

TAPE

RECORDING MAGAZINE

MARCH 1965



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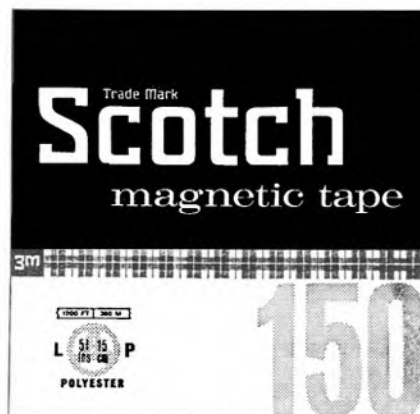
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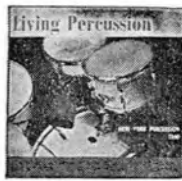




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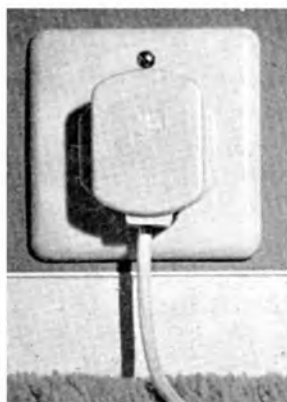
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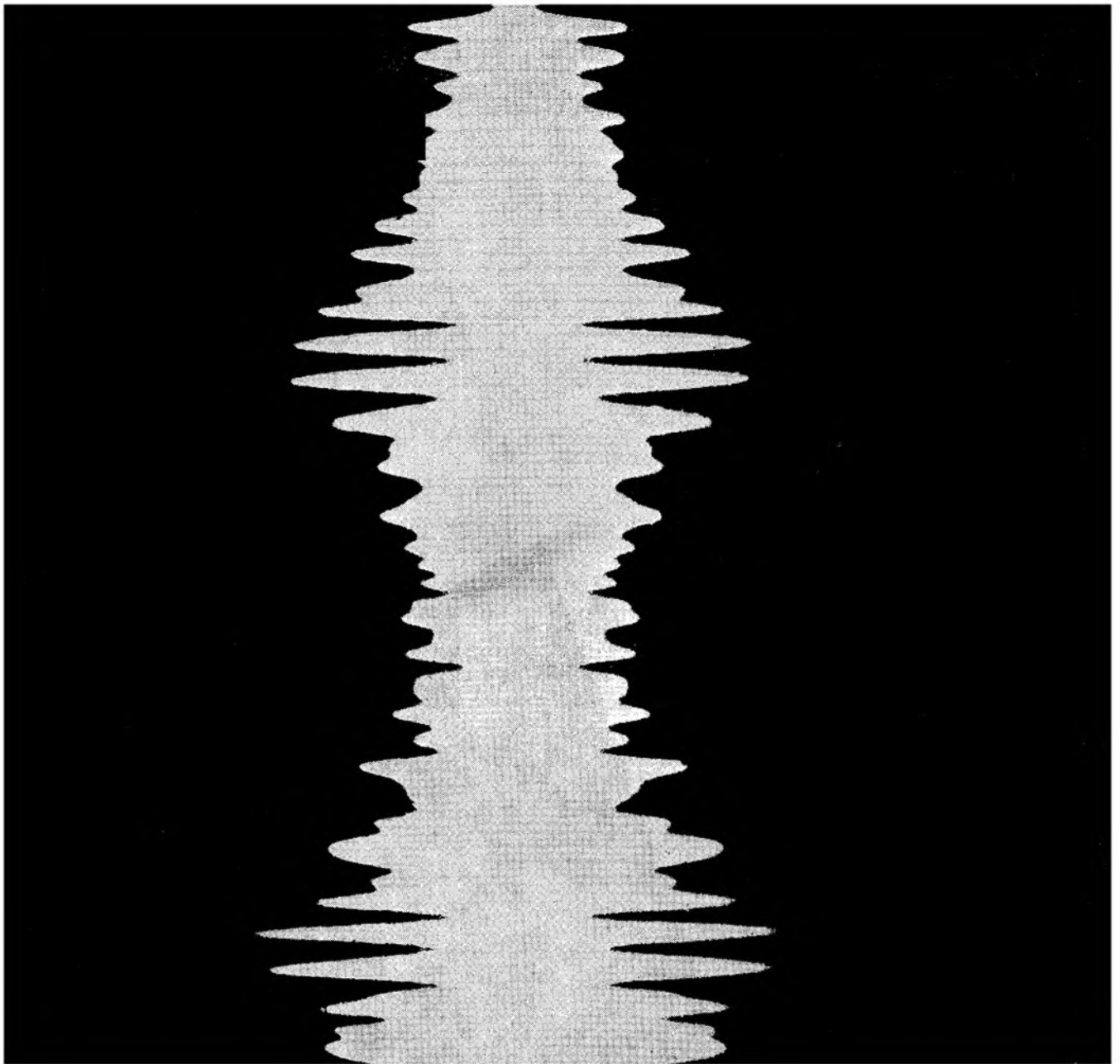
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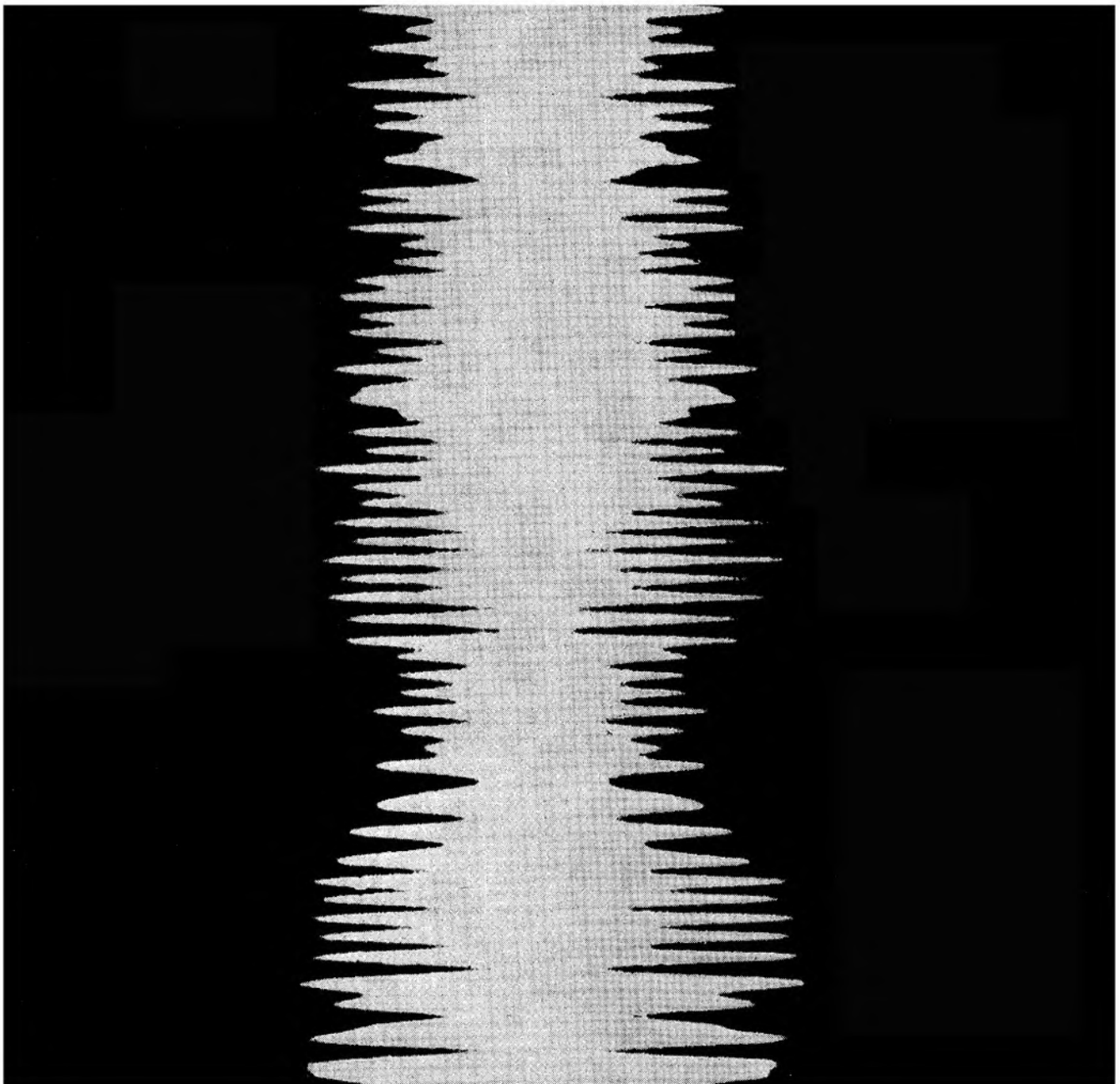
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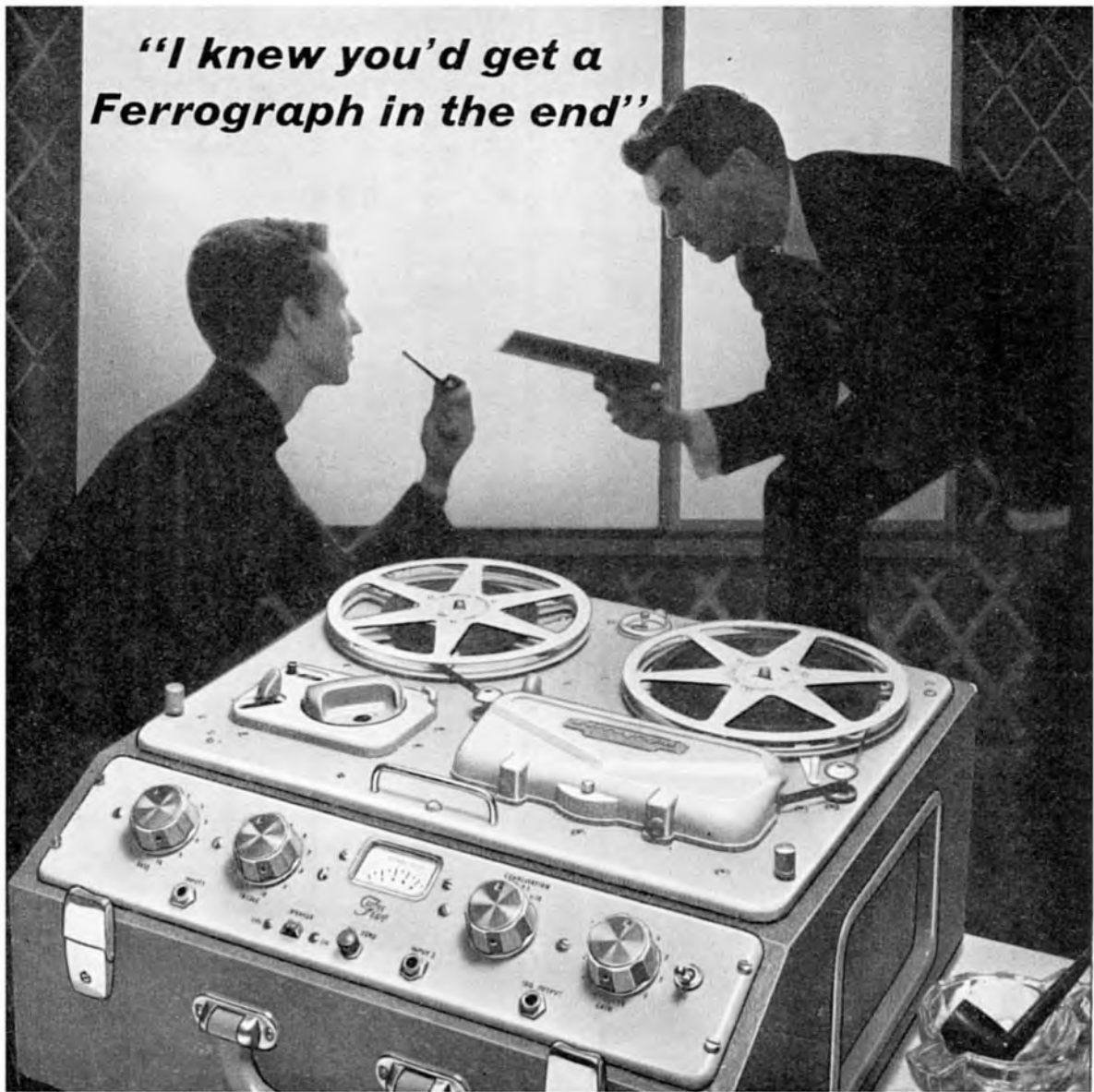
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COVER PHOTOGRAPH: John Cordeaux, Head of Sound Broadcasting in Thomson Television (International) Ltd. uses his Uher 4000 Report stereo battery model to record an interview with an "officer-in-charge-of-camels" in the South Arabian Desert. See also "Tape in his Knapsack" on page 105.

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Back numbers, if still in print, are available at 2s. 6d. per copy.

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EDITORIAL

FLEet Street 1455

Editor,
R. DOUGLAS BROWN

ADVERTISING

LUDgate 9088

Assistant Editor,
FRED CHANDLER

Tape trends and tape talk

By the Editor

THE VALUE OF TAPE recording in education now seems to be beyond reasonable challenge and most education authorities have now accepted that schools should be able to requisition for recorders as essential equipment.

Evidence of the importance now attached to a proper understanding of these new teaching aids comes in the form of a course and an exhibition which has just taken place in West Suffolk. The county's Education Committee closed every school in its area to make certain that all teachers should attend. The National Committee for Audio-Visual Aids in Education and the National Union of Teachers helped in the organisation and about 600 teachers were present.

The response to the invitation to the recording industry to participate in the exhibition was very impressive. The course and the exhibition covered visual as well as audio aids, of course; but tape has now found its appropriate place in the scheme of things.

It is impossible to over-estimate the value of getting children accustomed to tape recording activity while they are still at school.

THE ARRANGEMENTS FOR the holding of the Congress of the International Federation of Sound Hunters and of the judging of the International Recording Contest in London next October are going forward very well, I understand.

There are encouraging signs of BBC interest in the events and good reason to hope that CIMES 1965 will indeed be a milestone in the progress of amateur tape recording in Britain.

With a government department charged with special responsibility for encouraging the constructive use of leisure, the International may even hope for the sort of official government encouragement that it has been given in some other countries, notably France.

Talking of CIMES, Ray King, who walked off with the Grand Prix in last year's Contest for his "Sink Symphony" tape, tells me that he has now heard that his

prize trip to the United States will embrace the whole country from New York to San Francisco. He hopes for special opportunities to meet tape enthusiasts on the other side of the Atlantic. You'll be hearing about it from him when he gets back.

Full information about the British Tape Recording Contest 1965 was issued to the press at a recent gathering in London. The Contest has now blossomed into an all-industry exercise and the unique relationship which this magazine has had with it, as its originator and organiser for many years, has ended. The committee now hopes that the Contest will have the active support and stimulus of every publication which claims to serve the tape industry.

We shall continue to regard the Contest as the most important event promoting amateur tape activity in this country and it will be given the space and attention which this merits. In this issue we publish, as in previous years, the full rules and entry forms.

Next month we shall offer advice to competitors on the sort of points the judges look for when they come to select the winning tapes.

Recently I was invited to join the jury which picked the winners of a "Sound and Vision" contest organised by the 3M Company, the manufacturers of Scotch tape. In this contest, entrants were not called upon to do anything as difficult as produce a feature tape. But they did have to produce evidence that they had purchased a reel of tape.

The fact that there were 3,600 entries, therefore, was an encouraging indicator of the way in which amateurs are now buying tape.

It may be ambitious to hope for an entry in the British Tape Recording Contest on that scale (the judging of so many tapes would present a really formidable problem!), but we do hope for and expect a much bigger entry in the BTRC this year than ever before.

Tape recording clubs should make a point now of approaching their local retailers to make certain that they are displaying a poster advertising the Contest and that they have entry forms available. If not, let us know.

And every tape recording club should aim to enter a tape *as a club*, as well as at least one dozen tapes from individual members. The rules have been adjusted this year to make it easier to enter and the creation of a special novices class means that *anyone* can feel he (or she) has a fair chance.

WITH ALL THIS TALK about the need to hold down prices, I wonder what will be the effect of a legal judgment recently which frees British manufacturers from the obligation to pay patent royalties on transistors to America.

