 200 ohms; 100 mV, 100K. Outlet from pre-amp. 5-in. spools, $2\frac{1}{2}$ min. rewind. Pause control, straight amplifier. M.E. level ind. Two motors. F.R. $3\frac{3}{4}$ i/s, 50-13,000 c/s; $1\frac{7}{8}$ i/s, 60-5,000 c/s. Battery life 20-40 hours. Eight 1.5 V batteries. Size 12 × $9\frac{1}{4}$ × 6 in. Weight including batteries, 12 lb. Price £69 6s. Mains converter, £11 15s.

Butoba MT5

Butoba M17. Transistorised battery portable. Speed $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. F.R. 100-12,000 c/s at $3\frac{3}{4}$; 100-5,000 c/s at $1\frac{7}{8}$. W. and F. 0.5%. M.E. level ind. Output 0.8 watts. Four 1.5 V batteries. Weight 7 lb. Price (including m/c microphone and tape) £46 4s. Mains converter available.



Butoba MT7

Butoba MT7R. Details as for MT7, but with remote control facility and switched microphone.

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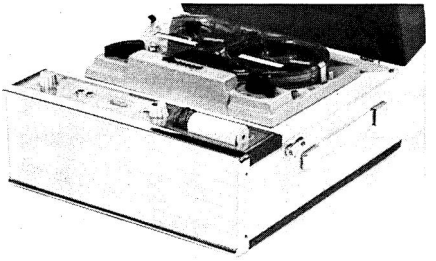
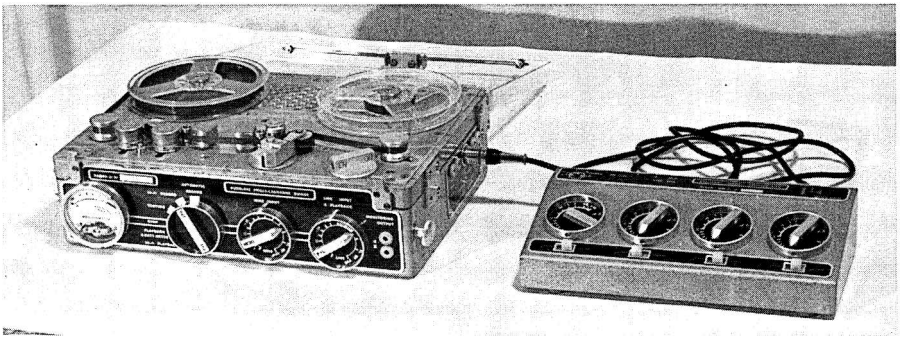
COSSOR Radio & Television Co. Ltd., 233 Tottenham Court Road, London, W.1. Tel. Gerrard 2931.

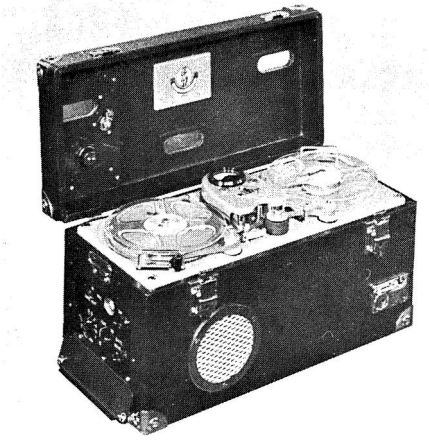
CR1620. Battery portable. $\frac{1}{2}$-track. Speed $1\frac{7}{8}$ i/s. W. and F. <0.5%. H. and N. −40 dB. F.R. 120-5,500 c/s ±3 dB. Inputs: mic 0.3 mV, 2 K; radio/gram 0.3 V,



Dansette Cadet



Nagra 111B with 4-channel Mixer unit



EMI RE 321

2 K. Outlet from pre-amp. One motor. 4-in. spools. Moving coil level meter. Size $11\frac{1}{2} \times 4\frac{1}{4} \times 7\frac{3}{4}$ ins. Weight 8 lbs. including batteries. Price (including microphone and tape) £26 5s.

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DANSETTE Products Ltd., 112-116 Old Street, London, E.C.1. Tel.: Clerkenwell 2133. Cables: Plusagram, London.

Cadet. Battery operated mono recorder. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. One motor. 4 in. spools, 2 min. rewind for 650 ft. tape. M.E. Size $11\frac{1}{8} \times 5\frac{5}{8} \times 12$ ins. Weight 10 lbs. Price £27 6s.

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DOKORDER. See The Gosho Co. Ltd.

THOMAS A. EDISON Ltd., Victoria House, Southampton Row, London, W.C.1. Telephone: Holborn 9988. Cables: Edisongram. Westcent, London.

Mohawk Midgetape 400. Transistorised battery portable. Speed $1\frac{7}{8}$ i/s. F.R. 150-5,000 c/s. H and H −42 dB. W. and F. less than 0.7%. Special tape cartridge and T50 Mercury battery. Battery life 50 hours. Size $8\frac{1}{2} \times 3\frac{7}{8} \times 1\frac{7}{8}$ in. Weight 3 lb. Price with transistorised speaker, microphone and battery, £129 10s.

Mohawk Midgetape 500. Transistorised professional battery portable. Speed $3\frac{3}{4}$ i/s. F.R. 50-10,000 c/s, H and N −42 dB. W and F 0.4%. Single battery with indicator. Size $8\frac{1}{2} \times 3\frac{7}{8} \times 1\frac{7}{8}$ in. Weight 3 lb. Price on application.

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EMI ELECTRONICS Ltd., Hayes, Middx. Tel.: Hayes 3888. Cables: Emidata, London.

EMI RE321. Transistorised professional battery portable. Speed $7\frac{1}{2}$ i/s. One motor. F.R. 50-10,000 c/s. H and N −44 dB. W and F 0.25%. Level meter. Eight 1.5 V cells. Full track recording and playback. CCIR characteristics. Size $14\frac{1}{4} \times 6\frac{3}{4} \times 8$ in. Weight $17\frac{1}{2}$ lb. Price £124.

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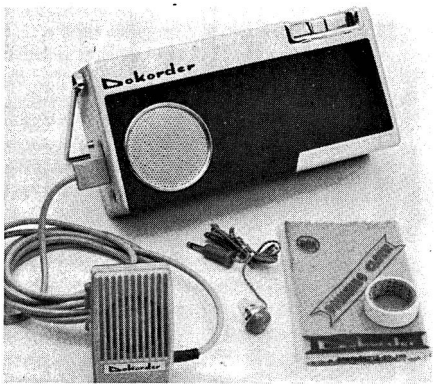
FI-CORD Ltd., 40a Dover Street, London, W.1. Tel.: Hyde Park 3448. Cables: Fi-Cord, London.

Cossor CR1620



Dokorder PT-4K

Fi-Cord 202. Portable battery/mains recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. 4 in. spools. F.R. 50-12,000 c/s ± 3 dB at $7\frac{1}{2}$ i/s; 50-8,000 c/s ± 3 dB at $3\frac{3}{4}$ i/s. W and F. $<0.3\%$ rms at $7\frac{1}{2}$ i/s; $<0.4\%$ rms at $3\frac{3}{4}$ i/s. V.U. meter. Mercury batteries. Size 9 × $6\frac{1}{2}$ × $4\frac{1}{2}$ in. Weight $6\frac{3}{4}$ lb. inc. batteries. Price inc. tape £69 6s. Mains converter £7 10s. extra.

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FONADEK (Branson) Ltd., Vivian Road, Harborne, Birmingham 17. Tel.: Harborne 2267. Cables: Fonadek.

Transicorder TR100. Battery portable recorder. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 0.3%. F.R. $3\frac{3}{4}$ i/s, 150 c/s-7 Kc/s. Replay char. CCIR. Input: mic. Outlet from pre-amp. 100 mV. One motor. $3\frac{1}{4}$ in. spools. VU meter. Controlled by microphone. Size 7 × 7 × $1\frac{1}{2}$ in. Weight 4 lb. Price £51 9s.

THE GOSHO Co. Ltd., Stone House, Bishopsgate, London, E.C.2. Tel.: Bishopsgate 5901/5. Cables: Gosho, London.

Dokorder PT-4KB. Kari-Korder. Battery operated portable transistorised recorder. Speeds $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. One motor. $3\frac{1}{4}$ in. spools. F.R. $3\frac{3}{4}$ 200-7,000 c/s; $1\frac{7}{8}$ 200-3,500 c/s. V.U. level meter. W. and F. 0.7% max. Outlet from replay head. Size $3\frac{7}{8}$ × $2\frac{1}{4}$ × $7\frac{3}{4}$ in. Weight 3 lb. Price, with telephone pickup, case, earphone, ext. lead, £51 9s.

Transicorder TR100

Belsona TRQ-370

HITACHI, Japan. Distributed by Lee Products (G.B.) Ltd., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

Belsona TRQ-370. Battery portable recorder. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. F.R. $3\frac{3}{4}$ i/s, 150 c/s-7 Kc/s; $1\frac{7}{8}$ i/s, 150 c/s-4 Kc/s. Outlet from pre-amp. One motor. $3\frac{1}{4}$ in. spools. Level meter. One knob control, remote control. Size 8 × $3\frac{3}{8}$ × 6 in. Weight 4 lb. 14 oz. Price £54 12s.

Belsona TRQ-399. Battery portable recorder. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. F.R. $3\frac{3}{4}$ i/s, 150 c/s-7 Kc/s; $1\frac{7}{8}$ i/s, 150 c/s-4 Kc/s. Outlet from pre-amp. One motor. $3\frac{1}{4}$ in. spools. Level Meter. One knob control. Remote control. Size $8\frac{13}{16}$ × $3\frac{3}{8}$ × $6\frac{1}{8}$ in. Weight $4\frac{1}{2}$ lb. Price £36 15s.

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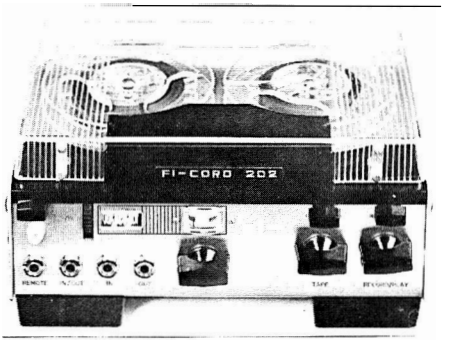
LOEWE-OPTA. Sole U.K. Distributors, Highgate Acoustics, 71/73 Great Portland Street, London, W.1. Tel.: Museum 2901.



Fi-Cord 202

Stella ST470

Optacord 412 and 414. Mains/battery portable recorders. For details see entry in previous section 'General Purpose and Domestic Tape Recorders'.

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NAGRA. Distributed by: Livingston Laboratories Ltd., 31 Camden Road, London, N.W.1. Tel.: Gulliver 4191.

Nagra IIIB. Prof. battery portable recorder. 15, 7½ and 3¾ i/s. One motor. 5 in. 15,000 c/s ±1 dB at 15 i/s; 30-12,000 c/s ±1.5 dB at 7½ i/s; 50-7,000 c/s ±3 dB at 3¾ i/s. SN −51 dB at 15 i/s; −53 dB at 7½ i/s. W. and F. 0.2% at 7½ i/s. Meter level ind. Batteries, twelve 1.5 V torch batteries, life approx. 20 hours. On alkaline accumulators, approx. 70 hours' life. Mixing on the 3 inputs. 3 heads. Monitor speaker, outlet from pre-amp. stage. Size 8¾ × 12½ × 4¼ in. Weight approx. 15½ lb. Price £339 including duty.

Nagra IIIP. Details as for IIIB, but an additional head called Pilotton capable of recording a signal of 50 or 60 c/s transversally on the tape; in effect, a second independent sound channel. This Pilotton signal is intended for use in achieving lip-sync in filming. Price £361 including duty.

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PHILIPS Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

EL3585. Battery portable recorder. ½ track. Speed 1⅞ i/s. W. and F. < 0.5%. H and N −40 dB. F.R. 120-5,500 c/s ±3 dB. Inputs: mic. 0.3 mV, 2 K; radio/gram 0.3 mV, 2 K. Outlet from pre-amp. One motor. 4 in. spools. Moving coil level meter. Size 7¾ × 11⅛ × 3⅞ in. Weight (including batteries) 8 lb. Price (with microphone and tape) £25 4s.

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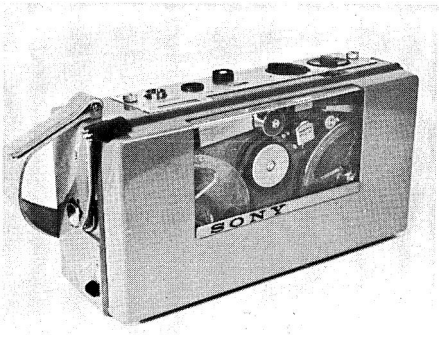
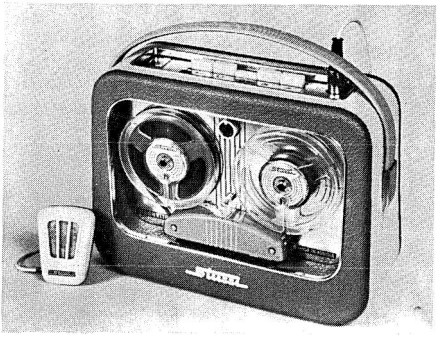
SOLARTRON Electronic Group Ltd., Victoria Road, Farnborough, Hants. Tel.: Farnborough 3000. Cables: Solartron, Farnborough, Hants.

AT300. Transistorised battery portable recorder. ½ track. Speed 7½ i/s. W. and F. ±0.16%. H and N < −59 dB. F.R. 40 c/s-14 Kc/s ±2 dB. Replay char. CCIR. Inputs: mic. 200 or 50 ohms. Output 2 K, 600 ohms. 7 in. spools (case open), 5 in. spools (case closed). VU meter. Variable or automatic volume control. Power supply: 1.5 V batteries, 30 hours' independent running time. Mains adaptor: 110, 127, 220 V. Size 12¾ × 8 × 4 in. Weight 13 lb. Price on application.



Sony 1-E.M.



Stuzzi Magnette

SONY. Distributors: Tellux Ltd., Avenue Works, Gallows Corner, Colchester Road, Romford, Essex. Tel. Ingrebourne 43971.

Sony 1-E.M. Professional Transistorised Battery Portable. $7\frac{1}{2}$ i/s. Clockwork 5 in. spools. W. and F. 1 %. F.R. 50 c/s-10 Kc/s. H and N −50 dB. Dist., 3%. Level meter also checks state of batteries. Six dry batteries. Size $13\frac{1}{4} \times 4\frac{3}{8} \times 6\frac{3}{4}$ in. Weight approx. 12 lb. Price £208 19s. complete.

Sony TC 801. Mains/battery portable recorder. For details see entry in previous section 'General Purpose and Domestic Tape Recorders'.

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STELLA Radio & Television Co. Ltd., Astra House, 121/3 Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7086.

ST470. Battery portable recorder. $\frac{1}{2}$ track. Speed $1\frac{7}{8}$ i/s. W. and F. <0.5%. H and N −40 dB. F.R. 120-5,500 c/s ±3 dB. Inputs: mic. 0.3 mV, 2 K; radio/gram 0.3 mV, 2 K. Outlet from pre-amp. One motor. 4 in. spools. Moving coil level meter. Size $11\frac{1}{2} \times 4\frac{1}{2} \times 7\frac{3}{4}$ in. Weight 8 lb. (including batteries). Price (with microphone and tape) £26 5s.

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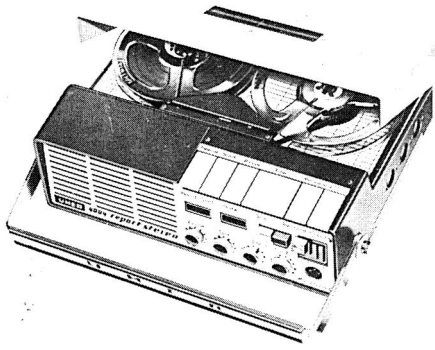
STUZZI. Sole U.K. distributors, Recording Devices, 44 Southern Row, Kensington, London, W.10. Tel.: Ladbroke 4775.

Stuzzi Magnette. Battery portable. $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. 2 motors. 4 in. spools. F.R. 40-9,000 c/s at $3\frac{3}{4}$ i/s; 80-4,500 c/s at $1\frac{7}{8}$ i/s. W. and F. 0.25% at $3\frac{3}{4}$ i/s; 0.35% at $1\frac{7}{8}$ i/s. SN, −45 dB. M.E. bar type, level ind.



Uher 4002 stereo

Outlet from pre-amp. stage. Extension speaker socket. Powered by four standard torch batteries; life, 30-100 hours depending on type of use. Battery indicators. Size $11 \times 4\frac{1}{4} \times 8$ in. Weight 8 lb. Price, with tape and mic., £61 19s.

Stuzzi Magnette Studio. Battery portable $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. 4 in. spools. F.R. 40-14,500 c/s. W. and F. 0.2%. H and N −50 dB. Magic Eye level indicator. Outlet from pre-amp. Extension speaker socket. Price £78 15s.

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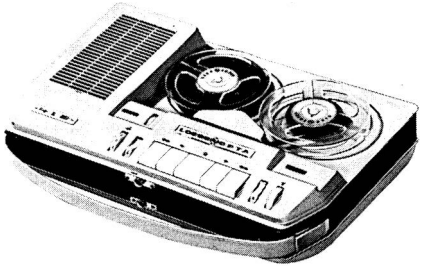
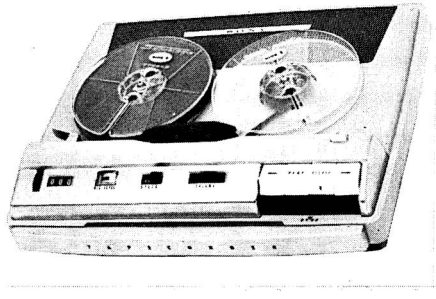
UHER. U.K. distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

4000S. Battery portable recorder. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. ±0.15 or better at $7\frac{1}{2}$ i/s. H and N < −50 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-22 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-18 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-11 Kc/s; $\frac{15}{16}$ i/s. 70 c/s-5 Kc/s. Replay char. NARTB. Inputs: mic. 0.1 mV, 1 K; radio 1 mV, 20 K;



Optacord 412



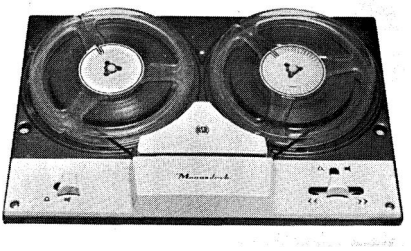
Sony TC 801

gram 50 mV, 1 Meg. Outlet from pre-amp. One motor. 5 in. spools, 2 min. rewind. VU meter. Accumulator rechargeable from car. Means of operation: mains, car battery, U2 cells. Rechargeable accumulator. Remote stop/start mic. Size $10\frac{1}{2} \times 8\frac{1}{2} \times 3\frac{1}{4}$ in. Weight approx. 7 lb. Price (including microphone and tape) £97 13s.. Mains charger accumulator £16 16s. Carrying case £9 9s.

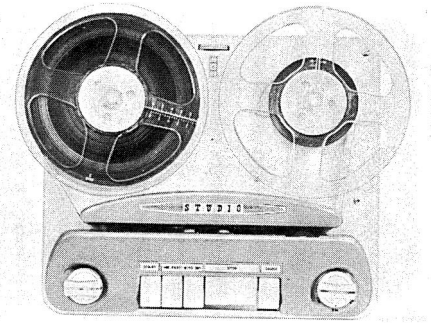
■4002. Stereo battery portable. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. $\pm 0.15\%$ at $7\frac{1}{2}$ i/s. H and N -55 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-22 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-18 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-11 Kc/s; $\frac{15}{16}$ i/s, 70 c/s-5 Kc/s. Replay char. NARTB. Inputs: mic. 0.1 mV, 1 K; radio 1 mV, 20 K; gram 50 mV, 1 Meg. Outlet from pre-amp. One motor. 5 in. spools. 2 min. rewind. Two VU meters. Pause control. Transistorised. Mixing facilities. Size $10\frac{1}{2} \times 8\frac{1}{2} \times 3\frac{3}{4}$ in. Weight 9 lb. approx. Price £115 10s. (including tape).

■4004. $\frac{1}{4}$ track version of the 4002. Details as given above. Price £115 10s. (including tape.)

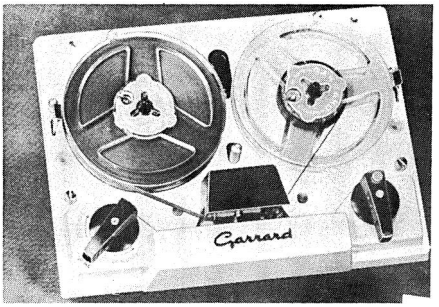
DECKS—GENERAL PURPOSE and SEMI-PROFESSIONAL



B.S.R. Monardeck TD2



Magnavox Studio



Garrard Battery deck

BSR Ltd., Monarch Works, Powke Lane, Old Hill, Staffs. Tel.: Cradley Heath 69272. Telex 33282.

BSR. Monardeck TD2. G.P. deck. $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. F.R.: with good amplifier equalisation 30-10,000 c/s ± 3 dB. 2 heads. W. and F. 0.2%. RMS. Size 13 × $8\frac{3}{4}$ in. Price £12 12s.; with 4 track head £14.

BSR TD10. G.P. deck. $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. One motor. 7 in. spools. F.R. 30 c/s-10 Kc/s ± 3 dB. Two or three heads. W & F: $7\frac{1}{2}$ i/s, 0.15%; $3\frac{3}{4}$ i/s, 0.26%; $1\frac{7}{8}$ i/s, 0.3%. Size $12\frac{1}{4} \times 8\frac{3}{8}$ ins. Price to be announced.

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BRADMATIC Ltd., 338 Aldridge Road, Streetly, Sutton Coldfield, Warwickshire. Tel.: Streetly 3171.

Bradmaster. Models 5B, 5CS, 5CD, 5D Semi-prof. tape deck. $7\frac{1}{4}$ and $3\frac{3}{4}$ i/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. F.R. $7\frac{1}{2}$ i/s, 40-15,000 c/s; $3\frac{3}{4}$ i/s, 40-7,500 c/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. Available with full track or stereophonic heads to special order. Prices on application.

Model 5DF. Semi-prof. tape deck. 15 and $7\frac{1}{2}$ i/s. 3 motors. $10\frac{1}{2}$ in. N.A.B. spools. F.R. 15 i/s, 30-18,000 c/s; $7\frac{1}{2}$ i/s, 30-15,000 c/s, both ± 2 dB. W. and F., 0.1% at 15 i/s. Variable spooling control. Size 20 × $14\frac{1}{2}$ in. Weight 20 lb. Price £62.

BRENELL Engineering Co. Ltd., 1a Doughty Street, London, W.C.1. Tel.: Holborn 7356-7-8.

Mark 5 Series 2. G.P. tape deck. 15, $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. 3 motors. $8\frac{1}{4}$ in. spools. W. and F. 0.1% at $7\frac{1}{2}$ i/s accommodates up to four heads. Size 15 × $11\frac{1}{2}$ × 5 in. Weight 16 lb. Price £32 11s.

Mark 510 Series 2. Deck mechanism. $\frac{1}{2}$ or $\frac{1}{4}$ track. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 15 i/s, <0.05%; $7\frac{1}{2}$ i/s, <0.1%; $3\frac{3}{4}$ i/s, <0.15%; $1\frac{7}{8}$ i/s, <0.25%. Three motors (synchronous type for capstan). $10\frac{1}{2}$ in. N.A.B. spools, 45 secs. per 1,200 ft. rewind. Pause. Accommodates 4 heads. Size 15 × $11\frac{1}{2}$ × 6 in. Weight 16 lb. Price (less heads) £40 19s. (with heads) price on application.

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GARRARD Engineering & Manufacturing Co. Ltd., Newcastle Street, Swindon, Wilts. Tel.: Swindon 5381. Cables: Telex 44-271.

Garrard Magazine Tape Deck. Half track. $3\frac{3}{4}$ i/s. Two motors. 4 in. spools or magazine. F.R. to 10,000 c/s. W. and F. 0.2%. No threading or spilling of tape. Size $12\frac{1}{4}$ × 8 × $3\frac{1}{4}$ in. Price £16 3s. Quarter track model £19 3s. 9d.

Garrard Battery Tape Deck. $\frac{1}{2}$ track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 0.2% at $3\frac{3}{4}$ i/s. F.R. $3\frac{3}{4}$ i/s, 40 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 40 c/s-6 Kc/s (depending upon amplifier design). One motor, 9 V D.C. 4 in. spools, 1-$1\frac{1}{2}$ min. rewind. Pause control. Garrard Magazine or separate spools, spool brakes, forward and reverse wind. Size 9 × $6\frac{5}{8}$ × $1\frac{5}{8}$ in. above and $2\frac{1}{4}$ in. below mounting. Weight 3 lb. Price (less tape or magazine) £12 5s.

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MAGNAVOX Electronics Co. Ltd., Ripple Works, Alfred's Way, By-pass Road, Barking, Essex. Tel.: Rippleway 5533. Telex, Barking 28748.

Magnavox Studio (previously Collaro). G.P. tape deck. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Three motors. 7 in. spools. F.R. 30 c/s-10 Kc/s at $7\frac{1}{2}$ i/s. Record-playback equalisation, two heads. Price £17 10s.

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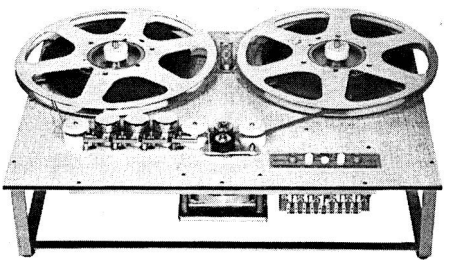
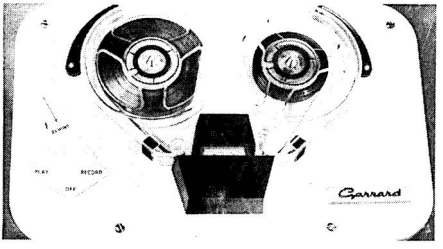
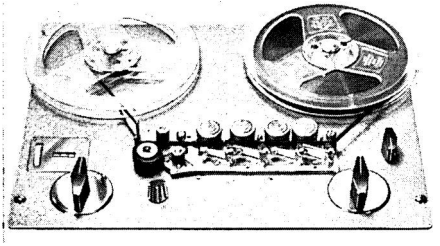
MODERN TECHNIQUES, Wedmore Street, London, N.19. Tel.: Archway 3114.



