MAY 1962
Vol. 4 No. 4

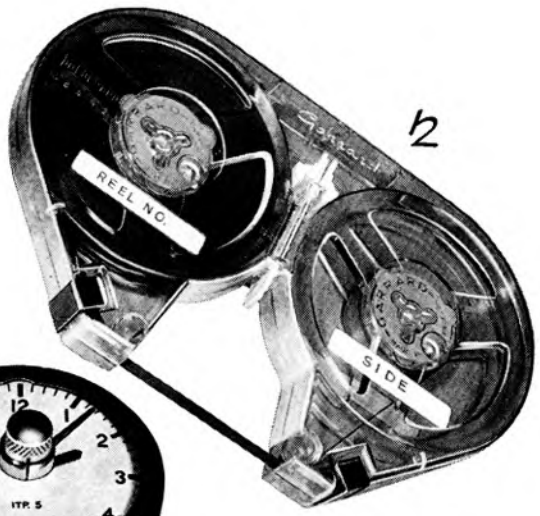
the TAPE RECORDER

PRICE 1/6

INCORPORATING "SOUND AND CINE"

IN THIS NUMBER

4 REASONS THAT MAKE THE Garrard TAPE SYSTEM SO SIMPLE



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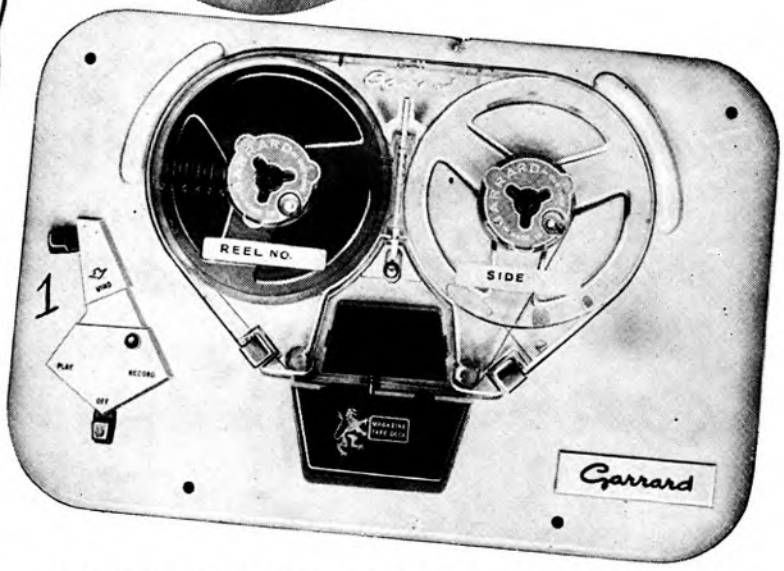

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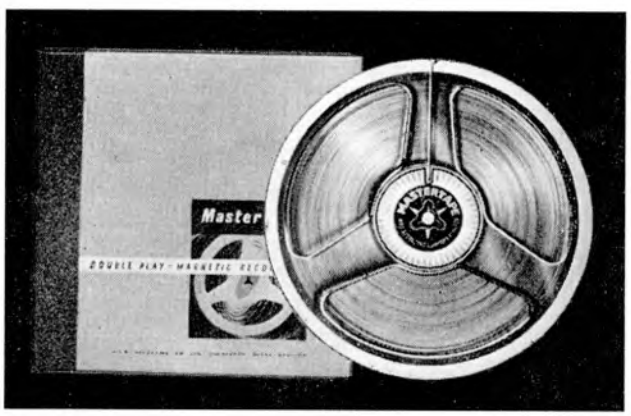

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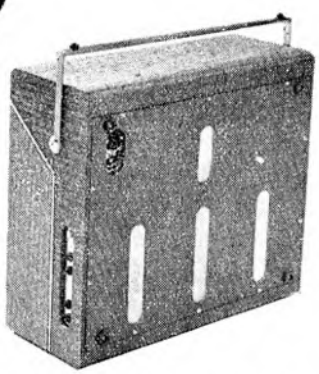

Cabinet designed by
LUCAS MELLINGER, A.R.I.B.A., A.M.T.P.I.

(above) ready for use and (right) as it looks when carried. Note that the handle does double duty as a carrying handle, and also as a support in the record/play position.

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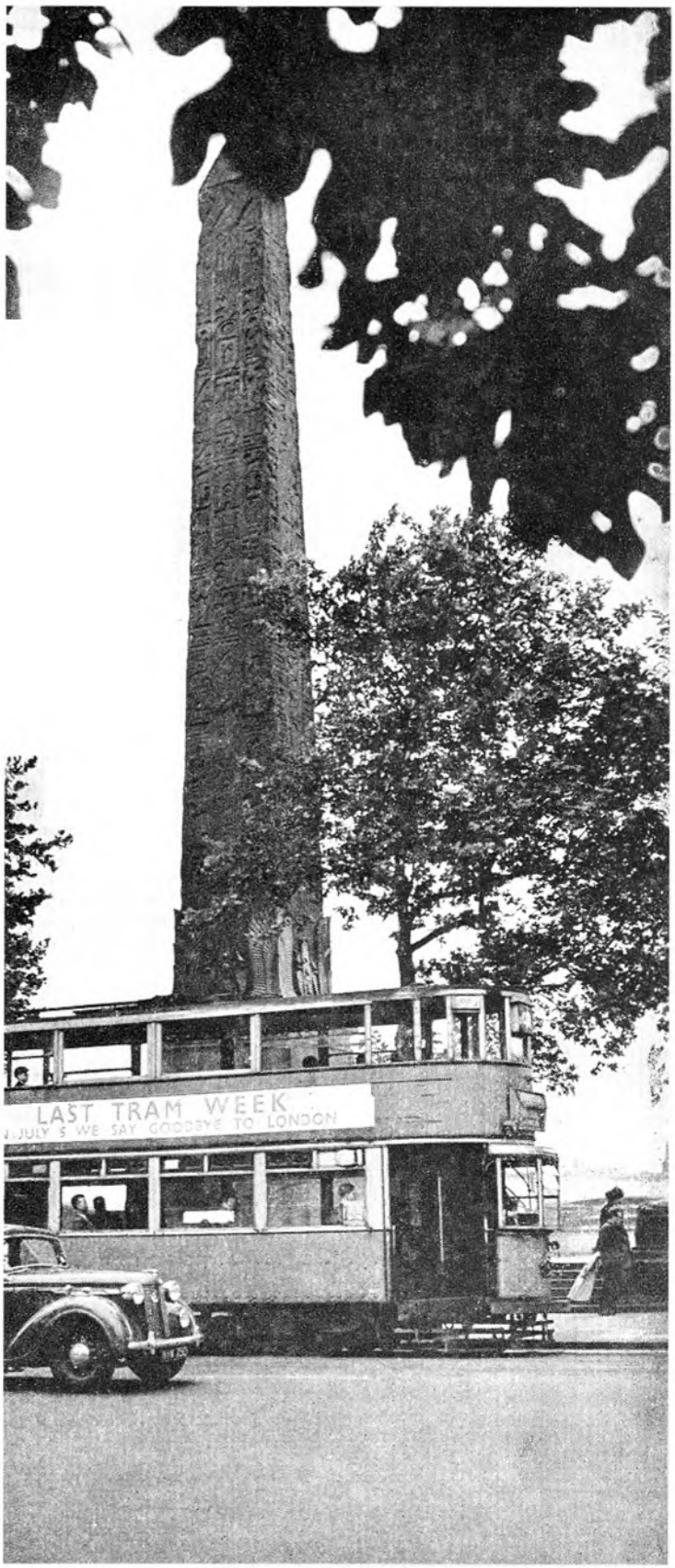

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EMI Emitape

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ET30

the TAPE RECORDER

MAY - - - - - - - - - - - - - - - - 1962
VOL. 4 - - - - - - - - - - - - - - - - No. 4

Editor - - - - - - - - - - - - - - - - MILES HENSLOW
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CONTENTS

EDITORIAL

ONE of the most interesting things to discover, in the realms of tape and audio covered by our two magazines, would be the approximate divisions of interests—the proportions of the various groupings—of all the people who have adopted tape and tape recording as a hobby. Short of a very thorough census, involving a most detailed questionnaire, this could never be ascertained. Even a sampling of a cross-section of tape users in the British Isles would not yield an accurate summary. It would be pointless for us to attempt to undertake it, for example, because the aggregate readership of *Hi-Fi News* and *Tape Recorder* is only some 52,000, and by now there must be considerably more than two and a half million tape recorders spread throughout the homes of this country; and, moreover, it would be fair to estimate that the majority of tape recorder owners do not read any magazine which deals with the subject. In this great majority lie the army of "problematical cases"—including, probably, nine hundred and ninety-nine occasional users, to every one person who has bought, and who uses, his machine for some very specialised and possibly very interesting job.

This subject may at first seem to represent mere idle and pointless speculation, but it is in fact a subject which—if a reasonably accurate answer could be found—could be of the very greatest interest and use to all concerned, and primarily to the people whose job it is to make the products we are all using. One thing which might well result, given the almost unobtainable answer, could be a very different approach to the market as a whole. Today, the manufacturer of tape recorders has to make (with a few very notable exceptions) an instrument which has the widest possible appeal to everyone, so as to be sure of the necessary slice of the annual sales to keep his factory busy and profitable. And because of this there must be many thousands of people who are either buying less than they should, or more than they need. The pages of directory entries in this year's edition of the **"Hi-Fi Year Book"** present this state of affairs in detail. Although the book divides the various classes of recorders as accurately as possible, and under such headings as *Professional*, *General Purpose*, *Battery Operated*, etc., there are overlaps in nearly every section. Only at the really high-priced "*Professional*" end of the scale do we find a small group of manufacturers whose plant is kept permanently busy, filling the needs of the truly "professional" user.

Summarised, the categories could very neatly cover: **Professional,** for broadcast studios, record manufacturers, film studios, and the like: **Semi-professional,** for advanced amateur workers, and for the professional users whose demands do not include the very high and costly standards that are necessary for the first category: **Professional Portables,** to work in with the first category: **Semi-professional portables,** to work in with the second category: **General Purpose Domestic** instruments: **General Purpose Portables,** and, finally **Tape Players.**

Such a classification—if it could be sensibly decided upon by the various manufacturers—would save a tremendous amount of energy, time and money now wasted by overlap. It would also mean that all buyers could expect better value for money in every case, because every machine would be designed, more or less, for its specific job; and buying would most certainly be a far simpler matter, because people would at least know what to look for, and what to ask for.

To give only one or two commonsense examples, the man who wanted a machine for playing recorded tapes *only* would not have to pay for all the unnecessary circuitry and switching that he now has to buy: the "play-it-once-a-month" amateur might save himself the cost of pause controls, super-imposition facilities, etc., which now complicate what he has to buy, and which also make it cost more: the "semi-professional" user could go out and select a machine which really would fall into that category—and not have to rack his brains, deciding which of the "all-purpose" recorders would give him the best bargain.

All the above is not meant to suggest that one manufacturer should make battery portables, and nothing else; but it does suggest that many manufacturers could make up their minds which markets to cater for, and so turn out one, two or three types of recorder, definitely and reliably classified—instead of making something that will appeal to the £33 purchaser, and making another model, with a few frills added, to appeal to the man who is going to spend £52.10.9.

As we said at the beginning of this column, life would probably be a lot easier (to say nothing of being very interesting) if it were known what the annual thousands of tape recorders that are sold were being used for. But, that being next to impossible to discover, the next best thing—and certainly the very best thing for makers and buyers alike—would be to formulate some plan for covering the market. *What about it?*

COVER PICTURE

OUR cover picture this month was taken by the B.B.C., and it shows some of the members of the 21st Special Overseas Course, held at the B.B.C.'s Staff Training Department. Here they are preparing an E.M.I. portable for use in one of the day's practical exercises. Many of our overseas readers will be particularly interested in this most cheerful gathering. Left to right (standing) are Mrs. Elaine Perkins, from Jamaica, who is filling in details of the recording on the box which will hold the completed reel of tape, and Miss Susan Booth (Assistant to the Overseas Instructor) who is checking that the E.M.I. (RE 321 model) is being prepared correctly. (Kneeling) Leander Komakec, from Uganda, plugs in the microphone, while Lazarus Rubongoya, from Uganda, and Gladstone Holder, from Jamaica, place the tape in position.

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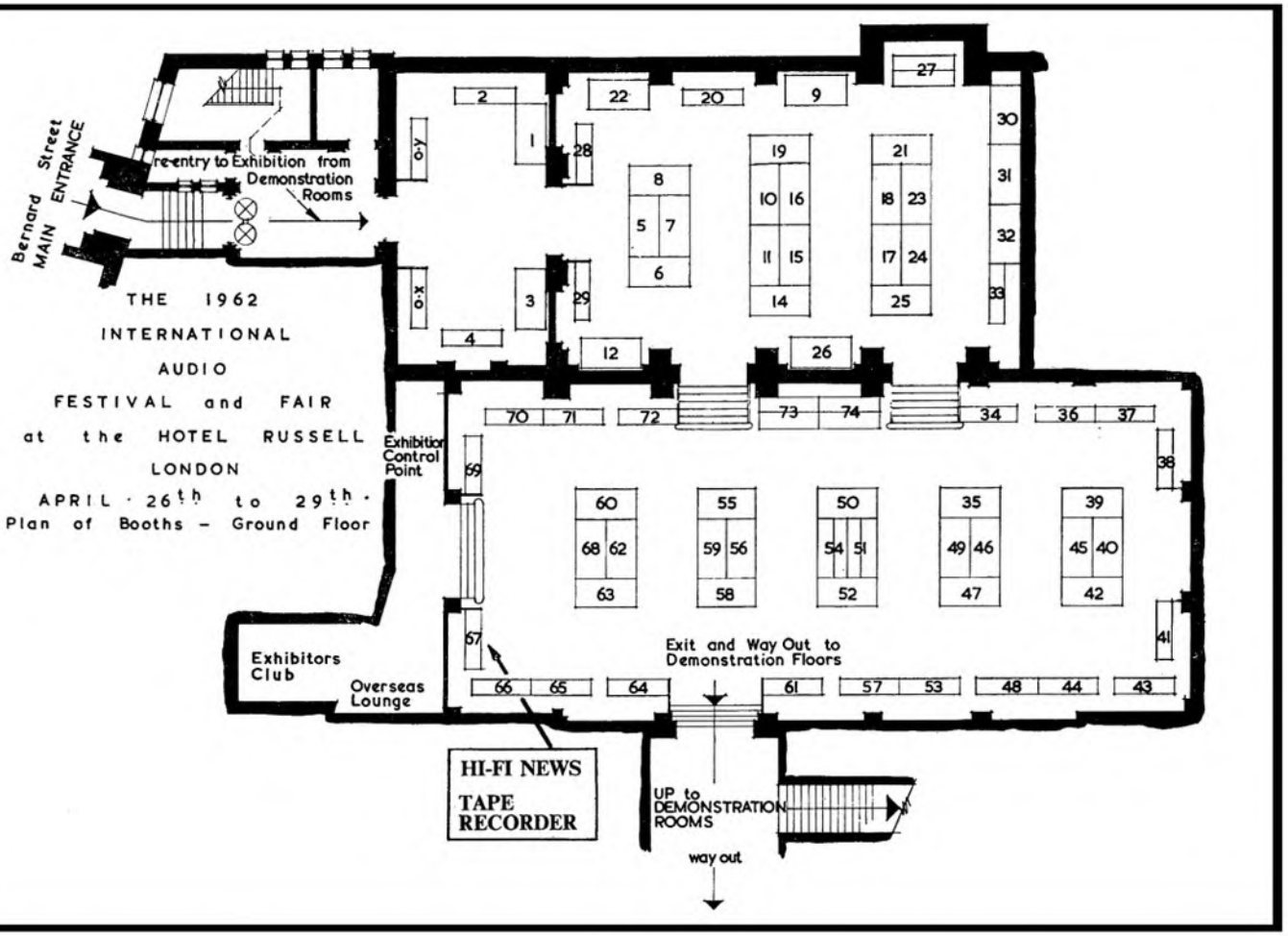
A.K.G.	69	321
Ampex (Gt. Britain) Ltd.	1	254
Armstrong Wireless & Television Co. Ltd. ...	9	359
Aveley Electric Ltd.	19	355
BASF	36	312
Braun Electric International S.A.	OX	319
Brenell Engineering Co. Ltd.	70	259
Chapman (Ultrasonics) Ltd.	17	347
Collel Ltd.	48	320
Clairtone Sound Corp. of Canada, Inc. ...	12	161
Clarke & Smith Manufacturing Co. Ltd. ...	7	211
Cosmocord Ltd.	64	302
The Decca Record Co. Ltd.	68	212
Denham & Morley Ltd.	40	118
E.M.I. Electronics Ltd.	54	354
Elstone Electronics Ltd.	24	255
A. C. Farnell Ltd.	23	—
Fi-Cord Ltd.	71	311
The Ferrograph Co. Ltd.	61	247
Garrard Eng. & Manufacturing Co. Ltd. ...	37	248
Gevaert Photo-Production N.V.	60	122
Goldring Manufacturing Co. Ltd.	53	215
Goodmans Industries Ltd.	14	317
Grampian Reproducers Ltd.	59	252
Grundig (Gt. Britain) Ltd.	8	115
Highgate Acoustics	55	314
K.E.F. Electronics Ltd.	20	214
H. J. Leak & Co. Ltd.	4	113
Leevers-Rich Equipment Ltd.	22	313
Lustraphone Ltd.	6	149
Lowther Manufacturing Co. Ltd.	34	237
Minnesota Mining & Manufacturing Co. Ltd.	49	120
M.S.S. Recording Co. Ltd.	35	
Mullard Ltd.	10	111
Miles Henslow Publications Ltd.	67	
Metro-Sound Manufacturing Co. Ltd. ...	72	112
Pamphonic Reproducers Ltd.	15	—
Parman Electronics Ltd.	11	352
Philips Electrical Ltd.	46	342
Planet Projects Ltd.	OY	233
Pye Ltd.	30	234
Reslosound	18	—
Rola Celestion Ltd.	58	348
Radford Electronics Ltd.	5	121
Record Housing	63	213
Recording Devices Ltd.	56	114
Reflectograph Tape Recorders	16	152
Rogers Developments (Electronics) Ltd. ...	2	202
Robuk Electrical Industries Ltd.	52	315
Simon Equipment Ltd.	65	220
Saga Records Ltd.	57	159
Shure Electronics Ltd.	43	361
S.M.E. Ltd.	66	
Soundcraft Magnetics Ltd.	26	218
Standard Telephones & Cables Ltd. ...	50	
A. R. Sugden & Co. (Engineers) Ltd. ...	47	304
Tannoy Products Ltd.	39	204
Tellux Ltd.	74	117
Teppaz S.A.	45	222
Truvox Ltd.	44	336
Vitavox Ltd.	25	337
Vortexion Ltd.	73	144
Waverley Records (Geo. Jeffrey) Ltd. ...	51	221
Welmec Corp. Ltd.	62	242
Wharfedale Wireless Works Ltd.	38	334
Wyndsor Recording Co. Ltd.	32	261
Whiteley Electrical Radio Co. Ltd.	33	322
Zonal Film (Magnetic Coatings) Ltd. ...	42	236