It seems that British makers and users of transistors have been paying about £1,500,000 a year in royalties to an American firm for the past 16 years. These royalties are stated to have added between 2½ and 5 per cent to the invoice price of many items of equipment which have incorporated them.

A writer in the *Daily Telegraph* hopefully greeted the court decision with a forecast that "widespread cuts in prices of radios, television sets, tape recorders and other equipment" would result. I wonder. In fact, of course, transistors have not yet been widely adopted in British-made recorder design.

It is, however, reasonable to expect increasing use of transistors in recorders and associated equipment. The judgment, therefore, should help to offset what seems the normal tendency for production costs to rise.

LAUGH WITH JEEVES



"This 1800 ft. reel of tape you sold me; it only measures 1723 feet 4½ inches."



PETER L. BASTIN who won the Philips Shield* for the best entry in the Documentary and Reportage section of the 1964 British Amateur Tape Recording Contest describes the preparation and production of his successful tape "The Devil Undone"



Imagination and patience are required for a feature tape

THE big problem was what to do. A gripping, cliff-hanger story, a bit of folksy stuff about charwomen, a documentary about turret-lathe operators, or four minutes of the lesser swallow-tailed swallow? No, all these had been done before, in countless different and indifferent ways. A friend suggested I stick to the dramatised documentary, with which I had had some success in the past. This meant a hefty search to find a suitable subject, and it proved to be the most difficult part of the whole thing.

It took me from Christmas until about March to hit upon the right material, discarding in passing some half-dozen different stories, legends, folk tales and so on. Even so, the legend which I eventually settled upon needed some careful scripting and re-writing to lend itself to dramatisation.

Fortunately a basic script emerged fairly rapidly. Douglas Brown, in a broadcast last year, confirmed the approach to a documentary which I have always considered to be the right one: simple, direct, with a punch in the right place. So the working script began to take shape, and I went into close co-operation with myself to work out the best means of putting the thing over.

The story opened at the present time and developed as a sort of "flashback." The idea was for a car to draw up at an old country pub, for me to get out and launch into the story. So one day, while out in the country, I found a layby where there was an enormous tip of ashes. I stuck the microphone of my Philips battery portable in the grit, switched on, shot off in the car, came back got out and recorded the opening words of the script. Only the latter half of the recording was used, of course.

I then needed footsteps on gravel and the opening of an old wooden door. Footsteps on paving slabs and the clattering of our coal-store door had to do. All this was carefully sorted out, dubbed on to one of my Ferrographs and put on ice until it was needed for integration in the master recording.

Some time in May I started on the recording. I recorded the opening sequence followed by the "narrative" track—the basic story of a cobbler who said he would sell his soul to the devil for a pot of gold, then turned the tables on the devil 1½ minutes from the end of the tape. This narrative track had gaps in it for other voices, effects and so on, and sounded quite silly when played back.

The next job was to record a second track with the voices of the devil and the cobbler on it. This was to be one of those split-second timing jobs and caused a good deal of paint to blister in my studio. The cobbler had a simple and indeterminate West Country accent, but it was some time before I evolved the right kind of voice for the devil.

I felt that this unsavoury character should have not only an unsavoury voice but something in it or about it that was sinister and comical at the same time. I tried everything I could think of, from cardboard tubes to double and half speed recordings. At last it came. I connected my microphone into an electric guitar amplifier of dubious fidelity, turned the tremolo half way up and there was the quavery old devil, large as life!

Now I sat back and reviewed the situation. I had the opening sequence and the narrative on tape. What I now had to do was to insert the cobbler's voice and the devil's voice into the spaces in the master tape. Not only that, I had to clip or expand their dialogue to fit the times in the spaces. I managed to do this with some cursing and recorded them with ten seconds between each. It was then comparatively simple to cue them into the master tape. I think I should say at this point, at the risk of promoting some argument, that I never edit my tapes by cutting: I don't believe that

* We would like to offer our apologies for incorrectly stating last month that Richard A. Margoschis was awarded the Philips Shield for his Contest tape "The Songster's Fantasia." In fact he was awarded the Kodak Shield presented by Kodak Ltd.

it is really necessary to cut tape when you have two or three machines at your disposal. It costs money, anyway!

I played the master tape over innumerable times but, despite the fact that I had recorded at 7½ ips on two Ferrographs, I was beginning to get a little worried about possible future loss of quality. Whatever anyone may say, there is a distinct dip in the quality of a recording after even the first dubbing, and here I'd dubbed over from one Ferrograph to the other more than once. As I saw it, I still had two more dubbings to do—the assorted background noises and a "linking track" which I had decided should be music of some sort.

I felt it was impossible to do a multi-track of both effect noises and the linking music, so I put on the effects first. A bar-room background of voices and clinking glasses was on an old tape loop, multi-recorded with my own sweet voice to produce an unintelligible babble. Horses' hooves were easy enough—a mouth "clocking" noise.

So I came to what I considered to be one of the most important tracks of the tape—the musical link, the means of "punctuation" and emphasis, the mood-setter and similar Hollywood expressions. I used an electric guitar, hooked directly into the receiving Ferrograph. Unfortunately I did not have my reverberation unit at the time, which may have been a pity—I don't know. I had umpteen musical dry runs, using chords, glissandos and what I imagined to be haunting melodies behind the narrative. Not being a very good musician, I made up the music as I went along, discarding quite considerably over the numerous dry runs. Eventually I was ready, and taking hold of the guitar in a murderous grip, I switched on. Fine.

I had left the music track until the last for two reasons. Firstly because it is impossible to gauge the mood of music required until the master tape is completed, and secondly because there would be very little deterioration of the quality due to dubbing. Speech can be dubbed several times without noticeable effect, but music can be ruined after two or three dubbings.

The tape was now complete but I had forgotten one thing. The original timing had been mucked about and I was not at all sure that I was still within limits. But I was, by 15 seconds! So there it was. One masterpiece completed. I was not too happy about the sound quality in parts, due to a good deal of dubbing, which is another point, I suppose, to the splicing enthusiast. On the other hand, you tend to listen to your own tapes with considerably more critical attention than another listener. I played the tape back some weeks later and the quality sounded perfectly adequate so I packed it up and sent it off.

It is said that you learn something every day and so you do. I know that you learn something every time you make a feature tape, something which helps you to make a better one next time. For example, I have learned that the essence of a good tape is a simple story, put over in such a way that the audience's attention is captured from the very beginning. A note of mystery in the opening statement makes people listen and say "Now what's all this going to be about?"

Music is also very important but not always necessary. A clock ticking or a roar of traffic may be just as effective, but the purpose is the same. Good tapes can be made with care, technical know-how and above all, imagination, and a great deal of enthusiasm and patience.

THE BRITISH TAPE RECORDING CONTEST

1965

The 1965 British Tape Recording Contest is organised in three sections: for Novices who have never entered a Contest before and who have less than a year's experience of the hobby; for Amateurs, with more experience but for whom tape recording is only a hobby; and, for the first time this year, for professionals—those who are, or have been, employed in professional studios.

Thus, for the first time, it gives the opportunity for enthusiasts at every level to compete on a basis which gives everyone a fair chance. The award-winning tapes will represent the best in tape recording activity in Britain at every level.

While the scope of the Contest has thus been broadened, in other ways its rules have been greatly simplified in order to make it easy to enter.

Once you have decided your status, i.e., novice, amateur or professional, your entry will automatically be submitted in the appropriate section of the Contest. It may be of any kind and on any subject; there are no limitations of any kind on content or technique. The only condition you must be careful to fulfil is the time limit.

Tapes sent by Novices must not exceed four minutes' duration. The limit for Amateurs is ten minutes, and for Professionals it is fifteen minutes.

The rules are printed in full on the opposite page.

Entries may be submitted by schools, clubs or other groups, as well as by individuals.

The best tape in each of the three sections will win a £25 cash prize and a Silver Trophy. And the best of the three section winners will be chosen as "Tape of the Year" and, as such, will be awarded an additional £50 cash and a special Silver Trophy.

Entrants in any of the three classes will have a fair chance of winning the top prize. All tapes submitted will be judged by a panel of distinguished tape recording experts. As well as hearing the tapes, they will study the entry forms and will make appropriate allowance for the capabilities of the equipment used, so that no one is handicapped by modest resources.

The entrant who demonstrates exceptional skill or ingenuity with a cheap recorder will stand a better chance than the professional with the most expensive equipment if he produces an unimaginative or pedestrian recording.

This is essentially a *Recording* contest and the prime aim of competitors should be to produce the best recordings they and their machines can give.

Three months to make your tape

The closing date for entries is Monday, 31st May, 1965. (Please note, this date is earlier than in previous years.)

All tapes, together with completed entry forms, must be submitted to reach British Tape Recording Contest, 7, Tudor Street, London, E.C.4, by that date. Stamps to cover return postage must be included.

JUDGING: Judging will take place in June. Names of Judges and other information about the Contest will be published as available.

ENTRY FORMS: You will find an entry form opposite. Further entry forms may be obtained from your local dealer or the secretary of your tape recording club.

COPYRIGHT CAUTION: Tapes must be original recordings. They must NOT contain any material from radio programmes or commercial recordings. If any copyright material is used (for example, if you play or sing a 'pop' song) full authorisation for its use must be submitted with the tape. For advice on copyright, you can consult the Mechanical Copyright Protection Society Ltd. at Elgar House, 380 Streatham High Road, London, S.W.16.

THE PRIZES

The Prize List for the 1965 British Tape Recording Contest includes:—

£50 and a **SILVER TROPHY** for "The Tape of the Year."

£25 and a **SILVER TROPHY** for the best tape entered by a **Novice** with less than one year's experience of recording.

£25 and a **SILVER TROPHY** for the best tape entered by an **Amateur** with more experience.

£25 and a **SILVER TROPHY** for the best professional recording.

In addition, there will be many other handsome silver trophies for outstanding entries.

The best Amateur British tapes will be considered for entry in the International Recording Contest, in which they may win further valuable prizes.

Winners will be brought to London for a special celebration party at which they will receive their awards and have the opportunity to meet the Contest judges and organisers.

SPONSORS: The British Tape Recording Contest is sponsored by an Organising Committee representing the leading firms marketing magnetic tape in this country: Agfa, BASF, Emitape, Kodak, Mastertape, Scotch, Philips and Ilford-Zonatape.

INTERNATIONAL CONTEST (CIMES) 1965: Since its inception in 1957, the British Contest has been linked with the International Recording Contest (CIMES), and this link will continue. The best entries in the British Contest will be eligible for consideration when a choice of six British entries for the International Contest comes to be made. This choice, and the submission of the tapes to the International event, is the responsibility of the Federation of British Tape Recording Clubs, which is represented on the Organising Committee of the British Contest. The International Contest rules vary from those of the British Contest, mainly in that entries must be made in one of half a dozen different classes. Those who are interested in having their entries considered for both British and International events should study the fuller explanation opposite.

ENTRY FORM

British Tape Recording Contest 1965

Name and Address (in block letters).....

.....

Age..... Occupation.....

How long have you been doing amateur recording?.....

Special interests.....

Data on the attached recording:—

1. Title—if there is one.....

2. Exact duration.....

3. Category in which you wish it to be entered (Novices, Amateurs or Professionals).....

4. Make of recorder used.....

5. Recorded at a speed of..... inches per second

6. Make of magnetic tape used.....

7. Any other equipment used (i.e., microphone, mixer unit, tape splicer, etc.). Give details and manufacturers.....

8. When and where was the recording made.....

9. Titles of works used. Names of authors or composers, duration, etc.....

10. Names of any assistants and how they helped in making the recording.....

DECLARATION (*cross out whichever is inapplicable*)

*I declare that the enclosed tape is entirely my own work, and that I have not included on the tape any copyright material from radio, commercial recording, or any other source.

*I declare that I hold documentary authorisation to use any copyright material included on the enclosed tape.

Signed.....

BRITISH TAPE RECORDING CONTEST 1965 RULES

1. Classes of entrants will be as follows:—

Novices.—Those who have owned tape recorders for under one year and have never entered a tape recording contest before. Maximum playing time for entries: four minutes.

Amateurs.—Those who have owned tape recorders for more than one year but for whom tape recording is only a hobby. Maximum playing time for entries: ten minutes.

Professionals.—Open to those who are or have been employed as professional sound recordists. Maximum playing time for entries: fifteen minutes.

2. If recordings are of singers, players, actors, etc., the quality of their performance in these roles will not affect judgment of tapes.

3. No tapes submitted may contain anything taken from radio or TV transmissions or commercial recordings. Any competitor who has fully or in part used any literary or musical production of which he is not the author or composer and which is still in copyright, must obtain authorisation from the author, composer or organisation owning or controlling the copyright and must produce proof of such authorisation. This proof must be submitted with this form and must state expressly that the author, composer or the organisation owning or controlling the copyright forgo any payment by the broadcasting organisations which transmit the recording. (This does not imply that, in the countries where they apply, the normal rights of payment arranged by the organisations owning or controlling the copyright are relinquished.)

4. Tapes must not include any matter other than that which forms the entry. The programme must commence at the beginning of the tape and only one track may be used (when judging, there will be no reversal of spools to hear second tracks). Tape should be prepared between white or coloured "leader" tapes.

5. Recordings must be made on $\frac{1}{2}$ -inch tape at either 15, $7\frac{1}{2}$, $3\frac{3}{4}$ or $1\frac{3}{4}$ inches per second. Stereo recordings may be entered.

6. The British entries in the International Recording Contest (CIMES) will be selected from among the winning tapes in the British Tape Recording Contest. The rules of the two Contests, however, vary in some important respects and if you wish your entry to be considered for both British and International Contests you should write for a copy of the International Rules to 7, Tudor Street, London, E.C.4.

7. All tapes will be returned to competitors, provided adequate return postage is sent with entries. But the Contest organisers will retain copies of the winning tape and of the runners-up tapes. Copyright of these will be the property of their owners, but the Contest organisers reserve the right to arrange for the publication of the whole, or parts, of any or all of them, by radio, disc or tape, or by any other means.

8. The Contest is open only to residents in the U.K. The decision of the judges will be final and no appeal may be made, nor correspondence entered into.

9. The closing date for receipt of tapes will be Monday, 31st May, 1965. No entries received after that date can be considered in any circumstances. The winners and the runners-up will be notified immediately judging is completed and a complete list of awards will be circulated to all entrants.

10. Every tape entered must be adequately packed and properly stamped and must be addressed to the British Tape Recording Contest, 7, Tudor Street, London, E.C.4. An entry form, fully completed, and return postage, must be included with the tape. Name and address should also be written on a small label firmly affixed to the tape spool and to the containers, and the title of the entry written on the leader tape.

INTERNATIONAL RECORDING CONTEST (CIMES) 1965 SUPPLEMENTARY RULES

1. The International Contest is open only to *bona fide* amateur recordists and the production of tapes submitted must be entirely the work of entrants both as regards recording and editing.

2. The International Contest is open to entries in six sections, as follows:—

A. Compositions (radio plays, drama, sketches, etc.). Entries must not exceed 15 minutes' duration.

B. Documentaries and Reportage. Entries must not exceed 10 minutes' duration.

C. Music or Speech (solo singer or player, orchestras, choruses, poems, etc.). Entries must not exceed four minutes' duration.

D. Actuality ("snapshots" of unusual sounds or historic moments). Entries must not exceed four minutes' duration.

E. Technical Experiment (electronic music, trick effects, etc.). Entries must not exceed four minutes' duration.

F. Schools (feature tapes on any subject and of any type). Entries must not exceed fifteen minutes' duration.

(NOTE.—Any tapes produced by amateurs to comply with the conditions of the International Contest in classes B, C, D and E would automatically comply with the rules of the British Tape Recording Contest 1965. But tapes intended to be eligible for classes A and F of the International Contest would have to be limited to a maximum duration of ten minutes if they were also to be entered in the Amateur section of the British Tape Recording Contest 1965.)

I should like my tape to be considered for the International Recording Contest (CIMES) as an entry in the section.

I declare that I have no professional status as a sound recordist.