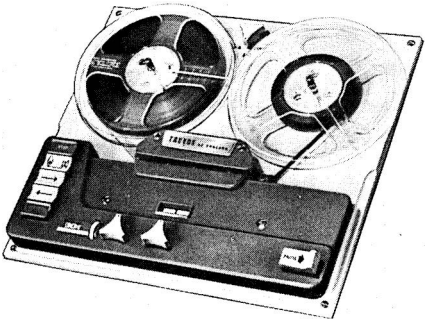
Bradmaster 5D



Garrard Magazine



Brenell Mark 5



Truvox D 82

Motek K10. G.P. tape deck. $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. 3 motors. 7 in. spools. F.R.: approx. 40-14,000 c/s at $7\frac{1}{2}$ i/s depending on amplifier used. W. and F. $<0.2\%$ at $7\frac{1}{2}$ i/s. 2 heads. High imp. record head. Size $15\frac{1}{4} \times 10\frac{3}{4}$ in. Price £22 1s.

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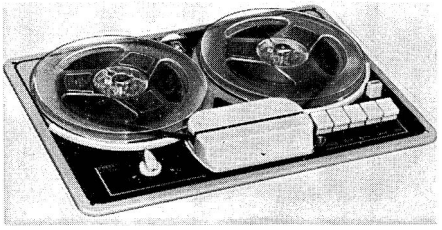
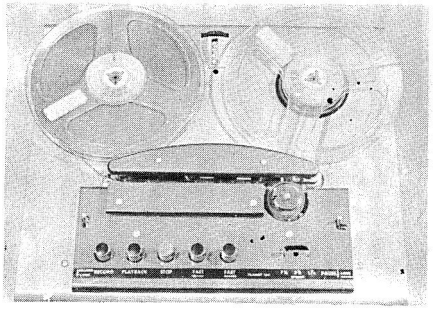
PLANET Projects Ltd., Goodman Works, Belvue Road, Northolt, Middx. Tel.: Viking 1775.

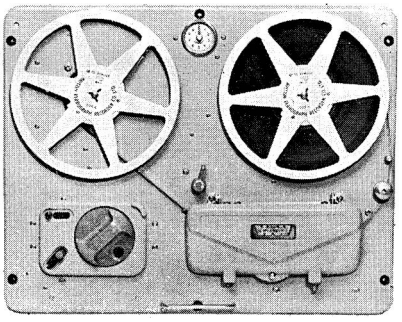
■**Planet U.1.** Stereo/mono deck mechanism. $\frac{1}{4}$ or $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0.08%; $3\frac{3}{4}$ i/s, 0.12%; $1\frac{7}{8}$ i/s, 0.18%. F.R. $7\frac{1}{2}$ i/s, 18 Kc/s; $3\frac{3}{4}$ i/s, 16 Kc/s; $1\frac{7}{8}$ i/s, 9 Kc/s. Outlet direct from three heads. One motor. 7 in. spools, 90 secs. rewind. Lockable pause control. Size 14 × 12 × 6 in. Weight $12\frac{1}{2}$ lb. Price ($\frac{1}{2}$ track mono with three heads) £39 10s., ($\frac{1}{4}$ track mono stereo with three heads) £45, ($\frac{1}{2}$ track stereo with three heads) £46.



Motek K 10



Planet U.1



Wearite Model 5A

■**Planet U.1/15.** Stereo/mono deck mechanism. $\frac{1}{4}$ or $\frac{1}{2}$ track. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. 15 i/s, 0.06%; $7\frac{1}{2}$ i/s, 0.08%; $3\frac{3}{4}$ i/s, 0.12%. F.R. 15 i/s, 20 Kc/s; $7\frac{1}{2}$ i/s, 18 Kc/s; $1\frac{7}{8}$ i/s, 16 Kc/s. Outlet from replay head. One motor. 7 in. spools, 90 sec. rewind. Lockable pause control. Size 14 × 12 × 6. Weight $12\frac{1}{2}$ lbs. Price (three head $\frac{1}{2}$ track mono) £44 10s. (three head $\frac{1}{4}$ track mono) £50, (three head $\frac{1}{2}$ track stereo) £51.

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TRUVOX Ltd., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng, London, N.W.10.

D82. Mono deck mechanism. $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0.1%; $3\frac{3}{4}$ i/s, 0.15%; $1\frac{7}{8}$ i/s, 0.25%. Three motors. 7 in. spools. 1 min. rewind. Pause. Superimpose. No-tape autostop. F.R. (with suitable amplifier) $7\frac{1}{2}$ i/s, 30 c/s-20 Kc/s; $3\frac{3}{4}$ i/s, 30 c/s- 12 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-8 Kc/s; (all ±3 dB). H and N −50 dB. W. and F. $<0.1\%$ at $7\frac{1}{2}$ i/s. Outlet from replay head. Size $14\frac{1}{4} \times 13 \times 6\frac{7}{8}$ in. Weight 15 lb. Price £26 5s.

D84. $\frac{1}{4}$ track version of D82. Price £29 8s.

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WRIGHT & WEAIRE Ltd., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 1981. Cables: Writewea, S.E.

Wearite Models 5A, 5B, 5C. Semi prof. tape deck. $3\frac{3}{4}$ and $7\frac{1}{2}$ i/s. 3 motors. $8\frac{1}{4}$ in. spools. W. and F. 0.16% at $7\frac{1}{2}$ i/s. Size $16\frac{1}{2} \times 13 \times 7$ in. Weight 18 lb. 5A standard monaural record/replay. Price £42. 5B monaural record/replay plus monitor head, price £47. 5C Industrial dual track, price £51 10s.

■**Model 5SN.** $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. Monaural record replay plus stereo replay. Price £49 7s.

TAPE UNITS

BRENELL Engineering Co. Ltd., la Doughty Street, London, W.C.1. Tel. Holborn 7356-7-8.

■**STB1.** Stereo/mono deck mechanism with pre-amplifiers. $\frac{1}{2}$ or $\frac{1}{4}$ track. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W and F 15 i/s, <0.05%; $7\frac{1}{2}$ i/s, <0.1%; $3\frac{3}{4}$ i/s, <0.15%; $1\frac{7}{8}$ i/s, <0.25%. Outlet from pre-amp. Three motors. $8\frac{1}{4}$ in. or $10\frac{1}{2}$-in. NAB spools to order. Two illuminated level meters. Twin record and replay pre-amps. Tape monitoring facilities. Price to be announced.

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CAPE ELECTROPHONICS Ltd., 43/45 Shirley High Street, Southampton. Tel. Southampton 74251.

Cape VLTA. Mono deck mechanism with pre-amplifiers. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 0.08% at $7\frac{1}{2}$ i/s. H and N −50 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-12 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-8 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-4 Kc/s. Replay char. CCIR and NARTB. Inputs: mic 30 ohms, 250 ohms. Provision for additional inputs. Outlets direct from replay head, or from pre-amp. (cathode follower). One motor. 7-in. spools. Level meter-PPM edgewise. Separate record and replay amplifiers with speed correction coupling to deck switch. Table top or cabinet fixing. Size $14\frac{1}{2}$ × $12\frac{1}{2}$ × $10\frac{1}{2}$ in. ($1\frac{1}{2}$ in. above motor board, 9 in. below). Price £85. Add-on units extra.

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GRAMDECK. U.K. distributors, Andrew Merryfield Ltd., 29/31 Wright's Lane, Kensington, London, W.8. Tel.: Western 3603. Cables: Technology, Kens, London.

Gramdeck. Head and drive mechanism for attachment to gramophone turntable. Speeds $7\frac{1}{2}$, 4.33, 3.2 and 1.6 i/s for the standard disc speeds. $5\frac{3}{4}$-in. spools. F.R. 60-10,000 c/s ±3 dB at $7\frac{1}{2}$ i/s. W and F 0.15%. Microphone to be used, Lustraphone LD61 medium impedance. Size $13\frac{1}{2}$ × 6 in. Weight approx. 2 lb. with tape. Price (including transistor pre-amplifier, tape and microphone) £9 19s. 6d.

GRUNDIG (G.B.) Ltd., Newlands Park, Sydenham, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London.

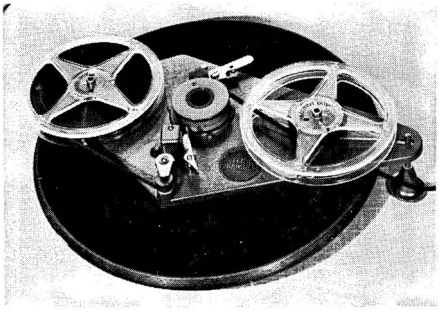
■**TM45.** Stereo/mono deck with pre-amplifiers. $\frac{1}{4}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, ±0.1%; $3\frac{3}{4}$ i/s, ±0.12%; $1\frac{7}{8}$ i/s, ±0.2%. F.R. $7\frac{1}{2}$ i/s, 60 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; char. NARTB. One motor. 7 in. spools. 2 mins. 40 secs. rewind for 1,700 ft. M.E. Pause, synchronous and multiple synchronous recording. Echo. Size $14\frac{3}{16}$ × 13 × $6\frac{1}{2}$ in. Weight $18\frac{3}{4}$ lb. Price £73 10s. (microphone extra).

Truvox PD83

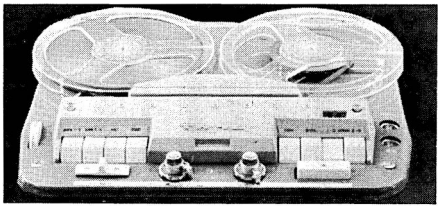
Truvox PD86 stereo

TRUVOX Ltd., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng-Norphone N.W.10.

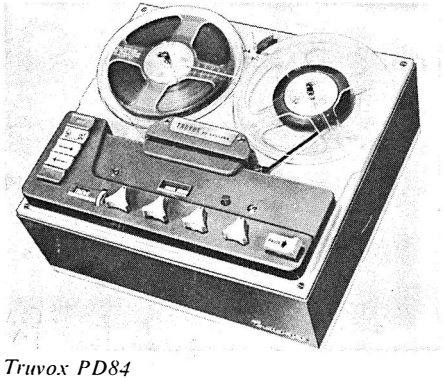
PD82. Mono tape deck and pre-amplifier. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, $<0.1\%$, $3\frac{3}{4}$ i/s, $<0.15\%$, $1\frac{7}{8}$ i/s, <0.25



Gramdeck



Grundig TM45



Truvox PD84

H and N <-50 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-20 Kc/s; $3\frac{3}{4}$ i/s, 30 c/s-12 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-8 Kc/s (all ± 3 dB). Replay char. CCIR. Inputs: 1 mV, 2 Meg; 150 mV, 500 K. Outlet from pre-amp. Three motors. 7-in. spools. 1 min. rewind. M.E. Pause. Superimpose. No-tape autostop. Size $14\frac{1}{2} \times 13\frac{1}{4} \times 7\frac{7}{8}$ in. Weight 26 lb. Price £42.

PD83. Mono tape deck and pre-amplifier. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, $<0.1\%$, $3\frac{3}{4}$ i/s, $<0.15\%$, $1\frac{7}{8}$ i/ss, $<0.25\%$. H and N -50 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-20 Kc/s; $3\frac{3}{4}$ i/s, 30 c/s-12 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-8 Kc/s (all ± 3 dB). Replay char. CCIR. Inputs: 1 mV, 2 Meg; 150 mV, 500 K. Outlet from pre-amp. Three motors. 7 in. spools, 1 min. rewind. Level meter. Pause, superimpose. No-tape autostop. Size $14\frac{1}{2} \times 15\frac{1}{4} \times 7\frac{3}{4}$ in. Weight 27 lb. Price £48 10s.

PD84. Mono tape deck and pre-amplifier. $\frac{1}{4}$-track. H and N <-45 dB. Price £46. Other details as for PD82.

PD85. Mono tape deck and pre-amplifier. $\frac{1}{4}$-track. H and N <-45 dB. Price £52 10s. Other details as for PD83.

■**PD86.** Stereo/mono tape deck and pre-amplifiers. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, $<0.1\%$; $3\frac{3}{4}$ i/s, $<0.15\%$; $1\frac{7}{8}$ i/s, $<0.25\%$. H and N <-45 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-20 Kc/s; $3\frac{3}{4}$ i/s, 30 c/s-12 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-8 Kc/s (all ± 3 dB). Replay char. CCIR. Inputs: 1 mV, 2 Meg; 150 mV, 500 K. Outlet from pre-amp. Three motors. 7-in. spools, 1 min. rewind. Level meter. Pause. Copying track to track with mixing. No-tape autostop. Size $14\frac{1}{2} \times 16\frac{1}{4} \times 7\frac{3}{4}$ in. Weight 30 lb. Price £63.

■**PD87.** Stereo/mono tape deck and pre-amplifiers. $\frac{1}{2}$-track version of PD86. Details as above.

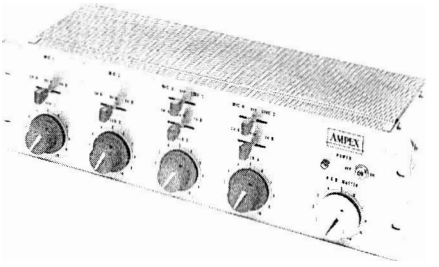
TAPE AMPLIFIERS AND MIXER UNITS

AMPEX Great Britain Ltd., 72 Berkeley Avenue, Reading, Berkshire. Tel.: Reading 55341. Cables: Videotape, Reading. Telex: 84146.

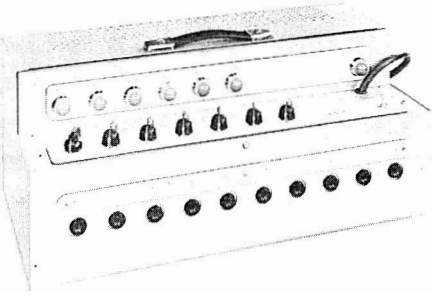
Ampex 620 Speaker/amplifier. Comprises 8 in. drive unit in special enclosure. Acoustically flat from 60 to 10,000 c/s. The built-in amplifier has 10 watts out-put. F.R. 20-20,000 c/s ±0.5 dB. Price £86.

■**Ampex MX10.** Stereo mixer unit. Inputs: 4 mic., or 2 mic. 2 line. Mic. 200 ohms, Line 100 K bridging. Gain −67 dBm mic., −27 dBm line will produce 1 V output. Up to 4 mixers may be coupled to give 12 in., 2 out channels. Output: 1 V normal, 30 V max. unbalanced. F.R. 40-1,500 c/s. Signal/noise 65 dB for inputs of −55 dBm. Controls: 4 pots, two gang master gain. Key switches, Line/Mic. A.C. line switch, mixer couple switch. Key switches, channel A, B or both. Four channels in, two out. Self-powered 105-125 V, 30 W. Size $5\frac{7}{32} \times 19 \times 5\frac{3}{16}$ in. Price £175.

■**Ampex MX35.** Identical to MX10, except in physical appearance.



Ampex MX10 stereo mixer

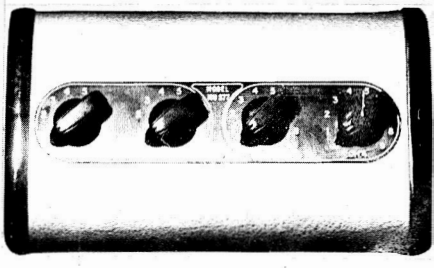


Astronic A1446 mixer

★

ASSOCIATED ELECTRONIC ENGINEERS Ltd., 10 Dálston Gardens, Stanmore, Middx. Tel.: Wordsworth 4474/5/6. Cables: Astronic, Stanmore.

Astronic A.1446. 6 channel electronic mixer unit. Designed for 5 low impedance sources each 10/30 ohms, 0.5 mV; 1 high impedance source 250 K ohms, 0.2 volts. There are four output sockets supplying 0.7 volts into 600 ohms. A master gain fader is incorporated, and each channel has an indicator lamp to show which sources have been faded up. A.C. mains required. Size 9 × 11 × $8\frac{1}{2}$ in. Price £58 10s.



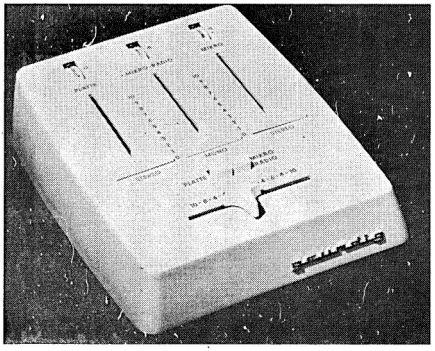
Lustraphone MU577

★

BRENELL Engineering Co. Ltd., 1a Doughty Street, London, W.C.1. Tel.: Holborn 7356-7-8.

Mk.5 Record/playback amplifier. Inputs: mic. 2 Series 2 mV, radio/gram 75 mV, both high impedance. Outputs: 200 mV at 50,000 ohms, and 4 watts into 15 ohms for direct

Binson Echorec Baby



Grundig 608 Stereo mixer

connection to loudspeaker. Headphone monitoring M.E. level ind. or meter if required. Price £26. Meter, £5 5s. extra.

Brenell Mixer Unit. 3 channel unit. High impedance sources. There are 4 sockets for jack plugs for the three inputs and the output lead, each input having a volume control. Price £2 18s.

★

DEIMOS Ltd., 8 Corwell Lane, Hillingdon, Middx. Tel.: Hayes 3561.

■**Deimos Tape Amplifier.** Stereo/mono Flexible tape amplifier system available with many alternative features to suit various decks and tape heads. Separate playback and record amplifiers. Basic input sensitivity: radio 50 mV, mic. 1 mV. Cathode follower output. Equalisation for any standard speed or playback characteristic. Level indicator optional, meter or Magic Eye. Separate power supply available. Full details and prices on request.

★

GRUNDIG (Gt. Britain) Ltd., Newlands Park, Sydenham, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London. Telex: 22054.

■**Stereo/Mono Mixer Type 608.** F.R. substantially flat, 30 c/s-20 Kc/s. Fully transistorised. Fed from two batteries type PP3 (or equivalent). Connecting sockets for two microphones (left-hand and right-hand channels), a further microphone, and connection of radio and stereo pickup. Mono/stereo output socket provided. Linear fading controls. Inputs from mono microphone or radio connected to appropriate socket can be mixed with stereo programme, and with aid of a "Directional Control" these mono inputs may be mixed with either left- or right-hand channels, or combined with both. Coarse level controls provided, and two press buttons select appropriate mono signal and feed this to directional control. Size $9\frac{1}{2} \times 8 \times 3$ ins. Weight $3\frac{3}{4}$ lbs. Price £18 18s.

★

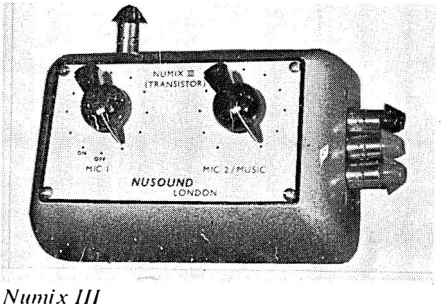
JASON Electronic Designs Ltd., Kimberley Gardens, Harringay, London, N.4. Tel.: Stamford Hill 5477.

■**JTL. Stereo tape pre-amplifier.** One input, 100 mV sensitivity. Output 0.5 volt. Equalisation for $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. M.E. level ind. Controls: function, record amplifier level, playback amplifier level, recording track, playback track, monitor, H.F. bias level, signal/bias. Simultaneous record/replay. Self-powered. Push/pull oscillator. H and N 55 dB down on 2% distortion. Suitable for any deck. To operate with Jason J2-10 amplifier. Size $15 \times 9\frac{1}{4} \times 4\frac{3}{8}$ in. Price assembled, £30 9s. Kit £22 1s.

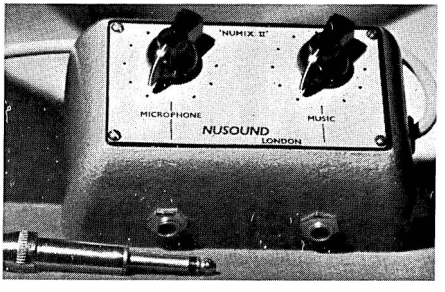
★

THE LOWTHER MANUFACTURING Co., St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

Companion Supply Unit No. 25. H.T. and L.T. power supply suitable to power radio tuners. Pre-amp and tape bias amplifier. Output 250 V at 40 mA, 6.3 V at 3 A. Price £5 5s.



Numix III



Numix II

Companion Supply Unit No. 15. H.T. and L.T. power supply suitable to power radio tuners. Pre-amp and tape bias amplifier. Output 150 V at 35 mA, 6.3 V at 2.5 A. Price £4 15s.

Companion Supply Unit No. 35. H.T. and L.T. power supply suitable to power radio tuners. Pre-amp and tape bias amplifier. Output 350 V at 35 mA, 6.3 V at 3 A. Price £5 5s.

★

LUSTRAPHONE Ltd., St. George's Works, Regent's Park Road, London, N.W.1. Tel.: Primrose 8844. Cables: Lustraphon, London.

M.U.577. Transistor mixer unit. Inputs: 1 and 2 are unbalanced and are suitable for low imp. mics. (line or high 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/s. Power by mercury cell with 1,000 hours life. Alternative input and output impedances to specification. Price, standard model, £19 19s.

A range of transistorised power amplifiers, up to 50 watts, and complete public address systems. Details on application.

★

MODERN ELECTRICS (Retail) Ltd., 120 Shaftesbury Avenue, London, W.1. Tel.: Gerrard 9692 and Temple Bar 7587. Cables: Modcharex.

Binson Echorec Mark 2. Pre-amplifier and echo unit. Enables echo to be imposed on any audio signal in a wide choice of timing. Facilities for the imposition of swell and reverberation. Three channels which can be selected as required. Completely portable. Operates from A.C. Mains supply. An exclusive design of magnetic wheel with transistorised circuitry. Price £176 8s.

Binson Echorec Baby. Single channel version of the Mark 2, for echo and swell. Price £110 5s.

Binson Echorec Mark 2

NUSOUND RECORDING Co., 35 Craven Street, London, W.C.2. Tel.: Trafalgar 2080.

Numix I. Low impedance two channel mixer. Output: high Z. Single control. For use with Ferrograph Model D, 2A, 3A, 4A. Price £4 7s. 6d.

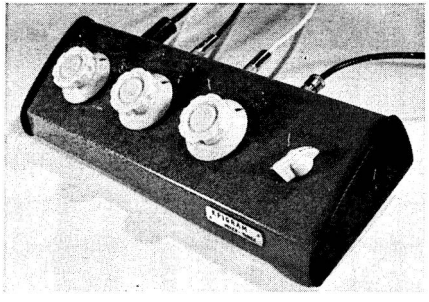
Numix II. Low or high impedance two channel mixer. Mic. and music control. For use with all tape recorders having a high impedance input microphone stage. Price £6 10s.

Numix III. Transistorised mixer. Inputs: mics. 1 and 2, 30-600 ohms, 0.2 mV; music 680 K, 140 mV. Outputs 80 mV at 25 K, terminated at phono socket. Up to 45 ft. of cable may be used. Signal/noise −51 dB referred to 0.2 mV i/p. Controls: mic. and music level controls. Three channels, 2 mic., 1 music. P.s.n. 8 V Mallory cell (TM146) or 9 V PP3 (battery may be changed by removing base plate mixer). Price (with Mallorycell) £9 6s. 6d. Set of phono to Jack adaptor leads £1 10s.

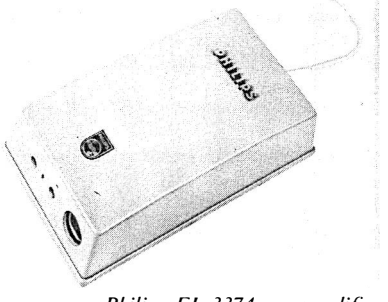
★

PENCO PRODUCTS, 36 Coniston Road, Kings Langley, Herts. Tel.: Kings Langley 3134.

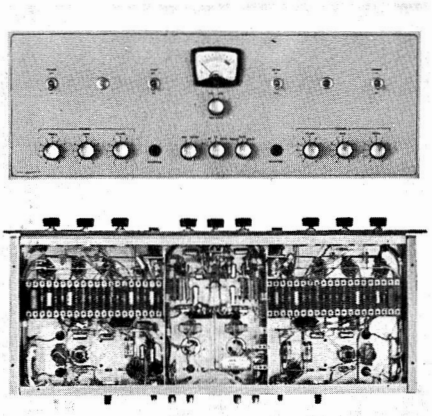
Epigram Mix/4. 3 channel unit. Incorporates 3 transistors and is designed for 2



Epigram mixer



Philips EL 3374 pre-amplifier



Shirley TWA/1515H front panel and underside

low impedance 15/30 ohms and one high impedance input. Power derived from $4\frac{1}{2}$ V battery. Output is high impedance. Rectangular case 12 × 3 × $2\frac{1}{2}$ in. Price £15 15s.

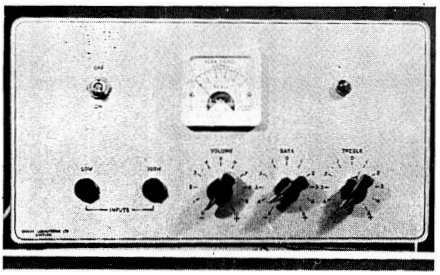
Epigram Mix/35. Details as above except that 5 transistors are included, giving extra gain, e.g. to by-pass input stage of recorder. Price £26 5s. Specials to order.

Epigram Mix/35L. As Mix 35 but fitted with low noise transistors. Price £29 8s.

★

PHILIPS Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

ET 1042/10. 4 channel mixer unit. Input impedance 50 ohms, 0.2 mV. Outputs: 50,000 ohms at 200 mV or 6,500 ohms at 10 mV. Four individual mic. input controls and master. F.R. 50-12,000 c/s with speech filter giving 6 dB cut at 60 c/s. S-N −70 dB. Self-powered, 200-250 V 50 c/s A.C. Suitable for all Philips amplifiers. Size $13\frac{1}{2}$ × 7 × $3\frac{1}{16}$ in. Price £35.



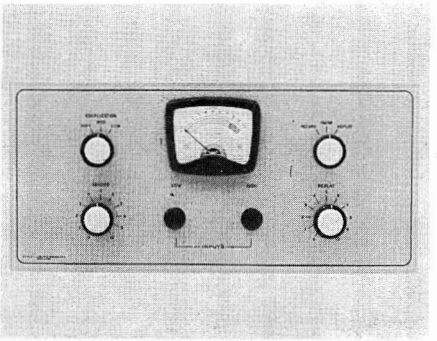
Shirley TWA/15

EL 3374. Tape pre-amplifier. Outputs 5 pin DIN socket, 1 volt across 150 K ohms; 2 pole socket, 200 mV across 1 K ohm. Response 5 pin DIN socket, 60-10,000 c/s; 2 pole socket, 60-4,500 c/s. Powered from tape recorder. Synchronised record/playback. Suitable for use with Philips EL 3541, EL 3542; Stella ST 454, ST 455; Cossor CR 1601, CR 1602. Size $6\frac{3}{8}$ × $3\frac{1}{2}$ × $1\frac{5}{8}$ in. Price £6 10s.

