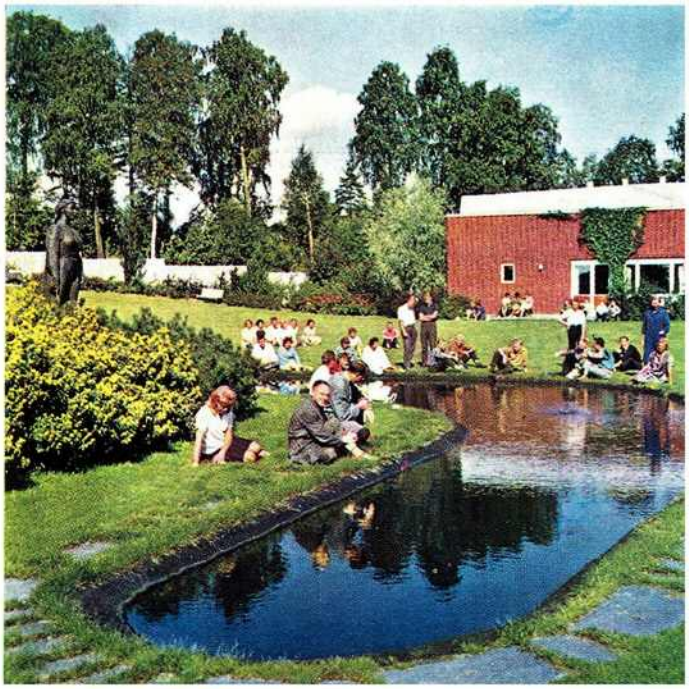
Amateur Tape Recording

VIDEO&HI-FI

December 1966 Vol 8 No 5 2/6



ATR VISITS TANDBERG, OSLO—Page 28

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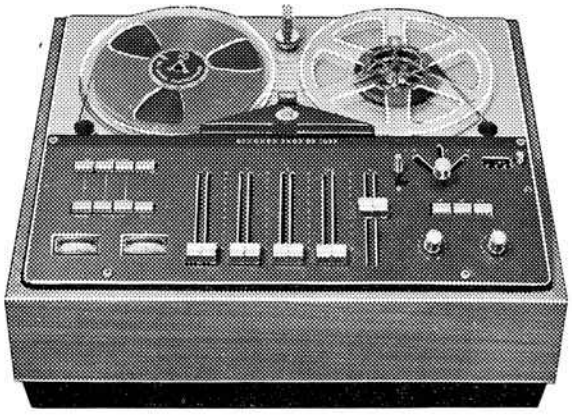

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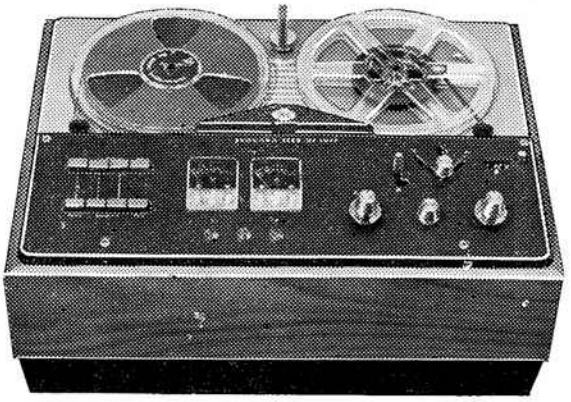

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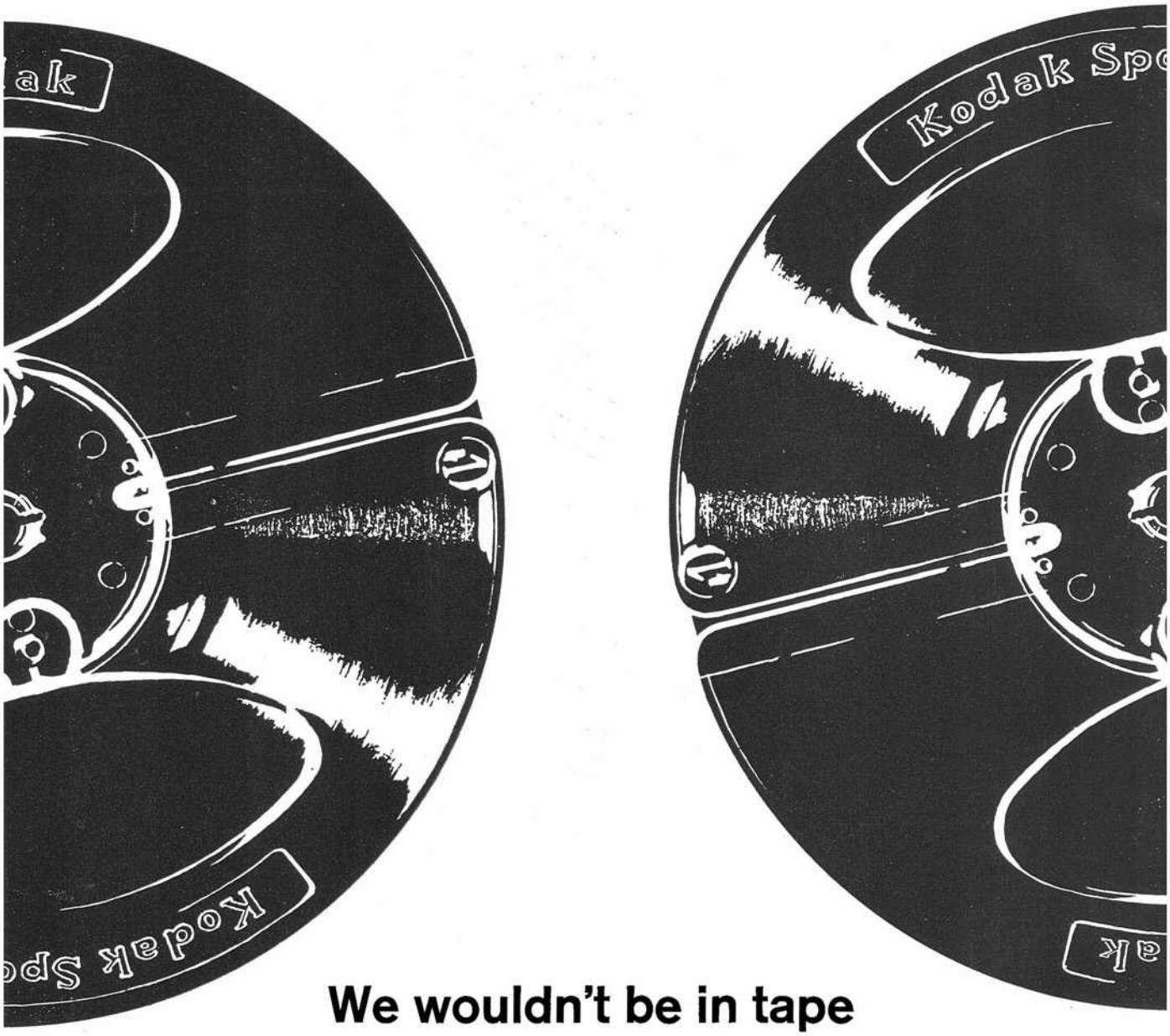

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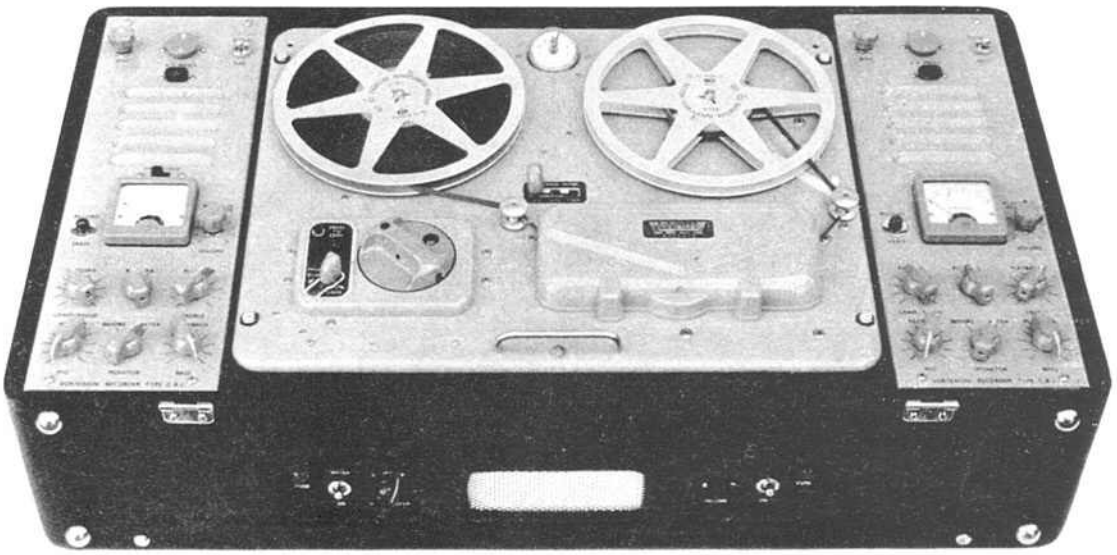

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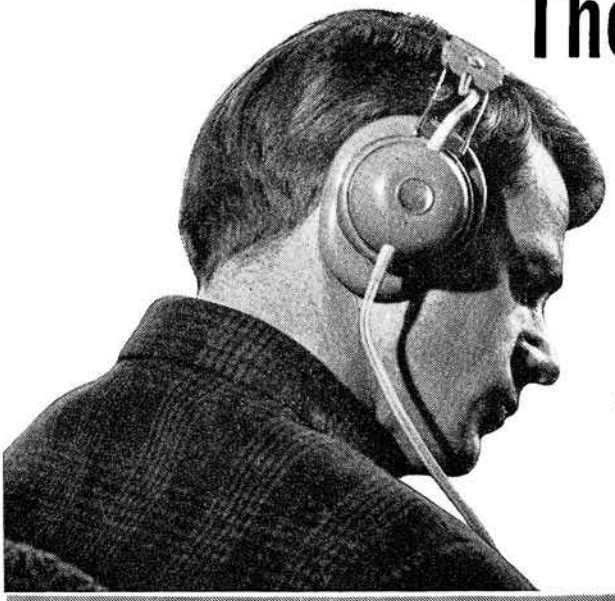

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Vol 8 Number 5 December 1966

EDITORIAL COMMENT

It is a few weeks yet to Christmas, but as this is our December issue, and incidentally, the seventh in my association with *ATR*, may I take this opportunity of wishing you all a happy Christmas. Special greetings also and '*mijn beste wensen*' to my newly made friends in Holland, some of whom are featured in this issue of *ATR* and who took part in the NVG Geluidsslipjacht on 1 October (see page 8). You may remember that in a recent Editorial Comment I said I was going to Holland to take part in this 'sound hunt'. Well, from the word 'go' it was an unqualified success and I mean just that. Nearly a hundred enthusiastic members of the NVG (Dutch National Sound and Photographic Society) assembled in Amsterdam for this special sound recording and photography day. What is more, they had the full co-operation of the Dutch Radio (Hilversum 2) and a Dutch national newspaper, *Het Parool*.

I must say I have yet to see the same kind of enthusiasm in this country. Could we get the BBC and a daily national newspaper to co-operate in an organized sound hunt in London? The tape recording enthusiasts in Holland have an eight-minute programme on Radio Hilversum *every* week! What about it, BBC?

Video Recording

This month we take another look at video tape recording in a survey which asks the question 'What's happened to video tape recording?' Perhaps this should have been 'What's happened to video tape recording for the amateur?' Equipment costing around £2,000 is all very well for professional purposes and full credit must be given to the manufacturers for producing it. On the other hand, can we regard even the new Sony TCV2000 which sells at just under £500, including camera and TV display screen, as being within a price range attractive and worthwhile, even to those with extra-deep pockets? The honest answer is 'no', but we feel that Sony have made a very good attempt to reach the amateur. If you do happen to have that extra-deep pocket then turn to page 13 and read the 'On Test' report and review on the Sony Videocorder by Peter Knight. FCT

FRONT COVER

ATR visits Tandberg

The picture at upper left shows the latest Tandberg Model 12 stereophonic tape recorder with twin 10 watt output stages.

Upper right: the Tandberg 'Factory in a Garden'.

Lower left: the beautiful ornamental gardens where Tandberg employees can relax during lunch breaks.

Lower right: this wall mural in the entrance to the factory symbolizes craftsmanship.

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GELUIDSSLIPJACHT 1966

The Editor goes sound hunting in Holland

2

For me this was a sound hunt which began at Southend Airport on a British United Airways Carvair and lasted until the end of the return journey by air from Rotterdam. For nearly a hundred Dutch tape recording enthusiasts, all members of the *Nederlandse Vereniging voor Geluid-en Beeldregistratie* (Netherlands Society for Sound and Photography), the search for sounds began on Saturday, 1 October, at 9.30 at the offices of a Dutch national newspaper, *Het Parool*.

Recording Assignments

By 10 am everyone was seated in the huge newspaper office canteen drinking coffee and talking, rather quietly I thought at the time. I was soon to discover why. At about 10.15 music from a radio receiver, tuned to the Hilversum 2 programme, was interrupted by an announcement concerning the *geluidsslipjacht* (sound hunt). Immediately all conversation ceased and nearly a hundred portable tape recorders were switched on to record the special programme. The announcements included a special welcome to myself and three other enthusiasts, two from Belgium and one from Germany. Then came the recording assignments for the NVG members. For the contest part of the sound hunt they had to go out and about in Amsterdam and interview a market or stores salesman, a typical Amsterdam taxi-driver and a single child or group of children. They also had to collect sounds from a newspaper office, the Netherlands railways and to record music in the streets. There was provision for one 'free' recording, i.e., any subject. For myself there was a special assignment – to proceed to Amsterdam Central Railway Station, which entailed another hair-raising car ride through the busy streets. Within minutes of arriving I was interviewed by a reporter from the Netherlands Radio, and half an hour later the interview was broadcast from Hilversum 2 Radio. So, determined to get a recording of it, I doubled back to my hotel, where fortunately the Hilversum 2 programme was included on the hotel room radio selector.

NVG Exhibition

This was by no means the end of the day for either the sound hunters or myself. In another part of Amsterdam, known as the Nes (Centrum), the Frascati Hall and an adjoining café had been hired for the day. Here an exhibition of NVG tape recording and photographic activity had been arranged, and this was where the sound hunters would finally assemble again during the afternoon to edit and listen to their tapes. One by one they returned and by mid-afternoon editing was well and truly in progress. All tapes submitted for prize winning were to be judged during the early part of the evening.

I left them all and went off to do a little sound hunting of my own, and there was certainly plenty to record. Amsterdam on a Saturday is a sound hunter's paradise. Everything seemed to be going on at once – parades, street organs, the town band, chiming clocks, popular tunes issuing from bell towers, the trams, the *Rondvaart* boats on the canals and the market places. The whole city was alive with people and sounds. I also had special permission to record and photograph the Netherlands Railways.

In the evening I returned to the Frascati Hall where lectures and films about tape recording were in progress. Towards the end of the evening the prizewinning tapes were played and the prizes distributed. I must say some really hard work and a lot of enthusiasm had gone into the whole project, which had resulted in some excellent recordings.

The photographs accompanying this report will, I hope, give some idea of sound hunting in Holland. The British United Airways flight from Southend to Rotterdam takes only an hour and hotels in Holland are not expensive. The highly efficient Netherlands railway will speedily convey you in comfort to Amsterdam, which, as mentioned before, is a paradise of sound. This is especially true at weekends, when you can also sample the night life in the Leidseplein area just south of Central Station. If you require permission to film or record Netherlands Railways you have only to write to the Railway Publicity Office, Netherlands Railways, Utrecht, Holland.

Next month we go to Paris 'on a shoestring' via the BUA Silver Arrow plane and train service, which takes just two hours from London Victoria Air Terminal to the Gare du Nord, Paris.

1

Illustrations

1. My companion, *ATR* reader John Ratcliff, interviews the BUA air hostess before the flight to Rotterdam (tape recorder Uher 4000 Report L with Sennheiser microphone type MD421 HN).

2. Recording the trains at Rotterdam Central Station.

3. NVG members book in for the sound hunt at the *Het Parool* newspaper office.

4. NVG members pose for a newspaper photo before going off on the recording assignments.

5. A member from Germany records some tram sounds. He also won first prize for the best recording of the day.

6. The town band plays in front of the Royal Palace every Saturday.

7. *ATR* editor F. C. Judd is interviewed by Joe Smidt (left), radio reporter from Hilversum 2 Dutch Radio. Note the popularity of Sennheiser MD421 microphones used by members of the NVG who were also recording the interview.

8. Amsterdam street organs are popular with everyone, including tape recording enthusiasts.

9. The tape recorder maintenance section of the NVG demonstrates deck mechanism adjustment to two visiting members.

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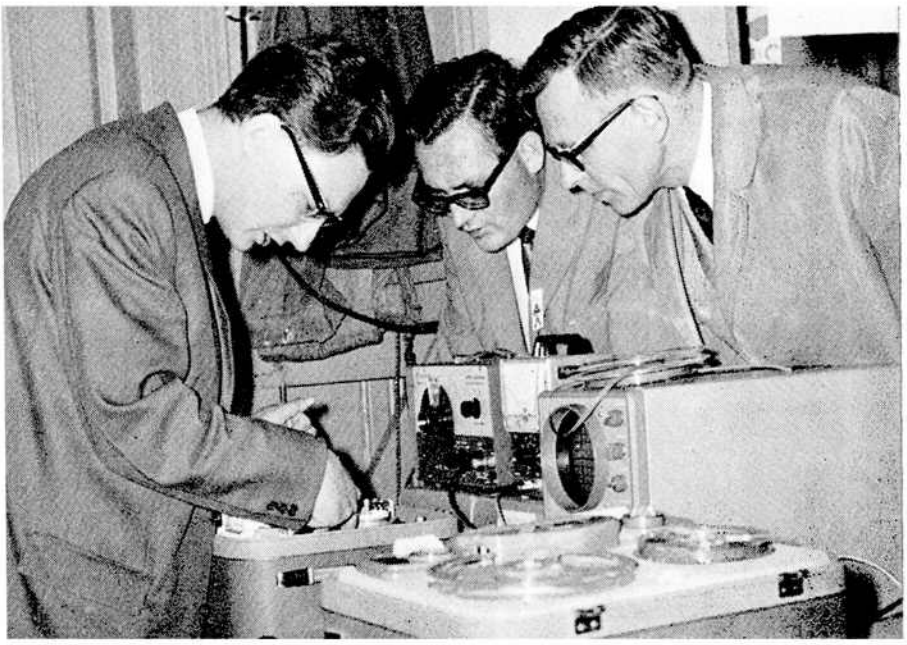

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WHAT'S HAPPENED TO VIDEO TAPE RECORDING?

Gordon J. King surveys the current video tape recording situation

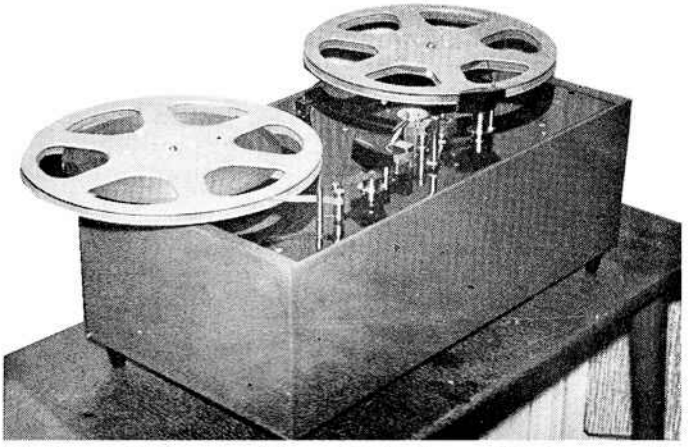

Fig. 1. Early Wesgrove kit-constructed home video tape recorder.

To provide the sufficiently rapid rate of change in signal at the picture tube modulation electrode to create a good quality 405-line picture, the video (vision or picture) amplifier must be able to handle without undue attenuation frequencies up to 2,700,000c/s. Theoretically, it should also respond to dc, but this is not absolutely essential since dc restoration circuits can be employed to secure this condition synthetically. Nevertheless, it must respond down to very low frequencies. This bandwidth influences the *horizontal definition* of the picture, while the number of lines of the picture fixes its *vertical definition.*

For a picture of optimum *overall definition* the horizontal definition should about equal the vertical definition. As the vertical definition is fixed by the number of lines of the system as a whole, the balance is attained by ensuring that the full video bandwidth is maintained right up to the picture (display) tube. The 405-line vertical definition, therefore, is balanced horizontally by the video signals extending towards 3,000,000c/s. If the video bandwidth is impaired the horizontal definition will suffer, but since the overall definition then also tends to unbalance, the picture is subjectively poorer than would be the case if the horizontal *and* vertical definition were reduced together. This is not possible since the vertical definition, as we have seen, is fixed by the number of lines. To balance the vertical definition of a 625-line picture the horizontal definition must correspond to about 4,700,000c/s.

The foregoing reveals the undesirability of operating a fixed-line television system with a video bandwidth below that required for the best overall picture definition. Indeed, it implies that by increasing the number of lines without arranging for a corresponding increase in video bandwidth and signal, the picture is likely to be subjectively poorer than when composed of the smaller number of lines. In essence, this is due to the greater velocity of the scanning spot on the face of the picture tube when the number of lines is increased; but we need not get too technical in this article.

To satisfy fully the horizontal definition requirements of a 405-line picture, therefore, a video tape recorder must have amplifiers responsive up to at least 2,700,000c/s and the signal recorded on the tape must also contain components up to this high frequency. The former represents no problem, but it is in recording such high-frequency signals magnetically that causes the head scratching. Many a back-room engineer has gone grey in trying to resolve this problem at a domestic level; it *has* been solved at a professional level, and most of our 'canned' television programmes come to us through the medium of video tape.

A high quality audio tape system using conventional techniques can record signals up to 1,000c/s at a tape velocity of $\frac{1}{2}$ ips. Thus, multiplying the velocity will multiply the top frequency, so that at a velocity of $7\frac{1}{2}$ ips the speed is multiplied fifteen times, giving a top frequency of 15,000c/s. A little arithmetic will show the incredibly high tape velocity needed to record up to 2,700,000 c/s on a conventional audio tape system. It works out to 1,350 ips. A 405-line picture can be resolved within a video bandwidth of 1,000,000c/s but the overall definition leaves very much to be desired, as may well be expected. Even a picture of this low definition would, however, call for a tape velocity of 500 ips, which is still mighty fast!

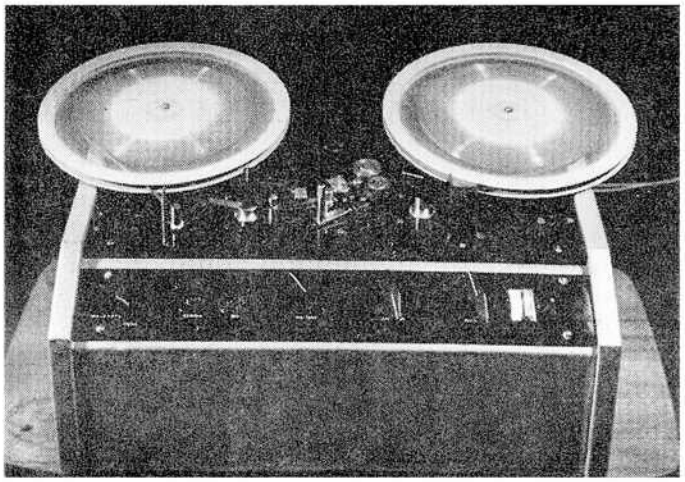

Fig. 2. A more sophisticated version of the Wesgrove video tape recorder.

Fig. 3. Showing the helical-scanning system of the Philips domestic video tape recorder.

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The Pioneers

Nevertheless, so-called *linear*, high-speed video tape recorders have been evolved for domestic applications at domestic prices (around the £100 mark) but, alas, not with a great deal of technical or, apparently, commercial success. One of the early pioneering firms created *Telcan*, which was all the rage in the Press and on television a couple of years ago, and this was followed by a machine of greater sophistication, but still relying on high, linear tape velocities, from a firm called *Wesgrove Electrics Ltd.* These machines were said to be available at the time either fully constructed or in the form of a kit of parts, and two versions of them are depicted in Figs. 1 and 2. The creators of these early models were highly enthusiastic members of a company concerned with the production of inexpensive closed-circuit television camera systems. It is this pioneering spirit that eventually leads to important, major breakthroughs but, unfortunately, not always to the commercial advantage of the pioneers themselves.

The Wesgrove VKR500 was a three-speed model for 90, 120 or 150 ips and it was claimed that, due to various developments in the recording system, signals containing components as high as 2,000,000c/s could be taped. A 2,000,000c/s video channel would give quite a fair picture on a domestic television receiver, and it was for such receivers that the VKR500 was designed. Even so, 150 ips is still fast – too fast for domestic comfort – and this high tape speed presented problems in terms of speed stability and wear on the heads. Picture synchronizing was also a problem and very careful and delicate setting-up was demanded. In spite of all this, these early models gave results and represented the first real breakthrough in inexpensive, domestic video tape recording.

Let us now see how a very high relative tape velocity, achieved with a head scanning system, is employed in the much more expensive domestic video tape recorders. Until now there have been two main firms producing these for sale in the UK, *Philips* with Model EL3400 and *Ampex* with Model VR7000. These models, although labelled *domestic* or *semi-professional*, cost about £900 and £1,400 respectively, *without* camera or monitor screen, and have much in common with the professional video tape recorders, costing many thousands of pounds.

Helical-Scanning

These domestic machines operate on the helical-scanning principle, in which the tape is transported from the left-hand spool to the right-hand spool, via a helical loop round a centre drum, instead of past the recording/playback head of the conventional system. This tape travel arrangement can be clearly seen in Fig. 3, which pictures the Philips recorder.

Since the helical path of the tape round the drum displaces the line of the tape, the left-hand spool is mounted a little higher than the right-hand one. The tape is retained in the helical path round the drum by guiding pins, and it is run through the system at a constant velocity of $7\frac{1}{2}$ ips by a capstan drive and pressure rollers.

Now, the video recording/playback head operates within the drum, and its active pole-pieces and gap protrude through a slit formed by two halves of the drum and it thus presses against the oxide side of the tape. The video head is arranged to rotate round the slit in the drum at a velocity of 50 revolutions per second. This means that the oxide side of the tape round the drum is 'scanned' by the head, but since the tape is itself also moving round the drum at $7\frac{1}{2}$ ips, each rotation of the head 'scans' the tape in the form of an equally displaced series of oblique tracks, as shown in Fig. 4.

Each obliquely recorded track is about 500mm in length, 150μm in width with a 30μm spacing between each one (i.e., centre-to-centre distance between two adjacent tracks is 180μm). This technique yields an effective head-to-tape velocity of over 1,000 ips (1,500 ips with the Ampex VR6000 which has a linear tape velocity of 15 ips), thereby making it possible to record and playback signals well up to 2,500,000c/s, representative of high-definition 405-line video signals.

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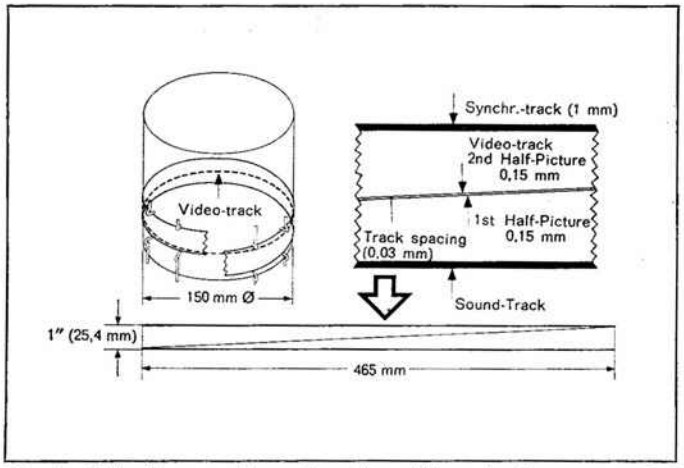

Fig. 4. This diagram shows how the oblique tracks are recorded on the tape with the control or synchronizing track at the top and the sound track at the bottom. A fully interlaced picture is composed of two fields and each field is recorded on one oblique track, the two adjacent tracks thus making up a complete picture.