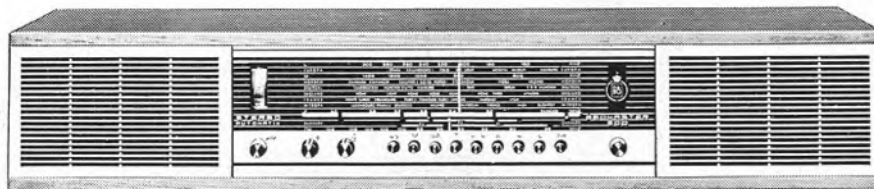
Signed

...when Quality is the First Consideration

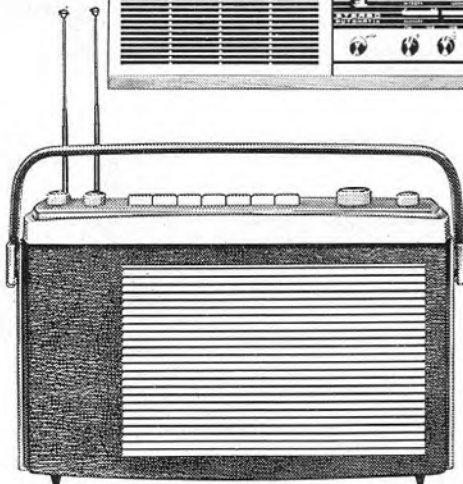
E. Rorbaek Madsen
World famous authority and chief of
B & O's Electro-acoustic Laboratory
and Sound-film Division.



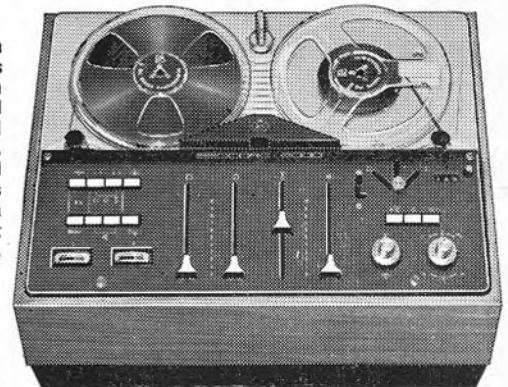
Bang & Olufsen—a brilliant combination of advanced Danish Radio Engineering and modern Scandinavian design



◀ **Master 900 K**, all-transistor mains-operated stereo radio. This set was awarded a prize at the 1964 Hanover Fair and introduces a new concept in radio styling. L.W., M.W., Marine, F.M. wave bands. Power output 2 x 6 watts. Dimensions 5.7" high, 29.3" long, 8.8" deep. 59½ gns.

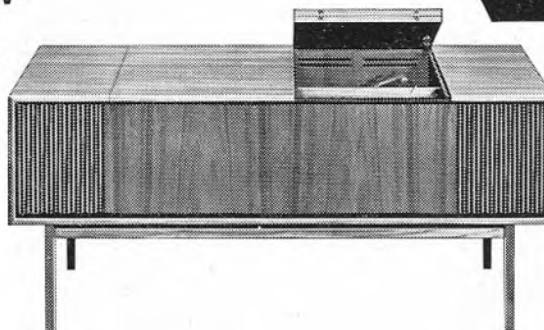


◀ **The Beolit 611 De Luxe**, a superb high fidelity portable radio, 4 wave bands L.W., M.W., S.W., and F.M. Push-button operation. "Floating Touch" duplex dial drive. Automatic frequency control circuit on FM. Large high-quality speaker. Unsurpassed sensitivity, reliability, and battery economy. Built in radiator gives positive tuning. Excellently suited as a car radio (lockable car mounting bracket available as an extra accessory). 34 gns.



▲ **Beocord 2000 K**, prize-winner at the 1964 Hanover Fair, a supreme example of B & O audio engineering. The first all-transistor hi-fi stereo tape recorder with a professional specification which has been acclaimed in international trade and tape-amateur circles for its carefully planned design, advanced features, and outstanding performance. The BEOCORD 2000 K is the ideal tape recorder for the enthusiast whose only interest is perfection. Available in a 2-track and a 4-track version. 112 gns.

▶ **Beomaster 900 RG De Luxe**, the first fully transistorised stereophonic radiogram from Bang & Olufsen. The Beomaster 900 RG de Luxe offers a new concept in stereophonic sound reproduction. Housed in an elegant low modern console are two superb instruments: the new all-transistor Beomaster 900 stereo radio and the internationally acclaimed B & O stereo record player with the sensational B & O pick-up. Built-in B & O pressure-chamber speakers provide rich tonal beauty. Space is provided for installation of tape recorder. There is also storage space for records and tapes. 159 gns.



Bang and Olufsen products are available only at authorised quality dealers

BANG & OLUFSEN U.K. SALES DIVISION

EASTBROOK ROAD, EASTERN AVENUE, GLOUCESTER. Tel GLOS 25634. Telex 43/215. Grams DEBELEC Gloucester

Northern Ireland Distributors: Messrs. Solomon & Peres Limited, Belfast 1.

Distributor for Scotland: Bryterlite Electrical Co. (Glasgow) Limited, Glasgow, C.2.



TAPE AND CINE.

The fourth article in our new series giving advice on the exciting possibilities when tape is linked with cine photography. This month our expert describes the use of perforated tape to maintain exact synchronisation of sound and picture.

Perforated tape is best for exact sync.

By PETER RYDE

FOR most straightforward film sound tracks, you will find normal quarter-inch wide recording tape quite adequate, at any rate to begin with. But as soon as you progress to more complicated tracks which are of greater technical intricacy, you will find it easier to work with perforated tape. This is more costly, but it gives you completely reliable synchronisation, which plain tape does not, and it also makes it a great deal easier to do all kinds of special jobs such as cutting to music.

The reason why you need perforated tape to ensure 100 per cent accurate synchronisation is quite simple. With plain tape, the drive can only be by friction, and you cannot rule out the possibility that the tape will slip between the capstan and the pinch roller. This does not matter in the recorder, but it matters very much at the synchroniser. For 100 per cent lip-sync., the synchronisation of speech with lip movements, or of spot sound effects with their screen cues, requires the sound and picture to be synchronised accurately to within about a twentieth of

in time. With plain tape, this stretching would cause the sound to get progressively further and further behind the picture as a cumulative error developed during the film.

For use with perforated tape, the normal synchroniser capstan is replaced by a sprocket wheel whose teeth engage with the holes. It is thus impossible for the tape to slip in the synchroniser. Perforated tape is unlikely to stretch, because it has to be made from standard play base—with thinner bases the perforations would tear. But if it does stretch, no sync. error results, because the engagement of the teeth in the holes provides a positive registration, and no cumulative error can arise. It would be virtually impossible for the tape to stretch enough to prevent the synchroniser sprocket engaging with the perforations.

Several kinds of perfo-tape are available. All are quarter-inch wide, but the pitch and size of the perforations varies from type to type to suit different purposes and equipment.

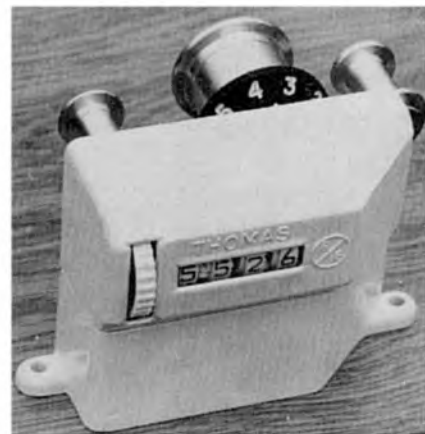
For amateur work, the most convenient type is Cinetape A. This has 16 perforations per $3\frac{1}{4}$ inches of tape, so that with the film running at 16 fps, and the tape at $3\frac{1}{4}$ ips, 16 frames of film and 16 "frames" of tape are used per second. Thus although the linear measurements of the tape and film are quite different (16 frames of 8 mm = 2.4 inches) it is easy to establish a 1:1 relationship between them, since an equal number of frames of each are used in a given time. For example, if you want a length of tape which will run for exactly as long as a particular shot in the film, you simply count the number of frames in the shot and cut a length of tape with the same number of frames. Or again, if you find that a particular screen cue begins at, say, the 94th frame of a shot, the sound for it must start on the 94th frame of the corresponding tape.

Since this 1:1 relationship is the basis of most of the special effects you will want to try, you need to equip yourself with some device for counting the frames of tape and film. The counter illustrated is for 16 mm film, but versions are available for 8 mm or for perforated tape. Ideally, one needs a counter each for the film and the tape, but at £5 a time, this is costly. A compromise is to have one counter with both tape and film sprockets on the same shaft. Alternatively, one can prepare table-edge scales against which lengths of tape and film can be measured by hand. These are adequate where only short lengths are involved.

To make a film scale, you need a piece of white lead or scrap film; this can be marked with blooming ink or a chinagraph

pencil, and taped to the table edge. There is no need to number every frame—alternate frames, or even every fifth one will be adequate. A tape scale can be made from a length of perfo-tape in the same way, but as it is very flimsy, it pays to stick it to a piece of stout card first.

Apart from the fact that the perforations reduce the area available for use, there is no difference between plain and perforated tape from the recording point of view. No modifications of any kind whatever are needed to the recorder, and you simply proceed as usual, except that you cannot use all the tracks. With Cinetape A, the perforations occupy the space of one-quarter track: according to which way up you use it, this can be either track 2 or track 3. Many people prefer to have the perforations in track 2, since this enables them to play tracks 1 and 3 in parallel. On twin-track machines, the perforated track has to



The Thomas frame counter. Available to suit all film sizes, and perforated tape.

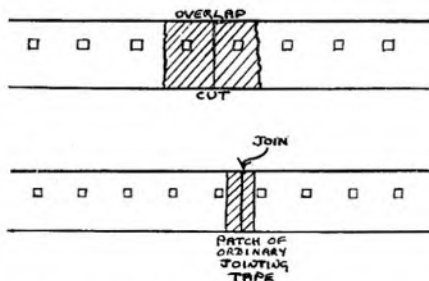
be lowest, and you can only record on the top track of the tape.

Unfortunately, not all synchronisers can be converted to take perforated tape, because the circumference of the plain tape capstan may not be equal to a whole number of tape frames and therefore it may be impossible to replace it by a sprocket wheel. However, the Eumig is readily convertible, and so is the Synchrondek, a separate unit which can be used with virtually any projector. Special conversions can be arranged for a few other machines with built-in synchronisers. In case of doubt, you should consult K.G.M. Electronics Ltd., who supply the special sprocket wheels, and whose address is given on page 102.

Once you have got yourself equipped to use perforated tape, all sorts of things become possible. You can even produce films with lip-sync. dialogue—though this must be left to a later article. For the time being, here are some more straightforward ways in which perforated tape can help you, apart from merely giving you more accurate sync.

Since the correspondence between the frames enables you to establish and maintain a sync. relationship between the tape and film even when they are not locked together by the synchroniser, you will find that it is no longer necessary to do all the recording after the film is edited. You may find it much more convenient to record the commentary, or parts of it, at the editing stage, and then build up the sound and picture together. This is particularly useful where the timing has to be very accurate.

(Continued on page 102)



Joining perforated tape. Top: Cutting. Overlap one complete frame, register the holes and cut halfway between them. Bottom: Joining. Perforated joining tape is not required.

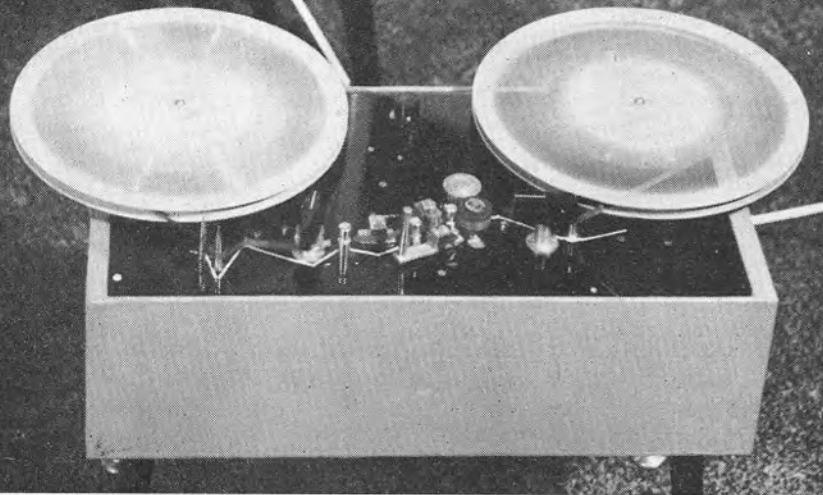
a second; the smallest amount of slip is therefore sufficient to upset lip-sync., although the same inaccuracy would pass undetected in a loosely synchronised commentary-and-music track.

It is also possible that the tape may stretch



DO - IT - YOURSELF

VIDEO



THIS was to be the first time that I had seen a video recorder. I'd heard about them, about the £35,000 Ampex, the lost-and-gone-forever Telcan and the £1,000 Philips machine. But this was different: a video recorder for the enthusiast, costing very much less than anything so far produced.

This machine which comes in a kit form at £97 10s. or assembled at £150, was designed by Bill Rundle and is marketed by Wesgrove Electrics of Nash House, Nash Street, Worcester. Mr. Jack Jones, who handles the marketing of the recorder explained to me that the machine has taken five years to develop but that research and experimentation stretches back a good deal longer than that.

The VKR500 uses the well-known

TAPE AND CINE

(Continued from page 101)

It is very difficult to achieve split-second timing when recording the commentary direct to the picture, or even when you are using a pilot. But if you have a difficult sequence to cope with, you can now record the commentary first, and then, by simple, if rather tedious, counting of frames, you can do the final cutting of the picture to match the recorded tape.

Any number of sequences can be prepared separately in this way and joined up later, but if the rest of the film does not require this special accuracy, you could join up the remainder and record the commentary for this in the usual way, direct to the picture, or by using a pilot. The lengths of tape and film for the special sequence would then be cut into the main rolls at the appropriate points.

In order to establish the correct points for the insertion of the additional lengths, you would have to wind the film through the counter from the start mark down to the insertion point and note the number of frames. By running the tape through its own counter for a similar number of frames,

you would discover where to cut the tape.

Another method, using a Synchrodek, would be to run the tape and film together from the start until the insertion point was reached, and then stop the film. The tape would be juggled back and forth until the needle showed zero (thus correcting any error which might arise on stopping) and the cuts would be made opposite the gate and the replay head. If the film had not stopped with the cutting point exactly in the gate, allowance could be made when cutting the tape.

A totally different approach to the use of perfortape would be to edit the film first and then record the commentary wild. By using blank perfortape as spacer, you could now edit the speech tape until it was in perfect sync. with the picture. Music could be added to the completed commentary by any of the methods described last month.

A more elaborate trick is cutting to music, which in its extreme form is known as Mickey-Mousing, a term used to describe very close correspondence between the action and the rhythm of the music, whether in live or cartoon work. It can be sickening if overdone, but when used in moderation with suitable film material, it can be very effective.

The technique is to record the music first

of all, on perforated tape. You now play it through and mark the back of the tape at the end of every phrase in the music where the shot is to be changed. Now wind back the tape and count the number of frames between the first two marks. The first film shot is cut to this number of frames, and the start of the second shot joined to it. The length of the second shot is reckoned up in the same way, and so on until the sequence is complete. On replay, all the shot changes occur rhythmically in time with the tempo of the music. More elaborate work, in which the action within the shots is also in time with the music ranks as lip-sync., and belongs in a later article.

One final word of warning about editing perfortape and film together. When joining tape that has perforations, you make a butt join half way between the holes, instead of at the frameline as with film. Thus the tendency is to either gain or lose a frame of tape at the join. You have to keep a watch on this, otherwise all your careful calculations will be upset.

The address of K.G.M. Electronics Ltd., from whom tape sprockets and Cinetape A are obtainable, is 2-4, Bardolph Road, Richmond, Surrey. Cinetape is also available from Zonal Film Facilities, Westfields Road, Acton, London, W.3.

direct recording principle used in normal audio recorders, recording with a band width of 2 M/cs on ordinary magnetic tape. Standard, long-play, double-play, triple-play and quadruple-play are all suitable. The circuits are entirely transistorised, employing twenty-four silicon transistors and six diodes on a single printed-circuit board. Non-integrating sync. regeneration is employed for the stable operation of the machine.

The video track records the spectrum up to 2 megacycles and is 70 mls wide on the outside edge of the tape. Inside this track is the FM carrier sound track, 20 mls wide. The vision system is direct recording of a pre-distorted video wave-form with a unique system of sync. recovery in the replay mode.