★

RESLOSOUND Ltd. (Derritron Group), 24 Upper Brook Street, London, W.1. Tel.: Hyde Park 2291. Cables: Derritron, Audley, London.

Reslo GE2. Transistor coupler. Designed for use between 15-50 ohm microphones with mu-metal screened balanced input transformer. Output at high impedance (nominal min. 100 ''' for microphone input of tape recorder or power amplifier. Response −1 dB at 40 c/s, +1.5 dB at 20 Kc/s. "Balanced to Earth" input transformer allows use of long lenghts of screened and twisted cable between microphone and GE2, without picking up noise or hum or degrading the quality of reproduction. Battery and screened plugs provided. Price £11.



Shirley TW/PA4

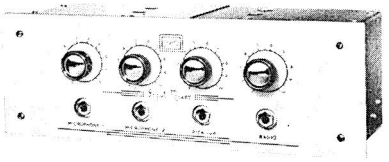
SHIRLEY LABORATORIES Ltd., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

TW/PA4. Recording amplifier for use with high quality power amplifier. Inputs: 1.5 mV and 60 mV. Bias and erase oscillator. Full corrections. Valve voltmeter modulations level ind. For use with Wearite or Ferrograph tape decks (TW/PA4U for Planet decks), can be supplied to order for any deck. Size 10 × $5\frac{1}{2}$ × $5\frac{1}{4}$ in. P.s.n. from main amp. or power pack can be supplied at £6 16s. 6d. Price £31 10s.

TWA/15. Tape amplifier for use with most tape decks, also for use with pickup or radio. Inputs for radio, gram (R.I.A.A.). mic. Output 15 watts, 20 watts peak. F.R.: as recorder 40 c/s —16 Kc/s; as reproducing and gram amp. 20-30,000 c/s. Bass and treble boost and cut. H and N 85 dB down. Valve-Voltmeter level ind. power supply on separate chassis. Price £47 5s.

■**TWA/1515H.** Complete stereo record and replay amplifier. Output 15 watts continuous, 25 watts peak on each channel. Inputs for radio, gram (78 and LP), mic. bass and treble boost and cut. Level indicated by separate sustained peak-reading valve voltmeter. 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 × 7½ × 7 in. Power unit 10 × 8 × 7½ in. Price £100 16s.

Mixer Units supplied to order. Up to 36 inputs. Prices on application.



Stern Mullard mixer

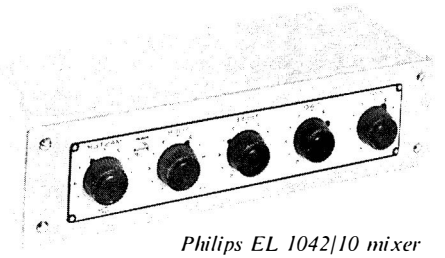
SOUND NEWS PRODUCTIONS, 10 Clifford Street, New Bond Street, London, W.1. Tel.: Regent 2745.

Unimixer 1. 3 channel unit. Channels 1 and 2 have independently controlled duplicate sockets for low or high impedance microphones 30 ohms or 400 K approx. Recommended load impedance not less than 500 K ohms. F.R. from 30 ohm input 50-10,000 c/s ±3 dB. Price £9 9s.

Unimixer 2. 3 channel unit. Inputs as above but high impedance is 5 M ohms in channels 1 and 2. Power supply needed 200/300 volts D.C. at 5 mA, 6.3 V at 0.3 amps. balanced. Special connectors available to obtain power supplies direct from Ferrograph or Vortexion recorders without any alteration. Price £15 15s.

★

STERN RADIO Ltd., 109 Fleet Street, London, E.C.4. Tel.: Fleet Street 5812-3; 23 Tottenham Court Road, London, W.1. Tel.: Museum 6128-9.

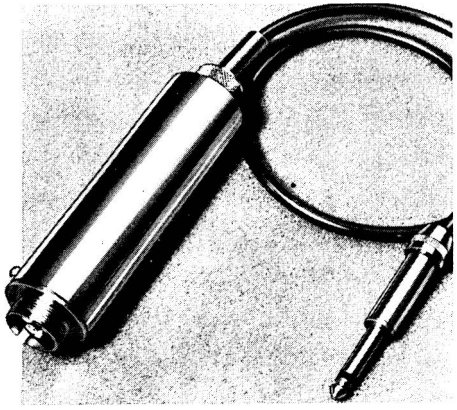


Philips EL 1042/10 mixer

HF/TR3 Mk. II. Tape amplifier. Inputs: mic. 2.5 mV, radio/pickup 300 mV. F.R. 35-17,000 c/s ±3 dB at 15 i/s. Equalisation available for 15, 7½ and 3¾ i/s or 7½, 3¾ and 1⅞ i/s. 3 watts output into 3, 7½ or 15 ohms. To Mullard design, suitable for Brenell, Collaro, Motek, Truvox and Wearite decks. Price, with separate power unit, £17. Plus £3 3s. for special matching to Wearite decks. Also available in kit form.

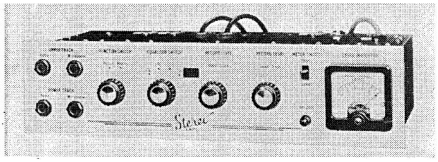
Type C Mk. II. Tape pre-amplifier. Inputs: mic. 0.5 mV, radio/pickup 250 mV. F.R. 30-17,000 c/s ±3 dB at 15 i/s. Equalisation available for 15, 7½ and 3¾ i/s or 7½, 3¾ and 1⅞ i/s. 250 mV audio output. To Mullard design, suitable for Brenell, Collaro, Motek, Truvox and Wearite decks. Price, with separate power unit, £17. Plus £3 3s. for special matching to Wearite 4A/5A decks. Also available in kit form.

Mullard 4 channel Electronic Mixer. Model 2H. Inputs: 2 × microphone. High "Z" 3 mV; radio/tape 250 mV; pickup 250 mV. Outputs: A: 40 mV; B: 100 mV; C: 250 mV; D: 500 mV. Impedance 600 ohms. Cathode follower. Individual channel controls. Response 15-20,000 c/s ±2 dB. S-N —50 dB. Self-powered. Suitable for most machines. Size 11 × 4 × 4 in. Price, assembled, £10. Kit £8 8s.



Reslo G.E.I. Transistor coupler

Model 1L. Alternative to Model 2H. Incorporates matching transformer in one microphone channel. Suitable for ribbon mics., etc. Price, assembled, £11 17s. Kit £10 5s.



Stern STP-1

STP-1. Stereo tape pre-amplifier. Inputs (each channel): radio 250 mV, impedance 500 K ohms; microphone 2 mV, impedance 2 megohms. Outputs: standard 250 mV (alternatives up to 2 volts). Response at .7½ i/s 40-16,000 ±3 dB. Equalisation for 15, .7½, 3¾ and 1⅞ i/s. 2 in. moving coil meter. Controls: function, equaliser, record level (2), meter, meter set zero. Separate track switch. H and N −55 dB. P.s.n. 290 V at 30 milli-amp; 6.3 V at 2 amps. Suitable for Brenell and Truvox (quarter-track Miniflux head) and Collaro (quarter-track Reuter head). Size 14 × 6 × 3⅜ in. Price £28. Available in kit form, price to be announced.

★

TECHNICAL SUPPLIERS Ltd., Hudson House, 63 Goldhawk Road, London, W.12. Tel.: Shepherds Bush 2581/4794. Cables: Teknica, London.

Sound Mixer Mk. 2. Three high impedance inputs, one output. Three individual controls for input levels. Three channels. Size 5 × 4 × 3 in. Weight 11¼ oz. Price £2 7s. 6d.

Stern Mullard Type C

TELE-RADIO (1943) Ltd., 189 Edgware Road, London, W.2. Tel.: Paddington 4455.

Masterlink M3. Tape pre-amplifier. Mainly for Wearite series of decks, but suitable for Collaro and Brenell. Inputs: mic. 3 mV, 1 megohm; radio/pickup 100 mV, 1 megohm. Output: approx. 200 mV. Response at .7½ i/s with Wearite deck 30-14,000 c/s. Equalisation for 15, .7½, 3¾ and 1⅞ i/s. EM84 level ind. Controls: bias, selector, indicator, equaliser, gain. Self-powered (separate power pack). Price £22 1s.

Master-Mixer. 4-channel electronic mixer, complete with power supply, in matching case and finish to Masterlink M3. Separate output control. Input sensitivity 3 mV per channel at high impedance for maximum output of 250 mV. Inputs and output connection at rear by jack sockets. F.R. 20 c/s-20 Kc/s ±2 dB. Modifications to specific requirements, also to low impedance channels available on request. Price to be announced.

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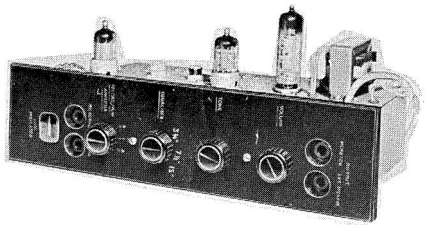
VORTEXION Ltd., 257/263 The Broadway, Wimbledon. Tel.: Liberty 6242/3. Cables: Vortexion, Wimble, London.



Stern HF/TR 3 MkII

Electronic Mixers. A variety of mixers are available: 3-channel with accuracy within 1 dB. Peak programme meter. 4-channel, 12-channel and 2 × 5 channel stereo. Tropicalised controls. Built-in screened supplies. Balanced line mic. inputs. 0.5 V or alternative 1 mW, 600 ohms balanced, unbalanced or floating outputs. A version is available which has recording erase and bias, playback and echo facilities with metering of bias and signal. Prices on application.

★

WAVERLEY ELECTRONICS Ltd., Waverley Road, Weymouth, Dorset. Tel.: Weymouth 3721.

Waverley Mixer/fader. Pocket 3 channel mixer. Jack sockets as standard. Input and output. Price £2 5s.

Waverley Monitor. Transistorised unit to provide monitoring or act as pre-amplifier. Powered by 2 torch cells. Price £5 5s.

TAPE ACCESSORIES and COMPONENTS

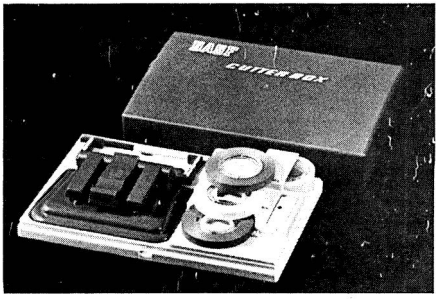
AGFA Ltd., 27 Regent Street, London, S.W.1. Tel.: Regent 8581.

Tape Accessory Kit. Plastic case containing red, green and white leader tape, adhesive splicing tape, silver stop foil, non-magnetic scissors, tape clips and splicing template. Price £1 14s. 6d.

★

AKG (Akustische und Kino-Gerate Ges. m.b.H.). Sole U.K. and Commonwealth agents, Politechna (London) Ltd., 3 Percy Street, London, W.1. Tel.: Langham 6326. Cables: Polindust, London.

A.K.G. K50. Dynamic headphones. F.R. 20-25,000 c/s. Impedance 400 ohms per ear piece. Suitable for stereo or mono. Weight 80 grams. Price £7 10s. Ear pads available.



BASF Tape Editing Kit

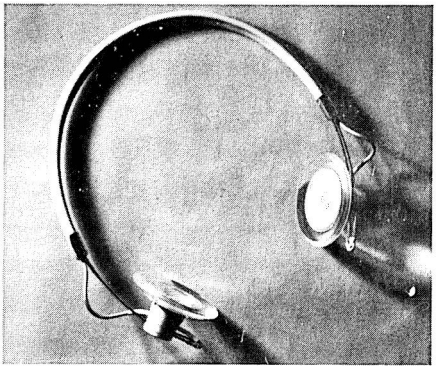
BASF Chemicals Ltd., 5a Gillespie Road, London, N.5. Tel.: Canonbury 2011.

Cutter Box. Contains automatic splicer, spare knife, 4 tape clips, stop foils, splicing tape, 3 leader tapes, spool labels. Price £2 12s. 6d.

★

BRADMATIC Ltd., 338 Aldridge Road, Streetly, Sutton Coldfield, Warwickshire. Tel.: Streetly 3171.

A range of twin track high impedance sound heads, single hold fixing, pole pieces are cylindrically ground flush with caps. Screening cans available.



A.K.G. K50 headphones

Type 5 RP. Combined record/replay head 0.0004 in. gap. Price £3 5s.

Type 6 RP. Super fidelity record/replay head 0.0002 in. gap. Price £3 15s.

Type 5R. Record only 0.0007 in. gap. Price £3 5s.

Type D5E. Erase head. Price £3 5s.

Full track versions of the above are also available.

Type ST-RP. Stereo record/replay head. Price with screen can, without fixing stem, £6.

★

A. BROWN & Sons Ltd., 24-28 George Street, Hull.

Tape Recorder Covers. For all popular makes. Prices range from £1 15s. to £4 10s.

A. Brown recorder cover

S.G. Brown Super K headphones

S. G. BROWN Limited, Communications Division, King George's Avenue, Watford, Herts. Tel.: Watford 23301.

A range of headphones suitable for recording and dictating equipment, e.g. lightweight miniature model. Price from £3 5s.

Super "K". Moving coil headphones. Available as monaural or binaural. Price £6 10s.

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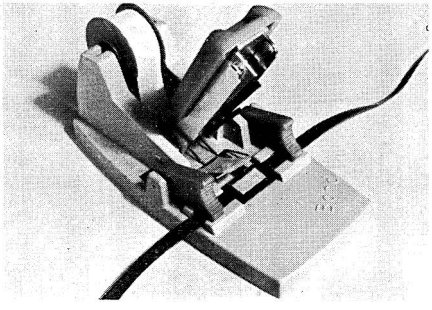
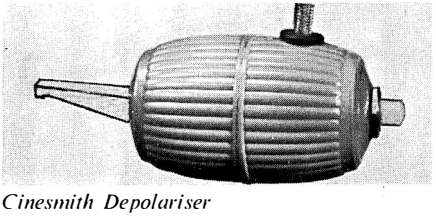


Bond Tape Splicer

CINE ACCESSORIES (Brighton) Ltd., 15 Bond Street, Brighton, Sussex. Tel.: 27674.

Bond Tape Splicer. Semi-automatic; self-contained tape dispenser. Price £1 9s. 6d.

★

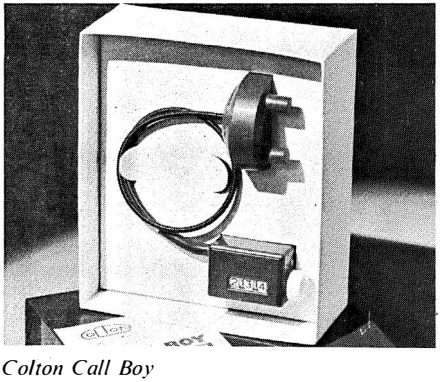


Cinesmith Depolariser

CINESMITH Products, Britannic Works, Regent Street, Barnsley, Yorks. Tel.: Barnsley 4445.

Cinesmith Depolariser. A special tool for demagnetising the record/playback heads of any tape recorder. Comprises a plastic moulding with operative switch at one end and demagnetising polepiece at the other, so designed that recording heads can be demagnetised *in situ* without any dismantling. Price £2 5s.

★



Colton Call Boy

COLTON & Co. (Lapidaries) Ltd., The Crescent, Wimbledon, London, S.W.19. Tel.: Wimbledon 9401.

Call Boy. Counter-type position indicator, incorporating three-figure counter and reset wheel. Provides accurate cueing for tape recorders with no counter device. Fitted by means of a suction pad. Drive taken direct from spool, obviating slip and ensuring accuracy. Coupling device, used to connect the counter with the spool, can be placed into position, or removed, swiftly and without disturbing tape. Available in two spool fitting. Price £2 2s.

★

ELIZABETHAN (Tape Recorders) Ltd., Bridge Close, Oldchurch Road, Romford, Essex. Tel.: Romford 64101.

Elizabethan Stethoset Headphones. Lightweight, high impedance. Price £1 1s.

Elizabethan Direct Recording Lead. 3 yards of low loss screen cable fitted with British Standard jack plug coaxial plug. Price 12s. 6d.

Telephone adaptor. Price £1 1s.

★

E.M.I. TAPE Ltd., Blyth Road, Hayes, Middx. Tel.: Hayes 3888. Cables: Emitape, London.

Emiguide AP128. Set of 6 instructional tapes, giving practical guidance in tape recording. Price £2 11s. Available separately, 8s. 6s. each.

Emitape Jointing Compound. AP35 for C.A. base tape. AP77 for PVC 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.

Emitape P.V.C. Leader Tapes. A range of six coloured tapes to enable colour code references to be inserted in a reel of recorded tape for quick editing and indexing purposes. Packed in plastic dispensers. 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 Spools in cartons. AP93 (3 in.) 3s.; AP93N ($3\frac{3}{4}$ in.) 3s.; AP121 (4 in.) 3s. 8d.; AP85 (5 in.) 4s. 6d.; AP89 ($5\frac{3}{4}$ in.) 4s. 6d.; AP87 (7 in.) 5s.

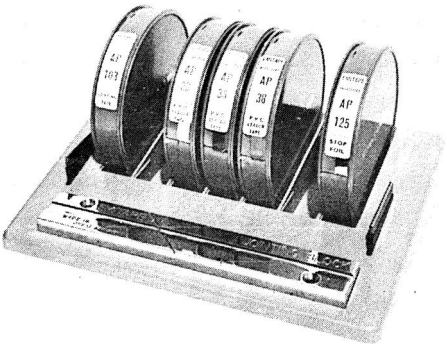
AP118 ($8\frac{1}{4}$ in. metal spool) 12s. 6d.

Emitape Jointing Block AP123. The undercut channel holds the tape securely enabling a clean cut at 45° or 90°. Price 10s. 6d.

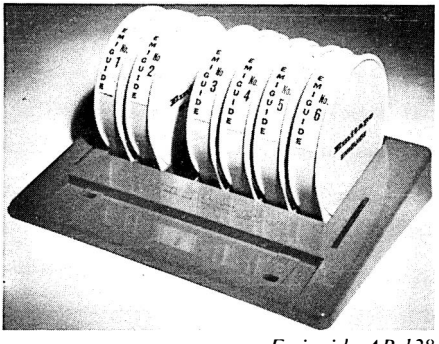
Emitape Non-magnetic Scissors. AP39. Made of non-ferrous metal, the scissors may be used for splicing magnetic tape without risk of magnetising, so ensuring a completely noiseless joint. Price 16s.

Emitape Accessory Kit AP124. Holds three reels of coloured leader tape, 1 reel of jointing, 1 reel of stop foil, 1 Emitape jointing block, 2 cutters. Packed in plastic rack (to hold 7 spools), designed for the workbench. Price £1 17s. 6d.

Emitape Metallic Stop Foil. AP125. Sufficient for 50 tapes. In plastic container. Price 6s. 6d.

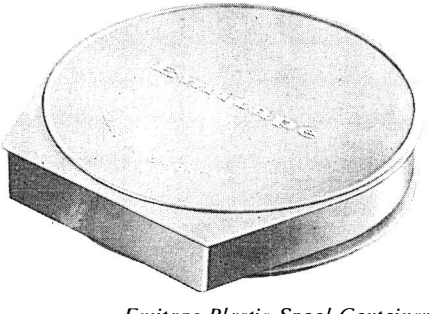


Emitape Accessory Kit AP124

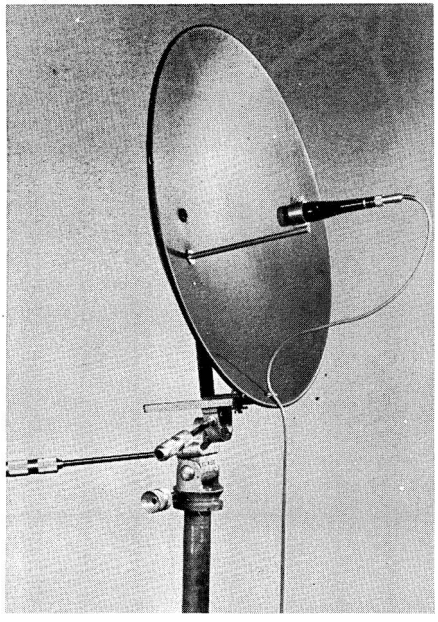


Emiguide AP 128

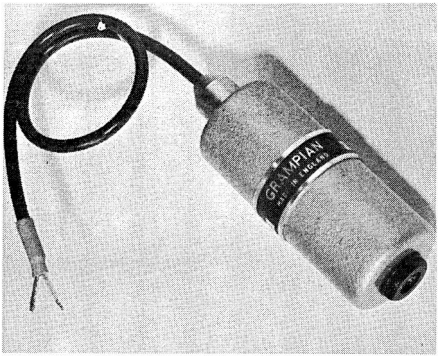
Emitape jointing compound AP77



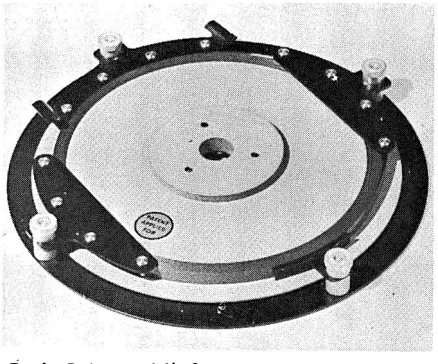
Emitape Plastic Spool Container



Grampian Parabolic reflector



Grampian G.7 matching unit



Guy's Brittape Mk 2

FILM INDUSTRIES Ltd., 90 Belsize Lane, Hampstead, London, N.W.3. Tel.: Hampstead 9632. Cables: Troosound, London.

Microphone Stands. Desk, table and floor stands. Grey Hammer finish with cast iron bases, stems in satin chrome. Price from £1 5s.

Matching Transformer. Enclosed in Mumetal screening case for fitting into microphone lead. Impedance ratio: 30 ohms to 60 K ohms. Price £3 5s.

Microphone Switch Assembly. To be used in conjunction with Type M7, M8 microphones. Price on application.

★

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

Grampian G.7. Matching units, consisting of double wound transformer in a Mumetal case with jack socket on the primary and a screened lead on the secondary. Dimensions $3\frac{5}{8} \times 1\frac{1}{4}$ in. diameter. Versions available for matching 15/30 ohms, 600 ohms and 50,000 ohms or greater. Price £3 5s.

Grampian Parabolic Reflector. Diameter 24 in., depth 5 in. Gain 14 dB over range of 500 c/s to 5,000 c/s. To take Grampian DP4 Microphone. Weight $4\frac{3}{4}$ lb. Price £6.

★

GUY'S CALCULATING MACHINES Ltd. (General Engineering Division), Truro Road, Wood Green, London, N.22. Tel.: Bowes Park 2258. Cables: Guycalc, London.

Brittape Mk. 2. Endless tape cassette providing up to 200 ft. of continuous tape, using long-play tape and up to 400 ft., using special lubricated double-play tape. Fits all flat topped 7 in. spool tape recorders. Price £6 6s.

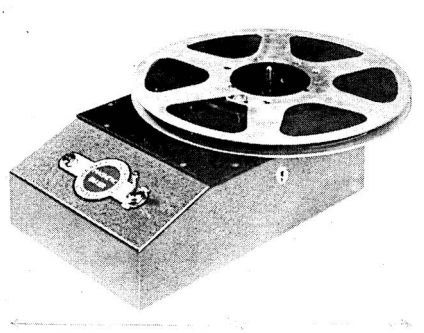
★

GRUNDIG (G.B.) Ltd., 40 Newlands Park, Sydenham, London, S.E.26. Tel. Sydenham 2211.

Sona Dia. Designed to synchronise a tape recorder with automatic slide change projector. Recording sense: lower $\frac{1}{4}$-track. Power consumption 3 W. Control Pulse Frequency 100 c/s. Price £15 15s.

HARVEY ELECTRONICS Ltd., 273 Farnborough Road, Farnborough, Hants. Tel.: Farnborough 1120. Cables: Harvelec, Farnborough, Hants.

A range of bulk erasers for 200-250 V or 100-130 V mains, 40-60 c/s. Smallest model will take $3\frac{1}{4}$ to 5 in. spools of $\frac{1}{4}$ in. tape, and the largest $3\frac{1}{4}$ to 12 in. spools of 1 in. tape. Prices, from £6 5s. to £15 10s.

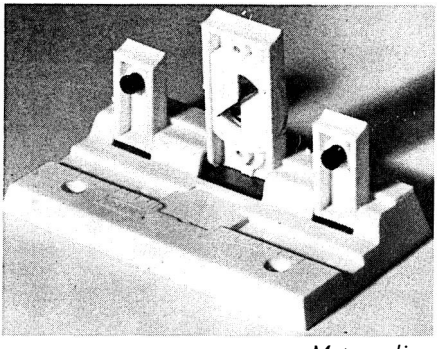


Harvey bulk eraser

★

LEEVERS-RICH Equipment Ltd., 319b Trinity Road, Wandsworth, London, S.W.18. Tel.: Vandyke 9054/6. Cables: Leemag, London, S.W.18.

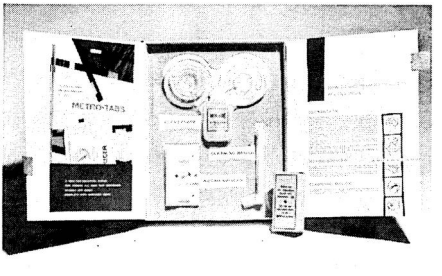
LeeRaser. Junior ER30A; Standard ER31B; Senior ER32B. Ultra rapid demagnetisers for spools of tape and accessories. Price £7 5s.; £9 15s.; £15.



Metro-splicer

★

METRO-SOUND Manufacturing Co. Ltd., 19a Buckingham Road, London, N.1. Tel.: Clissold 8506/7. Cables: Metrosound, London.



Metro Tape Kit

Klenzatape. Cleaning outfit for removing oxide deposits, dirt, etc., from tape heads in situ. Comprises a length of brushed velvet rubber-backed cleaning tape, two 3 in. spools and a bottle of cleaning fluid. Price 12s. 6d.