NEWS FROM AROUND THE CLUBS

FOURTEEN members of the newly-formed **Willesden Scout Film Unit** held an exercise on the Welsh Harp recently. Founded on March 1st to make Scouting films, its members lost no time in splitting up into four working sections with from three to five in each. Three of these formed teams consisting of a cameraman, director and continuity man and the fourth was a sound recording unit. Filming was in 8 mm colour and told the four-minute story, from a script, of the boys in a Sea Scout Patrol preparing, launching and rowing a boat. The boys were enthusiastic members of the 34th Sea Scout Troop (Neasden Methodist) under their Scoutmaster, Raymond Gray and his assistant Ian Jeffrey. Leading the camera teams were Keith Routley, David Walker and Derek Jones. John Moore was in charge of the sound-recording section. Still photos were taken by Ron Powell and Peter Morgan.

* * *

THE **Southampton Tape Recording Club** has moved to new premises, meetings will now be held fortnightly on Monday (March 26th) at Prospect House, 8 Manchester Street, Southampton.

The last meeting began with a demonstration of stereo given by Mr. Thear on a TK 60. Mr. Scarbro (ex Leeds club) then gave an interesting lecture on tape decks, using the TK 60 and a Ferrograph.

After refreshments, kindly provided by Mr. Scarbro's mother, the chairman, Mr. Wrigley, played extracts from a four-hour recording of the enthronement of the Bishop of Winchester. This recording was made by Messrs. Wrigley, Graham and Wallbridge, using three recorders and five microphones. Further information available from *R. J. Woolford,* 16 *Meadowhead Road, Bassett, Southampton.*

* * *

THE **Phoenix Drama and Tape Recording Society** of Windsor, Berks., covers Slough which is only three miles distant, and already has a number of members in this neighbourhood. The Society meets every Thursday at Windsor Guildhall from 7.30 p.m. to 10 p.m. Further details are available from *Mrs. H. Goddard,* 33 *Francis Road, Windsor.*

* * *

THE Annual General Meeting of the **West Herts Tape Recording Society** was held on March 7th. The three original committee members, namely Chairman John Grainger, Secretary Peter Holloway and Treasurer Sid Attwood were re-elected *en bloc* for a third term of office. Jack Hill was re-elected Social Secretary and Librarian. Owing to the Hospital Service not functioning for some time now it was agreed to dispense with this post and Michael Coates was elected as an ordinary member. However, John Grainger would continue to entertain the blind with club material besides some of his own individual recordings. Despite the small attendance, considerable discussion was given to the types of activities required in the future. After the A.G.M. there was a short time devoted to making the recordings for which the Safety Committee of Watford Borough Council had requested help. This dealt with the dangers of water in the home and on holiday, and the tapes will be played in the dressing rooms at the swimming baths so that people may be aware of the dangers of water.

Further details of club activities can be obtained from the Secretary, *P. Holloway,* 29 *Fishery Road, Boxmoor, Hemel Hempstead, Herts.*

* * *

RECENTLY, on a rather wintry evening, the **Brixton Tape Recording Club** were transported by coloured slides, taken by two of the members (Mr. Albert Porter of Brixton and Mr. Dale Griffiths of Australia), to the Highlands of Scotland, sunny Italy, gay Paris, the beautiful bulb-fields of Holland, and then back to London aglow with Christmas lights and snow. This "slide show" was accompanied by a very interesting tape commentary.

Membership is now spreading far and wide and a very warm welcome is extended to Mr. Peter Rodgers, at one time Secretary of the R.A.F. tape-recording club, now with the R.A.F. in Aden, who has become a member of our Group. As there must be many more tape-recorder owners living much nearer to the club than Aden, why not visit them on any Tuesday evening, or send a tape to the White Horse Public House, 94 Brixton Hill, London, S.W.2. For further details write to the Club Secretary: *R. G. Garrett,* 56, *Rattray Road, Brixton, London, S.W.*2.

* * *

PREPARATIONS for the Dedication of Coventry's new Cathedral are now well under way and members of the **Coventry Audio and Cine Club** are considering producing a tape of the Dedication service.

Mr. Lees of Decca Record Company Limited visited the club on March 13th demonstrating equipment and some of the new stereo recordings by Decca.

At the previous meeting, member Bill Tisdale gave a talk on fault finding, using the minimum of equipment, and members having faulty equipment no longer worry about repair bills. The meeting concluded with a demonstration by Keith Longmore of a column speaker built by himself. This impressed all the 25 members present. Further details of this club can be obtained from *W. Tisdale,* 6 *Dawlish Drive, Coventry.*

* * *

ON March 22nd, Peter Duddridge, a member of the **Cotswold Tape Recording Society (Cheltenham),** gave an illustrated lecture on "How to Produce your own Programme". This was based upon the monthly "Hospital Roundabout" which the Society prepares for local hospitals. This involves making numerous recordings, which have subsequently to be edited into a coherent programme, with announcements, interludes and the like. Peter gave an account of how this is done; and the lecture concluded with an actual demonstration of cutting and splicing, in which a "news item" badly marred by rustling papers, er-ing and um-ing and mistakes in reading was reduced by editing to a satisfactory spoken paragraph.

To conclude the evening, Ray Tingley gave a short demonstration of the "Tricolumn" loudspeaker (designed by R. N. Baldock, Hi Fi News April and May 1961), which he had just made. Neatly veneered and finished with grille, reflector and plastic trim, this presented a goodly appearance; but its sound bowled members over— particularly as it was powered by a thirty-shilling unit by

AROUND THE CLUBS

Goodmans, such as might be found in an ordinary AM radio set. This was deliberately fitted for the demonstration, in order to show what could be done for a total expenditure of *three pounds.* Members soon realised that there is no longer any need to endure indifferent reproduction, since this speaker can be fitted with a first-class unit, and still built for about ten pounds.

Further details available from *P. D. Turner, Cave Cottage, Oakridge Lynch, Stroud, Glos.*

* * *

TAKING just three meetings over the job, members of the **North London Tape and Hi-Fi Club** have built a three-channel mixer unit. A series of meetings devoted to equipment construction began with a talk and demonstration on soldering, choosing the correct iron for the job and the right way to handle it.

After an outline of how to read a circuit diagram had been given, various sections of the mixer were distributed for construction among members—some of whom had never before tried to build their own equipment.

At one stage it was discovered that only a small number could continue with the construction, and here the chairman, Sinclair Scott, and the guiding hand behind the meetings, member Ron Skeggs, took over to complete it. The mixer will be used in such instances as recording church services and the club's own quarterly news tape.

Visiting speakers gave the club two interesting talks recently. Mr. D. Dumville, of Northern Radio Services, demonstrated the company's Symphony Automatic Recorder, and Messrs. C. I. Jarman and Brian Sandford, of E.M.I., gave a talk on professional quality, demonstrating some of their range of professional equipment.

The club meets every Wednesday at *Bushy Hill Park School, Main Avenue, Enfield, Middlesex.*

* * *

ARRANGEMENTS have been made for the **Ilford and District Tape Recording Society** to move to the Gants Hill Library with effect from May 15th. Until that date meetings will be held at the Pioneer Committee Rooms, Ilford Lane, Ilford.

Plans for the coming months include outings to obtain interesting sound effects, the discussion and play back of member's tapes and the production of stories on tape for teaching deaf children. Full details of club activities can be obtained from *D. Bolton,* 13 *Gloucester Road, Manor Park, E.*12.

* * *

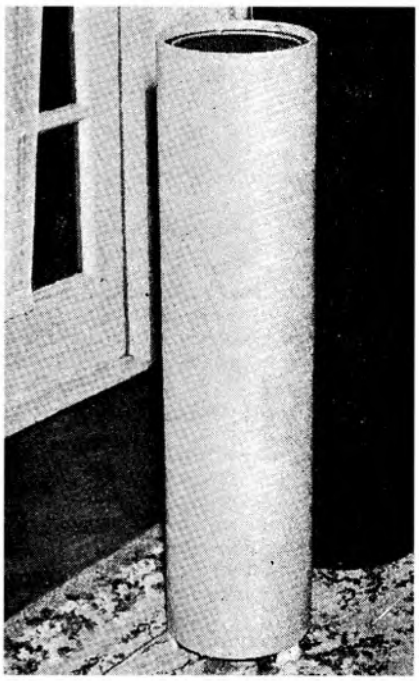
DESPITE the winter weather conditions, a good number of members attended the last club meeting of the **Whitstable and District Tape Recording Club.** The meeting commenced with a talk, given by the secretary, on battery tape recorders. Different models were discussed and the Steelman Transitape was demonstrated, with a number of recordings made during last summer.

The Playcraft Theatre Group of Canterbury, recently requested the assistance of the club in the preparation and recording of its entry for a national competition for drama on tape. After a number of rehearsals the recording was completed and the tape edited. The results are due to be announced in April. The drama group have asked the club's co-operation in producing sound effects for their next full length later this year. Full details of future meetings can be obtained from *T. Robinson,* 17*a St. Anne's Road, Tankerton.*

* * *

THE activities of **The Howard Wall and Bethnal Green Tape Recording Society** have been many and varied recently.

Three members namely Len Burchell chairman, Ron Gentle secretary and Les Hastings gave a demonstration of tape recording including stereo to the Bethnal Green Re-habilitation centre recently, it was so well received that it developed into an impromptu dance.



The photograph shows a Tricolumn speaker identical to the model built by R. Tingley of the Cotswold Tape Recording Club. This was designed by R. N. Baldock in Hi-Fi News *and reprint of this article will be available shortly from this office.*

The club also welcomed representatives of B.A.S.F. who talked about the manufacture of tape and illustrated the remarks with a very fine film. Members received an invitation to visit the Walthamstow telephone exchange where under the guidance of Mr. J. Burchell, they were taken from the basement to the "dialling tone" and came away from the building amazed at what equipment is needed to make a call possible. The club is increasing in membership and would welcome readers at their club rooms, Shoreditch Tabernacle, Hackney Road, E.2, on Friday evenings at 8 p.m.

Further information is available from *R. J. Gentle,* 24 *Hyde Road, London, N.*1.

* * *

AT the annual general meeting of the **Leicester Tape Recording and Hi-Fi Club,** it was decided to drop the Hi-Fi from the club title and also change the meeting place.

The club will now be known as the **Leicester Tape Recording Club** and meetings will be held fortnightly on Thursdays at the Leicester Museum. At a meeting held during February, the merits of mixing and superimposing were discussed and this was followed by a practical demonstration of adding sound to 8 mm films.

Many interesting meetings have been arranged for the coming year and new members are welcome. Details are available from *P. Starrie,* 56 *Minehead Street, Leicester.*

* * *

DAVID FREEMAN of Truro wishes to contact all people in the extreme South West interested in tape recording. There are many local needs to be met—the hospitals, blind homes and youth clubs and many activities which could benefit—natural history recordings, music drama and cine. Interested readers should write to *David Freeman, Chapel Porth, St. Agnes.*

You are invited to
STEREO FORTNIGHT
at TeleTape of Marble Arch

24th APRIL — 5th MAY

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To coincide with the 1962 Audio Fair, TeleTape are staging a special Stereo Fortnight at their Marble Arch showrooms. This advertisement is your free invitation to see – and hear – this unusual show.

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* A chance to win £100 of tape records of your own choice (mono or stereo) in the TeleTape Stereo Competition.
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Be sure you visit TeleTape – Britain's largest tape record and recorder specialists – during Stereo Fortnight. The TeleTape showroom is at 33 Edgware Road, W.2 (two minutes from Marble Arch) and open six days a week and up to 8 p.m. on Fridays.

Admission is absolutely free.

FOR PRE-RECORDED TAPES AND TAPE RECORDERS
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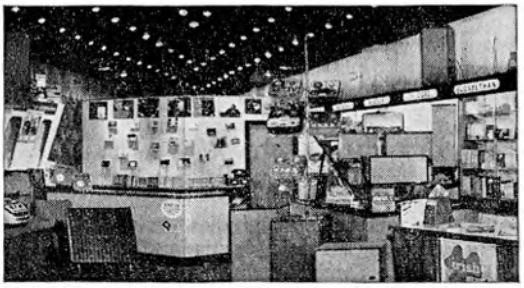

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See the **NEW** range of

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TAPE RECORDERS

* **NEW Telefunken Magnetophon 95** Entirely new design; attractively styled case. Twin track. Portable. Three speeds: 7½", 3¾" and 1⅞". Maximum spool size 7". **59 gns**
* **NEW Telefunken Magnetophon 96** This new FOUR-TRACK recorder has the same basic style as the Magnetophon 95, but offers all the advantages of the desirable four-track technique. Playing time over 16 hours on 7" DP tape. **69 gns**
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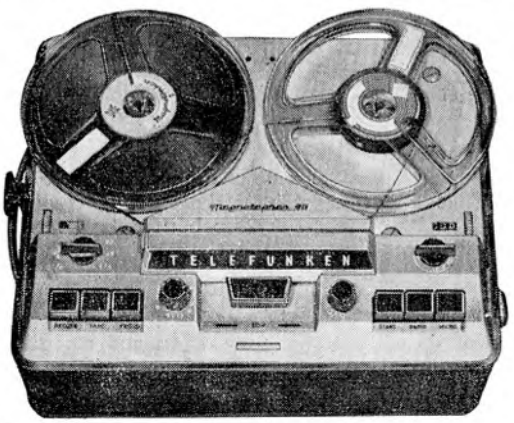
and of course the **75K/15 47 gns** and **85KL 79 gns**

* *All prices excluding microphone*

TELEFUNKEN EQUIPMENT–CHOSEN BY EUROPE'S MAJOR BROADCASTING SYSTEMS



TeleTape

TELETAPE OF MARBLE ARCH, 33 EDGWARE ROAD, LONDON, W.2. TEL: PADDINGTON 2924

our readers write . . . .

. . . about programmes for the blind

From: B. Thorpe, Royal Workshops for the Blind, St. Georges Road, Bristol, 1.

Dear Sir:—I hope to start in June a "Sound" magazine for the 3 homes we have in Bristol for blind people. At a later date this magazine will be offered to any social club for the blind in the West of England.

The Bristol Tape Recording Club have agreed to give me any help that I need and they will do a 15-minute feature on some aspect of local life, in fact they have promised to assist in any way possible.