The VKR500's magnetic flux density at any point along the recorded track corresponds to the magnitude of the video wave-form at that point. The tape is pre-magnetised in one direction by a permanent magnet before recording which not only erases the tape but has the effect that any further magnetisation of the tape during recording must be relative to this point which is not in the linear section of the tape. Therefore the recording signal-feed to the head must include some form of bias in the form of direct current. The synchronising pulses are not fed into the recording head in their original form but are differentiated. The video signal is fed into the recording head from a special head driver unit which contains the driver transistor and critical inductive components which pre-distort the video signal. This unit is supplied with the kit. The sound recording section consists of a frequency-modulated multivibrator which drives a conventionally-designed sound head.

The same head is used for both sound and vision record and replay. The vision signal from the head passes into the replay pre-amplifier then into an integrator stage with a non-linear input circuit which has an important effect in tilt correction. The signal then passes through a number of stages of amplification with a critical low frequency cut feature. After sync. re-insertion, the output is fed into the TV receiver. The audio replay signal passes through a four-stage amplifier and limiter to a diode pump demodulator and out to the reproducing compensating stage.

The VKR500 may be used to record direct signals from the audio and vision stages of a conventional TV receiver. Slight modifications are necessary to the receiver which do not in any way interfere with its performance. A TV camera may also be used which would, of course, give sharper pictures. Wesgrove Electrics hope to be able to market a suitable camera in the £100 price range. Replay may be made on either a 405 or 625 line receiver and can be taken through any channel setting. It is also possible to run a monitor receiver to check the recorded signals.

The machine I saw was mounted in a simple box for display purposes. The deck is about 24 by 14 inches but the large reels overlap both deck and casing by about four inches. A factory-assembled unit is properly cased, resembling in some way the cabinet of a Ferrograph recorder. There are four controls on the deck—Start/stop, record/replay, azimuth and contrast on replay. The head system is not covered which makes for ease of threading the tape. Reels are supplied and for half an hour's record-

ing 11½-inch reels are used at the lowest tape speed of 7½ feet per second. The reels contain 12,000 feet of tape which Wesgrove Electrics hope will be marketed by them at about £7, although it is quite possible to use reels down to three-inch in size without distortion.

The VKR500, in kit form is obtainable direct from Messrs. Wesgrove Electrics and Mr. Jones assured me that delivery time is not likely to exceed 3-4 weeks. Spares are readily available and it is interesting to note that new heads cost as little as 55 shillings and are likely to cost less as production increases. The life of the heads is estimated at about 100 hours. Assembly of the kit should take an enthusiast with average experience about five or six evenings.

Mr. Jones explained, with a great deal of enthusiasm, his plans for future developments. He hopes to market a portable battery-driven outfit which will include recorder and built-in eight-inch replay screen and camera. He also has plans for a replay unit in the £40 price range which will play



Opposite: The VKR500 tape recorder in operation, showing the quality of picture obtainable. Above, a close-up of the head lay-out system.

pre-recorded video tapes—very much on the lines of the pre-recorded tape system now operating. The problem affecting this last enterprise concerns the marketing of the pre-recorded video tapes: no one has yet set up any organisation for the commercial exploitation of vision entertainment.

NEXT MONTH

The latest developments and a special new series on recording television images on tape

When I visited the showrooms, Mr. Jones explained that he could not carry out a direct comparison test, due to rather bad interference on TV reception. He did, however, play a demonstration tape of material which he said he had recorded previously. This was an American programme, which I suspect was one of their more inferior video recordings. The replay results were fairly good, although it was difficult to judge honestly whether the flashings and slight distortions were due to replay or the original TV signal. The picture was equivalent to the sort of picture seen on industrially-installed closed circuit TV. I think it may have been unfortunate that the demonstration tape was of inferior original quality and I would have liked to see, in the absence of a comparison recording, something taken from a familiar TV production or something taken by camera.

PETER L. BASTIN

reports on the latest effort to market a video recorder for the amateur enthusiast; describes the Wesgrove Electrics equipment; and discusses its design and performance.

Sound quality was good and the amount of control on the video replay via the azimuth and contrast controls seemed satisfactorily elastic. The controls were easy to handle and braking was positive. I found that the noise of reels whipping round at 7½, 10 or 12 feet per second was a little disturbing and would no doubt be highly inconvenient if the machine were used in proximity to a microphone in any direct recording. There was no apparent hum or distortion on audio replay but the machine needs to run for several minutes before optimum video quality is attained.

The deck is workmanlike in appearance and the whole machine has a confident look and feel about it. The electronic unit is quite small, due to the transistorised circuit used, and mounts conveniently underneath the deck. The machine cannot be used vertically, which is no inconvenience, and can be described quite honestly as portable. For those enthusiasts who would like to convert to, or add, video resources, this machine, at less than £100, would represent a very sound investment.

SPECIFICATION

Sound: Frequency response: 50-10,000 cps. Tracking: dual. Output: 1v RMS. Input: 1v RMS.

Vision: Scanning: Linear. Tracking: dual. Output: 4v DAP. Input: 1v DAP.

General: Tape speeds: 7½, 10 and 12½ feet per second. Consumption: 200 watts. Maximum reel size: 11½ inch. Maximum playing time: Thirty minutes per side at 7½ fps.

The final article of a series explaining the mysteries of electronics to the layman. Below the author describes how sound is converted into electricity, amplified and re-converted through a loudspeaker.

This electricity: Putting it to work

By CHARLES NORMAN

OVER the last five months we have seen something of the value of electricity and some of the things it can do. Although we have just skated round the edge of the subject we should know enough to take a look at the way in which a tape recorder can pick up your raucous voice, store it on a plastic tape, and later inflict it on the ears of patient friends.

Before we start to discuss this we need a note. Any old note will do, but let us pick middle C on the piano. Assuming that we manage to strike the right key, a little hammer hits a stretched wire, making it vibrate 256 times per second.

This number, which is called the fundamental frequency of the note, is what gives it its pitch. High frequencies give high notes and low frequencies give low notes, which is all very logical and convenient.

The vibration of the wire makes all the air in the room vibrate in time with it, producing a sound wave which eventually hits you right in the ear and makes your eardrum vibrate in turn. This travels on to your brain, if any, which immediately pipes up: "You are hearing middle C on the piano." And so you are!

Our first problem is to convert the sound wave into something that we can use in a tape recorder. Electricity seems a good bet, but how do we set about it?

Well, last month we saw that we could produce electricity by moving a magnet inside a coil. This is a starting point, but even if we could manage to tie a magnet on to the end of a sound wave, we could hardly expect the poor little thing to wobble

a hefty great chunk of iron about. So we have to be a little more circumspect in our approach.

There are umpteen different ways to convert sound into electricity, but one will do to be going on with. Take a look at Fig. 1. This is supposed to be a thin, corrugated metal ribbon sitting between the ends of a bent magnet. Wires lead off from each end of the ribbon, which is so light that even the tiny power of a sound wave causes it to vibrate. And as it must vibrate in time with the force that is moving it, these vibrations will occur 256 times per second. So we have a conductor moving inside a magnetic field, which is just another version of the electrical generator we examined last month.

As the movement must produce electricity, we get a voltage varying in time with the sound wave. The whole contraption is called a moving ribbon microphone. So far, so good, but the voltage is so small that we must make it a lot bigger before we can think about using it.

This is where the clever stuff begins. We feed that voltage into a valve or transistor amplifier, which is a much simpler contrivance than it is supposed to be. Whether we use a valve or transistor is immaterial so long as we get the right answers, so let us choose a transistor. It is not so heavy to carry about.

A voltage applied to the input of a transistor causes a small current to flow. Because of the fiendish cunning with which the things are made, this causes a current to flow in the output too. What is more, this current is about fifty times larger than the input current. The output resistance is

about four times as great as the input resistance. So if we use our loaves and Ohm's law we see that the voltage at the output is in the region of two hundred times that at the input. This is all an amplifier does.

We can put the tiny voltage from the microphone through two or three amplifiers in a row. As it comes out of each bigger than it went in, we finish up with a reasonably hefty voltage.

This solves the first problem, but now we need a bit more clever stuff to enable us to hold down this varying voltage and store it. Putting salt on its tail is not the best way to go about this. Instead we use another of the properties of electricity.

Last month we saw that when a current is passed through a coil with a soft iron core a powerful magnetic field is created. When the current is switched off the magnetic field dies away at once and the iron becomes demagnetised. But a steel core stays magnetised after the current has ceased to flow.

With this in mind, we move along to the right-hand side of Fig. 1, which is labelled "Recorder Head." This is a coil wound in two halves round the arms of a nearly closed loop of soft iron. All the magnetic field produced by a current is then concentrated in the narrow gap between the two ends of the loop. In this way even a small current can produce quite a powerful field. The coil of the recording head is fed by the output of the recording amplifier which, provided we are still thumping away at that battered old middle C key, is varying at the rate of 256 cycles per second. So the magnetic field must vary at the same rate.

Very close to the core gap is a tape which is being steadily wound from one spool on to another. Just for the sake of argument, we will assume that it is moving at the rate of one foot per second. This is not a common or garden tape; it is coated with a plastic composition containing millions of tiny particules of a steel-like substance which can be permanently magnetised.

Now we have got just what we wanted. The amount of magnetism on the tape at any point will depend upon the strength of the coil current at the instant when the tape passes the gap in the coil. As the current is going through a complete change 256 times per second and the tape is moving at one foot per second, every foot of that tape will be printed with 256 variations of magnetism. As this is fixed, we have managed to tie down the sound on to the tape.

So we can make a magnetic recording of middle C or any other sound that happens to be around when we put the microphone into action. This is all very well as far as it goes, but miles and miles of magnetised

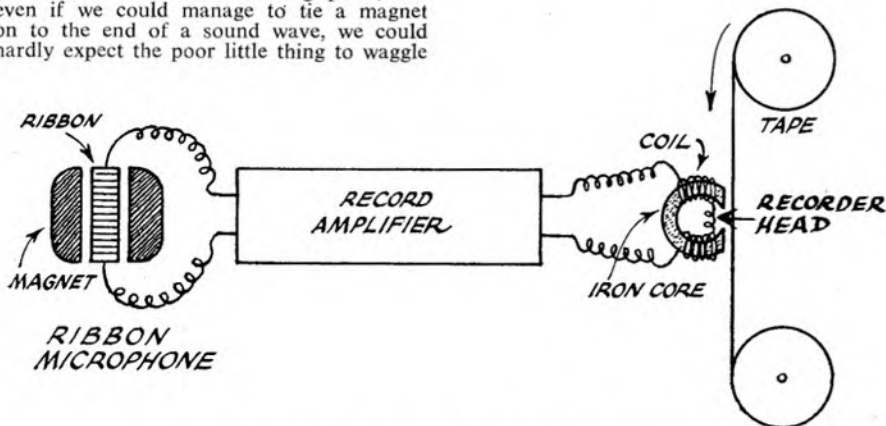


Fig. 1. Simplified lay-out of the recording sequence.

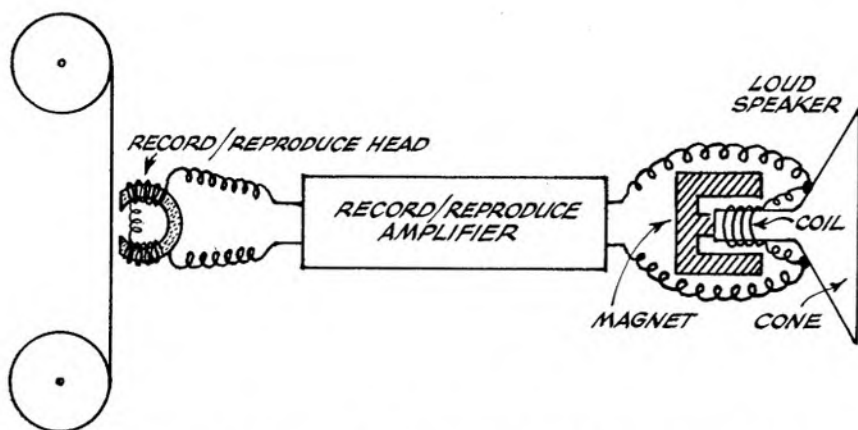


Fig. 2. A modified version of Fig. 1; showing the reproduction system lay-out.

tape is not particularly decorative and will do us no good at all unless we can scrape off the sound and shoot it at the ears of a few unoffending listeners. This is the next problem.

But this is a fairly easy one because we already know what, in the nicest possible way, we can do with a coil, a piece of soft iron, and a magnetic tape. Fig. 2 shows how easy it is to reverse the process.

By a little diabolically clever switchery we take the input current away from the coil, and connect the wires leading from it to the front end of the amplifier we used to do the recording. So our recorder head is promoted to the position of Record/reproduce head and the amplifier becomes the Record/reproduce amplifier. Then we wind back the tape with some more tricky switching and finally pass it back over the gap in the head at the same speed it was moving while we were recording.

We should not need telling by now that when we move a magnet in a coil we get a current. Well, we are not moving a magnet in a coil, but we are moving a magnet which varies in power along its length very close to a piece of soft iron. As a magnetic field will magnetise the iron this means that the core will change in magnetic strength as the varying magnetised tape glides past it. This is just the same as pushing a magnet in and out of the coil, so we get a small electric current. And as the tape is moving at the same speed as the recording speed, this current will vary 256 times per second.

The current produces a voltage which is fed to the amplifier and magnified many times, but although we can give ourselves an electric shock in time to the music we still have not produced a sound—except perhaps a cry of agony if our whiskers get caught up in the works.

Again though, the problem is fairly easy to solve. At the right-hand side of Fig. 2 is the loudspeaker. This is a coil of wire wound on a light former, one end of which is fixed to a stiff paper cone. The coil sits inside a gap in a powerful magnet and is suspended so that it does not touch the sides. To the ends of this coil we connect the output from our amplifier.

You should be able to see that this is a variety of electric motor. The coil must move in and out as the current through it changes, so it must move the cone. The cone in turn must move the air with which it is in contact and this must move all the

air in the room at 256 cycles per second. Oh goody! We have made a sound wave!

Just one more little problem. We can record; we can reproduce. But what about

the tape when we have used it once. Not very many of our recordings will be so good that we want to hand them down to posterity. It would be much nicer if we could use a tape more than once. So we have to know how to wipe off the recording.

To do this we put another head on our recorder and pass through it a current alternating many thousands of times per second. This sort of current produces a magnetic field which has the power to demagnetise steel, so as the tape passes it it wipes off the recording. So, either by operating a separate control or by using yet more switchery which brings this head into operation automatically as you record, you can use the same tape as often as you please. Strangely enough, this head is called the erase head.

This completes our present prying into the habits of the electron, but it is only fair to give warning that, subject to the whims of providence and editors, there may be more in due course. In the meantime, now that you are all expert in the technique of tape recording, there is only one thing left to say.

Welcome to the club!

TAPE IN HIS KNAPSACK

(See front cover)

ACCOMPANIED by his ubiquitous Uher (the 4000 Report Stereo model), John Cordeaux has visited ten of the Commonwealth's smaller broadcasting stations during the last twelve months. As Head of Sound Broadcasting in Thomson Television (International) Ltd., he has been particularly concerned with the radio side of broadcasting in the developing countries—territories where TTI is very actively helping to bring television to the people for the first time.

A year ago, John joined Thomson's after seventeen years in the BBC. During his time with the Corporation he has been an announcer and newsreader, a producer on the "Today" and "Ten O'Clock" programmes and, ten years ago as Overseas Instructor in the Staff Training Department, virtually started BBC training for broadcasters from all parts of the Commonwealth. He has personally trained staff from twenty-four different countries, and now (wearing, as he says, both his Thomson hat and his BBC tie) he is constantly meeting up abroad with all his old broadcasting friends and former students.

At the radio stations he visits, John is asked to advise on policy matters, he also records and produces many local programmes and, perhaps above all, he trains staff—whether in a makeshift classroom on a tropical verandah or "on the job" in the studio or in the field, bush, desert or jungle.

John tells us that recording is not only an important part of his work, but also an absorbing hobby—and it has been since, as a boy of ten, he acquired a little tracking gadget to fit on his clockwork gramophone and a number of aluminium discs: resulting in some rather nasty noises—albeit recorded ones.

In 1959, when he and his wife Shirley (now a producer in the BBC's African Service) ran a BBC training course in Grenada for Caribbean broadcasters, John took with him one of the first production models of the Fi-Cord 1A. He returned home with some eight hours of calypsos and West

Indian life on tape. He tells us that the BBC refused to believe the recordings were made on such a diminutive machine as the Fi-Cord (which they'd never seen before and were conservatively a little contemptuous of). A year later, though, when he was in the Far East, seconded by the BBC as Head of Programmes, Radio Sarawak, he learnt that the BBC had purchased 150 Fi-Cords!