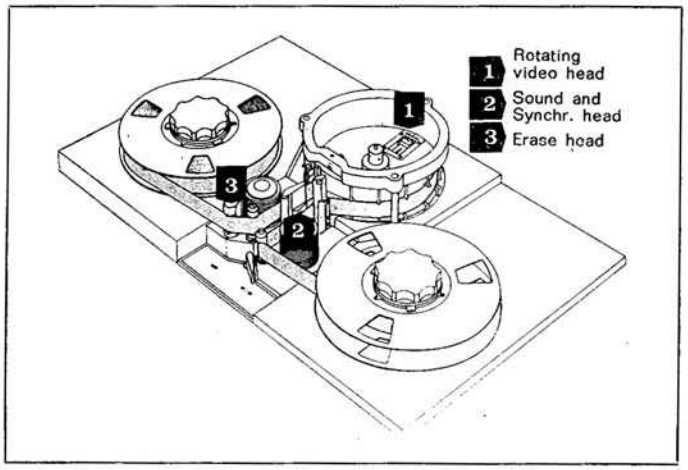

Fig. 5. This diagram shows the disposition of the heads in the Philips recorder.

Fig. 6. The Akai cross-field system is used in this recorder, Akai Model VX1100.

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What's happened to video tape recording?

continued from page 11

However, since a series of tracks is recorded, tape economy is preserved and, in fact, the Philips EL3400 gives the same playing time per length of tape as any ordinary audio recorder running at 7½ ips. The difference lies in the width of the tape, which for the helical-scanning video machines is four times wider than ordinary audio tape. Fig. 4 shows that two additional tracks are recorded linearly along the extreme edges of the tape. One of these carries the sound accompaniment in the conventional audio manner, while the second carries synchronizing signals to 'lock' the servo-operated drive motors at the highly constant and synchronous speed demanded for television recording and reproduction.

On the Philips machine, both the tape drive and the video head drive motors are 'speed-controlled'. This means that, should they tend to deviate from their true speed, a control potential (or signal) is created which quickly restores accuracy. The control potential on recording is derived from the field sync pulses of the television signal proper, and these are also recorded on the control track. On playback, the reproduced pulses can thus again be used to derive the control potential, thereby ensuring perfect synchronism. The control track can, in fact, be considered in the same light as the perforations controlling the speed of a cine film through a camera or projector.

A great advantage of the helical-scanning system is that one complete revolution of the video head 'scans' one complete field of picture. Thus, by halting the linear tape drive while leaving the video head rotating on playback, a still picture is obtained of that particular field, since it is continuously scanned.

Like audio recorders, video recorders must have a means of erasure. The helical-scanning machines, therefore, have four head systems, the rotating video head, the sound head, the sync head (which may be common with the sound head) and the erase head. The disposition of these heads in the Philips machine is shown in Fig. 5.

One more point before leaving the Philips and Ampex models: the video signals are not recorded in the raw, as it were, on the tape; they are caused to frequency-modulate a carrier and it is this carrier as a whole that is recorded on the tape. On playback, an FM detector is used to restore the 'raw' video signal. This technique avoids the use of hf bias which would be difficult to handle in the normal audio manner, video-wise.

Following in Telcan's footsteps, there are manufacturers producing and developing domestic video tape equipment based on the linear system of tape travel, devoid of the complications of a rotating video head. The beginning of this article detailed the limitations of this system, mainly in terms of fantastically high tape velocities. However, since Telcan went into production, various artificies have been evolved for recording higher and higher frequencies at nominal tape velocities, and some of these have already reached fruition, notably the cross-field system of tape recording.

Cross-field Video Tape Recorder

This system, pioneered by *Akai* and used in some of their audio recorders, can record and reproduce up to about 33,000c/s at a tape velocity of 1 ips. Thus, by using a tape speed in the order of 30 ips signals up to about 1,000,000c/s can be recorded and reproduced. This, in fact, represents the basic specifications of the Akai video tape recorder, Model VX1100. The cross-field system uses a second head for applying the bias signal to the tape, and this head is opposite that used for recording and playback and also slightly out of line to avoid the biasing field partially erasing the recorded tape, which is one of the reasons for the limited frequency responses of the conventional tape recording system.

Since linear recording is adopted, the Akai uses ordinary ¼ inch audio tape of good quality, and the sound accompaniment is recorded normally on a second track. Moreover, as the video and audio tracks are representative of the width of a four-track audio recording, the tape can be turned over for the second half of the taped programme in accordance with ordinary two-track audio practice. The complete Akai video tape recorder is shown in Fig. 6, and this delivers a video signal suitable for applying to the video amplifier stages of domestic television sets. While the limited video bandwidth may, on the face of it, appear to be a disadvantage, the great advantage of the recorder lies in its simplicity, and it should certainly provide the enthusiast with many hours of enjoyment.

Fig. 7. The new Sony video tape recorder employs a tape speed of 7½ ips and a rotating head record/playback system.

A relatively inexpensive rotating video head system will shortly be available in this country from Sony. It will cost about £500 complete with monitor screen and camera and tripod. It employs ½ inch tape and two rotating heads with the tape passing through the system at 7½ ips. The heads rotate at 30 revolutions per minute, and one of them records every other field of the television picture (it will be recalled that a complete television picture is composed of two fields, each of half the number of lines of a complete picture, with the lines of one field interlaced with those of the other).

Sony Bandwidth Halving System

On playback, both rotating heads are used in a clever arrangement whereby the second head re-scans the same field as the first one. This produces a picture of 405 lines which appears to be fully interlaced, whereas in actual fact the picture is composed of two fields of the same 202½ lines. In other words, each field is reproduced twice, thereby minimizing flicker and picture line effect, while also halving the bandwidth requirements. In this latter respect, the relative tape-to-head velocity can be halved for an overall picture definition. It will be appreciated from what has already been said that the Sony principle is a compromise helical-scanning system which falls more towards the average domestic market than, perhaps, the Philips or Ampex machines. But, of course, for this one gets only half the picture quality – but, then, the price is also very much lower.

The Sony system comes complete with a monitor receiver which can serve as an ordinary television set if required, and which will deliver suitable off-the-air television and audio signals for recording (Figs. 7 and 8). There is also a television camera and tripod, the video equivalent of the microphone and stand of the sound recording system. A detailed test report on this Sony Videocorder appears on page 13 of this issue.

It is known that other manufacturers are shortly to bring forth domestically-priced video tape recorders, which will certainly be investigated by *ATR*. Indeed, it is now very apparent that practical video tape recording for home use is here at last – and at a price that some of us can afford. There will now arise a new generation of tape recording enthusiasts, interested in the integrated aspects of video and sound. And at the present rate of development it will certainly be less than a decade before the old-hand or newcomer will be showing off *in colour* his hi-fi video tape recordings of his holiday in Spain.

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ON TEST THE SONY TCV2000 VIDEOCORDER

by Peter Knight

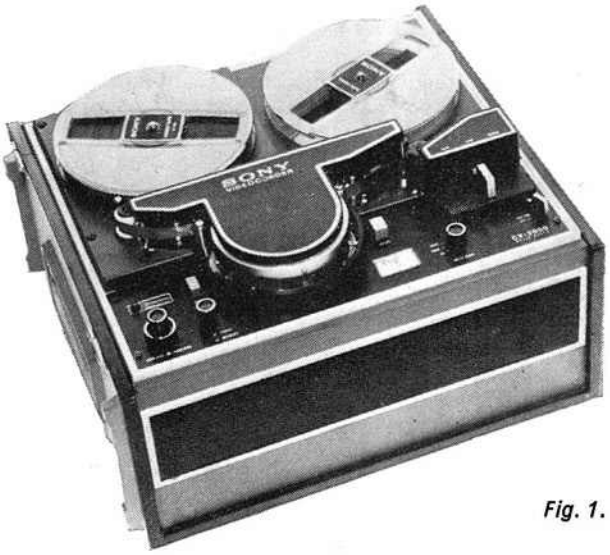

Fig. 1.

The Sony video tape recorder certainly represents a dramatic breakthrough in home television taping. For the tape enthusiast it provides a medium with a creative potential many times greater than that of sound alone. The Sony TCV2000 is no gimmick. It really works – and works extremely well. For years now engineers all over the world have been striving to develop an easy-to-operate television tape recorder with home appeal, which remains stable for long periods of time without constant re-adjustment and which is little more expensive than, for instance, a good quality stereo recorder.

Video tape recording can never be as cheap as sound recording – tape being one of the least expensive ways of storing sound (and vision) – because in addition to the recorder one requires a complete television camera system, with lenses and tripod, along with a picture display unit, which is a rather special television set. On top of all this, of course, one must have a microphone and loudspeaker for the accompanying sound recording and playback. The Sony handles sound and pictures on the one tape and on the one machine. Another thing which makes video tape recording more expensive than sound only is the tape. This must be of high oxide quality and is usually wider than ordinary sound tape, $\frac{1}{2}$ inch tape and 7 inch spools being used on the Sony. Sufficient tape for an hour's performance costs £12 0*s* 0*d*.

The actual recorder is no larger than a good quality sound-only recorder (Fig. 1) but the system which was tested was housed neatly in a carrying case together with the picture display unit which is shown separately in Fig. 2. The camera complete with lens, tripod and connecting leads was housed in a separate, smaller carrying case. The picture display unit is hinged and can be set to three viewing positions, vertically, horizontally (i.e., fully submerged into the case) or between the two. The approximate overall dimensions of the case with the display unit horizontal are 27 × 17 × 10$\frac{1}{2}$ inches high. The recorder alone measures approximately 16 × 14 × about 10 inches high. The complete set-up as shown in Fig. 3 will cost around £367.

The display unit is a slightly modified (internally) version of the Sony transistor television set. The size of the screen is 9 inch diagonal and this sells for about £90. The modifications, fitments and the carrying case could probably amount to about £50, which makes the price of the recorder alone in the region of £227. For a good quality video tape recorder this is certainly not an unreasonable price. On top of all this, though, one would want a camera system. A transistor camera with telescopic tripod and standard lens (1·9 to 22 and 25mm) in a case with leads, etc, adds about an extra £131 to the bill. This means that the system as a whole costs almost the same as a Mini car. Other machines in the domestic fringe cost at least twice as much.

The Videocorder Facilities

The Sony system does four things. One, it serves as an ordinary 405-line television display for BBC1 and ITV. Two, it records TV programmes (sound and vision) direct on tape and replays them with slight loss in overall quality. Three, it serves as a closed-circuit TV system. That is, the TV screen will show what the camera 'sees' even though the machine is not recording. And four, it records the camera signal together with a microphone signal (for the accompanying sound) direct on tape and replays with virtually no loss. Fig. 2 shows test card 'D' on the TV direct off-air. This has incredible definition, and on the original photograph, though probably not on the printed version on this page, the 3Mc/s frequency gratings (bottom right-hand set of gratings within the circle) are visible. The 2·75Mc/s gratings are defined at full contrast. This implies without any doubt at all that the vision channel bandwidth of the receiver is equally as good as the best domestic TV set.

Fig. 2. The display unit for recorded and direct tv pictures.

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Scan linearity, response characteristics and other technical factors concerned with TV are also very well presented.

The off-air signal in Fig. 4 was recorded and played back and Fig. 5 shows the results. On the original photograph the 2Mc/s frequency gratings are well revealed and the 1·5Mc/s gratings at full contrast. This display indicates that the overall vision response of the system is in the order of 2Mc/s. Subsequent frequency response tests into the camera circuit, on to the tape and to the set's video input gave a response characteristic of 1·8Mc/s between the half-power points with very little response ripple which could lead to overshoot and ringing (i.e., black-after-white and white-after-black) on the picture. The replay of test card 'D' is considered to be remarkably good for a machine of this nature.

An off-air picture (ITV on Channel 9 about 40 miles from the station with indoor aerial) is shown in Fig. 6. This was recorded and the result is given in Fig. 7. While there is some obvious loss in horizontal definition, the picture is well up to entertainment standard and is representative of many pictures viewed up and down the country on domestic receivers (i.e., vision bandwidth of about 2M/cs). Excellent results were also obtained direct from the camera (the system operating as a closed-circuit TV). Here the subject was sitting about 8 ft from the camera with the lens set to f/1·9 and was illuminated by a 375-watt floodlight. Close-up pictures can be obtained with even greater improvement in definition.

There is one thing about testing video tape recorders – the results can actually be *shown* in the report. Of course, there could be some errors in the photography itself, but the pictures submitted here are totally unretouched. A fine line of picture interference is visible towards the top of the picture in Fig. 7. This developed somewhere in the recording/playback process (not on the recorded signal), and one or two flashes of interference of this kind were noted during the tests. It is understood from the distributors, however, that they probably resulted from oxide particles round the head system, as the machine had been in considerably active use for a number of weeks prior to the review test and had not been cleaned or serviced.

The Video Camera

Fig. 8 shows the camera mounted on the tripod. The picture viewing frames at the top can be folded down when the camera is not in use. Any 16mm lens can be used with the camera, and that supplied for the test was the 'standard' fitment, ranging from f/1·9 to f/22 and able to focus from a foot or so to infinity. Extension camera leads are available, allowing the camera to be used at a greater distance from the recorder than provided by the normal leads. Apart from the optical focusing on the lens, the camera has an electronic focus control at the rear. This is normal on TV cameras for focusing the electron beam in the camera tube. There is also a beam-current preset, but once this is adjusted the beam current is controlled automatically by the light intensity, thereby allowing a wide range of light intensities to be handled by the camera without the need to frequently adjust the optical iris (i.e., stop down).

Signals from the camera are fed to the recorder through a multi-cored cable with DIN-plug terminations, and the power supply for the camera electronics and the camera tube heater is obtained via a separate cable which plugs into a camera power supply socket at the rear of the recorder. The tripod is the type well known to professional photographers: it has light-weight, metal telescopic legs and easy-to-work vertical, horizontal and axial shifts.

The Television Display

The front of the television display unit can be seen clearly in Fig. 2. The screen is 9 inch (extreme) diagonal, and the front panel carries the ordinary TV channel selector and fine tuner, the volume control and a slide-switch for changing from TV to VTR. This allows the picture display instantaneously to be changed from ordinary off-air TV to a taped programme, and vice versa. The switch operates both the vision and sound circuits simultaneously.

Fig. 3. The complete Videocorder outfit.

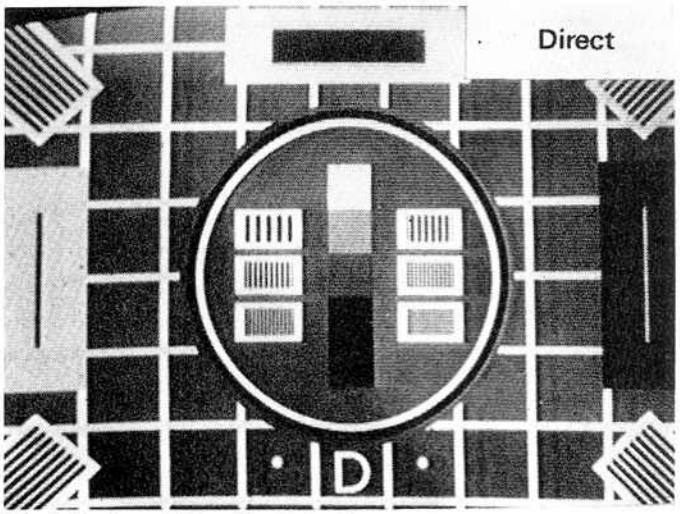

Fig. 4. Test card 'D' – direct viewing.

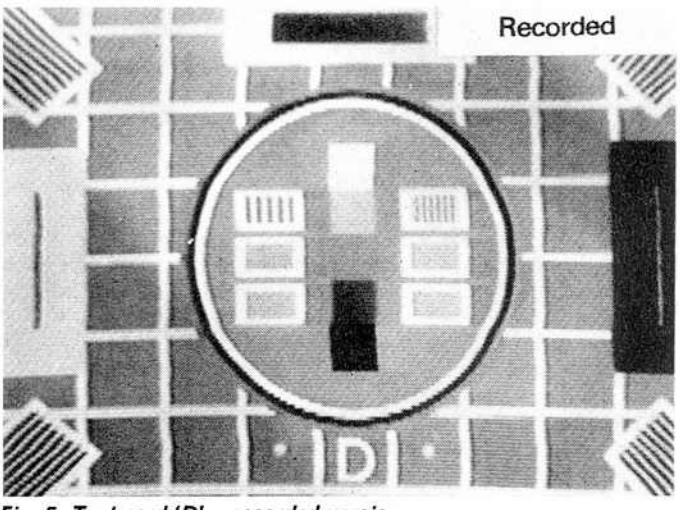

Fig. 5. Test card 'D' – recorded version.

The Video Tape Recorder

The heart of the recorder is the video head system. This is shown in detail in Fig. 9. There are two video heads, mounted in opposition each side of a rotating arm. The arm and heads

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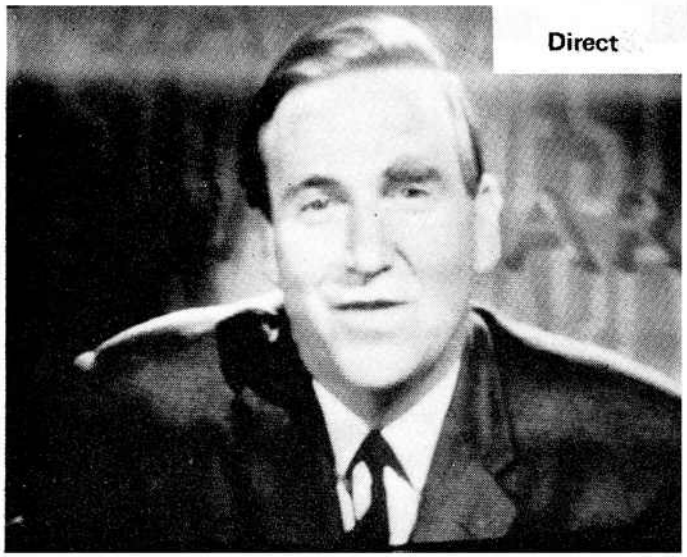

Fig. 6. Off the air' picture – direct viewing.

Fig. 7. Recorded 'off the air' picture (as Fig. 6).

operate inside the large drum shown, and round the middle of the drum periphery is a slot through which the active poles of the heads appear so that they are each alternately in light, physical contact with the oxide side of the tape for half a rotation of the arm.

Because the tape is transported around the drum in the nature of a helix, the tape width is scanned diagonally, first with one head and then the other. Connection from the heads to the recorder circuits is made by the three metal brushes that can be seen operating on contact rings at the top of the assembly. One connection to the two heads is made common, which is why there are only three (not four) brushes and rings. On record only one of the heads is used, and because the arm carrying the heads is rotating at a velocity of 25 rpm, a half of a revolution takes one-fiftieth of a second, which is equal to the period taken by one *field* of television picture. One complete *frame* (or picture) consists of two interlaced fields (see Fig. 10), which means that a complete frame occurs every twenty-fifth of a second (that is, twenty-five pictures per second).

Ordinary transmissions provide for the lines of one field to fall in the gaps between the lines of a subsequent field, as shown in Fig. 10. A 405-line picture, therefore, has 202½ lines per field, two interlaced fields giving a frame of 405 lines. In practice, not all the lines are used to carry the picture information, as some of them occur during the field blanking period when the screen illumination is suppressed. Actually about eight lines per field are lost in this way.

Clearly, then, the head which is switched in during the time that a video tape is being recorded gives one diagonal track on the tape (bearing in mind that the tape is being transported round the drum at the same time as the head is rotating) exactly equal to the time taken by one field. Thus, the picture information carried by all lines of a field are recorded on one diagonal track. When the recording head leaves the tape half way round the drum the subsequent field occurs, but this one is *not* recorded. Only every alternate field is recorded. The recording head pole is arranged to produce tracks on the tape of a width that makes adjacent ones almost touch, as shown in Fig. 11. These tracks correspond to every other field.

On playback both heads are switched into operation. This means that both heads 'read' the information on the diagonal tracks. The width of the tracks and the synchronizing are such that one field of information is 'read' first by one head and then by the second head a fiftieth of a second afterwards. A complete frame is thereby produced consisting of two fields of the same information interlaced!

This is a very clever idea, for it means that a complete frame of about 400 lines is composed of picture information consisting effectively of only about 200 lines. The vertical definition is, of course, impaired by this technique, but it does represent a closer match to the horizontal definition which is in any event limited by virtue of the signal bandwidth. It can be considered as an artifice allowing a smaller video bandwidth to match the vertical definition, while not reducing the actual number of lines on the picture.

The rotational speed of the video head system is synchronized by a servo arrangement, and to facilitate this a control signal is recorded on the top edge of the tape, while the sound track is recorded on the bottom edge (see Fig. 11.) Fig. 12 shows the control and sound head (this being a stacked assembly with poles adjusted to track a top and bottom edge on the tape). This picture also shows the capstan and pinch roller in some detail, and these are seen to be very similar to those used in audio-only recorders. To cater for the slight twist of the tape due to its helical path round the drum, the in and out tape guides are tapered.

The capstan is driven by a powerful, synchronous motor, locked to the mains frequency and the tape is transported at a velocity of 7½ ips. The relative video head to tape velocity, of course, is far greater than this due to the heads rotating against the direction of the tape. Owing to the need for a very high tape/head velocity to record video-frequency signals, early video tape recorders suffered from very speedy wear of the head poles,

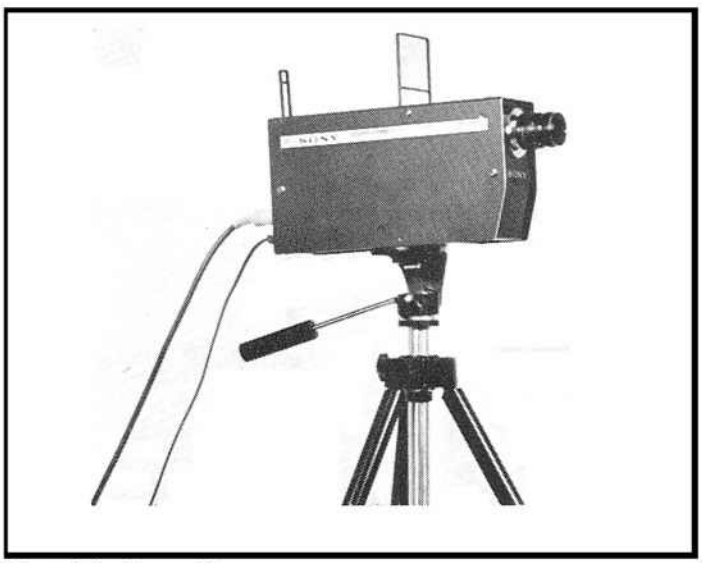

Fig. 8. The Sony video camera.

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distorting and widening the gap. It is understood that this problem has been combated in the Sony model by a special head pole-piece-making process in conjunction with special ferrites. It is claimed that this technique gives a head life of up to some ten times that of ordinary video heads.

Control Signals

The control track is recorded from the field sync pulses of the television signal. These, of course, are present on ordinary TV transmissions (serving to lock the picture steady on the screen) and are generated in the television camera. As the head assembly rotates within the drum, pulses of electricity are generated in a small winding fixed to the drum (this can be seen at the front of the drum in Fig. 9). These pulses are produced electro-magnetically by a piece of shaped metal passing close to the winding pole pieces as the arm rotates. Thus, the pulse rate is a measure of the speed of the heads.

These pulses are compared with those recorded on the control track of the tape in a discriminator. There is no output from the discriminator when the head-assembly-generated pulses coincide with those of the field. However, should the pulses tend to go out of step, due to the head rotating too fast or too slow, a control voltage is developed by the discriminator and this is fed to the servo which corrects the rotational speed of the head. In this way the head speed is accurately synchronized.

Controls and Electronics

Before the tape enters the machine it passes an erase head to clear it of previous recordings. This head, its guides and the tapered guide mentioned earlier, can be seen in Fig. 13. This picture also shows the main on/off button and the digital tape counter with zeroing press-button. The main controls of the deck include a large lever which provides 'play', 'stop' and 'wind', and another for fast 'forward wind'. To *record* the 'record button' is depressed and the deck lever pulled to 'play'. A special meter indicates ac voltage to the machine, video signal level and audio signal level, the required indication being selected by a control to the right of the meter.

The sound recording and playback follow conventional practice, as do the recording of the field pulses on the control track. The video signal, however, is not recorded direct, for the signal is first frequency-modulated on to an internally generated carrier, and it is this carrier so modulated which is recorded on the video tracks of the tape. When the tape is played back the extracted frequency-modulated video is fed to an FM detector, whence the video signal is obtained, and after equalisation and amplification it is fed to the display unit as pure video signal. The video delivered by the recorder has a peak-to-peak composite amplitude of 1·4 volts, with negative-going sync, making it suitable for the video stages of 405-line TV sets.

The machine is certainly no more difficult to work than an average audio tape recorder, and there is no difficulty whatever in securing good pictures from camera or TV direct. The synchronizing is extremely good, with no tendency towards field slip or line tearing. The display unit features all the ordinary television set controls, which need no explanation here. Both sound *and* vision can be monitored while a recording is being made, so one is always assured that the best picture signals possible are going on to the tape. The fact that pairs of lines of the recorded picture contain the same information is not noticeable, but there is a very, very slight vertical displacement which could have some bearing on this.

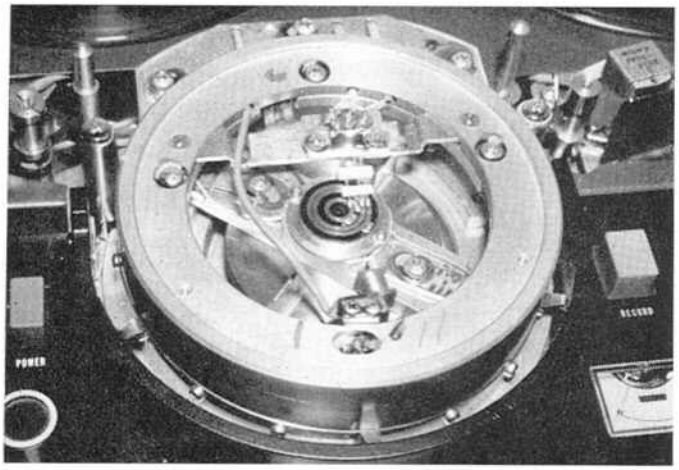

Fig. 9. Detailed view of the video recording head.

The tape supplied with the test machine gave 30 minutes programme time and at the end of the tape an auto switch closed the machine down. The noise level of the deck transport mechanism and head drive is a little above that of an ordinary audio recorder, but not distracting – rather like the noise from a cine projector. An outstanding point was the freedom from picture grain, which indicates that the specified 40dB signal/noise ratio is definitely not inflated. Indeed, it would seem that the ratio was more like 46dB subjectively.

Video tape recorders must have very good wow and flutter performance to keep the pictures steady on the screen, and one could definitely not argue with the 0·25% rms value for this given in the specification. In view of obvious video channel equalization, with possible hf emphasis, there was no sign of ringing or overshoot on the picture, so there was no point in making square-wave tests of the video sections – the pictures tell all.

This is most certainly a fascinating machine and, moreover, it is in a price range that could well encourage the popularizing of home video taping. It has much to offer above ordinary silent cine, and the fact that it can record TV programmes (albeit, unlawfully) is another big factor in its favour. There are two minor criticisms. One, the insensitivity of the microphone and/or microphone channel and, two, the fact that the machine in its present form cannot feed direct into the aerial socket of the

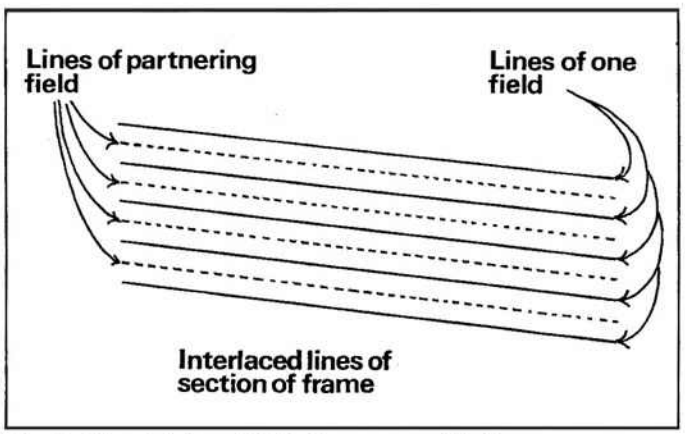

Fig. 10. How interlaced fields form a complete frame.

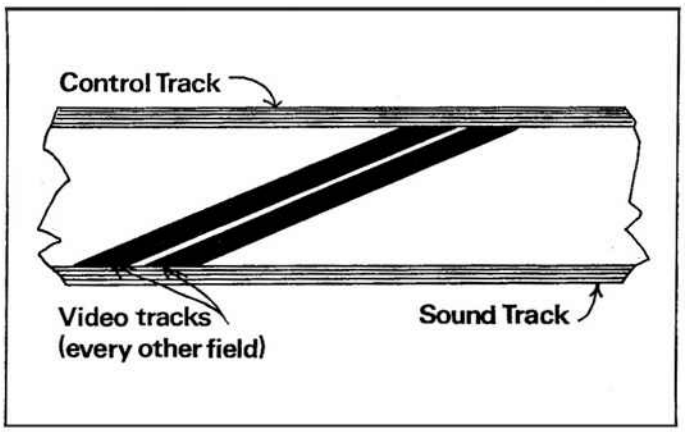

Fig. 11. How the video tracks are recorded on the half inch wide tape.

