

OCTOBER 1966

TAPE

RECORDING MAGAZINE

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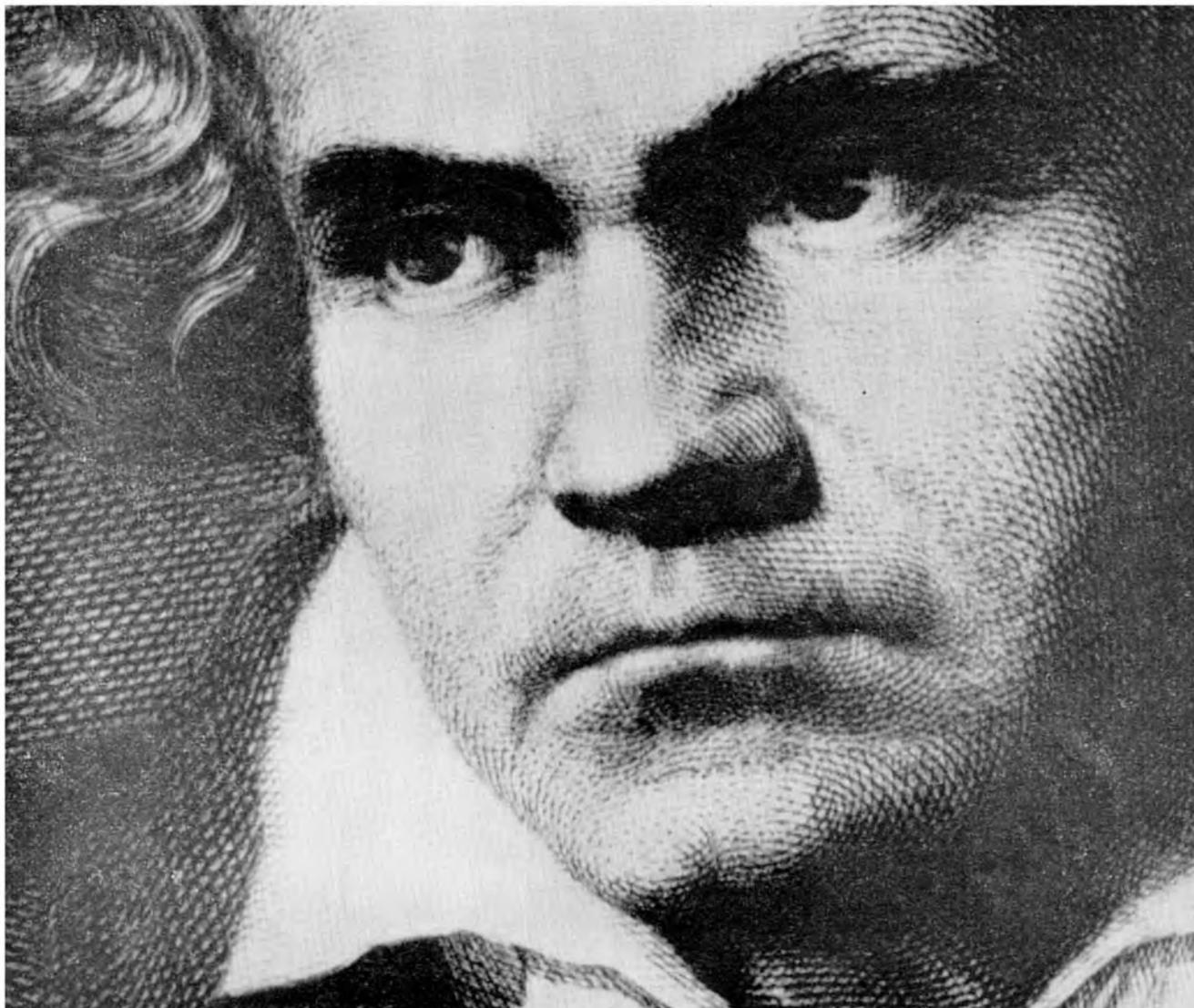
IN THIS ISSUE
VIDEO TAPE
RECORDING
FOR AMATEURS

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- Composing a sound picture
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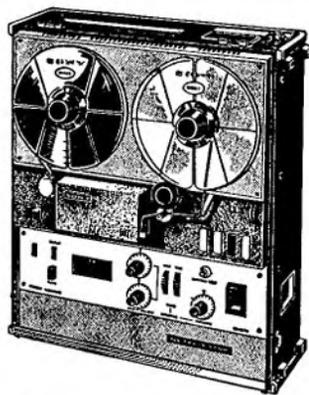
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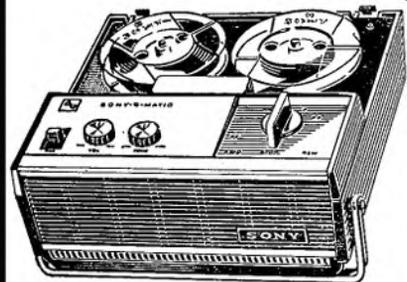


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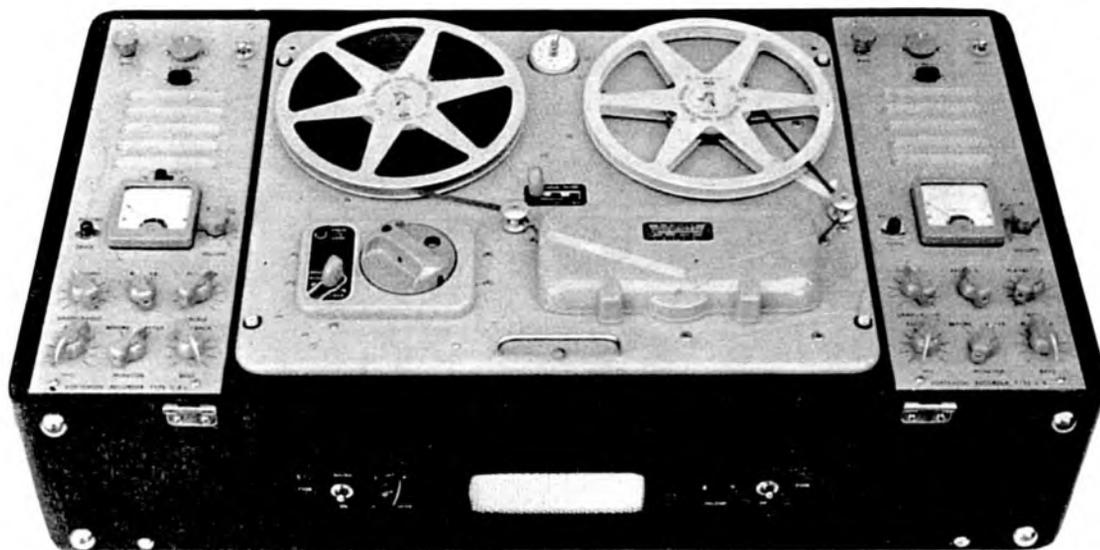
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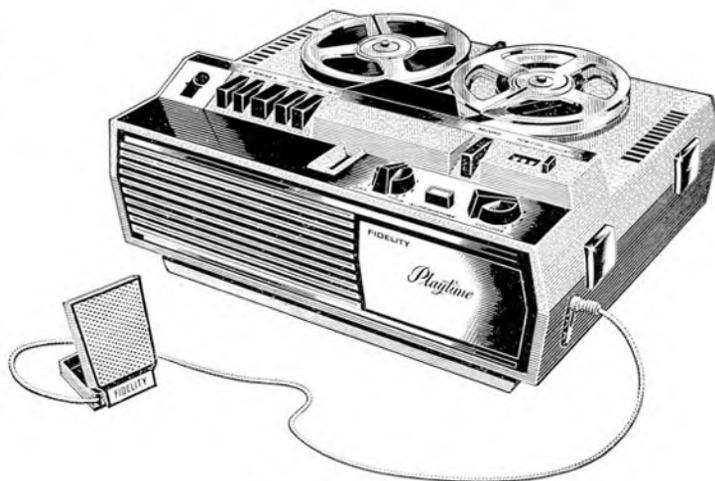
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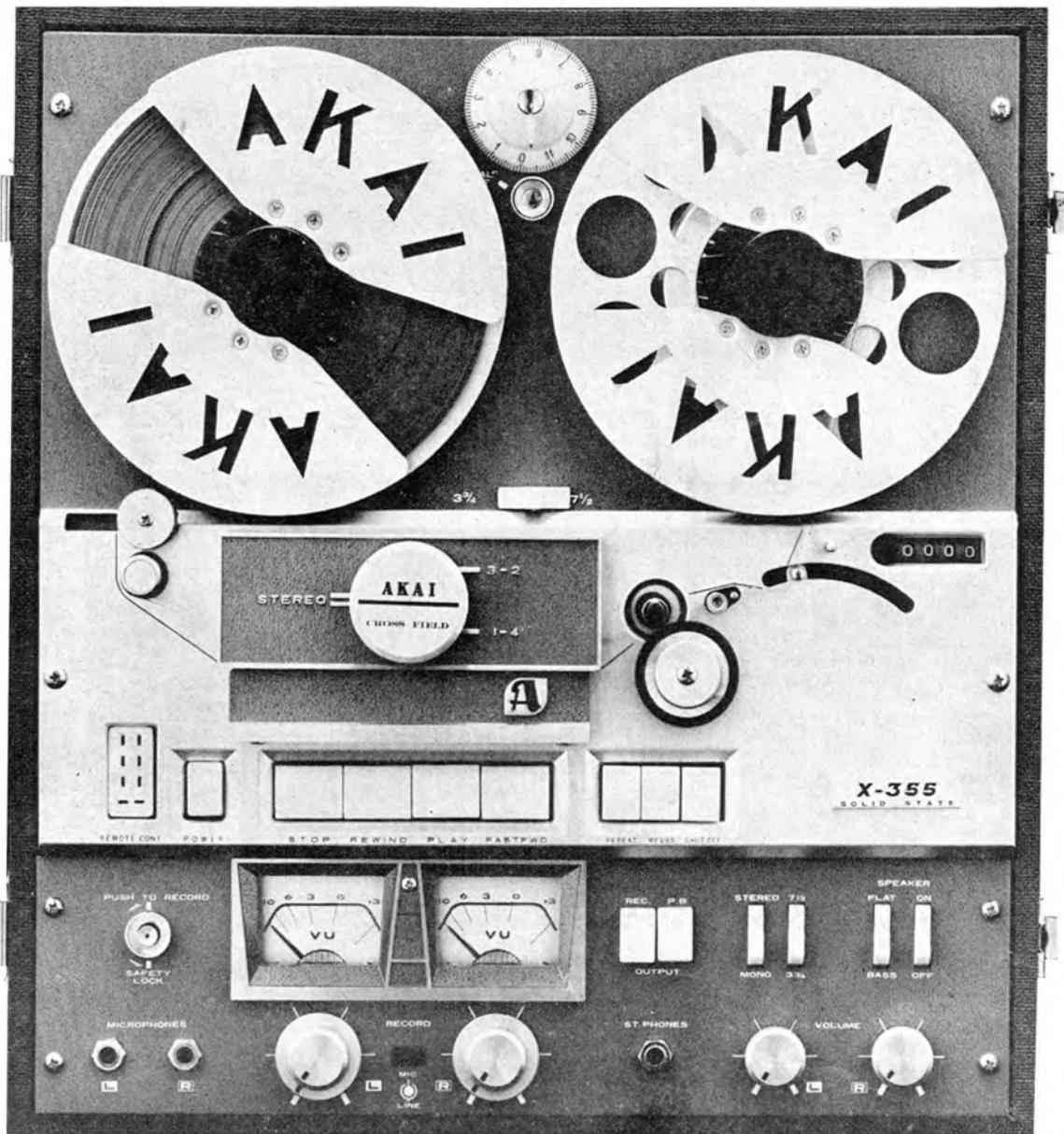
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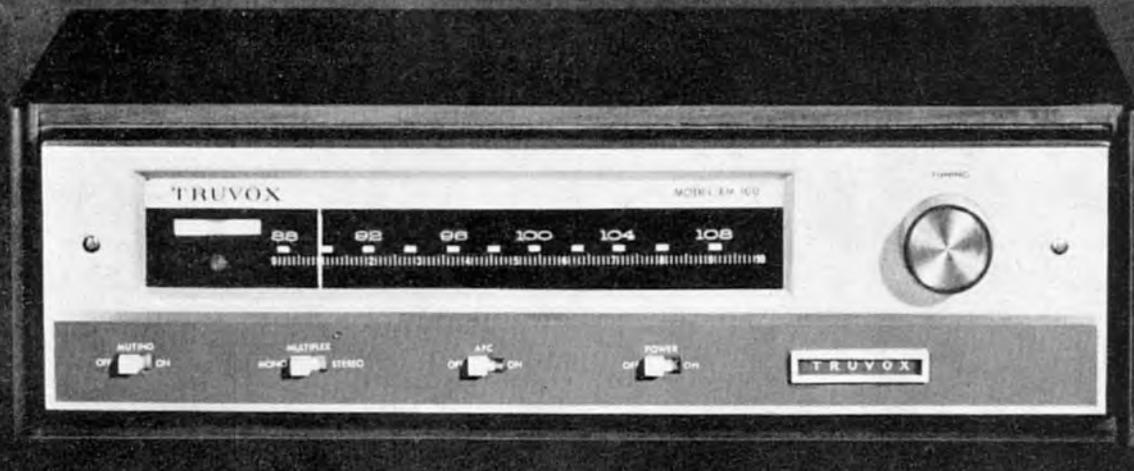
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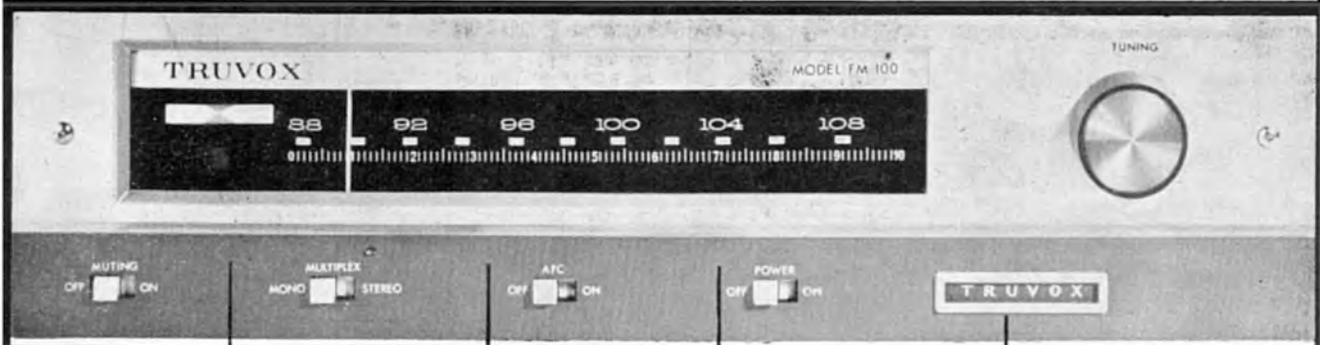
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Aerial Inputs—balanced 300 ohms, unbalanced 75 ohms
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Switched inter-station muting control
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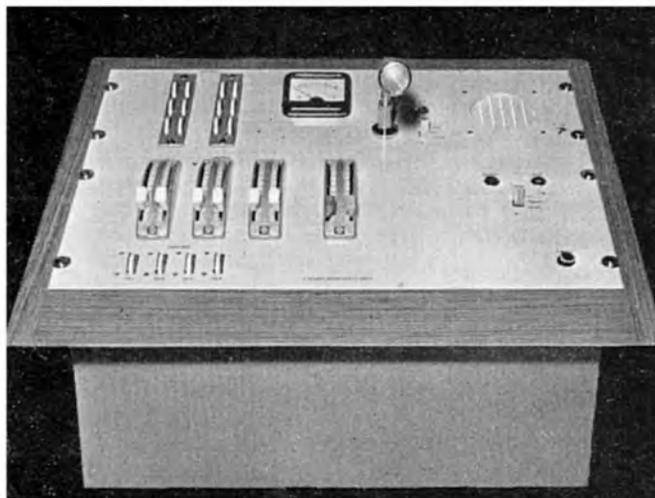