Nowadays, though, John is very much a "stereo-type." One of his last jobs in the BBC was when he made all the actuality stereo recordings for the BBC's first (and, so far, only) Actuality stereo feature—"Barnet Horse Fair," which was introduced by Wynford Vaughan Thomas and produced by Douglas Cleverdon in December 1963.

Today, with his stereo Uher machine and a Revox at base, John has acquired a unique library of songs and sounds—in stereo—from all parts of the Commonwealth. Either with the Uher stereo microphone or a pair of excellent Beyer cardioids, his recordings include the British Guiana Police Male Voice Choir (at the height of the "troubles"); inebriated (slightly) "Sega" singers on a beach in Mauritius; the calypsonian, Lord Radio of Barbados, with a special calypso in honour of a visit by the Duke of Edinburgh; Palm Sunday High Mass in the cathedral of St. Mary the Crowned in Gibraltar; "Rock'n'Roll" hymn singing conducted by a Bishop Moses in a church in Nassau; and, as you can see from this month's cover photo, an "officer-in-charge-of-camels" in the South Arabian Desert.

Under the title "The more we are together"—a collection of songs and sounds from some of the warmer countries of the Commonwealth, John will, incidentally, be presenting a selection of his recordings in the BBC Home Service in April. The programmes, broadcast on Thursdays from 11.30 a.m. to 12 noon, can be heard on April 8, 22 and 29. The programmes are to be recorded in stereo for future use, but will be broadcast originally, of course, in mono.

In a future edition of *TAPE Recording Magazine*, John Cordeaux hopes to recount some of his adventures, technical and otherwise, in getting the tropics taped.

THE main task of an amplifier is to convert the minute signals provided at the input into a version of the original sufficiently powerful to drive a loud-speaker. There are various estimates of the power required, based on the listening preferences of a large number of observers for particular sound levels. In general, men prefer their music louder than women, musicians louder than the general public, and engineers louder than anybody.

The power required is also influenced by the efficiency of the loudspeaker, the size of the room and the amount of sound which is absorbed by the furnishings. The dynamic range has to be considered in order that the amplifier be capable of handling sudden peaks without distortion to overloading. The minimum power which is considered adequate is about $2\frac{1}{2}$ watts and the normal figure lies between ten and twenty watts. Provision of a reasonable power output is a relatively easy matter but distortion and frequency response have to be taken into account.

Any deviation from the original sound is to be regarded as distortion. It is therefore important to decide how much is permissible, since we cannot hope for complete perfection.

It could be said that if distortion cannot be heard, then it is not objectionable. In a quiet home, the noise level is 33 dB above the threshold of hearing. In other words, the sound pressure level is a little over forty times greater than the smallest sound which can be heard under ideal conditions. The maximum level likely to be encountered is 100 dB or 100,000 times greater than the threshold, meaning that the permissible distortion should be 100,000 divided by 40, or 0.04 per cent. Fortunately, the presence of one sound tends to reduce the effectiveness of another and the lesser sound has to be increased in level in order to make it appear as loud as it would otherwise have been. This effect is known as "masking" and in raising the threshold of hearing, has the effect of increasing the amount of distortion which can be tolerated. Observations made by H. Olson indicate that in the case of music, 0.7 per cent is just perceptible, whilst Alons and Slot have shown that even experienced listeners cannot distinguish less than 0.3 per cent distortion of chords under ideal conditions.

If the maximum distortion is fixed at between 0.25 per cent and 0.5 per cent the system will be satisfactory. Background noise is assessed in much the same way. This is the contribution made by the amplifier which bears no relationship to the music and includes mains hum and noise generated by the circuit elements.

PETER MILTON examines the problems associated with domestic sound reproducing equipment and, in the light of these, establishes a specification by which the performance of an amplifier may be assessed.

The design and function of amplifiers

It is a characteristic of the ear that it is less sensitive to very low frequencies and so it might be possible to accept a greater amount of hum due to lack of smoothing or "pickup" on the leads. This would be permissible if it were not for the fact that the harmonics of the mains frequency usually give the most trouble since the ear is more sensitive to them.

Most modern amplifiers give less than 0.1 per cent distortion and background noise, leaving more latitude for imperfections in the loudspeaker, motors and interconnections.

It would be reasonable to expect the power output to remain constant regardless of the frequency of the signal, provided that the input level remains unchanged. There are practical limitations, in that losses in the iron of the output transformer limit the bass, whilst interwinding capacitance limits the treble. At the low end of the frequency spectrum

it has been shown that except for the special case of the church organ, the harmonics of most musical sounds are more prominent than the fundamental. Furthermore, the ear has the ability to detect the pitch of a note even when the fundamental tone has been suppressed.

Taking the size of a normal room into account (where very low notes would hardly be reproduced anyway) there seems little point in extending the response beyond 40 cps, provided the power response falls away smoothly below this point. At the upper end of the scale the range is governed by the presence of the harmonics, and it has been observed that in the case of cymbals these are stronger than many other instruments. Also, persons who are deaf to frequencies above 12,000 cps can discern the effect of a filter at 15,000 cps.

It would seem reasonable to specify that the power response should be main-

OHM'S LAW—a definition

Definitions will be given in these articles as technical terms are met and it is hoped that at the end the reader will have a reasonable chance of making a satisfactory choice between the many amplifiers which are at present available.

First, a definition of Ohm's Law. Let us assume that in a given material, the electrons are caused to flow in one direction under the influence of an electromotive force (e.m.f.). The flow depends on the magnitude of the force and the number of electrons which are able to pass from one atom to another along the material. In other words, the current is proportional to the e.m.f. and inversely proportional to the resistance in the circuit. This is Ohm's Law and is one of the foundations on which the science of electronics is built.

The rise in temperature due to the movement of electrons is proportional to the e.m.f. and to the current, the product of the two giving the power dissipated in the circuit. Power is the expression of the rate of change of energy from one state to another and in this case is the change of electron movement into heat.

Expressed in symbols, the foregoing statements become:—

$$E = I \cdot R \text{ or } I = \frac{E}{R}$$

$$P = I^2 \cdot R \text{ or } P = \frac{E^2}{R}$$

where E is e.m.f. in volts

I is the current in amperes
R is the resistance in ohms
P is the power in watts.

AN ESSENTIAL REFERENCE BOOK FOR TAPE ENTHUSIASTS

WHAT was the most significant development in the field of tape recording during last year? The question is raised by Douglas Brown, the Editor of *Tape Recording Magazine*, in the review of 1964 which he contributes to the new edition of "Tape Recording Yearbook," now on sale at 7s. 6d.

I shall not give his answer, but the discussion of the subject is one of the most interesting things in this new and essential reference book, now well established as a necessary "buy" for every keen amateur.

Mr. Brown has surveyed a year's developments in each edition of the Yearbook since it first appeared in 1958 and there is no doubt that a collection of these surveys today provides the most complete and most authoritative account of how tape recording has developed in the last exciting decade. If you have not bought previous editions of the Yearbook, start collecting them now; those who know it from the past will need no persuasion.

As befits a Yearbook, most of the content is factual and is intended for easy reference. The heart of the book, of course is the catalogue of tape recorders and associated equipment available in this country: the most complete and up-to-date catalogue of the sort available, valuable to those who are contemplating the purchase of new equipment, invaluable to dealers and others who need to hand the fullest information in the most compact form.

As well as details of the various recorders, decks, microphones, mixers and radio tuners, there is a detailed price list for all popular brands of magnetic tape and directories of manufacturers' addresses and of tape recording clubs.

This basic material, perhaps, is taken for granted. What distinguishes "Tape Recording Yearbook" are the special articles which are included to inform newcomers to the hobby and to stimulate those who are already engaged.

This year four of the best-known writers on tape recording contribute their advice: John Borwick on "Tape Recording as a Group Activity," Alec Nisbett on "How to use Acoustics—and when not to," Norman Paul on "Producing a Feature Tape," and Harry Mack on "Function, Maintenance and Design."

Between them, these four articles add up to one of the best general introductions to tape recording activity that has been published. At 7s. 6d., this Yearbook, which has 132 well-illustrated pages, is unchallengeably a "best buy." **G.H.**

tained to at least this figure, falling off thereafter at a rate of not greater than 3 dB per octave. The phrase "power response" has been used deliberately because although the voltage/frequency response can be made level when measured on a meter, the waveform could well deviate from the original when viewed on an oscilloscope.

The complete amplifier consists of two main sections, the power amplifier and the preamplifier. The power amplifier has the task of driving a loudspeaker when fed with a small voltage, usually of the order of one volt, and the preamplifier converts the signal appearing at the input into a form suitable for power amplification.

The functions of the preamplifier can be summed up in the words selection, equalisation, tone correction and amplification. The first function is self explanatory. The preamplifier must act as a junction box, selecting the appropriate input, usually pickup, tape, radio or microphone. It is not so important to have a microphone input as it would appear at first sight, since this, is usually incorporated in the tape recorder. A suitable microphone input would have to have provision for bass attenuation to give a reasonable sound balance on speech and this would then bring the system into the category of public address equipment. The most important point about switching the inputs is that there should be no break-through between them. Cross talk can be avoided if the unused inputs are earthed and some manufacturers disconnect the h.t. line of the tuner when it is not in use.

Pick-ups can be divided into two main types, crystal and magnetic.

The output from a magnetic pick-up is dependent on the recorded stylus velocity. This is the movement at right angles to the groove and is not to be confused with the speed of the disc. There is a definite relationship between velocity and frequency laid down by British Standard 1928 and it is therefore relatively easy to design a circuit having the inverse characteristic, matching the low impedance of the pick-up. The output from the crystal types is dependent on the amplitude of the groove excursion and when using records cut to B.S. 1928 can be made independent of frequency. The correct input would be flat and of high impedance, preferably one megohm or greater.

The primary function of the preamplifier is equalisation. The fact that voltage is proportional to rate of change of magnetic flux causes the output of a tape head to fall off at low frequencies and the finite length of the gap causes a corresponding fall in the treble. The preamplifier has to have a response tailored so that it is the inverse of the tape head. In

this way the net result would be independent of frequency. No two tape heads are alike and for this reason most amplifier manufacturers leave the equalisation to the tape preamplifier and provide a flat input suitable for a high impedance source.

An output from the preamplifier should be provided to feed the tape recorder, preceding the volume control so that recordings can be made with the rest of the equipment silent. A vital point to watch when connecting the recorder is that the low input resistance of some machines, particularly the continental types, can shunt the volume control, with consequent loss of signal.

Opinion is sharply divided as to the tone control facilities which should be provided. It seems reasonable to use a slight amount of bass lift to allow for the fall in bass characteristic of today's loudspeakers, provided a high pass filter is used to cut out the extreme bass, in order to avoid overloading due to motor noise. It is often necessary to use a slight amount of treble lift to compensate for the absorption of high frequencies by the furnishings and for the deficiency in treble due to the listening position. It may also be necessary to employ a low pass filter in order to cut out distortion in the extreme treble, leaving the overall balance unaltered. This would not be achieved simply by turning the treble tone control down.

Tone controls and their use are largely a matter of taste and are seldom used at their extreme limits.

To summarise, the requirements of a domestic high quality amplifier would be set out in a specification as follows:

- Power: between 2½ and 20 watts.
- Distortion: better than 0.25 per cent.
- Total noise: better than 52 dB down.
- Pick-up input: choice of flat at high impedance or low level, low impedance for magnetic types.
- Radio: flat, high impedance about 100 mV sensitivity.
- Tape: flat, as for radio.
- Microphone: flat, as for radio.
- All unused inputs to be earthed.
- Tone controls, bass and treble: 12 dB at 50 and 15,000 cps.
- Filter: steep cut at 7,000 cps (at least 12 dB/octave slope).
- Rumble filter: 30 cps (at least 12 dB/octave slope).

Output: tape output, low impedance, unaffected by volume control setting.

This is only a basic specification and is exceeded by the majority of amplifiers.

In subsequent articles we will examine each part of the amplifier in detail showing the design steps and indicating the methods of overcoming some of the problems encountered in constructing domestic equipment.

TAPE AND NOISE

B. E. WILKINSON discusses the various sources and causes of extraneous noise in recording systems, and offers advice on its suppression.

USING quite moderately priced equipment, almost anyone can, with a little practice, make tape recordings of a high standard. Faults which can mar a record can be divided into those concerning the presentation and arrangement of the programme material and those of a technical nature. One of the more frequent sources of trouble in the latter category is that of noise.

Noise can be defined as unwanted sound, which as far as tape recording is concerned can be introduced in many ways. Firstly, the complexity of the mechanical drive demands moving parts which are a potential source. The amount of energy derived from the record is very small, so that noise in the early amplifier stages can become significant. Any noise which might be added to the tape during recording is added to the noise generated by the system at replay. Then of course, there is the introduction of noise at the microphone itself.

If mechanical noise is present, it will occur both at record and replay, since mechanically, these functions are identical—the tape is drawn across the head assembly at a closely controlled speed. We can subdivide mechanical noise into that occurring above the deck and that being generated below. Above deck, the tape transport system can give trouble when moving reels or tape foul the deck or other stationary parts. Distorted reels are a common source, the lower flange of the reel being either bent down so that the edge touches the deck, or bent up, when it makes contact with the incoming or outgoing tape. The result is an irritating once-per-rev scrape, which is cured by replacing the faulty reel or bending it straight.

The pressure pad, usually a small square of felt which holds the tape against the record/replay head would hardly seem capable of causing any noise. But friction between pad and tape may make the latter vibrate longitudinally, emitting a high-pitched whistle

which sounds almost electrical in origin. This fault is due to the accumulation of oxide particles thrown off by the tape, and impregnated in the pad. The powder can be cleaned out using the point of a needle to scratch the surface of the pad.

Below deck, there are several sources of mechanical noise. Slipping clutches are fitted to the reel platforms to accommodate the change in reel speed as tape is wound on or off, and squeaks are sometimes generated by an accumulation of powder worn from the clutch faces. Where the recorder functions are provided by a single motor, belt and pulley systems are employed so that the drive may be switched to the capstan or either reel.

Belts are subjected to changes in temperature due to the warming up of the equipment, and stretching due to the starting torque of the motor—particularly where the capstan and its associated inertia wheel are belt driven. Belts may also pick up oil or grease flung off by other rotating parts and the overall effect is that after a considerable time, they tend to bow outwards when running. In such a compact assembly as a tape recorder, a stretched belt may foul other components and cause intermittent noise. A ringing noise in one of my own machines turned out to be due to an elongated belt striking a spring. Bearings that have dried out through lack of lubrication may squeak at first and later develop a slight “rumble” when sufficient side play has been worn. However, a small drop of oil at infrequent intervals will prevent any squeak and minimise wear.

Mechanical noise can sometimes find its way on to a recording when the microphone is placed close to the recorder, or on the same hard surface, thus providing a transmission path. Microphonic valves may become troublesome in this respect, as may be the sensitive lead which has somehow become bent so that it rubs

against a rotating part such as the fly-wheel.

Electrical noise like mechanical noise is likely to increase with age. It should be remembered that the decrease of signal-to-noise ratio is a gradual process and may go unnoticed until an overhaul is carried out, or until the performance is compared with something better. There is never a complete lack of noise in the amplifier, due to the passage of electrons through resistors, particularly in the grid circuits of early stages.

This type of noise takes the form of a background hiss which is random in nature covering the whole of the audio spectrum, and therefore cannot be filtered out. In modern mains-driven recorders, however, this form of noise is not likely to be unreasonable unless a grid resistor becomes faulty. Inexpensive transistor portables, where four, or even three transistors are driven hard to provide an acceptable level, are more likely to generate a background hiss. The answer seems to be to keep the gain down as low as possible consistent with making an acceptable recording.

Noise due to the mains supply, ultimately seems to creep into equipment in the shape of a 50 cps hum which can get into the system in two ways—via the amplifier input and via the power supply. There is the possibility of pick-up if the recorder is placed close to some mains-operated device. The replay head for example is essentially sensitive to magnetic fields.

During record, mains hum can be introduced to the input via the input lead. Dynamic, low impedance microphones are sensitive to magnetic influences and to place such an instrument on top of the refrigerator, the radio or any equipment which may not be adequately screened, is to risk making a poor record. The higher impedance microphones, such as crystal and condenser types, are voltage sensitive and may respond to static electricity or high-voltage discharges.