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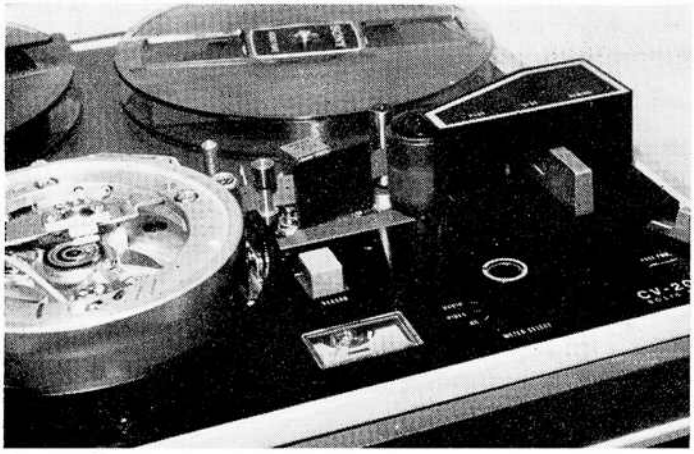


Fig. 12. Tape transport and deck controls.

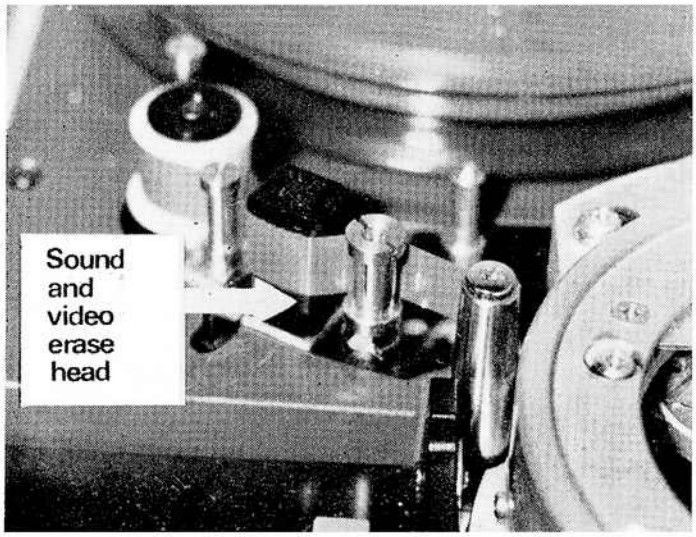


Fig. 13. Sound head and tape-guides.

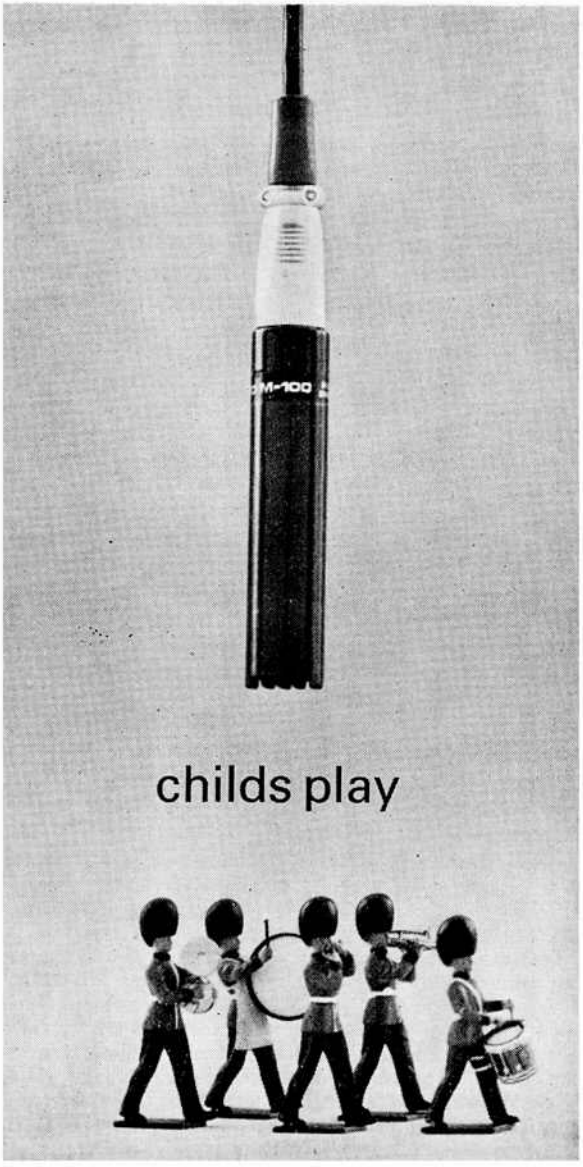
domestic TV set. The sound aspect could probably be cleared by a different microphone, but the TV connecting aspect would require an rf generator delivering sound and vision carriers modulated with the audio and video, the carriers being set to a channel in Band I. This is not an unduly difficult problem, and it is understood that it is, in fact, being currently investigated by the distributors, Debenhams of Gloucester. A unit of this nature would give the machine even greater domestic appeal, since almost everyone has a TV set, so why buy another?
The scope of this machine from the educational, medical, commercial and defence aspects goes without saying . . . but here we are concerned only with its domestic applications, which should now be apparent.

Makers' Specifications

Deck: Two rotary heads and helican scanning with edge control and sound tracks. *Servo:* Slow electro-magnetic. *Tape Speed:* 7½ ips ±0·2%. *Tape Width:* ½ inch. *Record Time:* 60 minutes. *Fast Winds:* 7 minutes. *Start Time:* Picture stable within 6 seconds. *Power Requirements:* 80 watts maximum. *Motor:* One single-phase hysteresis synchronous. *Erase:* Full track.

Video Section: Double sideband FM recording. *Input:* 1·4V composite p-p video negative sync, 75 ohms unbalanced. *Output:* 1·4V p-p composite video negative sync, 75 ohms unbalanced. *Signal/Noise Ratio:* 40dB.

Audio Section: *Input:* 600 ohms, unbalanced microphone, –60dB. *Line Input:* 10Kohms unbalanced –20dB. *Output:* 5Kohms unbalanced 0dB. *Frequency Response:* 80 to 10,000c/s ±6dB. *Distortion:* 5%. *Signal/Noise Ratio:* Better than 40dB. *Wow and Flutter:* Less than 0·25% rms. *Transistors:* 50 plus 28 semiconductor diodes and 1 thermistor.



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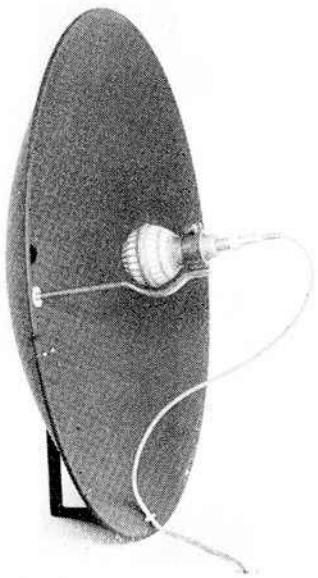

Fig. 1. The Grampian parabolic reflector fitted with a DP4 microphone and windshield.

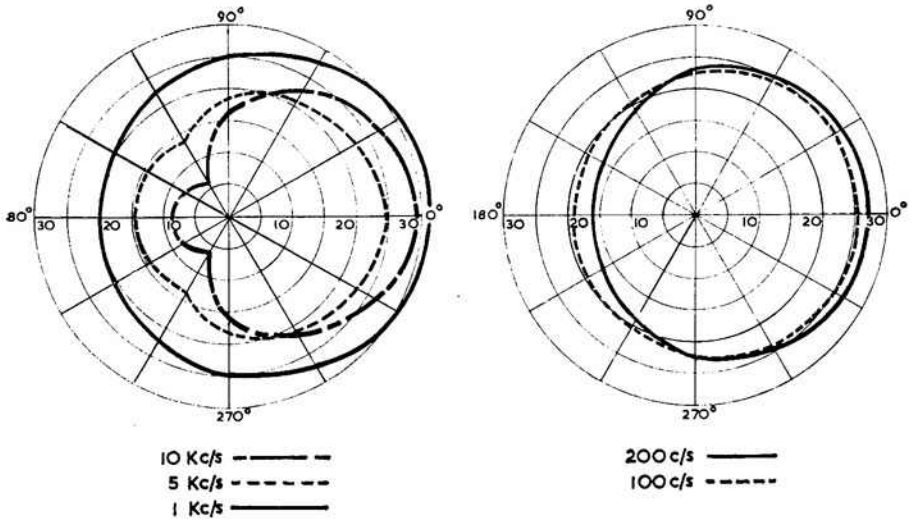

Fig. 2. Typical polar responses of a cardioid microphone. Taken from the Grampian cardioid microphone type GC1 (courtesy of Grampian Reproducers Ltd.)

SOUND SCENE LOOKS AT MICROPHONES

There are many different kinds of microphone, each with different characteristics, but none directly comparable in performance with the human ear. The small crystal microphones supplied with most domestic tape recorders are as a rule good enough for ordinary speech, but are not really suitable for music recording. There are, however, high quality crystal and ceramic microphones now available with a smooth frequency response which will make good recordings of music performed live. On the other hand it is surprising how certain sounds can be completely spoiled by using an unsuitable microphone (or a poor tape recorder). For instance, a recording of an express train will be little more than an unintelligible clatter should a cheap crystal microphone be used. The high-pitched hiss of steam and the deep rumble of the wheels would be lost completely. These are the sounds that identify the train and if they are not present such a sound could well be mistaken for a similar one such as running machinery. All in all, the better the microphone the better the recording, whether the recorder itself is cheap or expensive; the best advice is to *use the best quality microphone and the best quality recorder you can afford.*

Microphones fall into three main groups: (1) pressure-operated microphones; (2) velocity (pressure-gradient operated); and (3) combined microphones (cardioid). The pressure microphones which are usually moving-coil electromagnetic, crystal or ceramic types are the most widely employed because of their versatility and comparatively low cost. Condenser microphones are also pressure-operated but are normally extremely expensive and little used by tape recording enthusiasts. The sensitivity of pressure-operated microphones is generally higher than that of velocity microphones.

From the point of view of reliability the pressure microphone undoubtedly heads the list as the most useful one to the recording amateur. Pressure microphones are, generally speaking, omni-directional, which means that the area over which they will pick up sounds extends all around the microphone, i.e. the sensitivity for all directions is constant. They have one disadvantage and this is their inability to eliminate sounds reflected from walls or to differentiate between wanted and unwanted sounds. They are, however, probably the most ideal for outdoor work since they are not over sensitive to wind noise. To obtain directional effects out of doors a parabolic reflector (Fig. 1) can be used. This also helps to locate and amplify a single sound and at the same time to exclude a good deal of unwanted sound from other directions.

For music recording a velocity ribbon microphone or a cardioid microphone is undoubtedly the most ideal. Both these microphones have directional characteristics enabling one to reduce unwanted sound and room echo. The very smooth and wide frequency response of a good quality ribbon microphone makes it eminently suitable for high quality recording, but when used for speech or singing care must be taken to avoid close proximity to the microphone in order to prevent undue emphasis at the lower frequencies. The cardioid microphone has a frequency response which is equally smooth but does not always extend so far down to the lower frequencies as the ribbon microphone. The word 'cardioid' refers to the heart-shaped directional characteristic shown in Fig. 2.

Stereo Microphones

The ideal stereophonic microphone is usually composed of two ribbon units placed one above the other and set at an angle of 45° with respect to a centre line. The microphone is normally placed centrally to the sound source although when recording music some care must be taken with the placing of the

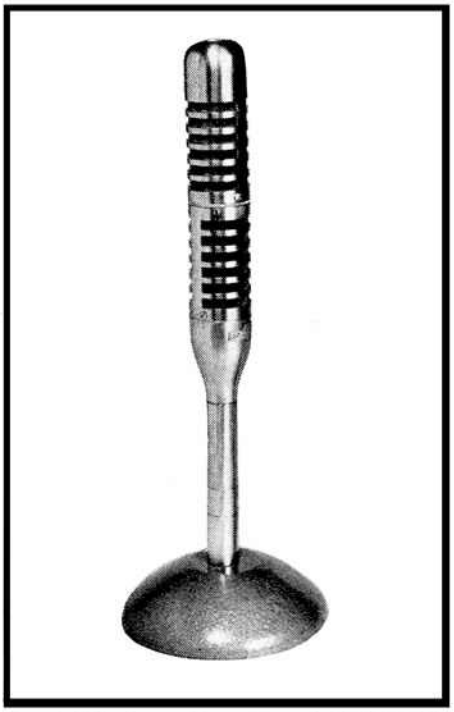

Fig. 3. The Lustraphone 'Stereolus' VR/65NS stereo microphone.

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various instruments. The Lustraphone 'Stereolus' stereo mic is shown in Fig. 3.

Frequency Response and Impedance

The frequency response and sensitivity of a microphone depends somewhat on its cost. Generally the cheaper the microphone, the narrower the frequency response. Probably the most important characteristic is the *impedance*. Many tape recorders nowadays have a microphone input impedance of around 200 ohms and there is a wide choice of microphones with this impedance. When you purchase a new microphone make sure that you know the input impedance at the microphone socket of your tape recorder or mixer. It does not follow, however, that a microphone of that exact impedance must be purchased. For instance one could use a low impedance microphone of, say, 25 ohms with an input impedance of 30 to 50 ohms. A microphone with an impedance of 200 ohms could be used with input impedances between 150 and 400 ohms without any undue loss. Low impedance microphones can, of course, be matched into high impedance microphone sockets by means of a suitable matching transformer. Crystal microphones which normally have a very high impedance must be matched into a socket of approximately equal impedance. One of the great advantages of low impedance microphones is that they can be used with long cables but if high impedance crystal microphones are used with long cables there is a risk of frequency and sensitivity loss.

Some Popular Types of Microphone

From our microphone directory, published in this issue, we have selected some representative types that are popular with tape recording enthusiasts. Undoubtedly the crystal and ceramic microphones are the most popular because of their comparatively low cost, but there are a few types available, such as the Acos MIC 39/1 (crystal) and the Acos MIC 60 (ceramic), which are capable of excellent reproduction, even of music. They can also be recommended for outdoor work and are fairly robust. For higher quality reproduction without excessive low frequency response, e.g. oversensitivity to wind noise, the magnetic or dynamic microphone should be considered. One of the most popular of these is the Grampian DP4 which is shown in Fig. 4 fitted with a Grampian windshield. The DP4 is available with impedances of 25, 200, 600 and 50,000 ohms and retails at £8 5*s* 0*d* for the 25 ohm model and £9 5*s* 0*d* for the others. The windshield costs 17*s* 6*d*. Film Industries also make an excellent moving coil microphone – the type M7 at £8 15*s* 0*d*. From the Lustraphone catalogue we have chosen Model LH/59 shown in Fig. 5. This is a lightweight microphone with a press-to-talk switch.

Ribbon Microphones

The real advantage of the ribbon microphone is its wide, smooth frequency response and a polar pattern that enables one to reduce unwanted sound to a minimum. The ribbon microphone is essentially a microphone for high quality recording indoors. One of the very popular ribbon microphones is the Reslo miniature broadcasting type VRP which will be reviewed shortly in *ATR*. Grampian also make a fairly inexpensive ribbon microphone, the type GR1 shown Fig. 6. This is available with various impedances and comes complete with screened lead and connector at £10 10*s* 0*d*. The table stand shown in the photograph costs £1 3*s* 6*d*. The frequency response of the GR1 series is 40 to 15,000c/s.

Another ribbon microphone popular with the high quality enthusiasts is the Film Industries type M8 shown in Fig. 7. This retails at £9 9*s* 0*d*. and has a frequency response of 35–13,000c/s. The table stand costs £1 5*s* 0*d* and the flexible stem complete with cable costs £2 2*s* 0*d*.

Cardioid Microphones

These are generally more expensive and favoured by the more discriminating recordist who wants to make high quality speech and music recordings. Provided the low frequency response does not extend too far down, the cardioid microphone is suitable for outdoor recording. Your reporter uses the Shure 55S ribbon cardioid quite frequently for outdoor as well as indoor work. It costs £23 13*s* 4*d*, has a smooth response from 50–15,000c/s and will match into 50, 250 or high impedance inputs with its built-in matching unit. There are cheaper cardioid microphones available but these mostly have a rather too limited low frequency response. They are, however, very good for speech recording. In this brief survey of microphones we have covered only a few of the hundreds of microphones now on the market. Our directory in this issue lists all those microphones which we think will be of interest to tape recording enthusiasts. In addition, we have included an extra page showing a few more of the popular types (see page 23).

Fig. 4. The Grampian DP4 microphone fitted with a windshield.

Fig. 5. The Lustraphone LH/59 magnetic moving-coil hand microphone.

Fig. 6. The Grampian GR1 ribbon microphone complete with table or desk stand.

Fig. 7. The Film Industries M8 ribbon microphone complete with table stand and flexible stem.

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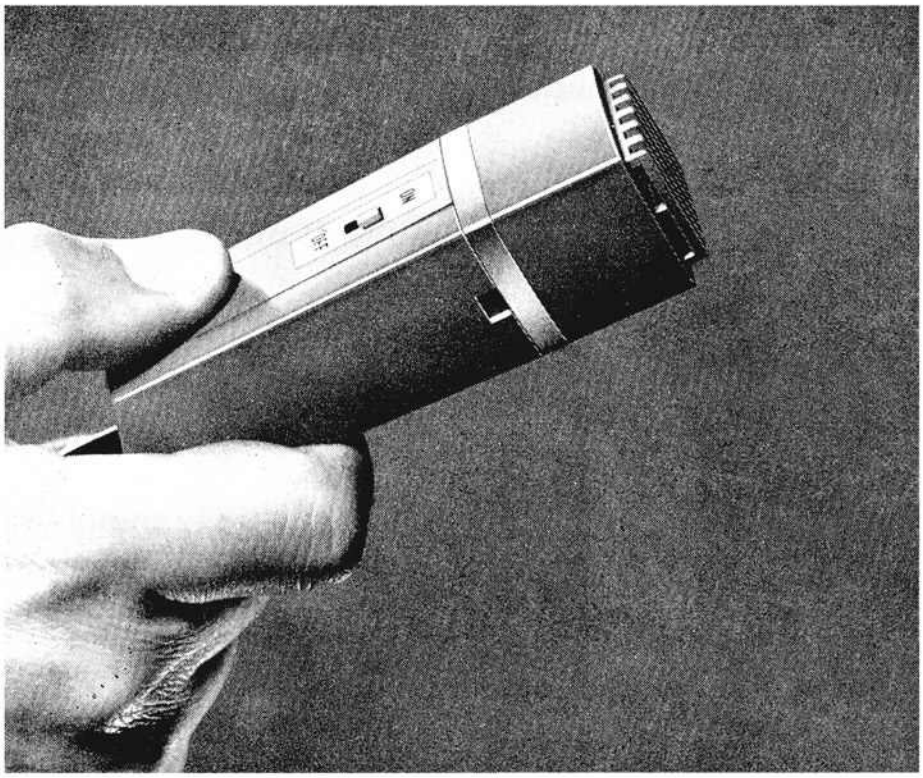
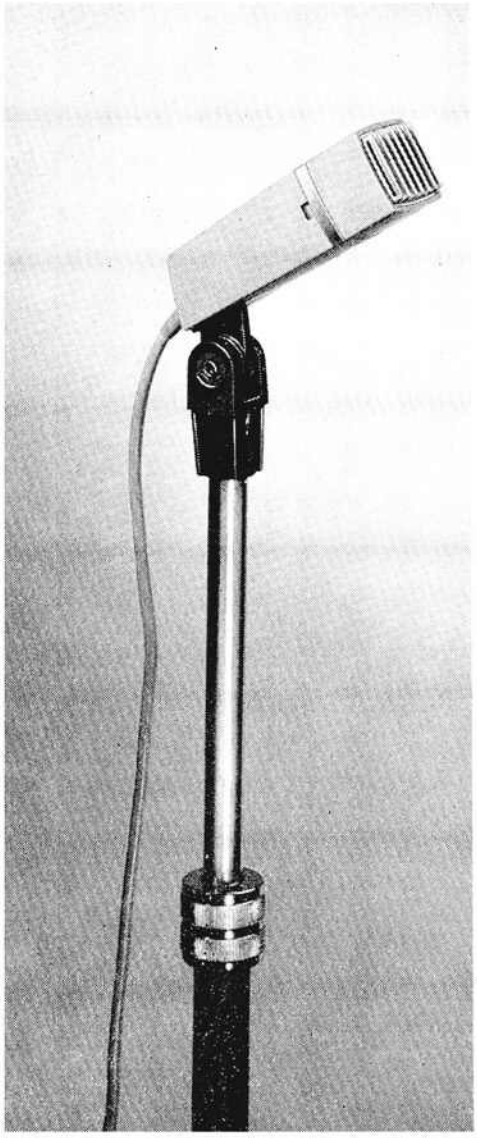


NOW
4-microphone versatility



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The Philips EL 7500 is a unique conception — a microphone and accessories cleverly designed to give you four configurations which cover every use — and to save you money, it's a kit.

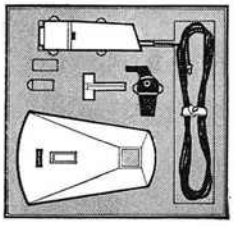
A high grade moving coil insert, transformer and switch are housed within the clean lines of a most attractive but durable case. The basic unit makes a very efficient, lightweight hand microphone; slip-on accessories immediately adapt it to a floor stand or a neck-sling mike, or support it from the smart, functional table stand.

The EL 7500 is engineered by Philips and backed by many years of experience in manufacturing moving coil microphones.

The kit comes absolutely complete with all components and materials, while the profusely illustrated instruction book makes assembly easy and fast for anyone with basic soldering ability. The transformer can be connected to give 50kΩ, 500Ω or 200Ω impedance.

The EL 7500 has a good frequency response; with omnidirectional characteristics, excellent sensitivity and unique versatility, it's the ideal general purpose microphone for the enthusiast who wants something a little better for recording, public address or amateur radio.

from one quality kit



The kit is as well engineered as the microphone. Components are located in an attractive, shaped moulding — and the box is designed for simple modification into a permanent storage case after the microphone has been assembled.

Best of all, it's inexpensive. With no assembly time to pay for, the EL 7500 is offered at only £7.7.0.

See one at your dealer's now.

PETO SCOTT

sound and vision

PETO SCOTT LIMITED
ADDLESTONE ROAD, WEYBRIDGE, SURREY
Telephone: Weybridge 45511

CW PS 1

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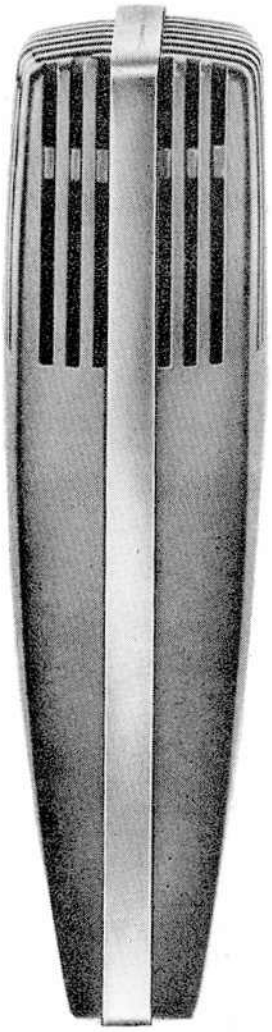

MD 411

The new super – cardioid microphone by

Sennheiser

Convert your bathroom into a recording studio. Almost possible with the ultra-directional MD411.

Cuts out background noise and room echoes; the smooth flat frequency response gives professional close-up sound in domestic surroundings. Developed from the famous Sennheiser studio microphones to meet the Hi Fi standard DIN 45 500. Integral triple impedance transformer matches to *any* type of tape recorder.

£13 . 9 . 0
With table stand, floor stand adaptor and zip-up cushioned case complete.

Audio Engineering Ltd

33 Endell St. London WC2. TEM 0033

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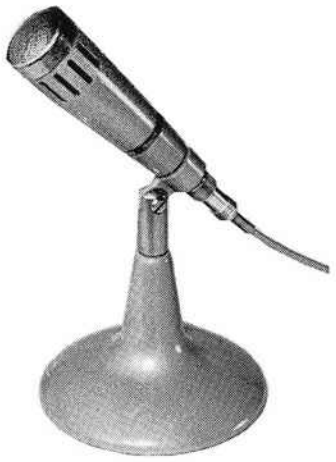

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MICROPHONES FOR TAPE RECORDING

1. The Grampian GCI cardioid microphone.
2. The AKG studio type microphone D12 for high quality recording.
3. The Sennheiser MD421 studio cardioid microphone.
4. The Hammond M-100 condenser microphone.
5. The Grundig GDSM-330 dual stereo microphone.
6. The Acos Mic 39/1 crystal microphone includes a lavalier (neck cord) attachment.
7. The Acos Mic 95 omni-directional microphone.
8. The Lustraphone VR/75 miniature ribbon microphone with built-in pre-amplifier.
9. The Film Industries M8S – a high quality ribbon microphone.

7

8

9

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TRAILING LEADS CAN BE EMBARRASSING

SO DON'T LET THIS HAPPEN TO YOU

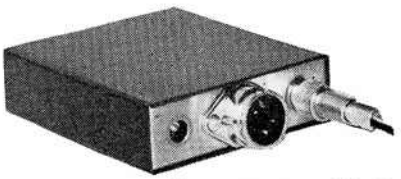
use the

Reslo radio microphone

A complete system consisting of a microphone (lavalier neck suspension type allowing unrestricted movement), a low power pocket transmitter for carrying on the person, and a sensitive high performance receiver, providing the audio signal for the associated amplifier and loudspeaker sound system. The purpose being to provide a high quality but *wire free link* between the microphone user and the sound reinforcement installation.

Approved by the Post Office

Radio microphone type MMD1



Transmitter type R.H.18

Reslo — Derritron Group

RESLOSOUND LIMITED

Reslo Works, Spring Gardens, London Road, Romford, Essex. Telephone Romford 49087

ATR MICROPHONE DIRECTORY

Make	Type	Polar Response	Frequency Response	Impedance	Price £	s	d
ACOS							
Mic 39/1	CR	O/D	30–12,000c/s	5,000 ohms	3	3	0
Mic 40	CR	O/D	30–7,000c/s	High (4·7 Mohms)	1	15	0
Mic 40	CER	O/D	30–7,000c/s	—	2	0	0
Mic 40	MAG	O/D	30–7,000c/s	—	2	5	0
Mic 60	CR	O/D	30–10,000c/s	High (4·7 Mohms)	2	2	0
Mic 60	CER	O/D	20–10,000c/s	10Mohms	2	7	0
Mic 60	MAG	O/D	200–5,000c/s	2,000 ohms	2	15	0
Mic 45	CR	O/D	30–8,000c/s	4·7Mohms	2	0	0
Mic 45	CER	O/D	—	—	2	5	0
Mic 55	CR	O/D (lapel mic)	30–10,000c/s	4·7Mohms	2	2	0
Mic 55	CER	O/D (lapel mic)	20–10,000c/s	10,000 ohms	2	7	0
Mic 55	MAG	O/D (lapel mic)	200–5,000c/s	2,000 ohms	2	15	0
Mic 95/2	—	O/D	80–12,000c/s	200 ohms	2	12	6
Mic 95/50	—	O/D	80–12,000c/s	High 50Kohms	3	3	0
(Manufactured by Cosmocord Limited, Waltham Cross, Herts.)							
AKG							
D7A	D	O/D	80–10,000c/s	200 ohms	4	4	0
D11C	D	C	80–15,000c/s	50,000 or 200 ohms	6	0	0
D12/60	D	C	30–18,000c/s	60 or 20 ohms	28	0	0
D14S	D	C	50–15,000c/s	200 or 40,000 ohms	10	0	0
D19C	D	C	30–16,000c/s	200 or 60 ohms	17	10	0
D19E	D	C	30–16,000c/s	High, 200 and 60 ohms	21	10	0
D119CS	D	C	30–16,000c/s	200 ohms	21	10	0
D119ES	D	C	30–16,000c/s	High, 200 and 60 ohms	24	10	0
D24B/60	D	C	30–20,000c/s	60 ohms	48	10	0
D66/200	D	C (stereo)	50–15,000c/s	High and 200 ohms	11	10	0
D58/60	D	(Anti-noise)	—	—	10	10	0
D501	D	C	50–15,000c/s	200 ohms	24	10	0
D503	D	C	15–15,000c/s	200 ohms	15	0	0
D505	D	(Anti-noise)	50–15,000c/s	200 ohms	13	15	0
D507	D	(Anti-noise)	50–15,000c/s	200 ohms	15	0	0
D109	D	(Neck mic)	50–15,000c/s	60 or 200 ohms	11	0	0
D202	D	(Two-way)	20–18,000c/s	200 ohms	30	0	0
(Manufactured by Politechna Limited, 182 Campden Hill Road, London W8.)							
AMPEX							
801	D	O/D	50–18,000c/s	20,000 ohms	20	0	0
802	D	O/D	50–20,000c/s	30–50, 150–250 and 20,000 ohms	25	15	0
803	D	C	45–15,000c/s	30–50, 150–250 and 20,000 ohms	33	10	0
(Manufactured by Ampex (Gt Britain) Limited, Acre Road, Reading, Berks.)							
BANG & OLUFSEN							
BM5	R (stereo)	COS	20–13,000c/s	150 ohms	60	5	0
BM6	R	COS	20–13,000c/s	150 ohms	13	2	6
MD8	D	O/D	50–17,000c/s	200 ohms	9	9	0
(Manufactured by Bang and Olufsen.) *(Distributors: Bang and Olufsen, UK Sales Division, Mercia Road, Gloucester.)*							
BEYER							
M119	D	O/D	50–16,000c/s	200 ohms	21	15	0
M160	D	C	50–18,000c/s	200 ohms	59	19	0
M260	R	C	50–18,000c/s	200 ohms	22	8	0
M69	D	C	50–16,000c/s	Low	27	1	0
M110	D	O/D	60–12,000c/s	200 ohms	27	7	0
M610	D	C	50–15,000c/s	200 ohms	22	10	0
M57	D	O/D (speech only)	300–4,000c/s	200 ohms	12	12	0
M64	D	O/D	100–10,000c/s	200 ohms	16	19	0
(Distributors: Fi-Cord International Limited, Charlwoods Road, East Grinstead, Sussex.)							
S.G. BROWN							
1C600	CER	O/D	50–12,000c/s	150Kohms	6	6	0
(Manufactured by S. G. Brown Limited, King George's Avenue, Watford, Herts.)							