I am anxious to contact people abroad who would be willing to act as a *voluntary* correspondent for my magazine. If any readers are interested would they please get in touch with me?

Yours faithfully.

* * *

. . . about selecting equipment

From: P. H. J. Pittam, 60 Moor Grange Court, Leeds, 16, Yorkshire.

Dear Sir:—Oh to be in London now that April's here, to visit the Audio Show and to follow the Editor's advice contained in the April issue of *Tape Recorder,* concerning listening to, and comparing, tape recorders.

Up here in this northern city, there is not, as far as I am aware, a single retailer with adequate audio facilities, where one can receive competent demonstrations of tape recorders, tuners, speakers, etc.

A couple of years ago it was possible to visit the Northern Audio Fair at Harrogate, but for unknown reasons, these highly popular fairs were discontinued, much to the chagrin of the tape recorder enthusiasts.

As I hate being asked to listen to begrimed audio equipment, in a shop, with a background noise of T.V.'s., radio's, pop records, people and extraneous street sounds, there are, if you want to buy tape recorders, three things you can do. (a) Make a visit to London, arranging appointments beforehand with competent dealers for demonstrations of the machines you are interested in. Select your machine and return home with it. This is expensive but effective. (b) Order by post from London, after reading every scrap of information contained in the *Tape Recorder, Hi-Fi News,* etc. This method can be dodgy, but with luck you may be successful. (c) Order through a local retailer. (It's ten to one that he won't have the machine you've seen in the tape magazines, and 100 to 1 that he's never heard of it). Anyway it's worth a try as he might be able to supply you if the manufacturers will supply him!

With (a) and (b). service and repairs are difficult, especially if the machine breaks down within the guarantee period. However, things may even be worse under (c). You never know your luck.

Sales and service could not be more difficult for someone wishing to buy two further recorders. I think sometimes that I will pack it all up and collect stamps. *Yours faithfully.*

* * *

. . . about ditto

From: Ian Leslie M.A., 129 Rosebery Road, London, N.10.

Dear Sir:—I take issue quite fundamentally with the philosophy implicit in the advice you give in your current editorial, to judge a tape recorder first by the results it gives with its built-in speaker. It seems to me that the essential function of a tape recorder is to record and reproduce as accurately as possible a fluctuating electrical voltage and it must be judged on how well it does just that.

I can scarcely imagine that anyone goes out and buys a tape recorder who is not already interested in listening to sound programmes of some sort and this presupposes that he has got some listening apparatus already—anything from highest-quality audio equipment to a simple table radio. If the latter, that is his standard and he is not going to be expecting to pay a great deal for his tape machine; if the former, that is his standard, he will not be satisfied with anything less and he certainly will not be wanting to pay what it would cost to duplicate it in the tape recorder!

At any level, we surely want the best we can get "tapewise" and there is just no justification for compromising the tape recording quality by allocating cost to any but the simplest monitor facilities nor ought the design of the "package" (for containing mechanical and electrical tape recording replay equipment in the most efficient and convenient way) to be in any circumstances compromised in order to provide a good acoustical environment for a loudspeaker.

To come down to hard figures from ideal theory, I wonder whether you would feel I overstate the case if I suggest that within a retail price of £50 (above which it is quite difficult to sell to the sort of people who will not in any case already have better than "average commercial" reproducing equipment) that within this cost limit it is only just possible to provide a versatile machine with satisfactory short- and long-term speed constancy, low distortion and a signal/noise ratio not significantly lower than the best the tape is capable of. If that is a substantially correct proposition, and it is also the case that reproduction equipment capable of anything better than even a reasonably good table radio can provide via its pickup sockets will cost some substantial proportion of such a low figure, then clearly the design philosophy should be: First, provide the best heads, tape transport mechanism and record/replay amplifier you know how, in a "package" designed round them; then and then only, find a space somewhere to put in a cheap speaker, and double your oscillator valve as an output stage by suitable switching. These facilities will serve for the odd "emergency" when replay is required away from one's usual listening room.

Monitoring for record purposes? Well, to do that usefully requires the use of a correct listening level and so in most circumstances pre-supposes a soundproof booth or the equivalent. In most of the situations in which an amateur recordist finds himself, it is both more practical and more satisfactory to use phones, and with just a little practice this becomes an entirely reliable method.

Some of the best low-priced tape recorders (I stress that because I mean "best" quality tape recorders) are designed precisely according to the philosophy I have outlined. They were judged poor in the CA review of tape recorders in *Which?* where the principal criteria were based upon subjective assessments of the performance "self-contained". You now support this approach. I suggest that, on the contrary, in choosing a tape recorder one should insist on hearing a signal recorded from a low distortion, wide-range source (e.g. a VHF tuner) and played back through a low-distortion, wide-range amplifier/speaker system. Yes, even if ones own equipment is not of that standard. It may become so, later on. *Yours faithfully.*

* * *

. . . about a holiday guide

From:—A. R. Hunt, "Winton", Palmers Road, Wootton Bridge, Ryde, Isle-of-Wight.

Dear Sir:—There are many excellent Guide books describing the Isle-of-Wight, but there may be some readers who contemplate a holiday here, and would like some details regarding how to get here, etc.; and if I can be of any assistance I would be only too pleased to answer any queries on tape to the best of my knowledge.

I would like to stress that I cannot act for anyone with regard to booking rooms etc.

I am not connected in any way with a travel agency or any travel concern, but if I can assist any reader at all with any of those odd thoughts that do sometimes trouble visitors, I would be only too pleased to assist, there is, of course, no charge, but return postage would be appreciated.

Hoping to be of some small help to someone. *Yours faithfully.*

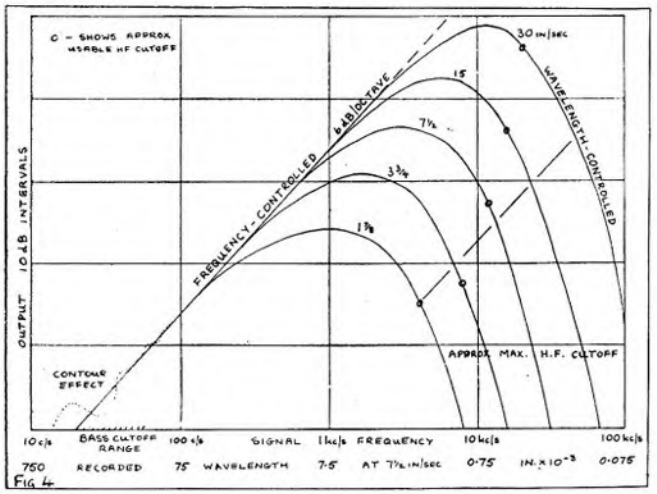


Fig 4

FREQUENCY AND WAVELENGTH IN RECORDING

PRACTICAL SYSTEM LOSSES

Fig. 4 *(left) Typical overall record-playback frequency response at various tape speeds, consisting of basic 6dB/octave response minus all wavelength-dependent losses (frequency losses assumed negligible).*

FIRST let us recapitulate last month's conclusions briefly. We postulated a near-perfect tape system, having no significant losses or distortions, in which the playback gap length is finite but much smaller than the shortest wavelength of interest. The tape magnetisation in such a system is independent of frequency or wavelength and instantaneously proportional to the signal input, which was assumed constant at all frequencies. Assuming also constant and equal tape speeds during recording and playback, we found that the *emf* induced in the playback head coil is proportional to the input frequency, and thus rises at 6dB per octave (see **fig. 4**) and that the emf at any given frequency is independent of tape speed; again, *in a loss-free system*.

Practicable tape systems for sound recording are not loss-free, however; so in practice we find the ideal 6dB/octave relationship holding over only a limited frequency range whose extent depends almost directly on the tape speed. I say "almost" because the lower limit of this range is also the lower limit of the whole frequency range, the bass cut-off, whose position is not directly affected by tape speed but nevertheless varies over a small range from machine to machine. The bass limit is a direct consequence of the 6dB/octave fall-off; below it, the signal is too small to be useful because recovering it in the normal playback equalising process (see Calibration and use of test tape, March and April, 1962) means dredging amongst the noise from the tape and playback amplifier and bringing that up also. Its position in domestic machines (usually 30-60 c/s) is thus related more to the general quality of the recorder than to any particular operating condition such as tape speed.

The position of the *upper* end of the limited 6dB/octave range is of no great interest in itself—it is anyway rather indeterminate—but what is interesting for our purposes is the point in the high-frequency range where we again have to stop dredging for fear of stirring up too much mud.

The losses encountered in our practicable system are of two main kinds: one depends on signal frequency, the other on recorded wavelength. The former occur in the heads themselves and are due partly to eddy-currents induced in the core and partly to its magnetic hysteresis. We shall ignore them here, since they are generally negligible within the useful audio range, except possibly in the case of a solid-pole head being used for recording. Wavelength-dependent losses are much greater, and the main ones will be discussed in some detail starting with those arising in the recording process.

Recording Losses

These are conveniently divided into (a) spacing losses, (b) biasing losses and (c) self demagnetisation, although the first two tend to overlap at some points. **Spacing losses** result from the tapes being in something less than intimate contact with the head. The spacing can be an avoidable physical one due to tape curl, head misalignment and so on, but there is also an unavoidable virtual magnetic spacing (unavoidable by the user, that is) caused by the surface roughness of the tape coating. The roughness layer contains perhaps only half of the magnetic oxide it ought to, or less, and is thus equivalent to a normal-density layer of half its thickness, or less, spaced away from the head by the remainder. The loss amounts nominally to about 55dB per wavelength separation (see **fig. 2a**) but in practice the bias should be adjusted for each particular tape—more being needed for a rougher tape since spacing losses also apply to the bias signal—and the actual loss may be greater even than appears inevitable (see below). It also follows that, rough surface or not, the magnetisation strength will generally be greatest at the coating surface and will decrease progressively below it (but again see below).

Biasing losses arise from the diffuseness of the high frequency bias field relative to the audio field on the trailing side of the record head, where registration takes place. (For an explanation of the recording process, see "Improving Magnetic Tape", *Hi-Fi News* Feb.-April, 1961). The recording itself is fixed at some point on the trailing side where the total field falls finally below a critical value characteristic of the tape, but the rapidly-alternating bias may act thereafter as a weak erasing field whose

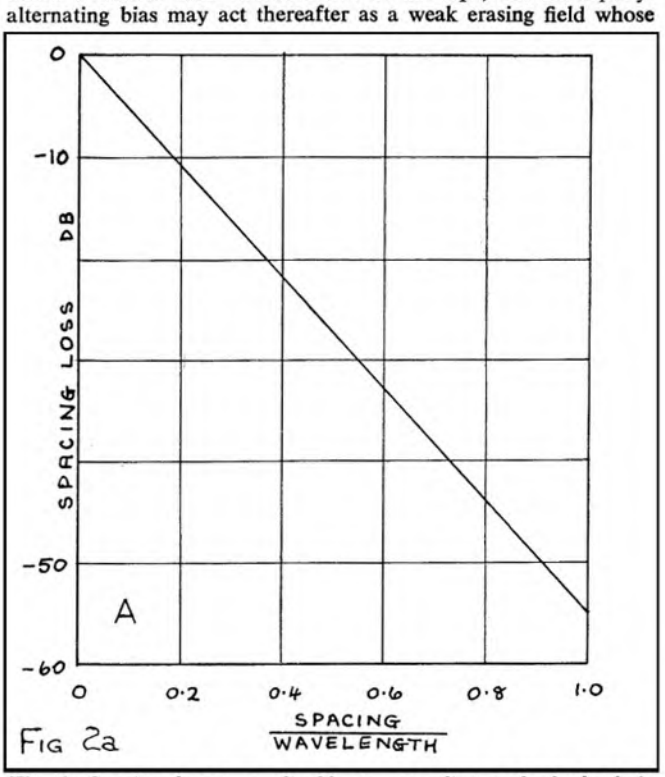


Fig 2a

Fig. 2a *Spacing losses, applicable to recording and playback in terms of wavelengths of separation.*

FREQUENCY AND WAVELENGTH IN RECORDING

by GRAHAM BALMAIN

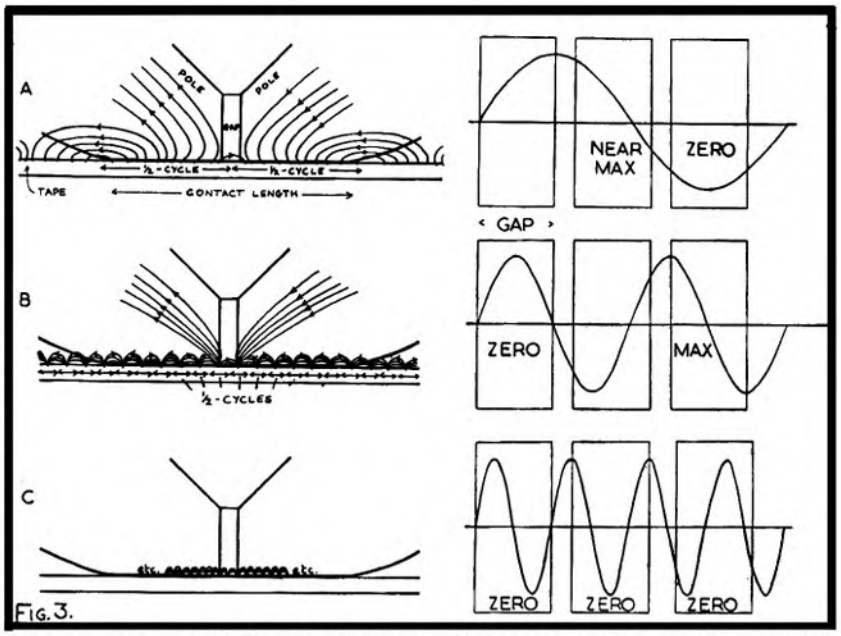


FIG. 3.

Fig. 3 (*right*). *Playback gap losses. Sketches (not to scale) of flux paths and corresponding gap-cycle m.m.f. relationships. "Max" and "zero" refer to m.m.f. across core and thus to head output. (a) Long wavelength (b) Gap length = half wavelength. (c) Gap length = full wavelength.*

effect increases as the recorded wavelength becomes shorter. An alternative explanation suggests that the recorded magnetisation at short wavelengths is unchanged in magnitude by the presence of or an increase in the bias, but that it takes place progressively further below the coating surface as the bias increases and/or the wavelength decreases, thus causing spacing losses on playback. This is quite feasible and it fits experimental observations just as well as the part-erasure hypothesis—or should I say "no less badly than . . .", for most measurements of this kind are pretty uncertain. My own view is that the true explanation probably contains elements of both ideas. Typical effects for a particular tape and recording head are shown in **fig. 2b**.

Self-demagnetisation is an effect noticeable in any permanent magnet whose length is comparable to or less than its thickness, and is caused by the proximity of the magnet poles which tend then to cancel each other out. Opinions vary as to its magnitude compared to other losses and as to the exact shape of the loss curve, but its contribution is almost certainly significant at the shorter wavelengths encountered at low tape speeds, although by no means in control. Self-demagnetisation cannot be assessed directly by experiment, unfortunately, partly because of some doubt as to the effective "thickness" of recorded short-wavelength elements (they do not generally occupy the full coating thickness) and partly because they are always associated with other losses and inseparable from them.

Playback Losses

Losses in the reproducing process are, in general, much more clearly defined than those in the recording process. The two important ones are (a) spacing losses similar to those occurring during recording, due to the surface roughness of the coating and penetration effects, and (b) the gap-length loss. Because the gap loss is what really decides the available high-frequency response of the system, it deserves some detailed explanation.

The magnetic conditions on playback can be said to approximate to those sketched in **fig. 3** where three particular cases are taken. For simplicity, we shall assume other parts of the system to be loss-free, for the moment. At long recorded wavelengths as in (a) the output from the head follows the ideal 6dB/octave relationship shown dashed in **fig. 4** provided the wavelength is no longer than the distance over which the tape is in contact with the pole faces. This is true of most domestic recorders down to frequencies of 30-40 c/s at 7½ i/s, where the wavelength (consisting of *two* of the recorded ½-cycle "magnets" shown in **fig 3a**, remember) is about 0.2 in. (see footnote).

It will be evident that a difference in field strength between the poles (to be more accurate, a magneto-motive force, or m.m.f., across the core), will cause a proportional magnetic flux through the core, just as in electricity a voltage applied across a resistance causes a current to flow through a resistance. In this case, half-cycles which span the gap or terminate in it will be effective in producing an m.m.f. according to their proportional contributions through the pole faces on either side, while others which may lie within the length of contact can be ignored since they produce only local short-circuit fluxes in the poles. In particular, when a symmetrical half-cycle (e.g. a half-sinusoid) spans the gap symmetrically there will be no flux in the core because there is no difference in field strength between the poles; conversely when two opposite half-cycles meet in the centre of the gap the maximum possible m.m.f. exists across the core. Thus, harking back to last month's arguments, we have a constant maximum flux swing over a range of long wavelengths which is transformed into a rising output voltage from the head only by virtue of its increasingly rapid repetition as the input frequency rises.