Probable sources are fluorescent lighting, television receivers, ignition systems, etc. It goes without saying that input leads should be screened and kept away from mains leads.

In order that the power derived from the mains can be used to drive the amplifier, the alternating current is rectified and the resulting direct current smoothed. The smoothing circuit, consisting usually of a choke and two electrolytic capacitors is necessary to eliminate the AC ripple. The life of an electrolytic capacitor is not indefinite, and ultimately the DC is not completely ripple-free and a hum becomes noticeable. If the recorder has given lengthy service, an overhaul of the smoothing circuit and replacement of the capacitors will reduce the persistent hum. Where other mains driven equipment is being used with the recorder, the earth leads should be taken to a single earth point. Potential differences between earth terminals may be sufficient to introduce hum.

Noise can find its way into the recorder from the tape, where it can be present due to external magnetic influences, or derived from the recorder when the record is made. Tapes which are accidentally submitted to extraneous magnetic fields either from permanent magnets or electric-driven machinery, may exhibit a rushing sound of a cyclic nature, occurring once-per-rev of the supply reel. The increasing use of permanent magnets in the home (cupboard door catches, etc.) is a hazard in this respect, and while the ideal storage is in metal cans, tapes should not be placed near magnetic influences. Tapes that have been moved in or out of alternating fields will suffer partial erasure.

Some battery portables employ permanent magnetic or DC driven erasure which erases the signal by completely swamping it, thus orientating the oxide particles in one direction. The "erased" tape is far from magnetically neutral and can introduce as much as 6 dB of hiss into the replay system. Transistors, as has been mentioned, tend to introduce hiss, and the combination of these sources can be quite irritating. I have found that records made on machines of this type can be considerably improved by using AC-erased (magnetically neutral) tape and ensuring that it misses the permanent magnet erase system.

Again, some portables do not provide record bias from an oscillator, but superimpose the record signal on a direct current. After considerable service, the core of the head may become magnetised, and while this is not sufficient to erase tapes, it may introduce background noise. Residual magnetism should be removed periodically, using a mains-driven defluxer.

BOOK REVIEWS

STEREO: All practical problems are solved in this important book for recordists.

PRACTICAL STEREOPHONY by H. Burrell Hadden. Published by Iliffe Books Ltd. 159 pp., 120 diagrams. Price 37s. 6d.

THERE are few owners of stereophonic tape recorders who have not been disappointed with their attempts to record even the simplest sound picture. Problems of microphone matching and positioning seem unsurmountable and after a few recordings of drama groups, parties and trains, the machine is regarded purely as a status symbol and used only to play back pre-recorded tapes.

H. Burrell Hadden is a prominent member of the BBC and as a contributor to this magazine, needs no introduction. His timely book on stereophony covers all aspects of the art and gives in a practical and non-mathematical form, information which should interest professional workers in the field of sound recording and broadcasting and enthusiastic amateurs interested both in improving their recording technique and achieving realistic sound reproduction.

Theories of hearing and methods of creating a stereophonic effect are discussed in detail and the history of the subject is given. It may surprise readers to know that in 1881 a patent was granted to a system whereby telephone subscribers could receive binaural relays of plays or operas direct from the concert hall.

Suitable equipment for use in the recording studio, including practical layouts is described. The most important chapter is that devoted to microphone technique and treatment of the recording studio, since this is where the essential art, gained by long experience, is most distinct from the practice indicated by pure electronic theory. The various systems of broadcasting and recording stereophonic signals are discussed and there are chapters covering domestic stereophonic reproduction, including some remarks on loudspeaker positioning and listening room treatment.

This book answers every question which is likely to be asked about stereophony except the one most often asked: "When are we going to have regular stereo broadcasts?" Verdict: An important book and well worth the price asked.

RADIO RECEPTION by H. Henderson. Published by the Focal Press. Price 42s.

THIS book continues the series on the technique of sound reproduction edited by John Borwick. It is intended for the serious amateur or the technical student who is interested in finding out how radio receivers work. Although the author points out in his preface that it is not a book for the designer or service technician, it is very likely that the clear explanations and adequate diagrams will earn it an honoured place beside the works of reference in many engineers' libraries.

The first section deals with basic AC and DC networks and the use of the valve and transistor as an amplifier. The properties of impedance, selectivity and voltage magnification are explained and use is made of numerical examples in order to clarify the text. An important feature is that a description of the appearance and construction of

the components introduced is given together with a key to the system of encoding their type and value.

The main part of the book consists of a logical progression of chapters each dealing with the main stages in a receiver, starting from the radio frequency stage and ending at the detector. Audio amplification is not discussed since this is covered in the companion volume on amplifiers by H. Lewis-York. The sequence within each chapter is identical in that the first part deals with valves and the second part with transistors. In this way the reader is given an opportunity to compare the two techniques.

A chapter describing the general approach and method of alignment of FM and AM receivers draws together the theory of the preceding chapters and concludes with a description and circuit diagrams of several current high quality receivers.

This is a well balanced book, covering every aspect of radio reception from aerials to stereophonic decoders in a thoroughly readable manner and is a worthy addition to the Focal Press series on sound.

AERIALS by D. J. W. Sjobbema. Part 3 in the series of Philips Paperbacks, distributed by Iliffe Books Ltd. Price 10s. 6d.

THE development of a radiogram seems to fall into four distinct phases. First, the tame artist employed by the company dreams up a cabinet acceptable to the Managing Director (and his wife) and the Drawing Office fits a slightly modified version of last year's chassis into the prototype.

Next the acoustic engineer struggles to get the best possible sound from the few cubic inches allotted to him while the radio engineer tries to offset the effects of acoustic feedback due to the improved loudspeaker response. Then, somebody, usually the Works Manager remembers that most receivers require an aerial and so the regulation two-foot-six lengths of metallised strip are hastily folded and tacked around the cabinet.

With the introduction of FM and television broadcasting the aerial has become more and more important, especially since ghosts, poor definition and interference can be associated with defects in the aerial itself or in the downlead to the receiver.

This book covers the basic theory of electromagnetic wave propagation in fairly simple terms and introduces the reader to the various types of aerial, indicating the situation where each particular type is of most use. The Yagi array, "V" reflector and helical aerial are discussed and formulae and curves are given enabling directivity patterns and bandwidth to be estimated. There is an extremely useful chapter on the practical aspects of aerial siting and erection and chapters on attenuators, connection of the aerial to the receiver and the treatment of several receivers connected to the same aerial.

This book is possibly only of "fringe" interest to the tape recordist but it will be invaluable to all those who wish to improve the performance of their receivers or are engaged in aerial rigging.

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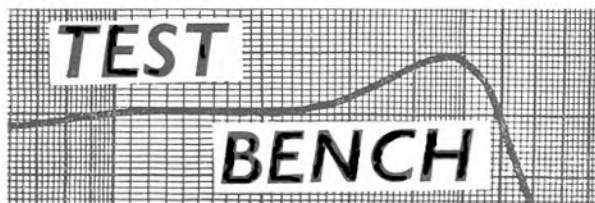
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MAGNETOPHON 96

By H. Burrell Hadden

THE Magnetophon 96 is a portable mains-operated tape recorder, operating on the four-track system. In addition to the numerous monophonic facilities provided, the machine will play back stereophonically in conjunction with any stereophonic amplifier system, or radio receiver equipped to receive stereophonic programmes. Considering the many facilities provided, the machine is very compactly designed, its overall dimensions being only 8 x 16 x 11½ in., and its weight approximately 24½ lb.

The equipment operates at three tape speeds, 7½, 3½ and 1½ ips, and will accommodate spools up to seven inches in diameter, giving a maximum playing time of more than sixteen hours, using double-play tape. The rewind time for a full reel of standard tape, 1,200 ft., is three minutes. This may seem a trifle slow, but the wind is very even, an essential feature if stereophonic tapes are to be preserved for any length of time. Any unevenness of wind will cause the edges of the tape to be damaged, with consequent deterioration of the stereophonic effect.

The controls on this machine consist of four rotary knobs and six large push buttons, together with stop bar, and two smaller buttons which select the required track. A thumb wheel operates a tone control on playback. The rotary controls are, from left to right; three position track selector; mains on/off switch, combined with the recording level control; pause control, and replay volume control. The large push buttons operate the tape handling mechanism, and provide for the selection of the various inputs available. Inputs switchable in this

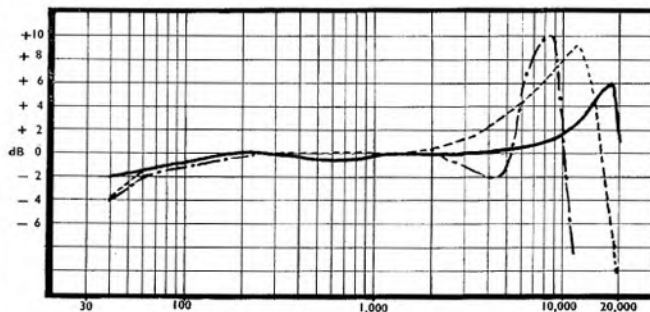
way are radio, phono, and microphone, and the three other buttons are the normal "start" or replay button, the record switch, and the "trick" or superimpose switch. An ingenious combination of switching allows the "stop" bar to be used as the switch controlling the fast forward rewind operations.

The two smaller buttons, one grey and one red, situated on the top of the head cover, control the selection of the appro-



priate recording track, and in conjunction with the "synchro" output socket, the stereophonic output. Record level indication is by means of the now familiar ribbon-type magic eye, and a digital tape position indicator is provided.

Five input and output sockets are conveniently grouped together on the right hand side of the machine. These are all of the now almost universal DIN type. From front to back they are as follows: firstly the microphone socket, then the usual socket providing two-way operation, record and replay, from a suitably equipped radio receiver, then a socket for a pair of monitoring headphones, available as an accessory. Next is the "synchro" socket, used for stereo playback, and when recording from one track to another, for example in the making of sound tracks for cine films. The last socket is for an extension loudspeaker of 5 ohms impedance, with the



Record/replay frequency response chart for the Magnetophon 96 stereo recorder

7½ ips —————
3½ ips - - - - -
1½ ips - · - · - ·

Frequency in cycles per second

possibility of disconnecting the internal speaker if required.

The machine was subjected to the usual practical tests, and in every respect came up to the manufacturer's specifications. It was given extended listening tests using tape records, both monophonic and stereophonic, and performed well, either on its own internal loudspeaker, or on external high quality equipment. The stereophonic reproduction was well balanced, and the excellent signal-to-noise ratio made the tape hiss the only audible background. Wow and flutter were inaudible at 7½ ips, and at 3¼ ips the machine still gave a good account of itself when reproducing a piano, a very exacting test.

The accompanying graph shows the record/replay response at the three available speeds. These were measured at the feed point for a high fidelity amplifier, at which point the tone control is inoperative. In each case there is a rather high peak at the high frequency end, but since no tolerance limits are specified by the manufacturers there was no means of telling whether this is normal for the machine in general, or whether it only occurred on this particular model. A standard replay tape showed no sign of this effect, so that the fault, if any, would seem to be in the record section of the amplifier. It was, in any case, possible to equalise this effect as far as the internal loudspeaker is concerned with the tone control provided, and with the tone controls on any external amplifier. The signal-to-noise ratio at 7½ ips was 55 dB, an excellent figure.

The Magnetophon 96 is supplied with a very good instruction manual, and a complete service sheet giving circuit diagram and components layout. It is a pity that more manufacturers do not see fit to supply this information, and Telefunken are to be congratulated on this. No microphone is supplied, but various types to satisfy a number of requirements are available from the manufacturers. The machine can be linked to a slide projector for the automatic changing of the slides.

All in all I found this machine to be excellent value for money at £45 3s., especially because of the varied number of uses to which it could be put. I can thoroughly recommend it.

MANUFACTURER'S SPECIFICATION

Tape speeds: 7½, 3¼, 1½ ips.

Recording sense: Four-track left to right.

Maximum spool size: Seven inches.

Frequency range: 30-18,000 cps at 7½ ips; 30-16,000 cps at 3¼ ips; and 30-9,000 cps at 1½ ips.

Signal-to-noise ratio: 50 dB at 7½ ips; 46 dB at 3¼ ips; and 42 dB at 1 ips.

Wow and flutter: 0.15 per cent at 7½ ips; 0.2 per cent at 3¼ ips; and 0.3 per cent at 1 ips.

Distortion: Less than five per cent.

Inputs: Radio (2 mV in 47 K ohms); microphone (2 mV into 2 ohms).

Outputs: Radio (One volt from 18 K ohms); earphones: (0.5 volt loaded with 5 K ohms); stereo output—synchro socket (two 1 V loaded with approx. 18 K ohms).

Loudspeaker: 10 x 3 inch elliptical.

Power output: 2½ watts per channel.

Power supply: 110, 127, 220 and 240 volts, 50/60 cycles, AC.

Tube line-up: EF86, two ECC83, EL95, and an EM84.

Power consumption: Approx. 80 watts.

Dimensions: 16 x 11½ x 8 inches.

Weight: 24½ lb.

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Letters to the Editor TAPE EXCHANGES IN ESPERANTO

I AM interested in contacting enthusiasts who can speak or who are learning Esperanto from any country. If they are stamp-collectors, so much the better.

G. STEPHENSON.

"Hazelwood," Langshott,
Horley, Surrey.

Readers wishing to contact other enthusiasts are invited to avail themselves of our "Tape Exchange feature (page 115) which lists, without charge personal and equipment details for the information of other readers. Just fill in and return form on page 118, and your name will appear in the first available issue. In answer to past questions, names are not repeated unless additional forms are received.—EDITOR.

SAJA SPARES AND SERVICE OFFER

WE have recently been inundated with requests for spares for the Saja range of tape recorders. It would appear we are now the only source for Saja spares in this country, and our stock will continue to be available for some years.

The range of Saja machines is no longer available, but we are, and will continue to hold comprehensive stocks of spares for the MK50 de luxe, M5 "Export," M40, M42, and M45.

We can also undertake to service these machines at our 266 Waterloo Road address.

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NEW PRODUCTS

**AKAI INTRODUCE
BATTERY/MAINS
STEREO MODEL**

HIGHLIGHT of the month's new products, and destined to create great interest in tape recording circles is the introduction to this country of the new stereo battery/mains tape recorder manufactured by Akai in Japan.

The first of the production models was received at our office straight from Japan at the beginning of February, and is now being reviewed for inclusion in our April number.

The new recorder, designated Akai X-IV, is a four-track, four-speed completely transistorised machine capable of stereo and mono recording and playback from AC mains or batteries. Outstanding feature of this 135 guinea machine is the quoted frequency response of 40-25,000 cps at the top speed of 7½ ips (40-20,000 cps ± 3 dB). Other responses (all ± 3 dB) are 40-17,000 cps at 3½ ips, 30-11,000 cps at 1½ ips, and 30-5,500 cps at 15/16 ips.

Wow and flutter is given as less than 0.16 per cent, 0.17 per cent, 0.28 per cent, and 0.35 per cent at the respective speeds. The signal-to-noise ratio is rated as 40 dB below the recorded signal level, and channel separation as better than 60 dB at 1,000 cps.

The X-IV illustrated top right, will accommodate up to five-inch reels, providing a playing time of 32 minutes per track using standard-play tape (600 ft.) at 3½ ips. Rewind for 600 ft. being achieved within 75 seconds.

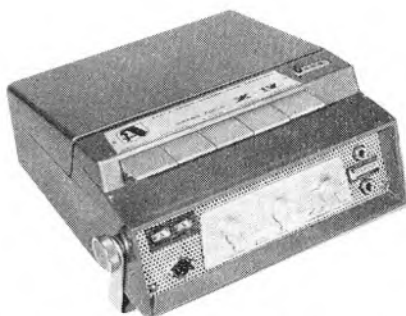
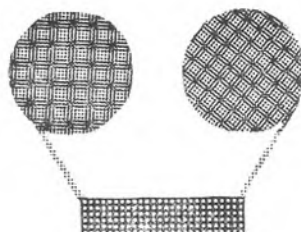
Among the many features are a pause control, digital rev. counter with a quick reset to zero button, two VU recording level meters which also serve as battery life indicators, push-button operation, and a combined AC mains adaptor which serves as an automatic charging device, power conversion circuit and main amplifier of the right-hand channel.

The machine operates from AC power supply with voltage selection from 105, 120, 135, 225, and 240 volts; a rechargeable battery, capable of providing six hour's continuous stereo recording; or four 1½-volt torch batteries.