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TAPE

RECORDING
MAGAZINE

Vol. 10

No. 10

October 1966

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COVER PHOTOGRAPH: This month we are proud to describe an experiment launched by "TAPE Recording Magazine" to produce the first amateur sound-and-picture tape recorded feature. Our illustration shows some members of the team who successfully achieved this ambition. Left to right are John Aldred (behind camera), Norman Paul, Chris Venn (Peto Scott video engineer), Douglas Brown, John Gilbert and Alan Stableford. The story is told in a special feature beginning on page 351.

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EDITORIAL

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Tape trends and tape talk

By Denys Killick

THE 1966 Television and Radio Show was held at Earls Court at the end of August. Tape recording equipment featured more prominently than at any previous "Radio Show," and, ironically, the public were excluded for the first time. And yet there were displayed developments that may well affect the whole future of recorded sound in this country.

For several years past progress has been limited to the production of machines with slow speeds and narrow tracks, inevitably resulting in quality losses. At times some of us despaired that such retrograde "progress" was bringing the entire field of tape recording into disrepute—the tape recorder came to be looked upon by some as nothing more than an expensive, teenage toy.

When we heard of the arrival of entirely new machines, designed around cassettes holding non-standard tape running at slow, and in some cases non-standard, speeds, it was felt that the ultimate limit in the degradation of our hobby had been reached. Secure in the knowledge that a tape speed of $1\frac{1}{2}$ ips is hopelessly inadequate for the reproduction of music due to limitations of frequency response, poor signal-to-noise ratio and persistent drop-outs, we looked askance at the proposed issue of low speed, pre-recorded tapes in cassette form.

Just how wrong can one be? As I write I am recording, "off the air," a string quartet—not at 15 or $7\frac{1}{2}$ ips using a hundredweight of mains equipment, but with a battery portable weighing just $7\frac{1}{2}$ lb. and running at the improbable speed of 2 ips on tape one-eighth of an inch wide. The black lines within which these words are printed is the shape of the future. This is the actual size and shape of the tape cassette and it can hold up to two hours of programme material.

In such a small machine the output of the internal loudspeaker is bound to be a limiting factor, but fed into a Leak amplifier driving a Goodmans full-range unit the result is astounding. Of course the critic could fault it—this is not perfection—but it is a means of offering low-priced tape equipment in an easy-to-use form with sound quality comparable to the average domestic gramophone playing lp discs.

THE SIGNIFICANCE of this trend in the development of recording equipment cannot be too strongly emphasized. For the first time the industry is producing a real threat to the conventional gramophone. Cassettes are smaller and neater than records, much less liable to damage. They are certainly far easier to use. As a bonus the user gets full recording facilities as well.

The particular machine I have been using, Grundig model C100L, sells at 39½ guineas, complete with microphone, one cassette and connection lead. Running on six $1\frac{1}{2}$ volt torch batteries it is beautifully styled and delightfully easy to use. The depression of the "stop" key even automatically ejects the cassette when required. Using a new type of motor, controlled electronically by six transistors, speed constancy and reliability is said to be equal to that of mains equipment. It will operate quite happily in any position, even whilst being carried about. Let us hope that the owners-to-be will show more restraint than some of the users of transistorised miniature radios.

But this is only part of the story. The potential market for this equipment is obviously vast and the giants

of the industry are fighting for the lion's share. Philips' cassette equipment, described last month, is very similar to the Grundig in appearance and in sound quality, and uses a cassette containing the same $\frac{1}{8}$ -inch wide tape. But the two systems utilise different speeds, Grundig 2 ips and Philips the standard $1\frac{1}{2}$ ips. They are therefore incompatible.

* * *

Tape Recording Magazine has always argued strongly against any departure from standardisation. If manufacturers did not conform chaos would ensue. Many of us remember only too well the struggles we had in the early days of recording to achieve universal acceptance of agreed standards. It is only through those efforts that it is possible to be confident that a tape recorded in this country on any machine, domestic or professional, can be played back virtually anywhere else in the world. And yet none of these cassettes may be used on an ordinary recorder.

It is of supreme importance that we should continue to maintain the agreed standards for conventional recording equipment, and no manufacturer to my knowledge is stupid enough to contemplate the slightest deviation from them. Cassette recorders are *not* conventional machines. Conformity to existing standards would achieve nothing—the cassette must be used in the mechanism designed to receive it. The old standards no longer apply; departures from them do not matter.

Which of the two systems, Philips or Grundig, is the better is not for me to say. Superficially they both sound equally good. Pre-recorded cassettes will shortly be available for both, and the most popular machine may well prove to be the one for which the best repertoire of recordings is offered. What is of interest is how this remarkable trend in development is going to affect us and our hobby. Does it mean that our equipment is out-dated and out-moded? Does it mean the end of the conventional domestic recorder?

The answer to both these questions is an emphatic *NO*. The cassette machine has been designed for, and it is hoped will be bought by, a completely new class of owner who will be interested only in entertainment coupled with ease of operation. The serious enthusiast would be ill-advised to consider them in any other light. They should be regarded as complementary to, but not in any way replacing, what I hope I may be excused for calling "proper recorders."

* * *

SO HOW DOES this affect us? It's bound to do so in two ways. Firstly because vast numbers of new people are about to be introduced to recording for the first time by ownership of one of these new machines. From there I have no doubt that many will graduate to standard equipment. Secondly, the quality is so good—so surprisingly good—that manufacturers of standard equipment will have to look to their laurels. Cassettes spell death only to poor quality conventional equipment, and this will benefit all of us.

Speculation on the future is as interesting as it is dangerous. Development is continuous. The shape of the cassette may well be the shape of the future for all of us, but that day is so far off as not to really concern us. The cassette was designed primarily for the mass market of the wealthy younger generation with whom it is bound to be a great success. But many of us, including not a few of the youngsters, are interested in pure quality and creative work. For these there is not the slightest doubt that standard tape and machines will maintain their position for many years to come.

A great many people will have a great deal of good, honest fun with their new machines, because they are fun to use and fun to listen to. The use of cassettes will strengthen the interest in sound recording generally—and the regard in which orthodox equipment is held.

VIDEO RECORDING FOR AMATEURS

A special feature describing the production of the first amateur sound-and-picture tape recording, together with conclusions drawn by members of the team involved in making this historic tape.

"TAPE Recording Magazine" Exclusive

SEVERAL firms have promised that they will market before the end of 1966 video recording equipment intended for the home enthusiast, at prices the amateur—or, at any rate, some amateurs—will be able to afford. A few technical details about this equipment have leaked out.

But what the keen amateur wants to know, above all else, is *what he will be able to do with domestic video equipment*. If and when he is able to buy it. Will he be able to exchange video tapes with other enthusiasts? Will he be able to make sound-and-picture documentary or drama tapes? Will he be able to dub or to edit video tapes?

TAPE Recording Magazine has been trying for some time to obtain a prototype of the promised domestic equipment so that we may seek the answers to these and other questions. To date, no home models are available.

Rather than wait longer, we have conducted experiments with equipment which, while not intended or priced for the amateur, is such that it provides some guidance about prospects for the home enthusiast.

The first VTRs, produced for television and broadcasting concerns, cost tens of thousands of pounds. The second generation of video recorders, now being widely used by institutions, commercial concerns and educational establishments cost, with their associated equipment, thousands of pounds. The third, and coming generation will be available to the amateur for some hundreds of pounds.

The equipment with which *TAPE Recording Magazine* conducted its experiments is of the second generation. The recorder, camera, monitor, microphone, etc., which comprised the full set-up cost, in round figures, nearly £2,000. It was, therefore, more sophisticated than anything the average amateur is likely to possess for some years yet. Nevertheless, the experience of amateurs using this equipment gives a real guide to the possibilities which will exist in the near future for video recording as a home entertainment.

The equipment used by *TAPE Recording Magazine* was made available by courtesy of Peto-Scott, a firm which has achieved a commanding position in this market.

THE EQUIPMENT

The VTR was a Philips model EL3400, which has a price tag of approximately £900. More information about this machine is given below.

The camera was a Video-Compact, which, in its basic form, with a simple lens, costs £225. For our experiments, however, we used a Cannon 4 to 1 zoom lens which could be opened up to an aperture of f/1.8 and the cost of a camera fitted with this is something like £400.

Given a lens of this quality and versatility, it is virtually essential to have facilities for the cameraman to see exactly what he is

shooting, and this means a television monitor mounted on the camera. The cost: £220.

The camera was mounted on a heavy, and expensive, tripod—heavier and more expensive than was considered necessary, but no satisfactory alternative has yet come on to the market with counter balanced head.

With the f/1.8 lens, reasonably good results were obtainable by ordinary room lighting, but we used two 500-watt photo-floods, which brought distinct improvement and played an important part in achieving our finished product.

The other important piece of equipment was a monitor screen, looking much like an orthodox domestic TV receiver.

THE RECORDER

The VTR was extremely compact, in a wooden case with plastic cover, and with overall dimensions of 24 x 16 x 15 inches. It used one-inch wide magnetic tape moving from reel to reel at 7½ ips. But the helical-scan head gave a relative speed of the tape past the head of 906 inches per second.

If it is recalled that the word helical is derived from the Greek and means *spiral* the principle of the helical scanning device will be easily understood. As the tape leaves the left-hand spool it is guided around a metal drum placed behind and between the tape spools. As it passes around the circumference of this drum it descends, in a spiral, so that it leaves it at a level approximately an inch lower, then moving on to the take-up spool.

Revolving anti-clockwise at high speed within the drum is a circular plate carrying on its outside edge the video record/replay head.

The effect is that this head "writes" or "reads" the tape in long diagonals, each diagonal track equalling in length the circumference of the head-carrying plate; and with each revolution of the plate the head passes from one track to another. At any given point on the tape, therefore, a number of these diagonal tracks lie alongside one another but contain recorded information which, upon playback, will be separated by appreciable time gaps. The implications of this are important when one considers the possibility of editing video tape.

The top edge of the tape carries a control track. The machine is synchronised to mains frequency. The lower edge of the tape carries the audio track, which is equivalent to that on a standard four-track sound recorder. Frequency range is given as 120 to 11,000 cps \pm 3 dB.

On the machine we used, the reels carried 1,800 feet of tape, giving 45 minutes of recording, but larger reels providing 67 minutes' recording, are available. Cost of the 1,800-foot spool, one-inch wide, Mylar-based, is about £20 and the life of the tape is about 500 hours minimum.

The Philips ferrite recording/replay head can be slipped into place or removed almost instantaneously. No connections have to be made; it drops into a recess in the metal plate. These heads are the result of a great deal of research. In fact, we were assured that the costs of development of the head were greater

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VIDEO RECORDING

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than those of the VTR and the £25 charged for a new head was described as a "nominal charge."

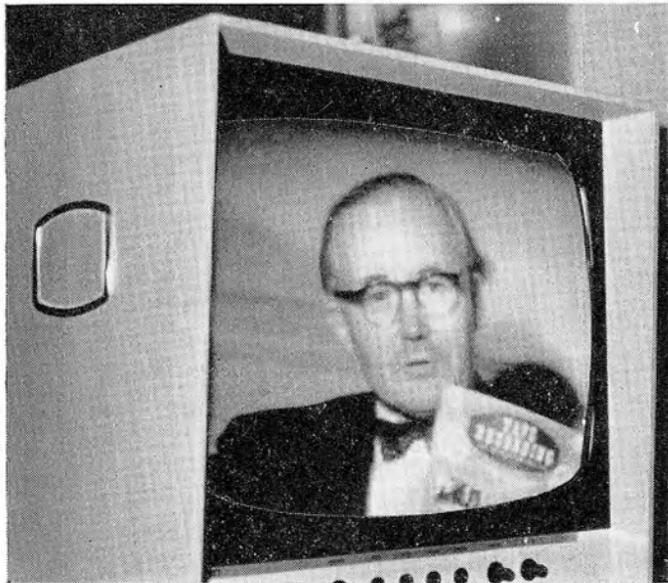
Naturally, the recorder has more controls than a sound recorder, but the amateur would not find them intimidating. Moving from left to right across the control panel, there is the piano-type on/off switch; keys for "Record," "Stand-by," and "Playback"; a counter, which gives time expired in minutes, to one place of decimals; more piano-type keys for Rewind, Start, Wind and Stop.