Output Peaks

Increasing the frequency and decreasing the wavelength further, we find that more and more of the effective half-cycles' contributions to the flux through the core have to enter the poles through their tips via the non-magnetic gap spacer, which is equivalent to putting a high magnetic reluctance (analogous to electrical resistance) in series with the low reluctance of the core, and that significant amounts of the flux will leak straight across the gap. Although the available m.m.f. is the same as before, still ignoring other losses, the flux in the core is thereby reduced and the head output falls progressively shorter of the ideal 6dB/octave expectation.

When the gap contains a complete half-wavelength, as in **fig. 3b** the output reaches its peak since there is then the maximum possible m.m.f. between the poles with two half-cycles meeting in the centre of the gap. Thereafter it can only fall, which it does until the gap spans a whole wavelength (**fig. 3c**) when there is *no* m.m.f. across the core at all, wherever the gap may lie in relation to the cycle.

Overall Response

It will by now have probably been deduced that this is not the end of the story. As the wavelength decreases still further, we shall again get an m.m.f. across the core; whenever the gap spans an odd number of ½-wavelengths there will be an output peak, and for an even number of ½-wavelengths (i.e. an integral number of full wavelengths) there will be no output at all. However, only the range up to the first zero-output point is useful—or part of it, at least—for we cannot possibly have holes in the overall frequency response.

Combining the 6dB per octave response with the gap response and the other losses at various speeds results in curves such as those shown full in **fig. 4**, which show well enough how the

FREQUENCY AND WAVELENGTH IN RECORDING-Cont

available high-frequency response is limited by wavelength effects at various tape speeds; I have already pointed out (*Tape Recorder*, January 1962) that the *usable* range at the higher speeds is necessarily less than that apparently available, for various reasons. The positions of these curves can be altered by changing the gap length, of course.

One other wavelength effect, the "contour effect" shown dotted at the bass end on this diagram, needs to be explained. In just the same way as the gap proper relates to short-wavelength signals in producing peaks and troughs in the high-frequency response, so the whole pole-face length compares with long-wavelength signals to produce similar but less marked effects at low frequencies. As before, when the pole faces cover an odd number of half-wavelengths there is a peak, and when they span an integral number of full wavelengths there is a trough. They are not so sharp here because of the indefiniteness of the pole-face ends. By careful pole-face shaping and an unsymmetrical tape wrap round them the effect can be reduced to insignificance.

Head Alignment

It may be of interest now to pick up the reference to head alignment I made at the beginning of last month's article and put it in context here. Normally the field distribution along the tape is the same at any point across the track width on the axis of the recording gap, which is usually set at right-angles to the length of the tape.

For best results at short wavelengths, the playback gap should be exactly parallel to the recording gap. As it deviates, the m.m.f.'s towards the outer edges (being from parts of the recorded waveform respectively leading or trailing those near the track centre) first contribute less than those from the centre, then tend to oppose them; and then, when the gap axis is a half-wavelength in advance at one edge of the track and similarly behind at the other, cancel them altogether. Further misalignment causes subsidiary peaks and nulls alternately, with the amplitude of the peaks decreasing successively on either side of the true main peak. Azimuth alignment will evidently become less critical as the track width decreases. I had hoped to illustrate the points pictorially, but this is more difficult than it appears and I must defer the attempt for the moment.

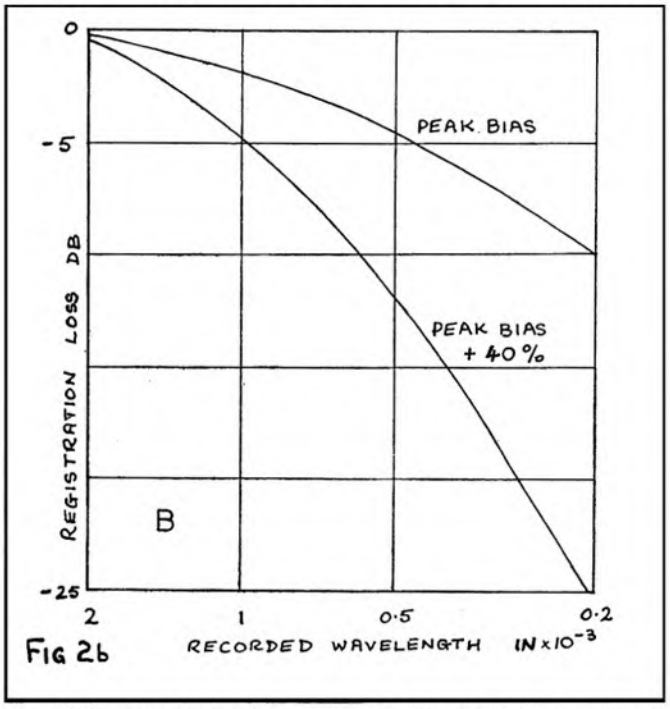


Fig. 2b *Typical biasing losses, at peak bias (giving max. output at long wavelengths) and at peak bias + 40% (giving approx. 1-1½dB output loss at long wavelengths). 1 Thou' wavelength corresponds to 7½ Kc/s at 7½ i/s, 3¾ Kc/s at 3¾ i/s, etc. Bias set at 10 thou' wavelength.*

Avoidable Losses

Such effects can hardly occur on tapes recorded and played back on the same machine using a single head (unless for reasons described in "Facts About Quarter-track Recording", *Tape Recorder*, November 1961) but they can and do happen on machines with separate record and playback heads and when tapes are transferred from one machine to another. For an example, a misalignment of only a quarter of a degree between the record and playback heads will result in a loss of about 6dB of a 10 Kc/s signal recorded on a ¼-track at 7½ i/s (i.e. a wavelength of 0.75 thou'.).

While we are on the subject of avoidable losses, you may like to know that a similar amount of loss can be caused by the spacing effect of a deposit of dirt on the head less than one-tenth of thou' thick, or even a slight curl. Or, for that matter, by adjusting bias indiscriminately to, say, 50 per cent. above the intended value.

So we return to our starting point: some of the simple things which are usually assumed to depend directly on signal frequency but in fact do not. Except when one has a tape machine with everything fixed—including tape speed—the notions of frequency and wavelength are *not* interchangeable. This does not prevent one legitimately talking about frequency-responses applied to recorders in a general way, but it does mean that the phrase "the frequency response of a head" for instance, is nonsense in its usually accepted sense unless one specifies the tape speed also, and even then its meaning is doubtful. The true frequency response of a head is a function only of its frequency-dependent losses which have been mentioned above; what one generally means for a playback head is its *wavelength* response, which is universally applicable and can be quoted without qualification or used in conjunction with the tone frequency response to determine its overall performance at any given tape speed. There is no such thing as the frequency response of a tape, of course. And indeed there are many tape reproducing system applications outside audio in which the concept of signal *frequency* is at best incidental and at worst wholly irrelevant or non-existent. I hope to touch on some of these off-beat reproducers in next month's article.

Footnotes: 1. The terms "cycle" and "½-cycle" are being used in the sense of a complete sinusoid or ½-sinusoid. A wavelength has the same overall length as a cycle, but may start anywhere on the cycle.

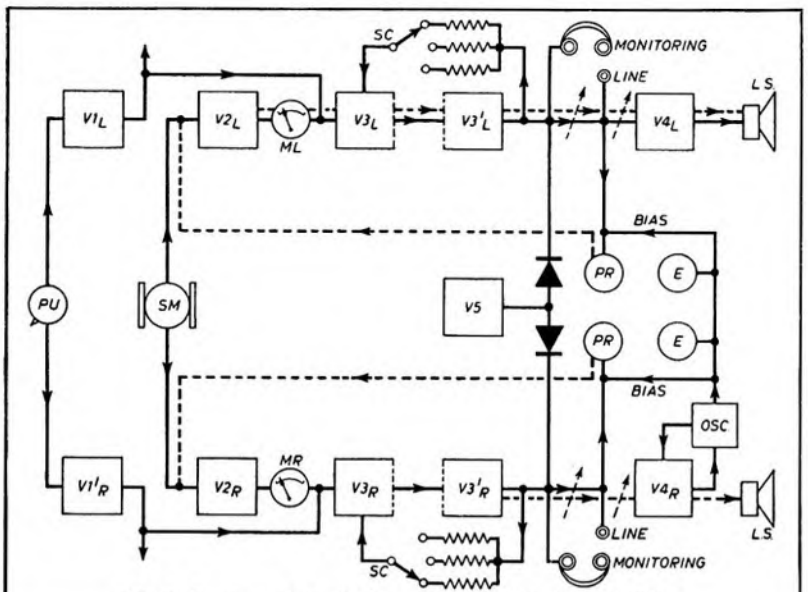
2. When the wavelength becomes greater than the head/tape contact length, not all of it contributes to the flux in the head core, so that the output falls off at more than 6dB/octave and reaches a limiting slope of 12dB/octave when the wavelength is much greater than the contact length. This turnover, rather than the mere 6dB/octave loss, is what tends to limit low-frequency response in recorders running at 15 and 30 i/s (for which reason such machines tend to have large heads) or in those running at lower speeds which have also heads with short pole-faces.

3. Wavelength = $\frac{\text{Signal velocity}}{\text{Signal frequency}}$

"signal velocity" being the same as tape speed for our purposes.

TAPE RECORDER SERVICING

3. PHILIPS TAPE DECKS



Block diagram of the Philips EL 3536 showing switching.

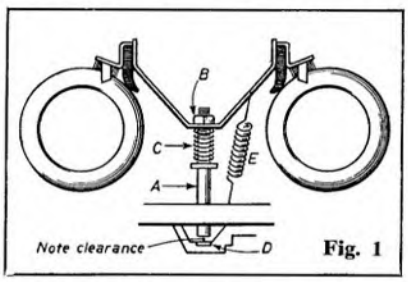


Fig. 1

CHOOSING a selection of machines from the wide range produced by Messrs. Philips is a difficult task. This firm has been in the tape recorder field from the beginning and a succession of models, all having quite different features, are in regular use. Space precludes our dealing with them all; indeed, it will be impossible to go into great detail here. Our aim must be to select salient features and observe special adjustments, while pointing out the differences between the various marks. For convenience, let us begin with the 1959/1960 models.

The EL3515 is a single speed, two-track machine with inputs for *microphone* (2.5 mV into 100,000 ohms) and *Radio/P.U.* (200mV into 1 megohm). Outputs are: *Radio* or *Hi-Fi Amp.* (at P.U. sockets, 1.5 volt into 50,000 ohms), *headphones* (100mV into 1,000 ohms) and *external loudspeaker* (2.5 watts at 3-7 ohm impedance).

Similar in construction and appearance is the EL3541, but this is a four-track, single-speed (3¾ i/s) machine, with superimposing facilities and a stereo output socket. The latter socket is connected to the lower head gap when the track switch is in the "Track 1-4" position, allowing pre-recorded stereo tapes to be reproduced through a suitable external amplifier. *Inputs* are: *Microphone*, (3mV into 100,000 ohms), *Radio/P.U.* (150 mV into 1 megohm). *Outputs*: *Radio* or *Hi-Fi Amp* (at P.U. sockets, 2 volts into 50,000 ohms), *Headphones* (as above), *External Loudspeaker* (as above), and *Stereo* (1mV at 166 c/s to 4.5 mV at 8,000 c/s from a 100 per cent modulated tape).

A later version of this machine is the EL3541/15B, which has circuit differences and a more roomy electrical layout, utilising two printed circuit panels (plus a small sub-panel holding the oscillator coil and the two concentric trimmers for adjusting bias frequency) The main switches are printed-circuit sliders, the arrangement being that in the stand-by position the circuits are at *Playback*, and a mechanical interlock system adjusts the "throw" when the *Record* button is depressed. A groove in the base of the *Record* button which is located by a fork actuated by the *Play* key, ensures that the machine cannot be inadvertently left in a *Record* position.

For operation as a straight-through amplifier, a push-key (P.A.) is fitted in the corner of the recess where the socket panel is housed. This operates the *Record* switch slider via its Bowden cable. A subsidiary slide switch, mounted at right angles to the main assembly is operated by the playback push key. The microphone is fed to the grid of the EF86, equalising circuits are switched out and the 4-stage amplifier provides a full 2½ watts. In addition, some mixing facilities are available, for the *Radio* input is left in circuit, driving one triode of the ECC83 and using the separate volume control R11, which acts as radio modulation control on *Record* and volume control on *Playback*. A tone control is added to the /15B circuit, from the anode of the ECL82 pentode section (output valve).

The EL3542

The EL3542 has the further refinement of three speeds, 1⅞, 3¾ and 7½ i/s., and a metal-foil operated auto-stop relay, with the extra circuitry and mechanical alterations this entails. It is a 4-track machine, with stereo socket and general characteristics as before, but has a 4-digital tape indicator, whereas the previous models use a 3-digit type, and an EM81 modulation indicator

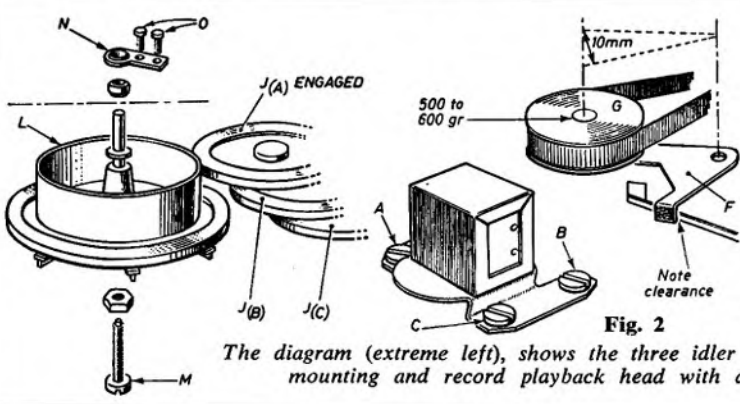


Fig. 2

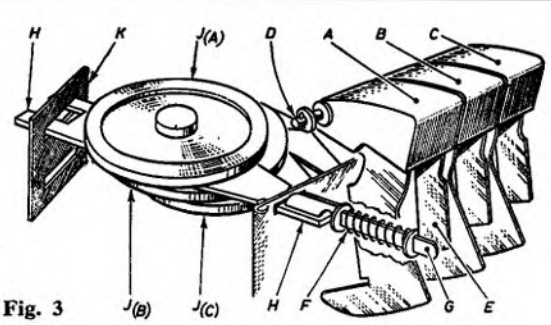
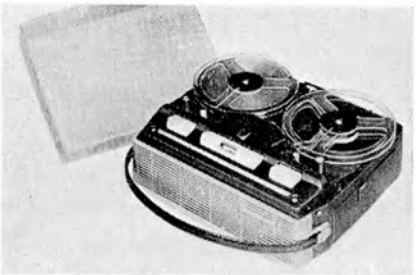


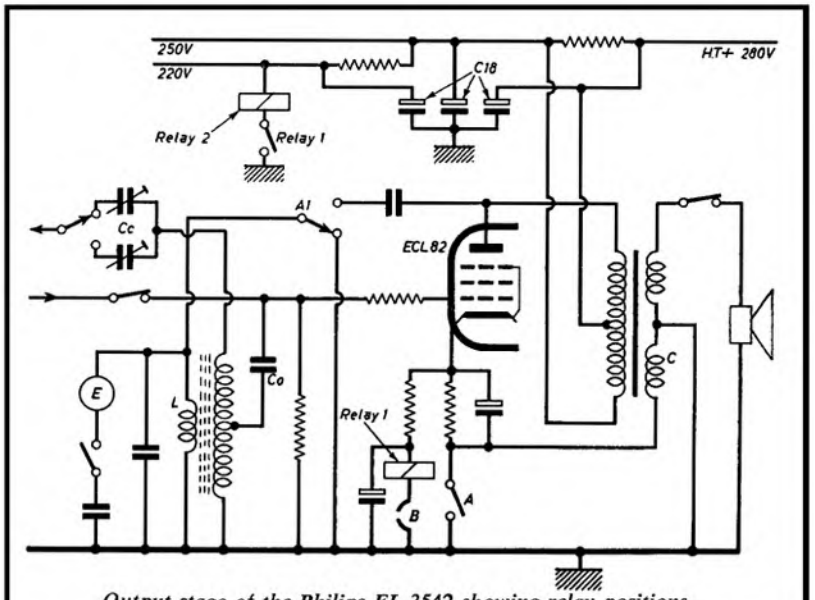
Fig. 3

The diagram (extreme left), shows the three idler wheels in position. **Fig. 2** *shows the tension wheel mounting and record playback head with adjusting screws.* **Fig. 3.** *The speed control keys.*

TAPE RECORDER SERVICING



By H. W. HELLYER



Output stage of the Philips EL 3542 showing relay positions.

instead of an EM84. It also employs a moving-coil microphone in place of the crystal. Although from the point of view of servicing this can be regarded as a completely different machine, there are certain similarities that can be discussed at the same time as we deal with the previous models.