Other features include special terminals which provide for connection from the recorder's own pre-amplifier to an external main amplifier, and from the X-IV's main amplifier to external loudspeakers. Stereo earphones provide quality monitoring.

A 5 x 3 inch oval loudspeaker is included in the smart all-metal case, and this handles one channel of the two watts per channel power output. The transistor line-up includes six 2SB302, four 2SB75, three 2SB370, a 2SB77, and a 2SB89 for the recorder; plus two 2SB370, a 2SB77, and a 2SB89 for the combined mains adaptor/amplifier.

Included in the price are two high sensitivity dynamic microphones complete with adjustable table stand, floor stand mounting, or lavalier neck halter, five-inch reel of tape, spare spool, vinyl cover, two connecting cables, splicing tape, and the most carefully designed transportation packing yet seen



for a tape recorder. The machine arrived in a wooden box, with eight springs anchored to each corner of the box suspending the recorder in mid-air.

Optional accessories include a durable leather carrying case, with storage section for microphones; a remote control foot-switch; and a seven-inch extension reel adaptor for rewinding tape on to a five-inch reel.

The Akai X-IV is 10 inches deep, 9½ inches wide, and 4 inches high. It weighs 11 lb. (12½ lb. complete with batteries and case).

Also announced this month from Akai are two further stereo machines selling at 110 and 151 guineas. Details and photographs will be published next month.

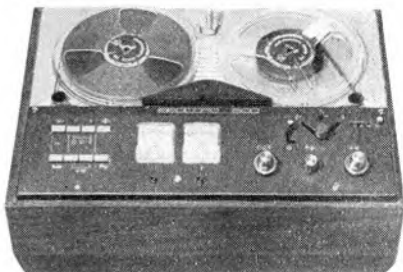
Pullin Photographic, 11, Aintree Road, Perivale, Middlesex.

**NEW TRANSISTORISED
UNIT
BY BANG & OLUFSEN**

ST. ALDATE WAREHOUSE recently introduced the latest transistorised tape recorder from the Danish firm of Bang and Olufsen.

The new recorder, designated the Beocord 1500, is similar in design to their earlier Stereomaster tape recorder (now known as the Beocord 2000).

Three tape speeds are incorporated on the new machine (illustrated below) which will



retail at 89 guineas. The quoted frequency response is 40-16,000 cps at 7½ ips, 40-14,000 cps at 3½ ips, and 50-6,000 cps at 1½ ips, all

± 2 dB. Signal-to-noise ratio is given as better than 50 dB; wow and flutter as better than 0.075, 0.011, and 0.018 per cent respectively. Channel separation is quoted as better than 45 dB.

The Beocord 1500 will accommodate spools of up to seven inches, providing a playing time of 32 minutes per track using standard-play tape at 7½ ips. The recorder can be simply adapted by the user for two- or four-track mono or stereo operation.

Among the features are meter recording level indicators, pause control, automatic tape end stop, safety erase lock, separate record and replay heads, separate bass and treble cone controls, and a digital rev. counter.

Unlike the Beocord 2000, it does not include facilities for mixing or an output replay amplifier. The Beocord 1500 is described as being more suitable for use with an existing hi-fi set-up.

The new model measures 17½ x 14 x 10 inches, and weighs 33 lbs.

St. Aldate also announce a change of address for their After-Sales Service Department. This is now at Eastbrook Road, Eastern Avenue, Gloucester (Gloucester 25634), and is responsible for spares and technical data for the servicing of equipment by Bang and Olufsen and the Japanese company of Sony.

St. Aldate Warehouse Ltd., Electrical and Radio Division, Innsworth Lane, Gloucester.

FI-CORD INTRODUCE NEW BEYER MICROPHONES

FOUR new Beyer microphones have been introduced by Fi-Cord International. All designed for amateur and professional use, the first of the new units is the M55.

This is an omni-directional microphone housed in an elegantly shaped die-cast zinc housing. The quoted frequency response is



70-16,000 cps and the deviation of sensitivity is given as ± 2 dB. The output impedance is 200 ohms and 80 K ohms. It sells at £6 17s. 6d.

The second unit is the cardioid M80 (illustrated on a stand in our photograph). With an output impedance of 200 ohms and 80 K ohms, it has a quoted frequency response of 50-16,000 cps. The price is £12 18s.

Both the above microphones are fitted with folding table stands, and can be supplied with three-pin continental plugs complete with matching transformer for use with continental tape recorders.

The third Beyer unit is the M110 dynamic directional microphone (illustrated with a lavalier neck halter secured) which is designed for theatrical use. The quoted frequency response is 60-12,000 cps and the impedance is 200 ohms. It retails at £28 11s.

The final new introduction is the Beyer M610 (illustrated top left of our photograph). This features a built-in music/speech (bass attenuation) and an on/off switch making it suitable for use under unfavourable acoustic conditions. This cardioid instrument is available with an external matching transformer bringing the impedance up to 50 K ohms. For public address applications, the M610 is available in 37.5 ohms impedance with a balanced line. Variations in price are as follows: 37.5 ohms with 16 ft. lead, £22 19s.; 200 ohms with 4½ ft. lead, £22; and 50 K ohms with transformer and 12 ft. lead, £26 12s.

Fi-Cord International, 40a, Dover Street, London, W.1.

BAIRD ANNOUNCE THEIR LATEST RECORDER

BAIRD have announced a further increase in their range with the introduction of the Varsity (Model 101). This is a four-track three-speed machine selling at 33 guineas.

With accommodation for seven-inch reels, it provides a playing time of 64 minutes per track using standard-play tape (1,200 ft.) at 3½ ips. Other speeds are 7½ and 1½ ips. Rewind for 850 ft. of tape is achieved within 2½ minutes.

Among the features are facilities for parallel track recording prior to superimposition, three digit rev. counter, neon recording level indicator, independent bass and treble controls, and a built-in 8 x 5-inch elliptical loudspeaker. The power output is rated at 3½ watts maximum. Inputs are provided for microphone (1-mV, 20 K ohms), radio/gram (200 mV into 250 K ohms) with mixing facilities provided. Outputs include high impedance for external amplifier, and low impedance (3-5 ohms) for external speaker with muting switch for internal unit incorporated.

The tube line-up includes an ECL86, EM87, EL84, and OC44 transistor, OA81 diode, and a C3B bridge metal rectifier. Mains supply required for operation is 210 250 volts AC, 50 cycles only. Power consumption is rated at 30 watts.

The Varsity measures 16½ x 16 x 8 inches, and weighs 24 lb.

Supplied with the recorder is a magnetic stick microphone and stand, spool of tape, spare spool, and recording lead.

Baird TV Distributors Limited, Empire House, 414, High Road, Chiswick, London, W.4.

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... also consult Audio Supply Association for unbiased information on reliable recording and reproduction equipment to suit your specific requirements. Members receive information on latest products and also benefit from special bulk purchases of tapes, equipment, accessories. (Membership 7s. 6d. p.a.). Please specify requirements. Sixty-page HI-FI catalogue 4s. 6d.

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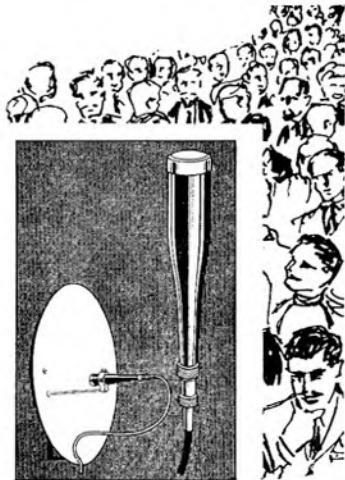
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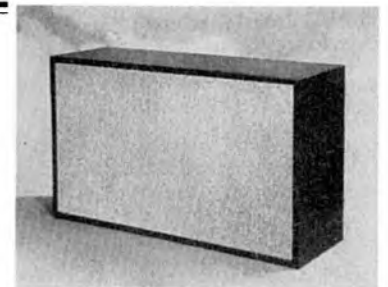


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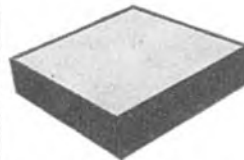


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ADDRESS





News from the Clubs

AYLESBURY

A change of secretary is announced for the tape recording section of Hazell's club, the social society of an Aylesbury printing works.

The new secretary is R. J. Johnson of 83 Abbey Road, Aylesbury, Berkshire.

BRIGHTON

The first meeting of the New Year for the Brighton club saw members listening to the playback of tapes made during the Christmas recess. Chairman R. Vivian took the chair first playing his recordings of carol singers who called at his home. Another member, Mr. Shanks, then produced the winning tape in last year's BATRC. Ray King's "Sink Symphony" was greeted with mixed feelings, most popular being amazement at the simplicity of the whole programme with a minimum of recorded material; but later all members felt that this year's contest should see a greater number of entries from the club.

At the following meeting many members were prevented from attending due to extremely bad weather. Those that attended were entertained to a tape received from a contact in Singapore by secretary Ken Upton.

The January 27 meeting saw the completion of a lecture by Mr. Shanks on the theory behind an equalisation circuit for use with a transcription deck. Earlier Mr. Vivian played a selection of stereo tapes recorded in various local churches, including one particularly well-recorded tape of a fourteen strong choir.

Secretary: K. W. Upton, 47 Kingsley Road, Brighton, Sussex.

CATHOLIC TAPE RECORDERS

A change of address for the U.K. Representative is announced for the tape exchange organisation known as Catholic Tape Recorders, International.

With a membership open to anyone, the club reports a successful year with U.K. Membership increasing by 250 per cent during the past year. Feelers are now out to tap the continental field for membership, and already new conquests have been made.

Among the activities of the society are round-robin tapes, slide shows, and taped discussion groups, and a service for the blind. The U.K. branch is at present organising the transference of copies of the American library to this side of the Atlantic. With the introduction of competitions, this should grow to be of great help to members.

The first of two marriages announced this month comes from CTRI, who

report that Maura Warren, previous U.K. Representative for CTRI, married the club's president and founder-member Jerome Ciarocchi after visiting him in America. They now live in San Antonio, Texas.

U.K. Representative: A. Dudley Chadwick, 91 Manor Drive, Upton, Wirral, Cheshire.

COTSWOLD

The most recent meeting of the Cotswold society was devoted to a live recording session, designed to assist members without experience or elaborate equipment. Colin Woods and Eric Jones organised the session, the object of which was to obtain an accurate recording of one item rather than record a whole programme. Bill Martin at the piano and Ray Tingley at the electronic organ acted as "signal generators".

Later in the evening Bill abandoned the piano in favour of the clarinet, and the session terminated with a short "jam session" for organ and clarinet.

Secretary: Peter D. Turner, Pike Cottage, Frampton Mansell, Stroud, Gloucestershire.

GLASGOW

The opportunity to make some live recordings was offered to members of the tape section of the Radio Club of Scotland when the producer of a local amateur drama group invited members to rehearsals. The idea was for the tape members to provide the actors with recordings of their Christmas show rehearsals to rectify speech and timing errors.

During recent meetings, Gordon Calder demonstrated his home-built tuner/amplifier. Peter Douglas lectured on the art of interviewing, and John Wood presented his programme "The Best of Spotlight". This was a review of the best items from the last six issues of the club's sound magazine "Spotlight".

Arrangements have been made for club members to visit the Cloch Light-house on the Firth of Clyde. This exercise on location recording is just one of the many outside recordings to be planned for the first half of the year.

Secretary: J. A. Douglas, 113 Novar Drive, Hyndland, Glasgow, W.2, Scotland.

ILFORD

Members of the Ilford tape society recently spent the evening discussing essential facilities for a tape recorder designed for live recording and quality playback for less than £100.

It was finally decided the "Ilford recorder" would require two speeds, 7½ and 3½ ips, a minimum spool size of seven inches, three inputs and three output sockets, and separate record and playback heads giving monitoring facilities. Exceedingly fast rewind was considered the least desirable feature.

A large party of members visited the International and Continental telephone exchange at Faraday House in the City of London recently. There they were entertained by GPO representatives who described the STD equipment using

animated pictures and telephones to illustrate the lecture. Some amazement was shown by members who witnessed operators connecting with New York and Sydney in less time than it takes to connect a local call.

Later in the month, the club welcomed Messrs. Truvox along for their third club demonstration. Mr. K. C. Smith demonstrated the new Series 90 equipment, and the first of the Truvox amplifiers, the TSA100. Of particular interest was the head covering on one machine which hinges back to provide a splicing block.

When the committee organised a prize of a spool of tape for the best publicity poster, some 27 entries were submitted from the 21 members. Brian Heard's winning design will be displayed at prominent spots in the Borough.

Secretary: Dave Bolton, 97 Seventh Avenue, Manor Park, London, E. 12.

IPSWICH

A talk on the history and development of tape and disc recording was given to the members when Mr. A. G. Griffith the Recording Manager of the World Record Club visited the Ipswich club on January 21. Details of the techniques used at recording sessions were described to members who were also entertained to mono and stereo demonstrations using both forms of recording.

Earlier, members had invited Mr. A. W. Dakin of Elstone Electronics Ltd., who spoke about and demonstrated the Tandberg range of equipment. Again, mono and stereo recordings were heard, using the Tandberg recorders in conjunction with a Scott stereo amplifier and Tandberg dual-concentric loudspeakers.

At the December 17 meeting, David Lockwood presented his tape and cine show of travel films he had produced. This was followed on January 7 by a very successful social evening and buffet dance attended by more than fifty members and guests.

Secretary: Malcolm Wilding, 31 Barwin Road, Ipswich, Suffolk.

NATIONAL FEDERATION

A change of address is announced for the secretary of the British Federation of British Tape Recording Clubs.

With the change of address is noted an increase in annual membership decided at last year's AGM. The new rate for club is two guineas; with the fee for Associate members set at 15s.

Some forty clubs now are registered with the F.B.T.R.C., and since last year's Audio Fair, over 80 Associate members have been enrolled.

Increased success is reported by the secretary regarding the Federation's copyright agreement with the Mechanical-Copyright Protection Society. This allows member clubs and Associate members to record copyright material for use in club rooms, members' homes, for charitable purposes, and for programmes entered in local, national and international competitions. The annual fee remains unchanged at 30s. for clubs (5s. Associate members).

Secretary: E. Roger Aslin, 53 Whitehouse Avenue, Boreham Wood, Hertfordshire.

NORTH LONDON

Ron Goodwin, newly-elected chairman of the North London tape club performed his first official duty at the annual Christmas party on December 9 when he presented a pewter tankard, the trophy for the club's "Tape of the Year" to Sinclair and David Scott.

Their pre-Christmas activities include a special edition of the club's newsletter for the blind "Enfield Microphone". Included were seasonal greetings from the Mayor of Enfield, together with messages from local newspaper columnist L. E. Eastwick who also read his own column "Townsmen's Notes" on to tape, and Miss Paula Loommore, the current Miss Enfield, and Father Christmas from a local store.

The following edition, issued in the

New Year included an introductory peal of bells of St. Alban's cathedral. The Enfield Scooter club have undertaken a new round of four listeners for the programme.

Secretary: John Wilson, 50 New Kent Road, London, S.E.1.

U.I.T.R.C.

News of another tape exchange organisation is received from Mr. J. Riley of the Unitas International Tape Recording Club.

The club forms part of the Unitas Social club, organised by a large insurance company in the City of London. Among their activities is the compilation of quizzes for social evenings, dubbing exercises, and tape exchange contacts.

Further details are available from the secretary.

Secretary: T. Maloney, 30 Alexandra Street, London, S.E.14.

WORLD ROUND-ROBIN CLUB

The international tape exchange organisation, World Round-Robin Club, announce the introduction of stereo tapes to their circulation. Already in circulation are two and four-track international round robins.

Included in the usual programme of news and information is information concerning members wishing to establish tape contacts.

Secretary: John Page, 45 Elgin Avenue, Belmont, Harrow, Middlesex.

WORLDWIDE TAPETALK

Another marriage sparked off through an exchange of tapes is announced by Worldwide Tapetalk. RAF Sergeant Geoff Abbott, stationed in England, established contact with Sue, WWTT's "Girl with the Golden Voice," who was resident in Paris, through the organisation's directory of members. Friendship ripened into romance, a meeting was arranged, and Sue and Geoff were married at the British Embassy in Paris.

Sue has recently been appointed European Representative for WWTT, and readers resident outside the U.K. interested in talking and listening to the tape-talking world at large are invited to contact Sue at 20 Rue de Seine, Thomey (S-et-Marne), France.

