

# the TAPE

PRICE 1/6

March 1962

Vol. 4 No. 2

# RECORDER

INCORPORATING "SOUND AND CINE"



## IN THIS NUMBER

The Calibration and Use of Test Tapes (Part 1) • Equipment Reviewed • Tape Recorder Service  
• Tape Recorder Workbench • Soft, for Art's Sake! • These Dealers offer Good Service • Our Readers  
• Write • Sound and Cine • Field Trial of the Dokorder PT-4K • News and Pictures from the Clubs

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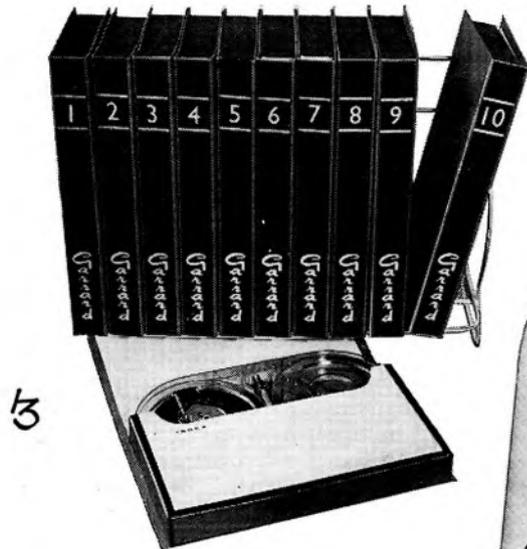
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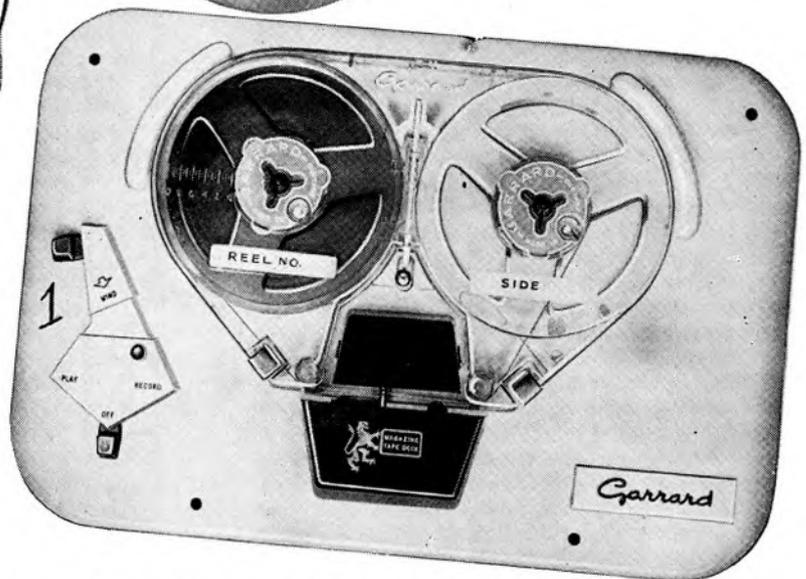
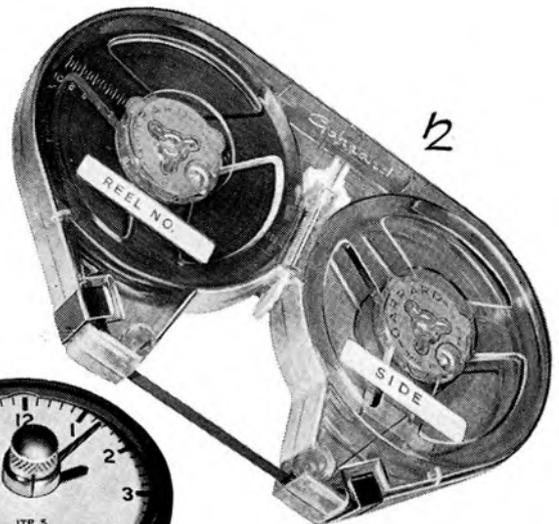
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# ANY 3



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2. Grieg Piano Concerto. Odd Gruner-Hegge dynamically conducts the Bavarian State Radio Orchestra. Alexander Jenner piano. Disc/Tape: mono only



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38. Hervey Alan, Ian Wallace, Marion Grimaldi and chorus sing the immortal Cobbler's Song, Robbers' Chorus, Chu Chin Chow, etc. Disc: mono/stereo. Tape: mono only



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40. Star cast sing highlights from Puccini's great opera, including famous One Fine Day. Disc/Tape: mono only



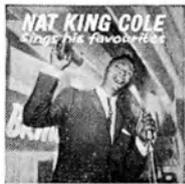
NAT KING COLE



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47. Brahms Violin Concerto. Superb playing by Endre Wolf and Sinfonia of London under the baton of Anthony Collins. Disc: mono/stereo. Tape: mono only

## THE BIGGEST BREAK-THROUGH SINCE TAPE RECORDING!

Not only is this the greatest World Record Club introductory offer yet made... it is a unique offer never before matched by any record club or company anywhere in the world!

### Any 3 for 30/-... Tape or Disc!

Choose now any 3 titles from the varied selections shown above. Next, decide whether you prefer them as high-fidelity 3 1/2 ips pre-recorded tapes, or as high-fidelity 12" LPs. Either way the price is the same. Just 3 for 30/- tape or disc. That's only 10/- each!

### Unconditional Guarantee

When you receive your 3 titles you have 7 days in which to listen to your selections and decide whether or not you want to keep them. If you don't, just send them back and you owe us nothing. This guarantee is absolutely unconditional!

### Joining World Record Club

We know however that you'll not only be surprised but amazed. A host of new technical developments have gone into the production of these tapes. They provide, at 3 1/2 ips, a range and response that was never previously attainable at

this slow speed. The LPs too, are the equal in quality of the world's best. We believe you will be anxious to keep them (if you do, you'll be saving up to £6 on shop prices for the tapes, or up to £4.10s. on the LPs). This decision will make you a full member of World Record Club, entitled to share all the many extra unique facilities that make the Club the only one of its kind in the world.

Your only undertaking is to agree to buy four more tape records (or 12" LPs) over the year from the exciting and adventurous selection of at least 60 titles that will be offered to you. Each of these future Club releases will cost you only 29/- plus postage. Tape or 12" LP—both cost the same. Again, far, far below any comparable shop prices for an original full length star recording. This is only possible because of the Club system of direct-by-mail distribution.

### The more you buy the more you save!

If you buy more than your agreed 4 (and most members do) you can choose yet another title absolutely free for every 3 extra selections!

### Your benefits as a club member

- \* FREE monthly magazine, packed with illustrated feature articles!
- \* FREE bonus tapes and 12" LPs!
- \* EXCLUSIVE extra releases!
- \* SPECIAL concert and theatre price concessions!
- \* EXPERT GUIDANCE: WRC recordings are planned by an eminent advisory panel including the Countess of Harewood, Lord Montagu of Beaulieu, Sir Arthur Bliss, Richard Attenborough, Cyril Ornadel, Ray Ellington, Leon

Goossens, Malcolm Arnold, Steve Race, John Hollingsworth and Antony Hopkins. As special technical adviser on tape, WRC are privileged to have the services of Miles Henslow, editor of this magazine and distinguished authority on electronics.

### Your Guarantee of Quality

WRC guarantees that every tape or record you choose (introductory offer, regular selection or bonus) will be of absolute top quality—the equal in every way of the very best recordings available anywhere in the world today. You may return any tape or record with which you are not entirely satisfied.

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- Gilbert and Sullivan: Mikado, Gondoliers, Pirates of Penzance.
- Enigma Variations. Boulton/LPO
- Nat King Cole, Lionel Hampton, Dean Martin, Duke Ellington.
- Beethoven: Symphonies 1, 4, 6 & 9. Josef Krips/LSO
- La Traviata—star cast and orchestra.
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- Porgy and Bess, Carousel, Desert Song, and many other great shows.

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Select the 3 titles you would like. Fill in and post the coupon today. Remember to indicate whether you require tape or disc. Send no money now. This is an opportunity you cannot afford to miss!

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32. Star cast and orchestra stage all the famous songs: Getting to Know You, Hello Young Lovers, etc.  
Disc: mono/stereo. Tape: mono only



33. Beethoven 5th, plus Egmont. Josef Krips and LSO in a titanic interpretation matching the power of the music.  
Disc: mono/stereo. Tape: mono only



34. Standout: How High the Moon, Searness of You, Round Midnight... 8 numbers by the vibraphone genius, Lionel Hampton.  
Disc: mono/stereo. Tape: mono only



35. Of Man River, Bill, Make Believe, many more memorably sung and played by full star cast.  
Disc: mono/stereo. Tape: mono only

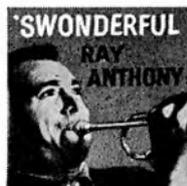


36. Best of Blues, After You've Gone. 12 hits by one of the world's greatest trombonists. Disc/Tape: mono only

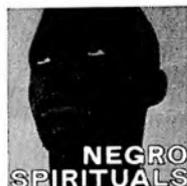


37. Thrilling playing: Revolutionary Study, Polonaises A and A flat, Fantasy-Impromptu, 12 favourites in all.  
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41. Night and Day, King Porter Stomp, Pennies from Heaven, plus 9 more sizzling tunes. Disc/Tape: mono only



42. George Browne, Isabelle Lucas and chorus sing Jericho, Swing Low. 12 well-loved songs.  
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43. Andy Cole, Barbara Leigh, Mike Sammes singers: High Society, Three Coins, Harry Lime, Gigi. 11 top film hits.  
Disc: mono/stereo. Tape: mono only



44. Leopold Ludwig and LSO in an exciting 'double': two of the world's greatest symphonies.  
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SIR MALCOLM SARGENT



45. Ian Wallace, Joyce Blair and chorus. Some Enchanted Evening and all the unforgettable songs from this great musical.  
Disc: mono/stereo. Tape: mono only



46. Marion Grimaldi, Linden Singers and Orchestra. Deep in My Heart, Serenade—all the old favourites.  
Disc: mono/stereo. Tape: mono only



49. Beethoven's Fidelio, Brahms' St. Anthony Vars, Mendelssohn's Hebrides, Wagner's Siegfried Idyll All under Britan's greatest young conductor.  
Disc: mono/stereo. Tape: mono only



50. David Hughes, Barbara Leigh, Andy Cole and chorus sing Indian Love Call, Rose Marie, many many more.  
Disc: mono/stereo. Tape: mono only



51. They Can't Take That Away From Me, Baby Doll, It Only Happens When I Dance With You. 12 favourite songs from the great Fred Astaire.  
Disc/Tape: mono only

## FACTS ABOUT WRC TAPE RECORDS

By the use of new electronic techniques, World Record Club is able to offer, at 3½ ips, tapes of a standard previously unattainable at less than 7½ ips.

All are recorded on the same high-class Emitape as that used for professional recordings, with extended frequency response. The tapes are twin-track and can be played on either 2 or 4-track recorders. The spool size is 5".

At this stage all WRC 3½ tapes are *mono* only. However for stereo enthusiasts we have something special too:

### STEREO TAPE RECORDS (7½ ips TWIN-TRACK)

An exciting catalogue of 7½ ips pre-recorded tapes *in stereo only* has just been prepared. These are *not* exclusive to club members and may be ordered direct by anyone individually and without membership commitments. Stereo tapes are on 7" spools and run at 7½ ips only. The reproduction quality of this series is fantastic and *must be heard to be believed*. Stereo tapes cost from 50/- to 60/- depending on playing time, plus 3/- postage, packing and insurance. A list of titles will be sent on receipt of a postcard to the Club, marked STEREO. *Do not use the coupon for this stereo list unless you are also joining WRC.*

## SEND NO MONEY NOW

TO WORLD RECORD CLUB (DEPT. TRR3)  
BOX 11, PARKBRIDGE HOUSE,  
THE LITTLE GREEN, RICHMOND, SURREY

I wish to join World Record Club as a

Tape member (3½ ips pre-recorded tapes)  Disc member (12" LPs)

(Please tick which you *want* to be. Members must select *all* disc or *all* tape—unfortunately it is not possible to mix.)

Please send me the three titles of my choice as indicated. If I keep them beyond 7 days you may enrol me as a member of World Record Club and I will pay you 30/- plus 3/- postage/packing/insurance. As a member I agree to choose a minimum of 4 releases at 29/- each (plus postage) from your annual programme of at least 60 exclusive selections. After 1 year I may cancel my membership with no further obligations if I so choose.

All records/tapes supplied to me are covered by your 7 day unconditional guarantee.

Signed .....  
This offer applies in Gt. Britain & N. Ireland only.

### SPECIAL NOTE FOR TAPE MEMBERS ONLY

Because of the Club outlay involved in setting up its new tape division, we ask tape members only to agree to pay £1 deposit AFTER approving their first 3 choices.

(Send no money now) This deposit will be deducted from the price of your 4th selection

Place record/tape numbers only in boxes

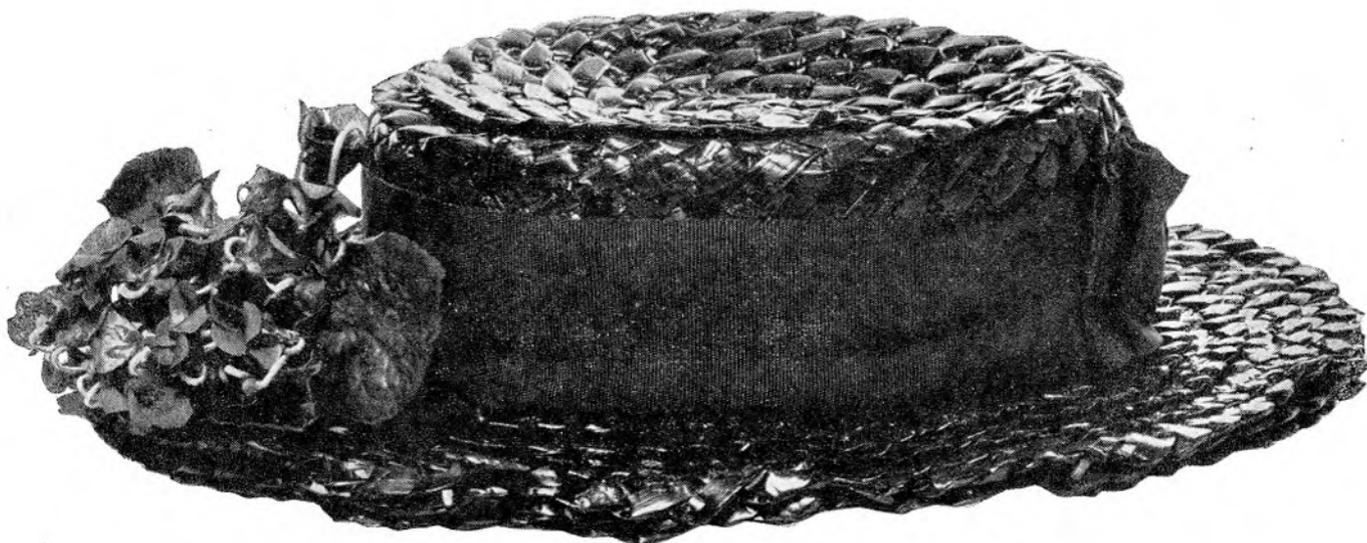
1st Choice No.  3rd Choice No.

2nd Choice No.

Tick here if stereo 12" LPs required where available   
Tick here if 7½ stereo tape leaflet also required

Mr/Mrs/Miss .....  
(Block capitals please)

Address .....



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 – says Emitape**

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## EDITORIAL

MEMBER OF THE  
 AUDIT BUREAU  
 OF CIRCULATIONS

IN November last, we wrote in this column about the plans that we had once proposed for the formation of a Tape Club, and we also mentioned that this idea had been dropped because of other events which occurred, and which would have made the whole idea too hazardous for the people who were then interested. We were, of course, concerned with the possibility of encouraging our friends to proceed with plans which might well have failed because of the formation of another London club. Indeed, two such ventures must, in our opinion, have divided the very membership that should have been united.

It is unfortunate that, in the meantime, those who were very interested in the plans that we put forward have since devoted their time, energy and enthusiasm to something quite different, and that they are no longer interested in the venture. That, however, does not in any way put a full stop to the idea, and we therefore outline publicly what we originally proposed privately, so that our readers may judge for themselves what we had (and still have) in mind. And we also announce that we have passed these details on to another group of people who may be interested in developing them. *It should be very clearly understood, however, that apart from the support which we and this Publishing House would naturally give to such a venture, we do not ourselves intend to be a part of it, or become financially associated with it, should it materialise; for this is not our line of country, and if it is to succeed it must be organised and run by people who understand what they are doing.* Briefly, then, our original proposals were as follows:

A club should be formed, with two distinct rates of membership for Town and Country members. It should be based on premises that could be found at a convenient place within the London postal area, where parking facilities are good, and where the astronomical rents of central London do not dictate an excessive membership fee. It should be large enough to include a number of small studios, a reading room and a lecture room, and possibly one fairly large studio for demonstrations and small recording sessions. All the small studios should be well and intelligently appointed and wired, so that members could hire them and be able to use them with any average equipment. There should also be a restaurant and bar for reasonably priced refreshments. There should be regular weekly lectures—visits by trained service personnel for the purpose of training members who wished to take up servicing, and for those who wished to learn something about the subject. There should be a wide range of equipment for temporary hire at nominal rates.