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A list of current microphones most suitable for tape recording enthusiasts

NOTE: This list does not include professional studio microphones, public address microphones or those of foreign manufacture not normally advertised and sold in this country.

Make	Type	Polar Response	Frequency Response	Impedance	Price £	s	d
DENHAM & MORLEY							
NB150	M/C	O/D	80–16,000c/s	200 or 50,000 ohms	3	3	0
NB250	M/C	C	100–16,000c/s	200 or 50,000 ohms	4	14	6
NB101	M/C	O/D	40–18,000c/s	200 ohms	14	14	0
NB201	M/C	C	50–18,000c/s	200 ohms	15	15	0
NB211	M/C	C	50–18,000c/s	200 ohms	16	16	0
NB301	R	C	40–18,000c/s	200 ohms	22	1	0
(Manufactured by Denham & Morley Limited, Denmore House, 173 Cleveland Street, London NW1.)							
ELECTRO-VOICE							
649B	M/C	O/D	70–10,000c/s	50, 150, 250 ohms	28	17	0
644	M/C	C	40–10,000c/s	150 ohms and High	28	18	0
(Manufactured by KEF Electronics Limited, Tovil, Maidstone, Kent.)							
ELPICO-GELOSO							
B72/1110	CR	O/D	40–12,000c/s	1Mohm	7	7	0
B92/1110	CR	O/D	40–12,000c/s	1Mohm	11	11	0
M51	CR	O/D	60–10,000c/s	1Mohm	5	5	0
M18	M/C	C (lavalier)	60–14,000c/s	250 ohms	10	10	0
M19	M/C	C (lavalier)	60–14,000c/s	50,000 ohms	10	10	0
M23	M/C	C	60–14,000c/s	50,000 ohms	9	9	0
M68	M/C	C	80–14,000c/s	250 ohms	10	10	0
M69	M/C	C	80–14,000c/s	50,000 ohms	10	10	0
(Manufactured by Lee Products (GB) Limited, 10–18 Clifton Street, London EC2.)							
FILM INDUSTRIES							
M7	M/C	O/D	60–9,000c/s	20 ohms	8	15	0
M8	R	COS	50–13,000c/s	Up to 57,000 ohms (built-in trfr.)	9	9	0
M8A	R	COS	50–12,000c/s	Up to 57,000 ohms	9	0	0
(Manufactured by Film Industries Limited, 90 Belsize Lane, London NW12.)							
GRAMPIAN							
GR1/GR2	R	COS	40–15,000c/s	25, 200, 600 and 50,000 ohms	10	10	0
DP6	M/C	O/D	200–15,000c/s	25, 200, 600 and 50,000 ohms	8	5	0
DP4	M/C	O/D	50–15,000c/s	25, 200, 600 and 50,000 ohms	8	5	0
DP8	M/C	O/D	50–15,000c/s	Type L low imp. 25ohms	9	10	0
DP8 Type XMH	M/C	O/D	50–15,000c/s	200, 600 and 50,000 ohms	10	10	0
GCI	M/C	C	40–12,000c/s	25, 200, 600 and 50,000 ohms	14	0	0
Parabolic Reflector			(for use with DP4 and DP6, etc, microphone)		6	10	0
Windshield			(for use with DP4, DP6 and DP8 microphones)			17	6
NOTE: Prices of the above microphones vary slightly for different impedances and whether or not they are fitted with an on/off switch. *(Manufactured by Grampian Reproducers Limited, Hanworth Trading Estate, Feltham, Middx.)*							
GRUNDIG							
GDSM330	M/C	(stereo)	150–15,000c/s	200 ohms or 100Kohms	Prices not quoted		
GDM312	—	O/D	150–15,000c/s	200 ohms or 100Kohms			
GDM302	—	—	150–11,000c/s	4,000 ohms	"		
(Manufactured by Grundig (Gt Britain) Limited, Newlands Park, London, SE26.)							
HAMMOND							
M-100	Condenser (mono)	O/D	30–20,000c/s	60 ohms	30	9	0
M-100	Condenser (stereo)	O/D	30–20,000c/s	60 ohms	51	9	0
(Manufactured by C. E. Hammond & Co. Limited, 90 High Street, Eton, Berks.)							

Continued overleaf

A Winner

The DP4 microphone is another winner—by performance alone it has achieved world wide acclaim. It is used regularly by P.A. engineers, broadcasting and television companies, film studios, etc., as well as by many professional and amateur tape recordists. Its winning qualities have been designed and produced by Grampian—specialists for over thirty years in the field of sound equipment. We shall be pleased to send you full technical details of the DP4 and other microphones, together with descriptions of various accessories.

Specially designed to use with the DP4, in order to cut down wind noise is the Windshield — as illustrated here.

There is also the "Grampian" Parabolic Reflector. Where it is not possible to place a microphone close to the source of sound such as when making recordings of bird songs, weddings, car and train noises etc. the Parabolic Reflector has been proved over and over again to be of enormous value.

Grampian

Grampian Reproducers Ltd.,
Hanworth Trading Estate, Feltham, Middlesex.

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ATR MICROPHONE DIRECTORY

Continued from page 25

Make	Type	Polar Response	Frequency Response	Impedance	Price £ s d
LUSTRAPHONE					
D159BS	M/C	O/D	150–14,000c/s	Low 600 ohms and High	15 15 0
LFV59	M/C	O/D	150–14,000c/s	Low 600 ohms and High	9 19 6
LVF/H59	M/C	O/D	150–14,000c/s	Low 600 ohms and High	9 9 0
LP62	Electro-magnetic	O/D (lapel mic)	—	30 or 1,000 ohms	4 14 6
LV59	M/C	O/D (neck mic)	150–14,000c/s	Low 600 ohms and High	9 16 6
LD66	M/C	O/D (neck mic)	70–12,000c/s	Low 600 ohms and High	5 5 0
LD61	M/C	O/D	70–12,000c/s	Low 600 ohms and High	4 4 0
C48	M/C	O/D	50–8,000c/s	20 ohms	7 7 0
C51	M/C	O/D	50–8,000c/s	Low 600 ohms and High	6 6 0
VR64	R	COS	—	Low 600 ohms and High	8 18 6
VR70L	R	COS (neck mic)	50–14,000c/s	Low and 600 ohms High	7 17 6
VR53	R	COS	—	Low 600 ohms and High	11 11 0
VR/65NS	R (stereo)	COS	50–13,000c/s	300 ohms	17 17 0
TH59/SB	M/C	O/D	150–14,000c/s	—	10 10 0
VC52/THSB	M/C	O/D (Anti-noise)	—	25 ohms	10 10 0
LTD/59	M/C	O/D	70–14,000c/s	Low 600 ohms and High	9 19 6
DH59HB	M/C	O/D	70–14,000c/s	Low 600 ohms and High	10 10 0

(Manufactured by Lustraphone Limited, St George's Works, Regent's Park Road, London NW1.)

PEARL					
LD18/19	D	O/D	80–18,000c/s	200 ohms or High	14 6 0
RD16/17	D	C	50–18,000c/s	200 ohms or High	14 10 0
RD34/35	D	C	30–20,00c/s	200 ohms or High	15 15 0
					17 10 0

(Distributed by C. E. Hammond & Co. Limited, 90 High Street, Eton, Berks.)

PETO-SCOTT					
EL6061/02	Noise cancelling Public Address	—	—	500 ohms	7 15 0
EL6150	Condenser	C	30–18,000c/s	50 or 200 ohms	-
EL6041	M/C	C	—	200 ohms	54 0 0
EL6021	M/C	O/D	60–15,000c/s	50,500 or 2,000 ohms	7 15 0
EL6014	M/C	O/D	—	500 or 25,000 ohms	9 0 0
ET1045	M/C	(neck mic)	150–20,000c/s	50 or 25,000 ohms	10 0 0
EL6031	M/C	C	—	500 or 25,000 ohms	17 0 0
EL6033	M/C	C or O/D	—	500 ohms	24 0 0

(Manufactured by Peto Scott Limited, Addlestone Road, Weybridge, Surrey.)

PHILIPS					
EL3750/00	M/C	C	150–10,000c/s	25,000 ohms	5 0 0
EL3753/00	C/R	O/D	100–8,000c/s	High	3 6 0
EL3755/00	M/C	C	150–10,000c/s	500 ohms	3 10 0
EL3756/00	M/C	O/D	200–10,000c/s	500 ohms	3 10 0
EL6021	M/C	O/D	60–15,000c/s	50,500 and 10,000 ohms	14 0 0
EL6031	M/C	C	70–15,000c/s	50 or 25,000 ohms	19 0 0
EL6040	M/C	O/D	60–20,000c/s	50,500 or 25,000 ohms	27 0 0
EL3752/00	M/C (stereo)	C	—	25,000 ohms	10 10 0
EL3782/00	M/C	C	150–10,000c/s	500 ohms	5 0 0
EL3784	M/C (stereo)	C	150–10,000c/s	500 ohms	10 10 0
EL1045	M/C	O/D	80–12,000c/s	50 ohms	15 0 0
EK3757/00	M/C (stereo)	C	150–10,000c/s	500 ohms	10 10 0
EL3790/00	M/C	O/D	50–10,000c/s	500 ohms	3 10 0
EL3797/00	M/C	O/D	150–10,000c/s	500 ohms	4 5 0
EL7500/00	CER	O/D	(mic kit for home assembly)	200, 500 or High	7 7 0

(Manufactured by Philips Electrical Limited, Century House, Shaftesbury Avenue, London WC1.)

RESLO					
RBT	R	COS	40–16,000c/s	Various	11 0 0
CR2	R	C	40–16,000c/s	Various	11 10 0
PR	R	COS	50–16,000c/s	Various	9 0 0
VRT	R	COS	30–16,000c/s	Various	17 0 0

Make	Type	Polar Response	Frequency Response	Impedance	Price £ s
RESLO *Continued*					
SR1	R	COS	30–20,000c/s	30/50 or 300 ohms	27 0 0
RL1	R	C (neck mic)	100–16,000c/s	30/50 or 300/600 ohms	15 0 0
PD	M/C	O/D	50–15,000c/s	Various	11 10 0
MPD	M/C	O/D	50–15,000c/s	30–50 ohms	10 0 0
CHM1	CR	O/D	50–7,000c/s	5Mohms	3 5 0

(Manufactured by Reslosound Limited, Spring Gardens, Romford, Essex.)

SENNHEISER					
MD421N	Dynamic	C	30–17,000c/s	200 ohms	31 12 6
MD421HL	Dynamic	C	30–17,000c/s	200 ohms or 24,000 ohms	32 10 0
MD411/HLM	Dynamic	C	50–12,000c/s	200, 800 or 25,000 ohms	13 9 0
MD408/N	Dynamic	C	100–14,000c/s	200 ohms	19 2 0
MD21/N	Dynamic	O/D	40–17,00c/s	200 ohms	22 3 6
MD21/HL	Dynamic	O/D	40–17,000c/s	200 or 30,000 ohms	22 15 0
MD211/N	Dynamic	O/D	40–20,000c/s	200 ohms	35 15 0
MD214/N	Dynamic	(Lavalier)	—	200 ohms	29 17 0
MD4/N	Dynamic	(Noise Cancelling)	50–10,000c/s	200 ohms	18 15 0
MD4/NT	(as above with switch)		—	—	20 19 0
MDS/1/N	Stereo		70–15,000c/s	200 ohms	26 5 0
MD601/HN	Dynamic	O/D	100–10,000c/s	200 or 50,000 ohms	4 15 0
MM23	Dynamic	(Min. lapel mic)	400–4,000c/s	2,000 ohms	5 15 0
MM61	Dynamic	(Fountain pen mic)	400–4,000c/s	2,000 ohms	5 19 0
MM301	Dynamic	(Module only)	500–5,000c/s	4,500 ohms	4 2 0

(Manufactured by Audio Engineering Limited, 33 Endell Street, London WC2.)

SHURE					
55S	R-M/C	C	50–15,000c/s	50, 250 and High	27 13 4
430F	Mag	O/D	60–10,000 c/s	Low and High	13 0 0
245	CER	C	50–7000c/s	High	11 13 4
545	M/C	C	50–15,000c/s	50 ohms and High	38 6 8

(Manufactured by Shure Electronics Limited, 84 Blackfriars Road, London SE1.)

STC					
4021	M/C	O/D	30–15,000c/s	30 ohms	16 10 0
4033	R-M/C	C	30–10,000c/s	30 ohms	54 0 0
4035	M/C	O/D	40–10,000c/s	30 ohms	16 10 0
4037	M/C	COS	30–15,000c/s	30 ohms	22 0 0
4038	R	COS	30–15,000c/s	30 and 300 ohms	50 0 0
4105	M/C	C	60–10,000c/s	30 ohms	22 10 0
4106	M/C	C	30–15,000c/s	30 ohms	49 10 0
4112	M/C	O/D (neck mic)	50–12,000c/s	30 ohms	21 0 0
4113/B	R	C	60–12,000c/s	30 ohms	11 11 0
4115	R	— (anti-noise)	70–10,000c/s	30 or 300 ohms	28 0 0
4119	R	C	50–20,000c/s	50,000 ohms	26 0 0
411A	M/C	O/D	100–8,000c/s	250 ohms	1 0 0
411B	M/C	O/D	100–8,000c/s	80,000 ohms	1 2 6

(Manufactured by Standard Telephones and Cables Limited, Harlow, Essex.)

TELEFUNKEN					
TD25	M/C	C	50–18,000c/s	800 ohms	5 5 0
TD20	M/C	O/D	—	800 ohms	3 3 0
TD11	M/C	C	80–14,000c/s	200 or 50,000 ohms	9 9 0
TD19	M/C		40–16,000c/s	200 ohms	22 10 0
TD300	(for M300/301 tape recorders only)				12 10 0

(Manufactured by AEG (GB) Limited, 27 Chancery Lane, London WC2.)

TRIX					
G7854	M/C	O/D	50–10,000c/s	30 ohms	8 2 0
G7871/D	M/C	O/D	50–8,000c/s	30 ohms	7 15 0
G7852/F	R-M/C	—	50–10,000c/s	30 ohms	9 2 0
G7823	R	COS	50–12,000c/s	30 ohms	Prices on application
G7871	M/C	O/D	50–8,000c/s	—	

(Manufactured by Trix Electronics Limited, c/o Ultra Electronics Ltd, Western Avenue, London W3.)

CODE USED IN MICROPHONE DIRECTORY

CR	Crystal	M/C	Moving Coil
CER	Ceramic	R-M/C	Ribbon-moving coil
MAG	Magnetic	O/D	Omni-directional
D	Dynamic	C	Cardioid
R	Ribbon	COS	Cosine (figure-of-eight)

NOTE: Many of the microphones listed are available with alternative impedances and/or stands, etc, at different prices. Readers are advised to write to the manufacturers for brochures if alternative impedances, microphone stands, matching transformers and other accessories or fittings are required.

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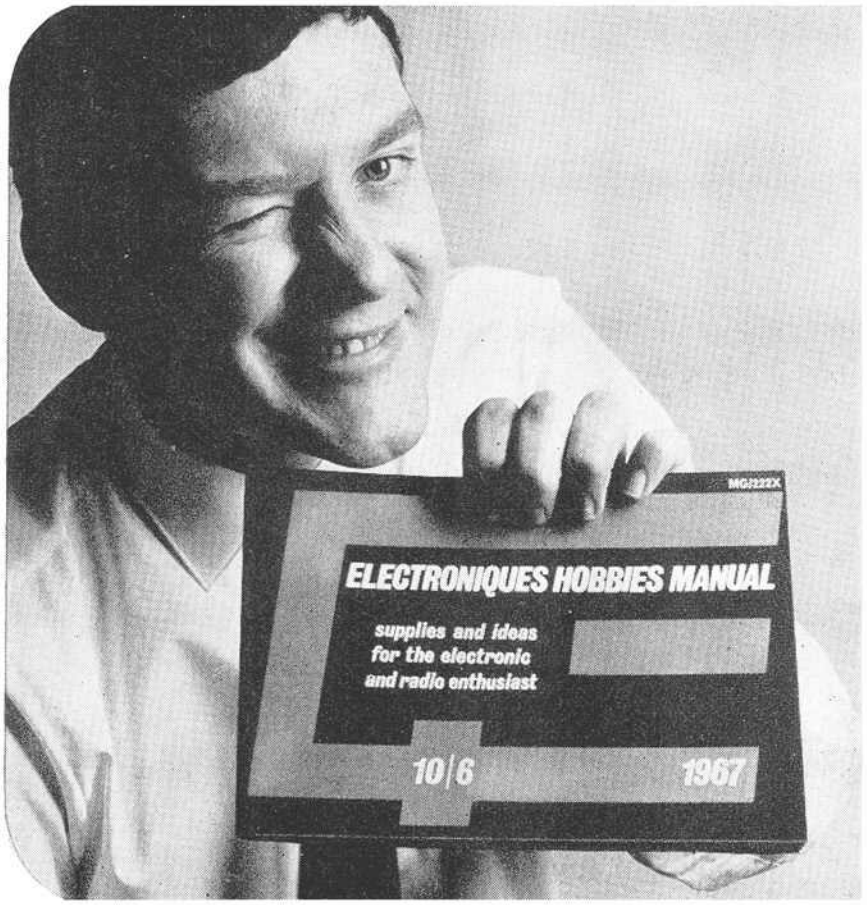

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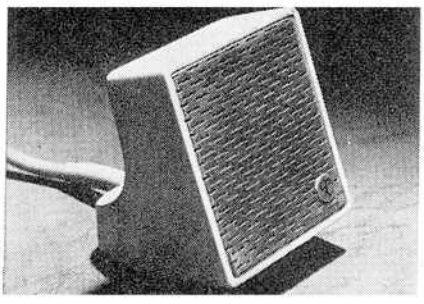

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TAPE RECORDERS IN THE MAKING TANDBERG

The Editor visits a tape recorder factory in a garden

Vebjørn Tandberg, founder of Tandberg A/S and 'father' to his employees.

To most of us Tandberg is simply the name of a tape recorder sold in the UK through its distributors, Tandberg (Elstone Electronics) Ltd of Leeds. In Kjelsås, on the outskirts of Oslo, Tandberg is thought of as a large family, very large in fact – for there are over one thousand members dedicated to 'father' Vebjørn Tandberg who founded the company over 30 years ago in a small back room in Oslo. Today Tandberg's Radiofabrikk A/S (the official name of the company) is a foundation controlled by four responsible employees of the company but who are guided by the experienced hand of Vebjørn Tandberg himself. No labour problem here, no trade unions, just one large contented family with one aim in mind – to produce high-quality tape recorders, television and radio receivers and hi-fi equipment to a standard set by Vebjørn Tandberg himself and the experience of senior engineers, most of whom have worked with him since he began producing his first high-quality radio sets.

Within almost minutes of setting foot in Oslo I began to experience the warm hospitality that Norwegians can impart. Before my visit to the factory at Kjelsas I was to be shown some of the highlights of Oslo, the beautiful surrounding countryside and, of course, the famous Oslo fjord. It had all been arranged. The Oslo ski jump, the television tower on the hilltop just outside the city, the Kon Tiki raft, the Viking ships, a trip on the fjord by the Hydrofoil and naturally the superb Norwegian food. Time enough for the factory tomorrow I was told. Who could refuse?

The Factory in a Garden

This is the best way I can describe my first impression of the Tandberg factory, in its beautiful setting beside a small lake, surrounded by the tree-covered hills so typical of Norway. The factory itself was designed by a leading Norwegian architect, Thorlief Jenson, but Vebjørn Tandberg had decided that his employees needed more than just a modern factory in which to work; they must have pleasant surroundings and an inspiring outlook too. During the tour of the factory and the gardens I was shown the Huldra, a legendary Norwegian figure beyond the reach of mortal beings, but which represents to them a symbol of perfection and quality. On this is based the Tandberg policy of absolute quality in all they produce and that is why the Huldra is the Tandberg trademark. One of the finest sculptors in Norway was commissioned to create the statue which stands in the gardens surrounding the factory (see photos and front cover).

Quality – the Tandberg Watchword

From the first stages of design right through

The Huldra – a Norwegian symbol of beauty and perfection and the hallmark of Tandberg products.

The main assembly hall at the Kjelsås factory where all Tandberg tape recorders are designed and produced.

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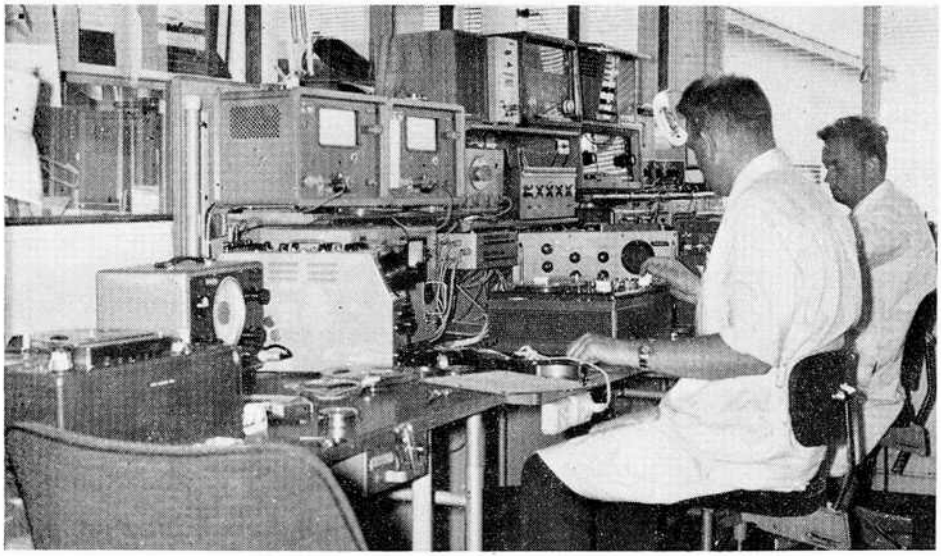
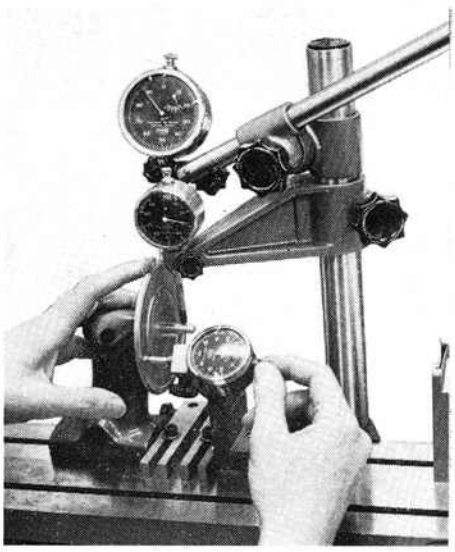


One of the quality control laboratories where extensive tests are carried out on production models.

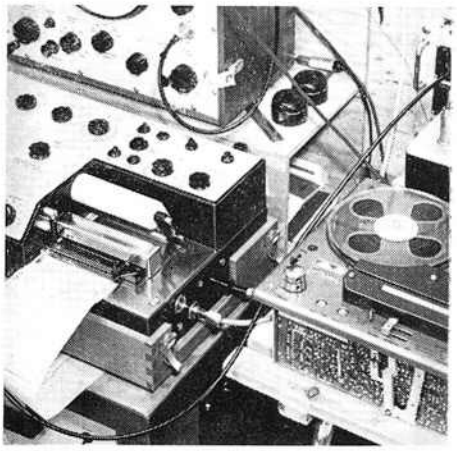


Every component in a Tandberg tape recorder is inspected and checked before use. Photo shows tape spool hubs being checked for accuracy.

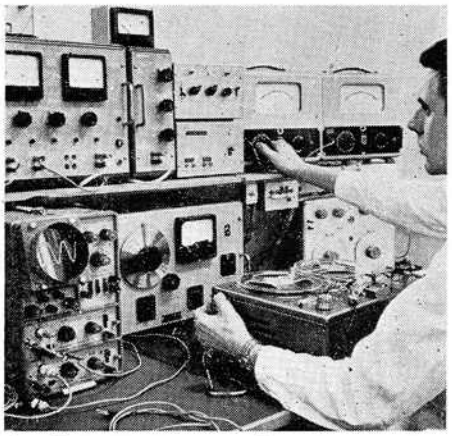
to the finished product 'quality' is the predominant factor. No materials or components can be used unless they have satisfied the quality control department. No product of Tandberg can be released until *Quality Control* are completely satisfied with design performance and appearance. An entire production department can be instantly brought to a halt by QC should some weakness in design or a component be discovered.

Tandberg make very few individual components for their tape recorders and can therefore concentrate on design, research production and testing. At every stage of production, spot checks are carried out by the quality control department. Even tape recorders already tested and packed for despatch can be seized by the QC engineers and subjected to a detailed laboratory check should they have the slightest suspicion of a probable electrical or mechanical failure. I was, to say the least, quite fascinated by this almost obsessive practice of check and double check, which I might add has rubbed off on the UK distributors of Tandberg tape recorders. On arrival in England every machine undergoes yet another complete performance test by Tandberg-trained engineers before being released to the dealers.

A final stage in assembly before the deck cover is fitted.



Every Tandberg tape recorder is put through a measurement and inspection routine.

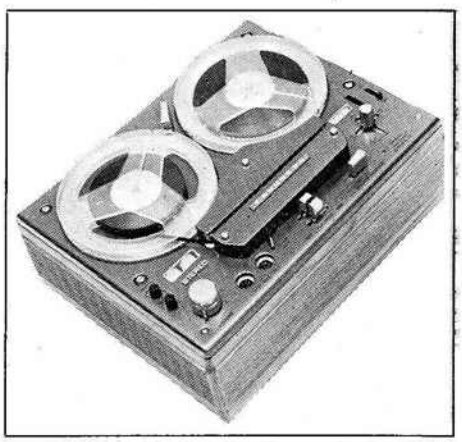


Sample testing. Tape recorders taken at random by Quality Control are thoroughly analysed and checked out so as to maintain high standards of production and performance.

Performance – Second to None

The Tandberg policy is to manufacture the kind of top-quality product they think you ought to have, and this is well and truly reflected in all Tandberg tape recorders as well as their TV and radio receivers. A long talk on technicalities with two of their senior engineers left me in no doubt that they really do know what is required of a tape recorder designed for the enthusiast. I was more than just intrigued by the specification of the current Tandberg Model 12, for instance. This is one of the very few tape recorders with a signal to noise ratio of −58dB and a distortion factor at less than 5% from a fully recorded signal. Tandberg are well aware that such a performance is necessary to meet the standard required for high fidelity reproduction and they say this is what the owner of a hi-fi tape recorder must have. From my own experience as the owner of a Tandberg Model 6 which is in constant daily use, I can certainly verify the reliability and performance of Tandberg tape recorders. What I saw and heard at the factory in Oslo left no doubt as to the high quality of all their products.