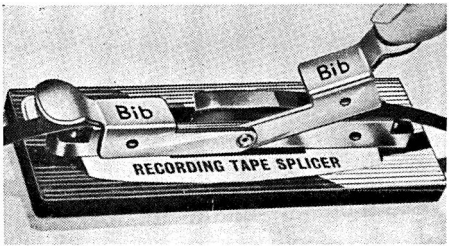
Metro-Tabs. Set of coloured identifying tabs for affixing to recording tape. Visible on the wound spool and may be catalogued on the folder supplied. Price 3s. 11d.

Metro-Brush. Made with specially angled Feathersoft Nylon for cleaning inaccessible places on tape decks, ciné cameras, projectors, etc. Price 2s. 6d.

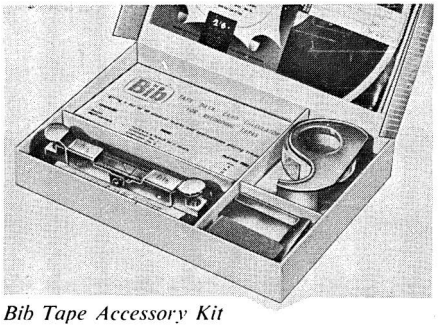
Metro-Splicer. Suitable for splicing tape and 8 mm. ciné film. Cuts at any angle. Non-magnetic blade. Price 15s.

Metro Klenzatape

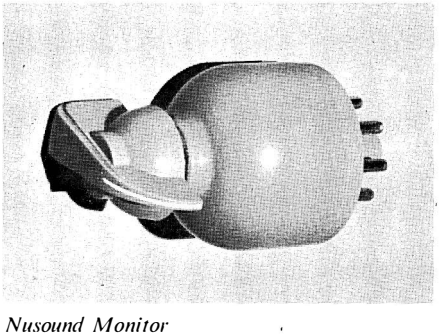
Scotch Accessory Kit



Bib Tape Splicer



Bib Tape Accessory Kit



Nusound Monitor

Metro-Stop. Auto-stop actuator fluid. Should be applied to tape to actuate the auto-stop mechanism of the tape recorder. Special removing fluid is also supplied and the kit includes rod applicator for both Metro-Stop and remover. Price per set 17s. 6d.

★

MINNESOTA MINING and Manufacturing Company, 3M House, Wigmore Street, London, W.1. Tel.: Hunter 5522. Cables: Minnesota, London.

Tape Calculator. Giving playing times of standard, long play and double play tape. Free on request.

Scotch Accessory Kit. Contains Splicer, roll of No. 41 Splicing tape on dispenser, roll of No. 24 White Leader and Timing tape, cutter, 10 magnetic tape fastening clips. Price £1 9s. 6d. Available separately: Tape clips. Price (per packet of 10) 2s. 6d. No. 24 Leader and Timing Tape. Price ($\frac{1}{4}$ in. × 100 ft.) 6s. No. 41 Splicing Tape ($\frac{1}{2}$ in. × 150 in.) 3s., ($\frac{7}{32}$ in. × 66 ft.) 3s. 6d., ($\frac{1}{2}$ in. × 66 ft.) 6s. 6d. No. 51 Sensing Tape. Price ($\frac{7}{32}$ in. × 150 in.) 14s.

★

MULTICORE SOLDERS Ltd., Multicore Works, Hemel Hempstead, Herts. Tel.: Boxmoor 3636.

The "Bib" Tape Splicer. This splicer enables the tape to be joined 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.

The "Bib" Tape Accessory Kit contains "Bib" tape splicer. Tape reel labels, data card giving tape speeds. Splicing tape and spare cutters. Price £1 8s. 6d.

"Bib" Tape Labels. Suitable for marking tape reels and boxes. Price 2s. 6d.

★

NUSOUND Recording Co., 35 Craven Street, London, W.C.2. Tel.: Trafalgar 2080.

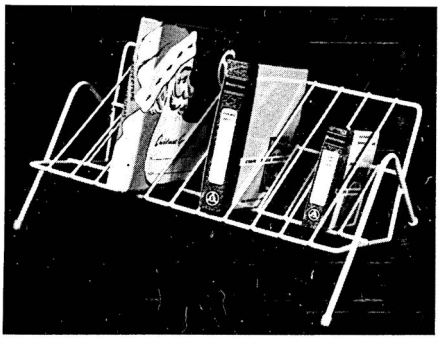
Nusound Monitor. Designed for use with Ferrograph recorders Model D, 2A, 3A, 4A and Series 4. Allows monitoring of the input signal through the internal loudspeaker. Price, black £1 1s., grey £1 5s.

★

M.S.S. RECORDING Co. Ltd., Colnbrook, Bucks. Tel.: Colnbrook 2431 (8 lines). Cables: Emessco.

Tape Calculator. Four speed Tape Calculator giving playing times at a glance. Price 2s. 6d.

M.S.S. Tape-Rack. Plastic covered steel rack designed to hold 12 reels of tape, reel sizes from 3 to 7 inches dia. Price 12s. 6d.

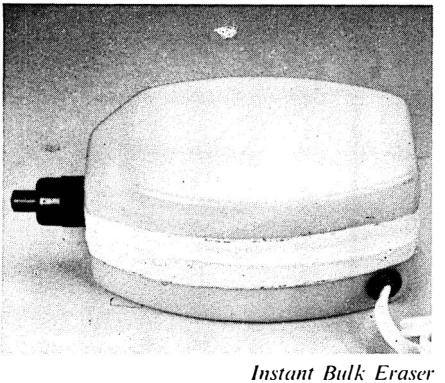


M.S.S. Tape-Rack

★

OSMABET Ltd., 46 Kenilworth Road, Edgware, Middlesex. Tel.: Stonegrove 9314.

"Instant" Bulk Eraser. Operates from A.C. mains to provide rapid and complete erase of tapes prior to making quality recordings. Price £1 15s.



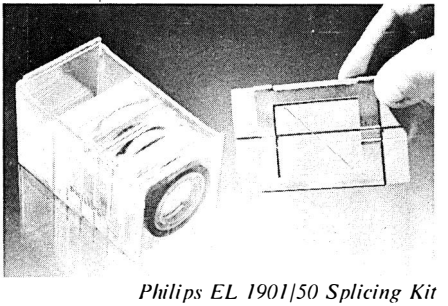
Instant Bulk Eraser

★

PHILIPS Electrical Ltd., Century House, Shaftesbury Avenue, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

Continuous Tape Cassette. Containing approximately 200 ft. of tape. Allowing continuous playback. Price £5.

EL1901/50. Complete tape splicing kit in transparent container. Includes tape splicing jig, four reels of coloured leader tape, 1 reel of metal switch foil, 1 reel of jointing tape, cutting blade and adhesive title labels. Price £1 3s.

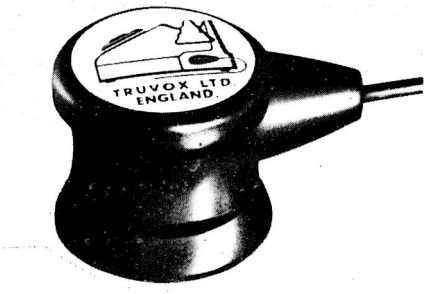


Philips EL 1901/50 Splicing Kit

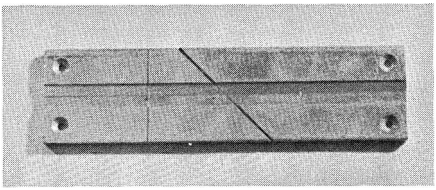
★

ROMAGNA REPRODUCERS Ltd., Distributor: S. Kelly, Romagna, Bycullah Avenue, Enfield, Middx.

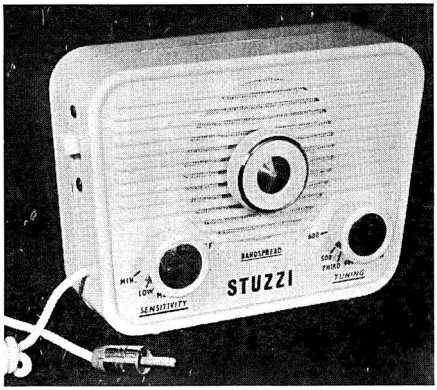
Romagna Editing Block. Accurately machined from aluminium and designed to



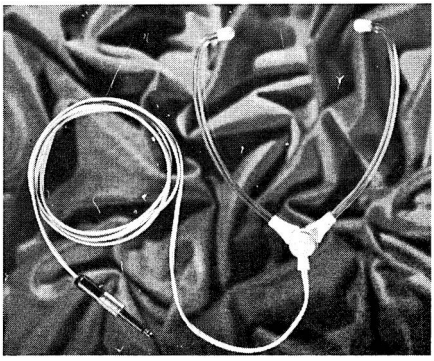
Truvox Telephone Unit TA 2



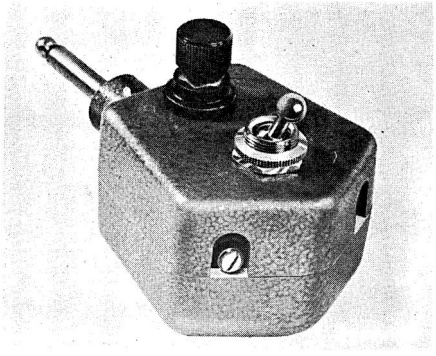
Romagna Editing Block



Stuzzi Tape Tuner



Sound Stethoset



Truvox Radio Jack TA 3

grip the edges of the tape. Diagonal or vertical cuts using razor blade. Price 7s. 6d.

★

STUZZI. Recording Devices Ltd. Distributors: 44 Southern Row, Kensington, London, W.10. Tel.: Ladbroke 4775.

Stuzzi Tape Tuner. A.M. tuner variable tuning F.R. 190-550 m and 1,500 m preset. Powered by one PP3 battery. Printed circuit construction. Size $5\frac{3}{4} \times 4\frac{1}{4} \times 1\frac{7}{8}$ in. Price £4 1s. 10d. (U.K. purchase tax 13s. 2d.).

★

SYMPHONY AMPLIFIERS Ltd., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314.

Model A Tape Timer Unit. Contains special electric Time Unit with normal 12 hour dial. Neon Indicator. Fitted to take 13 amp or 15 amp socket for mains output on the back of the cabinet. Mains input is by flying lead. Price £10 10s.

Model B. Similar to Model A, but in place of the neon indicator there is a special Process Timer with readings in one minute divisions up to 25 minutes. Price £15 15s.

★

TAPE HEADS Ltd., High Street, Wollaston, Stourbridge, Worcs. Tel.: Stourbridge 6021. Cables: Electronics, Stourbridge. Registered office: Monarch Works, Powke Lane, Old Hill, Staffs.

Simplex Tape Record Sound Heads. Complete range of half-track and quarter-track tape record heads. Details and prices on application.

★

TAPE RECORDERS (Electronic) Ltd., 784/788 High Road, Tottenham, London, N.17. Tel.: Tottenham 0811. Cables: Taperec.

Sound Stethoset. Lightweight headphones. Impedance 50 ohms. Weight $1\frac{3}{4}$ oz. Price complete with lead and screened plug £2 10s.

★

TELEFUNKEN. Sole U.K. distributors, Welmec Corporation Ltd., 147/148 Strand, London, W.C.2. Tel.: Temple Bar 3357. Cables: Welmcor, London.

Endless tape cassette. Price £2 10s.

★

TRUVOX Ltd., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng, London.

Telephone attachment TA 2, for recording 2-way telephone conversations. Price £1 1s.

Stethoset TA 2000, for use with any recorder with low imp. output socket. Price £3 3s.

Radio Jack TA 3. Price Standard (M.W. only) £2 10s. (U.K. purchase tax 9s. 2d.).

★

UHER. Distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

631 Midget Magnetic Earphones. Price £3 3s.

646 Stereo Midget Magnetic Earphones. Price £7 10s.

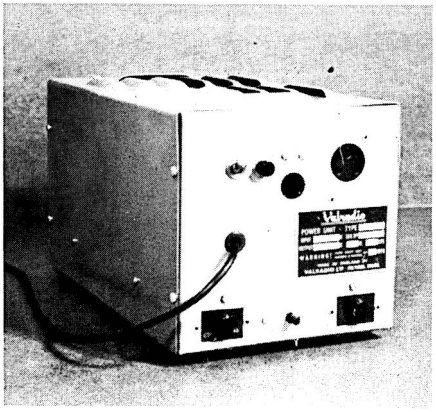
★

VALRADIO Ltd., Browells Lane, Feltham, Middlesex. Tel.: Feltham 4837.

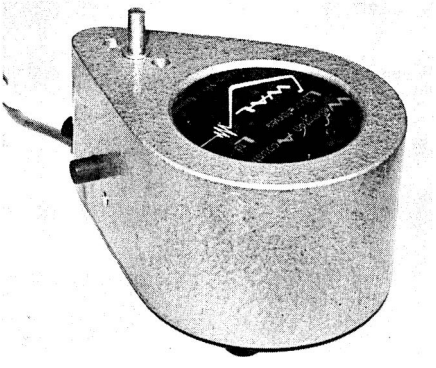
D.C. Converter for operating mains machines from low voltage or D.C. supply. Prices from £6 10s.

★

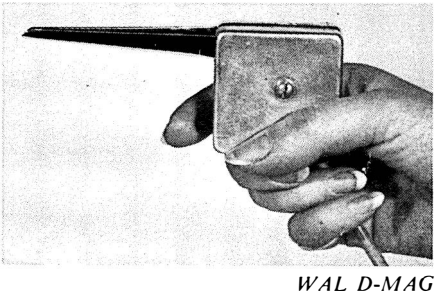
WAVERLEY Electronics Ltd., Waverley Road, Weymouth, Dorset. Tel.: Weymouth 3721.



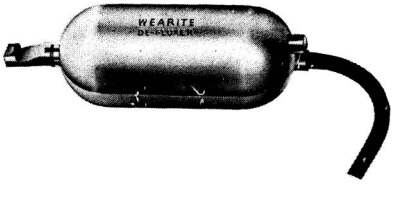
Valradio Converter



WAL Tape Eraser



WAL D-MAG



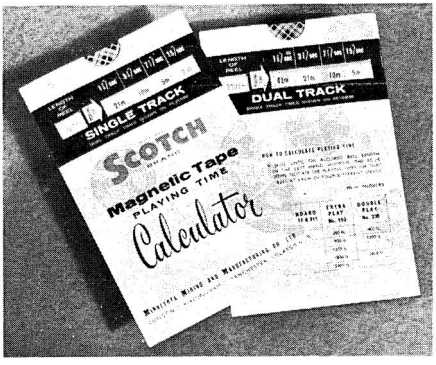
Wearite Defluxer

Telecon pickup. For placing behind telephone (no actual connection) when telephone conversations are to be recorded or amplified. Price £1 7s. 6d.

★

WELLINGTON Acoustic Laboratories Ltd., 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 200-250 V, 50 c/s or 110-125 V, 60 c/s. Price £7 18s. 6d.



Scotch Tape Calculator

WAL D-MAG. A mains operated head demagnetiser providing complete degaussing circuit. Suitable for erasing short passages from tape or striped film. Price £2 10s.

★

WRIGHT & WEAIRE Ltd., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 1981. Cables: Writewea, S.E.

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 attentuation of the higher frequencies. Price £2 10s.

M.S.S. Tape Calculator

DIRECTORY OF CONSTRUCTIONAL KITS

AVELEY ELECTRIC Ltd., Ayron Road, Aveley Industrial Estate, South Ockendon, Essex. Tel.: South Ockendon 3444. Cables: Telex 24120 Avel, Ockendon.

F.M. Dynatuner FM-1. (See tuner section.) Price, kit £38 12s. (U.K. Purchase Tax. Price £7 4s. 9d.)

Daystrom. See Heathkit.

★

HEATHKIT. Manufactured by Daystrom Ltd., Bristol Road, Gloucester.

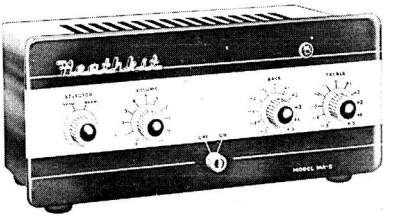
■S-99. Stereo amplifier kit. Output 9 Watts, 3 or 15 ohms, per channel. Distortion 0.2% at 1 Kc/s, 0.35% at 4 Kc/s, 0.42% at 40 c/s. F.R. 30 c/s-20 Kc/s ±0.5 dB. Feedback 26 dB. H and N: pickup 1 (magnetic) −55 dB; pickup 2 (crystal) −55 dB; Aux. (microphone, etc.) −60 dB; radio, tape −65 dB. Inputs: pickup 1, 4 mV, 100 K continuously variable; pickup 2, 180 mV, 47 K continuously variable; Aux, 20 mV, 500 K linear; radio, tape 100 mV, 350 K linear. P.s.n. 100-125, 200-210, 220-230, 240-250 V, 50-60 c/s. 100 W. Printed circuit boards for easy assembly. High sensitivity to suit all types of pickups. Variable filter. Price £27 19s. 6d.

■S-33. Stereo amplifier kit. 3 watts per channel. Distortion 0.3%. Input 100 mV at 1 megohm. Bass, treble, balance, volume. Price (kit) £13 7s. 6d.

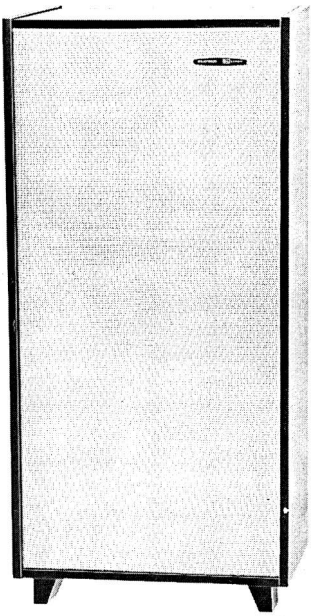
■S-33H. Stereo/mono amplifier. Output 3.5 watts. Distortion, less than 0.6% at 1000 c/s for 3 watts. H and N: gram −55 dB, radio −60 dB (referred to 3 watts). Sensitivity: gram 50 mV (high imp), aux. 150 mV, radio 100 mV. P.s.n. 100-125, 200-210, 220-230, 240-250 V A.C. 40-60 c/s. Size $11\frac{3}{4} \times 5\frac{1}{4} \times 10$ in. Based on Model S-33, but an extra stage is incorporated to increase the sensitivity required for the new high quality Ceramic pickups. Choice of three inputs provided, and close matched twin ganged potentiometers used for volume and tone controls. Price (kit) £15 17s. 6d.

MA-5. Monaural amplifier. Output 5 watts. Distortion less than 0.5% at 1000 c/s; less than 1% at 5 Kc/s. Sensitivity: radio 200 mV, 0.5 Meg; gram 200 mV, 0.5 Meg. Rec. impedance 2-4 and 14-16 ohms.

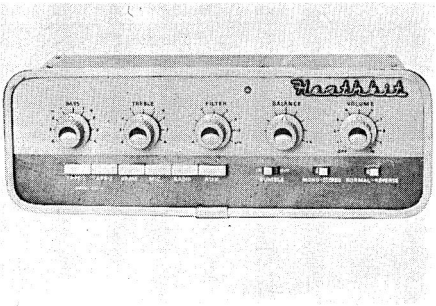
Heathkit S-99 stereo amplifier



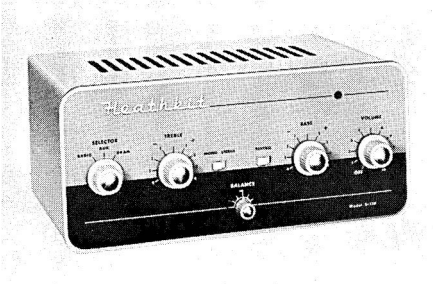
Heathkit MA-5 monaural amplifier



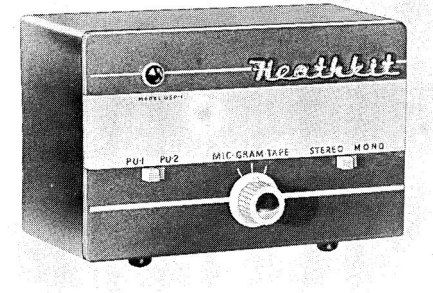
Heathkit Cotswold MFS



Heathkit USC-1 stereo control unit,



Heathkit S-33H stereo amplifier



Heathkit USP-1 booster amplifier

Heathkit MGP-1 power unit

H and N less than −60 dB referred to 5 watts. Output stages: ECC83, EZ81, 2 × EL84. P.s.n. 100-110, 200-210, 220-230, 240-250 V A.C. 40-60 c/s. Size 11 × $6\frac{5}{8}$ × $4\frac{3}{4}$ in. Panel $11\frac{3}{4}$ × $5\frac{1}{4}$ in. Suitable for most crystal pick-ups. Provision for connection of radio tuner or tape recorder. Price £10 19s. 6d.

MA-12. Mono amplifier. Output 10 W rms (12 W max.) between 30 c/s and 10 Kc/s. Distortion: less than 0.1% at 10 W, 1 Kc/s; less than 0.2% at 10 W, 5 Kc/s; less than 0.4% at 10 W, 40 c/s. F.R. 20 c/s-30 Kc/s ±1 dB. Feedback main loop 26 dB, subsidiary loop 6 dB. H & N −85 dB at 10 W. Input 120 mV for 10 W output. Output imp. 2-4, 8-11, 14-16 ohms. Valves, EF86, ECC83, EL84 (2), GZ34. P.s.n. 100-117 V, 200-250 V AC, 40-60 c/s, 100 W. Size $11\frac{1}{8}$ × $6\frac{3}{4}$ × $5\frac{3}{4}$ ins. Weight $12\frac{1}{2}$ lbs. Price £11 9s. 6d.

■**USC-1.** Stereo pre-amplifier. Inputs: pickup 1, 3-4 mV 50 K; pickup 2, 150 mV 1 megohm; tape 1, 2.5 mV 80 K CCIR, tape 2, 150 mV 100 K; radio 150 mV; mic. 3 mV, 1 megohm; aux., 4-150 mV, 1 megohm. Controls: bass, treble, rumble filter, variable low pass filter, balance, volume, function, channel reverse. Power required, 250 V 10 mA, 6.3 V 1.5 amps. Output voltage 1.3 V R.M.S. Price £19 10s.

MC-1. Mono control unit. Inputs: mag pu. 9 mV, 100 K, RIAA; crystal pu. 50 mV variable, 1 Meg linear; Aux. 120 mV, 500 K linear; mic 4 mV, 130 K linear; radio 100 mV variable, 330 K linear. Output up to 0.25 V. Controls: sel., bass, treble, filter, volume on/off. Low pass filter. H & N −65 dB. P.s.n. 180-300 V, 3 mA DC, 6.3 V, 0.6 A AC. Suitable for free standing or cabinet installation. Price on request.

USP-1. Booster amplifier. Suitable for stereo and monaural sources of low sensitivity, e.g. pickups, tape heads or microphones. Input sensitivity 2-20 mV. Output adjustable from 20 mV to 2 V. Maximum gain 100. Power requirements 180-250 V, 3-5 mA; 6.3 V 0.5 amps. Price £7 7s. 6d.

SSU-1. Speaker system kit. Comprises 8 in. and 4 in. matched drive units, and ducted-port bass reflex cabinet. Response 40-16,000 c/s ±5 dB, crossover frequency 3,000 c/s. Imp. 15 ohms. Size 23 × $11\frac{1}{2}$ × $11\frac{3}{4}$ in. Price complete £11 12s., without legs, £10 17s. 6d.

TA-1M. Pre-amplifier. Inputs. Mic. 0.5 mV. Radio 250 mV. Switched controls, record/replay, bias, level, mic., radio. H.D. <0.1% for 500 mV H and N −60 dB for

500 mV. Power supply required 290 V 20 mA D.C. 6.3 V 1 A per channel. Size $4\frac{1}{2} \times 13\frac{1}{2} \times$ 12 in. Price £19 2s. 6d.

TA-1S. Stereo version of TA-1M. Price £24 10s.

TA-IC. Conversion Unit for TA-IM to convert to TA-1S. Price £6 15s.

V-7A. Valve voltmeter kit. Printed circuit. Measures A.C. volts (0-1.5, 5, 15, 50, 150, 500, 1,500) R.M.S., A.C. volts (0-4, 14, 40, 140, 400, 1,400, 4,000). Peak-to-peak, D.C. volts (0-1.5, 5, 15, 50, 150, 500, 1,500). Ohms (with 10 ohms centre) × 1, 10, 100, 1,000, 10 K, 100 K, 1 Meg 0.1 ohms to 1,000 Megohms with internal battery. Input resistance 11 Megohms. Meter 200 micro-amps. Full scale deflection. Accuracy ±3% full scale. Price £13 18s. 6d.

MGP-1. Power supply unit. 200, 250, 270 V, 120 mA; 6.3 V, 2.5 A. Price £5 2s. 6d.

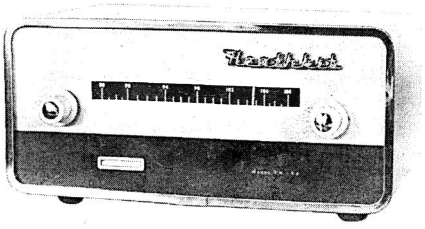
OS-1. Service oscilloscope kit. $2\frac{3}{4}$ in. C.R. tube. Printed circuit. Vertical bandwidth 10 c/s to 2.5 Mc/s. Built-in calibrator. "Y" sensitivity 10 mV R.M.S. per cm. "X" sensitivity 1 V R.M.S. per cm. Price £19 19s.

O-12U. General purpose oscilloscope kit. 5 in. flat face C.R. tube. Printed circuits. Vertical bandwidth 3 c/s to over 5 Mc/s. Built-in 1 V calibrator. "Y" sensitivity 10 mV R.M.S. per cm. "X" sensitivity 0.12 V R.M.S. per cm. Phasing control. Z-axis modulation. Price £38 10s.

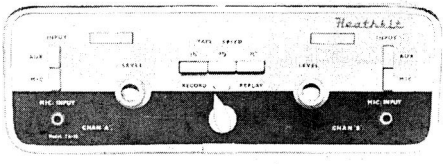
S-3U. Electronic Switch (oscilloscope trace doubler). Converts a single beam oscilloscope to double beam. Switching rates 150, 500, 1,500, 5,000 and 15,000 c/s. Signal frequency response 0-100 Kc/s ± 1 dB. Signal input range 0.1 to 1.8 V R.M.S. Price £11 15s. 6d.

CM-1U. Direct-reading capacitance meter. Uses a $4\frac{1}{2}$ in. meter with four ranges as follows: 100 picofarads, 1,000 picofarads, 0.01 microfarads, and 0.1 microfarads. Price £15 15s.