For members who required something more than the interests which even their own well-run local clubs could not provide, there should be weekly sessions for recording—Chamber music, Jazz, Soloists, etc.—properly organised, so that good material

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and good equipment could be made available in realistic circumstances. With these arrangements, the users of the small studios could experiment in comfort, and others could record "live", and gain experience from trained personnel in matters of microphone techniques, acoustics, etc.

Such a club would be devoted entirely and exclusively to the art of tape recording. It could prove of great use to manufacturers, since it would bring their customers into closer touch with the things that are all too often unnecessary problems. It could improve the understanding of maintenance and servicing. And, in its primary aim, it would enable the many enthusiasts to find a much wider field of interest for their work.

*We do not invite correspondence at this stage, but we will most certainly reopen this subject, and will ask for indications of possible support, if and when we ourselves succeed in enlisting the active interest of the people who we hope may take up the idea.*

## COVER PICTURE

One of the many activities of the Radio Division of the Central Office of Information is to produce recorded tapes for transmission by radio stations in many parts of the world. The front cover this month shows a technician of the C.O.I. producing multiple copies of a recording for dispatch to the overseas broadcasting stations. The equipment comprises Leevers Rich recorders, E.M.I. tape, and S. G. Brown headphones.

*(The photograph was supplied by kind permission of the Central Office of Information.)*

## NEXT MONTH

IN our next number we publish full advance details of the 1962 Audio Festival and Fair to be held at the Russell Hotel, London. Also in this number will be a further article on Tape Recorder Service and another by A. Tutchings dealing with recording characteristics for different speeds. The review section will be of particular importance for it includes a full technical report of the 2-track stereo Tandberg.

## SUBSCRIPTION RATES

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).

Here's the



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# TELEFUNKEN

## tape recorders



**TELEFUNKEN MAGNETOPHON 95**

Entirely new design in the Telefunken range with attractively styled case. Twin Track. Fully Portable. Three speeds:  $7\frac{1}{2}$ ",  $3\frac{1}{2}$ " and  $1\frac{1}{2}$ ". Maximum Spool Size 7". Frequency response: 30-18,000 c.p.s. at  $7\frac{1}{2}$  i.p.s.; 30-16,000 c.p.s. at  $3\frac{1}{2}$  i.p.s.; 30-9,000 c.p.s. at  $1\frac{1}{2}$  i.p.s. Special trick and "straight through" amplifier facilities.

59 gns (excluding microphone)



**TELEFUNKEN MAGNETOPHON 96**

This new FOUR-TRACK recorder has the same basic style and technical specifications as the Magnetophon 95, but offers all the advantages of the desirable four-track technique.

Playing time over 16 hours on 7" DP tape. Multiple transcription from one track to another. Facilities for playback of pre-recorded stereo tape through additional amplifier or radio.

69 gns (excluding microphone)



**TELEFUNKEN MAGNETOPHON 97**

The stereo tape recorder which provides not only the outstanding facilities of the four-track system with its manifold possibilities for transcribing and trick effects, but also the twin-channel stereo, four-track technique for recording and playback.

Speeds, frequency response and spool size same as Magnetophon 95. Extra speaker in the lid for stereo playback.

95 gns (excluding microphone)



*and of course*



75K-15

75K-15—Tape speeds  $3\frac{1}{2}$  i.p.s. and  $1\frac{1}{2}$  i.p.s.; frequency response of 60-16,000 c.p.s. and 60-9,000 c.p.s. Tone control; extension speaker socket; playing time of 6 hours on  $5\frac{1}{2}$ " DP tape. 47 Gns (excl. microphone)

85KL—Tape speeds  $7\frac{1}{2}$  i.p.s. and  $3\frac{1}{2}$  i.p.s.; frequency response 30-20,000 c.p.s.  $\pm$  3dB and 30-15,000 c.p.s. 6-watt push/pull power stage. Separate Bass and Treble controls. 79 Gns (excl. microphone)

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147/8 STRAND, LONDON, WC2

NAME .....

ADDRESS .....



# NEWS FROM THE WORLD OF TAPE

## WARNING TO READERS



**M**R. A. R. RIDLEY of the Castleton Hotel, Paignton, Devon, at home with his recording and cine equipment. He had just recorded sound effects from his Grundig TK 1 on to the master tape on track 1 of the 4-track TK 24. When the picture was taken he was playing music from the TK 35 through the GMU 3 mixer unit on to track 3 of the TK 24. At the same time he is recording his commentary and controlling the volume of the music. With the Bolex Synchronmat in operation while he is recording, Mr. Ridley is assured of perfect synchronisation throughout the film. Mr. Ridley also uses his Grundig equipment extensively for the entertainment of visitors to his hotel.

### Export Order for WyndSOR

**W**YNDSOR Recording Company Ltd. announce that since Christmas they have received export orders for WyndSOR tape recorders to a value in excess of £80,000 sterling. One of these is believed to be the largest single export order ever received by a British tape recorder manufacturer. This means that until at least the beginning of May the WyndSOR factory will be working at full capacity production solely for export markets.

Mr. H. M. Creek, managing director of WyndSOR Recording Company, says that whilst he deprecates this decision from the home market point of view, he is sure it will be generally appreciated that it is vital to consider the national interest and to give these export orders priority.

Anyone having difficulty in obtaining a WyndSOR tape recorder should therefore write to the Sales Department, WyndSOR Works, 2 Bellevue Road, N.11, where every endeavour will be made to put them in touch with a stockist, although the scarcity has already become aggravated due to the seasonable increased demand.

Meanwhile the WyndSOR organisation is trying to make additional production facilities available to increase their output, and thereby alleviate the otherwise inevitable shortage there will be in the home market, and also to facilitate the early announcement of two new tape recorder models, now in a late stage of development.

### New Name

**T**HE Emitape Division of E.M.I. Sales and Service Ltd., will now trade under the new name of E.M.I. Tape Ltd., and all orders and communications should be addressed to: E.M.I. Tape Limited., Blyth Road, Hayes, Middlesex.

The Office Equipment Division of E.M.I. Sales and Service Ltd., has been transferred to an associated company: C. & S. Office Equipment Ltd., Fenwick House, 289/293 High Holborn, London, W.C.2, to whom all communications for office equipment, should in future be addressed.

**D**URING the past two or three months we have been receiving numerous telephone calls from people who have been canvassed for subscriptions to magazines, and who have in many cases paid out money for these subscriptions. The callers—usually young men and women—appear to be representing themselves as agents for a subscription agency with its head office in America. In some cases mention has been made of a branch office in Dublin. In all cases the agency has been described as a “High Fidelity” Guild, or Association, or some such.

This inclusion of the term “Hi-Fi” or “High Fidelity” has been the cause of the numerous telephone calls, because people who have waited for some time for tangible results have looked the names up in the London telephone book, and have called this office—either under the impression that we were connected with the scheme, or in the hope that we might be able to tell them more about it.

For all that we know, this may well be a perfectly bona-fide subscription agency; but one thing we do know is that it is in no way connected with *Hi-Fi News*, or *The Tape Recorder*, or this publishing house. And we therefore warn our readers that they should be on their guard against any such callers who may, by statement or implication, suggest that they are associated with us in any way.

The complaints—if they may be correctly called such—have come from many parts of the country. Some people have told us that they paid out money (as much as £8 or £9) as long ago as November and December 1961, but that they had so far heard nothing further from the agency.

The stories told by the callers have varied considerably in detail. Some have said that by collecting subscriptions for magazines they were to receive money to pay for University courses. Others have said that their payment would enable them to travel for education. One said that the money so earned would enable him to launch out in chicken farming. In some cases the callers have travelled in a car in groups: in other cases young men and girls have called singly.

It might be of help to others if readers with similar experiences would write to us, giving us details. It would be of even greater interest if we could learn of even one case where such a call, plus a payment made, had been satisfactorily concluded by the receipt of the goods ordered.

Editor.

### Pre-Recorded Tapes Available

Readers will be interested to know that Teletape Ltd., 33 Edgware Road, London, W.2, carry a full stock of pre-recorded tape under the W.R.C. label.

★ ★ ★ ★ ★ THIS MONTH'S PLUM

★ **NEGRO SPIRITUALS** W.R.C. TLMP 12  
(For those who like Negro Spirituals !)

★ ... and a Stereo Plum

**OLIVER** W.R.C. STT 151

SELECTED BY “THE TAPE RECORDER”

# NEWS AND PICTURES FROM THE CLUBS



Members of the West Middlesex Tape Recording Club seen preparing for a recording. Secretary, H. E. Saunders (third from right) in charge of operations. (Photo: Middlesex Advertiser and County Gazette.)

THE last meeting of the London Tape Recording Club opened with a talk on "The working and principal functions of a tape recorder", by Mr. Buttle. This was the main item on the programme, and Mr. Buttle held the interest of members for a full hour. After his talk the question and answer part of the programme was mainly devoted to elucidating some of the points that he had made.

Ken Blake, the chairman, produced an edited tape of what had been broadcast on the B.B.C. in the "Sound" programme, which was devoted to tape recording clubs. The last item was a short talk and demonstration on "How to solder a reliable joint", given by Godfrey Mousset.

Meetings are held monthly and details can be obtained from T. Devereux, 32 Windmill Lane, Southall, Middlesex.

THE Wakefield and District Tape Recording Club, which was founded in April 1959, was officially disbanded at an extraordinary general meeting held at the clubroom on January 19th. The Wakefield club has been responsible for an exhibition of tape recording in 1960 and the Wakefield Audio Fair in 1961. It was greatly regretted that the club had to disband, but membership had fallen in recent months, and although the Wakefield Audio Fair was a success—it brought forth only one new member.

It was considered not worthwhile continuing club meetings, and obtaining speakers and demonstrations, etc. The nucleus of enthusiastic members have formed a new group whose title will be decided later. This new group will continue to meet, and will have no committee, constitution or subscription. Its main purpose will be that of furthering the group's interest in tape recording by meeting informally, and also continuing to produce "Wakefield on Tape" and producing recorded programmes for hospitals. Details may be obtained from M. A. Storey, 331 Horbury Road, Wakefield.

THE meeting on January 25th of the Cotswold Tape Recording Society (Cheltenham), was devoted to a recording session. It has been found that these opportunities to aim a microphone at a live signal under experimental conditions are among the most popular of the activities of the society, besides being a useful source of material for the Hospitals' Service.

On this occasion members welcomed a group of young men, who play under the name of the Comets: three electric guitars with amplifying facilities of unimaginable power, piano and

drums. Peter Turner and Colin Woods shared the duties of "signal generator", first signalling to the recordists to start their machines, and then to the players to strike up. It has been found that these sessions call for a great deal of discipline and self-restraint if all are to have equal opportunities.

After the interval, the society was privileged to receive two artists who, though strictly amateurs, attain to virtuoso standards: a soprano, Betty Howse, accompanied by her husband, John, on the piano-accordion. It is greatly hoped that these modest and talented performers will visit the club again.

Further details may be obtained from P. D. Turner, Cave Cottage, Oakridge Lynch, Stroud, Glos.

INFORMATION and ideas galore were provided by Teletape Ltd. representatives for the North London Tape and Hi-Fi Club when they were hosts to members recently at their Marble Arch shop.

Mr. G. N. Tughan and Mr. W. Thomas, service manager, not only demonstrated a number of machines, different uses of stereo and pre-recorded tapes, but also presented members with ample refreshments to keep them going for the following day as well. Further details will be supplied on request from R. Colinson, 30 Ridler Road, Forty Hill, Enfield, Middlesex.

ARRANGEMENTS for the Walthamstow and District Tape Recording Society's running commentary on the Whitsun Carnival procession through the streets of Walthamstow are well in hand.

For the third year in succession, the Society are proposing to present to patients in the Connaught hospital who would otherwise miss Walthamstow's big day of Carnival, a pre-recorded description of the gay floats and capture the atmosphere of the day at the Town Hall before the 150-odd floats start on their five-mile journey through the streets.

A more comprehensive arrangement than usual is planned and the site being negotiated for at the busiest possible junction on the route, the corner of St. James' Street and High Street, should provide exceptional opportunities for "atmosphere" recordings with the market stallholders crying their wares in the background and the busy shopping crowds of a June Saturday afternoon all adding to the gaiety of the background.

The plans made include laying a telephone line from a pre-destined point to the "studio" fifty yards farther along the route,



"I'm sure that none of us are amused by your little joke, Emily . . ."

# NEWS AND PICTURES FROM THE CLUBS

by which means advance information can be passed to the commentators. The whole of the work will be carried out on the High Street site and the tapes rushed back to the hospital for play-back on the internal headphone circuit. All material recorded will have been played back to the patients and the broadcast will have ended before the procession actually passes the hospital which is situated only a short way from the end of the processional route. Further information can be received from *K. Perks, 9 Third Avenue, Walthamstow, London, E.17.*

**T**HE members of the **Cambridge Amateur Tape Recording Society** are looking for a workshop and clubroom suitable for soundproofing and converting into a studio and control room.

Arrangements are being made for publishing the 1962 club handbook which is due out in March. Contents will include the programme for the remainder of the year, annual reports and accounts and enrolment forms. The booklets will be distributed to local dealers to be passed on to customers purchasing tape recorders.

Meetings planned for the coming month include a lecture and demonstration by Mr. G. A. Briggs of Wharfedale Wireless Works Ltd. (March 14th) and a competition and play-reading contest (March 21st). The secretary *M. E. Renshaw, 6 St. Vincent's Close, Girton, Cambridge*, will supply further particulars on request.

**D**URING the last few months, members of the **Huddersfield Tape Recording Society** have recorded many of the popular singers, including Billy Fury, Eden Kane, Johnny Leyton and Cliff Richard. This was done with the kind co-operation of the local cinema manager and the managers of the artistes. The interviews will be included in a programme produced by the Huddersfield Hospital Broadcasting Association. Anyone with relatives or friends in hospital in this area are invited to send a message to the *H.H.B.A., 24 Queen Street, Huddersfield*, giving the name and ward number.

**A**T a recent meeting of the **Medway Recording Club**, a new committee was formed for the coming year, and Mr. P. Bocking was elected chairman. Meetings arranged for the next few months include, a talk on the correct use of microphones, using two recorders and tape exchanging. It is also planned to make outside recordings at this year's Farnborough Air Show.

Meetings are held every Monday (7.30 p.m.) at 23 Edwards Close, Wigmore, Gillingham, Kent, and further information can be received by contacting *Miss B. Ridden, 88 Broadway, Gillingham, Kent.*

**A** CONSIDERABLE number of people attended the opening night at the **Northampton Tape and Cine Club's** new premises on January 9th. Members from other local clubs including Bedford, Rugby, Coventry and Nottingham saw a programme which included a Stereo demonstration on tape and disc and a 16 mm film entitled "The March of Time".

A special feature of the evening was the opportunity for recording enthusiasts to record two bands, and those members that brought a recorder with them lost no time in finding the best positions for microphones.

On average, four new members join the club every meeting, but still more members are needed. Details are available from *R. C. Foster, 17 Shakespeare Road, Northampton.*

**T**HE **Walsall and District Tape Recording Club** have, at last, found suitable premises for holding meetings, and new members are invited to visit the New Inn, John Street, Walsall. Club activities during the past month have included a visit to a local organist, to hear his recordings of recitals and amateur



*Mr. D. J. Baverstock, a keen recording enthusiast, is anxious to form a club in the Hockley (Essex) area. Interested readers may contact him at 45 Chestnut Close, Hockley, Essex.*

operatics, and also an open night where members had the opportunity of demonstrating tapes made on their own machines. Details of future meetings can be obtained on request from *Mrs. J. Walford, 41 Mill Road, Pelsall, Walsall.*

**T**HE **Thornton Heath Tape Recording Club**, formed nine months ago, has made vast strides in their production of recordings compared with the early attempts. Meetings are held weekly at the Wilton Arms, Thornton Heath on Thursday nights, when normal club activities take place. During the last two months members have manned stalls at the local fête and bazaar, and have also entered a local group of musicians in the Crawley Tape Club Competition. This obtained for them the 2nd prize.

A hospital service has been formed and a personal message was recorded by Frankie Vaughan for the patients. It is hoped to extend this service to other hospitals in the near future.

New members will find plenty of interest at this club and they are invited to attend. *Mr. E. Bashford, 4 Doneved Road North, Thornton Heath, Surrey*, will supply further information.

**T**ERRY DAVIS, a member of the **Rugby Amateur Tape Recording Society** was recently invited to demonstrate the synchronising of tape and film. Having dealt with this subject fully, he showed a test film to prove the difference in methods of optical and magnetic recordings. After the interval, the film taken by him during his continental holiday last year with a recorded commentary proved to members the difficult task of recording and filming at the same time.

Future meetings arranged include a members tape night (March 1st), a visit by Mr. L. W. Saunders and Mr. P. H. Wetherell of E.M.I. (March 15th) and a talk on mixing and superimposing by Peter Scott (March 29th). Further details can be obtained on request from *M. Brown, 219 Clifton Road, Rugby.*

**A**MONG the lectures arranged by the British Film Institute for March are some with special interest for Sound and Cine readers living outside London. For full details apply to the organising body.

Date	Subject	Speaker	Locale	Organisation
4	Analysis of "The Gunfighter"	Alan Lovell	Bexleyheath	Bexley Adult Ed. Centre.
16	The Imaginative Use of Sound	John Huntley	Midland Inst. Birmingham	Birmingham Film Soc.
22	The Swedish Cinema	Peter Harcourt	Attingham Park, Shrewsbury	Attingham Park Film Soc.
27	Film and Television	Tony Hodgkinson	Stafford House, Hassocks	E. Sussex Ed. Committee.