Secretary: Charles L. Towers, 35 The Gardens, Harrow, Middlesex.

TAPE EXCHANGES

TAPE recorder owners who wish to contact others with similar interests, to exchange news and views by tape are invited to fill in and return the form on page 118 giving their name, age, address, special hobby or interest for this section.

Details given here also include speeds and spool size to be used, name of recorder, and special area to be contacted.

Ainsworth, Eric (28). 61, Queen Street, Clayton-le-Moors, Accrington, Co. Durham. Hi-fi, magic, classical music. 7½, 3½ ips. 7-inch spool. Grundig TK830/3D. USA, UK.

Artington, Trevor (38). 3A, Egerton Road, Blacon, Chester, Cheshire. Astrology, classical music. 3½, 1½ ips. 3½-inch spool. Japanese National battery portable. Female contacts preferred.

Ashcroft, George R. S. (34). 4, Wilson Grove, Garston, Liverpool, Lancashire. Church bells, bugle bands, music. 7½, 3½, 1½, 15/16 ips. 7-inch spool. Stella ST459.

Ault, Charles (40). 85, Dale Road, Crayford, Kent. Sound effects, fairground organ music, musicals. 3½ ips. 5½-inch spool. Grundig TK18. Scotland and Copenhagen.

Brown, Charles A. (37). 18, Handel Street, Liverpool 8, Lancashire. Boxing, folk and C/W music. 7½, 3½ ips. Seven-inch spool. Truvox RE15. USA, UK, Commonwealth.

(Continued on page 118)

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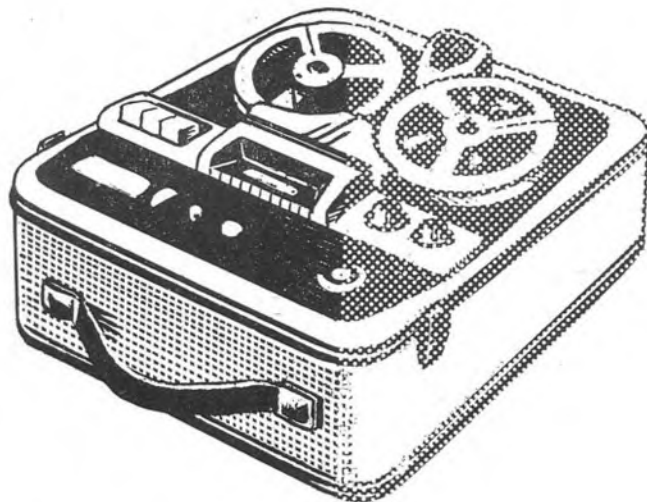
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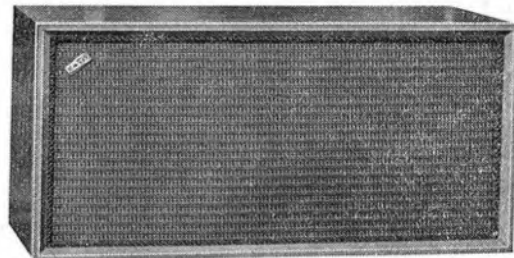


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Advice on Buying a Tape Recorder by J. F. Ling (1963). 40 pages. 2s. 6d.

Which! What! How! Where! Why! The answers are given and the comprehensive book contains chapters on Preliminary Considerations, The Tape Deck, The Amplifier, and Testing Tape Equipment.

A to Z in Audio by Gilbert A. Briggs (1960). 224 pages, 140 illustrations. 15s. 6d.

A first class book of reference.

Cabinet Handbook by Gilbert A. Briggs (1963). 112 pages, 90 illustrations. 7s. 6d.

Intended for the do-it-yourself man, and contains vital information on design and acoustic principles particularly in relation to compact enclosures which are now so popular for stereo.

Hi-Fi for the Music Lover by Edward Greenfield (1959). 40 pages. 3s.

Mr. Greenfield, well-known music critic of the "Guardian," sets out to help musicians and music lovers to cope with the baffling technicalities of recorded sound. He aims at giving the music lover at least a basic know-how to become a hi-fi enthusiast without developing into a hi-fi maniac.

High Fidelity Pocket Book by W. E. Pannett. 304 pages. 40s.

Clear explanations of each item in the chain of a high fidelity installation are accompanied by practical hints for the enthusiast.

How to Record Weddings by Paul Addinsell. 32 pages, illustrated. 3s.

Covers in great detail this important event—Preparatory Work—Microphone Positioning—Equipment, etc.

Loudspeakers (5th edition) by Gilbert A. Briggs (1963). 336 pages, 230 illustrations. 25s.

All aspects of the design and performance of loudspeakers and enclosures are dealt with in non-technical terms.

Practical Hi-Fi Handbook by Gordon J. King. 224 pages. 25s.

A guide to choice, installation and servicing of equipment, for dealer, engineer, and amateur enthusiast.

Practical Stereophony by H. Burrell-Hadden (1964). 159 pages. 37s. 6d.

The author, an instructor at the B.B.C., has been actively engaged for many years in research in this field. As a result the book is mainly directed towards those who make this art their profession, but there is much for the amateur enthusiast as well.

Sound Effects on Tape by Alan Edward Beeby. 66 pages. 3s. 6d.

How would you get on to tape the sound of a storm at sea, or a ghost in a haunted house, or a man splashing through a sea of mud? Answers in simple language to these and many other sound effects problems are given in this first-class little book.

Tape Recording and Hi-Fi by Douglas Brown (1961). 160 pages. 5s.

This interesting, informative and down-to-earth book by the Editor of "TAPE Recording Magazine" is now available as a paperback.

Transistors Work Like This by Egon Larsen (1962). 10s. 6d.

In the "Science Works Like This" series the book is well-illustrated and intended for the youngster.

You and Your Tape Recorder by Norman Paul (1962). 4s.

Very good value by a past winner of the British Amateur Contest.

Introduction to the Tape Recorder (Revised edition 1964-65) by Charles Langton. 48 pages, many diagrams. 3s. 6d.

Best possible value for the newcomer. The technician, however, has not been left out and the radio service apprentice studying for the R.T.E.B. Radio Servicing Certificate will find in the text sufficient material to progressively support his class work.

Tape Recording Yearbook 1965. Just out! 7s. 6d.

The 1965 edition contains all the well-known facts and figures of earlier editions, revised to date, as well as important contents vital to all interested in this field. Features include Club Secretaries addresses, Recording as a Group activity, Glossary of Technical terms, etc. Only available up-to-date catalogue of EVERY TAPE RECORDER on the market. Compiled by the staff of "TAPE Recording Magazine," this Yearbook is a must!

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CLASSIFIED ADVERTISEMENTS

TAPE EXCHANGES

(Continued from page 115)

Rayburne, J. (50). Safari Kwisha, Harnwood Road, Salisbury, Wiltshire. Colour photography, history, travel, Loom Society. 3 1/2 ips. 5 1/2-inch spool. Grundig TK23. Overseas only.

Redgrave, Clive (26). 40, Marston Street, Ifley Road, Oxford. Cinema, theatre. 7 1/2, 3 1/2 ips. 8 1/2-inch spool. Ferragroup 4A/N.

Richards, Michael (26). Lantivet Bungalow, Lanteglos, Fowey, Cornwall. 3 1/2 ips. 7-inch spool. Philips EL3541. Overseas only.

Robson, Clifford (24). 32, Prince Park, Chaulden, Hemel Hempstead, Hertfordshire. 8 mm and 35 mm photography, hi-fi, sound effects, amateur video recording, travel, gimmick recording, radio, TV, cars, films. Popular music. 7 1/2, 3 1/2, 1 1/2 ips. 8 1/2-inch spool. Sony TC500, four track stereo; Vortexion CB.L stereo, Philips EL3585 battery portable. Four-track stereo tapes only.

Schilder, Jon G. (27). 24, Windsor Avenue, Clacton-on-Sea, Essex. Philately. 1 1/2 ips. 4-inch spool. Philips EL3585 battery portable. France.

Seward, Miss E. Maude. 16, Lonley Street, Newcastle upon Tyne, 4, Northumberland. Humour, films, Baptist Church, pop music. 7 1/2, 3 1/2 ips. Seven-inch spool. Philips battery, Philips EL3542, Simon SP5 stereo. UK, USA, Congo.

Shackleton, Michael John (20). 42, Barwell Road, Sale, Cheshire. 35 mm photography, philately, hi-fi, trad jazz and classical music. 3 1/2 ips. 5 1/2-inch spool. Fidelity Playmaster Major, four-track, and Standard Unicorder. Australia, New Zealand.

Sidwell, H. Frederick (53). 9, Springfield Road, London, E.6. 35 mm photography, light and classical music. 7 1/2, 3 1/2, 1 1/2 ips. 7-inch spool. Philips EL3549, four-track. UK, Denmark, USA, Canada.

Smith, Peter W. (21). 1, Meadow View, Crockenhill, Swanley, Kent. Driving, pop music. 3 1/2 ips. 7-inch spool. Philips recorder. Female contacts preferred in UK.

Stang, Norman (21). 9, Monkton House, Pembury Road, London, E.5. Photography sport, music. 7 1/2, 3 1/2, 1 1/2 ips. 7-inch spool. Stella ST459, four-track.

Sullivan, George E. (38). 466, Gillott Road, Birmingham 6, Warwickshire. Photography, walking, sport, music. 3 1/2 ips. 5 1/2-inch spool. Fidelity recorder.

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Rushmore, Jennifer (17). 13, Eastview, Yaxham Road, Dereham, Norfolk. Photography, reading, pop music. 3 1/2, 1 1/2 ips. Five-inch spool. HMV, four-track. Norway, Greece, Australia.

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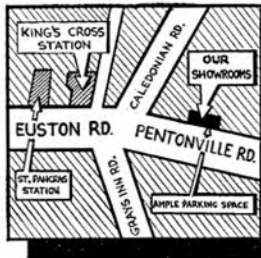
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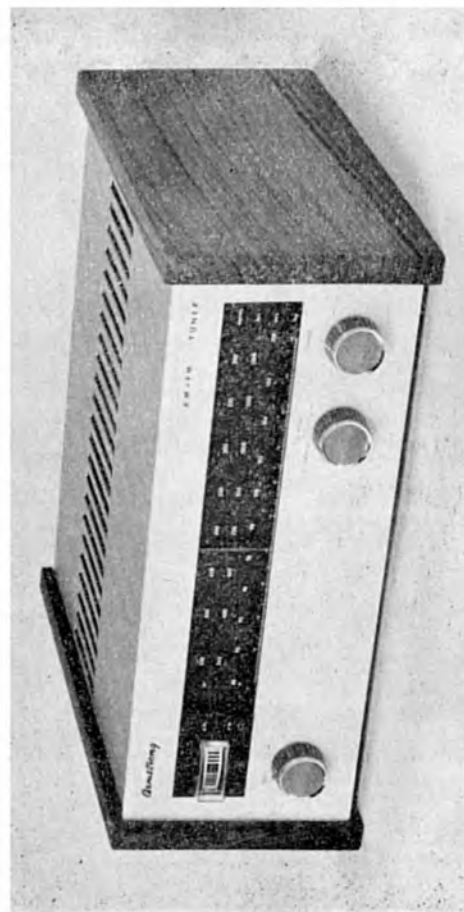
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Our saving on overhead costs is being passed on to you. NOW . . . you can really afford a portable tape recorder to take on holidays!

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60—10,000 c/s ±3db.

Sig./noise 38db. below test level. 50db. below peak. Weight 5 lbs.

3¾ ips NARTB standard, wide tone control, 4½ in. spool, over 2 hours recording time, two-track. Heads by Bogen, AC, Bias and erase. Straight-through amplifier.

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TAPE DECKS—HI-FI EQUIPMENT—MICS—RADIOS—SPEAKER SYSTEMS



Today's outstanding home entertainment is HI-FI.
YOU SAVE £££s BY CONSTRUCTING THESE FINE KITSSETS YOURSELF.



TA-15

TAPE AMPLIFIER UNITS: Models TA-IM and TA-15. The mono version, TA-IM, can be modified to the stereo version, TA-15, by the modification kit TA-1C. Special features include bias level control, recording level indicators, printed circuit boards.
TA-1C £6.15.0. TA-IM £19.18.0. TA-15 £25.18.0.

A Tape Recorder requires a Tuner

HI-FI FM TUNER Model FM-4U
Available in two units. Tuning unit (FMT-4U £2.15.0 incl. P.T.). I.F. amplifier (FMA-4U £13.3.0.) Printed circuit for I.F. Amplifier and Ratio detector own built-in power supply, 7 valves. Tuning range, 88-108 Mc/s.

Total Price £15.18.0 kit



FM TUNER

HI-FI AM/FM TUNER. Model AFM-1
Also available in two units as above: Tuning heart (AFM-T1 £4.13.6 incl. P.T.) and I.F. amplifier (AFM-A1 £21.16.6.)

Total Price £26.18.0 kit



AM FM TUNER

Equipment Cabinets



MALVERN

A range of equipment cabinets is available including kits, ready assembled cabinets or assembled and fully finished cabinets. Why not send for full details free of any obligation?
Prices from £6.19.6 to £29.8.0.

TRUVOX TAPE DECKS.

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High quality stereo Tape Decks.
D83-2 2 track for higher fidelity £31.10.0.
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TRUVOX D83



S-33

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HI-FI STEREO 6 W AMPLIFIER Model S-33
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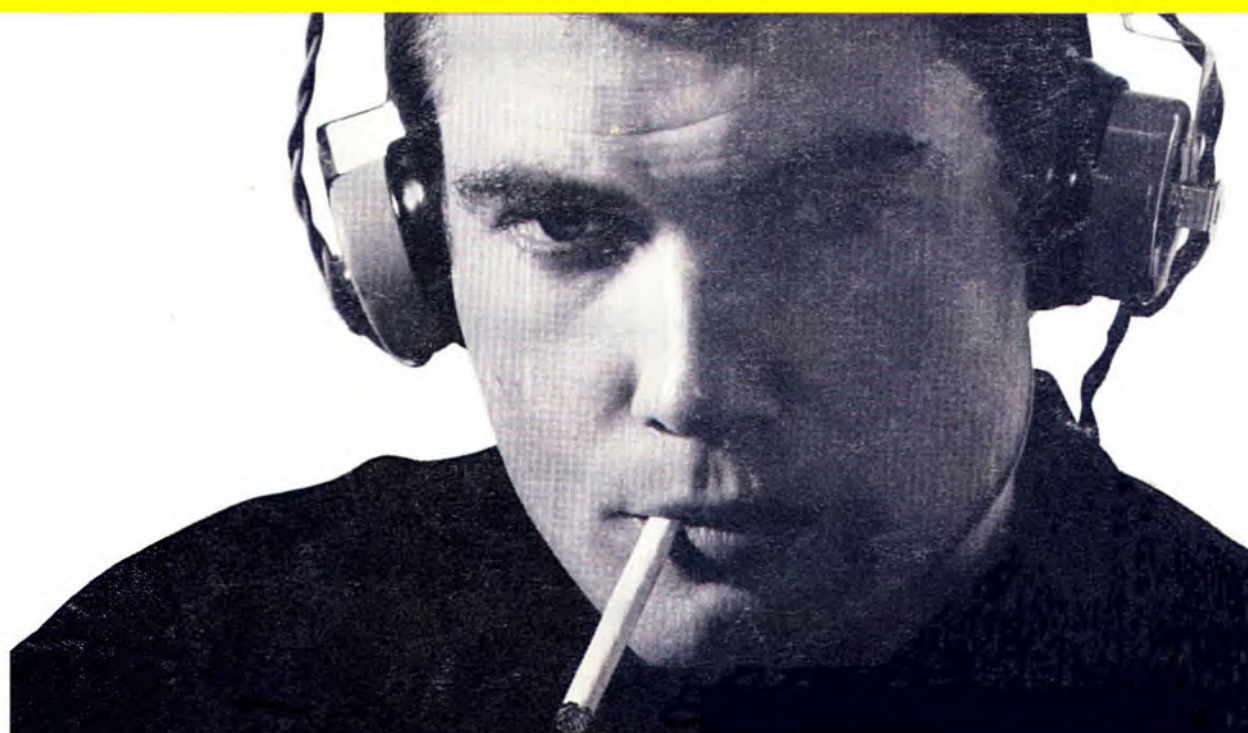
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T.2

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