Braking Adjustment

First of these common factors is braking, which is based on the balanced-lever system, as shown in **fig. 1.** This diagram is of the earlier arrangement and may be varied slightly in later models by the fitting of two nuts to secure the brake bracket to rod A and two springs in place of E. Adjustment of the brakes is made by moving nut B to alter the compression of spring C. There should be a 1mm. clearance of the brakes from the spool turntables when the machine is turned to *Wind, Rewind,* or R/P. When the Stop button is applied, the bracket D moves away, allowing rod A to move under the pressure of spring C. There should then be a 1mm. clearance, as indicated between the end of rod A and the lug on bracket D. Alteration of the engagement pressure can be made by changing the anchor position of spring E, and allowance for wear is possible by slight bending of the lugs. On the EL3542 model, the lever system is more complicated, but the general principle is similar.

The spool turntables are driven by a common belt from the motor pulley, with tension adjusted during running by a wheel mounted on a sprung bracket. When all is correct, this system ensures regular running, but a binding bracket, a weak spring or a wrongly mounted tension wheel can cause belt slip and erratic running. The symptoms may be sluggish rewind from an empty spool or uncertain take-up during *Record* and *Playback*.

Belt Systems

The rudiments of the tension system are shown in **fig 2,** from which it will be seen that there is a 10 mm swing against the belt tension, and a clearance between the angle bracket F and its support bracket when the belt is correctly driving. The correct spring tension that compensates for belt slackness can be checked by removing the belt and applying a pressure gauge to the spindle of wheel G, when a force of 500-600 grams should be required to return the bracket to its normal position.

On the EL3542 there is a small difference in bracket shape and a longer riding spring, but the same principle applies. Always ensure that the spring is not fouling levers and brackets, and has not stretched.

Because of the common drive belt system, it is imperative that the various items in the transport chain, i.e. the turntables, motor pulley and tension wheel, should be running level and true. Grub screw adjustment is possible for the motor pulley, and on the single-speed machines, the height of the flywheel should be adjusted so that its groove is in line with the grooves in the coupling wheels. This is altered by a central screw, locknutted, below the flywheel casting.

The flywheel on the three-speed machines is driven by edge-pressure of idler wheels, the arrangement being as shown in **fig. 3.** Height of the flywheel L is altered by adjustment of screw *M,* until the upper idler wheel ($1\frac{7}{8}$ i/s) engages just below the edge of the flywheel rim. There will be an axial play of about a half millimetre, which should be allowed for when making this adjustment. When disengaged, the intermediate wheels *J* should have a half-millimetre clearance from both flywheel and motor pulley.

Speed Change Mechanism

Although difficult to see *in situ,* the operation of the speed change system should be evident from **fig. 3.** When the key, *A, B,* or *C,* is depressed, it pivots on rod *D,* moving the lug *E* forward. This action pushes lever *G,* compressing spring *F* (which ensures return action for disengagement), sliding the guide bracket *H* forward through the slot in *K.* The intermediate wheel is mounted on the appropriate *H* bracket. The wheels are mounted directly above each other, spaced to correspond with the steps on the motor pulley, and the angle of thrust is determined by the shapes of the *H* brackets. Always ensure that the travel of these brackets is unimpeded by grit or that serviceman's bugbear—over-enthusiastic lubrication.

Not shown in the diagram is another function of the speed change mechanism, a selector switch operated by the key levers. This switch chooses the appropriate equalising circuit in the ECC83 stage, and its accurate engagement can be adjusted by the fork arms on the end of the bracket, which is engaged when the $3\frac{3}{4}$ or $1\frac{7}{8}$ i/s keys are depressed.

Also shown in **fig. 3** is the upper flywheel bearing, which is of some importance for true running. Switch the machine on and allow to warm up; engage the $7\frac{1}{2}$ i/s key and run for a short while, then depress the pause button adjacent to the speed change keys. This disengages the intermediate wheels and allows the flywheel to run down under its own momentum. If everything is correct, this should take $3\frac{1}{2}$ to 4 minutes. By adjusting screws O and moving the bearing plate N, the correct position for this flywheel setting can be determined. Some patience is needed for this job, and the screws should be carefully tightened and running re-checked after the operation has been carried out.

Setting of the flywheel is rather different on the single speed models. Here, the upper bearing is part of the main plate on which the heads and pinch wheel assembly are mounted. If the fixing screws are slackened slightly, this whole plate can be moved

(*Continued on page* 164)

sufficiently to ensure that the capstan spindle is vertical. Check this by running a tape through and noting that the tape lies flat to the heads without twisting. The lower bearings are adjusted by light taps with a mallet while the flywheel is turning, taking advantage of the self-centring action.

Here, I must apologise for running ahead of myself, for the above test pre-supposes that the heads and tape guides are themselves correctly levelled. This seems to be the factor that gives the most worry to owners of these machines. On a number of occasions, tape recorders have reached the author's workshop with guide and head level altered because the tape was not running true—the original cause of this probably being incorrect turntable height, or even a warped spool! After making the attempted adjustment, resetting of heads and guides is found to be extremely difficult—hence the requests for service. So let us devote a little space to the question of heads and guides, particularly on the more touchy 4-track machines.

The mounting of Philips heads is as shown in the lower part of **fig. 2.** Screws *A* and *C* should be adjusted for correct height and front-to-back sense, and screw *B* adjusted finally for sideways correction. Erase heads are similarly mounted, and all screws are spring-loaded.

Head Alignment

Before attempting to align the heads, make sure that the guides are level. These are spring loaded and adjustable by a self-locking nut on the main guide rod. On the two-track machines, adjustment is made to a measured level; the left hand guide should be adjusted until there is a 16.3 mm gap between the lower side of the guide bracket and the mounting plate; the right hand guide requires 16.5 mm. The tape should now run straight across the head faces, its top edge level with the top of the gap. Azimuth alignment is then quite simple: play a test tape through, adjusting the R/P head for maximum playback, then record a 1,000 c/s signal with a measured input voltage of 100mV (at the P.U. socket).

Next, check that the upper edge of the erase gap is no more than a half-millimetre above the edge of the tape. Play back the recorded signal and set the volume control to give a steady reading of 1 volt at the extension L/S socket. Turn the tape upside down and erase the unused track parallel with the previously recorded section, then turn it upside down again and play back the first recording, noting the output reading. It should not be lower than 850mV. Less than this indicates that the head is too low and the erase flux is overlapping the track. Check for a too-high head by erasing the original recording and noting that the erased portion of track should be silent. Incomplete erasure denotes the head is too high.

The four-track machines need a little more patience, although the principle of adjustment is basically the same. First check that the tape is mechanically true, and not being fouled by the pressure bracket, and that the upper edges of the head gaps are level with the upper edge of the tape. Set the track switch to 1-3 and record a 1,000 c/s signal on track 1, adjusting the input level for 100 per cent modulation, indicated on the magic eye. Parallel with this, record a 400 c/s signal on track 3. (The reason for the two different tones will be apparent when we proceed to the next test.)

Turn the tape over and play back the same section of tape, with the track switch now in the 2-4 position. The result should be silence. If the 1,000 c/s tone is heard, the head is too low, and if the 400 c/s tone is heard, the head is high.

To adjust the erase head, use the recorded section of tape, measuring the output during playback, and noting the positions of the volume control on tracks 1 and 3 that give a 1 volt output at the Line socket. Now erase a parallel portion of track 2. The result should be a "sandwich of silence." If, on playing back, the upper track is attenuated to less than 850mV, the erase head is too low. If track 3 is attenuated, the head is too high.

With a little practice it is possible to carry out these operations quickly, but it cannot be too strongly emphasised that alteration of head and guide settings should not be made unless you are sure they are incorrect. The trouble could, after all, be no more than a warped spool, or a turntable riding too low.

THE CALIBRATION AND USE OF TEST TAPES

PART 3——By A. TUTCHINGS

GIVEN a test tape with a known level and surface induction characteristic, we now have to see how it can be used to set up a recorder for optimum performance. The playback response and most of the required information on peak recording level and the proper setting of the record level indicator can be obtained with nothing more ambitious than a low range A.C. meter. The "*Avo*" *Model* 8 is very suitable, as it has a dB scale which simplifies response curve plotting and a level response to beyond 10 Kc/s when fed from a low impedance source such as the *Ext. L.S.* terminals of a tape recorder or amplifier.

The *Avominor* is also suitable, as regards frequency response and sensitivity, but dB conversion will have to be made by slide rule or table. For accurate measurement of signal noise ratio a sensitive valve voltmeter will be required with a low range in the order of 10 millivolts; and a cathode ray oscilloscope is useful for waveform observation. Finally, for record replay responses, a pure tone signal source of some kind is required. This could be a pick up and set of frequency records, or you could wait for the rather infrequent transmission of test tones by the B.B.C., but a signal generator, covering the range 40 to 10,000 c/s, is almost essential, and one going up to 100 Kc/s is useful for measurement of bias frequency in conjunction with the C.R.O.

Azimuth Alignment

All test tapes carry a high frequency recording for use in setting the replay head gap exactly at right angles to the edge of the tape and, in theory, it is only necessary to play the test

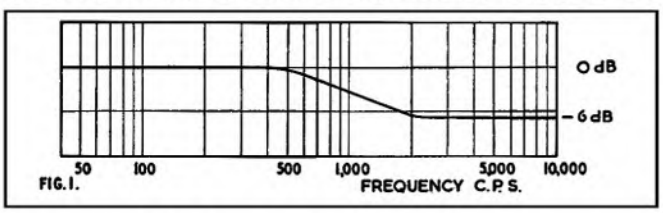


FIG. 1.

tape and twiddle the azimuth adjusting screw for maximum output. It is not generally realised that tape, being an elastic medium, can be temporarily deformed by friction on one edge, or by uneven pad pressure and it can thus give an apparent azimuth error when in fact the head is properly set. If you imagine a fishing net, with the vertical strings representing the flux pattern, pulled at diagonally opposite corners, you will see what I mean (see **figs. 2a** and **2b**). So first clean all heads and tape guides.

If you have a defluxer, degauss all heads and all parts of the tape path so that the calibration of the test tape can not be spoiled by even the slightest magnetic field. Clean the oxide from all pressure pads, and examine the heads for wear. Now insert the tape and play the high frequency test tone. If the output meter reading is unsteady, gently touch each pressure pad in turn with the point of a pencil and see if any improvement is possible.

Next, touch the top edge of the tape, on either side of the replay head, lightly with the pencil point. This will "yaw" the *tape* slightly out of azimuth, as described above, by making one edge travel slightly further than the other. If the level of the tone increases and becomes more steady then the playback head should be rocked slightly *without* loosening the adjusting screw; it will be found that the mounting plate will flex enough to move the head a small fraction of a degree by pressure on the top corners of the case. Then—*and only then*—should the adjusting screw be unsealed and the head rocked for maximum output.

The recorder should then be switched on and off several times to make sure than the setting is stable, and that the tape path does not vary from run to run. Time spent on this adjustment is well worth while as it ensures that pre-recorded tapes, or tapes recorded on other properly adjusted recorders, will be reproduced with the widest possible frequency response and steadiness.

Playback Response

This is the simplest of all tests to perform, as each tone is identified by a voice announcement or a printed leader, and one simply sits back and notes the meter reading for each frequency. It will simplify response curve plotting if the initial 1 Kc/s tone is set to 0dB on the output meter, or to, say, 2 volts on a meter which has only a voltage scale. The brain work starts if the response is not sufficiently level and you want to know what to do about it!

Generally, if the bass response is *up* the replay amplifier time constant is too low; if there is an unwanted rise in the middle high note response then the equaliser time constant is too high. Apart from the main bass rise time constant there is usually an extra top lift circuit which is used to compensate for head gap losses.

Procedure

The procedure is to get the response roughly level by changing the main R.C. time constant, and then level up the extreme top response by experimenting with the top octave high note lift circuit. Bumps in the low frequency response are probably due to the "wavelength wiggles" mentioned in *Part* 2, and there is little you can do about it beyond ensuring that the bumps and dips are fairly symmetric about the mean curve.

Fig. 1 shows a commonly obtained response, with a 6dB "step" between two regions of flat response. This indicates that the replay response of the recorder has been equalised for a recording characteristic which is exactly half that of the test tape used for the test—*i.e.* a C.C.I.R. 100 microsecond test tape played on a machine equalised for the N.A.R.T.B. 50 microsecond characteristic. A step *up* would indicate that the reproduce time constant was matched to a recording characteristic which was *twice* that of the test tape, such an effect could occur if a 100 microsecond 7½ i/s test tape was played on 3¾ i/s 200 microsecond playback equalisation.

Recording Tests

In *Part* 1 of this series we talked about the level on the test tape. This level has been carefully set so that it is exactly 12dB below peak recording level, where the *tape* harmonic distortion is 3 per cent. This information enables us to find out whether

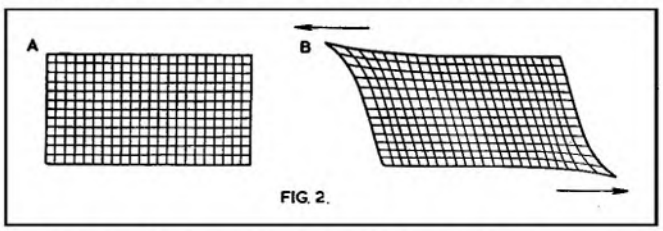


FIG. 2.

the full possible dynamic range of the tape is being used in the recorder under test. A 1 Kc/s tone should be recorded on the tape recommended for the recorder with the magic eye beams just closed, or the meter needle just entering the red sector.

On replay this recording should be examined on the C.R.O. to see if any waveform distortion is evident (5 per cent. third harmonic distortion can just be detected as a slight triangular tendency if the waveform is expanded so that about four cycles

(*continued on page* 166)

CALIBRATION OF TEST TAPES—continued

cover the screen). This test recording should be compared, *at a constant replay gain setting*, with the 1 Kc/s tone on the test tape.

If the tape is fully recorded the voltage ratio should be 4 to 1 or 12dB. If the test recording is less than 12dB above test tape level it may indicate faulty calibration of the recording level indicator, and further recording tests should be made to see if the recorded waveform remains pure at levels beyond those recommended by the indicator. If the level can be increased to 12dB above test tape level, then the indicator sensitivity should be reduced so that it reads true peak recording level. If, however, the indicator peak corresponds to the onset of waveform distortion of the recorded signal, and this level is less than 12dB above test tape level, then it is probable that the recorder is deliberately under-biased in order to exchange dynamic range for frequency response. It could, however, be overload of the record amplifier, and a C.R.O. investigation for possible distortion in the output stages of the record amplifier should be made.

When all adjustments have been made, peak recording level should be recorded and compared on playback with the recorded noise when the *recording* gain control is at zero. This ratio, converted to dB's defines the dynamic range or signal noise ratio. This should be checked at several settings of the replay gain control, as hum in the later stages of the replay amplifier could give a pessimistic ratio. The best figure will usually be obtained when the peak recording level test is replayed at a level just below overload of the output stage of the recorder.

Record Play Responses

On most good quality recorders this test should be done at, or about, test tape level as the 12dB margin to tape overload should cover any normal recording pre-emphasis at high frequencies.

At low tape speeds, or on recorders which have been under-biased for very extended frequency response, the level should be reduced to about 20dB below peak indication on the recorder being tested. A gliding tone should be used for these tests to pick out any small bumps or dips which may have been missed with the spot frequency response from the test tapes. If you have mixing facilities on the recorder under test, and are using a microphone to identify your test frequencies and levels, do keep the microphone gain well down and speak close to the microphone, particularly if the loudspeaker of the recorder is live whilst recording. Otherwise tones from the speaker picked up on the microphone, can cause violent peaks and dips due to standing wave effects which are not part of the real response of the recorder at all!

Other Uses of Test Tapes

Test tapes are recorded on semi-professional machines which are carefully maintained so that the *recorded* wow and flutter is at a very low level. This means that any speed disturbances heard are almost certainly due to the machine under test. Adjustments can be made to reduce such effects without the results of the adjustments being obscured by fortuitous cancellation between recorded and replay wow and flutter. One warning on this subject: if the tape is to be used for speed checking, do not stop and start the machine with the tape in place, as badly adjusted brakes can stretch the tape slightly on each operation and so introduce wow when the tape is reproduced at a constant speed.