**M**R. G. WEST, 187 Oldham Road, Middleton, Manchester, is contemplating forming a tape recording club, subject to enough people being interested. Anyone willing to assist should contact Mr. West direct.

Great newcomer to the Greatest  
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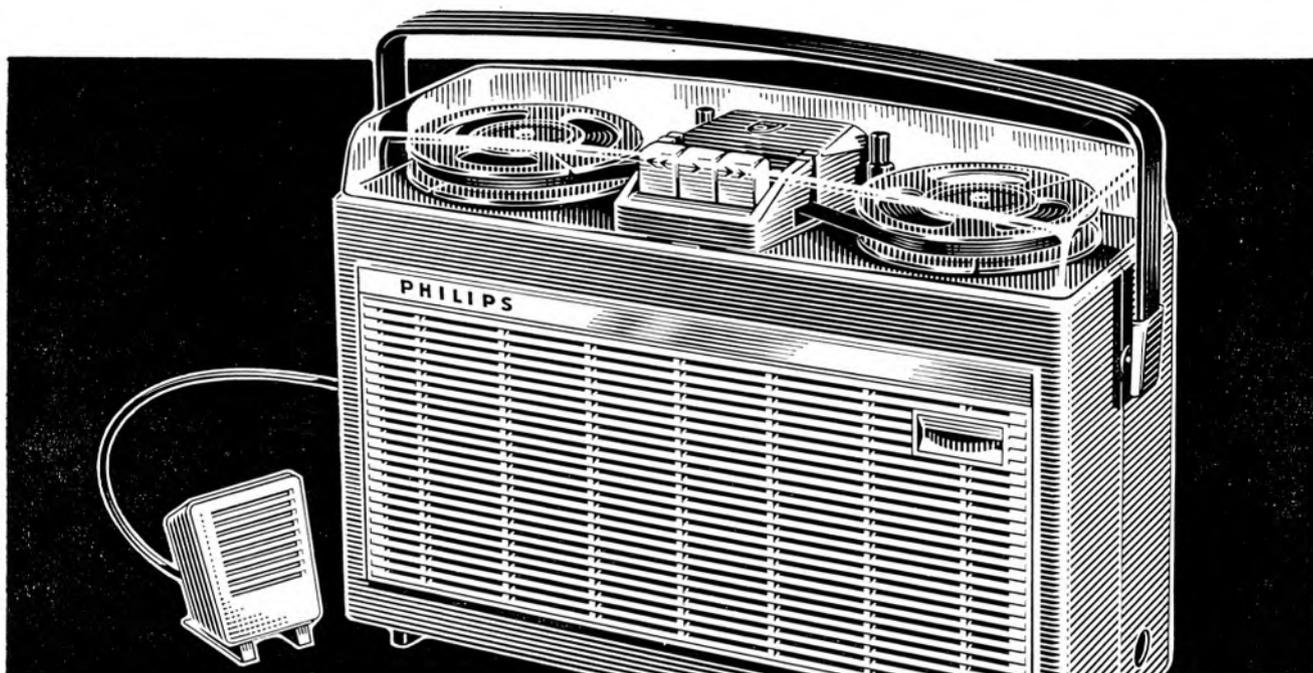
including  
microphone, 4"  
reel of L.P.  
tape and radio  
connecting lead.

Now the world's finest range of tape recorders gets a brilliant addition – the fabulous Philips 'Starmaker'. Combining snag-free ease of operation with revolutionary design and outstanding performance, it opens up a fascinating new world of exciting entertainment for the newcomer to tape recording.

Everything the 'Starmaker' does is governed *completely* by just six error-proof controls. It's got a whole host of other advantages, too: economical mains operation, 4-track recording and playback; 4 hours playing time on a 5" reel of double-play tape; fast winding and re-winding; moving coil microphone; *plus* brilliant reproduction from the 6½" loudspeaker.

The vertical design and lightweight compactness of this sleekly styled recorder make it exceptionally *portable*.

See the Philips Starmaker in operation and hear it play at your local Philips dealer. It will convince you that no other machine in its price range can give you such a marvellous performance.



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# THESE DEALERS OFFER GOOD SERVICE

IT is encouraging to note that the campaign for honest and efficient repairs, which the *Tape Recorder* inaugurated several months ago, is meeting with wide approval, both by our readers and responsible members of the radio-servicing fraternity.

A further list of dealers offering good service, plus some tributes from readers, can be seen below. It is evident that a fair section of the radio trade feels keenly about servicing. They take heed of such doughty champions as W. Norman Stevens, Technical Editor of *Radio & Electrical Retailing*, who says, in a trenchant article that appeared in *Mullard Outlook*, Jan. 1962: "... the rewards of service can be incalculably high. Good service, that is: trustworthy, honest, rapid and efficient service. It can make the customer a friend for life, enhance a business reputation, and promote untold goodwill."

But occasionally we see the other side of the coin. Readers tell us of sharp practice, overcharging, careless and incompetent repairs. It is not our intention to villify the radio trade, nor even to put the "black spot" on offending dealers. If we merely give an example, let that suffice.

Mr. W. J. Webber of Cardiff wrote to tell us that his Philips EL 3541/15B tape recorder was giving trouble. Although only a year old, it had started to build up a noise on playback, and was taken back to the shop where he bought it. After 3 weeks, he enquired, was informed that it had been returned to the makers and, as it was just out of guarantee, there would be a charge of £10 10s. 11d.

Unable to work because of bad health, Mr. Webber was perturbed. He could never afford to pay such a bill, so he asked that his machine be returned to him. When it eventually arrived it would not work at all, so he wrote asking if we could "suggest anything".

We certainly could—but it would not have been printable! We asked a friend, a local engineering consultant, to call and investigate. This was his report: "Machine has obviously never been returned to manufacturer."

"Recorder inactive because ECC82 valve fitted in place of ECC83. Correct valve fitted and further faults noted; recording weak and noisy, playback noisy, deteriorating when machine warmed up, loudspeaker rattling, braking erratic, several minor defacements. Connections to record head badly soldered."

"Record and playback faults due to misalignment of both heads. Loudspeaker rattle due to earth return lead disconnected and clamping nuts loose, the latter fault also causing crackling due to ineffective earthing of the loudspeaker support plate. Deterioration when warm caused by leaky C4, screen grid decoupling capacitor of EF86 valve. Heads aligned, brakes adjusted, bad connections resoldered, machine tested and demonstrated. N.B. microphone slightly below sensitivity, but owner records mainly direct from amplifier section of radiogram. Playback is through the external loudspeaker, plus a 10-inch unit in a separate cabinet, giving excellent quality."

Comment is hardly necessary, but we cannot refrain from quoting again Mr. Stevens' remark: "In all but the most bumbling business, the inefficient engineer is quickly found out. There is no other trade so prone to expose inefficiency as the trade of radio service—and no other trade where its results can be so directly drastic."

## Telemac, 45 Hopwood Street, Warrington, Lancs.

Dear Sir:—Reference your article in the December issue, we undertake repairs to all types of tape recorders on the premises, and carry quite a large stock of spares. Service personnel to date is two.

Yours faithfully,  
J. McMiken, proprietor.

## From: N. W. Angell, 16 Park Street, Chatteris, Cambs.

Dear Sir:—With reference to the Editorial in the December issue, I should like to inform you that I specialize in sales and service of "Ferrograph" tape recorders. I have had quite a number of years specializing on these machines and use several of them myself, professionally. I am, in fact, given all the

servicing of these machines for both the Isle of Ely and Huntingdonshire Education Committees. I carry, always, extremely good stocks of spares for all the models, and can normally carry out all repairs promptly on my premises, without having to return the machine to the manufacturers. The fact that I stock on spares could be borne out by the Ferrograph Company Ltd. This includes all mechanical as well as electrical components. I also have suitable test equipment for setting up the machines after overhaul and repair. I also am an appointed agent for Reflectograph tape recorders. I feel that your idea is a good one, and look forward to the results!

Yours sincerely,  
N. W. Angell.

## From: Radio Development, 26 & 28 Queen Street and 31 College Street, Belfast, 1.

Dear Sir:—Re your edition of the December issue of *The Tape Recorder*, we service and handle all makes of tape recorders, and are the official Irish Ferrograph agents. We carry normal spares for all makes of tape recorders. We have a regular service personnel of eight.

Yours faithfully,  
F. Blaney, D. Howard, directors.

## From: E. J. Nicholson, 31 Northwood Lane, Clayton, Newcastle.

Dear Sir:—In recent months there have been a number of letters and comments in articles in your magazine concerning the deplorable lack of interest which seems to be prevalent with certain dealers and manufacturers in dealing with customers' enquiries concerning their equipment. It is, therefore, with great pleasure that I write to you now to let you know of a personal experience which is all too rare it seems.

I have just purchased a Tandberg Model 3B recorder (the two track mono model), the choice being largely influenced by the fact that I had for some considerable time been conversant with the capabilities of this fine little machine from close contact with a Swedish tape friend who also has a similar model. On checking the machine over for frequency response, etc., against the manufacturers ambitious specifications I was rather disappointed to find that I was not actually achieving the desired results, the differences being quite small but nevertheless outside the specification.

As the machine was purchased outside my own district I decided to approach the main distributors for the Tandberg range in this country, Messrs. Elstone Electronics Ltd., Leeds. Several letters were exchanged with the latter firm, all of which were replied to by return of post with the utmost courtesy and with detailed comments by their service engineer. They even posted to me a trial replacement valve as at that time the original EF84 was considered as possibly faulty. Not only that, however, but they wrote to the dealer in this district asking if he could assist in service, if necessary, and following that I had a personal call to enquire if they could be of any service.

Let me hasten to add that the trouble was merely that in error I had been taking test measurements with a monitor speaker on load whereas tests on this model should apparently be made with no speaker in circuit. Upon correcting this, I immediately had the rather excellent results claimed by the manufacturers and indeed the tests gave figures infinitely better even than those claimed in the specification.

Having experienced some of the difficulties related by your other correspondents it is indeed refreshing to find such service as I have mentioned, both prompt and helpful, does exist and as a number of my friends appear to regard my own varied experiences in this field as a useful guide to themselves it is most gratifying to be able to pass on my unqualified recommendations where these are wholly justifiable.

With an excellent end-product and an unbeatable service such as I found in this case what more could one ask for? Spares for a continental machine, you may ask? . . . forget it—Messrs. Elstone stock everything down to the last nut and bolt and normally supply within 48 hours.

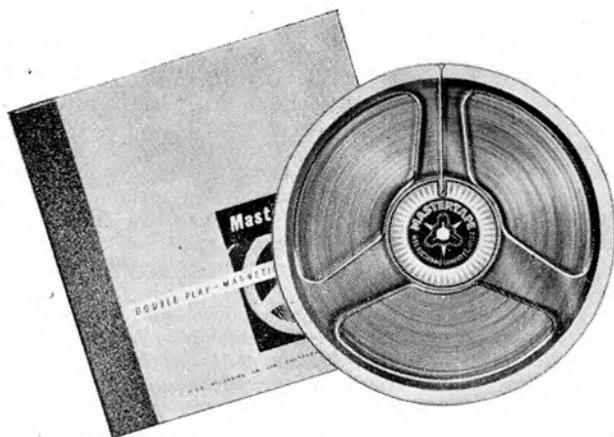
Yours faithfully,



*as perfect as  
human skill can achieve*

The symmetry and perfection of an ancient Greek vase is a criterion for human skill and craftsmanship. In the field of high fidelity sound recording and reproduction no less exacting standards are required in the design and manufacture of fine magnetic tape.

Mastertape is the end product of nearly thirty years' research and development by a pioneer company in recording techniques. Mastertape is of a uniform quality and strength which the most discriminating connoisseurs approve. Mastertape is specially approved by GRUNDIG (GT. BRITAIN) LIMITED for use on their machines, as well as by many other leading tape recorder manufacturers. Those who really care for fine recording always insist upon Mastertape.



# **Mastertape**

Obtainable from your local dealer or, in case of difficulty, write to the address below for your nearest stockist :  
MSS RECORDING COMPANY LIMITED, POYLE TRADING ESTATE, COLNBROOK, BUCKS. TELEPHONE: COLNBROOK 2431

A MEMBER OF THE **BICC** GROUP OF COMPANIES

# our readers write . . . . .

## . . . about hospital work

From:—K. Laraway, 17 Stone Fold, Rising Bridge, Baxenden, Accrington, Lancashire.



Dear Sir:—I have recently had the pleasure of having a tape played to me while in hospital and if it is possible I would like, through your columns, to offer my services to anyone who would like to send a tape to be played back to a friend or relative within a 30-40-mile radius. Yours truly,

## . . . about echo chambers

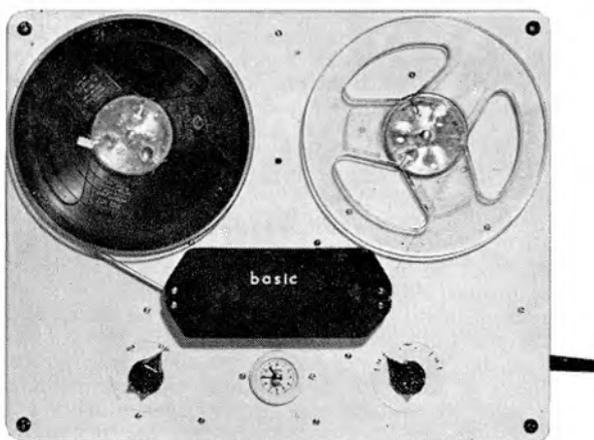
From: W. Edwards, 99 Great North Road, Potters Bar, Middlesex.

Dear Sir:—I am contemplating building an echo chamber in the unused cellar of a house. I have a number of long drain pipes which I intend to use, mounting a speaker in one end and a microphone in the other. I would like to hear from any reader who has experimented along these lines who could possibly assist me with the following (a) length of pipe required for  $\frac{1}{2}$ , 1 and  $1\frac{1}{2}$  sec. delay, (b) diameter of pipe required (c) baffles. Yours faithfully,

## . . . about a home-built deck

From a Reader.

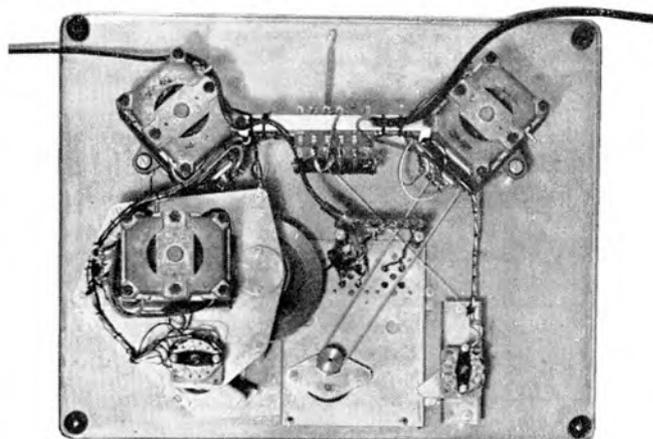
All tape mechanisms comprise a number of sub-sections, each with its own particular function. Many different mech-



anical principles have been used through the last decade to meet the requirements of each section, and these have been co-ordinated in numerous ways to produce a complete tape

transport. In most of them, at least one such principle has shown itself to be robust, reliable, easy to manufacture and assemble and to require little or no adjustment either at the factory or after prolonged use. It does not follow that these ideal principles must be expensive, in fact the opposite is true with an exception. For simple and reliable tape control 3 motors are essential, even so, this is only an extravagance when compared with a single motor device which must have less desirable features in some of its sub-sections resulting directly from the use of one motor.

A tape deck has been designed consisting only of ideal principles, so condensed by orientation and shape of components that only a few, of simple form are required. At the same time there is no loss of facilities such as choice of tape speed or foolproof interlock of controls to prevent tape damage or accidental erasure. The layout above the deck is pleasingly symmetrical with a tape position indicator in an easily viewed position at the centre front, made possible by lack of obstructing components in the path of its drive beneath the deck. The use of two rotary switches ensures precision control of the mechanism and its electrical switching. Attention has been given to the manual effort required to turn the switch knobs such that there is a light yet positive "feel" about them. The left hand switch is a Run-Stop control whilst the other is a 6-position mode selector on which fast wind, and play or record at either  $7\frac{1}{2}$  or  $3\frac{1}{4}$  inches per second is preselected. The design



includes much simplified and highly reliable spool braking, together with an improved and simplified method of ensuring good contact between the tape and the magnetic heads.

Because of the reduction in the number of parts beneath the deck there is ample floor space for directly fitting transistor units if desired. The maximum spool diameter which can be handled is 7 inches. Yours faithfully,

March with the times and take advantage of our TOP EXCHANGE allowances in obtaining an up-to-date Mono or Stereo Recorder.

New Model required	Allowance on TK8, TK20 or TK25	Allowance on Radios, Transistorised, etc.
Grundig TK60 Stereo...	£36	£10
Telefunken 97 Stereo...	£28	£10
Telefunken 85KL ...	£26	£10
Grundig TK35 ...	£23	£10
Grundig TK24 ...	£18	£10
Telefunken 76 ...	£19	£10
Butoba Portable ...	£21	£10

Compare our Exchange allowances, then write stating New Machine required, make and condition of Machine offered in Exchange, and we will forward a favourable allowance per return.