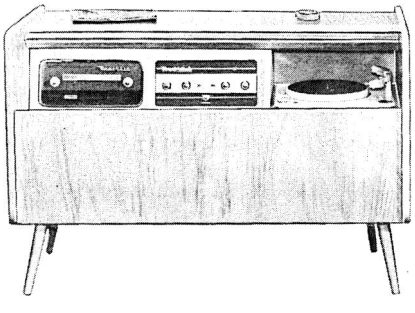
C-3U. Resistance-capacitance bridge. Self-contained and powered. Capacitance range 0.00001 to 1,000 microfarads. Resistance range 100 ohms to 5 megohms. Power factor and leakage also indicated. Polarising voltages available from 5 to 450 V. Price £9 5s.



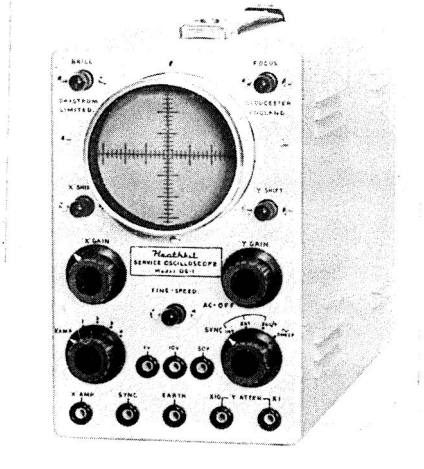
Heathkit FM tuner



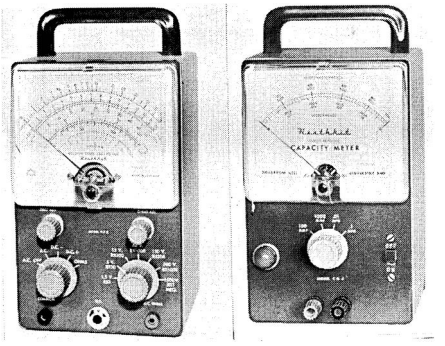
Heathkit TA-1M tape amplifier



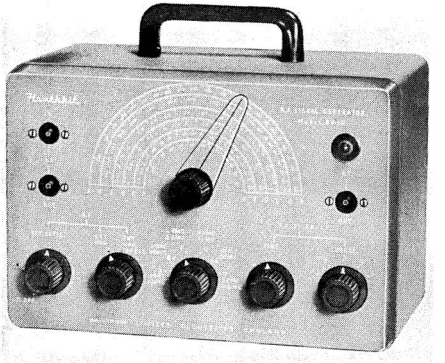
Heathkit Gloucester cabinet



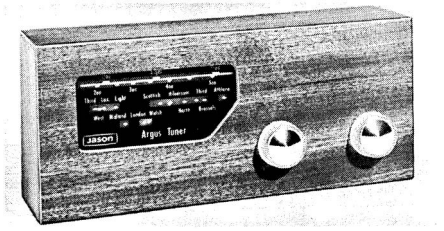
Heathkit OS-1 oscilloscope



(left) *Heathkit V-7A valve voltmeter*
(right) *Heathkit CM-1U capacitance meter*



Heathkit R.F. signal generator



Jason Argus AM tuner

AV-3U. Audio valve millivoltmeter. Measure voltages as low as 1 mV to a maximum of 300 V at high impedance in 10 ranges. Frequency range 10-400,000 c/s. Uses a $4\frac{1}{2}$ in. meter. Cathode follower output. Price £14 17s. 6d.

309-CU. RF probe. Extends the range of a valve voltmeter to 100 Mc/s. Uses a printed circuit board. Price £1 13s. 6d.

AW-1U. Audio wattmeter. Uses external loads or the following internal loads: 3, 8, 15 and 600 ohms. 5 power ranges from 0-5 mW to 50 watts. $4\frac{1}{2}$ in. meter calibrated in watts and dB. Price £15 15s.

AG-9U. Audio signal generator. Range 10 c/s to 100 Kc/s. Distortion less than 0.1% from 20 c/s to 20 Kc/s. Decade switching over 8 voltage ranges from 3 mV to 10 V monitored. Uses $4\frac{1}{2}$ in. meter. Price £21 9s. 6d.

AFM/1. AM/FM tuner. Variable tuning. FM frequency range 88-108 Mc/s. AM frequency range 16-50, 200-550, 900-2,000 metres. Wide band ratio discriminator plus two limiters. Magic eye tuning indicator. Self-powered. Size $10\frac{3}{4} \times 11\frac{1}{8} \times 4\frac{1}{2}$ in. Price £25 6s. 6d. (for both units.)

FM tuner. Comprises model FMT-4U tuner unit and FMA-4U IF strip and power supply. Flywheel tuning, thermometer tuning indicator, three IF stages with two limiters, printed circuit board and prealigned coils. Tuning range 88-108 Mc/s. Sensitivity 2.5 microvolts for 20 dB quieting. Price £15 1s. (for both units).

Cotswold. High fidelity three speaker system. Drive units are 12 in. bass, 8 × 5 in. elliptical, and pressure tweeter. Range 30-20,000 c/s. Two volume controls. Celotex lined enclosure. In white wood ready cut and drilled. Dimensions 26 × 23 × $14\frac{1}{2}$ in. Price complete with crossover unit, etc. £23 4s.

Cotswold MFS. Almost identical to the Cotswold, but specially designed to occupy minimum floor space. Slight reduction in output below 40 c/s with smaller source area. Recommended for small rooms. Dimensions: 36 × $16\frac{1}{2}$ × 14 in. plus two legs. Price £23 4s.

Gloucester. Cabinet for hi-fi equipment. Space available to house records, tapes, etc. Mk. 1 accommodates tape deck or record player, F.M. tuner, and stereo amplifier. Mk. II accommodates both tape deck and record player, F.M. tuner and stereo amplifier. Dimensions: length $46\frac{1}{8}$, height 30, depth 21 in. Price Mk. I £17 3s. 6d. Mk. II £18 10s.

Malvern. Cabinet for hi-fi equipment. Space available for transcription record player, tape deck, radio tuner, audio amplifier (or control unit and separate power amplifiers) and tape record/replay amplifier. Price £18 1s.

JASON Electronic Designs Ltd., Kimberley Gardens, Harringay, London, N.4. Tel.: Stamford Hill 5477.

F.M.T.I. Standard F.M. tuner kit. 4 valves only are used, giving an aerial sensitivity of better than 100 microvolts. A ratio detector is combined with a limiter for low distortion and good noise rejection. Price without valves and power supply £5 19s. Power Pack kit £2 14s.

F.M.T.2. This is the same unit as the F.M.T.1., but built into a shelf mounting case. Price, less valves, but with power supply £8 15s.

F.M.T.3. A fringe F.M. tuner with automatic frequency control. Two limiters combat the effects of aeroplane flutter and car interference. Price with case but less seven valves required, £9 19s.

Argus A.M. tuner. Manual tuning. Frequency range 186-530, 1,200-1,800 metres. P.s.n. one 9 V battery. Size 9 × 2·½ in. Price £7 10s.

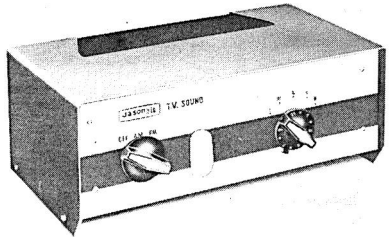
EM10. Valve voltmeter. A four valve bridge circuit, gives good stability. May be used as a general purpose meter. 23 ranges including D.C. current range. Price £23.

AG10. Audio Generator. A capacity tuned Wien bridge covers from 10 c/s to 100 Kc/s with excellent stability and low distortion while the output is held constant within 1 dB. Output impedance is 600 ohm from a cathode follower and the Attenuator uses resistors of 1% accuracy. The rise time on square waves is better than 2 microseconds. Price kit £15 19s.

CC10 Crystal Controlled Calibrator. The exact frequency of a generator may be found by connecting the output to this crystal calibrator when the self-contained audio section and loudspeaker allow marker pips to be heard directly. These marker pips are generated at 10 Mc/s, 1 Mc/s, 100 Kc/s and 10 Kc/s so that generators in the range of 10 Kc/s to 250 Mc/s may be checked. The basic accuracy of 0.01% comes from a 1 Mc/s crystal oscillator. Price kit £19 19s.

Heathkit audio signal generator

Jason EM10 valve voltmeter



Jason JTV2

OG10. 2¾ in. oscilloscope has a sensitivity of 10 mV/cm with a bandwidth of 2 c/s-2 Mc/s. Sweep linearity is good and push-pull amplifiers are used on both X and Y. Price kit £22 10s.

JTL. Stereo tape amplifier kit (see Tape Amplifier section). Price £21.

JTV2. Tuner kit. See details of built model. May be built for £14 19s. Four extra valves required.

Mercury 2. Tuner kit. See details of Monitor. May be built for £10 14s. Three extra valves required.

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MARTIN Electronics Ltd., 155 High Street, Brentford, Middlesex. Tel.: Isleworth 5885.

Martin Recordakits. For building complete recorders, using B.S.R. or Collaro deck. Details and prices on application.

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RADFORD Electronics Ltd., Ashton Vale Estate, Bristol 3. Tel.: Bristol 662301.

CMA 15. Mono amplifier. Details as for MA 15 Mk. 11 (see Amplifiers section). Price (kit) £17 15s.

CMA 25. Mono amplifier. Details as for MA 25 Mk. 11 (see Amplifiers section). Price (kit) £24.

■**CSTA 15.** Stereo amplifier. Details as for STA 15 (see Amplifiers section). Price (kit) £31.

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

See Amplifier Section for details of the following kits:

Bantam Combined Amplifier and Control Unit.

Cooper-Smith Mk. II Control Unit.

Cooper-Smith B.P.I. Amplifier.

Prodigy Combined Amplifier and Control Unit.

■**Cooper-Smith Stereo Control Unit.**

■**Cooper-Smith Stereo Amplifier.**

■**Smith Threesome 3 W Integrated Stereo Amplifier.**

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STERN RADIO Ltd., 109 Fleet Street, London, E.C.4. Tel.: Fleet Street 5812-3. 23 Tottenham Court Road, London, W.1. Tel.: Museum 6128-9.

Type C Mk. II Tape pre-amplifier. To Mullard design (see Tape Amplifier Section). Price £11 15s., power supply unit £3 extra.

HF/TR3 Mk. II Tape amplifier. To Mullard design (see Tape Amplifier Section). Price, including power supply unit, £13 13s.

Mullard Pre-amplifier Tone Control Unit. (See Amplifier Section.) Price £6 6s.

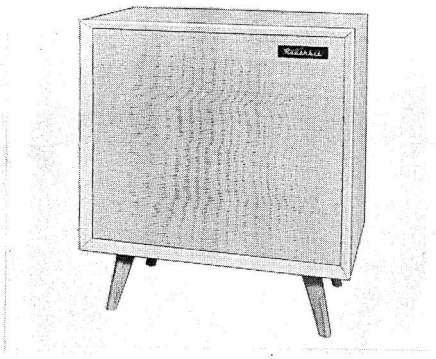
Mullard "5-10" Amplifier. (See Amplifier Section.) Price £10.

Mullard "10-10" Amplifier. (See Amplifier Section.) Price £16.

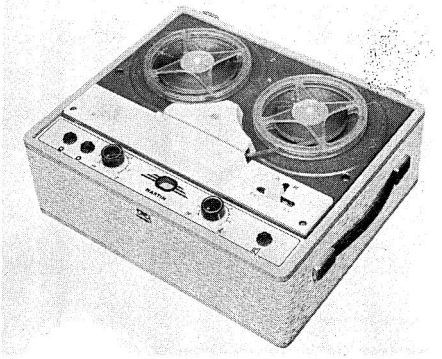
Mullard Dual Channel Pre-Amplifier. (See Amplifier Section.) Price £12 10s.

2H Mullard 4-channel electronic mixer. (See Tape Amplifier Section.) Price £8 8s. Alternative model **1L,** Price £10 5s.

STP-1 Stereo pre-amplifier. (See Tape Amplifier Section.) Price £22.



Heathkit Cotswold speaker



Martin Recordakit

WHEN DID IT HAPPEN?

Some memorable events in the history of the Art

1876 The telephone invented independently by Bell and Gray (USA).

1877 Mechanical sound recording and reproduction envisaged by Cros (France) and achieved independently by Edison (USA). Carbon microphone invented by Berliner (USA)—competing models devised by Edison (USA), Blake, Hunnings (England) and others. Moving-coil microphone invented independently by Siemens (Germany) and Cuttriss and Redding (USA).

1878 Capacitor (electrostatic) microphone and telephone receiver invented by Edison (USA).

1879 Selenium devices for speech transmission investigated by Bell (USA).

1881 Wax cylinder and disk recordings by Tainter (England) and C. Bell in Washington D.C. Binaural telephone transmissions from Paris Opéra by Ader (France).

1884 Constant linear speed disk record devised by Tainter in Washington D.C.

1887 Wax cylinder dictating machine (Graphophone) marketed (USA). Berliner (USA) announces invention of the Gramophone.

1888 Zinc-etching recording process for the Gramophone devised by Berliner. Edison produces improved wax cylinder recording machine.

1889 Stressed aluminium diaphragm invented in USA by Bettini (Italy).

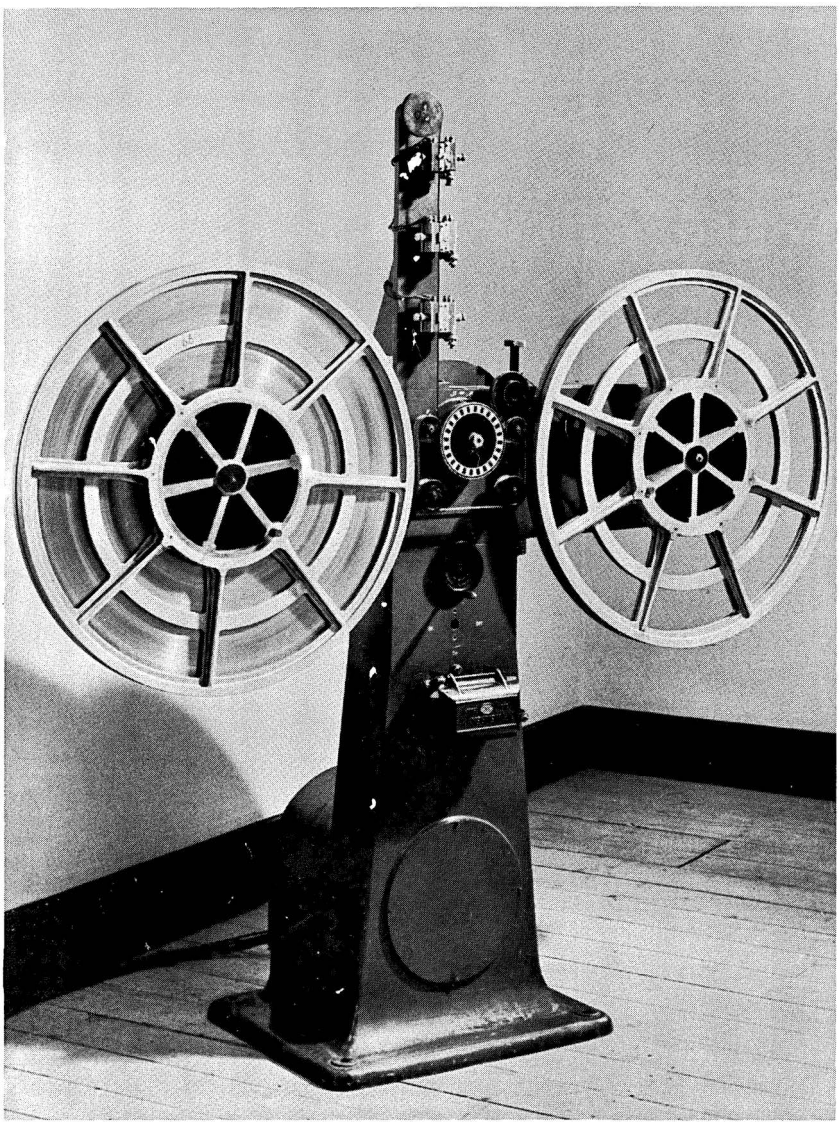
1890 Introduction of wax cylinder records for public entertainment at sideshows (USA). First—toy—gramophone records and gramophones manufactured (Germany).

1893 Lioret (France) produces moulded celluloid cylinder records. First manufacture of gramophones in USA.

1894 Production of cylinder records for home entertainment commenced in USA.

1897 The spring-driven gramophone. Shellac compound first used in record manufacture. First cheap cylinder phonographs marketed—as reproducers only.

1898 Poulsen (Denmark) invents magnetic wire recorder: the Telegraphone. Lodge (England) devises moving-coil loudspeaker.



Here is a flashback to the early days of magnetic recording. This machine—a Blattner-Stille recorder and reproducer—used steel tape. The drums held approximately one and three quarters of a mile of the tape, which was run at a speed of sixty inches per second, giving about 30 *minutes of programme. The photo is by courtesy of the BBC, and shows the instrument which was in use at Maida Vale in May* 1935

A RECORD OF AUDIO LANDMARKS—*Cont.*

1899 Johnson (USA) introduces wax cutting in gramophone recording. Stroh (England) invents the Stroh violin for use in recording studios.

1901 First 10-inch gramophone records. Moulded cylinder records perfected.

1902 Poulsen and Pedersen invent DC bias method of reducing distortion in magnetic recording (Denmark). Duddell (England) invents photographic method of sound recording.

1903 First 12-inch gramophone records. Improved magnetic wire recorders adopted by General Post Office, London. Parsons (England) demonstrates Auxetophone—practical method of using compressed air amplification.

1904 First double-sided gramophone records (Germany). Fleming (England) invents diode valve. First attempt at marketing long-playing record (England).

1906 de Forest (USA) invents triode valve and single-stage audio amplifier.

1907 Lauste (France) invents method of recording sound with picture, on film, in England.

1908 Four-minute cylinder records (USA).

1912 Cylinder records moulded in plastics (USA). de Forest (USA) invents multi-stage amplifier using triodes in cascade. Satisfactory commercial model wire recorder at last produced in USA.

1915 Colpitts (USA) devises push-pull output circuit.

1917 Wente (USA) devises high quality capacitor microphone for acoustic measurements. Langevin (France) devises means of using piezo-electric transducers in underwater signalling.

1919 First experimental work on high quality electrical disk recording: Guest and Merriman (England), Sykes (England), Frederick and Harrison (USA). First experiments on high quality photographic sound-on-film recording: Vogt, Engel and Massolle (Germany).

1921 Carlson and Carpenter (USA) invent AC bias method of reducing distortion in magnetic recording. Experimental binaural broadcasts by Doolittle (USA). Emerson (USA) proposes disk records with two recordings in a single groove.

1922 Semi-automatic record presses introduced. Hull invents indirectly-heated cathode valve. Pemberton-Billing introduces constant linear speed disk record (England). Stille (Germany) begins development of magnetic recording equipment for entertainment purposes. Daily broadcasting commenced by British Broadcasting Company: London, Newcastle, Birmingham and Manchester transmitters.

1923 Quiet-surface laminated shellac records introduced in England. High quality electrical disk recording system in advanced state of development in USA. Frederick (USA) invents "infinite baffle" loudspeaker enclosure. Many designs of moving-iron loudspeaker. Case (USA) invents Aeolight modulator—later basis of "Movietone" sound-film system.

1924 Major record manufacturers take licences to use high quality disk recording system. Seymour and Ginn (England) devise high quality handmade gramophones. Wilson (England) calculates and publishes tone arm tracking error formulae. Riegger (Germany), Round and Voigt (England) work on direct radiator moving-coil loudspeakers.

1925 First commercial electrical recordings by major manufacturers. Reisz (Hungary) invents diaphragmless transverse-current carbon microphone. Russell and Cotton (England) demonstrate piezo-electric crystal pick-up. The Rice-Kellog loudspeaker (USA). Weil (USA) devises corner speaker mounting. Minton and Ringel (USA) devise tweeter-woofer speaker combination. First commercial sound-films "Vitaphone" made in New York.

1926 Voigt (England) uses moving-coil disk cutter commercially. Vogt (Germany) develops small electrostatic full range loudspeaker.

1927 Preuss and Francis (England) devise variable-pitch disk recording method. Kellog (USA) devised balanced armature moving-iron pickup. High (USA) invents labyrinth loudspeaker enclosure. First commercial sound-on-film talking pictures. Pfleumer (Germany) and O'Néill (USA) devise coated tapes for magnetic recording.

1928 Pentode output valve invented (Holland). Bimorph construction for piezo-electric transducers invented by Sawyer (USA). Perforated steel tape magnetic recorder for sound-film use produced by Stille (Germany). Improved variable-density and variable-area sound-film recording equipment produced in USA and Germany. Round (England) produces electrically recorded microgroove long-playing records.

1929 Improved capacitor microphones introduced in USA and elsewhere. High quality moving-coil microphone and disk recording equipment designed by Blümlein, Holman and others (England). Needle-armature moving-iron pickups introduced.

1930 Thuras (USA) invents phase-inverter method of loading microphone and loudspeaker diaphragms. First experiments with extended vinyl materials for record manufacture (USA). BBC adopts magnetic steel tape recording.

1931 Olson (USA) invents limp strip ribbon microphone. Blümlein (England) works on coincident microphone stereophonic recording system. Frederick and Harrison (USA) devise high quality vertical-cut recording system for broadcast use. Development of "Magnetophon" plastic tape magnetic recording system commenced (Germany).

1932 Neumann (Germany) introduces improved capacitor microphone with gold-plated collodion diaphragm. Olson and Weinberger (USA) devise ribbon microphone with rear loading. Further attempts to market long-playing records in England and USA.

1933 Experimental complex-cut stereo disk records made in England. Experimental wire transmission of three-channel stereo in USA.

1934 Armstrong (USA) devises FM interference-free radio system. Direct recording blanks developed by Watts (England) and in France and Germany. Watts' equipment adopted by BBC. Alexander (England) designs standard BBC ribbon microphone. Black (USA) publishes details of negative feedback circuitry and principles. Voigt (England) devises quarter-wave loading principle for loudspeakers. First production of cellulose acetate based coated magnetic tape (Germany). Improved design of steel tape recorder adopted by BBC.

1935 "Magnetophon" tape recorder publicly demonstrated (Germany). High quality 25-gram pickup with sapphire stylus and oil-damped moving-iron cutting head with range to 10 kc/s designed (Germany). Spherical case moving coil microphone designed (USA). Directional (cardioid) capacitor microphone invented by Braunmühl and Weber (Germany). Sound recording committee of St. Dunstan's and N.I.B. ("talking books for the blind") established (England). Wide screen film with stereophonic sound demonstrated (England).

1936 Ultra-violet light recording introduced for sound-films. Experimental complex-cut stereo disks in USA. British Sound Recording Association founded. High-definition television service opened by BBC.

A RECORD OF AUDIO LANDMARKS—*Cont.*

1937 Noise-cancelling lip microphone adopted by BBC for outside broadcast work. Lightweight British moving-iron pickup designed. Triode-tetrode ("ultra-linear") output circuit devised by Blümlein (England).

1938 Negative feedback successfully applied in disk recording head (USA). High quality studio "Magnetophon" tape recorder introduced in broadcasting (Germany).

1939 Voigt moving-coil pickup designed (England). Development of stereophonic and multi-channel sound films commenced in USA. Further development of magnetic wire recorders commenced (USA).

1941 Braunmühl and Weber apply AC bias to "Magnetophon" sound recording system (Germany). Intensive development of magnetic wire recording by Camras and others (USA). Klipsch (USA) produces improved folded-horn loudspeaker enclosure.

1942 Intensive development of extended range disk recording by British record companies to meet needs of armed forces. National Association of Broadcasters (USA) adopts disk recording standards. First experimental stereophonic tape recordings (Germany).

1944 Commercial introduction of extended range gramophone records by British manufacturers. Improved "Magnetophon" equipment produced in Germany with PVC based coated tape.

1945 Miniature armature extended range gramophone pickups produced in Britain. First amplifier with 0.1 % distortion designed and produced in Britain. Vinyl based gramophone records made and sold in USA.

1946 Carrier-stereophony disk recording system designed in England.

1947 Improved disk recording heads—feedback moving-coil—produced in USA and Denmark. Magnetophon-type tape recording equipment and coated tapes widely adopted outside Germany.

1948 Long-playing records introduced (USA). Hot stylus disk cutting technique adopted. Improved (acicular) type of oxide coating adopted for magnetic tape, facilitating reduction in tape speed. Experimental work in England, USA and elsewhere on application of magnetic recording to sound-film systems. Invention of transistor announced (USA).

1949 45 rpm records introduced (USA). 78 rpm records with extended playing time introduced (Germany). Improved crystal pickups marketed (England).

1951 Experiments in microgroove stereo disk recording commenced in England. Very lightweight FM pickup (1 gram tracking) marketed (USA). Recorded tapes for home entertainment released in USA.

1952 Improved variable directivity capacitor microphones introduced (Germany). Modern type noise-cancelling lip microphone introduced in Britain. First multi-channel sound-films commercially released.

1953 Research on modern types of capacitor (electrostatic) loudspeaker commenced in Britain and USA. Introduction of modern miniature ribbon BBC microphone.

1954 Recorded tapes (mono) released in Britain. Tape cassette system developed for "talking books" (England). Experiments with complex-cut stereo disks in USA and carrier stereo lateral cut disks in England. First commercial recording sessions using stereo tape equipment by record companies.

1955 Stereo tape records marketed in Britain. Appearance of commercial electrostatic loudspeakers. BBC VHF transmitters at Wrotham, Kent, opened.

1956 First high quality stereo disk cutting equipment in advanced state of development. Experimental stereo disks demonstrated in London.

1957 European and US record manufacturers agree on stereo disk standards. First commercial stereo disks released in USA. Moving magnet pickups developed (Holland and USA).

1958 General introduction of stereo disks. First experimental stereo broadcasting by BBC. Compatible stereo record proposed by Goldmark (USA) but not adopted. Tape cassette four-track stereo equipment introduced in USA. Thinner based "double play" tape marketed.

1961 G. E.-Zenith system for stereo broadcasting is officially approved by the FCC and adopted by USA.

1962 Development of fully tranistorized high power audio amplifiers. BBC commences experimental transmissions using G. E.-Zenith stereo system.

Acknowledgement: Some data concerning the BBC have been checked by reference to the BBC Handbook, 1963 edition.

DIRECTORY OF HI-FI DEALERS

IMPORTANT NOTE: The following list is of shops where stocks of equipment are 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

AUDIOCRAFT (LONDON) LTD., 296 Kensington High Street, W.14

AUDIO SERVICES, 82 East Barnet Road, New Barnet, Herts.