Then there are five small knobs: the first controls recording of picture and the second and third picture playback; the next controls audio playback and the fifth microphone level.

Input and output sockets are close at hand for sound and picture. The sound output has to be fed into an external amplifier.

SETTING UP

We were anxious to conduct our experiments in conditions approximating to those of a large room in an average home and the equipment was, therefore, set up in an area of approximately 15 by 15 feet. The camera on its tripod was placed in one corner so that it commanded a sweep of almost the whole area.



An untouched photograph off the monitor screen during the opening sequence. Douglas Brown is seen with a copy of the first issue of "TAPE Recording Magazine"

A table was set up diagonally across the area from the camera; this carried the microphone and script and those who were being recorded sat behind it. The recorder was to one side of this table and the monitor screen to the other.

The zoom lens made it possible to pick up four people sitting side by side, but also to come into close-up on a single face so that it occupied the whole screen, without moving the camera position.

Between the equipment, of course, there were cables—enough of them to call for care when moving around. This fact, coupled with the heat from the photo-floods, might have made it difficult to have operated comfortably if, in reality, we had been working within walls spaced 15 feet apart.

The high ceiling and the consciousness of unused space around was a great help. Total power requirements were 8 amps and these were taken from two 5-amp sockets.

The equipment was accompanied by a Peto-Scott video engineer, Chris Venn, and he took responsibility for setting up the equipment in accordance with anticipated needs after he had studied the

script which had been prepared for the occasion. The setting up and some preliminary experimentation took something like three hours. The recording of a twelve-minute feature, with practice runs, and intervening discussion, took another three hours.

THE SCRIPT

It was considered wise to have an essentially simple theme, but it was desirable to work in a good deal of pictorial variety.

As the purpose was to make "the first amateur sound-and-picture tape recording," it was decided to make this purpose the theme of a short documentary.

This called for a compère—or "anchor-man"—and the editor of *TAPE Recording Magazine*, Douglas Brown, stepped into this role, in which his broadcasting experience as an interviewer and compère was of obvious value. This much decided, the best formula seemed to be a series of interviews. Mr. G. Bailey, Product Executive of Peto-Scott, Alan Stableford, Chairman of the Federation of British Tape Recording Clubs, Norman Paul, a first prizewinner in both British and International Tape Recording Contests, and John Gilbert, Head of the Electronics and Communications Engineering Department of the Northern Polytechnic, were asked to be interviewees.

The compère then prepared a working script creating the overall pattern of the feature, giving the text of the linking narrative between interviews, with an indication alongside of the picture content of the tape at each point.

THE TEAM

In addition to the five individuals cast to appear before the camera, Chris Venn operated the recorder, John Aldred the camera, and Fred Chandler acted as stage manager with special attention to the lighting. Tony Dawe, a professional dubbing editor, and Denys and Vivienne Killick closely observed the proceedings from the sidelines, so that their impressions should be available afterwards to those who had been actively engaged.

PROCEDURE

It was our purpose to discover the potentialities of the equipment before trying to record our feature proper. After studying the recorder and camera and shooting a stream of questions at the engineer, we ran through a pre-recorded tape brought along by Mr. Dawe, which had been taken from a TV transmission the previous day.

This experiment indicated two things. First, that the picture quality attainable with this equipment is very, very good, with excellent definition and picture stability.

But there were flares and moving white lines on the screen from time to time and this was the proof that compatibility between identical machines is not normally guaranteed. The tape had been recorded on the same type of Philips EL3400, but the full quality of the recording could only be realised on the identical machine on which it had been made.

These machines *can* be made compatible, if this is specially ordered by the customer. It is probable, however, that compatibility as a matter of course will be the next important step forward.

We are speaking, of course, about compatibility between two machines of the same type from the same manufacturer. We are probably a long way yet from the stage at which an amateur recording enthusiast in, say, New York will be able to record a video tape on one make of machine there and send it to a contact in London for playback on a recorder from a different manufacturer. At the time of writing, it must be said, the possibility of this kind of video tape exchange between amateurs seems still to be a year or two ahead.

Our next test was to record a few minutes of speech from the compère, with the camera moving in from a general view to a close-up of his face; and then to replay.

Reading from a script, and looking up at the camera in between, the compère tended to move excessively in his chair and, the lens having a rather shallow depth of field for the close-ups, the image tended to move out of focus. With head

bent forward over a script, the bright lighting cruelly exposes bald patches! Here were two good arguments to reinforce the case against reading a script and thereafter the compère tried to glance at it only occasionally and to improvise the narration.

This first recording also picked up hum on the microphone input and some experimental movement of equipment followed. More seriously, a regular drum-like banging was traced to movement of the table which carried the microphone and remedial steps were taken—partly by attention to the table, mainly by dire threats to the compère!

The next stage was a recording of a group of four in conversation, with the camera panning from one to another, shooting sometimes as a group and frequently zooming in to close-ups. This went well, without problems.

Before the recording session we had had an artist prepare three title cards: "PICTURES ON TAPE"—"The first amateur sound-and-picture recording"—and "THE END." The script provided that our feature should open with a shot of the video recorder and its operator, that this should be followed by the title and sub-title, followed by the narrator in close-up.

How switch from picture to caption? We tried moving the lens out of focus; the result was unsatisfactory. We tried covering the lens and then removing the cover. Equally unsatisfactory. Now we felt the need of studio equipment which was not included in our set-up. And we were face to face with the problem of editing with video tape: the impossibility of cutting the tape and splicing in inserts, as one can so easily do with sound recordings.

Chris Venn, our professional engineer, was game to try any experiment. So we decided to video tape the opening shot, then switch off the recorder and switch on again when we were ready to take the second shot. This is far more difficult than it sounds, and much more so than with a sound-only recorder. The control track on the video tape is used to bring the tape smoothly to a halt when the stop switch is used, and this takes several inches of tape; it is thus very tricky to mark on the tape the point at which one wishes to change from one picture to a different one. And it is necessary to back-wind the tape exactly the right distance before switching on again for the next shot.

We pointed the camera at the title card and started running, then panned to the VTR and Chris Venn's hand moving over the controls, then panned to the compère beginning his narration. The first section of this recording, when played back, was fairly satisfactory; but the panning from VTR to compère was excessively lengthy and poor in picture content. We decided, therefore, to try to insert over this section of the recording a retake of the sub-title card.



Overall view of the Peto-Scott Video Tape Recorder used for the experiments



Fred Chandler operates the Peto-Scott Video-Compact Camera, seen with the electronic monitor mounted above

Chris Venn ran through the recorded section and marked the tape at the points at which the insert would begin and end. Incidentally, there is no problem about marking video tape, provided it is done at the edges, over either control or audio track. If the video track were scratched or bent, however, it would cause picture damage.

We then pointed the camera at the sub-title, recorded for the pre-calculated length of time, tipped the card forward—and switched off. On replay, we found a perfectly acceptable result at the picture change from VTR shot to sub-title, but after the few seconds of the sub-title insert, when there should have been a smooth switch from sub-title to the previously recorded narration, the picture and sound went haywire. The trouble, it seemed, was that we missed the pulse on the control track and so, instead of continuing at $7\frac{1}{2}$ ips, the tape began to move at "fast forward wind" for a few seconds, before the control came into effect and restored the $7\frac{1}{2}$ ips speed.

This demonstrated the hazards of the method as a means of "editing." Further, there was no assurance that we would be able to repeat even this degree of success.

Time was passing and it was decided that the only way to complete a feature tape would be to take our three opening shots and start recording again where the third one ended, and to keep on recording right through to the end.

Narrator and all those to be interviewed were, accordingly, put in position, thoroughly briefed on what was expected of them, and the VTR started turning.

It was now up to John Aldred, at the camera, to pick up the right shots at exactly the right moments and to Douglas Brown to keep going with the narration, without hesitation or fluffing, and to call in the other speakers at just the right moments.

These two participants have a good deal of experience of these jobs and, strictly speaking, are not amateurs; genuine amateurs might not find it easy to sustain this sort of exercise, even for ten minutes, continuously.

On this occasion, however, fortune smiled and the recording was completed. It only remained to add at the end (and this was done without stopping the camera or recorder, by pointing the lens in the right direction) the caption "THE END."

On playback, most of those present professed themselves surprised by what had been achieved: a short feature tape which, while not of professional quality, was not at all bad; a video equivalent, one might say, of the average entry in the British Amateur Tape Recording Contest, if one measures the amateur result against normal professional standards.

CONCLUSIONS

What are the lessons of this pioneer effort to record a sound-and-picture tape under conditions approximating to those of an amateur enthusiast? Frankly, the main lesson is that any but the simplest form of video recording is not a practical proposition for the home enthusiast in the next few years.

Straight recording from TV transmissions will present no difficulties. Tape exchanges, sound and picture, with friends at a distance will also be possible; although, even here, stricter disciplines will have to be applied, as it will not be possible simply to switch the recorder off and on while one gathers one's thoughts; and compatibility between machines will be essential.

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VIDEO RECORDING

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There will, one presumes, be a market for pre-recorded video tapes; but here the expense will be a severely limiting factor. A commercial lending library of video tapes might be a way forward.

But any attempt at a feature tape—a drama or a documentary, for example—will have to be a major team effort, calling for something approaching a studio set-up. In fact, it may be said that fully satisfactory results can only be expected if all the normal equipment of the professional studio is available. This means a very expensive set-up indeed—until prices begin to come down.

That will happen in time. Meanwhile, as this practical experiment organised by *TAPE Recording Magazine* has shown, it will be possible for a competent team (perhaps a tape recording club) to make rudimentary features, getting a lot of fun and valuable experience in the process, with only a video recorder, camera and microphone and monitor screen.

Perhaps, by the end of this year, this equipment may be available for £500 or £600. Perhaps, one day, an amateur kit may be priced at about half that sum. But do not pitch your hopes too high. It is all going to take time and patience.

Definitely not for the lone worker

By John Aldred

I APPROACHED the offices of *TAPE Recording Magazine* with an easy state of mind for the first amateur video experiment, expecting to sit back and watch Editor Douglas Brown, Fred Chandler, and Peto-Scott engineers make a satisfactory feature videotape. Instead, I found myself promoted to camera operator for the experiment, and spent a good two or three hours learning some of the tricks of the trade.

Anybody who thinks that operating a video camera is as simple as home movies should try it sometime. The camera I was using was the Philips Compact Videcon, costing a mere £225, with an expensive Canon zoom lens (f/1.8 25-100mm). I soon found out that the target on the videcon tube has a high persistence image, and that cameras of this type are normally used in a static position only. Any lateral or vertical panning movements leave an unpleasant "ghost" on the picture, unless these movements are carried out extremely slowly. Professionals use Plumbicon or Image-Orthicon cameras, but these cost many hundreds of pounds.

The majority of Videcon cameras, and there are several on the market by Beulah Electronics, Grundig, E.M.I., as well as Philips, are not sold with any form of viewfinder. It is anticipated that they will be used either in a static position, or operated in conjunction with a standard 19- or 23-inch monitor alongside. Sometimes a simple wire frame finder is supplied; but whilst this may be satisfactory with a lens of fixed focus, a zoom lens requires something more elaborate.

I was fortunate in having an electronic viewfinder with a 6½-inch display tube strapped on top of the camera. Both units are transistorised and self-powered, but even so the viewfinder is twice the size of the camera and costs another £220.

Augmenting the room lighting with a couple of reflector floods, we first recorded a test scene of Douglas Brown to ensure that sound and vision signals were satisfactory. The camera had no controls at all apart from the lens iris, and I selected an aperture of f/2.8 which gave a satisfactory picture on the viewfinder.

The playback was surprisingly good, although Douglas was not always looking directly at the camera. I had not noticed this whilst we were recording, but it seems to be an obvious requirement if you wish to hold the attention of your audience.

There was also an embarrassing vibration on sound, which was traced to a table touching the microphone stand. This proved how fatal it was to carry out an elaborate video recording without a sound monitor. Sound is just as important as video, but with all the equipment in one room we just did not have any headphones.

The next scene covered a group of five people, and called for panning, tilting, zooming, and focus adjustments. Even with a professional type of viewfinder I found it difficult to co-ordinate all

camera movements with one pair of hands. Either zoom or focus had to suffer temporarily, and the depth of focus was very small since I was operating at f/1.8.

Our experiments included shooting, or should I say recording, some introductory captions (they don't call them titles in TV). These were set up on a chair for lack of a proper caption stand, and the cards flipped over by Fred Chandler's finger.

I suggested that the first card should be faded in on the recorder video control, but this introduced problems with the sync pulse which was faded in as well. In the end we settled for a rough "lens cap" job, leaving the video control at its normal setting and slowly uncovering the lens with the current issue of *TAPE Recording Magazine*! Exposure used—f/5.6.

Following the captions we attempted a "tape edit" into the next scene, a closeup of Douglas Brown. The method was to rewind a few feet, run up the recorder on replay, and then press the record button at an appropriate counter setting. This worked quite well except that we accidentally erased our last caption in the process! This I assumed was due to the counter slipping.

The final interviews showed how difficult it was to make a feature tape with only one camera. Everything has to be recorded in one take, unless you care to chance a tape edit, for there can be no serious tape cutting for a quick change of angle or you would lose some of your sound. Camera movements therefore have to be extremely accurate to give a neat and tidy scene, and a scene might last for the complete reel of tape (45 minutes). Fortunately, ours only lasted 12 to 13 minutes, but it was enough to give my arms a headache. A lot of concentration goes in keeping the lens trained on the right speaker at the right time, maintaining focus, and using the zoom control for close-ups to provide emphasis in the right places in the script (if you have one).