"TRANSTRONIC ELECTRONICS", "Pinjarra", Pinewood Grove, New Haw, Weybridge, Surrey.

by H. W. Hellyer

# TAPE RECORDER SERVICE

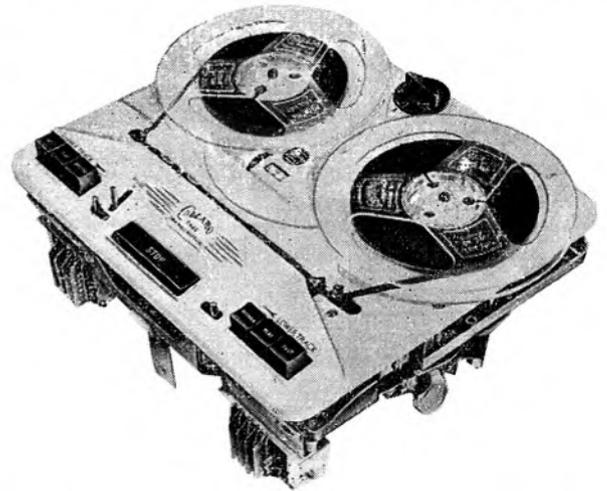
## No. 3 THE COLLARO MARK III & IV, AND GARRARD MAGAZINE DECK

IN the previous article, the modern version of the Collaro tape deck was discussed. A final comment was that its present form was a great improvement on previous marks. All the more reason to employ a little space on those previous models, for they enjoyed wide sales and are likely to be met quite often by the service engineer.

Totally different in conception, more ambitious—perhaps too ambitious—the *Mark III* and *Mark IV* decks became very popular when tape recording captured the public's imagination, a few years ago. They then represented an effective compromise between the "novelty" instrument and the "heavy engineering" of the high-price range. There were very few truly portable models on the market. Consequently, such equipment as the *Sound A20* met with wide acclaim, and gives good service.

The original *Mark III* deck has two motors and a very large flywheel, on which the capstan is directly mounted. Drive to the flywheel is via an idler wheel to the capstan of each motor, engaged by the selector mechanism. As the machine is intended to utilize each track of a twin-track tape without the necessity of removing the spools (maximum 7 in.), there are four heads, two upper track, tape travelling from left to right, and two lower track, right to left.

A large "Stop" key neutralises the drive and applies braking, which consists of double felt pads at each spool hub. As the change from one track to the other requires a reversal of



position, but this must be retained when the alternative track is used. Two lugs on each side, limiting the travel of the operating bar, need to be bent in the correct sequence if any adjustment is to be made. Typical procedure is as follows:

(a) With machine disconnected from supply, depress lower-track (R.H.) "Play" button.

(b) Check for 1/32 in. clearance of brakes from R.H. spool drum. If less, bend the lug adjacent the pivot on the diagonal operating bar, nearer the bar.

(c) Press the "Stop" button, then the L.H. "Play" button. Check that clearance of the R.H. brakes is still 1/32 in. If less, bend the lug that will be found above the brake mechanism, i.e. adjacent the braked stop secured by two cross-headed screws.

(d) Repeat procedure for L.H. brakes. Finally, check that the "Stop" button applies both brakes securely.

Brake tension is balanced by the aid of two springs just below the operating bar. It is not advisable to attempt adjustment by alteration of the tension of either of these springs.

Another common fault that may be the result of maladjustment is "judder" of either drive mechanism when the machine is switched from *Rewind* to *Play*, or from one track to the other. This can also be caused by an idler pulley fouling the step on the capstan of the motor pulley, and a quick visual check should be made before looking deeper for the fault. The stepped pulley can be raised or lowered by releasing a pair of 2 BA grub screws in the fan boss, and the idler is locked by a 4 BA self-locking nut in the centre of the cam that is used for speed selection (beneath the deck, adjacent each motor). In addition, there is a large pulley, used for rewind fast driving, which engages the portion of the motor pulley between the largest (15 i/s) step and the fan boss. Thus it can be seen that an incorrect adjustment of any of these three factors on either side will affect tape transport.

Correct method of adjustment is, first to set the speed change cam, by the 4 BA locknut, until there is about 1/16 in. clearance of the bracket above the "riding" pillar, when the machine is set to 3½ i/s. Then to reset to 15 i/s and adjust the motor pulley so that the idler contacts slightly above centre of the largest diameter. After checking that the underside of the idler pulley does not foul the other diameters when running free or engaging, check the position of the rewind idler, adjusting to the correct height as necessary. Tighten all locking screws, check fan blades.

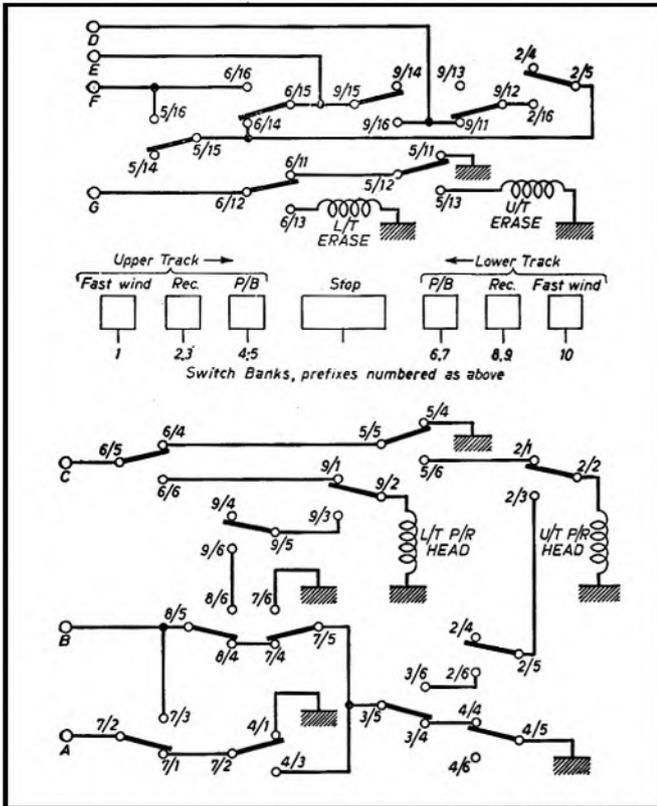


Fig. 1. Schematic of switch wiring of the Sound Model A20 tape recorder, contacts being shown in the relaxed (stop) position.

flywheel rotation, it can be seen that a "standard" fault on these models is tape spillage, often caused by erratic braking. Correct adjustment is to allow 1/32 in. clearance in the "Play"

Premature engagement of the idler wheels with the flywheel or motor pulley sometimes causes a similar symptom of erratic action. This may be noticeable especially in the 15 i/s position. The cause is often a slight distortion of the idler release lever. This will be found near the side edge of the top plate of the deck; one on each side. These levers, shaped like a pointing finger, are held by two screws, allowing a small adjustment. With the machine switched off they should nearly contact the withdrawal levers, which run from the horizontal control bar beneath the head plate to a point near the spool hub. The withdrawal lever is easily bent, and may have been displaced, allowing the release finger to ride beneath it at the higher speed. The inner end of the finger should be bent upwards to obviate this.

As usual, the most alarming symptoms can be caused by the simplest faults: spools that rub the top-plate, for example. Adjustment for spool level is by means of two 4 BA hex-headed screws in a triangular plate on which the spool carrier is mounted. These can be reached with a flat spanner with the top cover in position. Care should be taken, as the outer screw tilts the spool forward and outward while the inner screw tilts the spool backward and inwards. When replacing the cover, ensure that the central screw is the short one, as this is directly over the moving control plate.

Pinch wheel pressure is adjustable by a screw-head cam which will be found beneath the pinch wheel swivel lever, and is revealed when the machine is switched to *Play*. Correct pressure is obtained when a pull on the tape tends to turn the flywheel, without slip. A steady, gentle pull is needed.

One of the jobs that causes a frown is electrical testing of the switching circuit. At first sight, this is rather complicated; but it readily breaks down into a function sequence, as can be seen in **fig. 1**. Here we find the switches in their neutral position as employed in the *Sound A20* tape recorder. To give an example of circuit tracing, suppose the upper track is to be played back. The second button from the left is depressed, actuating switches two and three. (See footnote—correction).

Referring to the U/T P/R head, the circuit is now via 2/2, 2/3; 2/5, 2/6; 3/6, 3/5 and thence to connection B. At the same time the U/T erase head is open-circuited, as switch No. 5 only comes into action on *Record*. It will also be noted that connections D and E are short-circuited via the various switches during playback and E and F during *Record*.

Mechanically, these switches present little difficulty. One possibility is of the interlock bar fouling the tie bar. The latter will be found beneath the deckplate, with a spring to assist its return to central position at rest.

Footnote.

In **fig. 1**, Rec. and P/B buttons have been transposed. The Record buttons are the inner pair, switches 4/5 and 6/7.

#### Garrard "Magazine" Tape Deck

This is another deck that has found a wide use in machines of the "popular" range. And a quick look at the design and engineering should demonstrate that the term *popular* is not necessarily derogatory. The "Mag-deck" is another instance of ingenious simplicity, and, as such, gives the service engineer very little of a headache.

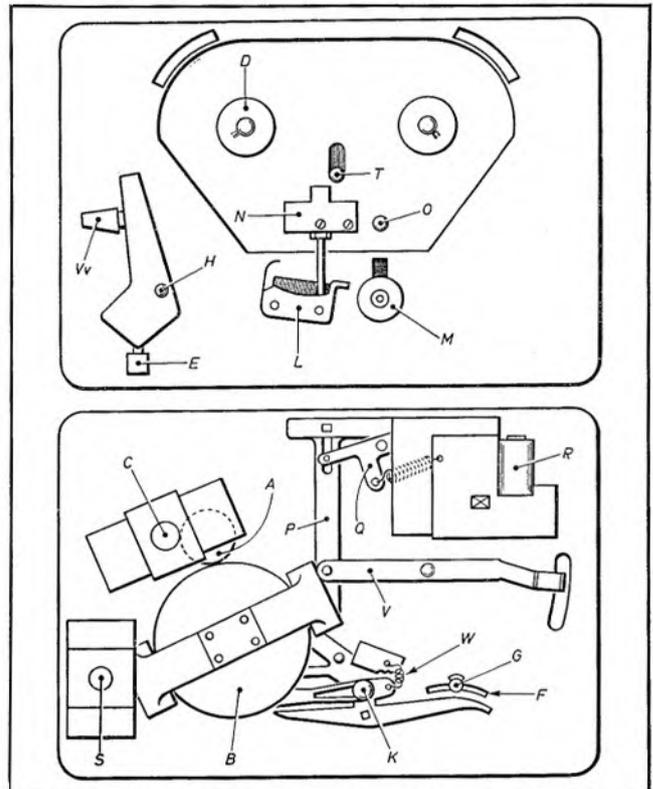
The complete layout of top and bottom, including the magazine itself, is shown in **fig. 2**. This is well worth studying, for it illustrates several unconventional features. For example, there is no "braking", in the usual sense. Instead, the spools are locked in the cassette, quite firmly, even when the plastic cover is opened, until lever U is raised. In action, rod T, actuated by the movement of lever P, raises lever U when the machine is switched to *Record*, *Play* or *Wind*.

Another feature is the constant engagement of the idler wheel A with the flywheel B, the drive motor S coming into play immediately when the tape recorder is switched on. Despite some head-shaking when this design first appeared, there have been none of the expected faults due to "flatted" pulleys: rather surprising, considering the trouble that can be experienced with other machines that have been left in an operational position by their owners. However, the pulley is sprung into position, and weakness at this point will lead to erratic running.

Except for the necessity to depress the safety button H on

Record, the mechanical functions performed by movement of knob E to *Play* or *Record* are identical. Briefly, a shaped cam, represented by F, is mounted on spindle G, the latter being suitable for the mounting of switch wafers for electrical selection of function. This cam swings the main lever on pivot K so that the tape guide assembly L and pinch wheel M moves inward. Some small adjustment of the pinch pressure is possible by a set screw altering the tension of spring W. Check this if wow is reported. Correct tension should be when slip is possible as the end of the leader is reached, to reduce the possibility of tape breakage.

The same action moves lever P, releasing the brake, as previously described. This also locks the cassette to the main deck and moves lever Q, which actuates switch R. The purpose of this switch is to bring in motor C, either at half-power for



**Fig. 2.** The Garrard Magazine tape deck showing views of deck layout and underside of deck

take-up or full power for fast wind. The last action is obtained by full movement of lever P, in response to the swing of lever V as knob Vv is brought downwards. A safety arrangement prevents this action during *Record* or *Play*. The lever Q now takes switch R to its second position and the brake is released in the same way.

Clutching, in the normal sense, is unnecessary, but there is a friction disc on the feed spool spindle, hardening of which could lead to the usual minor troubles. Head alignment is also "built-in" by this simple but effective method of construction, and provided the cassette seats properly on the spool hubs (check the splines) there should be no difficulty in ensuring correct tape transport. Two-gap heads are provided, and the cassette is turned over for lower track to be used (upper track working being used), thus fast rewind is not needed.

Electrically, there are six connections from the deck, and the R/P head can be connected for either high 70,000 ohms, or low 17,500 ohms, impedance. Since the first release of this deck there have been additions, such as a digital clock counter (designed by Smiths) which mounts on the take-up spool and a braking modification if the deck is intended to be used with individual spools. These are in the nature of accessories, however, and do not alter the basic description.

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It was only a short time ago that the Japanese "invasion" of Britain began with the import of portable tape recorders and transistor radios. This caused many manufacturers in this country to reach for their typewriters and submit long letters of protest to the Government. The main argument was that workers in Japan were paid far less than their counterparts in this country which thus lead to imported goods retailing for substantially lower prices. This of course may be true, but we believe that prospective customers are now becoming more critical when purchasing equipment and that demonstrations are now a necessity rather than an exception. Price verses quality is now resulting in a major swing to the latter. One important fact must not be overlooked, with Britain's entry into the Common Market many new recorders will appear adding still further to the complicated task of buying a recorder.

### First Impressions

After this preamble, readers may be wondering where I am heading for. Well it all started when a Japanese recorder was sent to this office—the Dokorder PT 4K—a portable tape recorder costing 49½ guineas. A price range where there is a definite gap in this country. First impressions always count, and one could not fail to be impressed by the presentation of the machine and its accessories. Everything was laid out in such a manner that a prospective buyer would be half way to buying the machine before it was demonstrated. The contents included: tape recorder, black leather carrying case, microphone, telephone adaptor, earphone, recording lead, splicing tape and a comprehensive instruction booklet.

It was observed when removing the machine from its case for a closer inspection that great care had been taken in the design of this portable. The case, constructed of an alloy material, measures only  $7\frac{1}{8} \times 3\frac{1}{8} \times 2\frac{3}{8}$  in. and weighs only 3 lb. Reels of up to  $3\frac{1}{2}$  in. can be fitted and these are secured to the spindles by holding pins allowing the machine to be held in any position without displacing the spools. Tape threading is clearly indicated by a black arrowed line inscribed on the deck. Two speeds are provided,  $3\frac{1}{2}$  and  $1\frac{1}{2}$  i/s. The change being affected

by removing the large capstan, underneath which is a smaller capstan for the lower speed. Adjacent to the idler wheel is a holder for the removed capstan, ideal for the absent-minded recording enthusiast.

The machine is operated by five 1.5 volt penlight cells (leak proof advised), which are housed in a small metal container, which can be removed in a few seconds. It is essential to follow the manufacturer's diagram when inserting new batteries, as the correct polarity of the batteries must be observed. Recording and playback is controlled by three press buttons, situated on the top right-hand corner of the machine. A switch fitted on the microphone allows the machine to be operated remotely when necessary. Of special interest is the battery life and recording level indicator. This shows the state of the batteries on playback and the recording level on record. Coloured portions indicate fully charged batteries and over recording.

Rewinding the tape is simple and efficient, taking approximately  $3\frac{1}{2}$  minutes. At the same time as the rewind button is moved the head cover containing the pressure pads is automatically opened.

### Outside Recording

After reading the instruction booklet (always recommended by manufacturers, but very seldom put into practice by the general public), the machine was prepared to record a series of sound effects for a proposed documentary. A visit to the local High Street on a Saturday afternoon was called for, and with the small dynamic microphone fitting comfortably in the palm of the hand the recording commenced. Footsteps on concrete pavements and the incessant noise of passing cars were faithfully recorded and even the local housewives out delivering the news of the past week contrived to find their way on to the tape, although this was not planned. A visit to the vast supermarket made the recording meter swing wildly towards the "overload" area, but a small alteration to the volume control restored it to its rightful position. Various other recordings were made for future use and these were played back first on the machine's own internal speaker ( $2\frac{1}{2}$  in.) and then on a semi-professional machine (fifty pounds heavier and fifty pounds dearer!) using a Wharfedale PST 8 speaker enclosure. Every sound issued from the speaker compared favourably with the original effect.

As a final test, serious music was recorded at the highest speed from an FM tuner using the recording lead provided. This was reasonably good, but there appeared to be a considerable amount of background noise due to the DC bias erase method. Nevertheless, there are quite a few mains machines that would do well to measure up to the Dokorder.

One small plea to the manufacturers on behalf of the serious amateurs and semi-professionals is that although it is appreciated that  $3\frac{1}{2}$  i/s and  $1\frac{1}{2}$  i/s provided excellent playing times, the speed of  $7\frac{1}{2}$  i/s is still recognised by many as necessary for good quality. A capstan could be produced for this machine quite easily with very little alteration in price, and to many it would be a wise and much welcomed investment.