A. Tutchings

SOUND and CINE

Camera Soundproofing

by Richard Golding

I WAS pleasantly surprised by the vast number of letters from readers resulting from my January article on blimps, barneys and tea-cosies. These letters described experiments with camera soundproofing for lip-sync shooting and were extremely interesting and enlightening. It would seem that there does already exist a great variety of blimps in the amateur film world, in all shapes and forms and constructed from all sorts of materials. The most successful material being chipboard and the most popular lining material being foam rubber.

The reasons for these are fairly obvious. Chipboard is more substantial than plywood and is easier and cheaper to work with than an alloy. Foam rubber is easier to cut and to fix into position than fibre glass or felt.

The wooden blimp seems to be quite satisfactory in sound muffling but some readers have had great difficulty with camera vibration. Camera vibration has a number of causes, one of which is the inability to marry the blimp firmly to the tripod, another being an unsatisfactory balancing of the instruments, camera, motor etc., inside the blimp. Where a platform has been used, supported at each corner by resilient rubber mountings, the vibration has been enough, in certain cases, to ruin the recording completely by the tripod giving out a steady purr and raising room sound to an inadmissable level.

Balance is very important, whether a platform is used or not, and it is worthwhile experimenting with various positions for the various instruments. Where it is desired that the platform remain, the answer may lie in a wider spacing of the rubber mountings and a further support clamped to the top of the camera, but, in some cases, the heavy chipboard base of the blimp may be enough in itself and the vibration cut down by removing the platform altogether and securing the camera and motor directly to the blimp floor. The slight loss, if any, in sound muffling being preferable to the annoyance of a tripod purr.

A popular design for this wooden blimp takes the form of a strong baseboard, fitting tightly on to the tripod, and on which a box is fitted. The box lifts off in an upwards direction, leaving the units free on all sides for easy access. Some readers have added slots, and soundproofed them in some way, for remote control of aperture and focus by levers which clamp over the respective lens ring, and most readers have made some provision for viewfinding through the blimp itself.

Which brings me to my next point. I have had enquiries from camera distributors for details of any ready-made blimp available on the market in this country. I have been unable to trace such a model myself and, I suppose, the reasons for the lack of such a blimp are, again, obvious. There are so many different systems of sound recording used in the amateur blimp and so many different camera models that one set design would be an absurdity. The set position of the viewfinding aperture alone would present enough problems to make the universal 16mm blimp an impossibility.

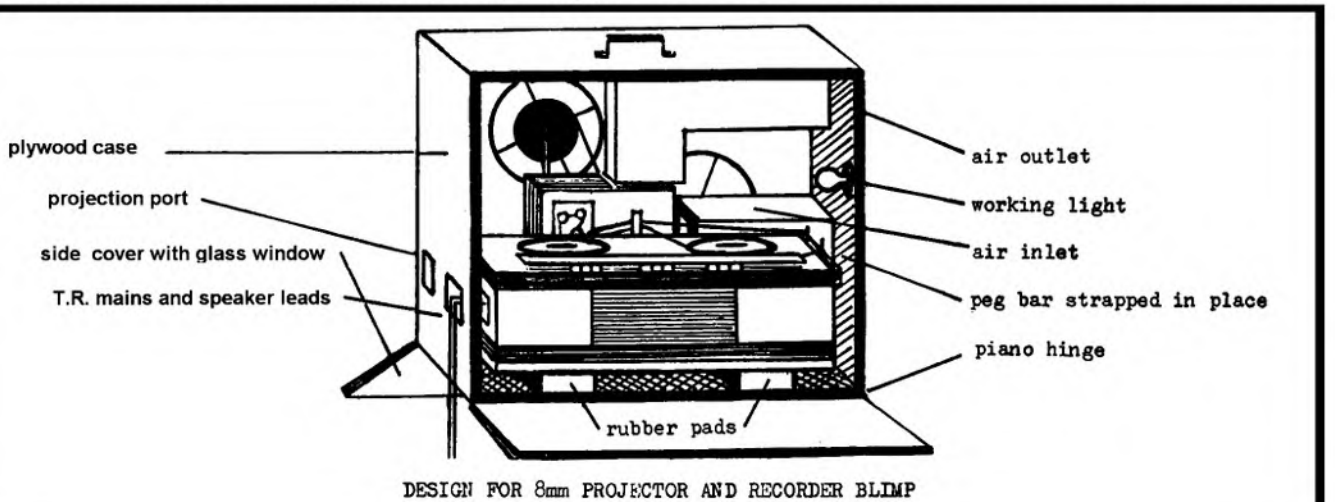
Soundproofing the Synchroflex recording unit

I am at the moment experimenting myself with soundproofing the *Synchroflex*. This unit is a miniature recorder designed to work in conjunction with the *Bolex* H16 camera. On first sight it would appear that the *Synchroflex* is ideally suited for blimp mounting by the fact that, as it is secured to the camera via the winding handle thread, the two units sit side by side on the same small platform. An electric motor, under this platform, drives the *Bolex* via the normal wind shaft and is powered by a 24 volt battery. The camera governor controls the motor speed and as the attachment is mechanically connected to the camera with a 1:1 drive between them, synchronisation of sound and picture is assured. The recorder uses fully coated sprocketed magnetic stock which can be edited by running double-headed on a magnetic projector. The problem here is the motor position for if the arrangement is not to be disturbed, and the arrangement seems ideal, balancing this platform is going to be very difficult. The blimp will have to be higher than normal and, in consequence, will add problems of its own when it comes to securing the blimp base to the tripod head.

A way out of this, initially, is to build a barney, aiming for as high sound muffling as possible. I have already begun designing such a barney for a tailor friend of mine who is going to make it. We are working on the tea-cosy idea where the units are enclosed entirely by quilted kapok but with two open sleeves for lens and reflex finder, the ends of the sleeves fitting tightly by means of built-in elastic bands. We are hoping that the barney will suppress at least 75 per cent of camera and motor noise and in a later issue of Sound and Cine I hope to report on this experiment but in the meantime I should be pleased to have more of your comments on this fascinating subject.

8mm projection and recording cabinet

The problem of overcoming unwanted projector noise is difficult to solve in the small room where the audience is not large enough to absorb the sound of the noise coming from the apparatus behind them which can detract from the sound accompaniment coming



DESIGN FOR 8mm PROJECTOR AND RECORDER BLIMP

from the direction of the screen. To beat this, and to provide somewhere to keep his apparatus at the same time, Geoffrey Hart of St. Albans has devised and constructed this very neat and compact blimp (*my diagram*). The case, which measures 21 x 21 x 19 inches, is made from 5-ply wood. The two side doors, one of which has a glass window on the projector side, are fitted with piano hinges and fold downwards. The tape recorder is mounted on thick rubber cushions which are fastened to the blimp base. The two ports are made from fibre board and contain baffles. The *Eumig* Imperial projector is mounted on a thick rubber pad.

Built in two weekends

This arrangement of the component parts is most compact although the ideal one would be, I suppose, to have the layout on an ironing board so that it would be possible to have all controls at the same side. A long narrow cabinet, however, would lack substance and present space problems. This blimp is practical because Geoffrey has made a peg bar that can be strapped to the side of the recorder to take the extra loop from the *Eumig* built-in synchroniser. This gives rise to the possibility of having a sliding peg bar that could be adjusted to counteract any sync error through the run.

In the front of the blimp there are two ports, one for the projector beam and the other for tape recorder leads. When the case is closed the noise cut-down is considerable and sound viewing more of a pleasure. It is mounted on a lightweight Negema projector stand and picture height is controlled by an elevator on the stand itself. The blimp took just two weekends to make.

The Third Tokyo International Amateur Film Festival

Eighteen prizes in a competition for 8 mm or 16 mm amateur films made after 1960 are offered in the competition which takes place in Tokyo in September. Applications to be in by the 10th August, films to be in Tokyo by 31st August. I have five spare sets of forms if anyone is interested.

Amateur sound films at the N.F.T. in May

The breakdown of the various sound systems used in this year's Ten Best Show at the National Film Theatre (May 24th-25th-26th) shows that 3 have a separate-tape accompaniment, 2 are optical sound-on-film, 4 are mag/stripe, and 1 has a disc accompaniment. All these films will be given an optical track for the presentation and for the rounds of the various Cine Clubs after May.

Three of the ten films that have special interest for Sound and Cine readers are: "*Hatapatu and the Bird Woman*" by Fred O'Neill of New Zealand, "*The Forgotten Faces*" by Peter Watkins,, and "*Sound and Vision*" by Derek Purslow.

Sound Alphabet (cont.)

Sound absorbtion: porous materials in approximate order of sound absorbtion efficiency are: loose cottonwool, soft felt, loose glass-wool, thick carpet, rockwool, layers of velvet cloth, foam rubber, draped velvet curtaining, fibre board, coconut matting and draped cotton curtaining. The relative value of each changes slightly to the particular frequency i.e. the absorbent co-efficient of loose cottonwool will be about 90 per cent. at 4,000 c/s and soft felt about the same, but a drop of 1 kc will see the cottonwool retaining, or even slightly increasing, its absorbtion co-efficient percentage while the soft felt drops to about two-thirds. The above order shows a behaviour over a range from 500 c/s to 10 kc/s. For lower frequencies and particularly those below 200 c/s heavier and more solid materials should be used.

Synchronous motor: is an electric motor running at a speed solely determined by the mains frequency supply.

Take: is the jargon used to describe a continuous piece of action on film.

Voice over: is sometimes called Narrative Sound and is usually delivered by an unseen narrator to accompany an already recorded music track.

Wow: refers to the unpleasant effect produced by uneven transmission and is usually a low frequency flutter.

"The above picture is a frame enlargement from Derek Purslow's prize-winning animated film "Sound and Vision".

"*Hatapatu*" is a plasticine puppet film based on a legend about the greatest of the New Zealand Maori Chiefs and the soundtrack consist of recordings of ancient Maori chants made many years ago but which, until this film, had lain forgotten in a museum.

For economy reasons, "*The Forgotten Faces*", a story of war-torn Budapest, was shot at 16 fps. Now it runs at 24 fps because of the Hungarian music on the optical track. Despite the occasional and noticeable speeding up of some action this is a remarkable film, even more so than the earlier Watkins' film—"*The Diary of an Unknown Soldier*" and deserves to be seen.

Hand-Painted Film

"*Sound and Vision*" is a hand-painted film, originally drawn on 35 mm filmstock with a mapping pen and indian ink. Using this filmstock as negative, a 16mm positive print was made so that the drawings would be white. The white areas were filled in with coloured inks and a laminated full stripe was added. The music track was composed, after the film was actually photographed—thus reversing the normal procedure—by Purslow himself, who is an Army Bandsman, and recorded by Army musicians from Sandhurst at a post-synching session with a B & H Mag/stripe projector.

Book in Advance

On 24th, 25th, 26th May this year the ten best films made by amateurs will be shown at the National Film Theatre, South Bank, Waterloo. As this is the most popular amateur show to be held in Great Britain throughout the year, we advise all readers who are interested in attending these films to book well in advance.

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,, TK.40	...	...	†
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,, TK.55	...	...	63/–*
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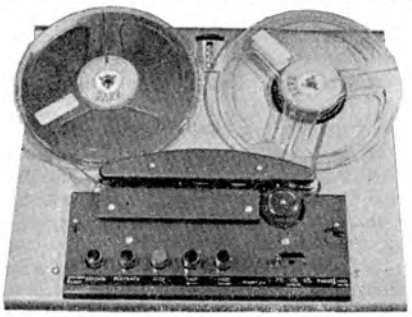
TAPE, RECORDERS & ACCESSORIES

FIRST DETAILS OF NEW PRODUCTS

● *We remind our readers that notices of equipment listed and illustrated in this monthly feature are in no sense reviews. When figures, specifications and diagrams are published, these data are extractions from manufacturers' lists. When samples of this equipment are submitted for test, they are passed to our technical contributors, whose reports are published in a separate section.*



★

PLANET U1 TAPE DECK

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A NEWS item was published some time ago regarding the Planet U1 tape deck. This is now available, price £39 10s. The specification supplied gives the following details. Speeds of 7½, 3¾, 1⅞ i/s. Wow and flutter is claimed to be better than 0.1 per cent. at 7½, 0.15 per cent. at 3¾ and 0.2 per cent. at 1⅞ i/s. The motor fitted is a single Papst hysteresis synchronous type driving a 2¾ lb. balanced brass flywheel. Up to 4 heads in line can be fitted to customer's requirements and the standard model is fitted with a triple erase, one half track record and one half track play back Miniflux heads. The press-button controls include the normal record with interlock to prevent accidental eraseure.

The model is fitted with an automatic stop operated by metal stop foils, which stops the spools before the end of the leader tape reaches the hub centre. Spools of up to 7 inches in diameter can be fitted. The dimensions of the Planet are 14 x 12½. with a depth of 4¾ in. Full details can be obtained on request from the manufacturers, **Planet Projects, Planet Works, Conlan Street, London, W.10.**

* * *

★

REVOX TAPE RECORDER

★

THE Revox Tape Recorder manufactured in Switzerland is now available in this country from Audiocraft Limited. This machine has speeds of 7½ and 3¾ i/s. The machine will accommodate spools up to 10½ inches in diameter. Frequency response claimed is 40 to 12,000 c/s at 3¾, both ±2/3dB. The amplifier output is 6 watts. Further details of this machine can be obtained from the distributors, **Audiocraft Ltd., 296 Kensington High Street, W.14.**

* * *

FERRANIA recording tape is now available in Britain for the first time and is to be marketed by Neville Brown & Co. Ltd., distributors for cameras, projectors and films, manufactured by the Ferrania concern.

All Ferrania tapes conform to international standards and are available in standard play, long play, double play, high output and professional tapes. The mechanical properties are stated to provide almost endless life and the tapes are suitable for use in all climates. Full details can be obtained from **Neville Brown & Co. Ltd., Electrin House,, 93/97 New Cavendish Street, London, W.1.**

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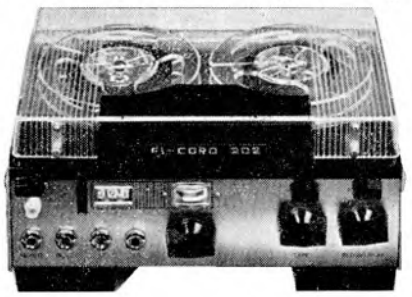

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FI-CORD 202 BATTERY RECORDER

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ADVANCE details were published last month of the new Fi-Cord 202 portable battery and mains recorder, weighing only 6¾ lbs. including batteries. This machine will be on show at this year's "Audio Festival and Fair". The price is 66 gns. and a full illustrated brochure can be obtained from **Fi-Cord International, 40a Dover Street, London, W.1.**

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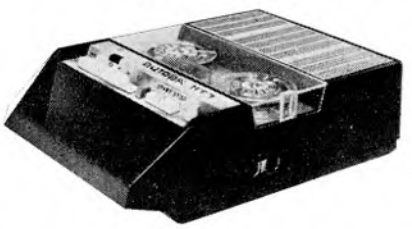

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BUTOBA MT 7 BATTERY PORTABLE

★

THE Butoba MT 7 tape recorder is a portable tape recorder smaller in size and performance than the MT 5. It has been designed primarily for the popular market and can be used for cine work and has sufficient quality to compare with mains machines in the lower price range. It is not, therefore, meant to compete with the MT 5 which is a portable tape recorder of professional standard.

The MT 7 is a fully transistorised model, using six transistors, one diode, and one magic eye tuning indicator DM 71. It has a transistor governed speed control, and guarantees constant speed ±0.5 per cent.

The machine is a two track, two speed (3¾ and 1⅞ i/s) model with a maximum spool size of 3 3/16 in. Frequency response claimed is 100-5,000 c/s at 1⅞ i/s, 100-12,000 c/s at 3¾ i/s. Output 0.8 watt. Batteries used are four 1½ v., and the weight including batteries is 8 lb. A mains convertor is available as an optional extra. The price will be announced later.