BERRYS (SHORT WAVES) LTD., 25 High Holborn, W.C.1

CHELSEA RECORD CENTRE LTD., 203 Kings Road, S.W.3

CITY ELECTRONICS LTD., 236-238 Imperial Drive, North Harrow, Middx.

CLYNE RADIO LTD., 18 Tottenham Court Road, W.1, 162 Holloway Road, N.7, 5 Camberwell Church Street, S.E.5 and 12 Suffolk House, George Street, Croydon

CUSTOM HIGH FIDELITY, 371 Green Lanes, Palmers Green, N.13

ELECTRONICS (FLEET STREET) LTD., 152/3 Fleet Street, E.C.4

C. G. GOODWIN LTD., 7 The Broadway, Wood Green, N.22

GRAMOPHONE EXCHANGE LTD., 80-82 Wardour Street, W.1

HAMPSTEAD HIGH FIDELITY, 91a Heath Street, N.W.3

H. C. HARRIDGE, 8 Moor Street, Cambridge Circus, W.1

THOMAS HEINITZ, 100 Queensway, W.2

ALFRED IMHOF LTD., 112 New Oxford Street, W.C.1

LARGS OF HOLBORN, Hanover House, 76/77 High Holborn, W.C.1

LASKY'S RADIO, 207 Edgware Road, W.2, 33 Tottenham Court Road, W.1 and 152/3 Fleet Street, E.C.4

LEE ELECTRONICS, 400 Edgware Road, W.2

LEWIS RADIO CO., 100 Chase Side, Southgate, N.14

MODERN ELECTRICS LTD., 120 Shaftesbury Avenue, W.1

MUSICRAFT HI-FI CENTRE, 13 King Street, Richmond and 20-22 High Street, Southall

NEWBURY RADIO, 274 Romford Road, Forest Gate, E.7

H. NORMAN DAVIS LTD., 91 The Broadway, Mill Hill, N.W.7

R.T.M. (RADIO & TELEVISION) SERVICE LTD., 387b Mare Street, E.8

RIMINGTON VAN WYCK LTD., 42/43 Cranbourn Street, W.C.2

H. L. SMITH & CO., LTD. 287-9 Edgware Road, W.2

A. L. STAMFORD, 98 Weymouth Terrace, E.2

STERN RADIO LTD., 109 Fleet Street, E.C.4 and 27 Tottenham Court Road, W.1

STUDIO 99, 57 Fairfax Road, Swiss Cottage, N.W.6

TELE-RADIO (1943) LTD., 189 Edgware Road, W.2

TELESONIC LTD., 92 Tottenham Court Road, W.1

WALLACE HEATON (CITY SALE) LTD., 93 Fleet Street, E.C.4

WEBB'S RADIO, 14 Soho Street, Oxford Street, W.1

BASINGSTOKE

THE BASINGSTOKE CAMERA AND HI-FI CENTRE, 44a Wote Street

BATH (SOMERSET)

C. MILSOM & SON, North Gate

BEXLEYHEATH (KENT)

BROADWAY RADIO, 228 Broadway

BIRMINGHAM

GRIFFIN RADIO LTD., 94 Bristol Street

JEWKES & CO., LTD., 285 Broad Street

NORMAN H. FIELD ELECTRONICS, 68 Hurst Street

BLACKPOOL

F. BENFELL LTD., 17 Cheapside

METCALFE'S RADIO STORES, 121 Whitegate Drive

BOGNOR REGIS

TANSLEY & COOKE LTD., 3/4 Odeon Buildings, and 46 Aldwick Road

BOLTON

HARKER & HOWARTH (MUSIC) LTD., 7 The Arcade, Bradshawgate

H. D. KIRK (STEREOLECTRICS) LTD., 150 Higher Bridge Street

BOURNEMOUTH (HANTS)

NATIONAL RADIO SUPPLIES, 66 Holdenhurst Road

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PACK'S LTD., High Street

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BRISTOL & WEST RECORDING SERVICES LTD., 6 Park Row

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STORRYS OF CHICHESTER LTD., 83 North Street

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JAMES KERR & CO. LTD., 435 Sauchiehall Street
M & M ELECTRONICS LTD., 91 North Hanover Street

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ESSEX SOUND SERVICES LTD., 6 The Facade, High Road

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TAPE RECORDER CENTRE (HALIFAX) (TREVOR FAWTHROP LTD.), 30 King Cross Street

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M. W. KEEN, Paul's Row

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TANSLEY & COOKE LTD., 37 West Street

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RECORD ROUNDUP, 154 Portland Road, Hove 3

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GORDON ROBERTS, Yorkshire Sound Centre, 5 Outcote Bank
M.R.W. ELECTRONICS, 222 Wakefield Road, Moldgreen
J. WOOD & SONS LTD., 67 New Street

IPSWICH (SUFFOLK)
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HORNS, 6 South Parade
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TANSLEY & COOKE LTD., Chapel Road and 187 Montague Street
CRAY OF WORTHING, 59b High Street

YEOVIL
YEOVIL'S RADIO HOUSE, Princes Street

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★ The following is a short list of dealers specialising in the sale of tape recorders and associated equipment.

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DAVENSET RADIO, 2 Burnt Ash Parade, Lee Green, S.E.12
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MAGNEGRAPH, 1 Hanway Place, W.1
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R. E. W. EARLSFIELD LTD., 266 Upper Tooting Road, S.W.17
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THE TAPE RECORDER CENTRE LTD. (Head Office), 447 Green Lanes, Harringay, N.4. (Showrooms) 75 Grand Parade, Green Lanes, Harringay, N.4. (West End Showroom) 82 High Holborn
TELETAPE LTD., 33 and 59a Edgware Road, W.2

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Studio	Telephone No.	Address
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Bishop Sound & Electrical Co. Ltd.	TEMple Bar 7484	48, Monmouth Street, W.C.2.
The British Homophone Co. Ltd.	NEW Cross 2080	Excelsior Works, Rollins Street, S.E.15.
Central Sound Studio	TEMple Bar 6061	6 Denmark Street, W.C.2
Custom High Fidelity	PALmers Green 5228	371, Green Lanes, Palmers Green, N.13
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Garland Bros. Ltd.	TIDeway 4412	Chesham House, Deptford Broadway, S.E.8.
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John Hassell Recordings	RIVerside 7150	21, Nassau Road, S.W.13.
Keepoint Recording Service	LEE Green 3310	1, Knighton House, Manor Way, S.E.3.
Levy's Sound Studios Ltd.	MAYfair 8521	73 & 104, New Bond Street, W.1.
Magnegraph Recording Co. Ltd.	LANgham 2156	1, Hanway Place, Oxford Street, W.1
R. G. Mander Ltd	TEMple Bar 1107	53, Monmouth Street, W.C.2.
Olympic Sound Studios	HUNter 1635	Carton Street, W.1.
Rapid Recording Service	COPpermill 3889 LARkswood 7889	The Chestnuts, 21, Bishops Close, Church La., E.17.
Recorded Productions (London) Ltd.	TRAfalgar 2618/9	Morris House, 1, Jermyn Street, S.W.1.
Recorded Sound Ltd.	GROsvenor 4634 & 3726	27/31, Bryanston Street, Marble Arch, W.1
Recording & Transcription Service	SPEedwell 5670	6, Chiltern Gardens, Cricklewood, N.W.2.
Regent (B. & E.) Sound Ltd.	TEMple Bar 6769	4, Denmark Street, W.C.2.
Leslie Robinson	TIDeway 5028	120, Barriedale, New Cross, S.E.14.
Sonotape Ltd.	GERrard 8464	18, Soho Square, W.1.
Sound Enterprise (and Gregorian Recordings)	HILLside 7612	2, Singleton Scarp, Woodside Park, N.12
Sound Level Studio	PUTney 0766	28, Putney Hill, S.W.15.
Sound News Productions	REGent 2745	10, Clifford Street, New Bond Street, W.1.
Star Sound Studios Ltd.	LANgham 2201	Rodmarton Street, Baker Street, W.1.
Tannoy Products Ltd.	GIPsy Hill 1131	Norwood Road, West Norwood, S.E.27.
Toucan Sound Productions	BALham 8313	122, Fernlea Road, Balham, S.W.12.
Universal Programmes Corporation Ltd.	LANgham 2000	35, Portland Place, W.1.
Leonard Wadsworth & Co. Ltd.	WIMbledon 9871/2/3	Bank Buildings, 47, Wimbledon Hill Road, S.W.19.
Warren Recordings	SUNnyhill 0306	59, Hendale Avenue, Hendon, N.W.4.
Associates		
C. A. Wolfe	FITzroy 4808	3, Park Road, Crouch End, N.8.
HOME COUNTIES		
Conway Sound Recordings	Spring Park 3152	29a, Kent Road, West Wickham, Kent
J. R. T. Davies	Burnham 381	1, Walnut Tree Cottage, Burnham, Bucks.
Hayton Recording Co. Ltd.	Sellindge 3195	Hayton Manor, Stanford, Nr. Ashford, Kent.
Ilford Sound Recording Service	CREscent 8947	63, Aintree Crescent, Barkingside, Ilford, Essex.
A. R. Itter	Burnham 1208	99, Green Lane, Burnham, Bucks.
J & B Recordings (Morden)	MITcham 9952	14, Willows Avenue, Morden, Surrey
R. G. Jones (of Morden) Ltd.	MITcham 3668	Morden Park Sound Studios, London Road, Morden, Surrey.
Livingston Recordings Ltd.	Hadley Green 1161-2	32, East Barnet Road, New Barnet, Herts.
MJB Recording & Transcription Service	Maidenhead 25630	7, High Street, Maidenhead.
M.S.S. Recording Co. Ltd.	Colnbrook 284	Poyle Close, Colnbrook, Bucks.
D. R. Neale	Tring 3135	Park Street Lodge, Tring, Herts.
Omega Recording Co.	Potters Bar 6428	112, Sunny Bank Road, Potters Bar, Middlesex.
Sound Snapshots	Enfield 1179	17, River View, Enfield, Middlesex.
Soundwork Services	UPLands 7667	Soundwork House, Station Approach, Coulsdon South, Surrey.
Clementswood Recordings	Ilford 0929	101, Grange Road, Ilford, Essex.
Studio Republic Ltd.	Pinner 6114	Church Farm, High Street, Pinner, Middlesex.
Transacord Ltd.	Princes Risborough 518	Bledlow Road, Princes Risborough, Aylesbury, Bucks.
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A. M. Andrews	West Drayton 3119	51, Cherry Orchard, West Drayton, Middlesex.
Glen Music	Buckhurst 2457	33, Monkham Avenue, Woodford Green, Essex.
Tape Sound	MITcham 1487	13, Island Road, Mitcham, Surrey.

Studio	Telephone No.	Address
SOUTH		
Arco Sound Recording Unit	Crawley 25830	23, Gossops Drive, Crawley, Sussex.
County Recording Service	Bracknell 1935	"Braeside", London Road, Binfield, Bracknell, Bucks.
John King Films Ltd	Brighton 5918/9	Film House, East Street, Brighton.
Personal Recordings Ltd.	Worthing 9160	22, New Broadway, Tarring Road, West Worthing, Sussex.
Trio Recordings	Crawley 22729	32, Southgate Drive, Southgate, Crawley, Sussex.
Associates		
Audio Recordings	Amesbury 2011	65, Solstice Rise, Amesbury, Wilts.
W. A. D. Hinde	Shrewton 233	Shrewton House, Shrewton, Nr. Salisbury.
Lawrence Recordings	Portsmouth 31083	41, Festing Road, Southsea, Hants.
SOUTH MIDLANDS		
Isis Recording Studios	Oxford 42858	6, Brewer Street, St. Aldgate's, Oxford.
Snellgrove's	Cumnor 2733	3, Third Acre Rise, Botley, Oxford.
Associates		
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Jack Bryant	Cromer 2150	Church Square, Cromer, Norfolk.
Jaybee (TV) Ltd	Ipswich 56187	75, Bramford Road, Ipswich, Suffolk.
University Recording Co.	Cambridge 54947	16, Burleigh Place, Cambridge.
WEST AND SOUTH-WEST		
Bristol & West Recording Service Ltd	Bristol 20763	6, Park Row, Bristol, 1
Cabot Productions Ltd.	Bristol 68-2193	109, Westbury Lane, Sea Mills, Bristol.
Fidelity Recording Studio	Weston-s-Mare 6702	49, Westbrook Road, Weston-super-Mare.
Record Centres (Bristol) Ltd	Bristol 28752	5, Denmark Street, Bristol, 1.
Associate		
South Somerset Recording Service	Yeovil 2366	8, Brimsmore, Yeovil, Somerset.
[illegible]	Coventry 75403	111, Sewall Highway, Coventry Craven Steet, Coventry 101, Mulberry Road, Dudley Fields, Bloxwich, Walsall, Staffs.
[illegible] Ltd.	Birchfields 4246	16, Grosvenor Road, Handsworth Wood, Birmingham, 20.
N. [illegible]	Nottingham 77077	Maville Works, Beech Avenue, Nottingham.
Millar[illegible]	Highbury 1314	112, Alcester Road South, Kings Heath, Birmingham, 14.
Northampton[illegible]ng Service	Northampton 33933	36a, Spring Gardens, Northampton.
Victor Buckland L[illegible]	Derby 46292	37/39, London Road, Derby
NORTH-EAST		
The Calder Valley Sound Recording Co.	Hebden Bridge 108	"Glenbraes", Mytholm, Hebden Bridge, West Yorks.
Peter Dearden	Darlington 3989	19, Post House Wynd, Darlington.
[illegible]cal Services	Shipley 55779	49, Bradford Road, Shipley, Yorks.
[illegible]nk. Harding Ltd	Pudsey 2558;3635	6a, Lowtown, Pudsey, Yorks
[illegible]nd Studio Reproducers	Dewsbury 3031	Red Gables, Northfield Road, Dewsbury, Yorks.
Mortonsound (G. L. Morton & Co. Ltd.)	Newcastle 2-6902	12, Oxford Street, Newcastle upon-Tyne.
Northern Sound Services Ltd.	Newcastle 26304/5	Broad Chare, Quayside, Newcastle-upon-Tyne.
Sound Recording & Equipment Hire	Leeds 26192	Wade Buildings, 21, Wade Lane, Leeds, 2.
Sunderland Sound Services	Sunderland 57032	28, Viewforth Terrace, Fulwell, Sunderland, Co. Durham.
Associates		
Henry Askwith	Leeds 663612	83, Shaftesbury Avenue, Leeds, 8.
Cestrian Sound Services		32, Melville Street, Chester-le-Street, Co. Durham.
Mobile Recording Services	Shotley Bridge 185	21, Ashfield Road, Shotley Bridge, Consett, Co. Durham.
NORTH-WEST		
Deroy Sound Service	Hest Bank 2444	52, Hest Bank Lane, Hest Bank, Lancaster.
"Eroica" Sound Recording Services	Eccles 1624	31, Peel Street, Eccles, Manchester.
Harker & Howarth (Music) Ltd.	Bolton 6247	7, The Arcade, Bradshawgate, Bolton.
Jack Michaels Mobile Recordings	Blackpool 62465	219, Westmoreland Avenue, Blackpool.
The Music Box	Southport 3778	16, Eastbank Street, Southport, Lancs.
A. Oliver & Son Ltd	Claughton 4023	13, Wellington Road, Oxton, Birkenhead, Cheshire.
Personal Recording Services	St. Helens 5752	15, Robin's Lane, St. Helens, Lancs.
P. F. Phillips	Anfield 5297	38, Kensington, Liverpool, 7.
Rendezvous Records	Rusholme 6868	9, Blackfriars Street, Manchester, 3.
R.H. Sound Recording Service	Whitefield 2755	3, Kings Avenue, Whitefield, Manchester.
W. D. Welsby	Rainhill 143	Red Trees, View Road, Rainhill, Lancs
Western Sound Recorders Ltd.	Warrington 2553	11, Wilson Patten Street, Warrington
Associate		
Glen Recording	Whitefield 2856	11, Wavell Drive, Unsworth, Bury, Lancs.
WALES		
Acoutape	Llandudno 76533	26, St. David's Road, Llandudno.
Ron Clough	Llanddulas 378	The Groove, Station Road, Llanddulas, Abergele, Denbighshire.
Colbeck-Lewis Recordings	Cardiff 33251	14, Kyveilog Street, Cardiff.
Welsh Recordings	Llanelly 3198	Marble Hall Road, Llanelly, Carms.
SCOTLAND		
Alexander Biggar Ltd.	Douglas 8774	271-5, Sauchiehall Street, Glasgow, C.2.
Grampian Sound Service	BRidgeton 1202	15, Broompark Drive, Dennistoun, Glasgow.
Jeffreys (George Jeffrey Ltd.)	Fou 8389	23, Earl Grey Street, Edinburgh, 3.
Larg & Sons (Dundee) Ltd.	Dundee 26061	16-24, Whitehall Street, Dundee.
R. C. Miller		136, Crown Street, Aberdeen.
"Studio 82"	DOU 1791	82, Buccleugh Street, Glasgow.
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Fantasia Recordings	Belfast 77181	8, Donegall Park Avenue, Belfast.
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Audiofare	Dublin 62215	59, Merrion Square, Dublin.
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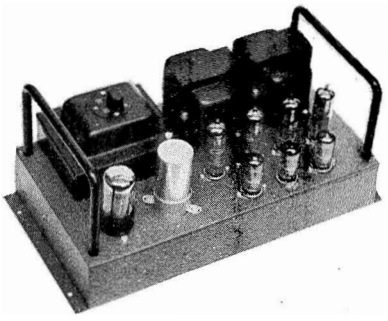

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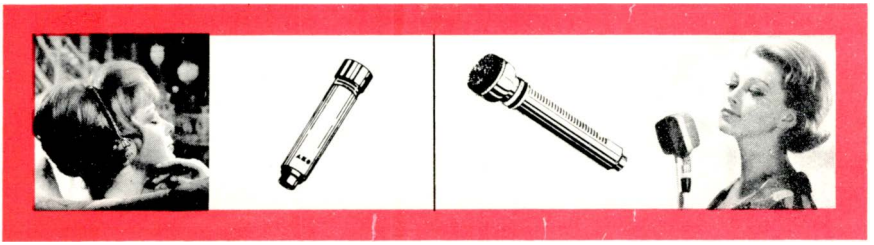

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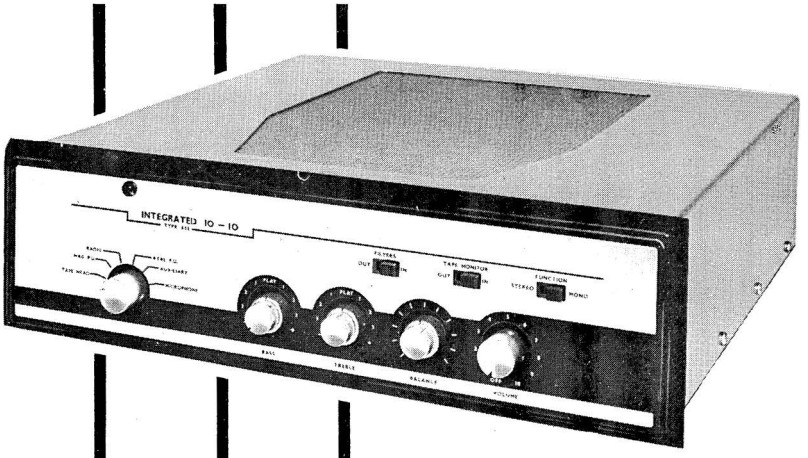

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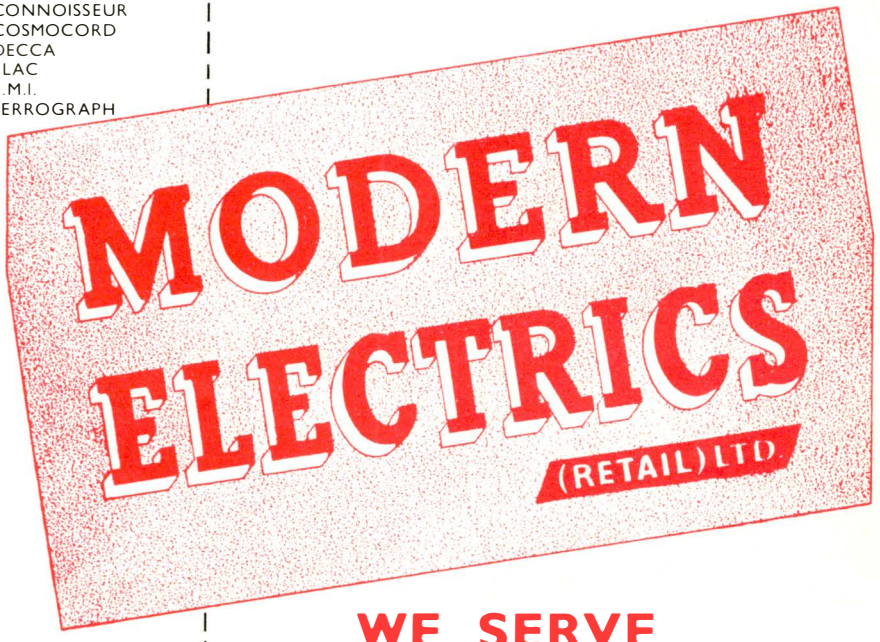

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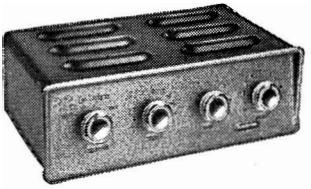

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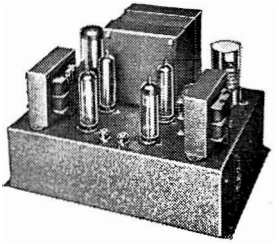

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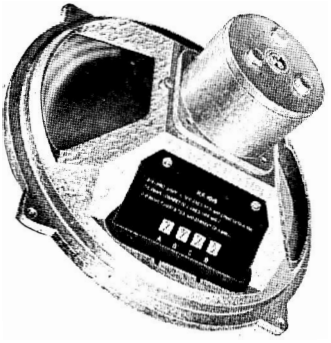

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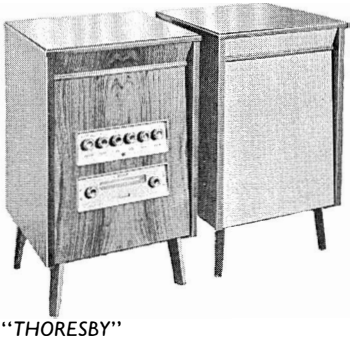

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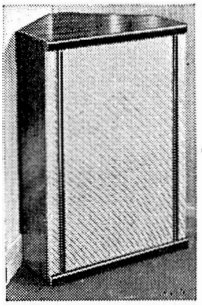

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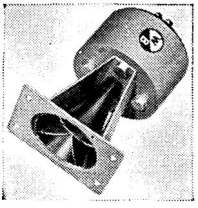

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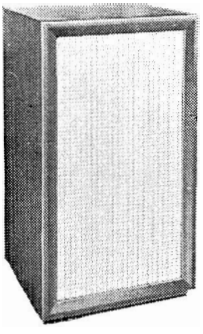

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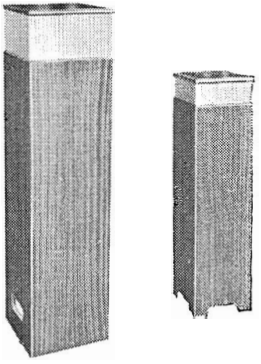

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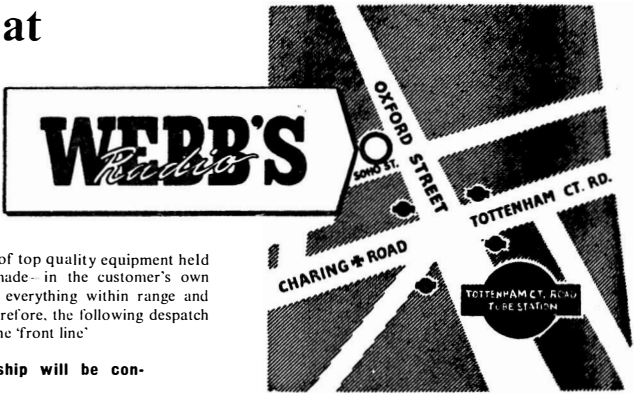

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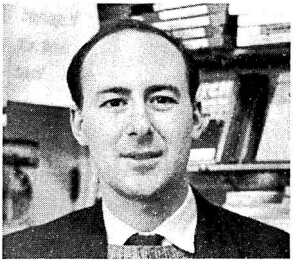

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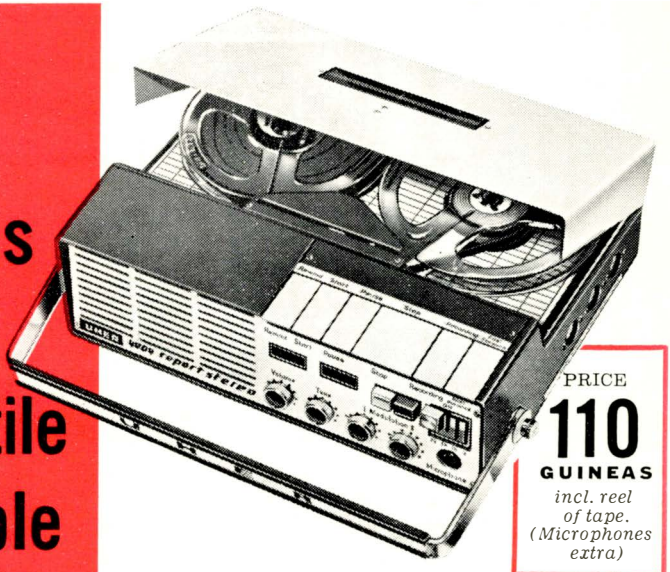

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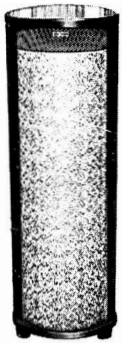

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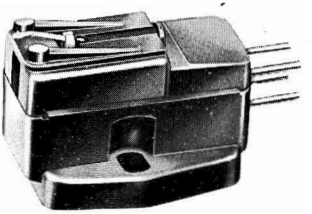

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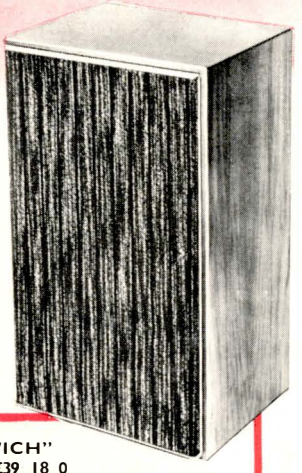
Quoted from the article "Frankly Speaking" by John Berridge. "Hi-Fi News".