This was my first experience of operating a video camera, and I sincerely hope it will not be my last. But it became abundantly clear to me that you must have a producer when making a feature tape of any kind: you just cannot operate a video camera upon instructions from a committee! This experiment taught me that video recording is definitely not for the lone worker, unless he only wishes to record "off the air" when all the hard work in compiling the programme has been done for him.

Serious competition against cine unlikely

By Norman Paul

I WAS impressed by the demonstration, but I do not, at this stage, foresee any serious competition against cine. At present the cost of equipment in comparison with cine is very high. In addition, video equipment is not very mobile. The cine man, whether he be a serious film maker entering for competitions, or simply interested in making family films for showing in his own domestic circle, needs to be mobile. The equipment demonstrated is far from so. It also needs a constant supply of mains electrical power which, more often than not, would be an impossibility for the type of shots the average cine man would want to shoot. Generally, too, the holiday and family



Close-up view of the deck showing (centre back) the metal drum housing the recording head

film enthusiast demands colour. Would he be content with black and white?

The man who is interested in making story films and documentaries relies very greatly, for the success or otherwise of his production, on editing his shots into their final sequence. This is, perhaps, the most creative part of film making, and certainly one of the most interesting. As I understand it there are technical difficulties in editing video tape, and therefore much of the basic requirements of a satisfactory production would be denied to the worker in this medium.

In most cases the serious amateur film maker hopes that his production will, at some stage of its life, be shown to collective audiences, at various places, on a large screen. At the moment a video tape performance would be available only to a living-room audience on the box in the corner—and then only from the same set of equipment on which the tape was recorded.

On the other hand, the two main advantages of tape over film are: (1) instant and perfect picture and sound synchronisation, without any of the heartaches undergone by amateur film users. (Maybe the threat of competition from video tape on the amateur market will at last urge the cine boffins to produce a workable system for amateurs to shoot sound and vision simultaneously!). (2) The immediate availability of material shot, without having to wait for processing. But I would say, at the present time, these advantages are far outweighed by the disadvantages. Who knows what a year will do?

Rigid discipline for the amateur

By Denys Killick

THE experiment I was privileged to witness was impressive—impressive for the simplicity with which superb quality television pictures were produced. Lighting and camera techniques were well within the scope of the average amateur photographer. Reproduction of the tape was no more difficult than playing back an audio tape. I am confident that the handling of the equipment itself will present few problems.

But the production technique is a very different story. Editing, by cutting and splicing the tape, was completely impractical on the equipment we used. Apart from a natural reluctance to cut tape costing £20 to £25 the head scans the tape on helical tracks about 13½ inches in length with the curves sweeping across the width longitudinally. A ninety-degree cut would therefore destroy a whole series of parallel tracks.

Unlike cine, where programme material is built up from a number of short sequences, video would have to be recorded as a complete programme without breaks. The difficulty for the amateur to successfully accomplish this is, in my opinion, insuperable.

In audio recording scripts may be read and small imperfections can be edited out with little trouble. How many such edits do we in the audio world expect to have in a short programme? In video a script cannot be read—or at least must not be seen to be read—and the programme must be recorded without a break or a



View of the electronic monitor mounted on the VTR camera

blemish. Our script readers taking part in the experiment performed as to the manner born, but then one would hardly call Douglas Brown an amateur at the microphone. Personally well acquainted with a very large number of amateurs in the recording world, I do not know of one whose technique is so well polished as to be acceptable in video recording. There will have to be a radical change of attitude and the imposition of rigid disciplines before creative video recording could even begin to be an amateur possibility.

I am not concerned unduly that the tapes produced are "incompatible." This is a technical limitation which will doubtless be overcome in the near future; in fact the Sony video equipment as demonstrated at the recent Radio Show is said to be fully compatible between machines of the same make. Nor am I concerned that the cost of a complete set of equipment will, at the minimum figure, become £500. This will inevitably be reduced in the face of consumer demand and improved technology.

I am concerned that video should be regarded as no more than glorified audio recording or as sophisticated cine. In fact it is an utterly different medium to either and will require its own specialised techniques. Its success in this country will depend upon whether we, as amateurs, are interested enough to develop those techniques.

MANUFACTURER'S COMMENT

IN general we are very pleased with the co-operation given us by this magazine in testing out a video recorder system by inexperienced amateurs. The differences of technique between VTR and Ciné are exposed but of course it must be borne in mind that VTR becomes easier with experience.

We should very much like to comment on the subject of compatibility, by which we mean the possibilities of exchanging tapes between machines. We prefer to be completely honest in our approach to this subject and continue to state that machines are not supplied as compatible unless specially requested. Compatible groups of up to ten machines can be supplied and for this process of selection we make no extra charge. Some of our customers who have had the longest experience of using compatible groups of the EL3400 are Dundee and Strathclyde Universities, also the J. Walter Thompson Advertising Agency.

Quite often machines drawn from stores at random prove to be compatible and this situation continues to improve. As market leaders for helical-scan VTRs we

naturally continue to make every effort in our laboratory to achieve complete compatibility and believe that this can be only a matter of time. This feature will obviously increase our sales but we have found many customer applications for internal consumption only where compatibility is superfluous to requirements.

One other point; we are amused at the amateurs discovery of vidicon smear. Firstly this is seldom significant at high light levels although it always remains a problem on fast moving subjects. The real solution, as stated, is to use a Plumbicon or image-orthicon camera. We have supplied many Hi-Q Plumbicon cameras at a price of around £1,500 and on certain occasions these are even broadcast, and quite satisfactorily.

(If any of your readers are particularly interested we will be pleased to forward them copies of an article on the use of VTR in apprentice training published in the Industrial Training International magazine for July and dealing with our VTR system as used by Leyland Motors and written by their Group Training Manager. Mr. Eric Tindall.)

Market Development Manager,
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E. FIELD

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IN the world of visual art there is more than one sort of "picture." At one end of the scale there is the picture composed by the true artist, in which every element within the frame serves his purpose.

At the other end of the scale is the holiday snapshot—where someone has seen something which interests them, pointed a camera and pressed a button. The artist creates a picture which speaks directly to its viewer: it is the entire statement, containing all that he wishes to say and nothing more. The holiday snap generally requires a little explanation; it is rarely complete in itself.

The first and most obvious difference is where the edge of frame comes, where the picture starts and finishes. The second difference lies in what is included in the picture and what (even though it may be there in the original) is omitted. Then there is the relative placing of the objects which are there and their relative emphasis by light and shade. And the artist may make subtle or gross changes in colour.

In other words, the artist *edits* reality.

All of the things that a visual artist can do are also open to the artist in sound. Even change in colour has its direct counterpart in sound, in deliberate distortion of the frequency range. (But note that the creative use of distortion requires great control over frequency characteristics—which in practical, technical terms implies that you can also ensure true freedom from distortion.) In fact, in sound, this subject is so complicated that I will say little about it here.* But I will describe the part played by each of the other functions of the artist in creating a sound picture.

THE THREE ROLES OF THE ARTIST

The artist's first step is choice of subject and treatment. To the artist these two things do not exist independently: art lies in interpretation.

The artist's second job lies in the application of his technique: this is, the part that can most readily be taught, learned and discussed. Inevitably, there are times in the artist's development when difficulties encountered here overwhelm all other aspects of his work.

Finally there is his role as critic. In creation, there is a continuous feedback process, in which effects are judged and either accepted or rejected. At the end, this tells the artist when his work is finished.

It is accepted by everyone that the visual artist should exercise these creative roles; the prospective artist in sound must make up his mind to do so also. Tape recording is a dull activity without art—and even the novice should not be afraid to take the plunge. It means (generally) cutting the tape—the first major creative act of the sound recordist. Not to do so (because tape costs money) is as ludicrous as not to start painting for fear of spoiling the canvas.

THE RAW MATERIALS: SOUND EFFECTS

The elements of a sound picture may already be recordings. But they are rather special recordings—so let's consider for a moment what they are and how they should be made.

Remember first that although sounds can be added together, they cannot be separated—unless their frequency range is mutually exclusive, or they are at least partially (and sufficiently) separate in time. This means that we should start by thinking in terms of fairly pure sound elements.

If we are recording the sound of a vacuum cleaner we don't want a door shut, or a sash window being opened, or passing traffic. Supposing, however, that the required sound picture included all of these four elements: would we record them all together on a single microphone? The answer, ideally, is *no* (given adequate mixing equipment—but we'll get to that later). It is, of course, possible to record the whole lot straight off, although to get it right you'd need separate monitoring facilities and then careful placing of the sound sources to achieve both the correct sound level and acoustic perspective, and exact timing.

But you would lose flexibility: supposing these sounds were to support a conversation piece, it would be very difficult to get the relative levels right.

So we require to build our picture from individual recordings or separate microphone sources. This also means that individual

* See the chapter on "Radiophonics" in "The Technique of the Sound Studio" by Alec Nisbett, published by Focal Press.

COMPOSING A SOUND PICTURE

By Alec Nisbett

attention can be given to perspective and acoustic colouration—by the latter we mean the proportion of indirect sound which tells whether we are out-of-doors or indoors, whether in a living room or a dungeon. Our individual elements must be fully equipped in this sense.

Even with the full facilities of a radio studio it is best to record and replay many effects separately, particularly the continuous ones. And when recording actuality—real events—it is best to separate the elements if possible and recombine them later.

There are famous exceptions to these rules. Ludwig Koch's sound pictures of the countryside—with birdsong, the buzzing of insects, the distant bleat of sheep and so on. Beautifully composed by careful placing of a single microphone, they are highly evocative. But try to use them as sound effects! . . . the levels are all wrong . . . and you find that you want to emphasise first this element and then that, and you can't . . . nor can you time the intermittent sounds as a counterpoint to speech, instead of perhaps distracting from the impact or intelligibility of a key word.

SPEECH AS A RAW MATERIAL

Already in preparing our sound effects, we may have encountered the need to edit, say to cut out a telephone which rang at the wrong moment, or the click of a door as someone barges in by mistake. The success of such an edit depends on the matching of sound before and after; it will only work if the sound is constant or repetitive. Also, you must avoid cutting into the tail of reverberation of the unwanted sound or you will get a jerk or click in the sound.

But for speech—except that specially prepared and then delivered by a good speaker—editing will often be required. For a start (literally), the first wanted words must be selected. To "get in" at this point they may have to be joined in to spacer or "atmosphere" (background sound at the same level).

In many cases it will improve a recording to get rid of "um's" and "er's." Not everyone will agree with this ("To 'er' is human") but for most people an "er" is inserted at the point when the speaker's own sense of timing tells him that the next word should come—but because it isn't ready he says "er". The remedy is simple: cut just before the "er" and just before the wanted word and join. The great value of this sort of cutting, which may also be used to delete words spoken in error or unnecessary qualifying phrases, is to improve intelligibility.

The rule is: *cut for greater intelligibility and clarity of expression.* And help the speaker to say what he would have wished to say if you hadn't falsified the situation by pushing a microphone under his nose.

EDITING TECHNIQUES

The technique of editing has several parts: the selection and marking of cutting points, and the physical cutting and joining.

Selection

Wherever possible cut in the pause *just before a word.*

In a breath pause nearly always cut *after* the breath.

In cutting inside sentences, prefer to cut before explosive consonants p, b, and t, even though this may mean you cut inside words.

Avoid impossible vocal contortions—words spoken together often sound different from the same words spoken separately, because the mouth has to get from one shape to another—so don't assume that words that can be written together can be edited together.

Avoid too sudden changes of pitch or mood.

Marking

Use a yellow wax pencil or a black felt pen. The latter may be preferable when using a recorder with pressure pads as it doesn't clog them.

Having moved the tape (by rotating both spools together) backwards and forwards over the replay head to determine the exact

cutting point, mark the tape over the replay head. In some recorders with pressure pads this can easily be done: simply remove the housing (or its front part) and lift the pressure pad off the tape. With other recorders it may be simpler to measure the distance from the replay head to the nearest guide pillar to the right; then, having located the cut-point over the replay head, you can actually mark it at the pillar. (This mark is then located on the editing block at the measured amount to the right of the cutting point).

Some virtuoso editors don't mark the tape at all: knowing the exact distance from the replay head to the end of the head assembly, they take the tape by finger and thumb at the edge of the head assembly and place it in the editing channel, offsetting at exactly the right distance. I wouldn't recommend this for slow tape speeds.

Cutting and joining

This is where paths differ. It is a curious fact that the more experienced editors use simpler equipment than those for whom editing is an occasional spare time occupation. A BBC editor will use a simple locating channel which grips the tape by its slightly overlapping edges, a roll of splicing tape, and a sharp razor blade. For a touch of neat workmanship a neat alternative to cutting off inch lengths as required is to use the now ready-cut splicing tape. The less experienced will often be happier with slightly more complex equipment which ensures a perfect splice every time, cutting slightly into the edge of the splice to ensure that no adhesive is going to rub and drag on any part of the recorder. Incidentally, a disadvantage of the professional's editing block is that its all too easy to lay the splicing tape on this join slightly out of true, so that you have to trim the edges clean with a blade.

There are other variations on the theme of techniques: with one recorder I've met, when you want to cut you press a button marked "schnitt" and a tiny pair of scissors whips up through the deck and schnitts the tape. When in doubt follow the makers instructions!

Mixing

The final stage in creating a sound picture of any complex tape programme is to combine together all the various sources of sound and do so without change in the frequency characteristic. Fortunately this is relatively easy to ensure.

Secondly, the mixer may have to combine signals at two levels, the low level, put out from a microphone or gramophone pick-up with the much higher level output of another tape recorder. The most satisfactory way of evening the levels out is to even them *up*, by amplification, rather than down into the noise—particularly as there will be further losses in the mixer.

A "passive" mixer has no amplification, an "active" mixer (today, often fully transistorised and consuming little power) sends on a signal that is at least partly amplified. Some mixers have a high impedance (high *z*) input for use with crystal microphone or pick-up.