The MT 7 is distributed by **Denham & Morley Limited, 173-175 Cleveland Street, London, W.1.**

* * *

Masterlink Tape Preamplifier

A TAPE preamplifier designed to be used with most of the well-known tape decks available has been developed by Tele-Radio (1943) Ltd., called the "Masterlink". This unit enables recordings to be taken direct from microphone, pickup and radio. Bias supplies can be varied by a control on the front panel. Equalisation is provided for speeds of 15, 7½, 3¾ and 1⅞ i/s. The price is £22 1s. Full details may be obtained from **Tele-Radio (1943) Ltd., 189 Edgware Road, London W.2.**

EQUIPMENT REVIEWED

★

SIMON SP5 WO-TRACK RECORDER

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Manufacturer's Specification: Tape speeds: 3¾ i/s and 7½ i/s. **Tape direction:** Left to right. **Max. spool diameter:** 7 in. **Number of tracks:** 2. **Track dimensions:** same for record and replay: from edges of tape to a blank lane 0.060 in. wide. **Playing time:** At 3¾ i/s with L.P. tape, 90 min. each track—total 3 hours. At 7½ i/s with L.P. tape, 45 min. each track—total 1½ hours. **Fast rewind time:** Approx. 75 seconds for full 7 in. spool. **Number of heads:** 4. **Type of heads:** One stacked record head, one stacked playback head and two half track erase heads. **Head adjustment:** Heads can be adjusted for height and azimuth. **Drive:** Three motors. **Braking:** Fast firm but gentle braking without stretch or snatch. **Indication:** Recording level meter, Bias indicator and tape footage indicator-clock face type. **Frequency response:** Overall radio jack in to low level jack out. At 7½ i/s 30 to 20,000 c/s ± 3dB. At 3¾ i/s 30 to 10,000 c/s ±3dB. Response at L.S. terminals is similar but subject to tone control settings. Recording and playback at 7½ i/s are to C.C.I.R. standards. **Wow and flutter:** At 7½ i/s, better than 0.15 per cent. *r.m.s.* At 3¾ i/s, better than 0.2 per cent. *r.m.s.* **Erase level:** At 1 Kc/s, better than 70dB. At 300 c/s, better than 60dB. **Track separation (cross talk):** At 1 Kc/s, 40dB approx. **Input levels:** Microphone (2 megs) sensitivity 1.8 millivolts. Radio and pickup, sensitivity 150 millivolts. **Output levels:** 5-6 watts into 15 ohms. Low level output from tape 350 millivolts. **Power amplifier distortion:** At 1 Kc/s rated output, better than 0.5 per cent. **Signal to hum (including noise) ratio:** Better than 50dB. Weighted against frequencies below 50 c/s. **Bias frequency:** 75 Kc/s push pull oscillator. **Tone controls:** Independent controls for bass or treble giving lift or cut on playback or P.A.: Treble lift at 10 Kc/s, 8dB. Treble cut at 10 Kc/s, 20dB. Bass lift at 50 c/s, 10dB. Bass cut at 50 c/s, 18dB. **Internal speaker system:** Main unit 10 in. by 6½ in. and 4 in tweeter built-in and specially balanced. **Facilities:** Pause control. Fader control. Input microphone and radio. Second channels provided for conversion to stereo. Output Ext. L.S. with or without internal speaker. Low level line output; second channels provided for conversion to stereo. Re-record from either track; re-recording on to same track (echo effects). Mixing of both radio and microphone inputs. Superimposition of either or both microphone and radio signals on pre-recorded tape. **Mains voltage:** 110 to 245 volts. 50 cycles A.C. **Price:** £97 13s. Manufactured by **Simon Equipment Ltd., 48 George Street, London, W.1.**

THIS recorder is original in every way; in styling. layout and circuit design. The layout of deck, loudspeaker, control panels and V.U. meter is very reminiscent of a B.B.C. control centre, and indeed the facilities provided are very similar. The loudspeakers and meter face the operator, so that he is in the best position for judging the quality and maintaining the correct recording level and balance. His hands fall naturally on the two control panels; record on the right and play on the left, and all input and output leads plug into standard jack sockets on either side of the console.

Two *erase, record* and *replay* heads are fitted to the deck although only one record amplifier and one replay amplifier are normally fitted. However, provision has been made for plugging in extra units so that conversion to full stereo is very simple; ganged controls and all the necessary input and output sockets are already *in situ*.

Switching facilities are provided so that recordings may be made on either track with the tape moving from left to right, or a signal may be transferred from one track to the other by re-recording with mixing facilities for adding microphone or line inputs as desired. This transfer process can be carried on indefinitely to an extent limited only by quality deterioration due to successive *replay* and *record* losses. As will be seen in a later section, the frequency response and signal noise ratio are excellent so that a complex track, built up as a result of many transfers and mixtures, is still crisp and clean.

My biggest thrill when reviewing this recorder was to remove the base plate and gloat over the beautifully arranged electronic sections. Most of the amplifiers use transistors; the head pre-amplifier, tone control section, drive amplifier and power output stage—together with a balanced push pull bias and erase oscillator—are all transistorised. On the recording side, valves are used for the microphone input stage, and for the very elegant peak reading record level meter; this is quite professional in appearance and performance covers a range of over 20dB, so that very quiet signals are still indicated as well as full peak recording level.

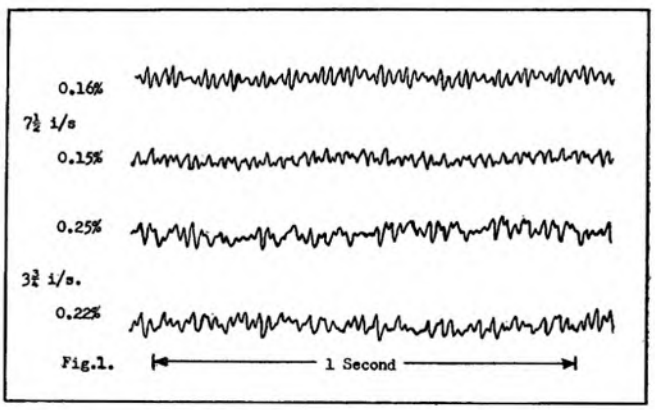


Fig.1.

My biggest disappointment was the deck used in this otherwise superb recorder. It has a slack, "clangy" feel about it, and tape threading is an absolutely infuriating business! If the tape is stretched out in the normal way and dropped into the slot it automatically arrives on the wrong side of the pause control knob and picking the tape out and looping it around the two guide posts drives me frantic—still this is a purely personal opinion and perhaps I have not yet discovered the knack! The tape can also tangle itself under the reels on the slightest provocation, and the tape also winds badly and unevenly on the reels on my review model.

Wow and Flutter

Fig. 1 shows the fluttergrams or pen recordings of the short term speed variations about the mean speeds of 7½ i/s and 3¾ i/s together with the integrated *r.m.s.* readings. It will be seen that they are just within the specification some of the time

(bottom traces), and just outside at other times when the recorded and replay wows happen to come into step. Although not shown very well on my one-second pen recordings, there was a cyclical variation of the meter reading twice per second at

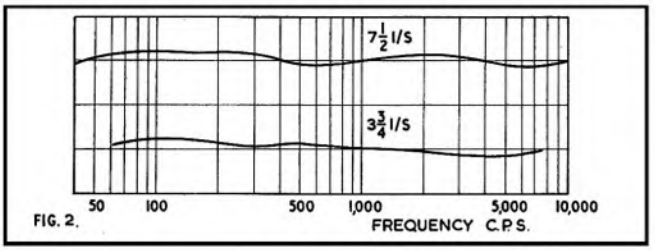


FIG. 2.

7½ i/s and once per second at the lower speed; this proved to be due to a slightly eccentric pressure roller. It can be distinguished on the bottom fluttergram for the 7½ i/s test.

The main flutter component at 7½ i/s is at the drive motor speed of 50 c/s (3,000 *r.p.m.*) and fortunately the ear is not sensitive to flutter at this frequency. At the lower speed there seems to be a 25 c/s flutter coming up at times, and although this was just audible on a pure tone the much smaller amplitude once per second *wow* was much more obvious and shows once again that very great care must be exercised in interpreting wow and flutter graphs or meter readings.

Playback Only Responses

Fig. 2. The "Playback only" responses are so good that they might just as well indicate errors in the calibration of the test tapes! The curves shown are for the low level line outputs, but the response across the loudspeaker jack, with the internal speaker in or out of circuit, was almost identical. This shows that heavy negative feedback is applied to the power amplifier and that the response is not dependent on speaker loading, nor is it affected by changes of speaker impedance. The response to the power amplifier only can be varied by the independent bass and treble tone controls (see specification).

Record/Play Response

As seen in **fig. 3**, the Record/Play response is excellent! What more needs to be said? These responses were taken at test tape recording level, i.e. 12dB below peak recording level. If the tests are done at 20dB below test tape level the high frequency response at the lower speed is level at 10 Kc/s and extends well up to 15 Kc/s. This indicates that recording pre-emphasis is in the order of 20dB and, to my mind, this is a bit much. On a very good F.M. transmission, with a fair frequency

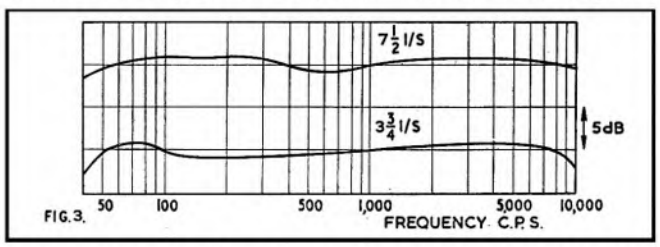


FIG. 3.

content around 10 Kc/s, it was noticed that very slight "clogging" of high frequencies in music, and sibilents on speech, could be heard on direct comparison with the original by means of the A-B switch provided. A 2 to 3dB reduction of recording level cured the trouble on most occasions, and this underlines the extreme convenience of instantaneous "off the tape" monitoring. The A-B switch also is a "must" as far as I am concerned on a recorder of this calibre. Any manufacturer who has the courage to fit one gets my vote straight away!

On this recorder the bias can be varied by a small pre-set panel control, and the bias on the head can also be measured on a second scale on the V.U. meter calibrated directly in volts. I found it most instructive to alter the bias whilst recording, and also to be able to compare the recorded signal with the original after each change of bias. In fact this recorder is almost a portable laboratory—sorry—did I say portable—well not quite—it weighs just over 50 lb.!

Signal Noise Ratio

Peak Recording level, as indicated by the V.U. meter, was exactly 12dB above test tape level, and the recorded level could be increased by a further 3dB before tape distortion reached 5 per cent. Noise and hum was 38dB below test tape level so that the total dynamic range or signal noise ratio exceeded 50dB. Transistor and recorded tape hiss was extremely low. The hum was not pure 50 cycle hum, otherwise it would have been completely inaudible at this level; it consisted mainly of higher order harmonics radiated, I imagine, from the capstan and rewind motors, another black mark for the deck! With the ear a few inches from the speaker this slight hum, together with the very slight tape hiss, was about the only clue that the signal was being heard via tape. At normal listening distance it was imperceptible.

Acoustic Response

The internal speaker system consists of a 10 in. by 6 in. main unit with a round 4 in. tweeter for high note response. The acoustic response of the speakers and cabinet was taken by loading the deck with a white noise test tape, containing

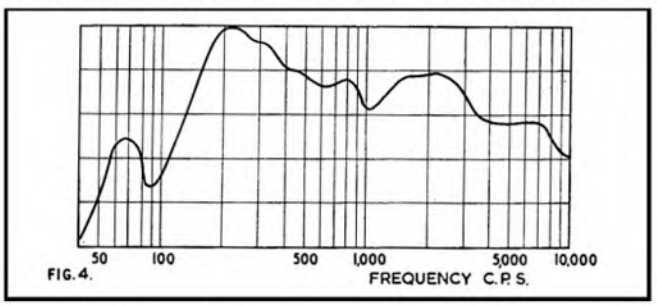


FIG. 4.

25 one-third octave bands of filtered white noise, and measuring the sound output on a calibrated microphone at normal listening position at a point midway between the two speakers. The response is shown in **fig. 4**. This confirms the very slight boxiness noticed on listening tests due to cavity resonance at 200 c/s. The main cone resonance appears to be at 65 c/s and it would seem likely that a little acoustic damping within the cabinet would lead to some improvement. Let me emphasise that the colouration is only noticeable on direct comparison with an external wide range speaker; and the quality is perfectly adequate for monitoring and programme balance, and is a vast improvement on the average built-in tape recorder speaker.

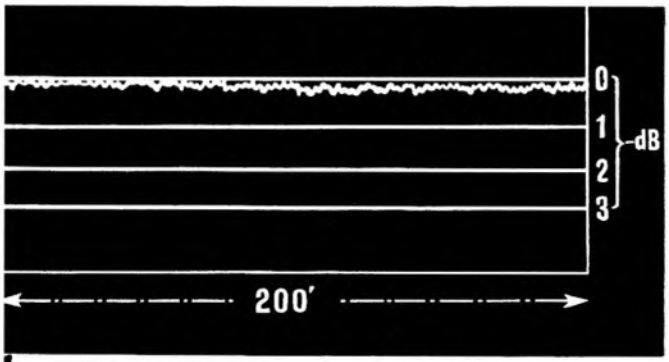
Comment: An excellent recorder, and warmly recommended. but please—will somebody throw away the pause control on the deck or, better still, bend the knob through a right angle so that it comes out at the side and does not clutter up the tape loading path? **A. Tutchings**

Manufacturer's Comment

The effect described by Mr. Tutchings in regard to deck controls can be achieved if one "feels" for the selected position. It is intended that the controls on the SP5 should be used in a firm, positive manner when selecting any of the deck functions.

We would suggest that Mr. Tutchings has found the answer himself to his criticisms regarding tape threading and the position of the pause control. We are sure that familiarity with the SP5 would have eliminated these difficulties in a very short time.

Variations in tape lay (on the fast wind function only and not in the normal functions of record and replay) can occur as a result of static, and air inclusion in the fast rewind operation. This does not affect in any way the performance of the recorder and is a factor against which must be set the obvious advantages of fast rewind time. (*continued on page* 175)



This is an outline . . .

of the penrecording made by
F. C. Judd, A. Inst. E., Technical Editor
"Amateur Tape Recording"

On Doubleplay Polyester

'ELECTRONIC WORLD' TAPE

Mr. Judd's other test findings include:-
Maximum drop-out, on any grade, less than 1.5 dB. Uniformity of output; Double Play Polyester ± 0.25 dB; Long Play Polyester better than ± 0.5 dB; Standard Play Acetate ± 0.5 dB. Noise level measurement recording and erase tests: Satisfactory in every way, even on a domestic tape recorder.

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7in.	spool	1,200ft.	17/6 per spool

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5in.	spool	900ft.	2 spools for 33/-
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7in.	spool	1,800ft.	29/- per spool

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4in.	spool	600ft.	2 for 27/6
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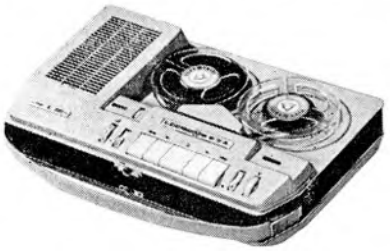

★

LOEWE OPTA MAINS/BATTERY PORTABLE

★

Manufacturer's specification: Power supply: A.C. 40-60 c/s 110/220 volts or 5 U2 1½ volt cells. **Tape speed:** 3¾ i/s double track, international standard. **Dynamic range:** 46 dB or better. **Reel diameter:** 4½ in. max. **Power output:** 1 watt with 10% distortion. **Bias and erase frequency:** 55 Kc/s. **Record level indicator:** magic light line tube. **Tape position indicator:** revolution counter. **Built-in loudspeaker:** 3¾ in. by 6 in. oval P.M. unit. **Dimensions:** 15¼ in. by 9¼ in. by 4¼ in. **Weight:** 8.8 lbs. **Battery life:** 20 hrs. with intermittent use. **Price:** £47 5s. From: **Highgate Acoustics, 71-73 Gt. Portland St., London, W.1.**

THE slim styling and elegant finish of this unit reminds one of a lady's handbag rather than a tape recorder, and if you want your wife to take an interest in your hobby, this could be the ideal introduction. The simple piano key controls

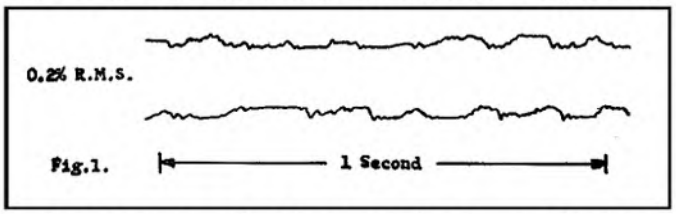

Fig.1.

would also appeal to the fair sex, and the all-up weight of less than 9 lbs. would hardly tax the strength of a child.