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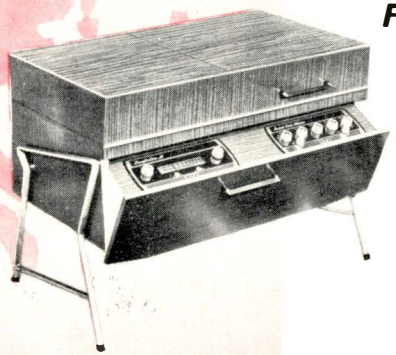

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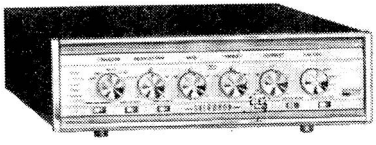

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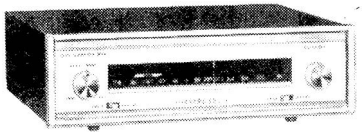
64 watts of music power (32 watts music power each channel, 30 watts continuous, 60 peak). All the important controls and facilities as S-5000 II. Phase-invert switch. Scratch and rumble filters. Tape monitoring switch. Total of 8 high-level and 4 low-level inputs provide for maximum flexibility.



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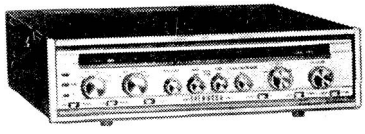

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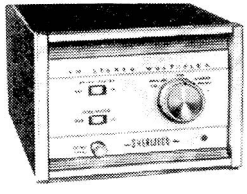
64 watts of music power (32 watts music power each channel, 30 watts continuous or 60 watts peak). The two 32 watt amplifiers, with preamplifiers for phono or tape, together with a highly sensitive FM/MX tuner, makes this receiver a complete home-music system. This receiver is ready to accept FM multiplexed stereo broadcasts. Just add speakers to complete your stereo home hi-fi music system.



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This self-powered adaptor is capable of converting mono tuners to stereo. The ultra-stable, phase locked oscillator provides for maximum channel separation even under weak signal conditions. Audio output 2v @ ⅓% distortion. Frequency response 20 to 15,000 cps ±½dB.

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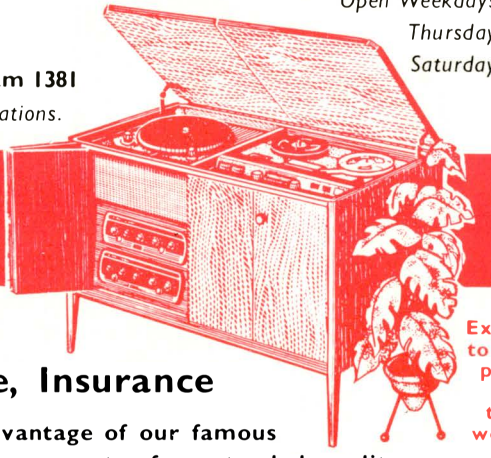

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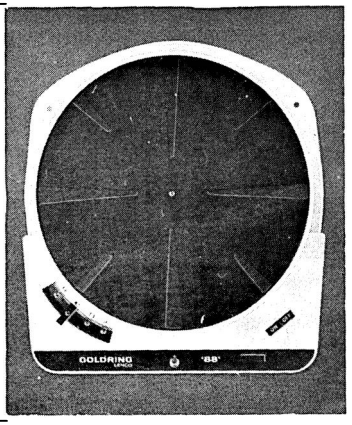
Price—14½ gns plus P.T. £2.9.6.



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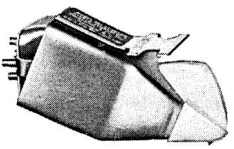

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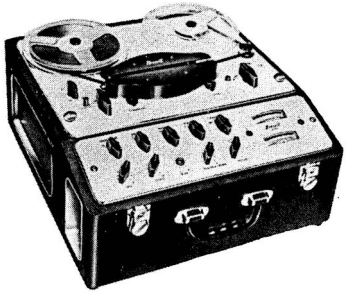

THE STB 1

This new stereo tape recorder from Brenell contains many new features which will appeal to the discriminating amateur and professional alike. It is beautifully designed both mechanically and electrically and some idea of the versatility of this new machine will be gathered from this very brief specification:—

4 speeds 1⅞, 3¾, 7½ and 15 i.p.s.—mixing—superimposing—sound-on-sound—immediate comparison of original and recorded signals—2 edgewise meters—replay facilities for ½, 2/2, ¼ and 2/4 track pre-recorded tapes.

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THE MARK 5 Type M

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4 speeds 1⅞, 3¾, 7½ and 15 i.p.s.—separate record and replay heads and amplifiers—reels up to 8¼" dia.—fast rewind (1,200' in 45 seconds)—mixing—superimposing—recording level meter—adjustable rotary tape guide.

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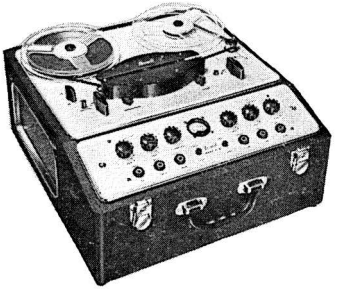

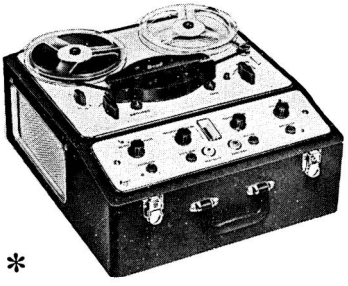

THE MARK 5 Series 2

This new machine replaces the MARK 5 and offers a number of improvements both in appearance and electrically. The amplifier has been redesigned to give an improved frequency response at all speeds on both record and playback. The output remains the same at 4 watts.

Specification: 4 speeds 1⅞, 3¾, 7½ and 15 i.p.s.—3 independent motors (synchronous drive to capstan motor)—instant stop without spillage—pause control—monitoring—superimposing—up to 8¼" reels—fast rewind (1,200' in 45 seconds).

69 gns.

* **The Mark 5 Series 2 deck, amplifier and power unit are available separately for installation in your own Hi-Fi system.**

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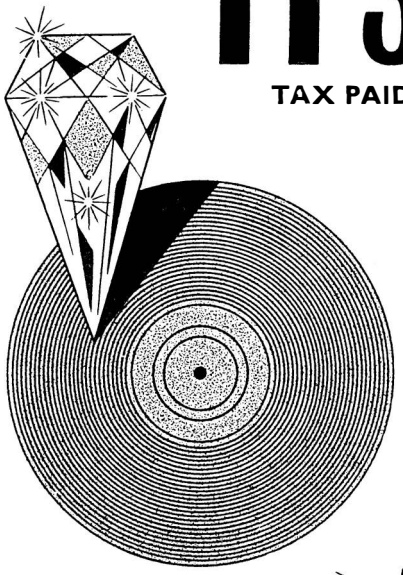

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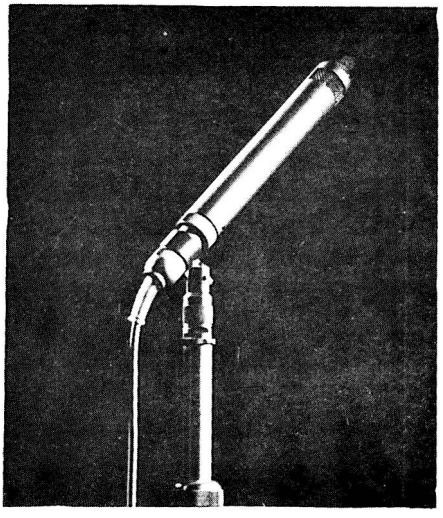
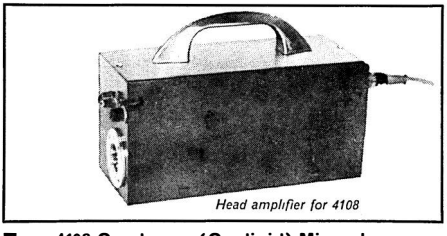




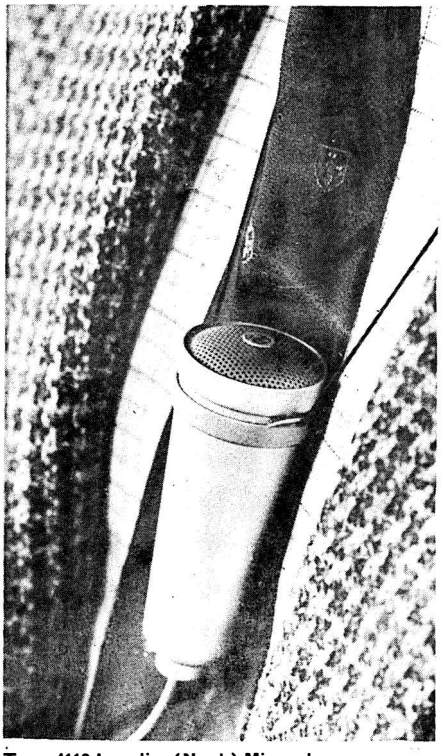
Head amplifier for 4108

Type 4108 Condenser (Cardioid) Microphone

The 4108 is a new addition to the STC range of high quality microphones. It has a cardioid directional characteristic which is specially suited to modern television studio techniques. Maximum pick-up is forward, in line with the longitudinal axis, which makes this microphone ideal for use by individual artists. Its high performance makesit eminently suitable for use in broadcasting, film and recording studios where high fidelity reproduction is an essential requirement.

Abbreviated Technical Data

Frequency range	*30 c/s—15 000 c/s*
Output impedance	*30 ohms (or 300 ohms)*
Sensitivity (front response plane wave)	*1mV/dyne/cm²*
Self-noise of microphone plus amplifier	*22 phons*



Type 4112 Lavalier (Neck) Microphone

The 4112 is a small, tubular, omni-directional, moving coil microphone designed for high quality speech reproduction of broadcasts, commentaries, announcements etc. It is light in weight and is provided with a slim neck halter and band-clip as well as a length of thin, flexible, PVC insulated, screened cable.

Abbreviated Technical Data

Frequency range	*Substantially uniform between 100 c/s and 14 Kc/s*
Output impedance	*30 ohms*
Sensitivity	*–82 dB ref. 1 volt/dyne/cm² (0.1 millivolt approx.)*
Polar response	*Substantially omni-directional*

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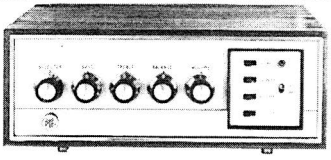
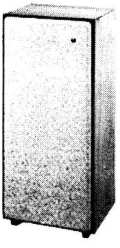
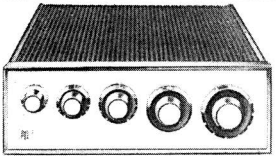


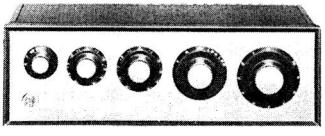
MODEL HFS30T
A fully transistorised high fidelity amplifier of 15 : 15 watts r.m.s. output, having true high fidelity performance and the improved transient response possible only with a transformerless amplifier.



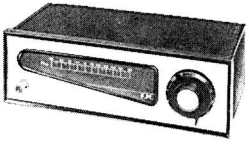
LOUDSPEAKER
MODEL HF9BS
19½ GNS.
Exceptionally fine reproduction in an elegant unit styled to fit happily with contemporary or traditional decor.



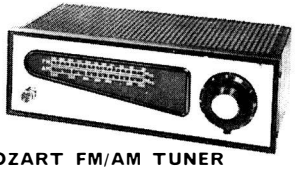
MOZART STEREO AMPLIFIER
MODEL HFS20M 36½ GNS.
Providing an undistorted output of 9 watts per channel on magnetic or crystal pick-up.



MONO AMPLIFIER
MODEL HF10M 24 GNS.
One of the smallest and most efficient high fidelity amplifiers ever devised for use in the home.



MOZART FM TUNER
MODEL HFT109M 24½ GNS.
Eliminates distortion, fading, or interference and ensures trouble-free reception with maximum fidelity of reproduction.



MOZART FM/AM TUNER
MODEL HFT113M 29 GNS.
Designed for the very best interference-free radio listening. FM performance as HFT109 with facility for AM tuning.

Send this coupon today for further details of Pye High Fidelity Equipment

To PYE LIMITED, HIGH FIDELITY DIVISION, P.O. BOX 49, CAMBRIDGE.

Please send me full details of the Pye High Fidelity range

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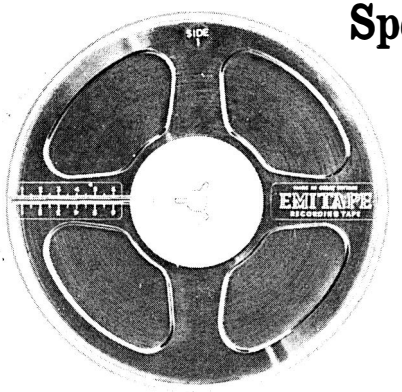
Emitape

magnetic recording tape– the finest in the world

Emitape	Type No.	Spool Size	Approx Length Feet	PLAYING TIME PER TRACK				PRICE	
				1⅞ IPS	3¾ IPS	7½ IPS			IN EMICASE
100 extra-thin double-play tape. 100% more recording time than standard	100/3N	3¼"	400	1 25 20	42 40	21 20	10 40	17.0	—
	100/6	4"	600	2 8 0	1 4 0	32 0	16 0	£1. 5.0	—
	100/12	5"	1200	4 16 0	2 8 0	1 4 0	32 0	£2. 5.0	—
	100/18	5¾"	1800	6 24 0	3 12 0	1 36 0	48 0	£2.17.6	—
	100/24	7"	2400	8 32 0	4 16 0	2 8 0	1 4 0	£4. 0.0	—
99 long-play tape on thin base. 50% more recording time	99/3	3"	250	53 20	26 40	13 20	6 40	9.6	—
	99/3N	3¼"	250	53 20	26 40	13 20	6 40	9.6	—
	99/4	4"	450	1 36 0	48 0	24 0	12 0	14.6	—
	99/9	5"	900	3 12 0	1 36 0	48 0	24 0	£1. 8.0	£1.10.6
	99/12	5¾"	1200	4 16 0	2 8 0	1 4 0	32 0	£1.15.0	£1.17.6
	99/18	7"	1800	6 24 0	3 12 0	1 36 0	48 0	£2.10.0	£2.12.6
	99/24	8¼"	2400	8 32 0	4 16 0	2 8 0	1 4 0	£3.12.6	—
88 standard-play tape, maximum durability for general use	88/3	3"	175	37 20	18 40	9 20	4 40	7.6	—
	88/3N	3¼"	175	37 20	18 40	9 20	4 40	7.6	—
	88/4	4"	300	1 4 0	32 0	16 0	8 0	10.6	—
	88/6	5"	600	2 8 0	1 4 0	32 0	16 0	£1. 1.0	£1. 3.6
	88/9	5¾"	900	3 12 0	1 36 0	48 0	24 0	£1. 8.0	£1.10.6
	88/12	7"	1200	4 16 0	2 8 0	1 4 0	32 0	£1.15.0	£1.17.6
	88/18	8¼"	1800	6 24 0	3 12 0	1 36 0	48 0	£2.17.6	—
44 acetate standard-play tape	44/3N	3¼"	175	37 20	18 40	9 20	4 40	6.9	—
	44/6	5"	600	2 8 0	1 4 0	32 0	16 0	18.0	—
	44/9	5¾"	850	3 1 20	1 30 40	45 20	22 40	£1. 4.6	—
	44/12	7"	1200	4 16 0	2 8 0	1 4 0	32 0	£1.10.0	—

The above figures are calculated times, and do not allow for slow- or fast-running motors or mechanical variations, etc.

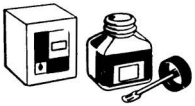


Special Emitape features

* Anti-static
* High sensitivity
* Low 'print-through' factor
* P.V.C. leader and trailer strip fitted to all but 'Message' spools
* In spool sizes for all tape recorders
* Metallic 'Auto Stop' foil fitted to all 44, 88 and 99 spools except 'Message'

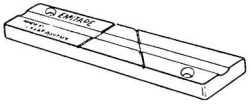
Emitape Accessories

JOINTING COMPOUNDS
AP 35 for C.A.-base Tape and AP 77 for P.V.C.-base Tape



Special jointing fluid to make a permanent welded joint when splicing either P.V.C. or cellulose acetate base magnetic recording tape. **7/6**

EMITAPE JOINTING BLOCK AP 123



The exclusive undercut channel holds the tape fast, enabling it to be cut cleanly at an angle of 45° or 90°. **10/6**

EMICASE

Polystyrene container. Solves storage problems, protects spools from dust and allows easy identification of leader tapes. 7"—**4/-**, 5¾"—**3/6**, 5"—**3/6**

NON-MAGNETIC SCISSORS AP 39

These scissors, made from non-ferrous metal, enable recorded tape to be cut for splicing or editing purposes without magnetising the tape. This ensures a silent joint. **16/-**

P.V.C. LEADER TAPES AP 38/1 TO 38/6

With this range of coloured tapes, colour code references can be inserted for quick identification and indexing purposes in a reel of recorded tape. Colours: White, Red, Yellow, Blue, Orange, Green. **4/6** a reel.

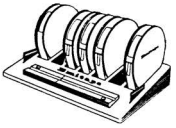
JOINTING TAPE AP 103

Specially prepared adhesive jointing tape for simple and quick splicing and editing of magnetic recording tape. In handy plastic container. **7/6**

METALLIC STOP FOIL AP 125

Sufficient for 50 tapes. In handy plastic container. **6/6**

ACCESSORY KIT AP 124

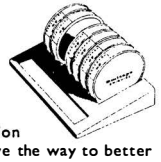


Holds 3 spools of leader, 1 spool of jointing tape, 1 spool of stop foil, Emitape jointing block, 2 cutters and full instructions. Packed in a plastic rack (room for 7 spools). Specially designed for the workbench. **37/6**

EMPTY PLASTIC SPOOLS IN CARTONS

AP 93 3"	3/-
AP 93N 3½"	3/-
AP 121 4"	3/8
AP 85 5"	4/6
AP 89 5¾"	4/6
AP 87 7"	5/-
AP 118 8¼" Metal Spool ...	12/6

EMIGUIDES



6 demonstration tapes that pave the way to better recording.
No. 1—Getting the Quality Right
No. 2—Microphone Technique
No. 3—Tape Editing
No. 4—Outdoor Recording
No. 5—Trick Recording and Sound Effects
No. 6—Producing Feature Tapes
Set of 6 (in plastic rack) **51/-**. Available separately **8/6** each.

ET89

EMI E.M.I. TAPE LIMITED · HAYES · MIDDLESEX · TELEPHONE: HAYES 3888

WITH THESE
HEADS YOU WIN

A first-class pick-up need no longer be expensive. It must, among other qualifications, produce negligible record wear. For this, a low tip mass and high compliance are necessary. If these two factors exceed the required limits, serious wear will result however low the tracking weight.

Decca offers two groups of pick-ups which are justly renowned for their exceptional performance and negligible record wear.

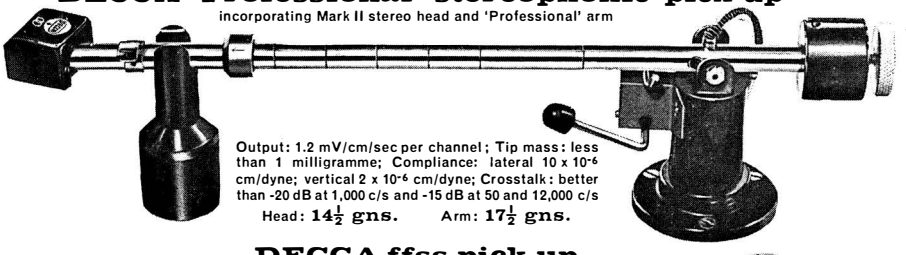
The Decca Deram pick-ups represent a major breakthrough. They are the first low-priced cartridges successfully placed on the market which almost eliminate record wear and yet do not require to be used with expensive amplifiers.

The Mark I magnetic pick-up is for use with high sensitivity amplifiers and for some months, now, a Mark II version of this head and a 'Professional' arm have been available.

Whichever of these heads you choose as meeting your needs you will have a winner.

DECCA 'Professional' stereophonic pick-up

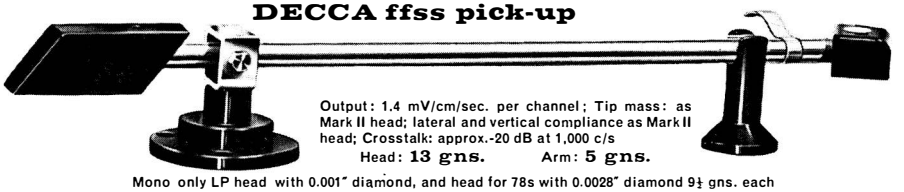
incorporating Mark II stereo head and 'Professional' arm



Output: 1.2 mV/cm/sec per channel; Tip mass: less than 1 milligramme; Compliance: lateral 10 x 10^{-6} cm/dyne; vertical 2 x 10^{-6} cm/dyne; Crosstalk: better than -20 dB at 1,000 c/s and -15 dB at 50 and 12,000 c/s

Head: **14½ gns.** Arm: **17½ gns.**

DECCA ffss pick-up



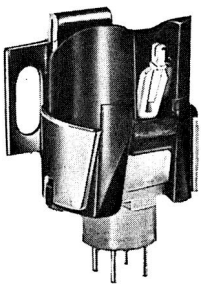
Output: 1.4 mV/cm/sec. per channel; Tip mass: as Mark II head; lateral and vertical compliance as Mark II head; Crosstalk: approx.-20 dB at 1,000 c/s

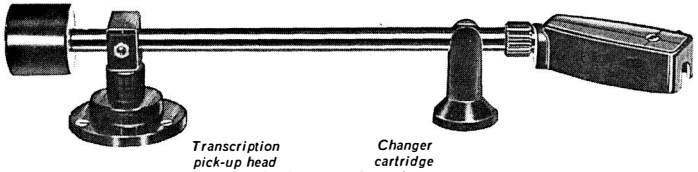
Head: **13 gns.** Arm: **5 gns.**

Mono only LP head with 0.001" diamond, and head for 78s with 0.0028" diamond 9½ gns. each

All these heads may be used on the 'Professional' arm, or the Mark II head on this arm

DECCA 'Deram' ceramic cartridges & transcription arm



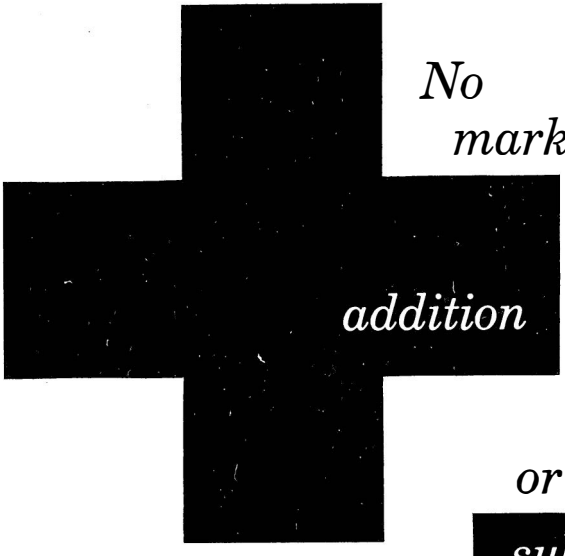


	Transcription pick-up head	*Changer cartridge*
Output	80 mV/cm/sec. per channel	
Tip Mass	0.6 milligramme	1 milligramme
Compliance lat.	7.5 x 10^{-6} cm/dyne	6 x 10^{-6} cm/dyne
vert.	2.8 x 10^{-6} cm/dyne	2.2 x 10^{-6} cm/dyne
Crosstalk	-18 dB at 1,000 c/s	-20 dB at 1,000 c/s
Stereo/mono heads	4½ gns.	3½ gns.
Mono only LP heads	4½ gns.	3½ gns.
Head for 78s (with sapphire stylus)	—	£2 : 17 : 6
Arm	5 gns.	—

All heads except the Deram changer cartridge for 78 rpm records are fitted with a diamond stylus.
All prices include purchase tax at January 1963 rates

DECCA

DECCA RADIO AND TELEVISION INGATE PLACE QUEENSTOWN ROAD LONDON SW8



or

subtraction

Philips Hi-Fi Equipment subtracts nothing from the original sound, adds nothing of its own. Full marks, in fact, for faithful sound reproduction. Select from anywhere in the range — a pick-up head, a record player, a loudspeaker, a complete tape recorder, magnetic tape — each item is a perfect example of dedication to an ideal : faultless sound reproduction. Many Hi-Fi authorities have spoken highly of Philips equipment. We think you will, too. See it at your Philips dealer's, or write today to the address below for details of equipment available.

Full marks for faithful sound reproduction

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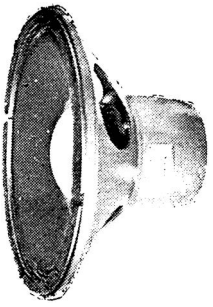
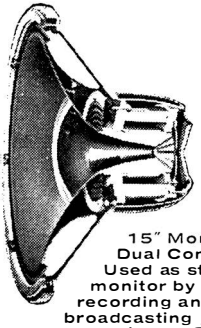
(PTR4188)

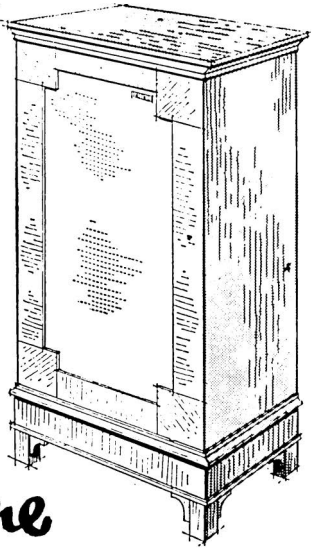


12" Monitor Dual Concentric. For highest quality Home music systems.

III LZ Monitor Dual Concentric. Ideal where space is restricted.



15" Monitor Dual Concentric. Used as studio monitor by recording and broadcasting companies.

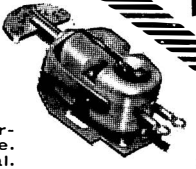


STUDIO STANDARDS *in your home*

The corner G.R.F. enclosure has for several years been regarded as a quality standard by professional users and music lovers alike. The introduction of a *free-standing model* built to the same exacting standards, not only increases its application to mono systems but makes it an ideal companion to the corner version in stereo systems of the highest quality.