The next important need is a fader on each channel. The quality of the faders makes a lot of difference to price. The most expensive are "balanced", that is, they present a constant impedance to all other sources whether faded up or not.

Each of the mixing operations take you a few steps down towards your noise level—another reason why its worth spending a little money.

Whatever equipment you choose, it is best—if possible—to listen to the results of the mix on a good external loudspeaker (and, of course, in a different room from any live microphones).

But however good your equipment, the quality of your mixing depends on one final link in the chain: your own ear. Only by sound judgment can you ensure that each technical operation fulfils its purpose in the artistic whole.



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CROSS

TALK

By Audios

THE pirate radio stations do not merely manage to stay in the news—with stories of murder, kidnapping and assault, they make it. The deplorable actions of those concerned, however sensational, are of no importance to us in themselves. And yet, in this land of freedom, law and order a handful of strong-arm men have forced the Government into action after the (more-or-less) honest electorate had miserably failed.

Its hand has been forced. It cannot stop the pirates without providing an alternative. And the only possible alternative is local broadcasting. But what form will it take, and under whose control? We might have B.B.C. VHF stations transmitting genuine local programme material as originally planned. On the other hand we might have "legalised pirates," removed from their ships or forts and based on dry land putting out their endless deluge of pop music under licence from the Postmaster General and financed by advertisements.

The burning question is, will the service offer programme material of positive or negative value? My own opinion, for what it's worth, is that endless pop is indeed moronic drivel. Before you take up arms against me, please consider this: there just isn't enough good pop to fill the time. Programmes go out for some sixteen hours a day, seven days a week, fifty-two weeks a year. If you had to fill that frightening time space with pops at three minutes a go I suspect you would admit defeat before the end of the first day. So we get drivel. Anything to make a noise and keep the programme on the air. This must not be allowed to happen.

A truly balanced local broadcasting system would cater for all sections of the population. We should have our pops for the youngsters, but in proportion to other kinds of music and other topics. If our politicians have sufficient foresight and courage this could be the dawn of a new age for sound radio. Our own B.B.C. programme, "Sound," was pushed off the air through lack of programme time; it could return locally. There would be time for all kinds of other interests to be dealt with—photography, stamp collecting, angling, motoring, sailing—the list is surely endless. And we, as the enthusiasts of the recording world, should have equally endless opportunities for offering programme material and suggestions.

The kind of service we get will depend upon Parliament. The M.P. for your constituency will have to vote when the subject is debated. Why not write to him and tell him what you think and what you want? Don't leave it to the other fellow—he's probably leaving it to you. Now is the time; later will be too late.

THE other day I was talking to Mr. Allerhand of the NuSound Tape Recording Centres. He had some most interesting news about video recording. This enterprising gentleman has secured an exclusive agency for Sony video equipment and he is forming a completely new company to handle it. Engineers and salesmen are being specially trained and it is hoped that marketing will begin in January, 1967. That's not very long to wait.

The equipment itself was demonstrated at the recent Radio Show, and it appeared to work very efficiently. Editing video tape remains a problem, although it could be overcome electronically. The Japanese experts assure me that the cost of an electronic editor would be greater than the cost of the machine itself, and the company has no plans to develop or market one. The half-inch tape on the Sony machine runs at 7½ ips and the rotating head assembly scans helically. I asked if the "photographic speed" could be considered in ASA terms as for film. The answer, strangely enough, is that the photographic speed is specific to the camera in use, not to either the tape or the recorder. The picture, by the way, is viewed on the built-in monitor screen, and is not intended for screening on an ordinary domestic TV screen. Similarly, when recording "off the air" the monitor becomes a TV receiver from which the signal is fed to the recorder. So the entire outfit is quite independent of any existing television installation the user might have.

REFERRING to the Radio Show I must mention the multitude of cassette recorders now being made. The Philips system and mechanism has been offered to manufacturers, many of whom have seized the opportunity with both hands.

The Elizabethan model LZ 612 selling at 45 guineas is described as "a revolution in concept and design". Operating from battery or mains power it takes full advantage of the quality of the system by incorporating a 5½ watt amplifier and a good ten-inch loudspeaker.

Full mixing facilities on the inputs and separate bass and treble controls on the amplifier makes this one of the most comprehensive cassette machines available.

A new name in the manufacturers' lists is Van Der Molen. This firm, in business less than twelve months, is making a highly

original range of equipment, including a Philips cassette model. At 35 guineas this is a little more modest than the Elizabethan, its 3½ watt amplifier driving an eight-inch speaker, but we still have mixing facilities and separate tone controls. By the addition of an extra loudspeaker unit stereo cassettes can be played back.

Philips themselves naturally have a full range of recorders using their own system, including a model at 48 guineas offering full stereo record and playback facilities. Even a stereo microphone is included in the price—the only extra to purchase is the loudspeaker. The machine is so small and light that a built-in loudspeaker would give poor sound and would spoil the clean lines. So the amplifiers are there, but no loudspeakers at all. This is a daring, but I think very wise, idea.

NEXT we have what is apparently a conventional car radio. But press a concealed button and out pops a tape cassette. It's all very confusing. Looking more closely we see the familiar name Butoba on the front panel and examining the cassette we find it's not Philips at all, but Butoba four-track using standard quarter-inch tape. Life gets more confusing every day!

FASCINATING as the new cassette machines may be, I had to tear myself away to examine an interesting exhibit tucked away on the Bosch stand. The Uher Reporter battery-operated recorder is now established as the leader in its field, but next to it was another machine not dissimilar in appearance. This, the Uher Pilot, is really quite different. Recording full track at a single speed of 7½ ips it incorporates full facilities for pulse recording for synchronisation with cine. With this machine coupled to a suitable camera the problem of lip sync is overcome. And if the cost at about £200 seems high, remember that the only other similar equipment available costs roughly twice as much.

THE announcer on the BBC early morning record programme was getting completely muddled with his items. Apologising, he said it should be quite simple to operate the equipment. "But", he added, "the trouble is all the instructions are in Japanese!"

ON THE FRINGE

A new monthly round-up of news from the world of hi-fi

ONLY a few audio designers in this country seem to us to have the know-how and intellectual integrity of David Hafner, founder of Dynaco Inc., Philadelphia, PA, USA. His range of Dynaco amplifiers and radio tuners is marketed here by Howland-West Ltd., 2 Park End, South Hill Park, London, N.W. 3. and his latest Dynaco 120 Solid-State Power Amplifier is just available here initially in kit form only, although

the assembled version should be released later this year.

This Stereo 120 amplifier has an exceptional performance providing high clean output power at all impedance ratings and at distortion levels that are virtually non-measurable, either for harmonic or IM distortion. No transformers are employed (other than in the power supply) and the circuit is built around 15 transistors and 13 diodes. Reliability of transistor amplifiers has been publicised as better than valve designs, but in practice it has been lower due to the ease of destroying expensive transistors and the necessity—in some designs—of operating them at maximum ratings. Such a simple act as shorting (with a whiskered flex connection) or open-circuiting the loudspeaker leads will render many transistor amplifiers inoperative or burn-out transistors. In the Stereo 120 electronic protection is incorporated—not the customary fuses, thermal cut-outs or circuit breakers—but simply by shutting itself off

(Continued on page 362)

RESIDUAL MAGNETISM. The principle of tape recording depends on the theory of magnetisation. Briefly, a signal fed into the tape recorder and amplified is passed as a varying current through the coils of an electromagnet. The core of this device has a gap arranged in such a way that the lines of magnetic flux are concentrated just before it. When a tape coated with magnetic oxide passes this gap, the flux magnetises the oxide, producing a magnetic pattern on the tape which is virtually permanent.

Moving the tape again along the line causes the patterns to pass a gap in a similar electromagnet and produce small currents in the coil of this second device—the Playback Head. These currents are amplified, corrected to compensate for non-linearity in the recording medium, and reproduced as an audio signal which should, ideally, be a replica of the original input.

This description omits several important factors, among them the need for high frequency bias and the question of residual magnetism, or remanence. The fact that the signal can be made to produce a rapidly varying flux at one point, the head, and a pattern on the tape which does not fade away when the energy producing it is removed, is itself significant. This depends on the “softness” of the head cores and the “hardness” of

SERVICE BUREAU

A glossary of tape terms—part 8

BY HARRY MACK

the tape oxide. The former has a low remanence, whereas the tape oxide must have a high remanence. Remanence is measured in *Gauss*.

Allied to this factor is the property of coercivity, which is the measure of self-demagnetisation. The high frequency sensitivity of a tape is dependent on its high coercivity. Coercivity is measured in *Oersteds*.

* * *
RESPONSE. A measurement of sensitivity at different frequencies. Thus, an amplifier may be stated to have a frequency response within ± 3 dB from 20 to 12,000 cps. This simply means that the output produced by a signal of any frequency between the given limits will not vary more than 3 dB from a mean level.

A response figure quoted without this

limitation figure is virtually meaningless; uniformity of response is as important as wideness of the frequency range when assessing the “goodness” of an amplifier or associated equipment. (See also *Range*.)

* * *
REVERBERATION. Echoes of the sound from a loudspeaker, caused by reflections of the audio waves from surrounding surfaces. A certain amount of reverberation is helpful in providing “room ambience” and devices have been produced which can give a controlled reverberation to the output from an amplifying system. These work on the principle of a slight delay in the sound, caused by feeding the tape along a longer path to a second playback head, or by electromechanical devices using delay lines which slow down part of the electrical signal, then add it to the original.

ON THE FRINGE

(Continued from page 361)

by a novel biasing circuit. The signal returns as soon as the intrusive load is removed.

Other features of this advanced amplifier include stable circuits with DC feedback control of transistor characteristics to produce a consistent level of operation over a wide range of transistor characteristics (in this case all silicon types); thermal stability by a self-adjusting bias arrangement; and a power rating based on rms continuous power handling from 20-20,000 cps. Mr. Hafler does not support music power ratings as a meaningful figure (now called IHF dynamic power incidentally), but insists that his amplifier should not be called “a 60 watter” (per channel) unless it can deliver 60 watts of sustained power.

This attitude to design problems is laudable, but is not the main platform for our opening remark. No, but what is significant is Mr. Hafler's statements that “transistor sound” is not necessarily better (than valve) sound, that transient distortion of most existing transistor equipment is far worse than quality valve designs, and—a topic studiously neglected by most audio writers and totally ignored by the ad. men—the fact that a top-grade thermionic valve amplifier's distortion drops to zero at low power levels, but most current transistor amplifiers show rising distortion at the very low power levels represented by normal domestic music reproduction. This “notch distortion” (revealed most clearly on intermodulation distortion measurements) explains why many solid-state exponents prefer to ignore IM

measurements and distortion specifications, other than at maximum power.

The prolonged research work into new circuits and finding acceptable components of the standard desired has enabled Mr. Hafler to introduce a solid-state power amplifier with a performance genuinely superior to the best so far achieved with valves. Some engineers believe that his design is at least two years in advance of the industry in general.

* * *
MOST owners of hi-fi equipment are handicapped by the fact that their knowledge of audio engineering is not advanced enough to put them in full control of the situation when faults arise or the performance seems to falter. Some, however, are unnecessarily modest and assume that only the expert can begin to tackle the problem—even if it means a lengthy check-up of all the equipment from beginning to end.

There is no need for anyone to be completely helpless, because logic and common sense can accomplish a great deal on their own. Lack of training and test equipment may prevent one from pin-pointing a fault precisely, but logic can often narrow down the search and considerably simplify the approach to servicing.

For example, if there is a falling off in quality of your tape recorder you can make a preliminary check by playing a pre-recorded tape which you know to be of top quality. If the fault does not appear then it is logical to assume that the trouble is in the recording part of the system, and if it does appear, then the playback chain

must be suspect. In the latter case you can plug in an extension loudspeaker to check whether this clears up the fault and indicates a breakdown of the built-in loudspeaker or its connections. In the former case you can test with an alternative microphone or some other sound source known to be in good order, such as a radio tuner.

Stereo equipment has what amounts to a built-in checking system. A good mono signal fed through first one channel and then the other will reveal by comparison, deficiencies in either one. The same loudspeaker should be used to minimise variables.

The loudspeakers themselves can be tested by using one channel and switching from one loudspeaker to the other.

Almost any defect can be roughly located by the temporary substitution of outside elements one by one. The aim is simply to restore normal performance, and the outside element that restores the quality logically indicates that the culprit is the item replaced.

The method is not completely fool-proof but it is a great help, enabling one to go along to the servicing engineer with a much clearer idea of what is needed—and it reduces transport problems.

Ideally, of course, two owners with similar hi-fi equipment can borrow relevant items from each other for substitution checks. However, most of us have amplifiers, pick-ups, tuners and other pieces of discarded equipment that can be made to function well enough to play a useful part. Moreover a second string of this sort can be handy for filling in when parts of the first team are out of action.

All this activity is so much easier these days, by the way, now that we have those phono-plug leads to simplify connections.

REVERBERATION TIME. This term relates to the characteristic pattern of echoes produced by a room and is a measure of its acoustic property. An empty room, or hall, will have a longer reverberation time than a full one, due to the lack of sound absorption. As a relative term, reverberation time is stated to be the period in which a sound dies to a level of one-millionth of its original strength. For a large, bare hall this could be several seconds.

REWIND. The process of re-spooling tape from the take-up spool back to the feed spool. Motors, or motor couplings, are arranged to carry out rewinding quickly, and the period this takes is termed the "Rewind Time."

RIBBON MICROPHONE. (See also MICROPHONES). Type of transducer that employs a delicate foil ribbon as diaphragm between magnetic polepieces. It operates on the same basic principle as a moving coil microphone. When both faces of the ribbon are free, it operates as a velocity device; with one face exposed and the other enclosed in an acoustic labyrinth, a pressure-operated version is obtainable.