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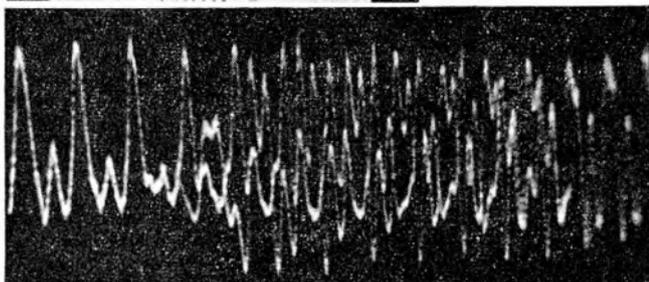
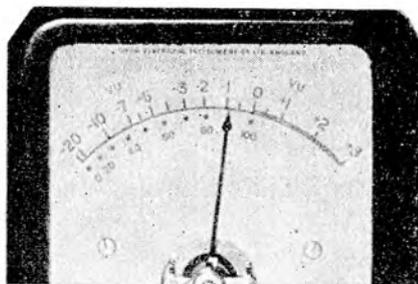


Fig. 2. The small photo above illustrates a VU (Volume Unit) meter. Below it is a waveform trace from Mrs. Dale's Diary taken from an oscilloscope.

**B**UT loud—as the early disc recordists used to say, “for goodness sake!” They had, of course, to contend with a surface noise which surely bore the adjective “background” only by extreme courtesy; we are in the fortunate position of having a small range of choice in the matter. Nevertheless, modern standards of reproduction demand accurate control of the signal modulation level on tape as a necessary technical condition for making good recordings. As we saw last month, too low a signal level leads to an unnecessarily high background noise and too high a level causes undue harmonic and inter-modulation distortion.

## Indicators are necessary

Almost all tape recorders are therefore fitted with some kind of modulation indicator which shows at least when the recording input is at or near the maximum permissible level, and should preferably also cover a fair range below this point. To coin a motto for a new industry from an old source: “Let your modulation be known unto all men.” Actually, you can be fairly certain nowadays that the absence of an indicator means one of two things: either the presence of an automatic volume control, such as is incorporated in some dictating and reporting machines to keep the user out of trouble; or that having one would not make much difference to the overall results anyway. Not every machine which *has* one is worth it, of course, but it is reckoned to be a good selling point in borderline cases.

## Waveforms

To business; and immediately to what may seem yet another red herring, but is not. Before we can understand how well various kinds of indicators work we must know something about what they are trying to measure, the programme waveform itself. The photograph shows such a waveform, which represents the electrical output from a radio tuner over a small fraction of a second, as displayed on the screen of a cathode ray oscillograph. The way in which the output amplitude—the height of the trace—varies as we move along in the horizontal (time) direction corresponds to the way the sound pressure varied at the studio microphone.

As I pointed out last month, and as you will see from the photograph, programme waveforms are neither pure, simple or steady in amplitude. Fig. 1(a) shows the waveform of a pure tone, which would also be steady if there were space enough to put in a few more cycles of equal amplitude. This “sinusoidal” waveform can be produced by tuning forks, electronic oscillators and one or two flute-like musical instruments (approximately) but

## MEASUREMENTS AND METERS

very rarely occurs naturally. The other illustrations in fig. 1 are of waveforms which are fairly simple, but not “pure” in the present sense.

Obviously we have to measure whatever appears at the output of our recording amplifiers, whether simple or complicated, pure or complex. But what to measure? One obviously measurable quantity is the amplitude of the voltage or current waveform. ( $P + P'$  on the waveform in fig. 1(a), for instance) which we might perhaps read on a suitably marked oscillograph screen. This is, very roughly, what a “magic eye” does in conjunction with some appropriate circuitry; instead of a scale mark to show maximum modulation, there is the point at which the two bright areas meet.

There are two other quantities which are conveniently measured: the average value and the r.m.s. (root mean-square) value. The r.m.s. value, by far the best-known and most-quoted of the three, is basically an indication of the heat produced by the current in any pure resistance through which it passes—the volume control across the output of the radio tuner, for example, or the fixed resistance in series with a recording head. Paradoxically, the r.m.s. value is also the one which is actually *measured* least of all, for it *can* only be truly measured, you see, either by actually heating up a resistance and measuring the heat produced (e.g. as in thermocouple or hot-wire meters), or by using even more elaborate instruments which respond in other ways to the square of the current. (See footnote 1.) True r.m.s. measurements are generally impracticable in audio programme work and are, in any case, not the best for the purpose, as we shall see later.

## Average Measurements

What passes for a r.m.s. “measurement”—well enough in most cases where simple waveforms are involved—is usually the reading from a rectifier-moving-coil meter whose scale has been marked in r.m.s. values. But such a reading is fundamentally an indication of the *average* value of the waveform; the basic instinct of a moving coil meter is to respond to the *average* value of the current passing through the coil. In this case the coil “sees” the original waveform with alternate  $\frac{1}{2}$ -cycles inverted by the rectifier much as is shown by the dashed curve in fig. 1(a)—a “pulsating d.c.” to whose average value the movement can respond (see footnote 2).

Now none of this would matter one jot if we could only be certain that the waveform we wanted to measure had always the same shape, for each particular waveshape is characterised by a particular and definite relationship between the peak, r.m.s. and average values. For example, referring to the table under fig. 1, you will see that a pure sinusoidal waveform has an r.m.s./peak ratio of 0.71, and average/peak ratio of 0.64 and an r.m.s./average ratio of 1.11. *Always*. This is why moving-coil meters used for mains voltage or current measurements can confidently be scaled in r.m.s. values even though they are actually responding to the average value; the mains waveform is invariably sinusoidal.

## Programme Measurements

Similar meters can obviously be used in any other situation where the waveform is sinusoidal. Or, for that matter, where any kind of waveform is present provided its r.m.s./average ratio is known; either the meter can be re-scaled or a suitable correction factor applied. And, in general, *any* kind of meter can be used to find *any* value of *any* waveform, provided *always* that the relevant correction ratio is known for each waveform encountered.

What, then, are we to do with the kind of waveform in the

# “soft—for art’s sake”

—by GRAHAM BALMAIN

photograph, the kind of input our tape recorders were made for? It varies in character vastly, rapidly and continually, and none of it looks much like anything in fig. 1 or any other imaginable simple waveform. Back to square one, apparently! What to measure? Many heads have been scratched over this problem, especially in broadcasting organisations, and two main lines of thought have emerged. It is probably best to approach them by considering why the obvious method failed.

The obvious solution was just to connect a conventional a.c. rectifier-voltmeter across the recording amplifier output and thus measure the average value. This proved unsatisfactory for two reasons. The first can be seen by looking at fig. 1 yet again; the waveforms there have been drawn so that their average values are all at the same level. However, their peak values are very different indeed, and as you may remember from last month’s discussion of distortion it is the peak of the waveform which will first enter the overload region and suffer distortion. Signal waveforms can be much peakier even than any of these, so evidently an average measurement will not help much in controlling peak levels. The second reason is the inherent laziness of most mechanical meter movements. The majority need at very least 200 milliseconds of steady signal before they will give a reasonably true reading, which is about 195 milliseconds longer than the shortest appreciable signal peak lasts.

## The VU Meter

One school of thought then argued thus: “Suppose we accept the limitations of average-reading meters and construct for this purpose a standard instrument whose mechanical response to changes in sound level corresponds roughly to the reaction of the human ear to them. A deflection will then be proportional to the average energy in the associated sound. We still have an average-reading meter, but, since the input to the broadcasting systems for which we are designing it is usually peak-limited or compressed into a limited dynamic range at some stage, we shall know the peak/average ratio of the programme material and consequently we shall know what average reading to aim at to avoid overloading our transmitters on peaks.” The result was the VU meter, shown in fig. 2 (see footnote 3).

Now this is fair enough as long as the signal is compressed and its peak/average ratio known, although even then the ratios are liable to differ quite considerably according to the kind of programme. That for speech may be as much as 20dB, for instance, and that for full orchestral music as little as 8dB, so much still depends on the programme engineer’s experience. But the VU meter has been widely adopted for use in systems where no compression or limiting is used, among them being tape machines used for live recording, of course. In my view, the VU meter is much less than satisfactory for amateur use unless the recordist is very experienced with it.

## Peak-Reading Meters

The other school of thought maintained that the logical way to prevent overloading on peaks was to measure them directly, and considerable effort was directed towards finding the most suitable dynamic characteristics and developing reliable circuits. Measuring peak values is easy enough in itself; the signal, or an amplified version of it, is made to charge a capacitor through a rectifier and the peak voltage thus stored can then be used to drive a d.c. meter amplifier. The practical problem is to choose dynamic characteristics such that the programme engineer can read all significant peaks accurately, and go on reading a succession of such peaks without eyestrain.

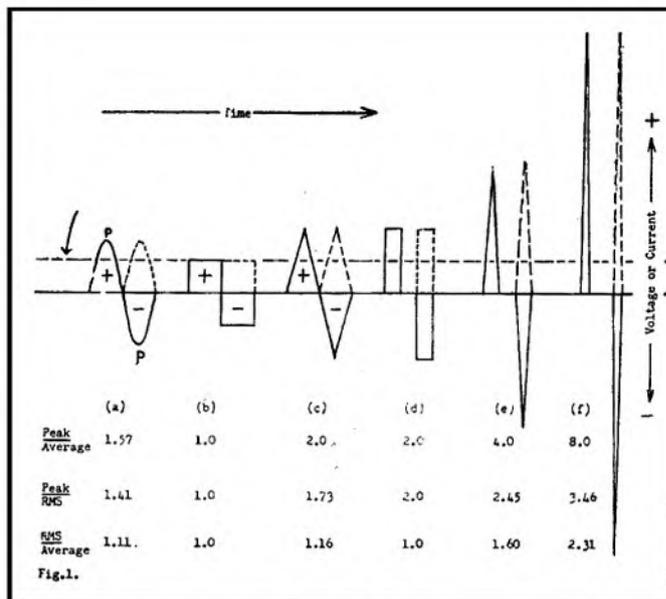


Fig. 1. Characteristic ratios of simple waveforms, drawn with equal average values, Rectified  $\frac{1}{2}$  c/s shown dashed, as for current through A.C. moving coil meter.

The B.B.C.’s solution was (and is still) to arrange that peaks lasting for 5 milliseconds or more are fully registered by a fast-rising meter circuit, but that the pointer should thereafter fall slowly at about 8dB per second, which gives the engineer time to read the peak comfortably without masking subsequent changes in average level too much. Peaks lasting below 5 milliseconds register progressively less as they get shorter because, as I pointed out last month, distortion of peaks becomes less obtrusive below this value.

My colleague, Bartlett Still, has unwittingly saved me the trouble of describing the principles of peak-reading circuits in detail by doing just that in *Tape Recorder Workbench* last month, so I will do no more than point out why the rise- and fall-times of his circuits differ from those quoted above.

The main reason is that the B.B.C. have been able to use a very nice (but expensive) fast-acting meter in their circuit. It cannot by itself rise fast enough to catch a 5ms peak, of course—the storage capacitor takes care of that—but it still has to rise fast enough to catch up with the stored voltage before the latter decays significantly; the capacitor must be discharged some time, and obviously the slower the meter movement rises the slower must the rate of discharge be.

## Fast Up—Slow Down

However, this doesn’t matter too much in most amateur and domestic applications, and it is possible to use cheaper and slower instruments so long as the discharge time is increased suitably. Bartlett Still’s meter falls at roughly 3dB per second, if my calculations are correct, and other published circuits show fall-rates as low as  $1\frac{1}{2}$ dB per second. This latter would be about the minimum tolerable even for domestic use. His magic eye circuit, on the other hand, has a fall rate of over 30dB per second, which serves to bring out two of the magic eye’s main advantages. The first is the inherent alertness of the device; there is no mechanical inertia in an electron beam—none that we need worry about, that is—so it has to be slowed down to a visible rate of response or it would be more useless in its peak-fluttering way than the ordinary average-reading voltmeter is in its lumbering fashion. The second is that, given equal time-constants, it is easier to see when the two bright areas of a magic eye meet than when a pointer reaches a certain scale mark.

You will gather from this that, unlike most professional engineers, I like eyes. Not indiscriminately, of course; their major disadvantages are the small range covered below the peak indication—only about 10dB except on one or two older types



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which cover about 20dB—and their short effective “scale length”, though even this has been improved on the newer miniatures. But they are certainly better than plain voltmeters and can even improve on the so-called “peak” meters which adorn some of the cheaper recorders. If your capital is limited, a good magic eye in a well-designed circuit is highly recommended. Nevertheless, if you can afford it, a good peak-reading meter is better and a B.B.C. peak programme meter better still. With the editor's permission, I may describe a P.P.M. circuit which is not too hard on the pocket in a later article.

The next article in this series will deal with frequency and wavelength in tape recording, partly to point out the controlling influence of wavelength rather than frequency in the process, and partly to prepare the ground—remote though the relationship may seem—for the subsequent article on unconventional playback heads which I threatened some months ago.

#### Footnotes

(1.) Even though the measuring instruments used in light-current electronic work are mainly average-reading moving coil types, *r.m.s.* calibrations persist as a hangover from power engineering, where the supply company must assess the total electrical power used by consumers in their lamps, heaters, ovens and so on. Power consumed is most conveniently calculated as *r.m.s.* supply voltage  $\times$  *r.m.s.* current drawn (the domestic electricity meter performs this multiplication automatically) or alternatively as (*r.m.s.* current)<sup>2</sup>  $\times$  load resistance; hence the necessity for using a meter whose deflection is proportional to current<sup>2</sup> if a true *r.m.s.* measurement is needed. However, there is little justification for using *r.m.s.* measurements in audio work; the only reason it persists is the influence of several generations of engineers and instruments accustomed to expressing voltages and currents in *r.m.s.* values.

(2.) Without a rectifier, a moving-coil meter would not indicate at all at audio frequencies because of the mechanical inertia of its movement; the alternate positive and negative current  $\frac{1}{2}$ -cycles follow so rapidly compared to the time needed to overcome this inertia that they effectively cancel each other. The whole process is analogous to two men trying to move a car. If one stands at each end and they push alternately in opposite directions, the car will get nowhere (although it might perhaps rock to and fro slightly). If they both push alternately at the same end, the car may eventually start moving. This is not the best way of doing the job, of course, just as passing pulsating d.c. through an average-reading meter is not the most efficient way of using the instrument or measuring the current.

(3.) The VU (volume unit) meter itself is designed to be fed from a 300 ohm source impedance (e.g. a terminated 600 ohm line output) and to deflect to 0 VU when the average power in the termination is 1 milliwatt. Although basically a rectifier-moving-coil meter, the total series resistance is so low that the non-linear forward characteristic of the rectifier makes the response something near a square law. It is thus more an energy- or power-reading instrument than a current-reading one. The scale is marked in VU, each of which is numerically equal to 1dB when the instrument is measuring steady, pure tones.



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## ... tape recorder workbench

No. 32. CONNECTING EQUIPMENT By A. Bartlett Still

ONE of the very satisfying things about having a regular series such as this is that there are many opportunities to be of help to individual readers. I am not infallible, of course, and every so often a letter sent to me, or sent to the Editor and passed to me by him, contains a problem that I do not succeed in answering correctly first time. The fault may lie in myself, the letter may not contain *all* the relevant facts, or it may be that the equipment concerned is just that little bit different.

I have not attempted, ever, to classify the queries I get in any way, but if I did I feel sure the largest group, by far, would contain problems concerning the connection of a tape recorder to other equipment for record or replay. I think this is because the manufacturers will not get together on signal levels and produce standards. Let us suppose that we have a tape recorder with a “Hi-Z” output socket, and amplifying equipment, the control unit of which has a “Tape Replay” input socket. (Some control units have a corrected tape input for direct connection to a tape head, but that is another story.) One might reasonably suppose that all that is required is a screened lead with suitable plugs between the two.

The tape recorder output may be, according to manufacturers' figures that I have been able to obtain, anything from 200 mV to 1,500 mV, these probably should be halved for mean programme level. If we now look at the input requirements of a number of control units, via the tape-replay socket, we find a range from 20 mV to 500 mV. Again these figures should be reduced for mean programme conditions, and also considering that not many people run a 15-watt amplifier flat out! I think it is fair to say, then, that on the one hand we range from 100 to 750 mV, and on the other from 8 to 200 mV, or thereabouts.

It will be readily seen that we are faced with three possible alternatives. If we are lucky the two units will be compatible and all will be well. Many of my readers will, in fact, have been happily replaying through their amplifier, and they are doubtless wondering what all the fuss is about. But this is not always the case. Considering one extreme, an output of 700-800 mV would prove to be rather an embarrassment to an amplifier requiring only 10 or so. The result would probably be that the tape recorder gain control would have to be turned down to an extent that considerably worsened the signal/noise ratio, giving a high hum and noise level in the amplified output. In the opposite case both tape recorder and amplifier would be set to full gain without adequate output being available.

The two extreme cases that I have instanced are such as to make it obvious that something is not right. The veriest beginner will be asking himself, or someone else, how to set about correcting the trouble. There will, in addition be a “fringe” condition wherein trouble is not immediately apparent, but that is not giving the best possible performance in terms of distortion and signal/noise ratio.