Finally, I would like to convey my thanks to the UK distributors, Elstone Electronics of Leeds and to Mr Brodtkorb, the chief engineer of Tandberg A/S, and his colleagues, Mr Jachwitz and Mr Speten, who made my trip to Oslo an experience both pleasant and interesting.



The latest model from Tandberg – the Model 12 *(two- or four-track) tape recorder with twin* 10 *watt output stages and a distortion factor of better than* 0·5%.

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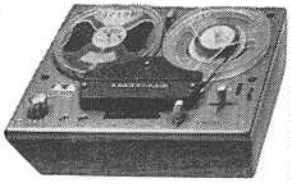
move up to Tandberg



SERIES 6
Semi professional Stereo/mono tape recorders with cathode follower output. Three speeds — Three heads — Four amplifiers — "Sound on Sound" etc.
Model 64 4 track
Model 62 2 track
110 gns. each.

SERIES 8
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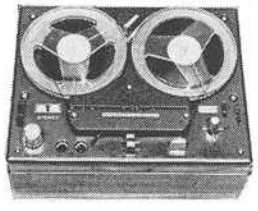

SERIES 12
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Model 12 2 Track 105 gns.

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Two 10 watt stereo amplifiers and outstanding radio performance.
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tape club news

The Christmas month is a very busy one for everyone and we on *ATR* are no exception. As you can see, there is so much interesting material for all our readers this month that we have had to economize on space for the Club News feature. We are sure that you won't mind just this once sharing the extra space with other readers. I hope you all have a very happy and busy Christmas, recording and enjoying the Christmas fairs, carol concerts, parties and special services. KC

BRIGHTON
Members of the Brighton TRC are now in contact with the North Shore branch of the New Zealand TRC and a number of British clubs through the Dartford 'South Link'. Recordings of the Brighton speed trials (always popular), Isle of Man TT races, Farnborough '66 and the *Farewell to Steam* (The Royal Scotsman's journey to Brighton) have all been heard at the club. The latest issue of *Acoustic*, the club's monthly newsletter, is a particularly full one, covering the details of the club's own recording contest and featuring a special article explaining the production of a special tape using equipment set up in the clubroom.

BROMLEY
An invitation to anyone living in the Bromley area to come to meetings of the Bromley TRC has been extended by the club's secretary, Miss J. Rivett, who assures all newcomers a warm welcome to the club. Recent projects have included the preparation and selection of material for *Let's go Guiding* for the Sidcup Girl Guides, a competition entitled *A Day in the Life of a Commuter*, preparation of material for a tape for the blind and also for Dartford's *Sound Link*.
Future meetings include a special New Year's party and the club's AGM. The club meets at St Mary's Church House, 61 College Road, Bromley, on the second and fourth Thursdays each month at 7.30. The secretary's address is The Old Thatch, The Glen, Farnborough Park, Kent.

COVENTRY
A very welcome assignment for members of the Coventry TRC was the recording of the wedding of Alison Stanley, daughter of the club's chairman, Cyril Stanley, at St George's Church in Coventry. At a later meeting, club member Mr G. Taylor entertained members with a tape slide show featuring the Ruins of Pompeii and scenes of Paris. For some time club members have been recording English/Czech in books on to tape for a school in Czechoslovakia, under the Coventry Committee for International Understanding. Finally, the club has settled itself into its new (and much more convenient) clubroom, which is the conference room at Tudor House, Spon Street, Coventry.

DERBY
At a recent meeting of the Derby TRC, Douglas Flecknoe started the evening off with his 15-minute tape, *Visit to Italy*, a travelogue in sound based on live recordings made with a Philips cassette portable while on his holiday this year. Nicholas Potter described and demonstrated his own-built recorder consisting mainly of a Collaro deck and Martin kit amplifier. For the benefit of new members chairman Ernest Flecknoe gave a demonstration on the use of a splicer to make noiseless joints in tape. Another interesting programme was provided recently by Derek Hill. It included a selection of recordings of his daughter Susan, ranging from the age of 18 months to 8 years, showing the gradual development of her speech and ideas.

DONCASTER
Colour slides have been prominently featured in the recent programme of the Doncaster and District TRC. One meeting was concerned with the club's major project, *Around London*, and on this occasion the club's London member, Mr John Pound, aided everyone in arranging the sequence so that the programme appeared as a complete tour of London. At the next slide show John Pound provided an interesting programme of his recent holiday in Austria, while the third slide item featured a local traction engine rally which had been well attended by club members.

LEEDS
Members of the Leeds and District TRC have also been traction engine rallying, with Jasen Atkinson, Bill Rowe, Chris Eagle and Joe Newby all recording. Not surprisingly, they bumped into a member of the Doncaster club, Ralph Broome. Later that week Bill Rowe and John Newton did their hospital broadcast, and at midnight Bill Rowe left Leeds to go to Northern Ireland, the final destination being a work camp. Between digging and laying paths they visited the Giant's Causeway, Glens of Antrim and Mountains of Mourne, and recorded a variety of sounds including local Irish folksongs.

LEICESTER
Leicester TRC has had a full programme of outside recordings including a conducted tour of the railway station and adjacent goods yard. At the following club night Dave Angrave gave a stereo demonstration using two Ferrographs with a single tape on the twist threaded between the two. On an outing to the fire station, the local brigade described all the appliances and very kindly turned out three engines, each with a totally different bell or siren. A mock message was passed through the control room for members to record and while in this room an actual alarm came through and a real turnout was followed later by a report over the radio that the fire was under control.

LONDON
Following a special session at which members of the London TRC put forward ideas and suggestions for a winter programme, the club committee is considering the introduction of some new features into the programme. Recent items have included a talk by vice-president Richard Keen, a BBC producer, entitled *What Suits the Microphone*. A general get-together with friends and families for an evening of films (with sound, of course) is now on the agenda.

NORTH LONDON
Members of the North London Tape and Hi-Fi Club were delighted to hear the Enfield Microphone featured in a BBC programme *In Touch* especially for blind people. Gordon Snell described the Enfield Microphone, playing short news items and interviews with Ron Goodwin, Joe Collinson, Mr D. Parry, and Mr J. Dredge. Other items on the club programme have included a further lecture by Ron and Den Goodwin covering volume and tone controls, and a recent quiz evening was a hilarious success. The second part of the quiz was devoted to a two-team buzzer and bell contest in which team members had to spot the deliberate mistakes in the playback of certain items.

READING
The 1966/67 season of the Reading Cine and TRS opened with a programme entitled *The Year in Retrospect*, consisting of tapes, slides and films made by members who had won major awards during the year. A large audience including many new members had the opportunity of hearing Doug Noyes's unique tape *My Friend* which won him last year's Grosvenor Cup. After this programme the chairman spotlighted some of the interesting tape evenings for the coming year, which will include the *Abbey Cup* tape and slide show of the year, Microphone Art and a visit to the Oxford Society.

RUGBY
The theme of a recent meeting of the Rugby TRS was *Unusual and Unorthodox Recordings*. Gordon Routh acted as compère to the programme, and commenced with one of his recordings – a humorous mock radio programme dealing with the futility of nuclear war. Frank Hopcraft presented a Christmas tape sent by a relation stationed in Malaya, while Jack Willis played a portion of a talk given to a past convention of TR clubs sponsored by the society where the speaker was BBC producer Charles Parker.
The first presentation of the Ron Barrett Memorial Trophy, presented by Mike Brown in memory of his late colleague and club friend, will take place this month. The award is to be made quarterly for achievement, and the first award takes into account the period from 8 September to 1 December.

SOUTH DEVON
The highlight of recent news from the South Devon TRC is that *Tutti*, the club's official entry in the BATR contest, gained second prize in the Groups section. Producers of *Tutti* were Joe Pengelly, Peter Cox and John Penty. The club has won the BASF Shield and £10 worth of tape.
The first major talk and demonstration of the winter season was made by Mr R. Fisher of the electro-mechanical division of STC. His talk covered design principles of microphones, the different types of instruments and how they react under various acoustic conditions.

THORNTON HEATH
Big news for members of the Thornton Heath TR club was Alan Brown's outright win in the BATR contest with his masterly tape *Macbeth*. Not surprisingly, the club devoted a whole evening to the playback of the winning tapes with *Macbeth* as the highlight. This tape, which is an edited version of the one produced for his Duke of Edinburgh Gold Medal, features Alan in all the parts. The witches' voices were simulated by the use of different size capstans to add the required quality to the voices.
An excellent number of entries was received for the competition *My Job*. Alan Brown was again in a winning mood and won first prize, followed closely by Morris Webb, with new member Mr Mitchell coming third.
The club has now decided to invest some of its accrued funds on a pair of Maxim speakers, so that the chore of taking a pair of speakers here and there is rather lighter!

WEST MIDDLESEX TRC
A very interesting and instructive visit to the Brentford Piano Museum was made by some 50 members of the West Middlesex club. Some excellent tapes were made.
Other meetings included the club social, a visit by Frank Parrington of BASF, and a demonstration by club chairman H. E. Saunders entitled 'Putting Sound to 8mm Cine'.
Further enquiries concerning the club should be addressed to 20 Nightingale Road, Hampton, Middlesex.

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ON TEST THE TELEFUNKEN 204E

by Peter Knight

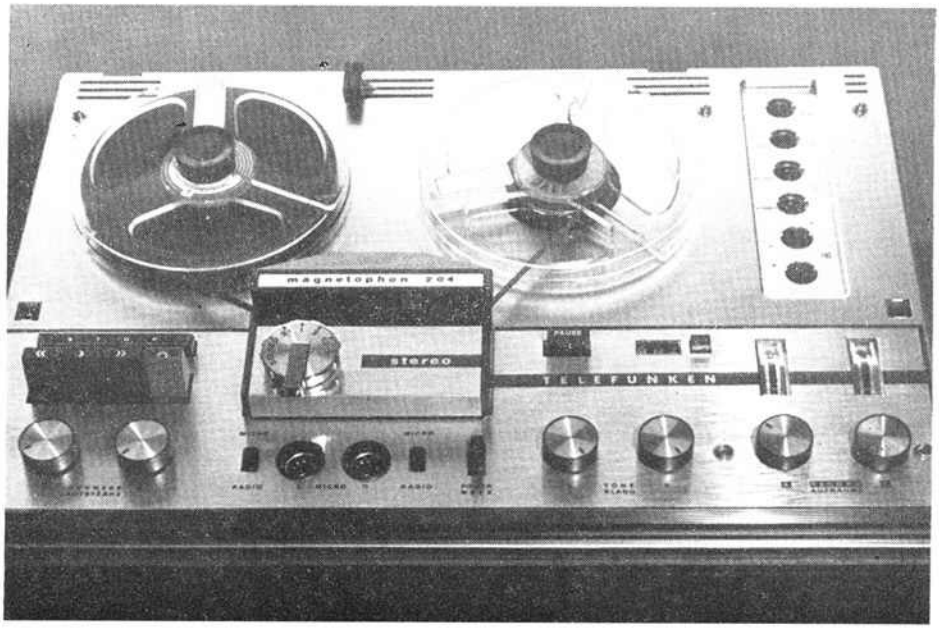

Fig. 1. Top view of recorder.

So new is the Telefunken 204E all-transistor, mains powered tape recorder to the British market that its instruction booklet has not yet been printed in English. That is, at the time of writing this test report; no doubt by the time this test is in print this 'problem' (to me, anyway!) will be resolved.

The 204E is a fully contained stereo model, meaning that in addition to its dual channel recording and playback amplifiers, deck equipment and so forth, it also features built-in speakers looking out from the left- and right-hand sides of the cabinet for reproducing *in situ* the corresponding A and B stereo channels. While these inbuilt speakers are not intended for serious high-quality reproduction, they do give quite a good account of themselves, in spite of their relatively small size and absence of specialized acoustic loading in the cabinet. For the reproduction of stereo tapes the machine is best positioned in the corner of a room so that the adjacent walls can act as diffusers for the sounds emanating sideways from the cabinet. Of course, for the best results a pair of good speaker systems are called for, and these can be connected to the outlets on the sockets panel (see Fig. 1).

Two-speed Four-track

The machine is four-track and two-speed, 3¾ ips and 7½ ips. Speed change is accomplished by a 'flick-over' control located at the top of the tape deck, between the two spools, and this differs from most machines, as will be explained later. Head switching is handled by a rotary control knob positioned near to the head system. This control switches in heads A or B, giving two tracks, the two other tracks being picked up with the tape inverted, in the usual way.

There is also a 'stereo' position on this control which switches the A and B channel heads to the corresponding amplifiers. Another position puts the two head sections in parallel so that recordings made on tracks 1 and 2 (or on tracks 3 and 4 with the tape inverted) can be heard superimposed on playback. This position makes it possible for a stereo tape-record to deliver a fully-fledged mono signal which, for instance, may be required for dubbing on to a single track of a mono-only recorder.

This facility also makes it possible to superimpose two *separate* recordings to a single track with far better quality than muting the erase signal or lifting the tape clear of the erase head (as is often practised) and then superimposing on a track already recorded. Other head switch positions are track-2-to-track-1 and track-1-to-track-2. These positions make it possible to listen to the track which is being transferred while at the same time recording new material. For instance, in the 2/1 position, the material already recorded on track 2 can be monitored in the internal speaker (or in headphones if required) while it is actually being recorded on to track 1 along with the new recording. The recording level meter indicates the signal level sum of both the material being transferred from one track to the other and the new material. These positions on the head switch could prove of great use to the real tape enthusiast.

Duplicated Controls

Each stereo channel has its own controls. These are playback loudness (i.e., volume), tone and recording level. There are also two recording level meters of the side-deflection type, not calibrated, but with full recording level indicated by a mark on the scale, which is a demarcation between the black (ordinary recording level) and red (overload) zones. These meters are nicely damped and thus easy to use. They are pretty flat response-wise up to about 5,000c/s but then there is a distinct lift due, possibly to treble boosting in the recording amplifiers.

Other features include a three-digit tape

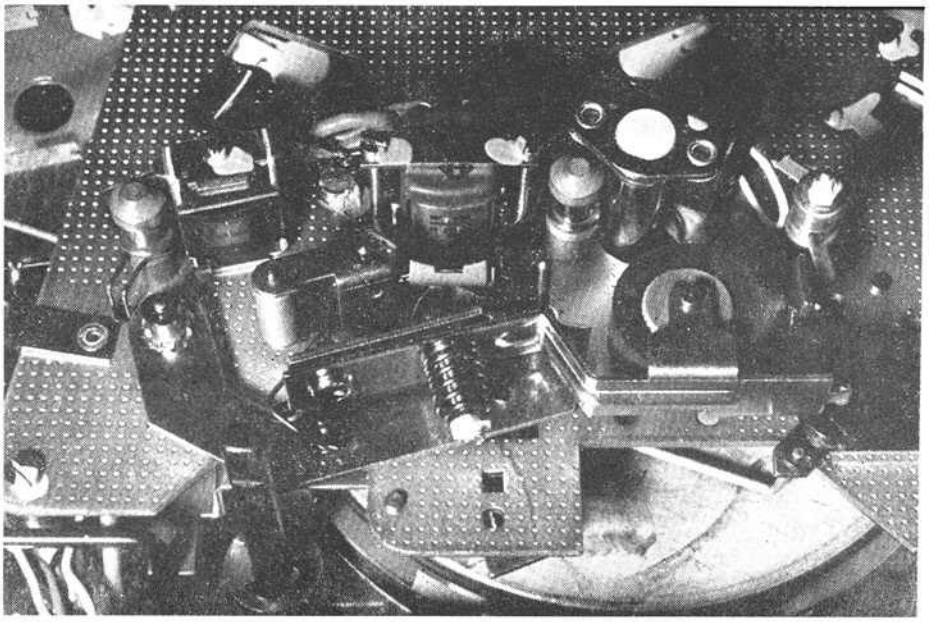

Fig. 2. Showing belt-coupled capstan, flywheel and heads.

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counter and push-button type of pause control – press for pause and then press again for release. The tape functions are controlled by four push-buttons, giving the two fast winds, ordinary motion and record (red button), which must be depressed with the ordinary motion button to secure the recording condition. However, it is possible to press down and hold-on the red recording button without having to depress the ordinary motion button. This allows the recording level controls, etc., to be set up correctly and balanced before bringing the tape into motion.

When recording, the playback volume controls can be advanced to bring the signal into the internal speakers for monitoring purposes or into headphones. Care has to be taken over this exercise, of course, to avoid acoustical feedback from the speakers into the microphones, if such are being used to provide the recording signal.

DIN sockets are used throughout, as would be expected. A row of six sockets on a socket panel at the top right-hand corner of the tape deck provides radio, pick-up, headphones mono and stereo and left and right external speaker outlets. A pair of sockets near to the head switch accommodates left and right-hand microphones. Each channel also has a switch between microphone and radio, permitting immediate changeover, since there are no fader controls or mixers. The tape deck is 'de-programmed' by a *stop-bar*, while the machine as a whole is switched on and off by a press button.

The recorder as a whole is very well made and the design is good. It has much in common with the mono recorder, Model 201, reviewed in the June 1966 issue of *ATR*. The substantial flywheel capstan can be seen in Fig. 2, which also shows the head system. The flywheel capstan is belt-driven from the motor, via speed-change gearing (also belt-drive). The speed-change is rather amazing in that when the speed-change lever is flicked over a belt jumps into two different sets of pulleys, giving the different coupling ratios. The action is incredibly accurate, yet on the face of it would appear to be impossible! But much as I tried to fault it, the belt just would not jump out of its pulleys. Some of the belt-drive mechanics are shown in Fig. 3. Braking and spooling works extremely well, and the only comment on the drive system is the rather high noise level; but this appeared on the test sample to be coming from the motor – possibly due to slight unbalance in the bearings in this example. Not sufficient to be detracting, though.

Circuit Features

The circuit is built upon printed circuit boards, there being a board catering for the A and B channel audio output (playback) stages, each consisting of a driver transistor transformer-coupled to the pair of push-pull output transistors in transformer-less connection with the internal loudspeaker. Each channel has five transistors in its recording amplifier and early playback stages. These account for sixteen transistors, and there are two more, including the hf oscillator, making a total of eighteen in all.

The transistor supply voltage is obtained from a bridge rectifier system, fed from a low-voltage winding on an isolated-winding mains transformer. The drive motor is fed direct from the mains supply, via the recorder's main on/off switch.

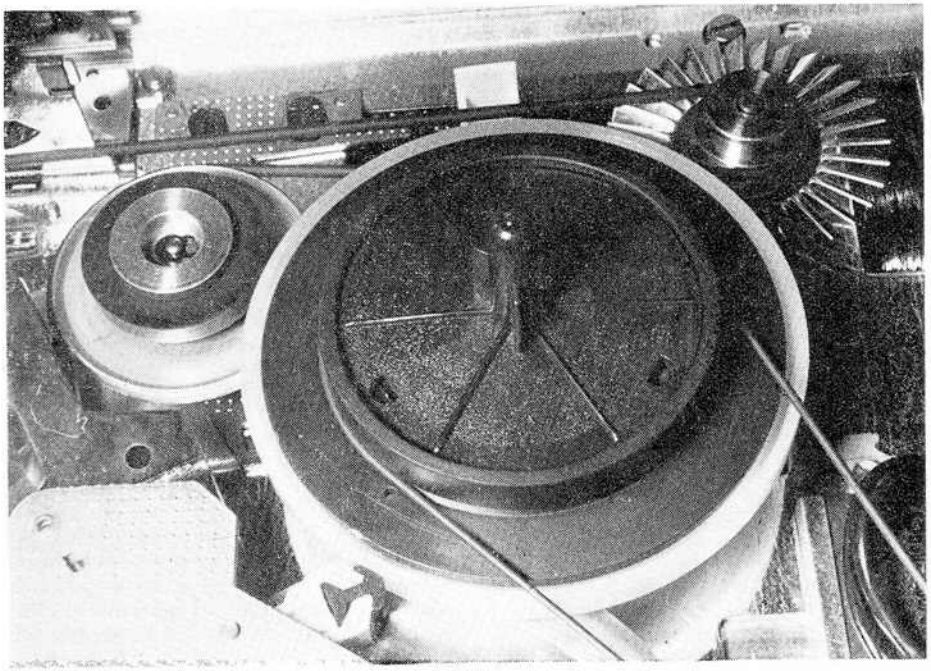

Fig. 3. Showing the drive system.

Overall Frequency Response

The overall record/playback frequency response was checked by recording sine-wave signals on a new tape at frequency intervals between 20c/s and 20,000c/s, with the recording level meter indicating approximately —6dB below full recording level at 1,000c/s. The input signal was applied to the microphone input and tests were made to ensure that the level was constant at the imput at all frequencies recorded. The sine-wave signals so recorded were then played back and the output level monitored on a frequency-corrected valve voltmeter across the loudspeaker socket loaded with a 4 ohm wire-wound resistor. An oscilloscope was also connected across the load to check waveform The full-line curve in Fig. 4 depicts the overall response curve derived as explained above the output voltage across 4 ohms at 1,000c/s corresponding to 2·25 watts of audio. The broken-line curve on the same diagram gives an indication of how the recording level meter varied over the spectrum with a constant input signal. This signifies the presence of treble-boost on the recording channel, within influence of the recording level meter, and this starts rising where the overall response starts falling, which is quite logical. The response is very good it being within a little over 3dB from 40c/s to about 18,000c/s at a tape velocity of 7½ ips. Note, however, that the output is in terms of voltage changes across the load, and these are translated to decibels. Both A and B channels were checked in this manner, and there was no significant difference between them.

Power Output

The full power output of the playback amplifier was checked up to sine-wave clipping point at 1,000c/s with the input signal applied to the microphone input and with the output taken from across a 4 ohm wire-wound resistive load connected across the corresponding external loudspeaker socket. The

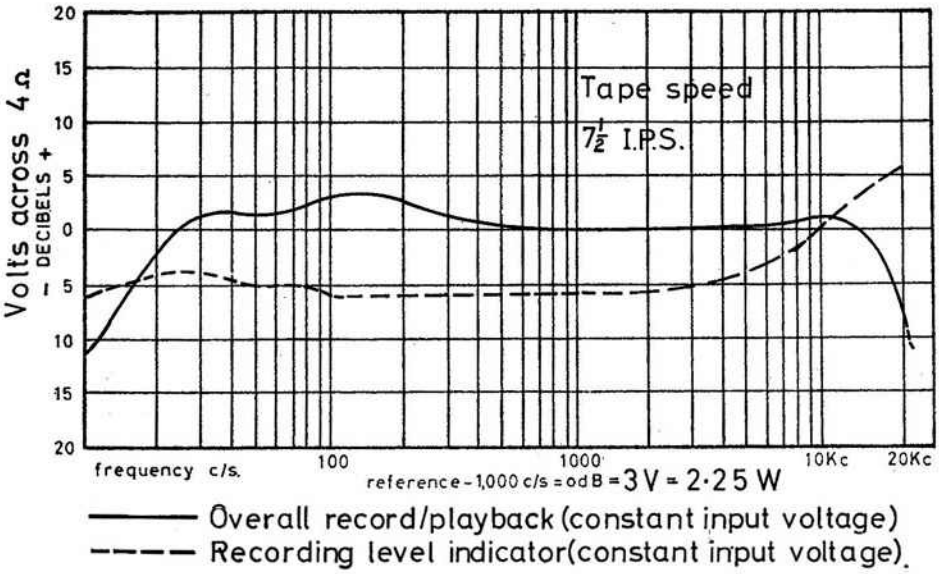

Fig. 4. Overall frequency response curves.

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continued from page 33

output was just approaching the clipping point which, incidentally, was symmetrical, when the voltage across the load was 4·5 rms. This corresponds to an audio power of a little over 4·5 watts. The full power on tape playback, of a 1,000c/s sine-wave recording, was 5 volts rms across 4 ohms, or a little over 6 watts. This would imply that the input stages were clipping when the signal was applied direct to the microphone input.

The distortion was not particularly low towards full output from the speaker outlets, as would be expected with the nature of the playback circuit employed. Extremely good quality, however, was obtained by running at about half-power with two reasonably sensitive external speakers. The Jordan Watts *Juno*, using the well-known modular hi-fi speaker unit in an infinite-baffle enclosure, worked very well in this role. About 3 watts on two stereo channels (6 watts mono) is a reasonable domestic power with a good speaker system. It was also found that the 'monitor' output signal, prior to the power amplifier stages in the playback channel, could be fed into a hi-fi amplifier system for even better results.

The machine is pleasantly housed in a walnut-finished cabinet with a fold-down handle (large one) on the front to assist transportation, while a clip-on plastic top embraces the whole of the top deck when the machine is inactive. The approximate cabinet dimensions are height 7½ inches, width 18½ inches and depth 14 inches.

This is the kind of machine that would please anyone changing over from ordinary domestic mono to stereo. The machine is easy to operate and works quite well. It may also suit the less exacting general tape recordist; but the real hi-fi type would probably discover that it is not quite up to his mark except perhaps when used with a hi-fi amplifier for playback. But improved quality would mean a deeper dig into the pocket than is necessary for this versatile machine. And its versatility alone will suit a very large proportion of tape enthusiasts.

In conclusion, it should be mentioned that the machine is designed for vertical as well as for horizontal mounting. In vertical orientation, the spools are secured to their carriers by the use of rubber retainers pushed on to the protruding spindles. It was noticed on the sample machine that the motor noise was less with the machine operating in the vertical position, but this could have been due to the table on which the machine was stood. On a solid mounting, the noise was insignificant in both vertical and horizontal orientations.

Mains Specifications from Instruction Booklet

Mains input: 110/127/220/240V, 50c/s. *Bias frequency:* 85 Kc/s. *Sockets:* All to DIN standard. *Speeds:* 7½ ips and 3¾ ips. *Tracks:* Four. *Frequency response:* 40 to 18,000c/s at 7½ ips and 40 to 15,000c/s at 3¾ ips. *Wow and flutter:* ± 0·2% at 7½ ips and ± 0·3% at 3¾ ips. *Inputs:* Microphone 0·15mV across 2,000 ohms. Radio 0·15mV across 2,000 ohms. Pick-up 150mV across 2·2M (doubled for stereo). *Outputs:* Radio 1·5V across 8,000 ohms Phones Mono and Stereo 1·5V across 15K. External Loudspeakers 10 ohm (doubled for stereo). *Power output:* 6 watt (music). *Distortion:* Less than 5%. *Weight:* 14·5kg. *Microphones:* Two Telefunken TD25's supplied. *Retail Price:* 106*gns*.

THE THINGS YOU SAY

Service after Sales (?)

After reading some of your readers' experiences in *The Things you Say* regarding service, I should like to tell you mine. I purchased a Ferguson Tape Recorder type 3218 on 24 June from Nusound of Lewisham, and after a few teething troubles it is now in satisfactory condition. At about the same time I made an enquiry to the technical department of Nusound Limited and received a prompt and very satisfactory reply.

At the beginning of July I ordered an extension microphone lead from Ferguson listed by them as a standard item in their accessory list, and in spite of it being ordered twice over by the Manager of Nusound Limited it has not yet turned up. I also wrote to the makers about two weeks ago and they did not even bother to reply. I must admit that this is the first time over a long period that I have personally met this sort of thing and I don't like it.

London SE12. **H. G. Weston**

Sound Hunting

Re: your Editorial Comment Sound Hunting (October *ATR*).

(A) Yes, I for one would be interested.
(B) One day only.
(C) A prize for the best tape is a good idea.

Jean Weir

Rainham, Kent

(*See page 8 A Sound Hunt in Holland. Ed.*)

Good Service – Bad Service

Whilst reading through the June issue of *ATR* and the letter from Mr C. J. Street in particular, I was reminded of my own experience of good and not-so-good service which may be of interest. First the good service. I had the misfortune to break a spool carrier on my Ultra 600. I 'phoned Ultra, was referred to their service department, quoted a price and on offering to send a cheque prior to despatch, I was told I could send the cheque on receipt of the goods which arrived two days later. This, I feel you will agree, was good service.