The polar diagram is thus a figure-of-eight or modified cardioid, lending itself to wide variations in employment. Quality is nor-

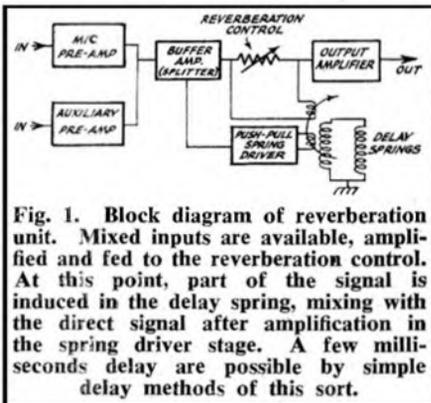


Fig. 1. Block diagram of reverberation unit. Mixed inputs are available, amplified and fed to the reverberation control. At this point, part of the signal is induced in the delay spring, mixing with the direct signal after amplification in the spring driver stage. A few milliseconds delay are possible by simple delay methods of this sort.

mally high, impedance and output low, and physical robustness dependent upon the type of housing. Normally used for studio work.

RIM-DRIVE. Application of the motor pulley directly to the flywheel or capstan wheel. This method of direct drive is used mostly on small battery-operated tape recorders, where the use of idler wheel and flywheel drive would require either a larger motor or greater power. General practice is to achieve good contact with the rubber tyre of the capstan wheel by fitting a fairly long bush on the motor spindle and allowing this to run on the flat surface of the wheel, rather than vertically at its edge.

Reversal of the drive direction may be obtained by pivoting the motor, a similar bush on the other end of the protruding spindle then contacting a second wheel for rewind purposes. Such systems are very dependent on the pressure of the motor pulley to the wheel rim and wow can easily result from incorrect pressure.

RING HEAD. The shape of early electromagnetic record/playback heads was roughly circular in plan. The polepieces had the coils wound on opposite diameters, with one portion between them flattened and cut to form the gap. Hence the term ring-head. Modern tape heads usually have two gaps, the rear air gap serving to main-

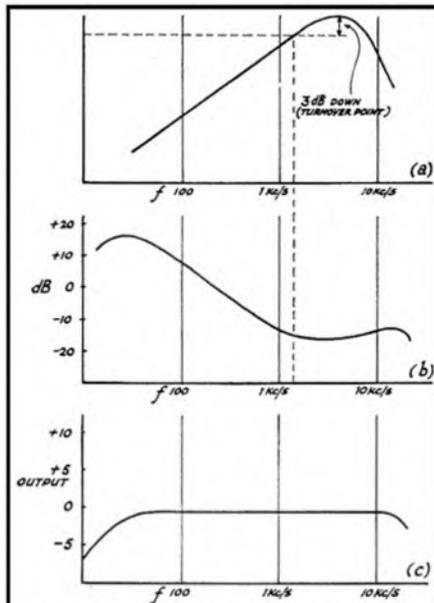


Fig. 2. Typical response curves. (a) signal from playback head; (b) amplifier response tailored by equalisation circuits; (c) resultant amplifier response curve.

tain the linear relationship between the flux at the front (recording) gap and the recording current. The shape is more cubic, better quality types being stamped from laminations and encapsulated.

SAFETY SWITCH. Tape stop device that interrupts the motor supply—or, in some cases, the supply to the complete machine. Usually consists of a tape-operated lever which retracts to open a switch when the tape breaks, ends, or is removed.

The term is also used to denote the interlock device, key or button-operated, which locks the "record" button to prevent its being accidentally engaged.

SALIENT-POLE MOTOR. A form of synchronous motor of the induction type with an armature milled so that flat spots on its upper face lock into the rotating magnetic field. Only used on some cheaper machines because of its tendency to "hunt," causing wow and flutter. Hysteresis synchronous motors are more generally used, with mechanical safeguards against speed variation.

SCREENING. Protection against reception of, or radiation of, electrical or magnetic impulses. This usually consists of a shield surrounding the protected part, made

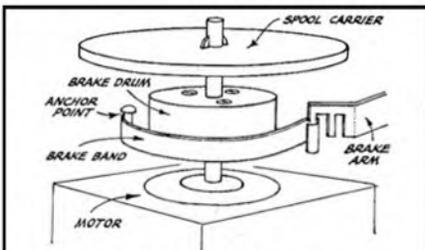


Fig. 3. Typical servo brake. The arm is spring loaded to press flexible band against drum when brakes are applied. Band is anchored at outer end, direction of drum rotation determining brake pressure.

of a material with high conductivity. Magnetic screening of heads is carried out by a Mumetal shield. This encloses the head except for the portion of the facing contacted by the tape and serves to protect it from external magnetic fields and prevent radiation of signal flux from the head. Other parts of the tape recorder that are usually screened are input sockets, early stages, oscillators and valves themselves. In many machines, the deckplate itself is a screen for the amplifier.

SENSITIVITY. This may be simply quoted as an input figure of X microvolts, in which case it denotes the input required to fully modulate the tape. Correctly, the reference level should be given, i.e., input to produce a given output at a certain distortion level, and this is stated in amplifier specifications.

SELF-THREADING SPOOL. A type of tape spool with solid flanges and a "capture" feature which automatically winds on the tape when this is placed between the flanges. Some expensive types of tape recorder take advantage of this feature by enclosing the take-up spool and providing only an extended tape slot for loading.

SEPARATION LANES. Also known as "Safety Lanes." The unrecorded portions of tape between the adjacent tracks, preventing "crosstalk" due to interaction of recorded signals. For dimensions, see TAPE and TRACKS.

SERIES BIAS. Early tape recorders employed a circuit in which the "record" head winding and the "erase" head were in series, fed from a winding on the oscillator transformer. The disadvantage was that alteration of recording bias interfered

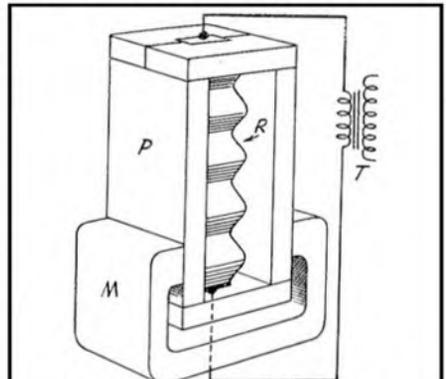


Fig. 4. Specimen of ribbon microphone construction. The delicate, corrugated foil ribbon, R is suspended in clamps between polepieces attached to the poles of a magnet. The ribbon thus forms a virtual half-turn and is coupled, via a transformer, to the input circuits.

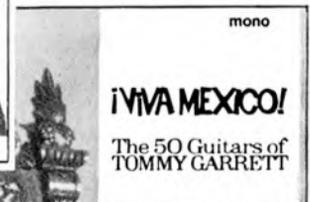
with the erase current, and erase current limitations restricted recording head design. Modern machines use shunt-fed recording heads.

SERVO BRAKE. This is a type of "wrap-around" brake, consisting of a pliable strip of fabric (or of metal in at least one instance where a plastic spool is braked). The advantage is that the rotation of the brake drum assists braking tension, maximum braking force being obtained when rotation is contrary to the wrap of the brake.

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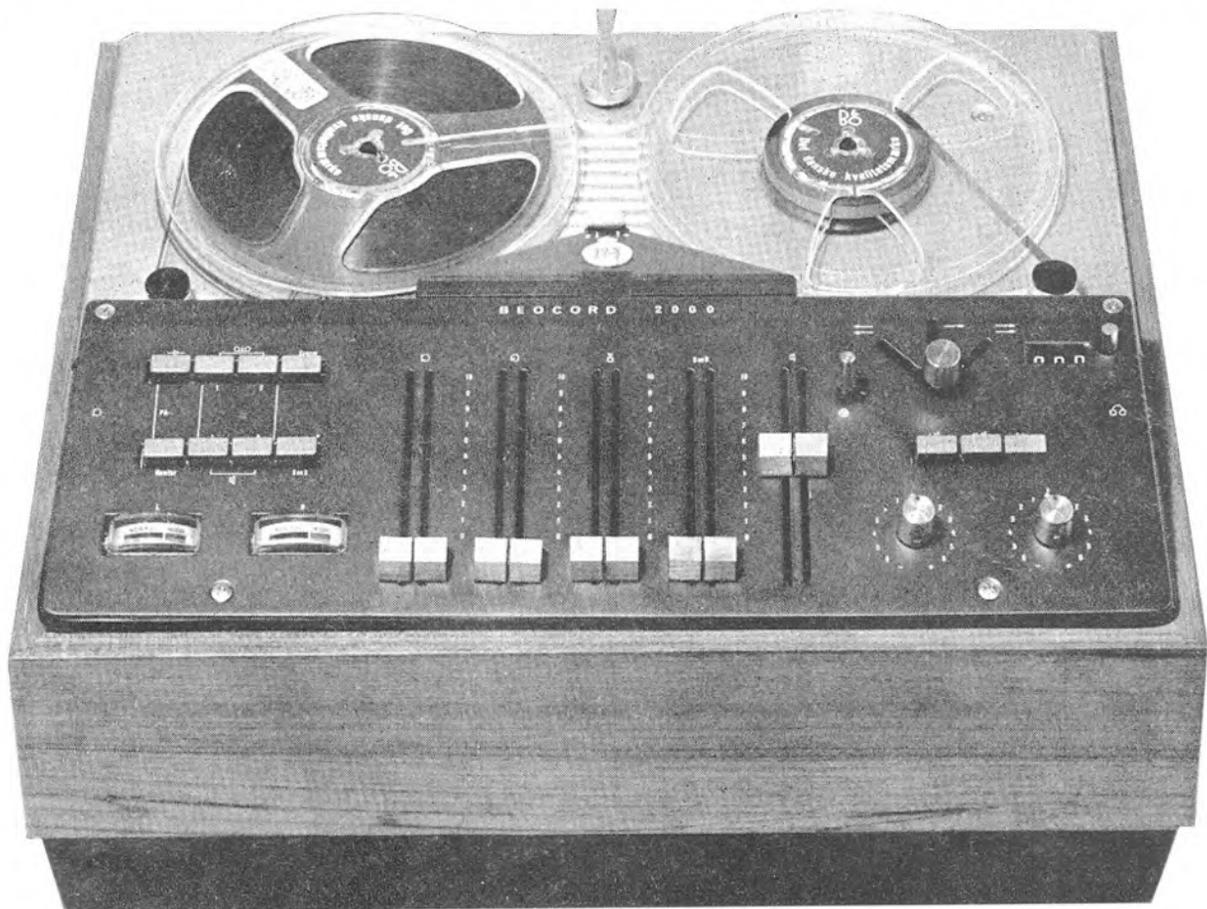
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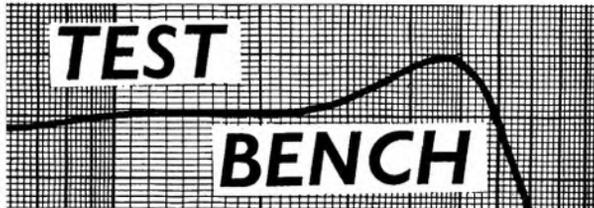
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MARCONIPHONE 4210

By Robert Turner

QUITE often a very attractive external case contains little of note with regard to the audible performance and sometimes it is suggested that an unattractive rugged exterior is more likely to yield performance of a high order. This statement is, of course, quite untrue and could not be more emphatically repudiated than by reference to the Marconiphone 4210.

The visual design is of a luxurious nature, the black leathercloth finish blending extremely well with the wide chrome loudspeaker enclosure. The internal presentation leaves little to be desired in the way of clarity and the controls are easily distinguishable. These take the shape of large piano type keys situated at the right hand of the machine which have a positive, yet delicate action.

The electronic controls are well spaced at the front of the instrument and in the record position allow for the mixing of two channels. At the rear of the unit, situated between the two spools, lies the speed change switch which provides variation in the three steps, $7\frac{1}{2}$, $3\frac{1}{2}$ and $1\frac{7}{8}$ ips. On a further raised panel at the front of the recorder, the footage indicator, level meter and the track selection switch are within easy reach of the operator. At this stage it is worthwhile mentioning the very fine positioning that one may achieve by referring to the fourth digit of the footage indicator. However, in the rewind condition, this finely geared unit revolves in a most ferocious manner. It is with no small degree of dexterity that one is able to trap the required digit, although I did find that "operator" efficiency improved with use and at the end of a few hours was able to pinpoint the final digit with remarkable accuracy. Not at all at home with the type of microphone input socket that has become an everyday hazard, it may be with some bias that I found this socket somewhat difficult to use with regard to quick and positive insertion of the microphone plug.

From the mechanical point of view, the wow and flutter figures corresponded to

those claimed by the manufacturers and in fact presented a motion comparatively free from any disturbing irregularities. The rewind is longer than one associates with tape recorders built around a three motor system, but is sufficiently speedy, rewinding 1,800 feet of tape in less than $3\frac{1}{2}$ minutes. More important, the spooled tape is very evenly wound under a tension ideally suitable for tape storage. Occasionally, how-



ever, the very rapid braking action did tend to snatch at the thinner grade of tapes and could under certain circumstances stretch tape with a base of high elasticity. This may, unfortunately, have been due to the brake settings of this particular machine.

An automatic end of tape stop facility has been incorporated, being triggered by the metallic stop foils that one associates with the majority of tapes available on the market. I feel that this asset is an essential and coupled with the stop start mechanism actuated from the microphone itself, makes the instrument a pleasure to handle in even the most awkward circumstances.

Audibly, however, the 4210 gains by far its highest marks and surprisingly the internal loudspeaker provides a quality of sound that would be normally indicative of a much larger unit and as we can see from the accompanying graph, the response at both ends of the register is well represented. Quite obviously the internal loudspeaker cannot be expected to handle the very low frequencies that may be contained in the recording of an organ recital and to this end one would take advantage of the

external loudspeaker socket situated at the rear of the machine. The tone control had a very smooth action, operating in a linear fashion over the whole sweep of the control, making a selection of the listening point an easy operation. The signal-to-noise ratio was better than 40 dB below the peak recording level and the lack of tape hiss indicated a bias oscillator design of a low distortion content with a slow decay time upon switch off, minimising any risk of magnetising the record/replay head.