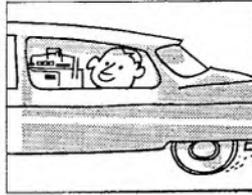
In the example where insufficient output is available from the tape recorder there is little or nothing that I can suggest that will remedy the state of affairs. In my opinion the manufacturers of both recorder and amplifier should be approached for suggestions, since either more output must be obtained or greater sensitivity achieved. Any suggested modification may be carried out in the home workshop, or by a dealer, but if it has the maker's blessing it may be tackled with confidence.

Problems at the other end of the scale are more numerous, but also more easily solved. The introduction of a simple resistive attenuator will bring the signal level to the right region and allow the operation of both pieces of equipment at optimum conditions. This is obviously an advantage when considering a tape recorder whose signal/noise ratio and distortion factor must both be considered as limiting factors in the performance of the whole set-up. So far so good. The snag, it seems there always must be one, lies in the fact that if it is to be just right, “Simple Resistive Attenuator” is a misnomer to the uninitiated.

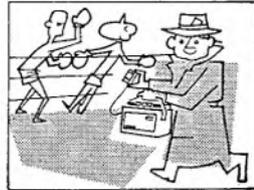
Simple it is, in that two resistors may be all that are required, but there will be a number of factors that go to determine the value of each. And I shall try to explain these next month.



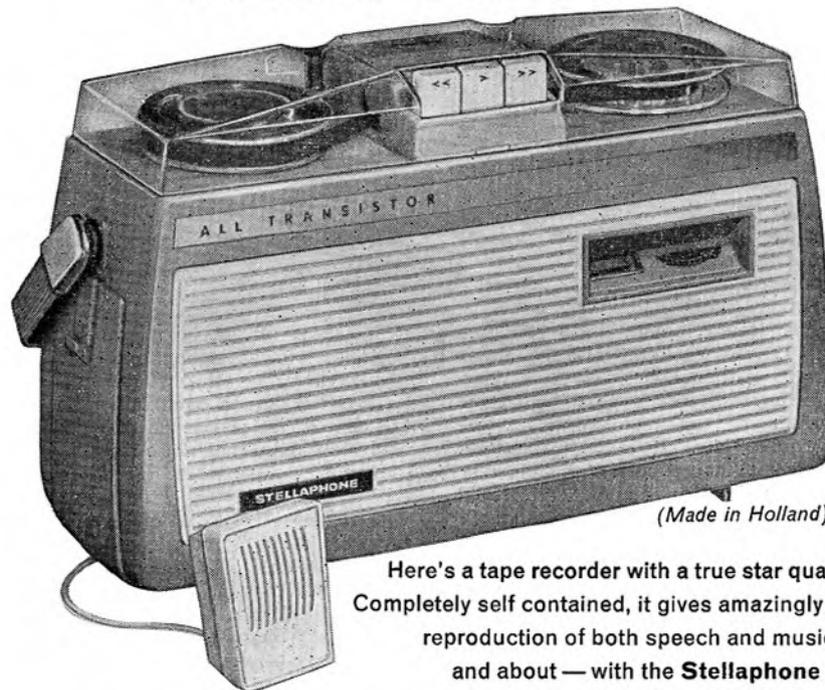
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# THE CALIBRATION AND USE OF TEST TAPES

PART I ————— By A. TUTCHINGS

IN my capacity as reviewer of tape recorders for this magazine, test tapes are part of my stock in trade. Without them it would be extremely difficult to separate the record and replay characteristics of a recorder, or to measure the signal noise ratio and peak recording level. From time to time readers write asking for definitions of some of the terms used in the reviews. Some typical questions are: What do the letters C.C.I.R. and N.A.R.T.B. stand for? How can a recording characteristic be defined as a time constant of so many microseconds? How is the level on a tape measured, and what is the difference, if any, between Maxwells, Milli Maxwells, Lines, Lines per square centimetre and Gauss? What is Surface Induction? What exactly do we mean by Root Mean Square Alternating Flux Density? As you can imagine, it is not possible to answer these questions in a few words, and so, with recording standards being reviewed and new recording characteristics suggested and likely to be adopted in the very near future, this seems to be a good time to clear the air.

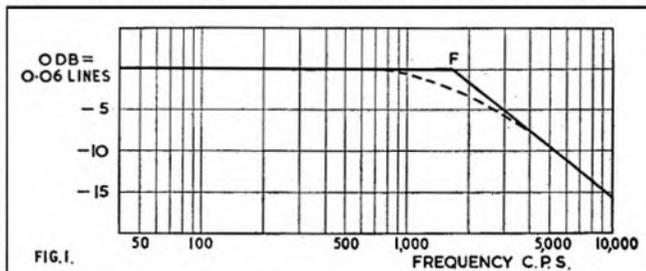
## Some Standards

Let us take the easy ones first! C.C.I.R. stands for Comite Consultatif International Radio communication, an international committee which deals with the standardisation of all kinds of recording characteristics, disc, film and tape, so that recorded programmes may be freely interchanged and played on any equipment equalised to these standards in Europe and in this country. N.A.R.T.B. are the initials of the National Association of Radio and Television Broadcasters in the U.S.A. who have adopted slightly different standards for use over there.

In both organisations there are Standards and Recommendations. The standards are quite rigid and are meant for use on professional equipment, and they are mainly limited to the higher tape speeds of 50 i/s, 15 i/s and 7½ i/s. The 3¼ i/s recommendation has been fairly universally adopted, but 1½ i/s and 15/16 i/s recording characteristics have not yet settled down, and are not likely to, until more recorders using these very low speeds come on to the market. Further discussion on standards will be shelved until we have waded through a few more basic definitions.

## Flux

If tape is passed over a full track head at a speed of 30 i/s and the current in the head is reversed thirty times per second, and if the current through the head is sufficient to

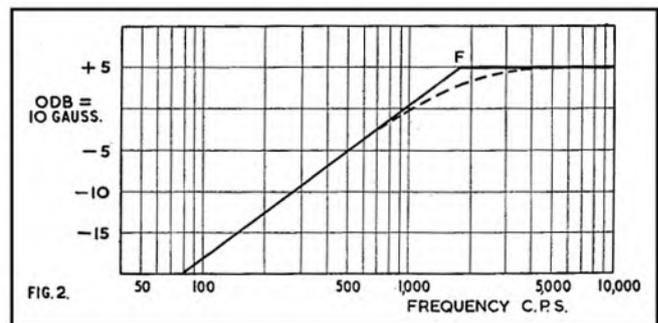


saturate the tape, then a series of alternating magnets will be recorded on the tape in the form of a square wave flux pattern. Each elementary magnet will be one inch long by one quarter inch wide and will maintain a flux which will depend on the thickness, density and magnetic characteristics of the magnetic oxide used to coat the tape.

If the specifications of a number of modern tapes are examined it will be found that the Remanent Flux for fully saturated tape varies very little from sample to sample, and is in the order of 0.6 Flux Lines per ¼ in. tape, with top and bottom limits of 0.5 and 0.7 lines. It may also be expressed as 0.6 Maxwells.

This flux will remain constant as the magnets are made shorter, until the magnet length becomes comparable to the thickness of the magnetic oxide, then mutual demagnetisation of adjacent poles will occur and the flux will fall. Another contributory factor is that very short magnets only exist on the surface of the oxide, so that the volume of magnetic material contributing to the maintenance of the flux is reduced. Thus a logical recording characteristic, which allows maximum flux on the tape at all frequencies, may have the form shown in fig. 1. Note that this characteristic is plotted in terms of Flux, where the flux remains constant up to a turnover frequency F, and then falls 6dB per octave at higher frequencies.

Now test tapes are not, of course, recorded at saturation level, but the example given above introduces the idea of an



alternating flux. In the case of a square wave the Peak and Root Mean Square values are the same, but in practice a sinusoidal change of flux is recorded on the tape and the r.m.s. level is about 20dB, or 10 times less than the saturation level. Thus the flux on a typical test tape would be 0.06 lines for all frequencies below the turnover frequency. This method of expressing the recording characteristic is used exclusively on the continent.

## Flux Density

In this country we prefer to think in terms of flux density or number of flux lines leaving or entering the oxide surface per square centimetre, because it is the rate of change of flux which determines the voltage output of the recording head. As the frequency rises, and the magnets get shorter, there will be more of them per unit tape length so that, up to the turnover frequency, the flux density will be proportional to frequency and the open circuit voltage of a perfect playback head will rise 6dB per octave.

Beyond the turnover frequency the rate of change of flux will remain constant as the rise in density is exactly cancelled by the fall in flux. Thus fig. 2 represents the alternating flux density or Surface Induction method of plotting the recording characteristic. The level on the test tape is usually specified at 1 Kc/s as 0dB, and the surface induction at other frequencies in dB's above and below the 1 Kc/s level. Figs. 1 and 2 show different ways of presenting the same recording characteristic.

## Recorded Level

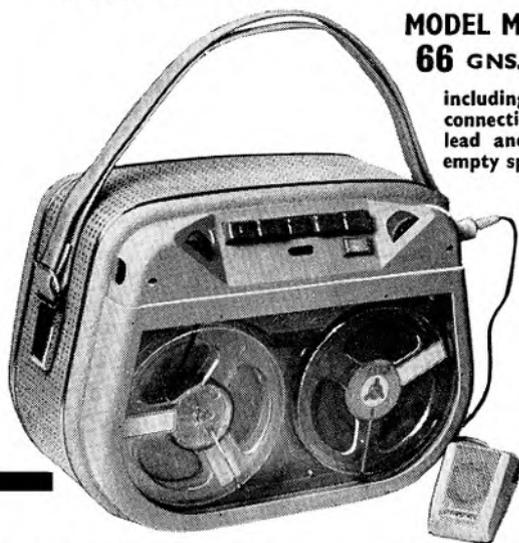
We have seen that saturation flux at low and middle frequencies is in the order of 0.6 lines for most contemporary tapes, so that the maximum flux density for a frequency of 1 Kc/s at 7½ i/s can easily be calculated by dividing the flux by the area of a half wavelength magnet of full tape width; this gives a saturation flux density of approximately 100 lines per sq. cm. Modern tapes show recorded waveform distortion in the order

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### THE USE OF TEST TAPES—(continued)

of 3 per cent. at a level about 8dB below saturation; this corresponds to a flux density of 40 lines per sq. cm.

It can also be shown that most random noise, including speech and music, has a normal (Gaussian) amplitude density distribution with a crest factor of about 4, i.e. peaks of 12dB above the r.m.s. level occur only infrequently. It is therefore convenient to record test tapes at a level 12dB below peak (3 per cent.) distortion level so that the test tones have the same r.m.s. levels as normal programme signals. Thus the 1 Kc/s tone on a  $7\frac{1}{2}$  i/s test tape is recorded at an r.m.s. flux density of 10 lines per sq. cm. or 10 gauss.

The above calculation gives a rough idea of the desired level on a test tape, but it is necessary to be able to measure the absolute level to an accuracy of about 1dB, and to be able to maintain this level on production tapes within limits of plus or minus 1dB. The absolute level on a tape may be measured by means of a conducting loop placed against the oxide surface of the recorded tape see fig. 3. If the conducting wire is very

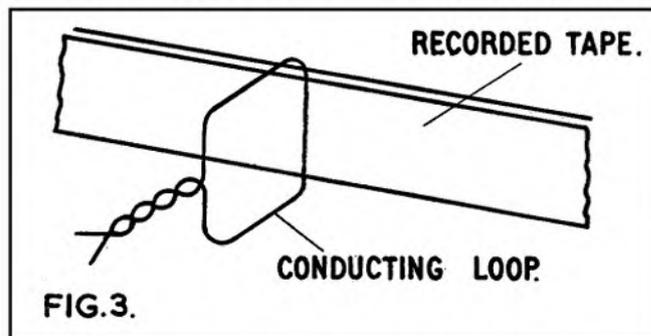


FIG.3.

thin compared to the spacing of the magnet poles on the tape the e.m.f. generated by the loop  $E = vwB$  where  $v$  is the speed of the tape,  $w$  is the width of the tape and  $B$  is the surface induction of the tape at the frequency under test.

This method does not affect the flux distribution from the tape and provides an e.m.f. which can be very simply related to the surface induction of the tape when it is *not* in contact with a magnetic head. The flux pattern is, of course, considerably modified when a conventional head is brought into contact with the tape, but, with modern high coercivity tapes, the effect is constant over a very wide range of recorded wavelengths, so that any temporary distortion of the flux distribution must be considered as part of the characteristic of the head under test.

If the head output is to be a true measure of the alternating flux density on the tape the width of the recorded track must be appreciably wider than the pole face width of the head. Two track test tapes are therefore recorded with tracks extending from the outer edge to the centre of the tape so that any slight vertical misplacement of the head will not give a false reading. In Part 2 we shall discuss recording characteristics for different tape speeds.

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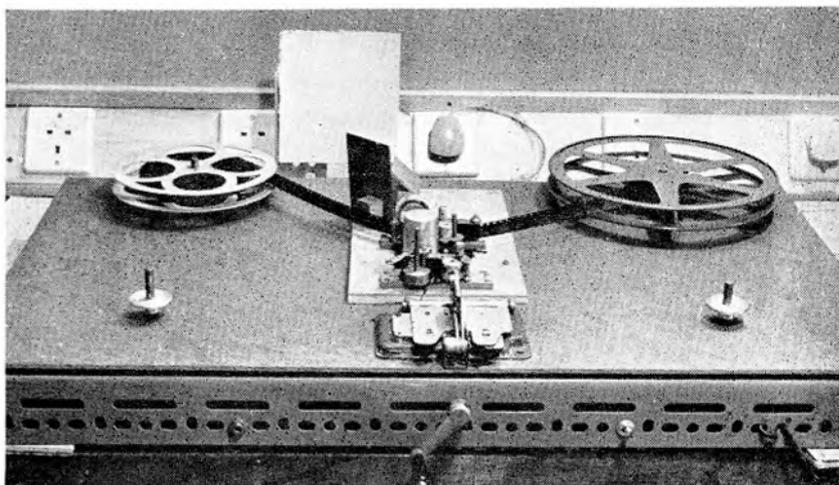
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# SOUND and CINE

by R. GOLDING

The photograph shows the magnetic sound editing section of the editing bench. As is plainly visible here the optical system and the sound head form one unit mounted on a separate piece of board. The system of mirrors needed to bring the picture upright on the white card screen was found by trial and error. The magnetic coated film has been removed from the bench in order that the film sprocket, and film guide may be seen to advantage.



THE story of Laurie Hickman, one of this year's "Ten Best" entrants, is rather similar to that of many among the thousands of cine-amateurs in this country. After years of still camera work his collection of transparencies suddenly meant nothing to him when he got the cine-bug. His first step was very practical, for he joined a club to find out something about filmmaking before ever he bought his first item of equipment. Now, theoretically, this is the thing to do; but it hardly ever works out, as Laurie discovered. The general reason for this is that while there are many clubs to be found all over the country, the number of club films in the making are relatively few, and the chances of joining a club and being taken immediately into a production even fewer.

The cine-club is a great social thing and the film shows and discussions are very valuable, but most members prefer to remain lone workers when it comes to actual filming (and this is evident when we examine competition award lists). This is understandable for we all want the satisfaction of having made it ourselves apart from the fact that, privately, we all consider our ideas and technique to be superior to the next. There is also the human attitude that if we have paid out some large sums of money on equipment we want to get full credit for using it.

### Exceptions to the rule

There are exceptions to this, of course, and these are to be found in every club. These exceptions, however, usually find themselves enrolled into a committee where they are expected to do everything—publish newsletters, organise film shows and competitions, raise money, sweep up and make the tea—everything in fact but make films. The club film is usually launched by the man, essentially a lone worker, who would like to make a more ambitious film than he has done to date, but who lacks finance and equipment. He is joined by new members seeking experience, and by old members seeking to use their equipment. The cameraman owns the camera, the sound engineer the tape recorder and so on. The members without equipment taking their place in the team as continuity, make-up, scene painters and actors. The result is usually not very exciting. It is, however, usually quite enjoyable and quite necessary to give purpose to the very existence of the club.

It was this sort of set-up that Laurie met; but although there was no immediate vacancy for a new Hitchcock, advice on buying equipment was readily forthcoming, so before long he found himself the owner of what was regarded as 16 mm basic documentary film-making equipment, a *Bolex Reflex*, a *Fi-Cord* tape recorder and a silent *Specto* projector. The choice of projector was dictated by (first) budget, and then the half promise of the loan of a 640 for the final transfer; for it's a big step to take, especially during the first year, to lay out great sums on equipment when one's filming policy has not yet been clearly formed.

So Laurie went off on holiday to Morocco, armed with *Bolex* and *Fi-Cord*, to make his first documentary. His many years in journalism had prepared him for the rare and exciting; his

thousands of transparencies had given him a sense of composition and selection, and he had fifty rolls of *Kodachrome* on which to chance his arm. All he had to do was learn how to use the *Bolex* as it should be used. When he returned there were but three weeks to go to the "Ten Best" deadline. The 5,000 ft. of colour film had to be cut down to a reasonable length and main themes and interlinking themes had to be chosen. The task of discarding perfectly good material (and I have seen nearly all of it at various times)—over 4,000 ft.—to give power and coherence to the finished film was a colossal task. Laurie tried several versions in a final 800 ft. length before accepting the final shape and then, with only a few weeks to go before acceptance day, a striped copy had to be made and a sound transfer effected.

The facilities of the club were inadequate for this last rush job for everybody seemed to be getting ready for the "Ten Best", so Laurie was forced to hire a tape recorder at £4 per week and then to go to a professional recording studio for the transfer to striped film. Naturally Laurie is a little disappointed with his first year of club life for the transfer cost him far more than had been budgeted—he refuses to say how much—but it is the sort of thing that must be expected with the best of clubs. The sound recording side is usually the weakest part of any club film and the reason for this is not hard to find but as sound is becoming more and more important to the amateur film in general, committees, sooner or later, must begin to give it the attention it deserves.