Now the not-so-good. I purchased a Philips EL3586 from a local radio dealer, and at the same time I ordered the carrying case. However, after three months of enquiry and waiting I gave it up as a bad job. I then contacted another dealer and it took him from Cup Final day until three weeks ago to produce a case for a model still in production and this only after numerous 'phone calls and visits to the dealer. I am considering the purchase of another more elaborate recorder to give me more scope than my Ultra model, but after Mr C. J. Street's and my own experiences I find myself wishing that Ultra had such a model in the £70 price range. **R. J. Griffiths**

Swinton, Lancs

ATR Hi-Fi Section

I am writing to thank you for the excellent issue of *ATR* October. The inclusion of a Hi-Fi supplement is a worthy addition. It would seem that the future role of the tape recorder will be even closer integration with Hi-Fi than at present and that tape recorders will become static and fitted into the furnishings of the house or quite small and movable such as a transistor radio. I think that those who record and listen in the home will become even more separated from the present small band of 'up and doing' outdoor recordists. (*Mr D. J. Shaw continued his letter with a few technical queries.*)

Tiverton, Devon **D. J. Shaw**

In Praise of Tape Recording

I have a friend who has been blind since a very early age and he uses a tape recorder and radio (being a radio ham) for most of his communications. About a year ago he had to leave Glasgow to go to Leeds University to study for a degree. As none of the textbooks for his subject was available in Braille, he had to depend on other students reading to him. As the course progressed this was not possible, but on the advice of a friend he contacted the Governor of Blundeson Prison for permission to send his tapes and textbooks. The Governor was able to get suitable inmates to record all the textbooks for him.

The prisoners took a keen interest in his progress and eventually he obtained his degree and is now engaged with Stow College, Glasgow. He sends messages of thanks to all the prisoners who helped him and he still keeps in touch with one or two who are now outside. His name is Dick Craig and he taught at least one of the prison inmates to read Braille.

I think this is one of the best uses I have heard of for tape recording and if any reader would like to get in touch with Dick Craig, his amateur radio callsign is GM3NIF and his address is 272 Billrock Street, Cranhall, Glasgow.

Glasgow E1 **R. J. Burns**

Speeches by Aneurin Bevan

The Society for the Study of Labour History (President Professor Asa Briggs) and The Trade Union, Labour, Co-operative-Democratic History Society (President George Woodcock) are conducting an exploratory survey to try to establish the whereabouts of any recordings of speeches by the late Aneurin Bevan, M.P. On behalf of these societies, I would like to appeal through the columns of your journal to readers who have such material in their possession, or who know of the whereabouts of such material, to get in touch with me. If possible, I would also like to know whether individuals or organizations possessing recorded material would be willing to let us examine it. I can assure readers that every care would be taken of material loaned to us for the purpose of our investigation.

Sheffield 10 **William Carr,**
Department of Modern History,
Sheffield University.

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99

Emitape 99–the long play tape formulated for 4-track recorders

Emitape 99 has been created by E.M.I., the original and largest British manufacturers of magnetic recording tape, in co-operation with I.C.I. who have produced a special 'Melinex' film base material for this new production.

Emitape 99 has greater strength—perfect tracking at all speeds—and outstanding hi-fi performance has been achieved by the most up-to-date coating techniques.

Three other high quality grades are in the Emitape range:

Standard Play 88 for use at professional tape speeds; **Double Play 100** for more recording time; **Triple Play 300** for maximum playing time on battery portables.

Emitape is supplied in a free transparent two-piece library case originally designed for computer tapes. It gives compact dust-free storage and easy indexing.

Emitape is used nine times out of ten by the B.B.C.
All the best dealers are Emitape stockists.

EMITAPE

THE MOST ADVANCED MAGNETIC RECORDING TAPE IN THE WORLD

EMI

AN E.M.I. GROUP PRODUCT
E.M.I. TAPE LIMITED,
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MANUFACTURER'S SPECIFICATION FOR THE FERROGRAPH MODEL 633

(*Omitted from the November issue of* ATR)

Recording medium: magnetic recording tape, $\frac{1}{4}$in wide, on reels up to $8\frac{1}{4}$in diameter, coating inside. **Track width:** 0·1in – displaced to one edge. **Number of tracks:** 2 (recorded separately). **Operating tape speeds:** Model 633, $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ ips ± 2%; Model 633H, 15, $7\frac{1}{2}$, $3\frac{3}{4}$ ips ±2%. **Playing time per track:** (standard play tape) large reel (1,750 ft) $22\frac{1}{2}$ min at 15 ips, 45 min at $7\frac{1}{2}$ ips, $1\frac{1}{2}$ hrs at $3\frac{3}{4}$ ips, 3 hrs at $1\frac{7}{8}$ ips. **Playing time per reel:** double these times. **Fast wind time:** less than 1 min for 1,200 ft tape (either direction). **'Wow' and 'Flutter':** less than 0·16% at $7\frac{1}{2}$ ips. **Long-term speed stability:** better than 0·5% (for constant mains frequency). **Frequency response:** 15 ips, 30–20,000c/s ±3 dB; $7\frac{1}{2}$ ips, 30–16,000c/s ± 3 dB; $3\frac{3}{4}$ ips, 40–11,000c/s ±3 dB; $1\frac{7}{8}$ ips, 40–6,000c/s ±4 dB. **Record/playback characteristic:** 15 ips, 35 microseconds; $7\frac{1}{2}$ ips, 70 microseconds; $3\frac{3}{4}$ ips, 140 microseconds; $1\frac{7}{8}$ ips, 280 microseconds. **Input level** (minimum signal for full depth recording): microphone 1·5 mV (2 Megohms), pick-up – magnetic type (velocity characteristic) 12 mV at 1,000c/s (50 Kohm), input 2 – 45 mV (200 Kohm approximately). **Output arrangements:** 15 ohm – 3 watts (maximum); monitor – 6V (maximum); output 2 – 300 mV (1 Kohm – cathode follower). **Bass control:** continuously variable ±10 dB at 40c/s. **Treble control:** continuously variable ±10 dB at 15,000c/s. **Signal to noise ratio:** unweighted, including hum, better than 52 dB. **Mains supply:** 200–250V, 50c/s. Alternative models: Suffix A – 117, 60c/s, Suffix E – 110, 50c/s. **Power consumption:** 115 watts. **Overall dimensions:** $17\frac{3}{4}$in wide × $18\frac{3}{4}$in deep × $9\frac{3}{4}$in high with lid. **Weight:** 48 lb.

ATR JANUARY 1967

NEW YEAR—NEW TAPE FEATURES

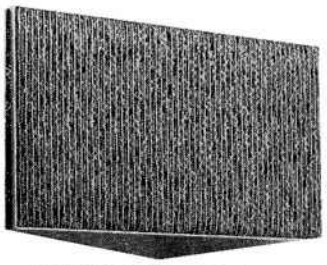
On Tape

- ★ Tape and Travel – a new series of articles by Bob Danvers-Walker with photographs by the Editor
  I. Paris on a Shoestring
- ★ Test Reports on New Microphones
- ✶ On Test – Ampex 1150 Tape Recorder
- ★ Speed Variation – Cause and Cure
- ✶ Stichting RIOP – a report on a hospital programme service in Holland

Plus the Hi-Fi Section

On Hi-Fi

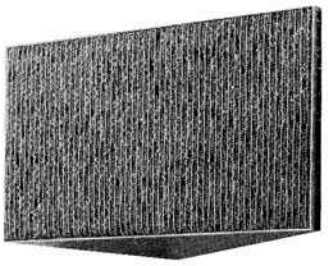
- ★ Impedance Matching Circuits – plugs and sockets
- ★ Design for a Loudspeaker Enclosure
- ★ Test Report – Goldring Transcription Unit and Pick-up



Owing to changes in marketing arrangements, increased production, and the fact that we now make our own crossovers, we have been able to reduce the list price of the OMNI to

29½ guineas

This product remains identical in construction and performance.



HARMONY (Mus)

Can be variously described by simple phrases such as "a Melodious Sound", or "a Combination of musical notes to make a chord".

It is also the name for the science involving musical sounds in their combination and progression. It is a most complicated science in its own right, for the simplest chord on the purest-toned instrument is a remarkably complex thing: an orchestral climax would probably defy complete analysis.

HARMONY (domest)

A highly desirable state of peace and completeness which can be attained in musical families by the simple expedient of mounting a pair of extremely good loudspeakers on the walls of the listening room.

Floor space is saved, the vacuum cleaner can be used again, cables are not lying all over the floor, and a flower vase (if essential!) can be stood on top: "She" is happy.

The phasing does not get disturbed, the loudspeakers do not get moved about, stereo is consistent, and the reproduction is truly excellent : "He" is happy.

The effect is cumulative within the household of course; each is happy because the other is.

The Jones' are not so. (Unless they did it first).

Visit your dealer, ask to hear a pair of OMNIs on their sides or on a shelf (or something) about 4-5ft above the floor with the controls level.

And make sure you do just that – it makes a vast difference and could save you a small fortune if it is realism with extreme smoothness which you are after.

If your dealer turns out to be a helpless square, tell us, at Rectavox, and we will soon find you a better one!!

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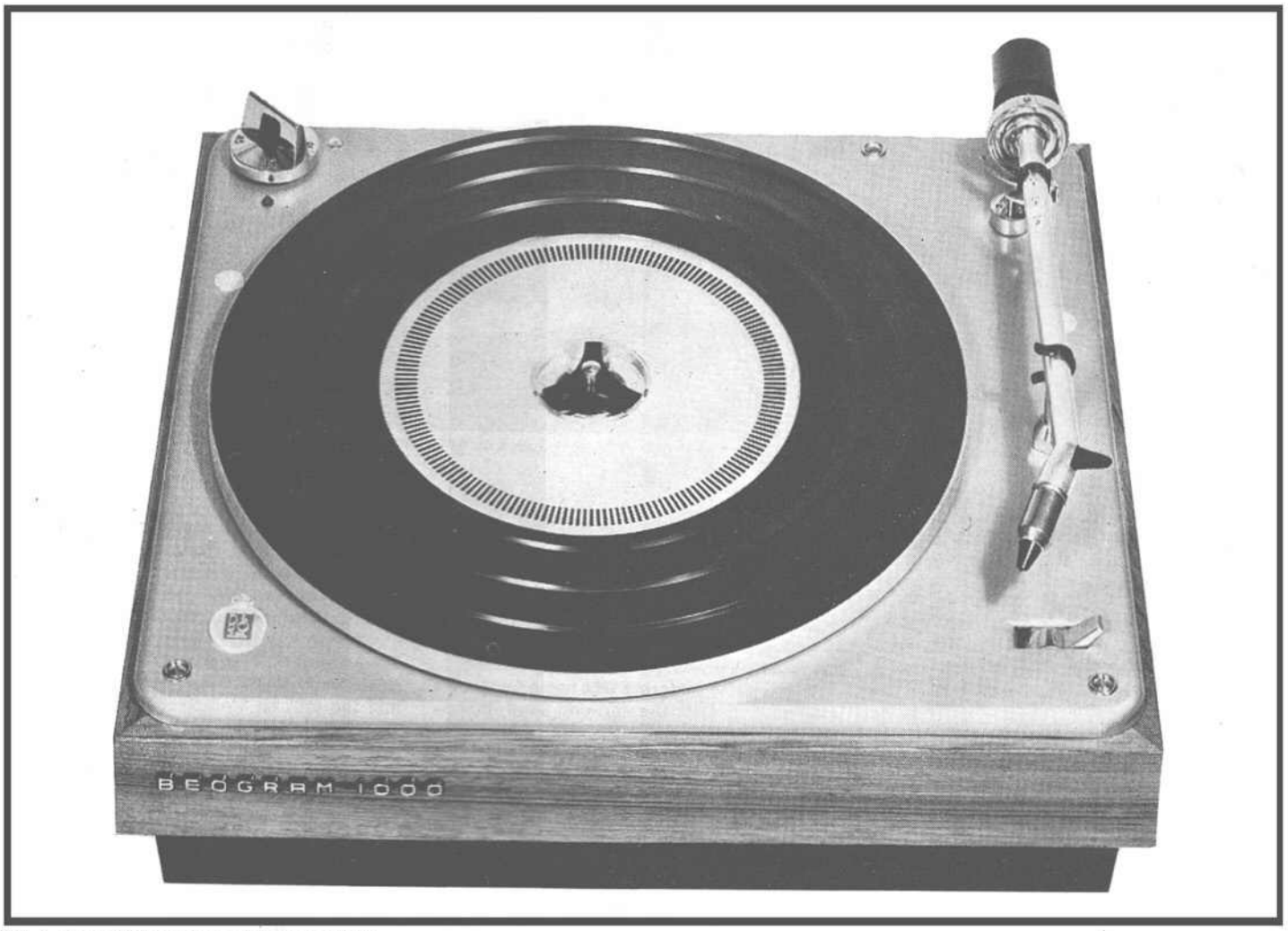

Fig. 1. *General appearance of Beogram 1000.*

TEST REPORT - THE BEOGRAM 1000

by Peter Knight

The Bang and Olufsen Beogram 1000 comprises a mounted motor unit, pick-up arm and cartridge and a Perspex cover that can be placed upon the system when not in use. Some hi-fi systems of this kind can cost up to £70 or more, but the Beogram is only about half this price and yet very much hi-fi. Fig. 1 shows the overall appearance of the system with the Perspex cover removed, ready for playing. The plinth is available in teak or Brazilian rosewood, and this is 'floating' on the black base to give a microphonic-free suspension, which damps acoustic vibrations from the table or support and ensures optimum tracking under most ordinary domestic environments. The motor unit and its coupling together with the pick-up are mounted on a fairly substantial pressed metal plate, and the turntable, while not massive, has sufficient inertia to damp down wow and flutter to values readily acceptable by most hi-fi types. The turntable mat is ridged for record support and coupling, and a stroboscopic disc, tailored to a speed of 33⅓ rpm when illuminated by a lamp powered from the mains supply, is incorporated in the centre of the turntable.

Although the motor is four-speed, the speeds are all correct once adjustment has been made at 33⅓ rpm, and a knurled control in the centre of the speed-change knob is available for motor-speed control. The motor is automatically switched *on* when the arm is moved from its clip rest, and then, after placing the pick-up over the record at the required playing position, the arm slowly lowers on to the groove when the toggle-type control in the near right-hand corner of the motor plate is operated. Of course, there is no automatic switch-off device at the end of a record.

Belt Drive

The turntable unit is extremely well thought out and differs from many other units in that a belt drive to a pulley ridge on the inside of the turntable couples the driving force. The turntable pulley is coupled to a substantially smaller diameter pulley which itself is mechanically coupled to a slightly larger diameter friction wheel, and this picks up its coupling direct from the motor spindle, via stepped diameters, to give the various speeds. These mechanics are highlighted in Fig. 2, which at the top shows the belt drive, a little below the friction wheel and the stepped diameters on the motor spindle directly below the turntable pulley ridge.

The drive motor is fairly large, fully screened and would appear to have plenty of power in

continued overleaf

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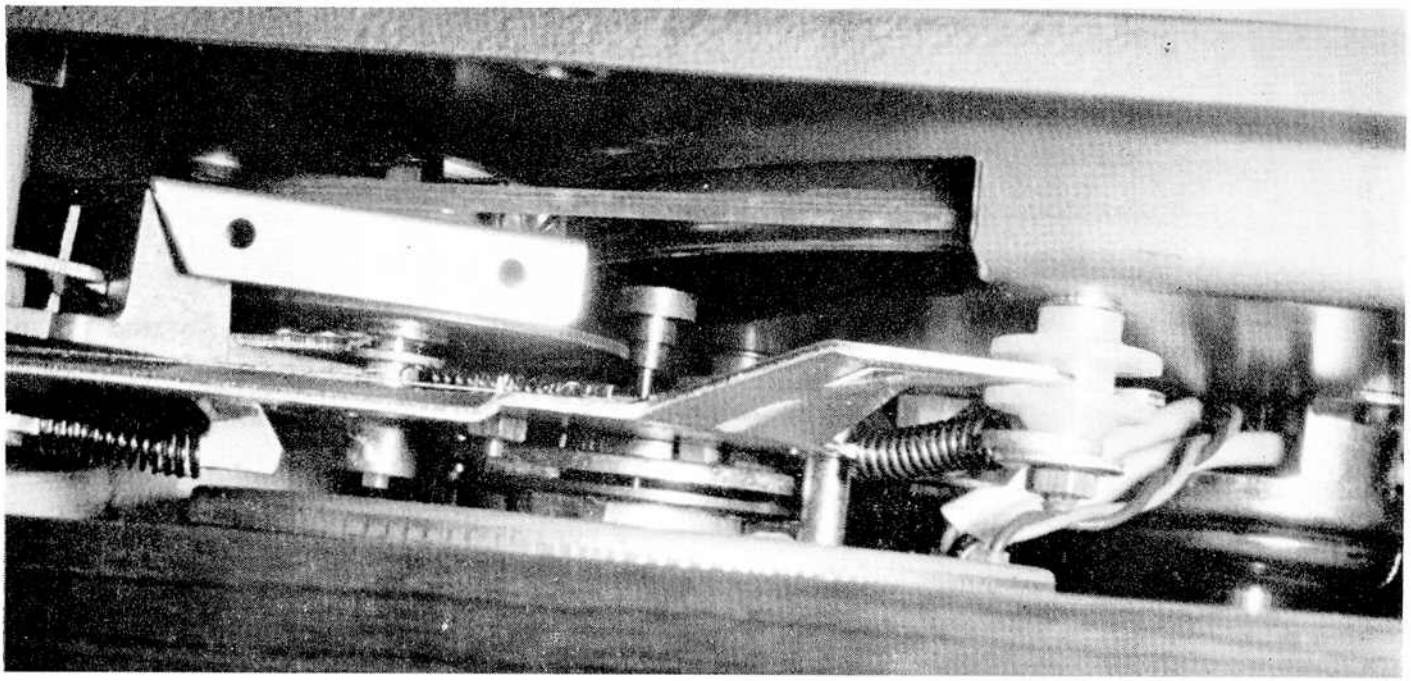

Fig. 2. *Showing the drive mechanism of the motor.*

reserve. Its speed is controlled over a small range, via the speed control knob previously mentioned, by an eddy current disc arrangement, which is brought down in closer proximity to a similar rotating disc on the motor when the control knob is turned to make the motor run more slowly. A micro-switch passes current to the drive motor when the arm is removed from its resting clip. Thus, no pressure is applied to the arm or its bearing by the process of switching on.

The lowering device works in conjunction with a 'remote controlled' (from the toggle-type control in the corner) hydraulic plunger unit, located towards the bearing end of the arm. The plunger rises in the *lift* position and engages on a lifting flange, in the form of an arc secured to the underside of the arm. To avoid the flange from slipping on the plunger when it is required to lower the pick-up at a critical point on a record, the flange has a friction surface against the plunger.

The arm employed is the Bang and Olufsen ST/L (15 degrees) in static balance on the unit. One would these days, of course, expect arms in the hi-fi class to be statically balanced or to embody adjustments for this purpose, such precision being reflected in their price. It is amazing, therefore, to find this attribute on such a reasonably-priced unit having so many other desirable features as well. Statically balanced means basically that in any position the arm will balance on its bearings and that there is no undue bias or force acting in any direction. When an arm is mounted on a motor plate it is not an easy matter to determine the degree of such balance; one of the best ways is to remove the arm, mount it on a special jig and then measure with delicate instruments the degree of balance.

It was not possible to test the Beogram 1000 in this way, but proof that the balance was not very far out (if out at all!) was dramatically obtained by running the unit in an almost vertical position, as shown in Fig. 3. Here the unit is shown tracking a 33⅓ record at about 2 grams and reproducing at normal quality. The only disturbance was a slight internal knocking coming from the motor mechanics, but the test certainly proved the point. Of course, any arm, complete with head, which is in correct static balance should track even mounted on a wall, juke-box style!

The arm of the Beogram 1000 has a removable counterweight at the far end, and this is locked into position on the arm by means of an internal spring-loaded ball that clicks into a corresponding hole on the arm. The spring-loaded ball of the test sample was unfortunately stuck, allowing the counterweight to alter a little in position while playing. Downward or tracking pressure is applied by a spring coupled to a slider on the arm and calibration marks on the arm tell the degree of tracking pressure applied, this being easily adjustable from zero to 3 grams or more beyond the scale markings, and pressure tests indicated the fair accuracy of this calibration. Pick-up location over any point on the record is facilitated by a short, finger-lifting arm near to the head.

The well-known B & O SP series pick-up was fitted to the test sample. This is a magnetic stereo head incorporating a symmetrical microcross armature section designed for minimizing stereo crosstalk and harmonic distortion. A great deal of design has gone into this head, and other features include protection against damage should the arm be dropped on a record, uniform stylus compliance in all directions, adequate screening to reduce hum sensitivity and interaction to steel turntables and a diamond stylus.

The frequency response is substantially flat from 20 to 20,000c/s within $\pm 2\frac{1}{2}$dB, while the channel separation is in the order of 28dB at 500c/s. Other details are given at the end of this article. The head is in two sections as shown in Fig. 4. The section on the right contains the magnet, and this pushes into the armature section on the left, and is then locked in position by the small grub screw. The stylus assembly is, in fact, replaced by this operation. As the pick-up output is relatively low-level (7mV per channel at a recorded velocity of 5cm/sec), it requires an amplifier with a low-level input and magnetic equalization to work it correctly.

Two-channel Transistor Amplifier

However, B & O have solved the problem so that the unit as a whole can partner amplifiers with inputs of considerably less sensitivity by the design of a small, two-channel, plug-in printed circuit board transistor amplifier. This slips into a suitable socket within the base of the Beogram 1000 and thus automatically introduces the amplifiers in series with the right and left signal circuits of the pick-up. The two-channel pick-up signals are then lifted to 560mV at 1,000c/s from 7mV, corresponding to a gain of 38dB. The power supply is derived from a winding on the motor to avoid a mains transformer which could produce hum in low-level circuits.

Each channel of this amplifier employs an n-p-n transistor dc coupled to a p-n-p transistor with negative feedback in a frequency-selective loop. The 14V ac obtained from the motor winding is rectified by a pair of OA70 diodes and adequately filtered before arriving at the transistors. The signal level from the amplified version is sufficient to feed the 'radio' input of many tape recorders, allowing dubbing from disc to tape, or should it be required, for the recorder's playback amplifier to double as a disc record playback amplifier. The 'direct-from-pick-up' version has a little printed circuit strip which plugs in in place of the amplifier board, the strip being interconnected so that the pick-up signals are conveyed direct to the output leads. This was the type of unit tested, and ideally it partners the B & O Beomaster 1000, which is the amplified FM stereo tuner. It was tested with this and worked remarkably well. It was also tested with amplifiers of other makes incorporating low-level magnetic pick-up inputs and gave good results with all of them.

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Fig. 3. *True picture showing the unit actually tracking at about 2 gram at 33⅓ rpm in an almost vertical position.*

The speed control was found to be non-critical and easily set-up with the stroboscopic disc on the turntable, and it was discovered that once the motor speed was correctly established, further adjustment was not really necessary during the whole period of the tests – the motor holding its speed very accurately during protracted playing sessions and from one session to another.

Wow was undetectable under ordinary playing conditions, even with the most wow-prone record available, and rumble was well below disturbance threshold. To obtain a subjective test of rumble, the pick-up stylus was rested on an empty matchbox on the motor plate, and even under this rumble-emphasizing condition the rumble was a little below the level of background hiss with the amplifier's volume control fully advanced! Channel separation and stereo balance provided by the SP7 pick-up was very good in spite of the lack of any obvious bias compensation on the arm system. The value of bias compensation to neutralize the tendency for the pick-up to swing towards the centre of a playing record due to overhang and offset of the head is now well known in terms of obtaining optimum stereo balance. Some arms, of course, feature elaborate devices for the application of bias compensation, but the B & O ST/L arm has no external mechanics of this nature. However, the nature of the arm's pivoting and balance certainly provides some degree of 'built-in' compensation, ensuring that the pressure of the stylus is substantially equal on each of the two walls of the groove. A pick-up system with total lack of this bias would subject a greater stylus force on the inner wall of the groove than on the outer, an effect that can disturb the stereo balance of the pick-up.

For anyone desirous of obtaining a completely self-contained record-playing system of undoubted hi-fi quality and of modern design, the Beogram 1000 is well worth exploring; it certainly represents very good value for money.

Makers' Specifications

Speeds: 78, 45, 33⅓ and 16⅔ rpm. ***Dimensions:*** Width 14$\frac{1}{16}$ inches; depth 12$\frac{1}{8}$ inches (12$\frac{3}{8}$ inches including counterweight); height about 5$\frac{3}{8}$ inches (6$\frac{1}{4}$ inches including dust cover). ***Supply Voltage:*** 220V ac 50c/s. ***Arm:*** B & O ST/L 15 deg. with built-in hydraulically-damped pick-up lift. ***Rumble:*** About 35dB below reference voltage from pick-up at 1·4cm/sec, 100c/s with NARTB equalization. ***Wow:*** ± 0·2% (peak value). ***Pick-up:*** SP7. ***Frequency Response:*** 20 to 20,000c/s ±2½dB. ***Output:*** 7mV per channel at 5cm/sec. ***Channel Separation:*** Approx 28dB at 500c/s. ***Stylus Pressure:*** Min. 1 gram, max. 3 gram. ***Compliance:*** 12–15 × 10^{6}/cm/dyn. ***Tip Mass:*** 1·5 milligram. ***Recommended Load:*** 47,000 ohms. ***Stylus:*** Spherical 17 microns. ***Amplifier Frequency Response:*** 40 to 20,000c/s ±2½dB (overall for pick-up and amplifier). ***Output Voltage:*** 560mV at 1,000c/s for an input of 7mV (+38dB). ***Noise:*** −62dB. ***Supply Voltage:*** 14V ac from motor (see text). ***Current Drain:*** 4mA.

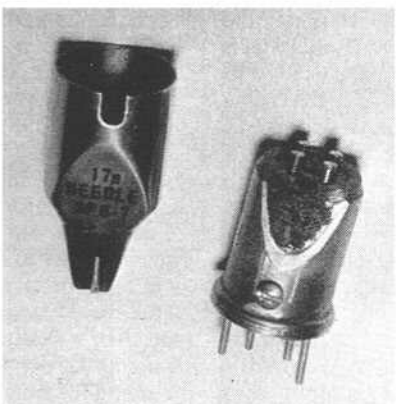

Fig. 4. *The magnetic stereo head with the stylus section parted from the magnet assembly.*

SOUND EFFECTS RECORDS

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CASTLE, 7" 45 rpm records, approximate playing time 10 minutes. Each contains selection of sound effects in separate tracks. Complete with sleeve and paper inner jacket. Sleeve includes description of each sound effect and playing time in seconds

A ABX/1—BELLS AND SIRENS *Price 7/6*
Side 1—Fire engines with bells Fire engine—alarm and sirens S.S. Queen Mary siren Factory siren Telephone bell Door bell
Side 2—Clock chime Alarm clock Westminster chime Bow bells

B AFX/1—WILD ANIMALS *Price 7/6*
Side 1—Male and female lions Gibbons Chimpanzees Bell bird Rattlesnake Baboon Viper Emperor geese Fish eagles Mountain lion (puma) Kookaburra (laughing jackass)
Side 2—Elephants Mississippi alligator Indian tiger Sea lions Male lion In the jungle (a background of typical sounds)

C BGX/1—BACKGROUND SOUND EFFECTS *Price 7/6*
Side 1—Sea (breakers) Wind (howling—eerie) Thunder (light rain)
Side 2—Rain (heavy shower) Factory sounds (industrial) Traffic (busy street)

D EFX/1—ELECTRONIC SOUNDS AND MUSIC *Price 7/6*
Side 1—Space ship—take off Space vehicle—imaginary take-off Space vehicle—imaginary landing Ring modulation—tonal Modulated tone glide (descending) Modulated tone glide (ascending) Sibilation—white noise (pitch octave low)
Side 2—Sibilation—white noise (pitch) Sibilation—white noise (pitch octave high) Three-tone ululation Filtered tone Stridor (tonal) Ring modulation and sibilation

E EFX/2—ELECTRONIC THEMES AND MUSIC CONCRETE *Price 7/6*
Side 1—Delta F Study in Sinetones
Side 2—Sound object Montage

F HMX/1—HAUNTED HOUSE, MYSTERY SOUNDS AND MUSIC *Price 7/6*
Side 1—Thunderstorm Mysterioso Electronic Music
Side 2—Spooks Intruder Creaks Fright Dungeon Ghosts Ghouls Maniac laughter

G MFX/1—AUTHENTIC HIGH-FIDELITY SOUND EFFECTS *Price 7/6*
Side 1—Lion roaring Twin piston aircraft landing Building and debris falling Road drills and compressor Ship's siren Steam train leaving station Small steam loco and whistle Cell door, keys and locks
Side 2—Police car and bell, chase Police launch and siren Steam goods train and whistle Car door slam, and starter Storm at sea, thunder, wind and gulls Tube train, stop, doors and start

H MFX/2—AUTHENTIC HIGH-FIDELITY SOUND EFFECTS *Price 7/6*
Side 1—American police car with siren—arriving American police car with siren—departing American police car escort with sirens—passing American police motor-cycle patrol with siren—stopping Applause (hand clapping) Orchestra tuning up Car crash Glass breaking (repeat)
Side 2—City and Waterloo tube train—arriving City and Waterloo tube train—departing Footsteps (continuous track) In subway (mixed) In narrow streets (female) On pavement (mixed) Running in street (female) Running in street (male) Up and down (wooden stairs) Workmen hammering and sawing

I MPX/1—MILITARY PARADE AND WARFARE SOUNDS *Price 7/6*
Side 1—March past—Guards, and crowd sounds, etc. Royal Salute—Parade commands and National Anthem Drums and pipes—with parade commands
Side 2—Aircraft—low level attack (bombs, machine-gun fire, aircraft) Artillery—tanks—rifle fire, etc.