The quality of the recordings through the microphone, supplied with the machine, were excellent, but the small built-in stand left something to be desired with a view to stability. All the accessories, including microphone, extension lead and connectors were easily contained in the compartment at the rear of the recorder and this compartment also gave access to the mains adjustment panel and the subsidiary input and output sockets.

As mentioned earlier, the footage indicator does tend to revolve rather rapidly and may be more easily controlled if reference is made to the paragraph on inching, set out in the instruction booklet issued with the machine. After making a recording, taking advantage of the double-track playback facility, I noticed that the output level from each track in the parallel condition was audibly different, but, as each track was then played individually, the output level per track appeared to be equal. This was in fact borne out by measurements made upon instruments and rather suggested that the phasing of the two halves of the head in this one condition was somewhat out of order. It must be realised that a unit under conditions of review does tend to receive handling that is by necessity more abusive than one would normally confer on any piece of personal equipment and possibly the latter problem may stem from this. Apart from the points mentioned above, the recorder produced a quality of performance that would have done credit to a machine in a substantially advanced price bracket.

MANUFACTURER'S SPECIFICATION

Frequency range: 40-18,000 cps. at $7\frac{1}{2}$ ips; 40-14,000 cps at $3\frac{1}{2}$ ips; 40-7,000 cps at $1\frac{7}{8}$ ips.

Wow and flutter: Better than 0.15 per cent at $7\frac{1}{2}$ ips; 0.2 per cent at $3\frac{1}{2}$ ips; 0.25 per cent at $1\frac{7}{8}$ ips.

Max. spool size: Seven inches.

Signal-to-noise ratio: 40dB (unweighted).

Record level indicator: Moving coil meter.

Audio output: Three watts (speech and music conditions).

Power supply: 200-250V, 50 cycles, AC only.

Power consumption: Sixty watts.

Input/output sockets: Radio In/Out (input: 1.5 mV into 68 K ohms; output: 1 V at 22 K ohms; PU2 (input: 75 mV into 3.3 M ohms; radio output: 1 V at 22 K ohms); PU (input: 180 mV into 200 K-500 K ohms); Auxiliary (for use with accessories): (a) remote pause operation; (b) 32 V DC at 50mA; (c) fully compensated playback signal outlet. 1 V at 22 K ohms; and (d) winding on unselected track of record/playback head for stereo tape records, second-track monitoring or slide projector sync.

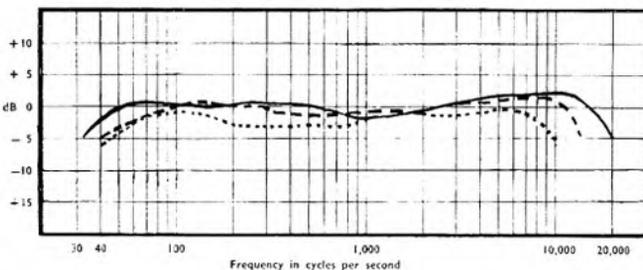
Loudspeaker socket: 3 ohms at 3 watts.

Re-spooling time: 1,800 ft. in 3 m. 20s.

Size: $16\frac{1}{2}$ x $14\frac{1}{2}$ x $7\frac{1}{2}$ inches

Price: 45 guineas.

Manufacturers: British Radio Corporation Limited, 284, Southbury Road, Enfield, Middlesex.



Overall record/replay response of Marconiphone 4210

$7\frac{1}{2}$ ips —————;
 $3\frac{1}{2}$ ips - - - - -;
 $1\frac{7}{8}$ ips

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NEW PRODUCTS

VTR IN NEW RANGE FROM SONY

AMONG equipment introduced by Sony at the recent Radio Show were two stereo units.

Also shown, and to be described fully next month, is the Sony Video Recorder the least expensive available in this country. Estimated price is 351 guineas for the recorder and necessary monitor screen and 125 guineas for the camera (plus lens) and tripod.

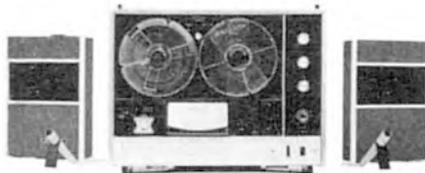
First of the recorders is the TC-350 stereo tape unit (illustrated right) which features playing speeds of $7\frac{1}{2}$ and $3\frac{1}{2}$ ips.

A four-track unit, the TC-350 is completely transistorised and will sell at £78 15s. The quoted frequency response for the top speed is 50-15,000 \pm 3 dB, wow and flutter being rated as less than 0.17 per cent.

With accommodation for seven-inch spools, it provides a playing time of 64 minutes per track using standard play tape (1,200 ft.) at $3\frac{1}{2}$ ips.

Among the features are facilities for sound-on-sound recording, track transfer, "off the tape" monitoring, separate V.U. meter recording level indicators for each channel and inputs for stereo microphone, radio or pick-up.

Second of their new models is the complete stereo recorder, TC-530 (illustrated below) which features built-in loudspeakers and supplementary satellite units mounted in the dividing lid.



With playing speeds of $7\frac{1}{2}$, $3\frac{1}{2}$ and $1\frac{1}{2}$ ips, the TC-530 provides a playing time as for the stereo unit above. Additional features include power output of five watts per channel and separate dynamic microphones for A-B stereo recording. The price is £126.

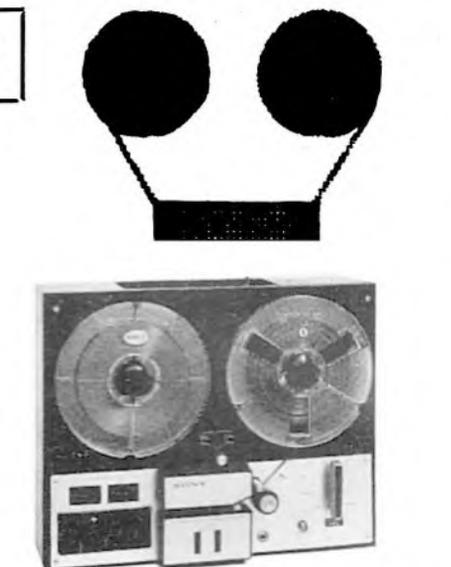
Sony U.K. Sales Division, Mercia Road, Gloucester, Gloucestershire.

NEW MAGNETIC TAPE BY LEDA TAPES

A NEW range of magnetic recording tape is announced by Leda Tapes. Standard, long, double and triple play varieties are available on 3, 4, 5, $5\frac{1}{2}$ and 7-inch spools.

Standard-play (PVC base): Three-inch reel (150 ft.) 2s. 3d.; 4-inch (300 ft.) 3s. 9d.; 5-inch (600 ft.) 8s. 3d.; $5\frac{1}{2}$ -inch (900 ft.) 10s.; and 7-inch (1200 ft.) 12s. 3d.

Long-play (PVC base): Three-inch (225 ft.)



3s., 4-inch (450 ft.) 5s.; 5-inch (900 ft.) 9s. 9d.; $5\frac{1}{2}$ -inch (1200 ft.) 12s. 3d.; and 7-inch (1800 ft.) 17s. 3d.

Double-play (Polyester base): Three-inch (300 ft.) 4s. 3d.; 4-inch (600 ft.) 8s. 3d.; 5-inch (1200 ft.) 15s. 3d.; $5\frac{1}{2}$ -inch (1800 ft.) 19s. 3d.; and 7-inch (2400 ft.) 21s. 9d.

Triple-play (Polyester base): Three-inch (600 ft.) 8s. 9d.; 4-inch (900 ft.) 12s. 6d.; 5-inch (1800 ft.) 22s. 6d.; $5\frac{1}{2}$ -inch (2400 ft.) 28s. 6d.; and 7-inch (3600 ft.) 38s. 6d.

All reels of 5-inch and above have fitted leaders, stop foils and trailers.

Leda Tapes, 30 Baker Street, London, W.1.

GRUNDIG INTRODUCE THEIR CASSETTE RECORDER

GRUNDIG have introduced their battery/mains operated cassette-loaded tape recorder announced last Spring. The new machine, illustrated below, is the C100 which uses the DC System International recording at the new tape speed of 2 ips.

With a quoted frequency range of 40-10,000 cps, and a signal-to-noise ratio given as better than 45 dB, the C100 will retail at 39½ guineas. The playing time available for each of the two tracks of the $\frac{1}{2}$ -inch



wide tape is 45 minutes using the 4 x 2 x $\frac{1}{2}$ -inch DC90 cassette, or one hour using the DC120.

Among the features are pause control, safety erase lock, tone control, headphone monitoring, external amplifier socket, and a built-in 6 x $3\frac{1}{2}$ -inch loudspeaker handling the power output of two watts.

Measuring 11½ x 7½ x 3½ inches, the C100 weighs 7½ lb., and is supplied complete with moving coil microphone, connecting lead and DC90 cassette.

Grundig (Great Britain) Limited, Newlands Park, Sydenham, London, S.E.26.

VAN DER MOLEN ANNOUNCE SECOND RECORDER

A SECOND tape recorder was introduced by Van Der Molen at the Radio Show. Their new model is the VR7, illustrated below, a four-track three-speed recorder selling at 39 guineas.

Designed for vertical operation, the transistorised VR7 operates at 7½, 3½, and 1½ ips, and will accommodate spools up to seven inches in diameter. The playing time available using standard-play tape (1,200 ft.) is 64 minutes per track at 3½ ips. Rewind is achieved within approximately two minutes.

The quoted frequency response is 60-15,000 cps ± 3 dB at 7½ ips, 60-10,000 cps ± 3 dB at 3½ ips and 60-4,000 cps ± 3 dB at 1½ ips. Wow and flutter is rated as better than 0.15, 0.25 and 0.35 per cent respectively and the signal-to-noise ratio as better than 40 dB.

Among the features are facilities for mixing, loudspeaker monitoring, separate bass and treble controls, magic eye recording



level indicator, digital rev counter and a built-in eight-inch elliptical loudspeaker handling the power output of 3½ watts.

Inputs are provided for microphone (2 mV at 1 M ohms) and radio/pick-up (200 mV at 1 M ohm). Outputs are for external amplifier or headphones (1-3 volts, RMS) and extension loudspeaker (3 ohms).

Mains supply required is 200-250 v., 50 cycles and the power consumption is given as 50 watts. The VR7 measures 18½ x 11½ x 7 inches and weighs 21 lbs.

Van Der Molen Limited, 42 Mawney Road, Romford, Essex.

NEXT MONTH

THIS month's special article on video recording has led to the omission of some regular features, including Denys Killick's series on "Tape Recording Techniques." This series will resume its monthly appearance in the November issue of "TAPE" when we shall also provide full results and a report on this year's British Amateur Tape Recording Contest.

ULTRA ANNOUNCE TWO NEW MODELS

LATEST additions to the Ultra range of recorders are the 6208, four-track two-speed recorder (illustrated below) and the 6210 two-track, single-speed unit of similar appearance.

Quoted frequency response of the 6208 is 60-10,000 cps at 3½ ips and 60-6,000 cps at 1½ ips. Wow and flutter is given as better than 0.2 per cent (RMS) at the top speed, and signal-to-noise ratio as better than 40dB.



With accommodation for 5½-inch spools on the Thorn Mk II deck incorporated, the playing time available using standard-play tape (850 ft.) is 45 minutes per track at 3½ ips.

Features include facilities for monitoring, parallel-track playback, superimposition, remote pause control, straight through amplification, automatic tape end stop operated by metal foil, safety erase lock, digital rev counter with zero reset and a built-in 7 x 3½ inch loudspeaker handling the power output of three watts.

Measuring 14½ x 12½ x 7½ inches, the Ultra 6208 costs 35 guineas.

Second of their new models is the 27 guinea half-track 6210 operating at 3½ ips. With accommodation for 5½-inch spools playing time is as for the 6208, rewind being achieved within two minutes.

Features include a 7 x 3½ inch loudspeaker handling the power output of three watts, pause control, piano-key controls, digital rev counter with zero reset, safety erase lock and combined tone control.

Measuring 14½ x 12½ x 7½ inches, the 6210, as the 6208, is supplied with microphone, reel of tape, spare spool and connecting lead.

British Radio Corporation Limited, 284 Southbury Road, Enfield, Middlesex.

INTRODUCTORY OFFER FOR TAPE BY NEW COMPANY

AN introductory offer of Mortone magnetic recording tape is being made by Studioproduktur of Sweden who announce their UK agent.

A seven-inch spool of acetate tape (1200 ft.) or a five-inch reel of Mylar (900 ft.) are being offered for 11 shillings each inclusive of postage and packing. Their pre-campaign offer also includes a guarantee ensuring cost and post refund if not satisfied.

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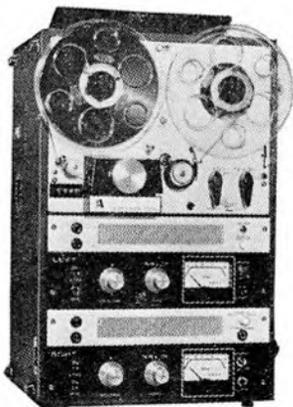


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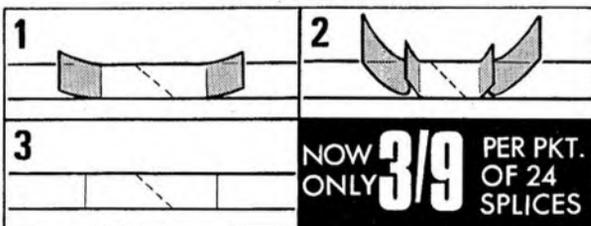
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TAPE EXCHANGES

BELOW are listed tape recorder owners wishing to contact others with similar interests to exchange news and views by tape. Details supplied in addition to name, age and address include special hobby or interest, speeds available, spool size, name of recorder and special areas to be contacted.

Owing to an increase in the number of names received for publication the regular form for details is being temporarily held out. Readers wishing to avail themselves of this free service will be advised when the list of names is nearly exhausted.