### Amateur Magnetic Sound Editing Bench

One club secretary who realises the importance of sound, but rather prefers to build up his own equipment in his own home than use sound equipment owned by the Grasshopper Group is Leslie Morris, and his new house at Highgate now boasts a small room kept exclusively for sound editing. The reason for this is that Leslie's last film documentary on Greece consisted of some very long and involved sound editing sessions that had to be wedged in between other members' wants. The result of this is a very good looking 16 mm editing bench which contains a magnetic sound reader and viewer constructed after the I.T.V. system of a horizontal bench and turntables and made for Leslie by that well-known sound boffin—Keith Raven.

The film viewer follows the normal arrangement of lamp, prism and mirrors, while the sound side employs a magnetic head and amplifier. The gears and supporting apparatus beneath the bench are mainly old Meccano parts and the whole machine cost only a few pounds to make up. The action is manual, that is to say that a small handle to the front of the bench is geared to wind both picture film and magnetic film at the same speed. The manual operation is found to be quite satisfactory, and fairly good reproduction can be obtained by winding the handle at a constant speed. With striped or coated film this is easier to obtain than with optical film, but the installation of motor and slipping clutches to take out film and sound paths is being considered.

(continued on page 74)

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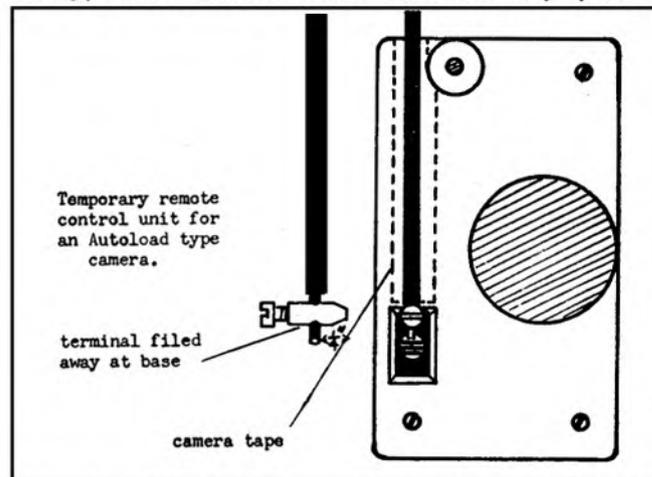
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My recent paragraph on converting an *Autoload* to reflex viewing has brought some rather interesting comments from other magazine camera owners. A need for some form of remote control is expressed, especially while shooting titles, for it is not possible to fit a cable release to most makes.

A quick and easy way, without having to tap into the camera body, is to fit a lug or a terminal from an ordinary electric switch on to the end of a short cable release (cost—a few shillings) and to fasten the cable to the camera body by means



of camera tape. The action will be to push the release button in the required direction and the lug or terminal may be set so that the continuous release is not affected. In my diagram the cable is attached above the release button for normal running. For stop motion the cable can easily be set under the aperture and taken along the base of the camera for a short distance.

For those who would prefer something more substantial I would recommend a letter to Burgess Lane, Thornton Works, Chiswick, London, who specialise and, indeed, take a delight in solving such cine problems.

#### Sound Alphabet

**Dubbing:** means to re-record from existing material. Dub, dubbing and dupe are all nouns used to indicate the duplicated recording itself.

**Erase Head:** is a device used to neutralise the magnetic pattern on tape or stripe by placing it in a strong magnetic field, thereby removing the existing sound. This can be in the form of either an energised head fed from the oscillator in circuit or a separate permanent magnet.

**Feedback:** refers to the accidental or unintentional mixing of signals from more than one input, i.e. speaker and microphone.

**Flutter:** is an effect caused by quick variations in the speed of the sound recording apparatus resulting in frequency alterations in the higher registers. A form of distortion similar to wow.

**Guide track:** is the original recording made when the picture film was shot, possibly on location. It is used to guide the actors at a post-recording session and to help them with pace and inflexion.

**Hum:** is strong interference which is sometimes caused by the incorrect positioning of the power line. Can sometimes be removed by the simple reversing of mains connections.

**Impedance:** refers to the ohms rating of the input or output of any electrical component. When connection is made between any two such components the input and output impedances must match.

**Induction motor:** is the electric motor commonly used in most home projectors and tape recorders and its speed is mainly dependent on the mains supply frequency.

**Key sounds:** are main sound effects that can indicate locale or period quite simply, i.e. a train whistle, etc.

# 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.

★

**DAIWA  
DE-30  
THREE-SPEED  
RECORDER**

★



PIANO key controls, three speeds and a digital counter are three of the features on the new Japanese Daiwa DE-30 tape recorder. Frequency response claimed is 70-11,000 c/s at 7½ i/s. The machine will operate at any voltage from 100-125 volts and 200 to 245 volts, 50 or 60 c/s. Seven-inch reels can be fitted and tape speeds of 7½, 3½ and 1½ i/s give playing times of 1, 2 and 4 hours respectively. A 6 × 4 in. speaker handles the 2 watts output. Other features include: tone controls; instant stop/start button; safety lock; separate inputs for microphone and radio and monitoring. The price of the Daiwa recorder is £46 14s. 6d. (approx.). Sole agents: **Cromptons (Manchester) Ltd., 29 Minshull Street, Manchester, 1.**

★

**SHURE  
SONADYNE II  
DYNAMIC  
MICROPHONE**

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THE new compact microphone, the Sonadyne II, recently introduced by Shure Electronics Limited, features variable frequency response enabling the user to select the best microphone characteristic for the application.

The microphone, designated Model 540S, has a high output dynamic element with a frequency response of 60-10,000 c/s. The list price is £16 13s. 4d.

Further information is available from the manufacturers: **Shure Electronics Ltd., 84 Blackfriars Road, London, S.E.1.**

★

**Tape Height Adjusters**

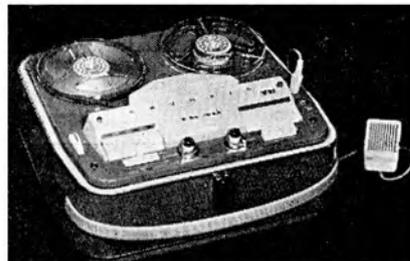
★

THE Tape Height Adjusters described in the article "Common Tape Faults" in the December issue of the *Tape Recorder* caused considerable interest, as a result the author has had these produced from drawn brass and finished in nickel plate. The price is 15s. per pair, post free, from **Rawson and Panton Ltd., 107a Lion Road, Bexleyheath, Kent.**

★

**GRUNDIG  
TK40  
FOUR-TRACK  
RECORDER**

★



THE TK 40 introduced by Grundig (Gt. Britain) Ltd. has been designed with the keen amateur in mind. It is a four track, three speed (7½, 3½ and 1½ i/s) with facilities for mixing, superimposing, and synchronised superimposing. A remote control can be easily fitted if required. Sockets are provided for recording from microphone, radio, radio tuner, telephone adaptor, and gramophone pickup. Outputs provide for the connection of an extension speaker, monitor amplifier, extension amplifier and magnetic heads fitted to cine projectors.

Many new features are incorporated including multi-disc clutches, which are adjusted so that the tape moves gradually at the start. A pressure tape fitted to the pressure roller arm ensures a uniform contact between the tape and head. A retractable tape cleaner is also fitted. On fast wind and rewind it is possible to "inch" the tape. The technical specification quoted reads: Frequency response 7½ i/s 40-18,000 c/s, 3½ i/s 40-15,000 c/s, 1½ i/s 40-9,000 c/s; Wow and flutter 0.1 per cent. (7½), 0.12 per cent. (3½), 0.2 per cent. (1½); Signal to noise ratio 50dB. The price is £78 15s. Manufacturers **Grundig (Gt. Britain) Ltd., 39/41 New Oxford Street, London, W.C.1.**

★

**COSSOR  
CR 1603  
FOUR-TRACK  
RECORDER**

★



COSSOR Radio and T.V. Ltd. have increased their range of tape recorders, with a single-speed four-track recorder giving a playing time of 6 hours with a 5½ in. reel of D.P. tape. Housed in a two-tone green polystyrene cabinet this new machine is priced at £29 8s. It weighs only 11 lb. and has a tape speed of 3½ i/s.

With this machine, the C.R. 1603, it is possible to record from the microphone, radio or gramophone pickup and play back through a radio, amplifier or extension speaker. A moving coil meter indicates the recording level, which can be adjusted while the tape is stationary.

The recorder is supplied with a 5 in. reel of long-play tape, an empty 5 in. spool, a sensitive moving coil microphone and a screened connecting lead. Reels up to 5½ in. diameter can be used. Other details include: Frequency Response: 80 c/s-13 Kc/s. Power Output: 1 watt. Signal to Noise Ratio: better than -36dB. Loudspeaker: 4 in. diameter. Microphone: moving coil. Dimensions: 12 × 10½ × 6 in. Manufacturers **Cossor Radio & Television Ltd., 233 Tottenham Court Road, London, W.1.**

# EVERYTHING YOU'VE WANTED!

Here, for the real enthusiast, is a new tape recorder to make your dreams come true. Not only does its performance meet the most exacting standards; but it has also brilliant operational refinements which make it a delight to use. Please study some of the highlights of the specification below and then try a TK.40 for yourself. We are proud of it, and are sure you will be too.



## STAR FEATURES

### Three tape speeds

1½, 3½, 7½ i.p.s.

### Frequency response

60 to 10 Kc/s at 1½ i.p.s.  
60 to 15 Kc/s at 3½ i.p.s.  
60 to 18 Kc/s at 7½ i.p.s.

### Wow/Flutter

± 0.1% at 7½ i.p.s.  
± 0.12% at 3½ i.p.s.  
± 0.2% at 1½ i.p.s.

### Four-tracks

Selected by positive piano-type keys.

### Signal to noise ratio

Better than 50 db at 7½ i.p.s.  
Better than 45 db at 3½ and 1½ i.p.s.

### Pressure sling

This, unlike the conventional pad, is flexible and maintains even pressure over the whole surface of the head. It gives better H.F. response and minimises "drop-out" effects.

### Multi-disc clutches

In addition to the normal slipping clutches the TK.40 embodies additional multi-disc clutches to remove excessive tape strain. Using *double-play* tape you can switch immediately from fast-forward to fast rewind or vice versa without tape breakage or stretch.

### Inching

Fast-forward and rewind are controlled by a slider actuating a progressive clutch. Inching is thus unusually easy and accurate. A lock position is also provided.

### Cine-socket

To connect magnetic heads from a cine projector to the TK.40 to record sound films or play back from them.

### Built-in tape cleaner

Retractable, and press-button operated.

### Indicator re-set

The digital indicator is provided with a button for immediate zero re-set.

### Automatic stop

At the end of the tape.

### Remote control

An adaptor is available.

### Mixing facilities

For microphone/pickup and microphone/diode.

### Monitoring

Through loudspeaker when required.

### Synchronous recordings

Output for monitor amplifier provided.

### Superimposition

Push-button provided for adding effects or commentary to existing recordings at will.

**GRUNDIG**

Ask your Grundig Approved Dealer for a demonstration or write to us for an illustrated leaflet.

**TK40**

**75 GUINEAS**  
(INCLUDING MICROPHONE)

**GRUNDIG (Great Britain) LIMITED** NEWLANDS PARK, LONDON, S.E.26.  
(Electronics Division, Gas Purification & Chemical Company Ltd.)

GS.301

# EQUIPMENT REVIEWED

★  
**E.M.I.  
 VOICEMASTER  
 FOUR-TRACK  
 RECORDER**  
 ★

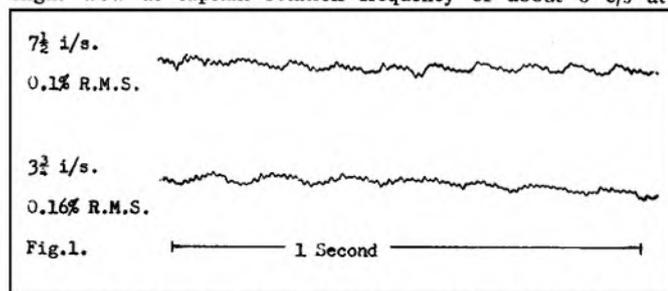


**Manufacturer's specification:** Total playing time using recommended thickness tape (E.M.I. 99): 7 in. spool (1,800 ft.)  $7\frac{1}{2}$  i/s—3 hrs. 12 mins.,  $3\frac{3}{4}$  i/s—6 hrs. 24 minutes. Spooling: fast spooling in either direction approx. 90 secs. for 1,800 ft. Dynamic range: 45dB unweighted referred to fully modulated tape. Record and replay characteristic to C.C.I.R. recommendations. Overall frequency response:  $7\frac{1}{2}$  i/s—60 to 15,000 c/s  $3\frac{3}{4}$  i/s 60 to 10,000 c/s both plus or minus 3dB. Power output: 4.5 watts for 10 per cent. dist. into 3.5 ohm load. Wow and flutter: less than 0.15 per cent. R.M.S. at  $7\frac{1}{2}$  i/s, less than 0.3 per cent. R.M.S. at  $3\frac{3}{4}$  i/s. Oscillator frequency 65 Kc/s. Internal speakers: lower register— $9\frac{1}{4}$  in. by  $4\frac{1}{2}$  in. elliptical, upper register  $2\frac{1}{2}$  in. round. Price £68 5s. Manufacturers: The Gramophone Co. Ltd., Hayes, Middlesex.

THIS is a rather large machine with modern styling and with the amplifier placed adjacent to the deck, rather than under it in the normal manner. Advantage has been taken of the large internal volume of the cabinet to fit a pair of matched speakers: an elliptical one for the bass and a small round tweeter for the high note response. It is a four-track recorder, and three double quarter track heads are fitted, together with separate record and replay amplifiers, so that the signal may be monitored a fraction of a second after recording as in most professional recorders.

The record-level indicator is an edge reading moving coil meter, scaled in dB, and marked into white, grey and red sectors to indicate medium, high and overload recording levels respectively. Switching facilities are also provided for cross recording from one track to another with superimposed speech or music via the microphone input, so that quite ambitious sound tracks may be compiled with earphone or speaker monitoring of the combined track at the instant of recording.

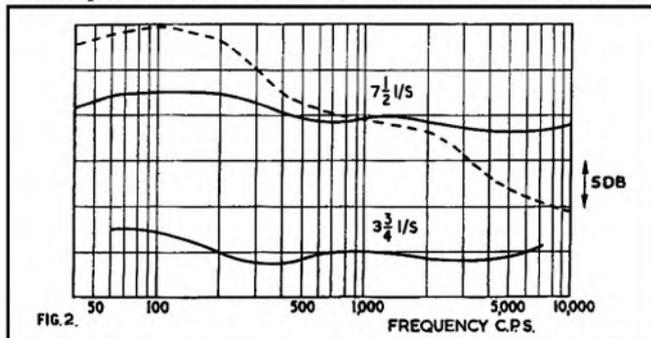
**Wow and Flutter:** The fluttergrams of fig. 1 show that short term speed variations are well within the specification, with only a slight wow at capstan rotation frequency of about 6 c/s at



$3\frac{3}{4}$  i/s, and 12 c/s at the higher tape speed. The  $3\frac{3}{4}$  i/s tape speed was within 1 per cent. of the nominal speed, but the

$7\frac{1}{2}$  i/s speed was nearly 6 per cent. low. The capstan bearings seemed a bit tight and it is possible that the speed would be O.K. after running in.

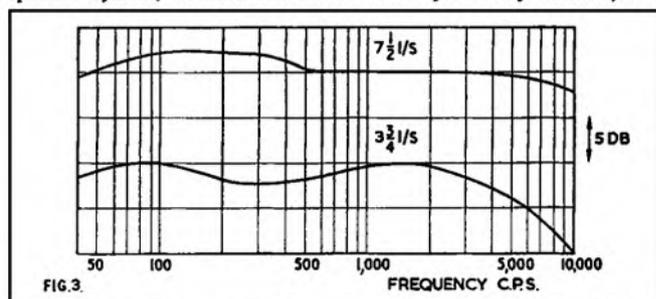
**Playback Only Responses:** 100 and 200 microsecond test tapes were played and gave the solid line curves of fig. 2. This shows that the playback responses are to C.C.I.R. recommendation within plus or minus 2dB. The dotted curve illustrates the



effect of the tone controls. It was noticed that the effective range of the treble control was compressed into the last few degrees of anti-clockwise rotation. The responses shown are for the low level output.

**Record Play Responses:** The overall record play responses at the two speeds are shown by the curves of fig. 3. The  $7\frac{1}{2}$  i/s response is very close to that of the test tape; the  $3\frac{3}{4}$  i/s response falls slightly at high Kc frequencies but stays within the specification up to about 6 Kc/s.

**Signal Noise Ratio:** This is the weakest feature of this machine—both valve noise and hum are much higher than they should, or could, be. Hum and noise on the top track was 25dB below test tape level, and that of the bottom track only 20dB down. Most of the hum was lost due to low note cut-off in the internal speaker system, but the valve hiss was unpleasantly audible, and



was at least 6dB higher than bulk erased tape noise. Examination of the playback amplifier circuit diagram shows that a grid stopper R2, having a value of 1 megohm, is fitted between the head and the grid of V1. So far as I can see this serves no useful purpose whatsoever, indeed it probably generates thermal noise and may be the prime cause of the trouble. I would guess that it is a draughtsman's error that has been "built in", and that it should in fact be 1K!