J TFX/1—AUTHENTIC BRITISH TRAIN SOUNDS *Price 7/6*
Side 1—Train departure—main line Train arrival—main line Express train passing—with whistle Fast goods train passing—with whistle Express train passing Small tank loco—passing
Side 2—Local passenger—arrive and depart Fast goods train—passing Central London tube train—arrive and depart Train over points and crossing Slow goods train passing—with whistle

K MFX/3—HORSES *Price 7/6*
(10 effects) Trotting Walking Jumping Composite recording of foxhounds, calls, horns, etc. Cows Cats Pigs Blacksmith's shop

L LFX/1—SOUNDS OF LONDON *Price 7/6*
Guards, Bow Bells, River, Markets etc., etc., with linking commentary. Ideal for cine films and colour slides

N STX/1-SOUNDS OF TORBAY, DEVON *Price 7/6*
(33⅓ rpm LP 7inch). A take-your-holiday-home record with commentary by Johnny Morris. Authentic sounds of Torbay night life, Kent Caverns, Brixham Harbour, Fishing boats, Moorland streams, etc.

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MIKE HOWELL LOOKS BACK AT AUDIO

Just like a chicken dinner without all the necessary trimmings, the 1966 Audio Fair cannot be viewed without the excitement of that weekend's activities. Romantic though the details appear, time has never altered their bright colour. We tend to overglorify the past in many cases but the visit to London has neither gained nor lost any of its riches.

The first moment which springs to mind was our retirement to bed at 2 am on the Saturday, only eight hours before our departure. I blame tape and disc for my feeling somewhat drowsy on the long journey, and though my two companions were hungry as we neared Birmingham, a point where we were to pick up another friend, I could not work up the slightest inclination to eat – not even to save my reputation as an amateur champion. The truth is that this was the only occasion in twentieth-century history when the advert said less than the goods offered. Among other items displayed on the menu were Old English Beef sandwiches and I chose these because the word 'salad' did not appear after this description. My first disappointment came when I found that the ordered articles contained a depressingly large amount of salad and precious little Old English Beef. Doubtless my mother would still dub me a clot should she ever come to know of my misfortune, but in answer to the question I can now hear her asking, the removal of the salad could not be effected without the total destruction of the triple-deck monster which sprawled lazily on the plate. Apart from the size aspect was the fact that the bread was of a touch-me-and-I'll-drop-to-pieces' nature. Obviously, the worst moments of the weekend were now coming to fruition and, with immense difficulty (and quivering throat), I raised the skyscraper to my open mouth and bit tentatively. Needless to say, this was a dreadful error and more by accident than by design, the sandwich, minus one huge gash, was replaced speedily and with a professional air to its rostrum. At this point I wish to record regret at having struggled through two of these delicacies, but should anybody be partial to Old English Beef sandwiches (with compulsory salad) I am compelled out of common consideration to all fellow citizens to recommend 'The Surfe Side Restaurant' in Birmingham, the location and nature of whose duo-sex convenience still fascinates me to this day. Above the door of this small office are inscribed the important words: 'His surfe; her surfe.' Apart from having the 'his-her' priorities incorrect, one can only administer a sincere praise on the management of the premises for their use of the semi-colon.

From the tramp who lay sleeping in the sub-way of the underground station to the Spanish singers in the English café, I will never forget the atmosphere of Saturday night in London, and should I ever come to think that the seething gaiety of the crowded streets was something quite banal, I shall put it down to my being accustomed to the apathy of our Northern cities. The electrical shops, for instance, held our interest at every corner. To us, good equipment was a picture and description in a pamphlet or a promise to buy and then a long wait for delivery . . . but London! The shops were full of electrical gems which our friends in the North viewed as names or even myths. Only a pane of glass separated us from professional machines and only our fear of the law prevented our removal of those huge windows. Everywhere was massed with people; the most discriminating nose could not have hoped to count the variety of scents which the female population wore that night, and even when that big city sank to rest, the sound of heavy traffic, the thought of the past hours and the promise of tomorrow lulled one to sleep with a gentle contentment. 'Sunday in New York' was once the theme of a long-playing record, but the equivalent day with the addition of a tape recorder in London offered an equally descriptive promise. My friends were anxious to reach Russell Square but ten minutes of persuasive banter convinced them that we simply must go to Westminster to record the chimes of Big Ben. I can only look upon those ill-spent minutes with mixed feelings for, though we expected to be at Westminster by eleven o'clock, we arrived there by ten minutes past and I had to endure fifty minutes hard ragging from three irate companions. The time was utilized by recording the sounds of London plus a wonderful old man whose main ambition was talking to outstretched microphones. Soon, however, the mad rush was on. My own lack of composure assured me that I had been under a false impression about the size of the audio exhibition and indeed my former conclusion about our being able to get round the stands in three or four hours was quickly dispelled.

The first thing which could be said about the Audio Fair proper – and this was something on which we agreed unanimously – was the venue. To us 'The Hotel Russell' seemed an ideal situation for such a big and well-spread exhibition. But what of the exhibits themselves and those who demonstrate their uses? How did the Audio Fair strike a group of young enthusiasts?

Four hours' hard rushing around in a crowded place does not give me the chance to provide very much technical information, but I honestly wonder what most readers want to know about such an exhibition. When considering that most of them have not and will never visit this festival, then the probability is that they want to hear about the public and its annual meeting with the manufacturer on neutral territory just as much as they wish to learn about what will be in the shops in six months' time. A quick visit does have the advantage of providing a more lasting impression, mainly because of the lack of technical data. A thorough tour of the Fair could only be made over two or three days. From a short inspection like ours, the galling feature was the nature of the Fair and for those for whom it catered – the enthusiasts. You can get attention at your radio shop at home very easily, but at the Audio Fair you must, having decided that you will see a display, stand right at the back of a long queue. Unlike the shop at home, everybody wants to see the man in charge and in this instance he is everything – expert, artist, craftsman, actor – and he really knows his job. I imagine that when a man is chosen by his firm for Audio Fair duties he must feel like someone in the Long Room at Lord's. However marvellous all the salesmen were, the man most in line for my award was a gentleman who nearly blew our heads off with his demonstration. The aids to success which he held were a signal generator, a vhf radio and one or two other objects which we did not see. He was the keenest man you could wish to see; even his voice bounced like a glass marble on a tiled floor. He was charged with electronic exuberance and the way he played with his toys simply had to be admired.

From our position at the back of a jostling queue it was somewhat difficult to fathom out the real point of his demonstration. Basically, he was trying to illustrate frequency response and the importance it has or does not have for the amateur recordist. Periodically he would send out a high-pitched whistle which forced the hissing audience a sharp pace in the reverse direction. The main reason for his being eligible for a prize was the interest he imparted to those around him. Personally, I am not fond of hearing high frequencies in long sustained blasts and then having a new pair of shoes trampled on by retreating high heels, but on this occasion I was prepared to endure the pain. Incidentally, another point in the demonstrator's favour was that he himself was completely impervious to the harsh whistles emitted from his equipment. Eventually he was compelled to leave his novelty while an enthusiast posed an interesting question: 'Is vhf sound true to life?' There was not the slightest question of the artist being sent reeling on to the ropes by a query of this nature, something which had sent him into mental contortions for years. 'I could ask you the same question of AM sound – do you think this is nearer to reality?' Yes, this really was the season of goodwill towards all enthusiasts and a diplomatic answer had avoided what would have proved to be an enlightening discussion. Clearly, the No 1 feature of the exhibition was the signal generator. 'After all,' the demonstrator confessed openly, 'It has such a tremendous range – and power too.'

Time passed quickly with rushing around and enjoying the comments of the manufacturers advertising their products' advantages. Everywhere there was good sound, be it from tape or

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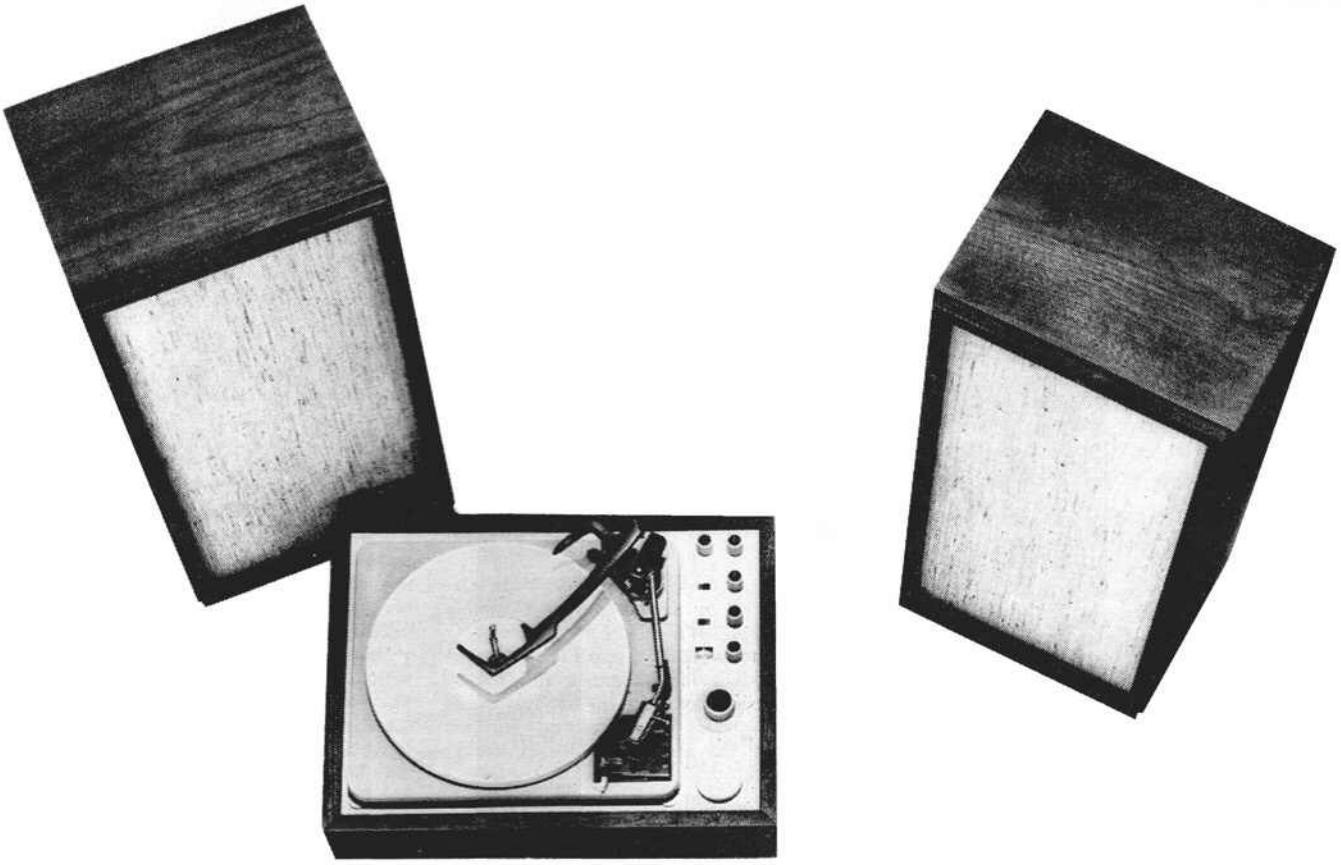
AUDIOVIEW LOOKS AT ANOTHER HI-FI MUSIC SYSTEM

Hi-Fi



KLH Model Twenty

The KLH Research and Development Corporation of Cambridge, Massachusetts, has been well known for some years in America as manufacturers of high-fidelity loudspeakers and complete hi-fi music systems. The latter are now being sold in this country and are expected to satisfy the demands of a great number of music lovers who have hitherto been troubled by two main problems.

Many potential purchasers of hi-fi equipment have been frightened off by sheer technical confusion and by the difficulty of selecting, matching and assembling the several separate pieces of equipment required for a complete music system. On the other hand, many people who preferred simple-to-operate radiograms or stereograms have sometimes also wanted such equipment to be far more compact than those usually available.

The KLH music systems go a long way towards solving both these problems. The Model Eleven is a high-performance stereo system comprising a Garrard turntable with low-mass tone arm, Pickering V-15 magnetic pick-up with diamond stylus, two KLH miniature full-range speakers and an all-transistor amplifier. All this equipment, perfectly matched, fits into a smart vinyl-clad suitcase and weighs only 28 lb. It costs £91 5*s*, including purchase tax. The model Twenty, costing £172 2*s* 6*d*, is a powerful and versatile stereo system incorporating a Garrard transcription unit, Pickering cartridge with diamond stylus, stereo amplifier, stereo FM tuner, comprehensive control panel and two special speaker enclosures each containing a 10 inch high-compliance woofer and 1¾ inch direct radiator tweeter. The ability of the large speaker's cone to move without restriction over an unusually long distance helps to provide excellent bass response with low harmonic distortion even at very high volume. The dimensions of each speaker cabinet are 23⅛ × 11¾ × 9 inch and they are finished in oiled walnut veneer to match the plinth of the 'control centre'.

The quality of reproduction from both these KLH models is extremely good. The UK distributors, P. J. N. Collaro Electronics Ltd, 1 Regent Street, London W1, are so confident of the quality and reliability of this equipment that they give a full *two-year* guarantee which covers both components *and labour charges*. Brochures containing full technical details from P. J. N. Collaro Electrics Ltd as above.

PRICE REDUCTIONS

The Rectavox Company announce that owing to vast changes in marketing arrangements, coupled with increased capacity, they have been able to reduce the list prices of their products very considerably.

The OMNI Mark II loudspeaker system, for instance. is now 29½ *gns.* and the AMBI 28 *gns*. The products remain identical except that Rectavox crossovers are used, employing Rectavox epoxy-potted coils of extremely low d.c. resistance.

It is understood that Rectavox intend to make their coil-winding capacity available to constructors and others who require special one-off coils.

1966 BRITISH AMATEUR TAPE RECORDING CONTEST

It is regretted that an error has occurred in the *Groups* section of the Awards. The trophy for the 2nd prize will be the *Mastertape Trophy*, and for the 3rd prize, the *BASF Shield.*

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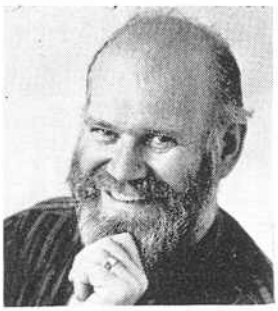
TAPE RECORD REVIEWS



by Russ Allen

Revolver. *The Beatles, Parlophone TA-PMC 7009. Mono 3¾ ips.*
Not as good as *Rubber Soul* but very original and containing a couple of absolute gems. *Eleanor Rigby* must be one of the most beautiful songs to be written during the pop era. The words, please do listen to them, are so extraordinarily sad with their theme of lonely people. Lennon and McCartney wrote it as they have written eleven of the fourteen tracks. The attractive Rigby tune has a delightful string quartet backing with a cello obligato to Paul's voice.
George Harrison, who is responsible for the remaining three compositions, plays his sitar to good effect on several tracks and I was particularly impressed by his introduction to *Love You Too.*
Track six is *Yellow Submarine*, which must surely become the community song of all time. Already we've heard Chelsea fans singing it as the club's anthem. As it's Ringo's only solo he makes the most of it and teenagers are writing in to *Melody Maker* and similar musical papers asking that he should be given more singing to do in the future.
Final track, *Tomorrow Never Knows*, is a weirdie which sounds like a multi-track job with a wowed vocal. All very odd but strangely attractive. At least it's different.
Altogether this tape is a grand mixture of the peculiar Beatle talent.

Pet Sounds. *The Beach Boys. Capital TA-T 2458. Mono 3¾ ips.*
Second to the Beatles in the recent *Melody Maker* Pop Poll, this American group have been likened to the Beatles but I just cannot see any resemblance at all. Possibly a very slight similarity in the unison vocal sound and sometimes similar harmonic style during vocals but otherwise they are way apart. For one thing, the backings are heavily orchestrated with a strong accent on organ harmonies to the point where some of the numbers sound positively religious.
Their singing voices are good and their diction enables you to understand the lyrics.
Most of the arrangements sound as if a pop Souza has been let loose and they really are a bit too much with choir and the bloomin' lot *and* that organ remaining prominent all the while.
Many people will, I'm certain, enjoy every moment of it but somehow I feel it's over-orchestrated and I wonder how they get on during their public appearances. They will have been on a flying visit to Britain during November so perhaps some of you will have heard them in the flesh by the time you read this.
I Just Wasn't Made For This Time has what sounds like a storm going on and *Petsounds* has a really weird electronically distorted melody. Almost certainly these tracks must have been made as tricky stereo stuff and as such would have more to offer than in mono. Question: When, dear EMI, are we going to get stereo?

Latin Romance. *Requinto Gonzales with Orchestra directed by Lucho Neves. Columbia Studio 2 Stereo. TWO 120. LP 33⅓ rpm.*
Requinto is the name for a small four-stringed guitar of a particular resonance and beauty of sound, especially when in the magical hands of Señor Gonzales upon whom, for his mastery of it, the appellation Requinto has been bestowed.
He and *it* combined with the fine orchestra of Señor Neves make the most delightful Latin American music I've heard in many a year. I won't list the twelve Spanish titles, but one or two will be familiar to your Western ear I think, such as *Perfidia* and *Autumn Leaves* disguised by Spanish to read *Las Hojas Muertas.* Gonzales is one who mostly plays with tasteful simplicity, often just picking out the melody on a single string, but whose technique is astounding and, like the joke says, 'quick as a flash', as in *Contiga en la Distancia* when his notes cascade in flashing brilliance.
At other times he makes the instrument sound like a mandolin.
This is an exceedingly lovely record by any standard and the quality of recording is very, very good. It's as clean as a whistle without a trace of surface noise. The stereo is first class and has a pure and natural effect. Beautiful!

Harp and Soul. *David Snell. Columbia Studio 2 Series. TWO 129. LP 33⅓ rpm.*
Kenny Clare – drums, Arthur Watts – bass, Johnny Scott – flute. Arrangements by David Snell and Johnny Scott with the Johnny Scott Orchestra. The harp is not, it would seem, an instrument that lends itself to jazz. I can only think of a couple of jazz harpists off the cuff, Casper Rearden and Mario Harp Lorenzi, and I hope I'll be forgiven if I've spelt those names wrongly. David Snell has a very good go and is certainly a talented musician, as proved here by both his playing and arranging. He was, the sleeve notes say, 'one time principal harp at the Royal Opera House, Covent Garden'.
I find it difficult to assess him as a jazz man and perhaps I shouldn't try on the strength of this performance, not because it's not good, it's delightful, but because almost every track is multi-taped so that we are usually getting one or more harps from each channel with at times ditto Johnny Scott's flute.
The arrangements are interesting, the playing excellent although for jazz, a little too clinical. If we forget the jazz idea and treat it as just popular light music then I have nothing but the highest praise to offer. The tunes are the usual standards, *Gone with the Wind, This Can't be Love, When you Wish Upon a Star* and a very up-tempo *There will Never be Another You* where Mr Snell nearly falls over his fingers and a super Scott arrangement of *This Can't be Love.* For good measure and to keep to fashion *Michele.*
Exceedingly pleasant listening and quite different from the usual run of things, but I should have preferred it had there been less effort to be clever. Perhaps we can persuade EMI to have Mr Snell and company back to the studio again to just be his singular self so that we can enjoy him as if he were a human being instead of a multi-headed studio creation.
Anyway plaudits to all the lads concerned and especially to those responsible for the good, clean, bright recording and well-defined stereo band.

MIKE HOWELL LOOKS BACK AT AUDIO *continued from page 40*

disc, and one of our group was forced to remark that he would not play his own equipment for a week or more. The demonstration rooms were crowded as the afternoon wore on and we found it impossible to visit the BASF stand and the Ferrograph demonstration. A long conversation with the Brenell representative convinced us that this name was still the king in tape recording; another discussion in the EMI room assured us that their studio recorder was the finest in the world; and Tandberg! They just knew they were the best. Whatever conclusions we could draw from our visit, clearly no amount of trade talk or reputation could be quite as convincing as the sound made by the equipment itself and in this department we received a shock which really made us think. We had discussed the possibility of creating real sound at home, and after much lively discourse the only conclusion we arrived at was that, even though you may not approach reality, you must have stereo. My own pompous view was that *true* orchestral sound could never be achieved, but suddenly, whilst threading our weary way through the crowds, we pulled up at the sound of a trumpet, real and true. We stood, shocked and amazed and then the strings came in, only to confirm the fact that stereo was here to stay . . . or perhaps Ortofon had hired the London Symphony Orchestra for the day.

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The 633 is the latest addition to the Ferrograph range and is intended for the serious home recordist as well as the professional user. Each instrument is supplied with an abstract of actual performance in the form of a test certificate. Spare parts—as with all Ferrograph instruments—are guaranteed available for at least 10 years.

Interested? Then complete and post this coupon to:
THE FERROGRAPH CO. LIMITED
84 Blackfriars Road, London, S.E.1.

☐ Please send me the FREE illustrated Ferrograph leaflets.
☐ Please send me the comprehensive 64-page model 633 Ferrograph Manual, for which I enclose £1—refundable when I purchase my Ferrograph.
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AT6 _____

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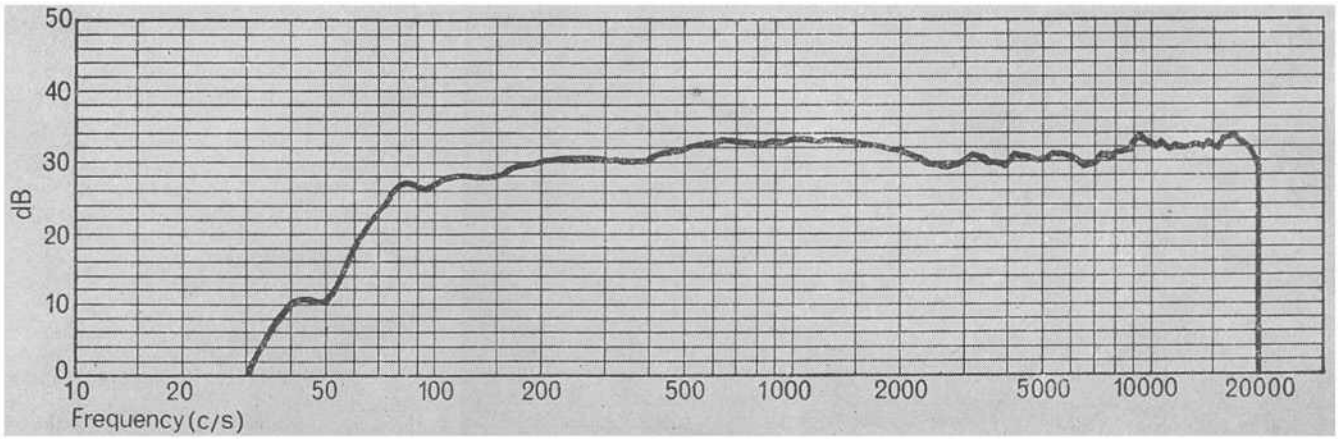
Don't buy a speaker

unless you have this Sonotone Challenge Chart with you—



This is the performance of the Solent, a new speaker by Sonotone, costing only £18 in a modern stylish veneered cabinet. You can easily pay £10 more for speakers which barely equal the performance of the Solent. Clip out this chart. Use it as your yardstick of value when you're shopping for speakers.

Hi-fi connoisseurs have long been familiar with Sonotone, as engineers of fine pick-up cartridges. Now this respected company has produced its own speaker. It's already the sensation of the Audio World. Read the facts. They may revise your thinking about what you should pay for a good quality speaker.

The problem with buying a speaker is knowing where to stop on price! Unless you are a sheepdog or an orchestra leader you may end up with refinements so acute you will rarely be able to appreciate them.

For some years Sonotone have been looking into the question of speakers and have set out to offer three important things:—

Three Achievements

1). High enough performance to satisfy 99% of enthusiasts.

2). A unit of a suitable size to fit on a bookshelf.

3). A sensibly priced speaker.

It wasn't easy—but now Sonotone have achieved all three objects. But claims alone are not enough! Sonotone offer proof!

We don't thihk you will find a speaker that delivers so much commonsense value. And the ones that deliver this standard of performance will invariably cost you up to £10 more.

Why not write for more information to:—

Sonotone

Technical Ceramics Limited, New Lane, Havant, Hants.

A member of Plessey Components Group.

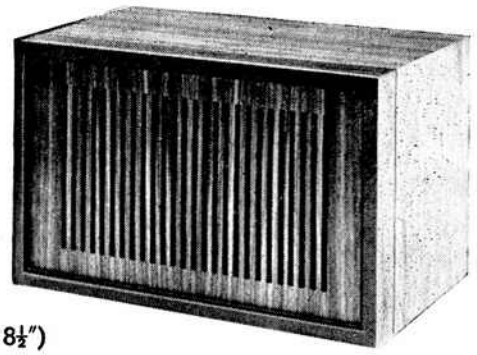
Attention all addicts

So far we've talked about the logic of this new speaker.
Now for the technical details:
Woofer: 6½", 10,000 gauss, 1" pole.
Free Air resonance: 50 c/s.
Tweeter: 3⅜"—acoustically loaded (i.e. custom made to the actual cabinet).
Frequency Response: 40 c/s—20 kc/s.
Sensitivity: 98 dB at 12 w. (microphone 6ft).
Power Handling: 12 w programme level.
Impedance: 8 ohm system suitable for 8-15 ohm valve or transistor amplifiers.

Drive units coupled with the cross over network have resulted in an outstanding and unusually smooth response. Due to the special design of the bass unit suspensions, linear restoring force against cone movement is ensured. This, coupled with a high degree of damping ensures a bass response free from resonances and other tonal colouration. The use of highly absorbent organic fibre to line the cabinet ensures a clean middle and upper response.

NEW!

Sonotone Solent £18



(14" × 9" × 8½")

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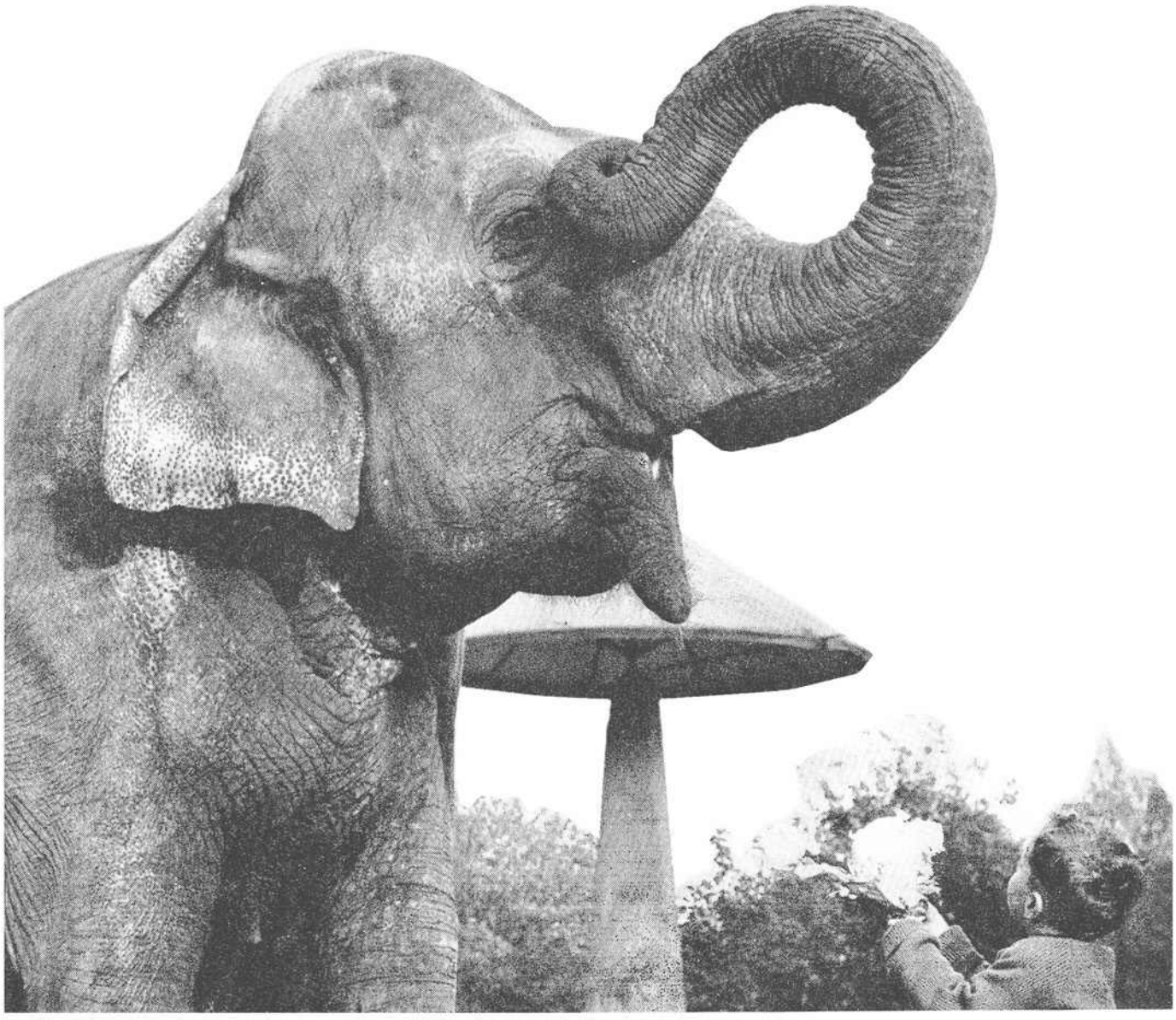

Bring home an elephant

in this handy container:

Get out on location with the fantastic Grundig TK6L portable tape recorder! Mains or battery operated, this machine is ready for action any time, any place. With the specially designed auto accessory, even a car or boat power supply can be used. The TK6L captures living sound—wherever you are. Superb Grundig engineering means a professional performance—with a dynamic range of 50dB, and a frequency response of 50-13,000 c/s at 3¾ i.p.s. The 6" x 4" speaker punches out a big life-size sound, with precise clarity.