Currie, Richard (30). 36d, Lewis Trust, Warner Road, London, S.E.5. 78 rpm records (Formby discs), pop music. 3½ ips. 5½-inch spool. Ferguson 3210. UK only.

Curtis, G. (47). 45, Holyrood Avenue, South Harrow, Middlesex. Amateur radio, outdoor activities. 3½, 1½ ips. 5½-inch spool. Philips EL3548, four-track. UK, Commonwealth. Letters first please.

Davies, John (20). 7, Deanswood Green, Leeds 17, Yorkshire. Photography, art, travel, mod. jazz music. 3½, 1½ ips. 5-inch spool. Hitachi Belsona, four-track. Overseas only.

Dwyer, Matthew J. (40). 364, Cooksey Road, Small Heath, Birmingham 10, Warwickshire. Photography, classical and jazz music. 7½, 3½, 1½ ips. 7-inch spool. Philips EL3527, Elizabethan L229. Overseas only.

Elwin, K. John (24). c/o O.V.C., 180, Earls Court Road, London, S.W.5. Electronic music, organ work. 7½, 3½ ips. 7-inch spool. Home-built recorder.

Everard, Anthony Colin (25). 34, Wootton Road, Abingdon, Berkshire. Travel, pop music. 7½, 3½ ips. 8½-inch spool. Ferrograph 4A/N. Australia, Scandinavia, USA. "Lundy," Sand Road, Sand Bay, Weston-Super-Mare, Somerset. Short-wave radio, ships, lighthouses, popular classical music. 3½ ips. 5½-inch spool. Grundig TK18. Europe.

Fisher, D. J. (34). 5, Nelson Terrace, East Kilbride, Lanarkshire,

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Scotland. Tropical fish, classical music. 15, 7½, 3½, 1½ ips. 8½-inch spool. Brenell Mk 5, Series 2, USA. **Fisher, John** (36). 36, Langham Crescent, Coatbridge, Lanarkshire, Scotland. 3½, 1½ ips. 5½-inch spool. HMV 220B, four-track. New Zealand, Canada.

Flynn, William (48). 61, Garstang Road North, Wesham, Kirkham, Lancashire. 7½, 3½ ips. 7-inch spool. Telefunken recorder. USA, Canada.

Forrest, Neville John (22). Flat 47, Hunters Hill, Burghfield Common, near Reading, Berkshire. Electronics, photography, music. 7½, 3½, 1½ ips. 7-inch spool. Truvox PD86, stereo.

Gaiger, Colin (42). 17, Oakhurst Road, West Ewell, Surrey. Italian language. 7½, 3½ ips. 7-inch spool. Collaro Studio and BSR decks. Letters not required.

Gibson, Leonard John (30). 40, Minet Avenue, Harlesden, London, N.W.10. Sound effects, humour, rambling, chess, all music, not classical. 7½, 3½, 1½, 15/16 ips. 7-inch spool. Philips EL3541/15, EL3585 (battery portable) and EL3549, four-track. Any Island dwellers (Channel, Scilly, etc.). Letters not required.

Gloag, Ian (34). 3, Baffin Street, Dundee, Scotland. Do-it-yourself, travel, motoring, music. 7½, 3½, 1½ ips. 7-inch spool. Simon SP2, Collaro deck.

Gould, Douglas N. (32). 67, Queen's Crescent, Kentish Town, London, N.W.5. 8mm cine and 35mm photography, motor-cycling, round robin tapes, organ music. 3½ ips. 5½-inch spool. Elizabethan 200 and 400.

Grannum, Gerard (21). 109, Broughton Road, Edinburgh 7, Scotland. Photography, philately, people, all music. 3½ ips. 5½-inch spool. Fidelity Playmaster, four-track.

Green, John K. (38). 16, Knight's Hill, High Wycombe, Buckinghamshire. 7½, 3½ ips. 7-inch spool. Simon SP5, stereo and Q-Cord 203. Female contacts preferred. UK. Letters first please.

Harmer, Richard (30). 64, Middleton Hall Road, Kings Norton, Birmingham 30, Warwickshire. 8mm cine photography, most music. 7½, 3½, 1½ ips. 7-inch spool. Truvox, four-track. Male contacts only.

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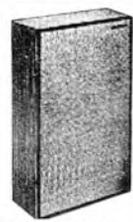
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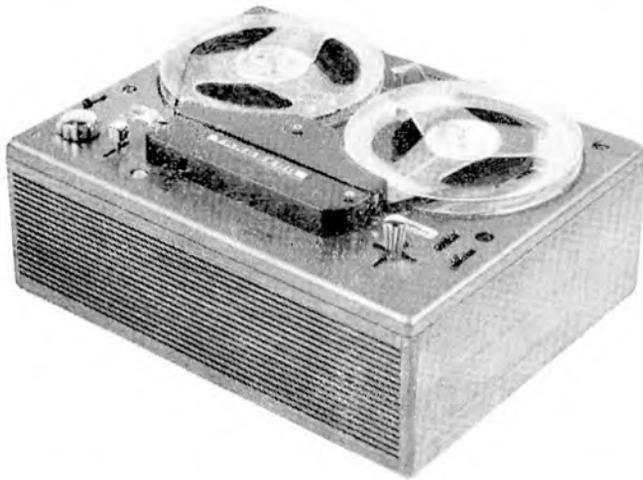
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Brand new, fully guaranteed, Premium Grade Magnetic Tape. Complete with the specially designed Grundig Plastic Tape Storage Cassette (Except 7" size which is in Manufacturers' Cardboard Boxes). Full leader and stop foil at both ends, and suitable or use with all makes of tape-recorder.

DON'T MISS THIS RARE OPPORTUNITY. SEND NOW!

TYPE	DESCRIPTION	LIST PRICE	ONE	THREE	SIX
GL18	1800' L/P 7" reel	50/-	29/6	86/-	165/-
GL15	1200' L/P 5½" reel	35/-	22/6	65/-	125/-
GS15	900' S/P 5½" reel	28/-	17/-	49/-	93/-

Post and Packing 1/6d. for single reels. OTHERWISE POST FREE!

ILFORD TAPE NEAR HALF PRICE

A bulk purchase of premium grade, top quality POLYESTER MAGNETIC TAPE from one of the world's foremost experts in film coating technology. With FULL LEADER stop foil, Polythene wrapping, and in original manufacturer's boxes. Available in long-play base only at these BARGAIN PRICES!

	ONE	THREE	SIX
900' on 5" reel. List price 28/-	16/6	48/-	90/-
1800' on 7" reel. List price 50/-	28/6	84/-	160/-

Please add 1/6 p. & p. for single reels. Otherwise POST FREE!

TRIPLE PLAY TAPE—HALF PRICE!

A large purchase from a famous world renowned manufacturer enables us to make this unique half-price offer. Brand new, fully guaranteed, premium grade Polyester Base Tape with FULL LEADER and stop foil. In original maker's boxes and polythene wrapped at these EXCEPTIONALLY LOW PRICES!

	LIST PRICE	ONE	THREE	SIX
450' on 3" reel	22/-	12/-	35/-	66/-
600' on 3½" reel	27/6	14/6	42/6	82/6
900' on 4" reel	39/-	20/6	60/-	117/-
1800' on 5" reel	66/-	34/-	101/-	198/-
2400' on 5½" reel	90/-	46/-	137/-	270/-

Post and Packing 1/6. ORDERS OVER £3 POST FREE

SCOTCH MAGNETIC TAPE AT NEARLY HALF-PRICE!

Over 3,000 REELS of top quality MAGNETIC TAPE, double coated, SCOTCH made to the best possible specification and intended for the electronic industry. This type of tape is rarely, if ever, offered for domestic consumption and is unobtainable elsewhere.

THIS UNREPEATABLE OFFER REMAINS OPEN ONLY WHILE STOCKS LAST! DON'T DELAY—SEND NOW!

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Don't forget our other ACCESSORY BARGAINS!

Tape Head Demagnetiser, essential for any enthusiast! Ready for immediate use. Fully guaranteed. Worth 50/- Only 27/6 P. & P. 1/6
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International Polyester Tape 2,400' 7" reel (boxed) Only 25/- P. & P. 1/6
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Finest quality American made Tape—at lowest ever prices! Fully g'reed			
3 in. Message tape, 150 ft.	3/6	5½ in. Long play, 1,200 ft. Acetate	12/6
3 in. Message tape, 225 ft.	4/11	7 in. Standard play, 1,200 ft. Mylar	12/6
3 in. Message tape, 300 ft.	7/6	7 in. Long play, 1,800 ft. Mylar...	19/6
3½ in. Triple play, 600 ft. Mylar...	15/-	7 in. Double play, 2,400 ft. Mylar	25/-
5 in. Double Play, 1,200 ft. Mylar	15/-	7 in. Long play, 1,800 ft. Acetate	15/-
5 in. Long play, 900 ft. Acetate...	10/-	7 in. Triple play, 3,600 ft. Mylar...	58/6
5 in. Standard play, 600 ft. PVC...	8/6	Post 1/- per reel—4 reels & over Post Free	
5 in. Triple play, 1,800 ft. Mylar...	35/-	Clear Plastic Spools (empty): 3" 1/6,	
5½ in. Double play, 1,800 ft. Mylar	22/6	4" 2/-, 5" 2/-, 5½" 2/3, 7" 2/6. Post 6d.	

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THE ULTIMATE IN TAPE VALUE! British made to full specification. Leaders-Trailers and Stop Foils on all types 5" and above. Strong, attractive hinge-lid boxes.

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4"	300'	3/9	4"	450'	5/-	4"	600'	8/3	4"	900'	12/6
5"	600'	8/3	5"	900'	9/9	5"	1200'	15/3	5"	1800'	22/6
5½"	900'	10/-	5½"	1200'	12/3	5½"	1800'	19/3	5½"	2400'	28/6
7"	1200'	12/3	7"	1800'	17/3	7"	2400'	21/9	7"	3600'	38/6

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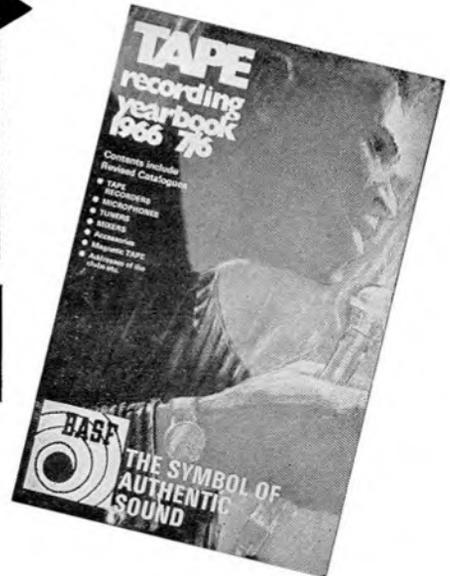
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The Elizabethan LZ32, a brilliant three speed, twin track recorder. Combines consummate reliability and accuracy with the unerring attention to detail for which Elizabethan are so famous. Wonderful value at 32 gns. . . indeed the LZ32 is hailed as producing sound equal to some tape recorders costing three times as much.

Just check these exciting features :

Light-weight (24 lbs) with rugged construction

A special 10" elliptical speaker for superb tonal quality

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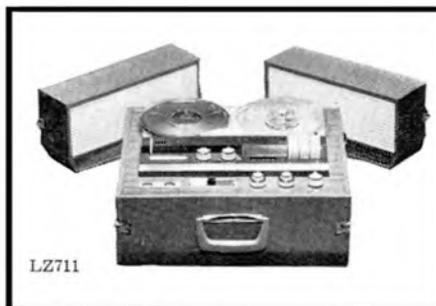
And if you want four tracks there's the LZ34, available at 34 gns.

Of course, there's no limit to the versatility of the Elizabethan range. For the avid enthusiast who can afford to pay a little more there's the LZ102, a fully transistorised 4-track 3-speed mains operated recorder, at 49 gns. Or the magnificent LZ711, a complete stereophonic tape recording system with facilities for sound on sound and sound with sound, at 75 gns. *Prices quoted are recommended.*

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LZ102



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TC250A Tape deck completes your system

FEATURES ■ Long life, solid state, all transistor circuit ■ Single lever control for all tape functions ■ Smooth and wide frequency response ■ Automatic end of tape switch, tape index counter ■ 57 Gns.

SPECIFICATIONS:

Power requirement	100, 110, 117, 125, 220 or 240 V, 40 watts, 50/60 cps.	Input	Low impedance microphone inputs – Transistorised (will accommodate any Microphone from 250 ohm–1 K ohm impedance)
Tape speed	Instantaneous selection, 7½ and 3¾ ips. (19 and 9.5 cm/s).		Sensitivity – 72 db (0.2 mv)
Frequency response	30–18,000 cps at 7½ ips. ± 3 db 50–15,000 cps at 7½ ips. 30–13,000 cps at 3¾ ips.		High impedance auxiliary inputs Sensitivity – 12 db (0.2 v)
Signal-to-noise ratio	Better than 50 db	Output	Low impedance line outputs
Flutter and wow	Less than 0.19% at 19 cm/s Less than 0.25% at 9.5 cm/s		Auxiliary Record/Playback connector 2SD64 (x6), 2SB382 (x2), 2SB383 (x2)
Harmonic distortion	1% at 0 db line output.	Transistors	Approx. 16.9 lbs.
Erase head	In-line (stacked) quarter track, EF17–2902H	Weight	Dimensions
Record/Playback head	In-line (stacked) quarter track, PP30–420	Dimensions	14.2 (W) x 6.3 (H) x 11.4 in (D) (360 x 158 x 287 mm)
Bias frequency	Approx. 55Kc	Accessories	Connecting leads. Head cleaning ribbon. 60 c/s pinch wheel capstan
Level indication	Two VU meters (calibrated to 0 VU at 12 db below saturation of tape)		

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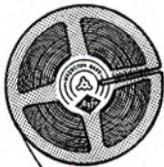
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Gevaert tapes add a thrilling new depth and richness to stereo . . . make listening more of a joy than ever. Let Agfa-Gevaert bring the full excitement of stereo home to you.

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