TANNOY

LEFT: NEW—Pressure Operated Moving Coil Microphone. 25 cps-14Kcs. Omni-directional.
CENTRE: NEW—Velocity Ribbon Microphone. 25 cps-14Kcs. Symmetrical bi-directional characteristic.
RIGHT: NEW—Single Element Cardioid Microphone. Front to rear discrimination exceeding 15 dB. 25 cps-14Kcs.



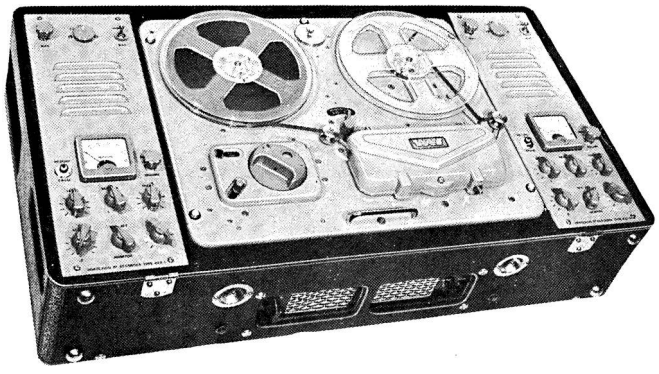
Variluctance Turnover Mono Cartridge. As used by the B.B.C.

Varitwin Stereo Cartridge. For high quality Home music systems.

One of the Tannoy Group of Companies

TANNOY PRODUCTS LIMITED, West Norwood, S.E.27. Gipsy Hill 1131

Vortexion—



quality equipment

The Vortexion C.B.L. Recorder is the latest stereo version of the twin C (recorder) using "B" type monitoring with mixing of inputs, stacked heads and over 6 watts total output. All the usual features of the "B" recorder are retained including metering of bias and signal plus the ability to record the signal from one track to the other together with additional signals from the mixed inputs. The separate 30/50 ohm microphone inputs allow for the microphones to be placed at any distance apart according to the result required. The right hand channel may be switched off entirely when only single channel working is required.
The Vortexion Super/30/50 Watt Amplifier is an extremely versatile unit capable of delivering 50 watts at 30 cps to 20,000 cps at .2% distortion. One model has tone controls, and 4 inputs which may be any combination of microphone (low impedance), guitars or P.U. inputs. The outputs are for 4, 7.5, 15 and 250 ohms or 100 volt line.

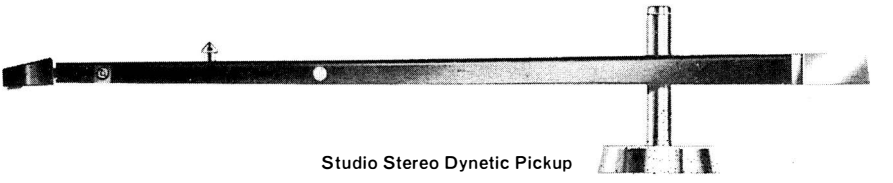
Other items of our manufacture are:—
WVA Recorder
WVB Recorder
Erase Fader units for recorders
2 way 30/50 ohm in and out stud type Mixers
3 way Mixers and Peak Programme meter
4 way Mixers
12 way Mixers
2 × 5 way Stereo Mixers
4 way Mixer with 10 watt output and tone controls
Record and Playback Mixer

VORTEXION LIMITED

257-263 The Broadway, Wimbledon, London, S.W.19

Telephones: LIBerty 2814 and 6242-3. *Telegrams: "Vortexion, Wimble, London"*

connoisseurs of audio equipment eagerly acclaim Shure components



Studio Stereo Dynetic Pickup

Shure audio components and microphones are world acclaimed for sound reproduction and re-creation of the very highest order. They are made only for the discriminating listener with the experienced ear to appreciate their true quality. If you seek nothing but the finest in audio equipment, you will want to write at once for the current Shure catalogue of pickups, cartridges or microphones.

Model 545
'Unidyne III'

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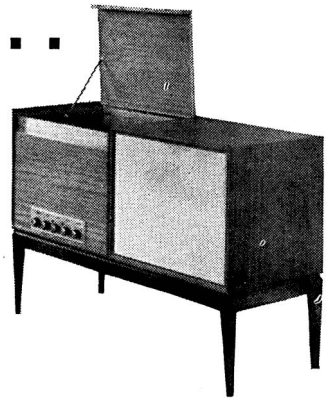
HI-FI CABINETS BY . . .



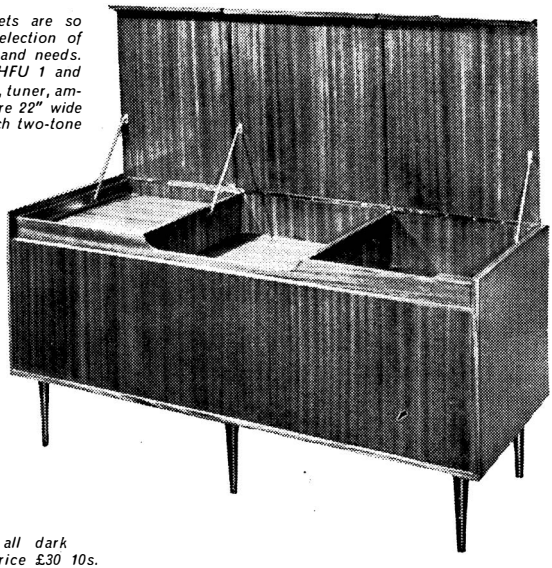
IMHOFS exclusive hi-fi cabinets are featured on the fourth floor at Imhof House . . . you will covet their craftsmanship, their excellence of finish in selected woods, their unique fitness for hi-fi purposes. You may have seen them at the Design Centre—they have also been proudly shown at exhibitions in London, in New York, and on the Continent.

IMHOFS

Type HFU 1/2/3

The Imflex Range of really attractive cabinets are so designed that you can arrange your own selection of units in a manner suited to your own tastes and needs. Shown here is a typical arrangement using HFU 1 and HFU 2 cabinets on a HFU 3 base, housing player, tuner, amplifier and loudspeaker. Both of the cabinets are 22" wide by 16" deep by 17" high and are finished in a rich two-tone mahogany, the matching base is 12" high. Other size cabinets and bases and special finishes are also available.

Prices HFU 1 £15 15s.
HFU 2 £16 16s.
HFU 3 £6 16s. 6d.

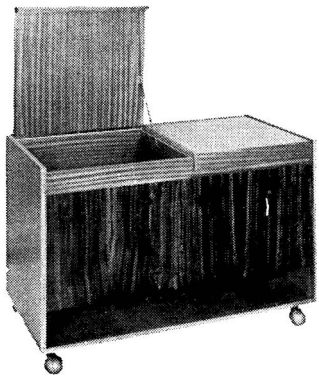


Type HFU 10

A handsome cabinet of surpassing elegance, finished in either sapele, mahogany or walnut. It will house transcription motor, tape deck, and amplifier, and is 50" wide by 21" deep, standing 25" high including 8" legs. Price for cabinet 38 gns.

Type L

This popular trolley cabinet, exhibited at the Design Centre, has ample room for newest equipment—it is 24" high (including castors), 18¼" deep, and 35½" wide. Standard finishes are walnut, mahogany and rosewood (as the photograph), all light mahogany, or all dark mahogany. Teak is a little extra. Standard price £30 10s.



ARE EXCLUSIVE

IMHOFS are world-famous experts in hi-fi, and can supply any worthwhile piece of equipment. You are cordially invited to IMHOFS hi-fi listening rooms, designed and built for sound perfection. There, by means of the unique Comparator, you can hear up to 4,000 alternative choices of equipment—mono and stereo—under ideal conditions.

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Dept. 4/63 112-116 New Oxford Street,
London, W.C.1. Telephone: Museum 7878

4/63

TELEFUNKEN tape equipment is first choice with major European radio stations. It should be, because TELEFUNKEN have more than a quarter century research experience behind their name, experience built into every machine. Select the recording that suits your requirements — there are nine models all full of exclusive features and great TELEFUNKEN quality. It's fine on its own, or coupled with your Stereo or Hi-fi equipment, to produce an integrated recording system. You will find TELEFUNKEN has sound quality taped!

CLEAR THE DECKS

This is the
MAGNETOPHON 85 DE LUXE.
New look, new magic-eye recording level indicator, new mixing facilities. 2 speeds—7½ and 3¾ ips. Frequency response 30-20,000 cps. ± 3dB; 30-15,000 cps; DC heated pre-amp valves. **83 GNS** (excl. microphone)

MAGNETOPHON 98 STEREO Twin-track Stereo; ideal for the recording enthusiast requiring high-quality trick facilities.
95 GNS (excl. microphone)

MAGNETOPHON 97 STEREO Stereo or 4-track recording and playback. Additional speaker in lid for stereo playback.
95 GNS (excl. microphone)

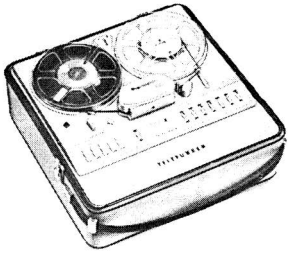
MAGNETOPHON 96 4-track plus full controls for trick recording, superimposing, intertrack transcription. Frequency response 30-18,000 (7½ ips), 30-16,000 (3¾ ips), 30-9,000 (1⅞ ips).
69 GNS (excl. microphone)

MAGNETOPHON 95 Twin-track, 3-speed. Frequency response as Magnetophon 96. Easy operation. **59 GNS** (excl. microphone)

FOR TELEFUNKEN

MAGNETOPHON 75K-15 6-hour playing time on 5¼" double-play tape. There is a wide range of accessories for this 2-track, 2-speed machine.
50 GNS (excl. microphone)

MAGNETOPHON AUTOMATIC Brilliant design eliminates most controls to make this a truly automatic machine. Marvel at it in operation.
50 GNS (excl. microphone)



And now, for high performance, top fidelity recording TELEFUNKEN introduce

MAGNETOPHON M26KL & MAGNETOPHON M24KL

These two machines bridge the gap between home and studio quality tape recorders. Extremely low wow and flutter on all speeds! The machines are identical in appearance, differing only in speeds. Both machines have separate record and playback amplifiers.
M26KL (price to be announced)
M24KL 209 GNS (excl. microphone)

TELE FUN KEN

TELEFUNKEN WORLD'S FIRST TAPE RECORDER
Write now for full details and new TELEFUNKEN brochure to
DEPT. Y1, WELMEC CORPORATION LTD, 147/8 STRAND LONDON WC2

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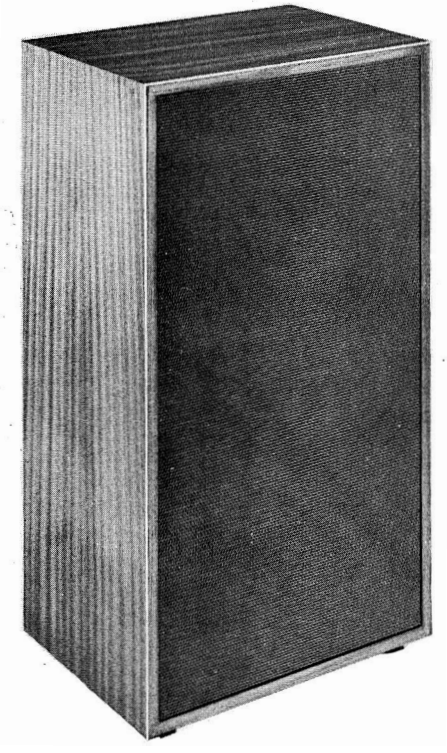
The specialists with the HI-FI know how



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DYNA-STATIC

Speaker of tomorrow success of today.

PRICE £45

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* *Our loudspeaker demonstrations are renowned throughout the Hi-Fi world.*
* *A large selection of superior equipment always available at competitive prices.*
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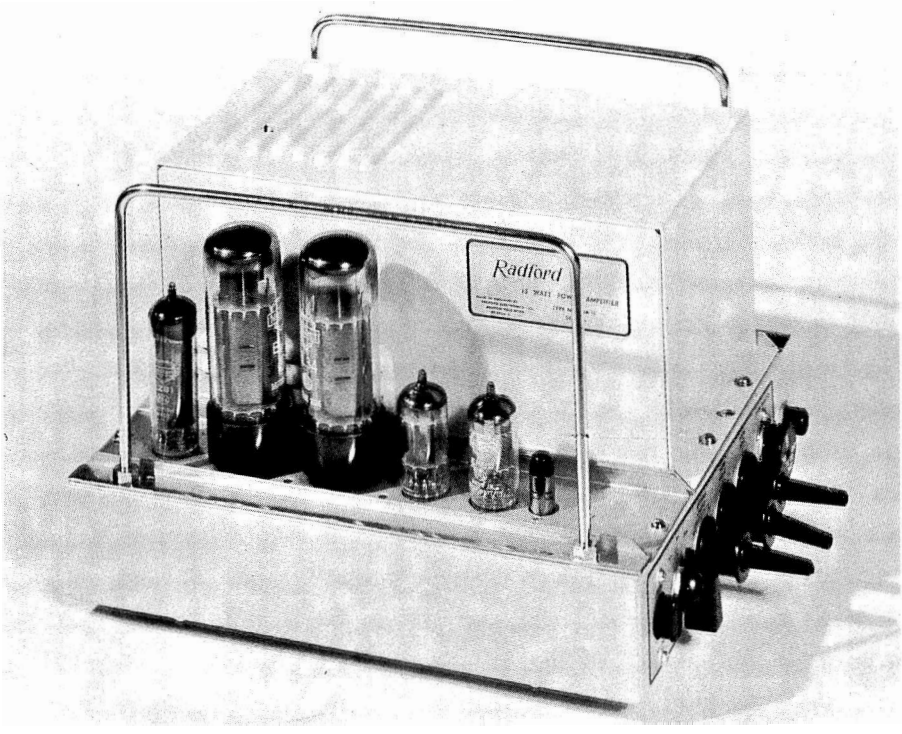
RADFORD ELECTRONICS



Illustrated—RADFORD MA 15 Mk. 11 amplifier, the design and construction of which was described in Hi-fi News, June to September, 1962.

A range of audio equipment of interest to the professional engineer, hi-fi enthusiast, and music lover is available. This includes amplifiers, pre-amplifiers (valve and transistor types) —available as complete units or kits. Ancilliaries include a range of loudspeakers, an FM tuner with multiplex, and a pick-up cartridge and shell. Of interest to the engineer is a Low Distortion Oscillator and Distortion Measuring Set.
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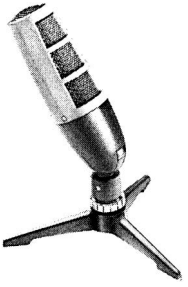

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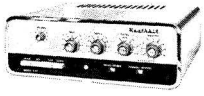

S-99

HI-FI STEREO AMPLIFIER Model S-99 Within its power rating this is the finest stereo amplifier available regardless of price. Printed circuit board, ganged controls, U/L push-pull-out, 0.2% distn. at 9 W/chan.

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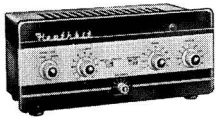

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HI-FI STEREO AMPLIFIER Model S-33H De-luxe version of the S-33 with many refinements. Ideal for use with Decca Deram pick-up. Two-tone perspex front panel.

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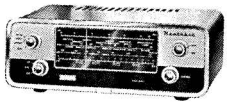

AM/FM TUNER

FM TUNER KIT For your convenience available in two units. Tuning Unit (FMT-4U **£2.15.0** inc. P.T.) with 10-7 Mc/s. I.F. output, and Amplifier Unit (FMA-4U **£12.6.0**). Built in power supply; 7 valves. Attractively styled. Total **£15.1.0**

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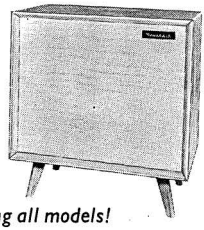

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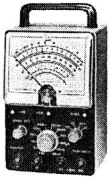

MM-1U

MULTIMETER Model MM-1U
Measures wide range of voltage, current, resistance and dB in over 20 ranges. Sensitivity 20,000 ohms/volt D.C. and 5000 ohms/volt A.C. 0-1.5, 1500 volts A.C. and D.C. 0-150 μA, 15A D.C. Resistance 0.2 ohms to 20 megohms. 4½" meter, 50 μA f.s.d. **£12.10.0**

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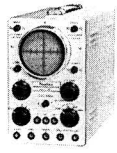

OS-1

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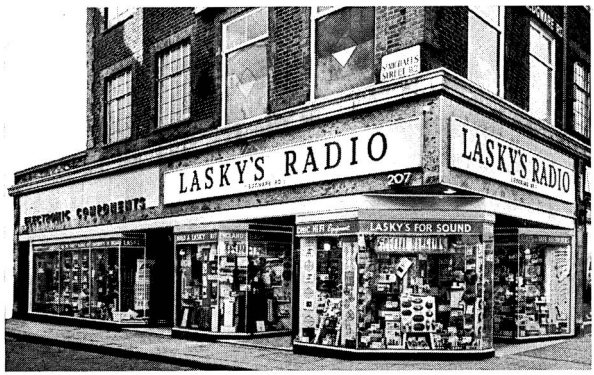

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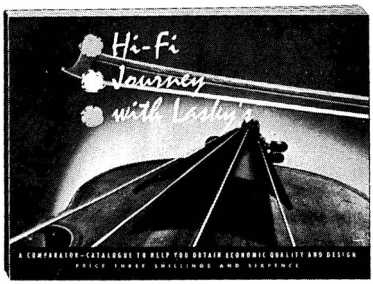

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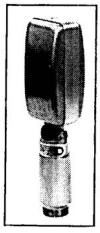
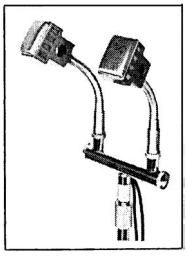


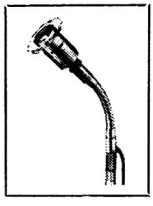
Studio Ribbon S.R.I.

Miniature Ribbon type R.B.



Stereo bar for microphones

Transistor Coupler type G.E.1.



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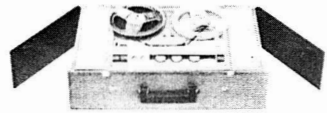

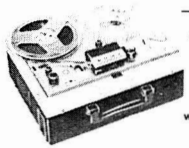

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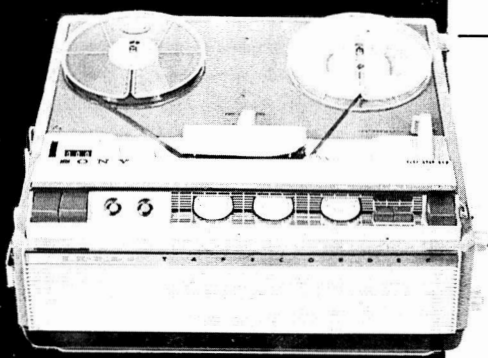

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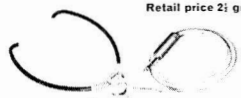

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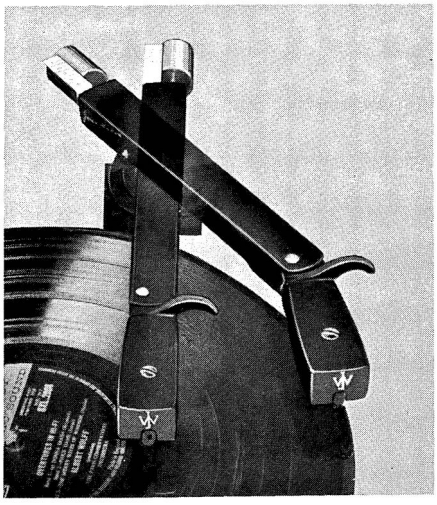

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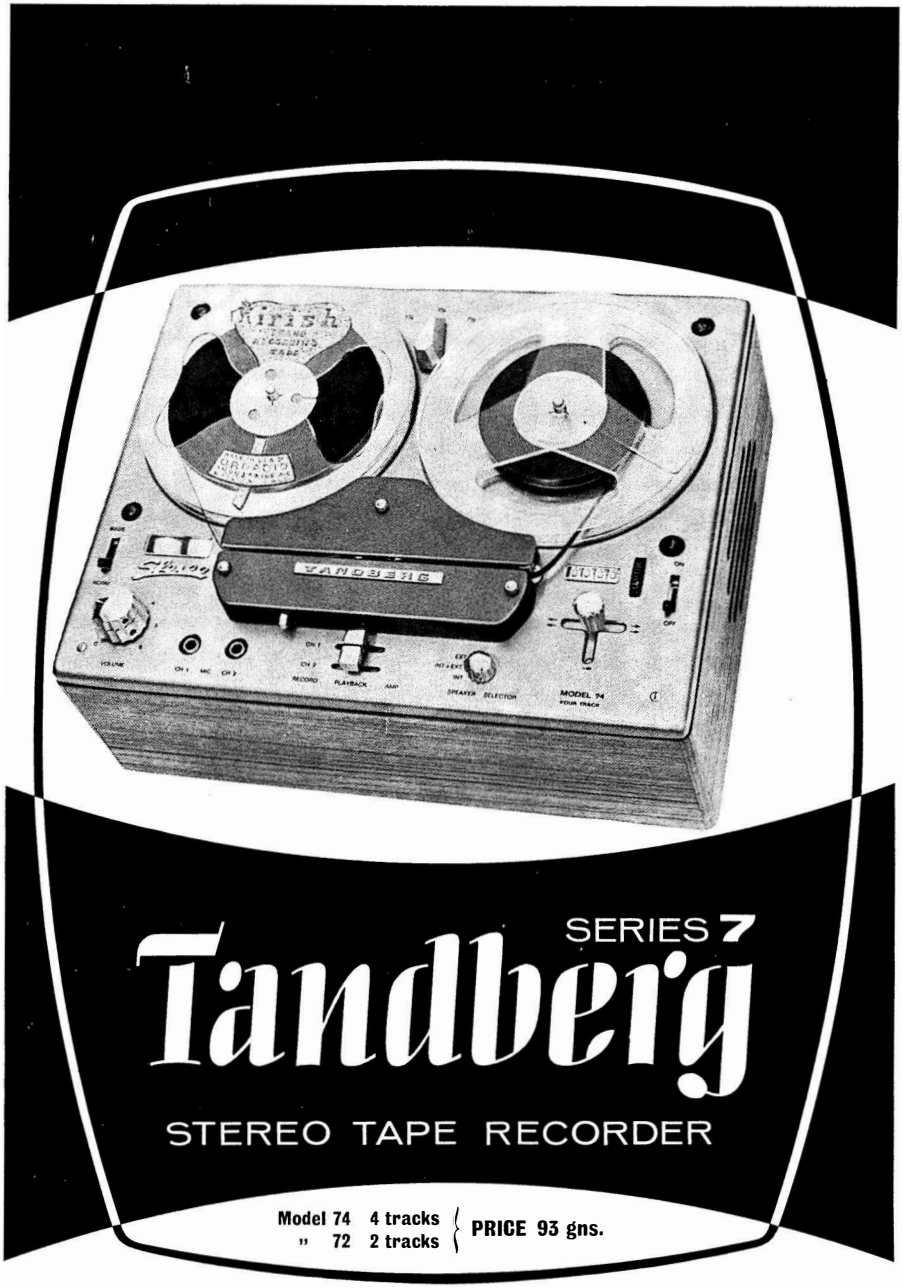

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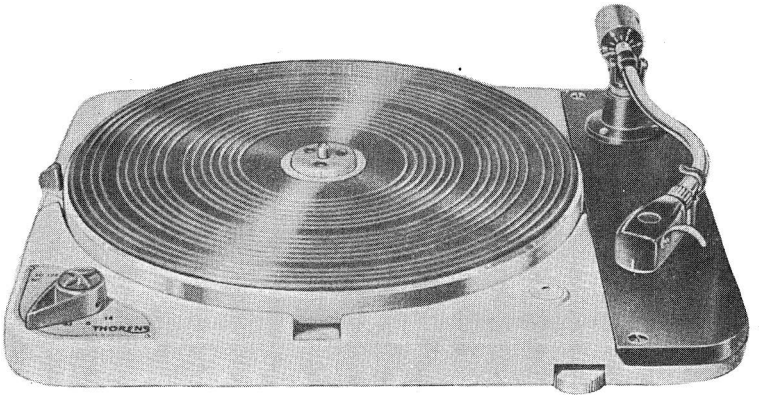

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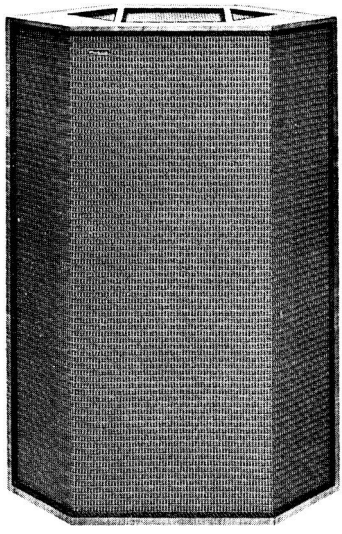

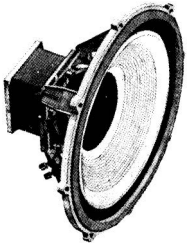

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ADVERTISERS' INDEX

NEW PRODUCTS AND LATE INFORMATION

Space was allocated at the end of this book for a few items of equipment which, it seemed, would arrive too late for classification. Notes to this effect appear in the various directory sections. We are glad to say that, through the co-operation of manufacturers and agents, all pictures and data were received in time for normal publication, and it was therefore possible to dispense with this unclassified section.

this

is a SAGA tape record

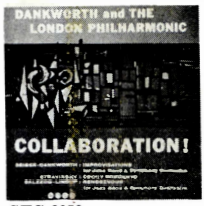
– to be exact, it is our "MESSIAH" Highlights (STE 3034, available in stereo only. The complete "MESSIAH" is available in mono only, STG 8051-3).

For those discriminating music-lovers who seek and value the original sound – Saga tape records are the answer. More permanently recorded, more precisely recorded, Saga tape recordings are the hi-fi devotee's only satisfactory answer. Saga tape records, both mono ($3\frac{3}{4}$ i.p.s. 32/6) and stereo ($7\frac{1}{2}$ i.p.s. 63/-) are the commonwealth's most accepted tape records.

Ask your nearest retailer for a free SAGA tape record catalogue.

Ask for SAGA by name

SAGA RECORDS LIMITED **127 KENSAL ROAD, W.10**



STG 8059
STE 3056* Stereo

STG 8043
STE 3052* Stereo

STG 8047
STE 3051* Stereo

STG 8063

STG 8057

STG 8033
STE 3033* Stereo