The reels are held firmly in position by the slotted plastic spindles, and the take-up reel clutch is not affected by the position of the recorder, so that it may be used upright, or even upside down if required. Recordings may be made with the lid closed, but it is necessary to open the lid during playback, so as not to obscure the loudspeaker. Parking space for the microphone is provided within the case, and, during portable use, the main lead is also stowed away inside; indeed it must

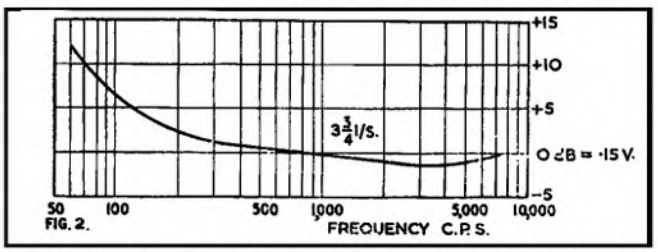

FIG. 2.

be, because the two-pin plug on the end of the mains lead has to be plugged into an internal socket to switch over to battery operation.

Speed wow and flutter

The speed was checked on a constant frequency test tape and was found to be 3% fast on mains, and 2% fast on batteries. **Fig. 1** shows the instantaneous speed variations about the mean speed of 3¾ i/s. It proved difficult to get a representative pen trace because the integrated *r.m.s.* reading was changing continually between about 0.15% and 0.25%. It was decided that operation of the D.C. motor governer was changing the speed just enough to cause an addition and a cancellation of the recorded and playback 7 c/s capstan flutter. The effect can be seen even in the one-second fluttergrams. The effect on speech or music, however, is completely negligible, and for such a small lightweight machine the wow and flutter performance is eminently satisfactory.

Normal carrying by the handle does not introduce any audible speed change, but violent fore and aft pitching can "move the case round the flywheel" and produce some peculiar effects. If the machine is to be used in a vehicle, where it may be subject to vibration or bouncing, it is better to lie it flat on the seat or floor.

Play only response: The curve of **fig. 2** indicates the response to be expected from a pre-recorded tape with a recorded characteristic of 200 microseconds. The response shown is that from the low level line output; the bass rise does not affect

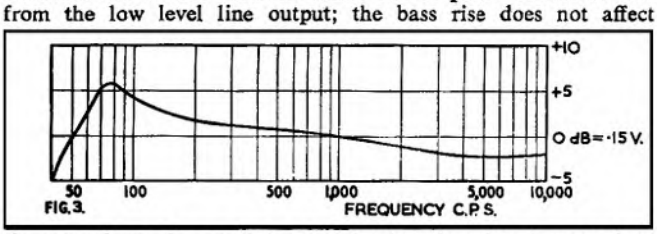

FIG. 3.

the tone from the small internal loudspeaker, but it may show up as a slight "heaviness" when feeding an external power amplifier and speaker. Mains hum was 28 dB below test tape level on mains operation. On batteries the transistor and motor noise was 34 dB below test tape level.

Record play responses

Fig. 3 shows the overall record replay characteristic from radio input to line output. The slight bass rise is still in evidence but, on live recordings, it will help to offset the falling response of the microphone at the lower frequencies. The magic eye indicator beams clashed at 12 to 14 dB above test tape level, which is exactly as it should be!

The ratio between peak recorded signal and total transistor, motor and tape noise was 46 dB on battery operation. This dynamic range is very satisfactory as it means, in practice, that the recording gain can be set to a "safe" level, well below overload, and the case closed for portable recording, with little chance of background noise obtruding during playback, and with some insurance against overload from loud unrehearsed sounds.

Acoustic response

The acoustic response, shown by **fig. 4,** was obtained by recording one-third octave bands of filtered white noise and replaying into a calibrated microphone on the axis of the internal loudspeaker at a distance of one foot. The high note response is reasonably level, but the speaker cone resonance is

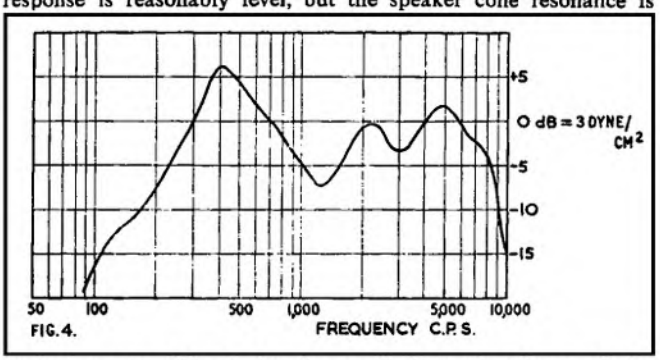

FIG. 4.

pushed up to 400 c/s by the small internal volume of the recorder case. The resultant peak is undamped and gives a slightly "boxy" quality to the radiated sound.

The microphone supplied with the recorder also has a slight mechanical resonance at 400 c/s, and the combination is unfortunate in adding to the colouration already produced by the loudspeaker and recorder case. The microphone response and other details are shown by **fig. 5.** It is a pressure-operated moving coil microphone with a non-directional response at low and medium frequencies. (*continued on page* 176)

EQUIPMENT REVIEWED—(continued)

Comment: If I seem to be rather too critical about the microphone and loudspeaker fitted to this recorder it is only because I feel that the recorder proper is worthy of better input and output electro acoustic transducers. A certain amount of

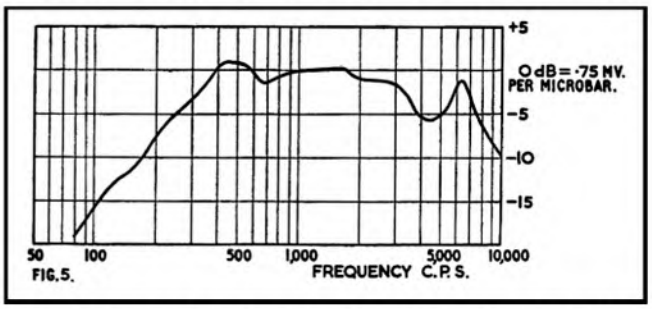

FIG.5.

mechanical noise is radiated by the recorder, but, in itself, it is barely enough to intrude on normal replay. If, however, a microphone recording is made and replayed on the internal speaker the noise can be quite objectionable. A cheap directional (cardioid or pressure gradient) microphone with a low frequency response down to say 200 c/s would affect a vast improvement both in quality and reduction of the recorded motor noise. This is not pure theory—I've tried it—and it does!

A. Tutchings.

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The firm in question is Messrs. Ray Electrical, Ltd., 287 High Street, Cheltenham, Glos.

I enclose my professional card and I am sure I need not assure you that I have no connection whatever with this firm, except as a very satisfied customer of many standing who is grateful for the good service received, and the extra personal interest and attention that I know to be given to all their customers, and which means so much to someone working with intricate and delicate equipment day in and day out. *Yours sincerely.*

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The subscription rate to *The Tape Recorder* is 21/- per annum (U.S.A. $3.00) from The Tape Recorder, 99 Mortimer Street, London, W.1. Subscription + Index, 24/- (U.S.A. $3.25).

.... tape recorder workbench

No. 34 MICROPHONES (Part I)

by A. Bartlett Still

IT must be admitted that, what ever limitations be imposed by the copyright acts, tape recorders are used in the main for recording from the radio, or for dubbing gramophone records. With the advent of VHF/FM broadcasting there is no doubt that a source of programme material of extremely high quality is available to the majority of tape recorder owners.

It is a fact, however, that while radio recording may perhaps be the most common use of tape recorders, the making of one's own recordings in the home provides the most exciting use of the medium. These are live recordings and require the use of a microphone, together with a certain knowledge of microphone technique. It is however unfortunately true that the performance of the microphone used rarely comes up to the performance of the tape recorder, with the result that recordings never approach the quality obtained in other directions. It is therefore proposed to examine the whole question of microphones and their use, to see whether the weak link cannot be strengthened.

To do this we must first determine exactly what our microphone is required to do. It is a device which will pick up acoustic energy from the surrounding air, and transform it as faithfully as possible into electrical energy, such as may be amplified and recorded satisfactorily. It is natural to seek the most efficient type of microphone, and it is therefore advantageous to determine exactly what is meant by efficiency in such an instrument. One microphone may be said to be more efficient than another if it provides a greater electrical signal for a given sound, alternatively efficiency may be reckoned in terms of fidelity. Unfortunately any one type of microphone is rarely efficient in both these respects; in other words one cannot have both quantity and quality.

Probably the most efficient microphone in terms of magnitude of output is the *Carbon Granule* type used in the ordinary telephone. However, the performance of such a microphone in terms of frequency response and distortion is such as to render it virtually useless in any form of high fidelity recording work. *Piezo-Electric* or Crystal microphones are very popular at the present time and the price ranges from a matter of a pound or two upwards. In general they are sensitive, and some of the more expensive types are capable of reasonable fidelity. Though there are certain disadvantages in the use of this type of microphone it will be worth our while to examine it in greater detail later on.

The *Condenser* Microphone has never become really popular though one particular type is readily available. The Dynamic, or *Moving* Coil, microphone, similar in construction to a small loudspeaker, will often provide a useful compromise between performance in respect of frequency response, and the sensitivity that is so often required. It has however long been agreed that the ultimate performance in terms of frequency response and fidelity can only be obtained through the use of a *Ribbon* microphone. This type of microphone, unfortunately, is in general rather less sensitive than other types, by virtue mainly, of the way in which it has to be used.

Nowadays, several manufacturers make certain models of microphones available in three different impedance types. The usual lower impedance matching is for 25 or 30 ohms, one alternative is the usual line impedance of 600 ohms, and latterly microphones are provided in hi-z versions designed to do away with an input transformer in the pre-amplifier unit. These types are usually known as high impedance versions, although the actual matching impedance is only of the order of 50,000 ohms. The uninitiated may be somewhat confused, however, in that with such an arrangement three different figures have to be quoted for the sensitivity of what is, after all, basically the one microphone. In consequence a word of explanation as to the method of indicating the sensitivity of a microphone might not be out of place.

As mentioned earlier, sensitivity of a microphone is reckoned in terms of the magnitude of electrical signal delivered for a given acoustic signal. This in a practical sense is usually taken to be a sine wave signal of 1,000 cycles per second, the acoustic level being one dyne/cm². The sensitivity of a given microphone may therefore be quoted as X mV per dyne/cm², though it is more usual to refer to the sensitivity figure as being a certain number of decibels down upon one volt per dyne/cm². This may be even further complicated by virtue of the fact that the "dyne/cm²" portion may be omitted and the sensitivity given simply as XdB.

The lay mind may at once be confused by the term "dyne/cm²". It is a way of expressing atmospheric pressure, and sometimes the

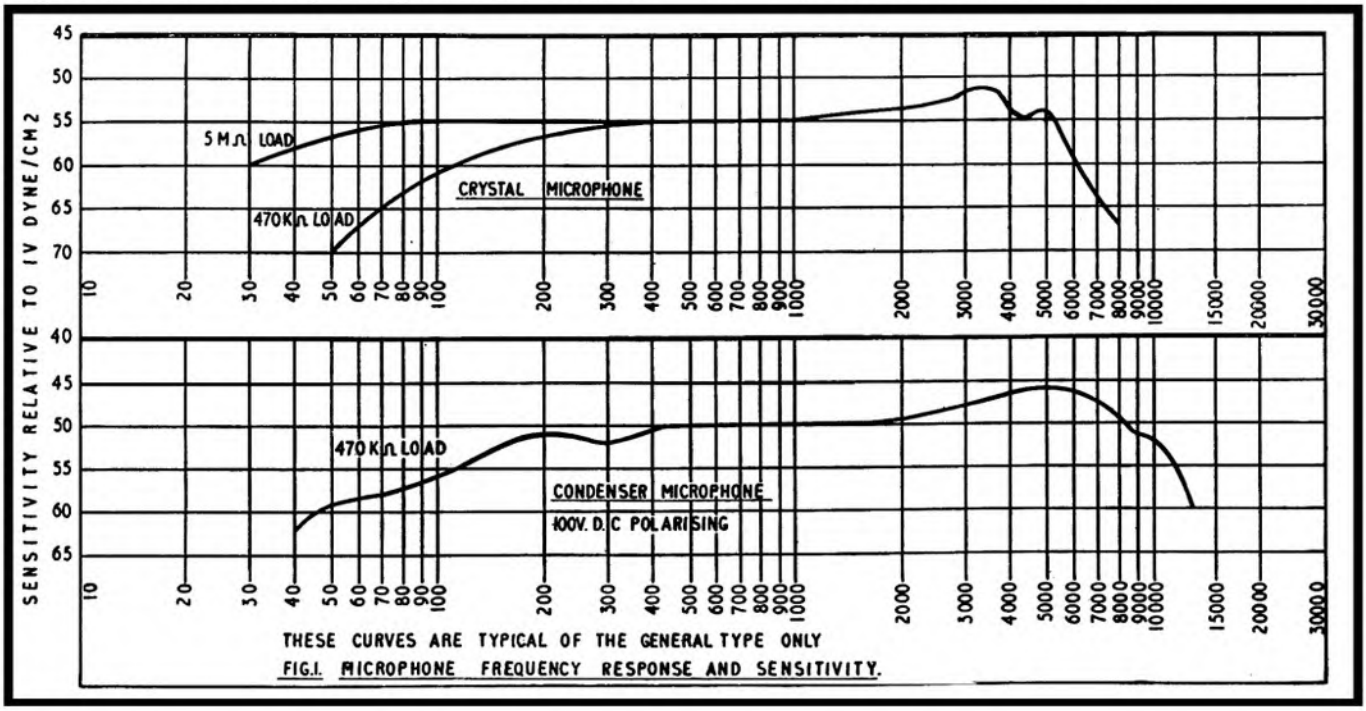

FIG.1. MICROPHONE FREQUENCY RESPONSE AND SENSITIVITY.

term "microbar" (μbar) is used. Some Rule of Thumb is obviously required, and fortunately one exists. The average man's conversational voice, speaking at a distance of three feet, exerts a pressure on the microphone of approximately one dyne/cm². Taking, as an example, hi-z moving coil microphone with a published sensitivity of −54 dB, one would expect, under those conditions, to obtain an output of 2 millivolts, during the peaks of sound.

Let us leave the question of the "quantity" of electrical output for a moment, and look at the other variable, "quality". Although the two terms *Distortion* and *Frequency Response* will both spring to the mind of the High Fidelity enthusiast, it is unlikely that the microphones we are considering will give rise to measurable distortion under normal conditons of use. Unfortunately while many manufacturers will cheerfully claim the frequency response of their product to be "*x c/s to y Kc/s*" few of them are prepared to give the equally important "± ZdB". Leaving aside the really expensive, professional equipment, it is the writer's experience that, over the range specified, the general curve will lie within ±5dB, with occasional peaks or troughs extending to 10dB.

Such limits, though at first sight poor when compared to the usual specification of a good quality amplifier or tape recorder, prove to be adequate in practice. This is due to the marked effect of "room acoustics" on the apparent performance on the one hand, and also to the fact that certain conditions of use require not a wide, but a restricted response in order to achieve the cleanest recording. But more of that later, for the moment let us examine the various types available in turn to decide upon their relative advantages or otherwise.

Crystal Types

Crystal microphones are normally of high impedance, though occasionally can be obtained with a built-in step-down transformer, and consequently are suitable for direct connection to the grid circuit of a valve. Sensitivity is generally of the order of −55dB and so should be suitable for a tape recorder requiring an input of 2 mV or thereabouts.

The frequency response of the cheaper crystal microphone is not wide, and can in fact be something of a variable quantity. The usual range quoted is about 50-6,000 c/s, but it must be stressed that the low frequency performance is dependent upon the input load. The microphone insert is capacitive, about 1,500 to 2,000 pfd, and this capacity, being in series with the ouput voltage, forms a bass cut filter with the input load. This load has, in consequence, to be about 5 megohms if the response is to be maintained down to 50 c/s. This will call for careful attention to the design and screening of the microphone pre-amplifier.

This unique feature of crystal microphone can often be turned to advantage. It is well known that for speech recording only, a good low frequency response is sometimes a disadvantage. A crystal unit, working into a load of 470 Kohm or 1 Megohm will give very "clean" results on speech, with an absence of "building rumble".

By virtue of the capacitive nature of the source, and the high input loading required, particular care has to be taken when wishing to extend the microphone cable. The self capacity of the cable, if allowed to become an appreciable quantity when compared to the microphone capacity, tends to reduce the output in addition to any slight effect it may have on the frequency response. Should it be allowed to equal the microphone capacity, the output will drop by 6 dB. As indicated in respect to the preamplifier, the screening of the cable will have to be very good if hum is to be avoided. As a practical note, it must be said that normal 75 ohm co-axial cable will not be good enough.

Condenser Microphones

Much that has been said about crystal microphones applies equally to condenser types. The frequency response and sensitivity are generally better, but a good microphone built on this principle is definitely more expensive, and usually out of reach of the pocket of the home constructor. It also suffers from the added disadvantage that a DC polarising voltage is required. This not only tends to complicate the pre-amplifier circuitry, but also requires that the connecting cable, in addition to the features shown above, must have a very high leakage resistance if unwanted noise is not to be introduced.

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(*continued on page* 180)

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