Another source of recorded noise is slight magnetisation of the record head due to switching transients in the record amplifier. If the machine is switched to record, and the record head degaussed without further switching, the recorded noise is a simple hiss, but if the switches are operated in the normal fashion a low pitched "grumble" is added due to head magnetisation. Further random operation of the switches may cancel or aggravate the trouble—it all depends on the polarity of the switching transients. Another complaint, which affects the overall signal noise ratio, is that a level only 8dB above test tape level can be recorded without marked distortion; this corresponds to

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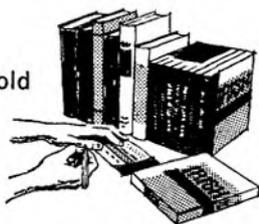
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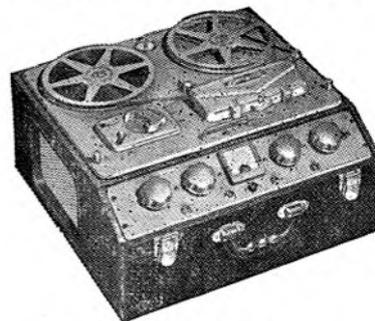
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		REPS R10 ... ..	59 gns.

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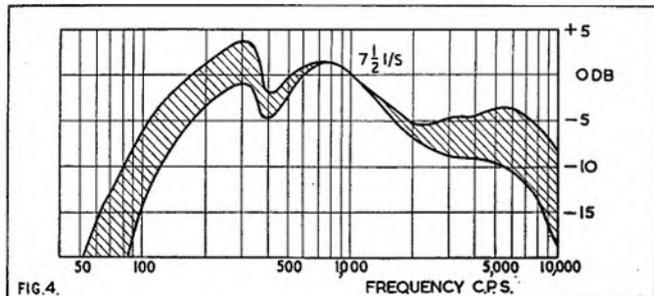
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**EQUIPMENT REVIEWED—(continued)**

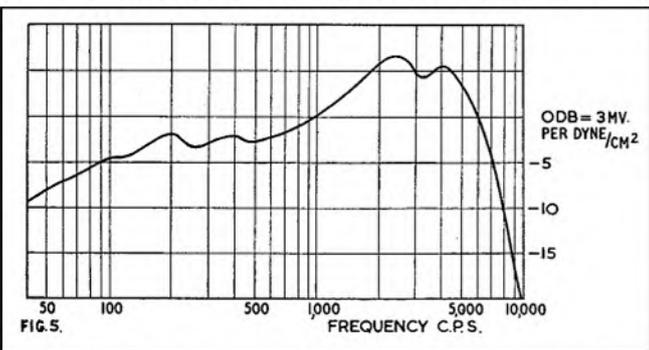
the start of the grey sector on the indicator, if the level is turned up to the 12dB point, or the edge of the red sector, then the waveform is visibly distorted due to tape, amplifier or head overload.

**Acoustic Response:** The overall response from tape to loud-speaker output was checked by playing a White Noise test tape containing 25 one third octave bands of filtered white noise and measuring the speaker output with a calibrated microphone one foot from the front of the cabinet at a position midway



between the two internal loud speakers. The response at extreme positions of the tone controls is indicated by fig. 4. Between 2 and 4 Kc/s the output varied with the position of the test microphone indicating that both speakers were radiating in this range and that interference effects were responsible for the variations.

**Microphone Response:** The microphone response was measured because recorded voice quality sounded rather better than that expected from the acoustic response of fig. 4. The



curve of fig. 5 shows why—the high note response rises slightly in the middle top range so that the overall air to air response is sensibly level from 100 c/s to about 7 Kc/s.

**Comment:** Despite the poor measured signal to noise ratio, the results on the internal speakers are pretty good as judged subjectively. I think this is in part due to the tape monitoring facility which allows the highest possible level to be placed on the tape so as to overcome the background noise. Nevertheless if the dynamic range could be improved this would be a really excellent recorder with facilities not normally obtainable at this price. One final criticism: the tape loading path is far too cluttered by the movable guide and pause control knob and, although the rear dress cover for the heads can easily be removed, access to the front of the heads for cleaning, degaussing, or tape editing is not possible without a major operation.

**A. Tutchings**

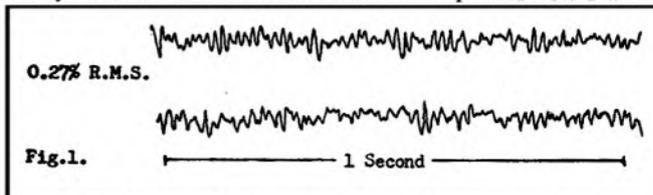
*This review was submitted to the manufacturers for comment, but due to postal delays, the reply has not reached this office. However this will be printed next month.*



★  
**STELLA  
ST 470  
BATTERY  
PORTABLE**  
★

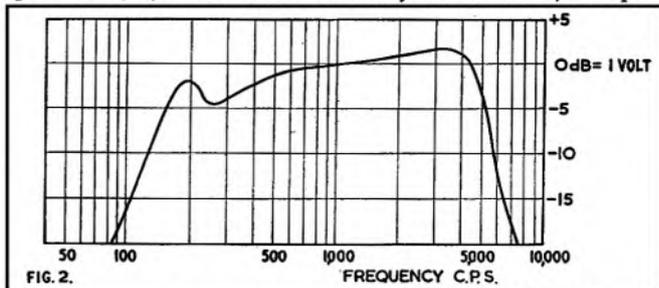
**Manufacturers' Specification:** Tape speed 1 1/2 i/s. Fast wind: 300 ft. of tape in 115 seconds. Fast rewind: 300 ft. in 90 seconds. Standard International track positions. Frequency response: 120 to 5,500 c/s ±3dB. Batteries: six U2 1 1/2 volt torch batteries. Current consumption: 120 mA. Battery life: approx. 20 hours. Meter record level indicator and battery check. Sensitive cardioid moving coil microphone. Mic. Gram. and Radio input sensitivity: 0.3 millivolts across 2,000 ohms. Line output: 1 volt across 1,000 ohms. Dimensions excluding handle: 7 1/2 in. by 12 in. by 4 1/2 in. Weight: 8 lb. Price with microphone, tape, spare spool and input-output lead: £26 5s. Optional extras: imitation pigskin carrying case with shoulder strap £2 5s., power supply unit to operate from A.C. mains, as alternative to batteries £5. **Stella Radio & Television Co. Ltd., Astra House, 121-3 Shaftesbury Avenue, London, W.C.2.**

A FIELD trial of the Philips equivalent of this machine was reported in the August issue of this magazine, just as it came on the market. I recently had the opportunity of hearing one at my local radio dealer's and I was so impressed that I asked



the editor if it would be possible to borrow one for further tests. These tests have fully confirmed my opinion that the S.T.470 is a thoroughly outstanding little recorder. Styling is unusual in that the reels and tape controls are placed on top of the machine so that, at first glance, it looks rather like a portable radio. As will be seen later, the shallow cabinet and large flat baffle area makes good use of the 4 in. internal speaker. The gain control is placed adjacent to the meter type record level indicator, which also measures the battery voltage when switched to playback.

**Wow and Flutter:** Fig. 1 shows the fluttergram or pen recording of the instantaneous speed fluctuations from the steady mean speed of 1 1/2 i/s. The flutter is mainly due to the 3,000 r.p.m.



motor which causes the 50 c/s flutter shown. The integrated r.m.s. reading remained steady at 0.27 per cent. and wow was extremely low. The ear is very tolerant of high frequency flutter in programme content, and reaches its maximum sensitivity at about five cycles per second. The relatively high capstan and flywheel speed renders the machine insensitive to normal movement, and the fore and aft swing applied when walking and carrying the recorder by its handle has no audible effect, even

*(Continued on page 81)*

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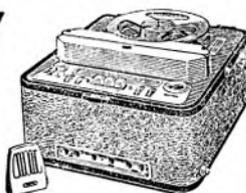
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	Deposit	18 Monthly Payments	Cash
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<b>MAINS 2-TRACK</b>			
Truvox R82 ... ..	11 11 0	2 11 4	55
Brenell 3 Scar ... ..	12 4 0	2 14 0	58
Reps R.10 ... ..	12 8 0	2 15 1	59
Brenell Mk. 5 ... ..	14 4 0	2 18 11	64
Telefunken 85KL ... ..	17 19 0	3 12 3	79
Ferroglyph 4A/N ... ..	18 1 0	3 14 6	81
Brenell 5 Type "M" ... ..	18 10 0	4 2 2	88
Simon SP/5 ... ..	19 11 0	4 6 10	93
Reflectograph "A" ... ..	22 5 0	4 17 6	105
<b>4-TRACK MONAURAL</b>			
Grundig TK24 ... ..	11 11 0	2 11 4	55
Brenell 3 Scar ... ..	12 4 0	2 14 2	58
Philips EL3542 ... ..	12 8 0	2 15 1	59
Stella ST455 ... ..	12 8 0	2 15 1	59
Truvox R84 ... ..	12 8 0	2 15 1	59
Elizabethan Major ... ..	14 5 0	3 0 0	65
Reps R.10 ... ..	14 10 0	3 4 5	69
Grundig T.K.40 ... ..	15 15 0	3 10 0	75
<b>4-TRACK STEREO/MONAURAL</b>			
Korting MT 157 ... ..	17 17 0	3 19 4	85
Telefunken 77K ... ..	17 17 0	3 19 4	85
Philips EL3536 ... ..	19 12 0	4 5 7	92
Telefunken 97 ... ..	20 0 0	4 8 8	95

## WHAT?

What type of Tape Recorder, among all the machines now on the market should I buy? What are the various characteristics, for instance, of a Grundig TK40, a Simon SP/5 or a Telefunken 97 and other recommended machines?

## WHERE?

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<b>MAINS TWIN-TRACK</b>			
Argyll Minor ... ..	2 6 3	2 6 3	22
Grundig TK14 ... ..	3 13 6	3 13 6	35
Elizabethan TT3 ... ..	4 2 0	4 1 11	39
Reps R.10 ... ..	6 3 11	6 3 11	59
Spectone "161" ... ..	5 2 11	5 2 11	49
Telefunken 95 ... ..	6 3 11	6 3 11	59
<b>4-TRACK</b>			
Stuzzi ... ..	2 16 6	2 14 6	26
Philips 'StarMaker' ... ..	2 16 9	2 16 9	27
Argyll 4-T ... ..	3 4 0	3 4 0	29½
Elizabethan FT1 ... ..	3 11 5	3 11 5	34
Philips EL3541 ... ..	3 11 5	3 11 5	34
Stella ST 454 ... ..	3 17 9	3 17 9	37
Sound ... ..	4 15 0	4 14 6	45
Elizabethan FT3 ... ..	4 15 0	4 14 6	45
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Clarion Mk. 1 ... ..	1 19 11	1 19 11	19
Minivox "C" ... ..	2 8 4	2 8 4	23
Philips EL3585 ... ..	2 10 5	2 10 5	24
Clarion Mk. 2 ... ..	2 16 9	2 16 9	27
Grundig TK1 ... ..	3 1 0	3 0 11	29
Optacord Battery/ Mains ... ..	4 15 0	4 14 6	45
Ficord IA ... ..	6 3 11	6 3 11	59
Stuzzi Magnette ... ..	6 3 11	6 3 11	59
Butaba MT5 ... ..	6 18 8	6 18 8	66

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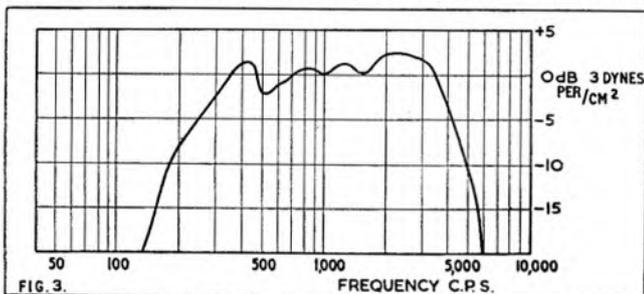
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when recording a pure tone. Only when it is twisted on its axis fairly violently is there any marked disturbance.

**Record Replay Response:** Fig. 2 indicates the overall record replay response from microphone input to line output. The high note response is well maintained to 5 Kc/s, and the low note response falls sharply below the speaker resonance at 190 c/s. The response is well balanced about the centre frequency of 1 Kc/s. A test tape was used to determine the recording characteristic used and this was found to be 200 microseconds. There is no C.C.I.R. recommendation for a tape speed of  $1\frac{1}{2}$  i/s, but many recorders have adopted 100, 200 and 400 microseconds as the recording characteristics for  $7\frac{1}{2}$ ,  $3\frac{1}{2}$  and  $1\frac{1}{2}$  i/s. The difference between 200 and 400 microseconds is only 6dB, or plus and minus 3dB about 1 Kc/s, so that music recorded on the home recorder and played on the portable may sound slightly rounded, and speech or sound effects recorded on the portable and played on the home recorder may be slightly "top heavy", but the tone control on the static recorder will restore the balance. Full peak recording level can be placed on the tape without distortion, and 12dB above test-tape level is recorded on pure tone with the meter needle just above the red sector of the indicator.

**Signal Noise Ratio:** Motor and transistor noise is 40dB below test-tape level, or 52dB below peak recording level. Erased and



biased tape noise is 36dB below test tape level, or 48dB below peak. This very satisfactory dynamic range allows one to under record slightly if loud peaks are expected, without the background noise obtruding. Mechanical noise from the recorder is low, and, by making use of the directional polar response of the microphone, can be eliminated altogether.

**Acoustic Response:** The acoustic response of the speaker and cabinet combined with the electrical response of fig. 2 was obtained by feeding bands of filtered white noise into the radio input and measuring the speaker response at a distance of one foot from the front of the cabinet by means of a calibrated microphone. This response is shown in fig. 3. Once again the response is well balanced about the centre frequency and covers the range 200 c/s to 4,000 c/s smoothly without peaks or dips.

**Microphone Response:** The free air axial response of the microphone is shown in fig. 4. This is an excellent microphone response by any standards and the response is equal to that obtained from units costing almost as much as this complete recorder. It is called a cardioid microphone in the specification, but it should more accurately be called a pressure gradient unit, as both sides of the

(Continued on page 83)

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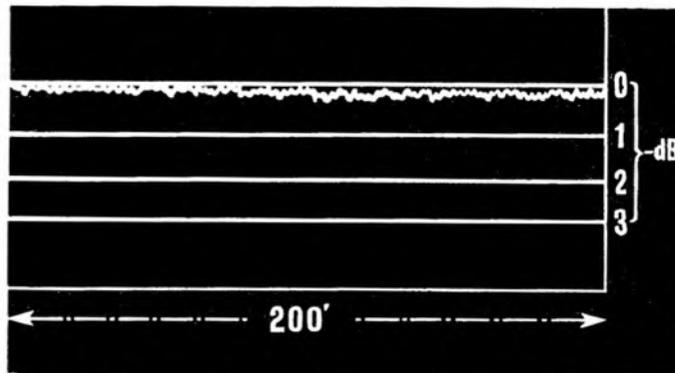
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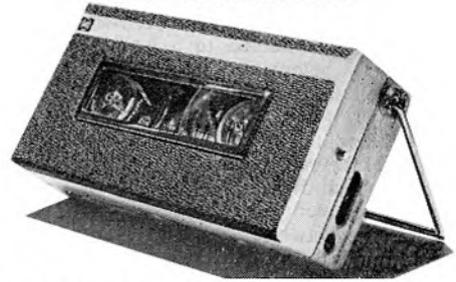
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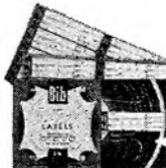
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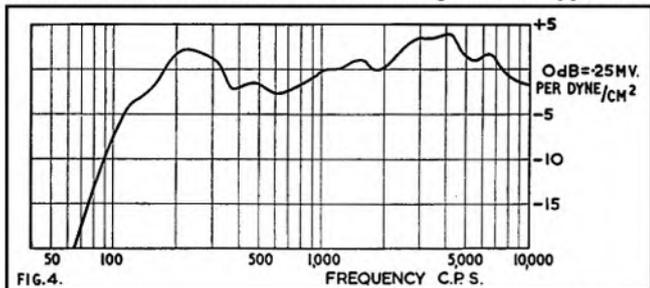
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response is obtained directly from the back. As mentioned earlier, a knowledge of the polar response is useful in eliminating unwanted sounds or motor noise. The microphone should be placed upright on the weighted base and never laid on its back, as this obstructs the rear entrance and cuts the bass response.

*Comment:* As readers will have gathered, I am wildly enthusiastic about this little recorder. I think it is excellent value for money. It is a useful adjunct to a large static home recorder, and even if this recorder has a speed of  $1\frac{1}{2}$  i/s you need have no qualms about re-recording from the line output of the S.T. 470. The connecting lead is fitted with an internal resistor so that recordings may be made from a radio tuner or the extension speaker terminals of a radio set or recorder, but, as is usual with a good microphone, recordings made via the microphone from the acoustic output of any good quality speaker are much better than we have been taught to believe possible. Finally a word of praise for the really comprehensive instruction book. It is really worth reading.

A. Tutchings.

This review was submitted to the manufacturers who returned it without comment.

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All advertisements for the April issue must arrive not later than March 1st.

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