Twin track, two speed (1⅞, 3¾ i.p.s.), the TK6L has sockets for radio, record player, second tape recorder and extension speaker. Other features? Six smooth piano-key controls, temporary stop, digital position indicator, and monitoring while recording. A newly developed Grundig DC motor, fully electrically controlled and stabilized, provides excellent reliability and freedom from noise. All this for 73 gns. The Grundig TK6L—portable high fidelity.

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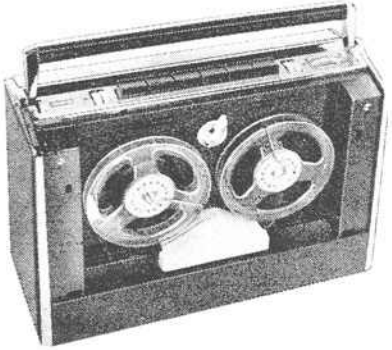

the Grundig TK6L

Please tell me more about the Grundig TK6L, and send your 32-page colour catalogue illustrating new Grundig recorders, radios and stereograms.

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Post to Grundig (GB) Limited, London, S.E.26 ATR2

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Record it...and hear the play-back simultaneously on the Brenell Mk5 Type M

—*and be sure it sounds superb!*

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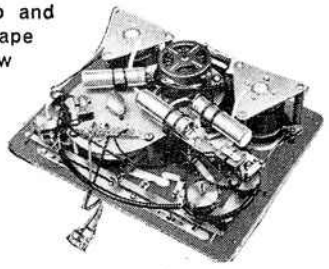
Used on all Brenell models mono and stereo. Provision for 4 heads. Four tape speeds. Wow and flutter content below 0.10 at 7½ i.p.s. Fast rewind and 8¼" dia. reel accommodation. (Version available to take up to 10½" NAB reels) Price £34.0.0.



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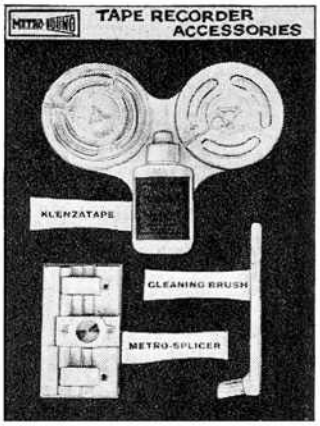

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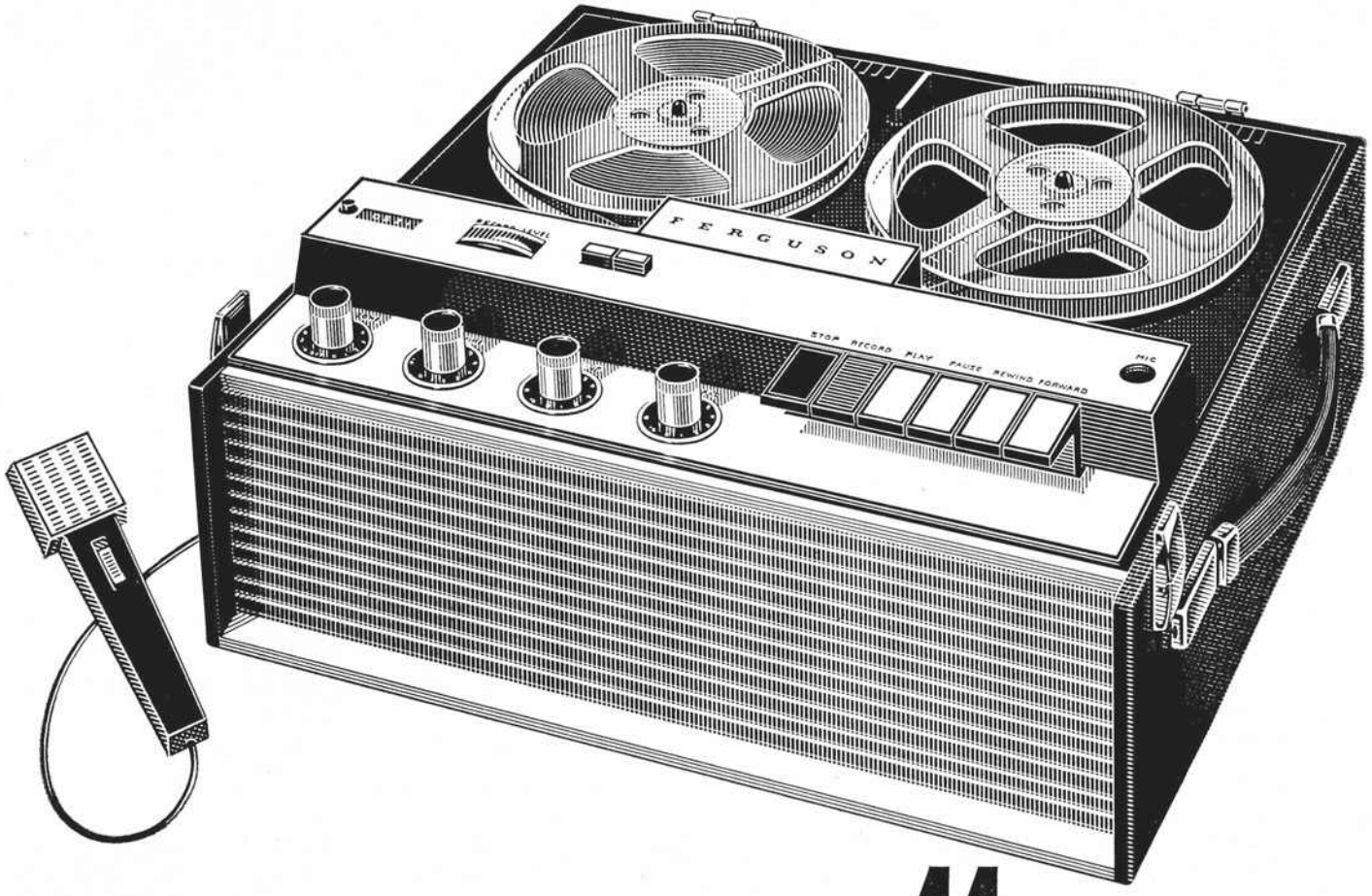
Look at all the features on Ferguson's new 'professional' tape recorder–



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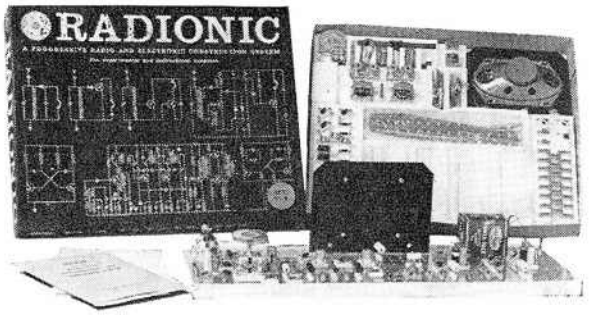

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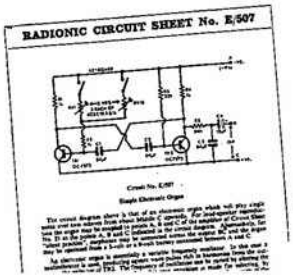
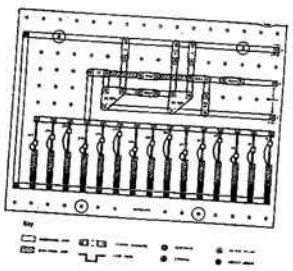


Theoretical Circuit



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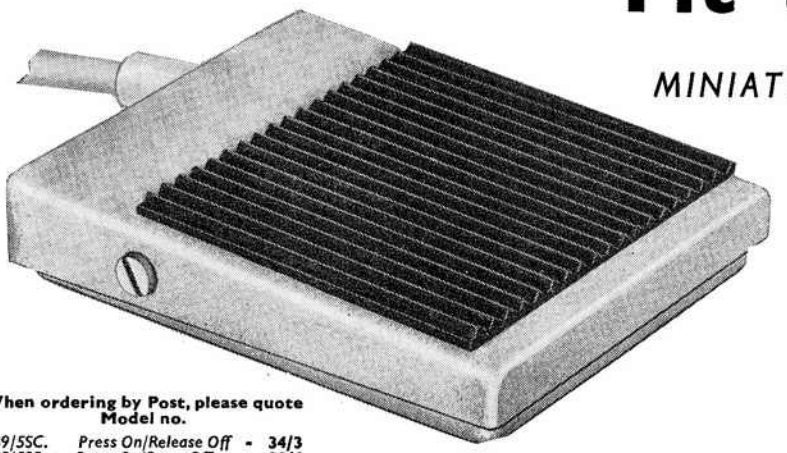

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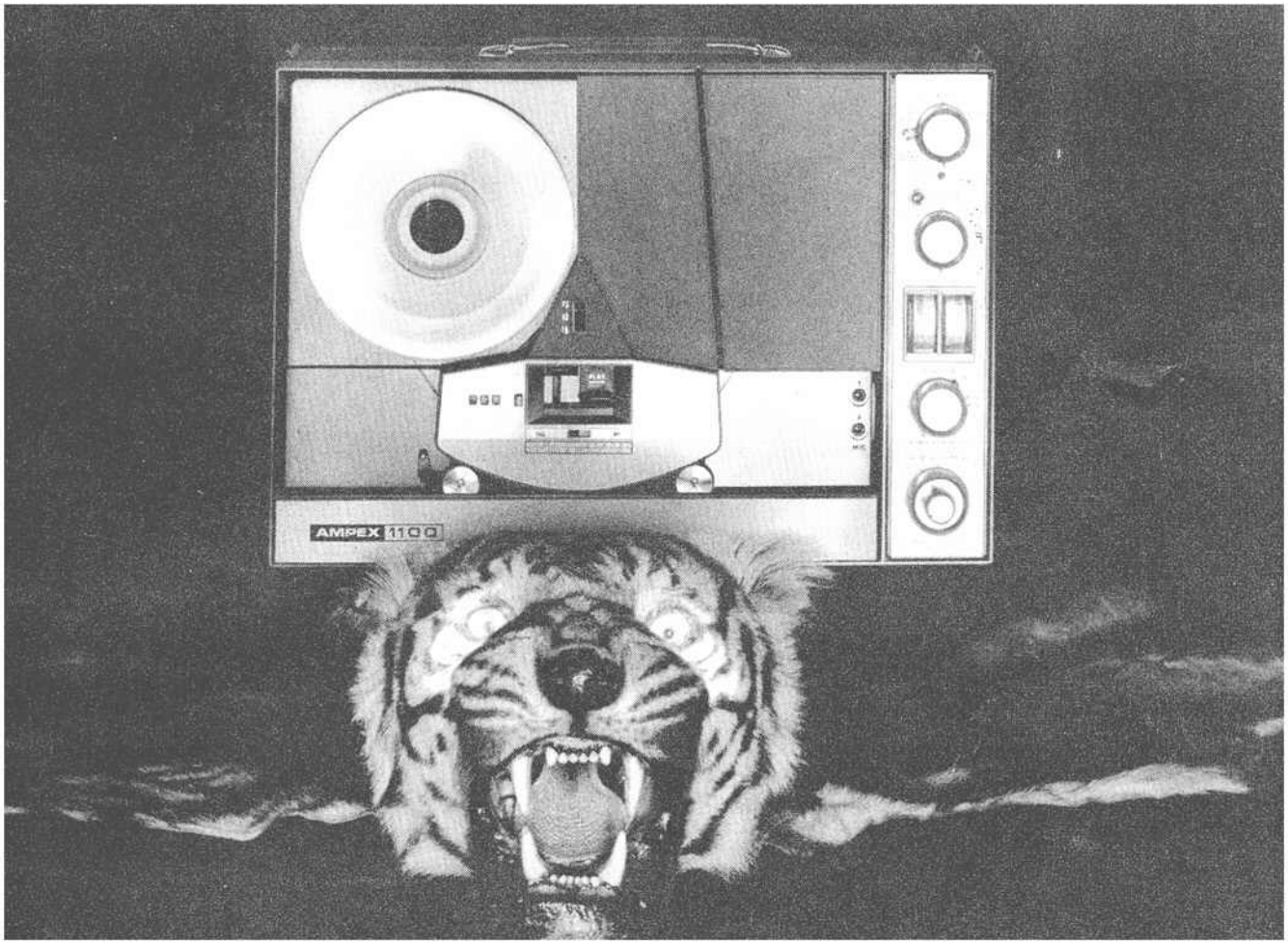

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Classified advertisements in 'Amateur Tape Recording' cost 1*s* per word, minimum 10*s*. Box Nos. 1*s* 6*d* extra. Advertisements and remittances should be sent to Classified Advertisement Department, ATR, 86–88 Edgware Road, London W2.

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Tape recorder repairs. We specialize in the servicing of recorders including professional machines. **Telesonic Ltd, 92 Tottenham Court Road, London W1. MUS 8177.** (12/67)

Chatterbox Record Club. Confined to the British Isles. **Free** membership to everyone. A SAE will bring you full details from **C. Forrister, 368 Rush Green Road, Romford, Essex.** (12/66)

The perfect companion to ATR is 8mm Magazine – an unbeatable combination for the sound and cine enthusiast. **8mm** tells you all you need to know on how to take cine films and where to look for subjects. Packed with news of the latest cine developments, unbiased test reports and hints on sound and cine. All for only 2*s* 6*d* a month, or special introductory subscription offer of 25*s* a year from **Subscription Dept, 8mm, Haymarket Press Ltd, 9 Harrow Road, London W2.**

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Tape to Disc Recording. Finest professional quality: 10 in LP, 42*s*; 12 in LP, 48*s*; 7 in EP, 21*s*; 40 ft recording studio; 48 hour postal return service. Any speed tapes. SAE for leaflet. **Deroy Sound Service, High Bank, Hawk Street, Carnforth, Lancs.** (TC)

Rapid Recording Service. Records made from your own tapes (48-hour service). Master Discs and pressings. Recording Studio – Demo Discs. Mobile recordings, any distance. Brochure from **21 Bishops Close, E17.** (TC)

If quality and durability matter (especially with LPs from your precious tapes), consult Britain's oldest transfer service. Our mobile units attend anywhere for mono-stereo master recording. Studio with professional facilities available. Records published tax free for schools, choirs, orchestras. **Sound News Productions, 18 Blenheim Road, London W4. Tel: 995-1661.** (4/67)

MAGNETIC TAPE

A unique tape buy. Top brand 7 in, 2,400 ft. 25*s*; 5½ in, 1,200 ft. 15*s*; P & P: 1 at 2*s*, 2 at 2*s* 9*d*, 3–6 at 3*s* 6*d*. Bargains in all sizes. SAE for list. **E. C. Kingsley & Co Ltd, 93 Tottenham Court Road, London W1. EUSton 6500.** (TC)

Ampex Series 600 Professional Recording Tape. Type 641. 1800 ft Mylar on 7 in spool. Complete with leader. Brand new, in maker's boxes. Usual price £3. Limited quantity available at 67/- for two spools P & P 2/- (or 37/- singly P & P 1/6). **E. C. Kingsley & Co, 93 Tottenham Court Road, London W1. EUS 6500.** (TC)

Amazing quality recording tape at exceptional prices. We guarantee maximum satisfaction. Send SAE for full price list to: **Tape Division, 100 Greatfield Road, Kidderminster, Worcestershire.** (12/66)

EQUIPMENT FOR SALE

Have you details of my inexpensive RMS Fluttermeter? Also available on hire. Leaflet on request. **W.H.M. 35 Villiers Road, Watford, Herts.**

EMI Professional unused tape, long play, 3,600 ft. **Highchute Ltd, 359 Oxford Street, W1.** (GRO 7288). (12/66)

Cash discount on most famous makes of tape recorders, Hi-Fi equipment, cameras and typewriters, to club members. Join England's largest Mail Order Club now and enjoy the advantages of bulk buying. Send 5*s* for membership card, catalogues, price lists and ask for quotation on any item. **C.B.A. (Dept A1), 370 St. Albans Road, Watford, Herts.** (1/67)

Unbiased guide. Our latest 65-page, photographically illustrated hi-fi catalogue (4*s* 6*d*). Advisory service, preferential terms to members. You'll be glad to have consulted **Audio Supply Association, 18 Blenheim Road, London W4.** (4/67)

Akai M-8. Never used. 15 ips, 7 ips, 3¾ ips, 1⅞ ips. Must sell it fast. £120. **Phone Rainham, Essex, 51769.** After 7 pm. (12/66)

PRE-RECORDED TAPES

American 4-track stereo tapes covering most famous labels at realistic prices. Why pay more? Imported directly by us, saving distributors' profits. Vast selection at 75*s* each – send SAE for free lists or call at London showrooms. **Teletape of Marble Arch, 33 Edgware Road, W2.** (TC)

American pre-recorded stereo tapes are cheaper from Dublin. Complete range and prices from Harrison catalogue at 2*s* 6*d*. Details: **Music USA, 201 Pearse Street, Dublin 2, Ireland.** (12/66)

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LEADING PRE-RECORDED TAPE STOCKISTS

Offer a comprehensive range of E.M.I. Stereo and Mono music on tape. Also full range of Language course tapes. Send S.A.E. (6d) for free list. By return postal service of stock items from:—

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Please send **AMATEUR TAPE RECORDING Video and Hi-Fi** for one year, commencing with the next (.....) issue, to the address below. I enclose the annual subscription of thirty shillings (30*s*). **ATR will pay the postage.**

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Tape Club members wishing to avail themselves of the special Club Subscription rate of 25*s* per annum should apply to their local Club Secretary. All Club orders must bear the Club Secretary's signature and be sent to the Subscription Department.

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TEST REPORTS

Complete and comprehensive test reports on tape recorders and related equipment are included in every issue of ATR. The following are still available and may be ordered for 3s. each by completing the coupon below.

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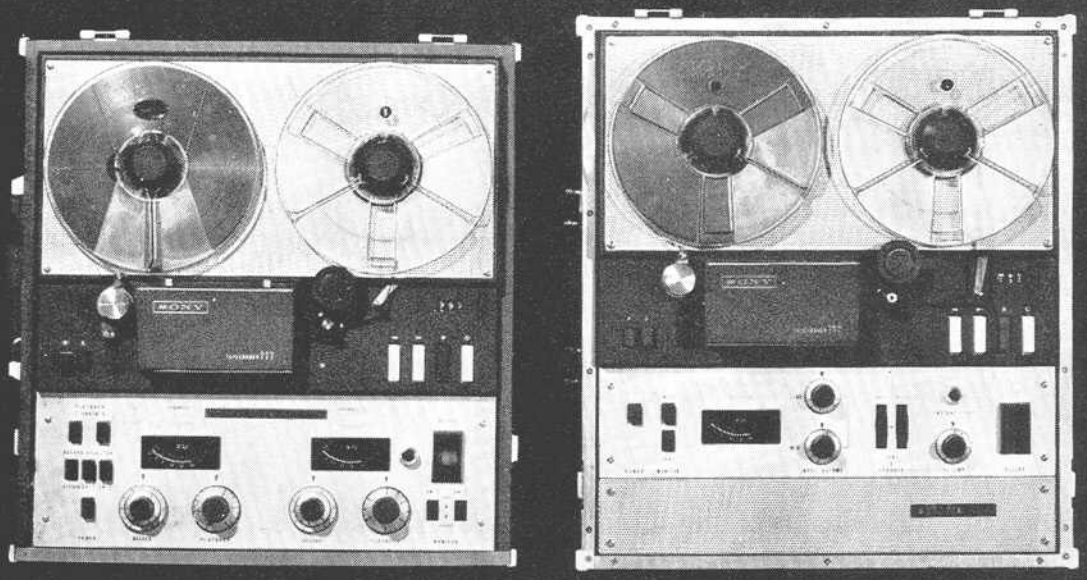

MODEL TC 777 4J (left) and M (right). FEATURES ■ Fully transistorised ■ 3 head, 3 motor system ■ Separate record and playback amplifiers ■ Individual Mic/Line level controls for mixed recordings ■ Sound-on-sound and sound-with-sound recording ■ Electro-magnetic controls, duplicated in remote control unit ■ Flywheel balanced tape guide ■ Integral Record/replay head ■ Price TC 777 4J – 297 gns. TC 777M – 195 gns.

SPECIFICATIONS:

Power requirements:	90 watts. 100, 110, 117, 220 or 240 volts. 50/60 cycles.
Tape speeds:	Instantaneous selection 7½ ips or 3¾ ips.
Recording track:	¼ track.
Operating angle position:	Horizontal or Vertical.
Frequency response:	30–17,000 cps at 7½ ips. 30–10,000 cps at 3¾ ips.
Signal-to-noise ratio:	Better than 50 dB.
Harmonic distortion:	Less than 1% when recorded at normal max. recording level. (12 dB below saturation of tape).
Recording level indicator:	VU meter.
Monitor:	From input or off the tape while recording.
Erasing effect:	Better than 65 dB.
Flutter and wow:	Less than 0.15% RMS at 7½ ips.
Fast forward and rewind time:	Within 105 seconds using a 1,800 ft. tape.
Bias frequency:	92 kc ± 10%.
Inputs:	Microphone low impedance 600 ohms unbalanced. High impedance 100 K ohms unbalanced.
Outputs:	External speaker monitor 3 watts RMS into 8 ohms external amplifier load impedance not less than 10 K ohms earpiece monitoring.
Motors:	Capstan motor—4 pole Hysteresis synchronous. Reel spindle motor—2, 4 pole induction motor.
Dimensions:	16¼" (W) x 10¼" (H) x 18¾" (D).
Weight:	Approx. 42 lb. Accessories approx. 10 lb.

The following specifications apply to the 777 4J only:

Power requirements:	85 watts. 100/240 VAC. 50/60 cycles.
Recording track:	¼ track record playback plus ¼ track playback only.
Frequency response:	40–15 Kcs±2 dB at 7½ ips.
Inputs:	Microphone –65 dB (0.44 mv), 600 ohms unbalanced. Line –12 dB (0.2v), 100K ohms unbalanced. Rec/PB connector (DIN).
Outputs:	Line output (switched) 0 dB (0.775v), 600 ohms unbalanced. 0 dB (0.775v), 100K ohms unbalanced. Binaural monitor –3 dB (0.55v), 100 ohms unbalanced.
Fast forward and rewind:	Within 90 seconds (1,800 ft. of tape).
Dimensions:	17.5" (W) x 8.7" (H) x 17.9" (D).
Weight:	Recorder unit approx. 42 lb. Accessories approx. 11 lb.

SONY®

RESEARCH MAKES THE DIFFERENCE

See your local Sony dealer now or write to:- Sony U.K. Sales Division, Mercia Road, Gloucester. Tel: Gloucester 26841. London Showrooms: 70-71 Welbeck Street, London, W.1. Tel: HUNter 2143.

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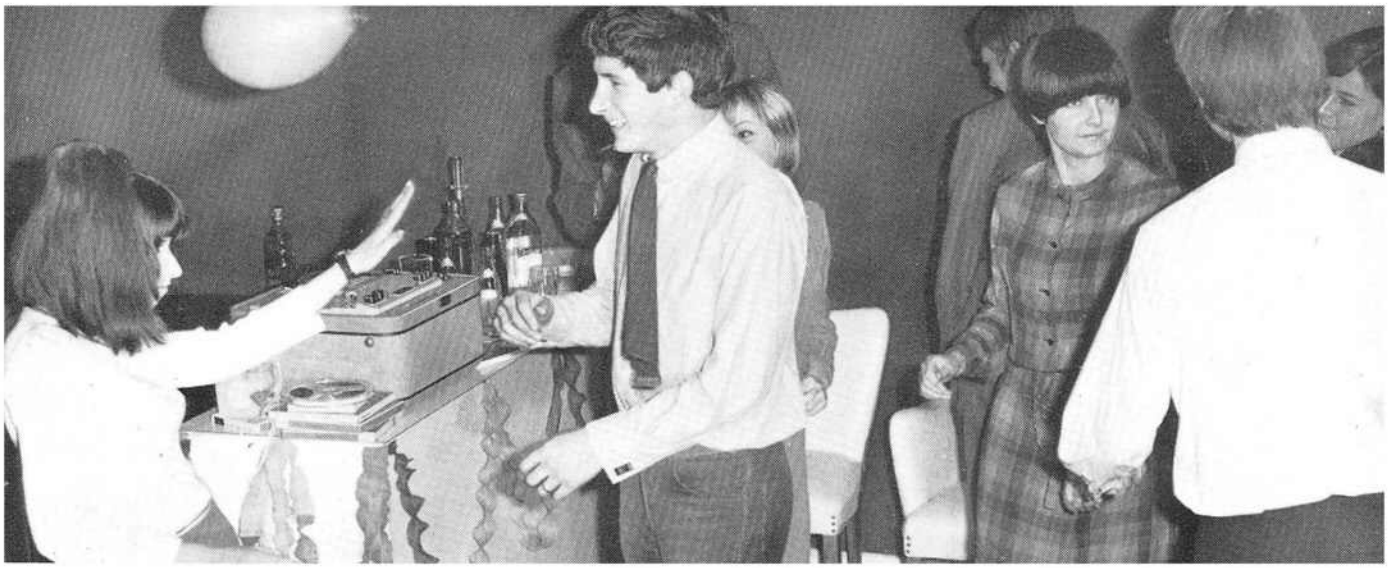
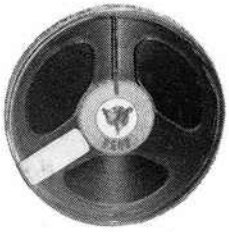
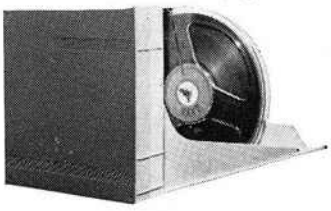


Christmas time! Party time! Any time! BASF Recording Tape will make it permanently memorable

Having the family over for Christmas? Then remember it all on BASF Tape. BASF's world-wide reputation for quality will keep these memories alive for ever.
Remember this too: BASF Tapes and accessories make really wonderful gifts at Christmas or at any time.

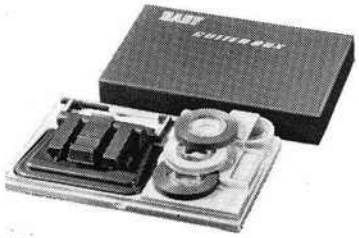


New BASF Round Pack
Newly launched this year, Round Packs are completely airtight—ensure that tapes arrive absolutely free from dust and dirt.



New BASF Library Box
The new BASF Library Box is better looking; harder wearing, and *costs no more*. It's solidly built to give valuable tapes greater protection and longer life than ever before. Perfect for use with the new BASF Round Pack.

BASF Letter Tapes
Your friends will be delighted to **actually** hear from you this Christmas. Use a BASF Letter Tape **specially** made for mailing.



Tape Cutter Box
A complete kit containing everything needed for editing tape. Semi-automatic splicer with spare knife and groove; tape clips; leader tape; splicing tape; labels etc. In attractive plastic box.

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